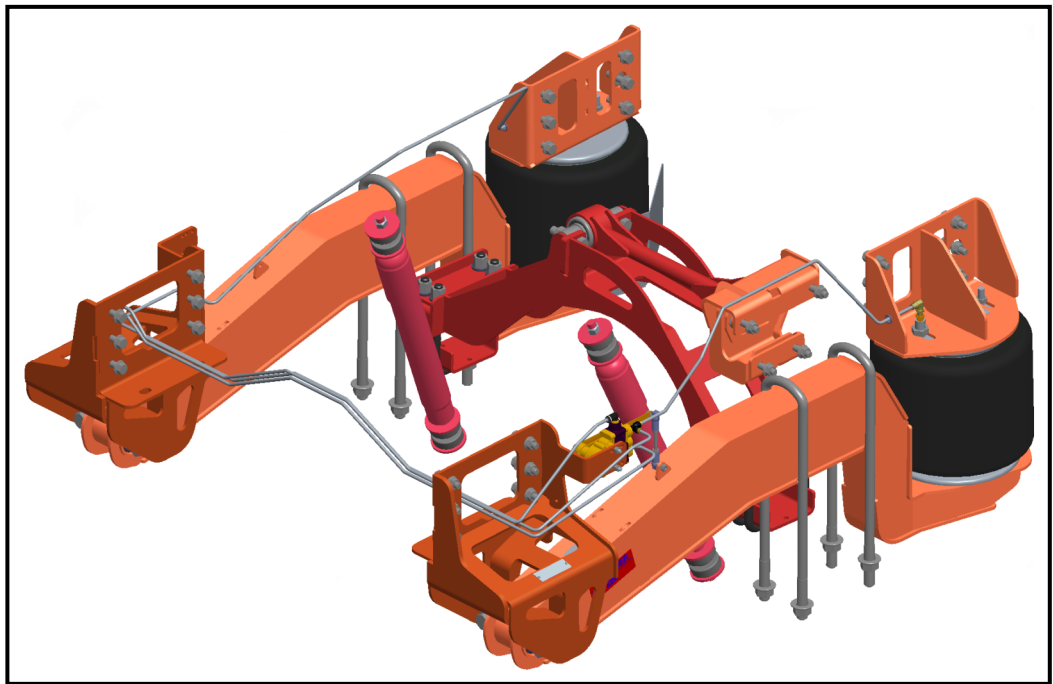




OWNERS MANUAL

GMC C5500 15K AND 19K GVW CHASSIS CAB 2004-NEWER MODELS (Link Part No. 8M000050)



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INSTALLER SIGNATURE : _____

DATE : _____

80000988
SEP 1, 2015

INSTALLATION INSTRUCTIONS INDEX

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1. INTRODUCTION

IMPORTANT! It is important that the entire installation instructions be read thoroughly before proceeding with suspension installation.




WARNING! A correct installation must result in the suspension and axle being “loaded” within the range specified by axle and suspension manufacturers. Please check vehicle specifications and intended usage to insure axle will be within Gross Axle Weight Rating (GAWR). No alteration of any suspension component is permitted.

PRODUCT INSTALLER RESPONSIBILITIES

- ❑ Installer is responsible for installing the product in accordance with Link Mfg. specifications and installation instructions.
- ❑ Installer is responsible for providing proper vehicle components and attachments as well as required or necessary clearance for suspension components, axles, wheels, tires, and other vehicle components to ensure a safe and sound installation and operation.
- ❑ Installer is responsible for advising the owner of proper use, service and maintenance required by the product and for supplying maintenance and other instruction as readily available from Link Mfg.

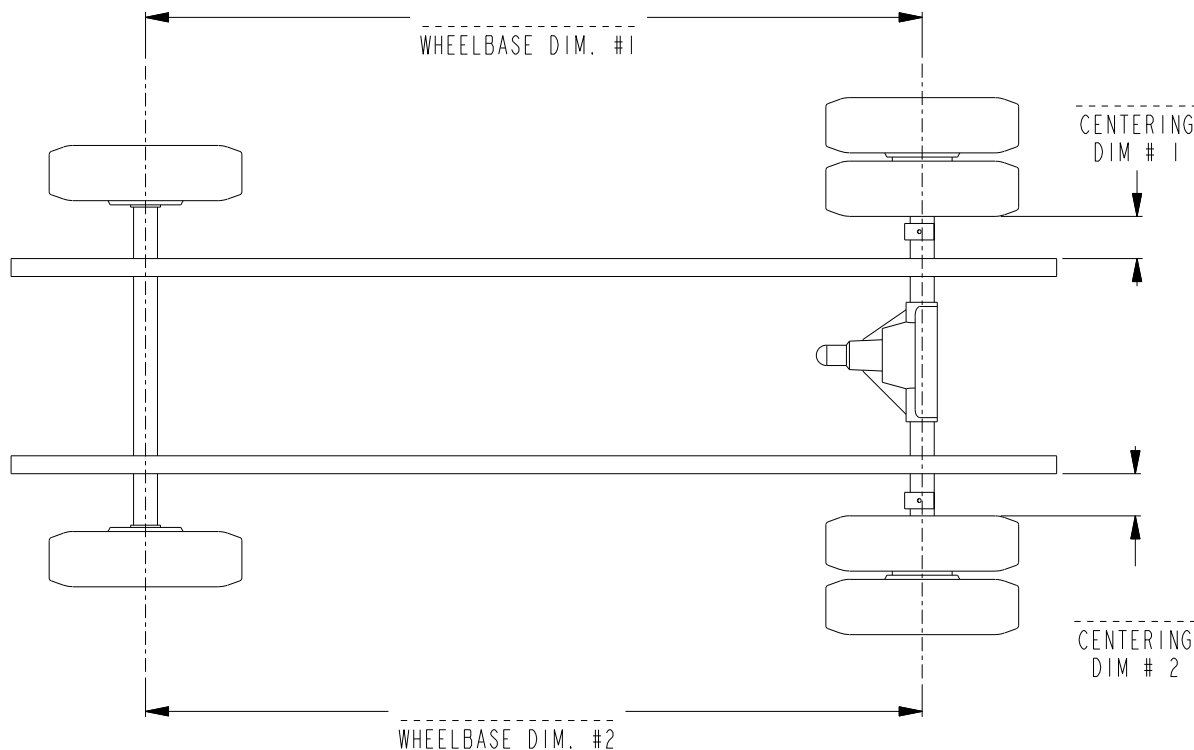
INSTALLATION NOTES:

- ❑ Proper tightening of U-Bolt nuts and mounting nuts are required for proper operation. Need for proper Torque value is indicated by wrench symbol; values will be found in Table 10-1 in Maintenance section of the instructions. Failure to maintain proper torque can cause component failure, potentially resulting in accidents with consequent injury. 
- ❑ No drilling of new frame holes is required for installation of the suspension. Mounting of the air control system will require holes to be drilled into the frame where necessary.
- ❑ Exhaust modification will be needed during the installation and is the responsibility of the installer.
- ❑ The GMC C5500 UltraRide with 15K rear axle and the 19K rear axle are shown throughout these installation instructions. The only difference between the suspensions for either axle depends on which shock is used. Both will follow the same sequence and setup as depicted.

NOTE: When completing the installation of the UltraRide on the GM chassis, please refer to appropriate sections of the GM Service Manual for additional requirements.

PRE-INSTALLATION CHECKLIST

- ❑ Check the vehicle wheel alignment prior to installation to ensure no precondition already exists; record the information for verification.
- ❑ Remove the attached body, if applicable. Remember to disconnect all electrical connections to the body and fuel filler tube before removing the body. The installation can also be completed using a lift to raise the vehicle. If using a lift, chassis body removal may not be necessary, but removal of rear wheels will aid in installation. Refer to GM Document 812944 and 827666.
- ❑ If not using a lift, block the front wheels and apply the emergency brake so the vehicle cannot roll.
- ❑ Jack up the rear frame of the truck in order to unload the rear leaf springs (or use an overhead hoist). It may also be advantageous to place jack stands under the rear axle itself. This will take some of the weight off the axle, and help to keep it from moving during disassembly. The stands **should not** raise the tires off the ground.
- ❑ Install the suspension in the listed sequence. Install one side of the suspension at a time. First install the driver side completely, then install the passenger side. Removal of the rear wheels may aid in installation if using a lift, but it is not necessary.
- ❑ Measure & record the wheelbase and centering dims before beginning installation.



2. DRIVER SIDE DISASSEMBLY

1. With weight taken off the rear springs, as noted in pre-installation checklist, remove the rear bolts from the **rear leaf spring hanger bracket**. Remove the **front spring hanger bracket**. **DO NOT** re-use the bolts that mount the hanger bracket, or the leaf spring itself. New fasteners are provided, and must be used to achieve proper clamp load on the hanger. See Figure 2-1. Refer to GM Documents 800862 and 1202795.
2. Remove existing **U-bolts** that attach the **axle** to the **leaf spring**. After this is done, the axle, spring, and hanger will be loose. Remove only the **leaf spring** from the axle; **DO NOT** re-use existing fasteners such as the U-bolts or nuts.
3. Grind/remove 6 rivets that connect the aft of the axle cross-member to the frame. This cross-member will be located 9.72 inches aft of the axle centerline. (See Figure 2-2 for location of these rivets).



WARNING! If truck has C5V042 option, the fuel tank will not be in this location but will be mounted further back on the truck. If this is the case, holes will need to be drilled using the provided paper template. Part # 80001039.

4. Remove the OEM **shock absorbers** and retain the mounting fasteners for later use.
5. Remove the OE jounce bumper bracket from the frame, on Driver side only. These Frame holes will be shared with Lateral Control Bracket, mounted to the inside of the frame.

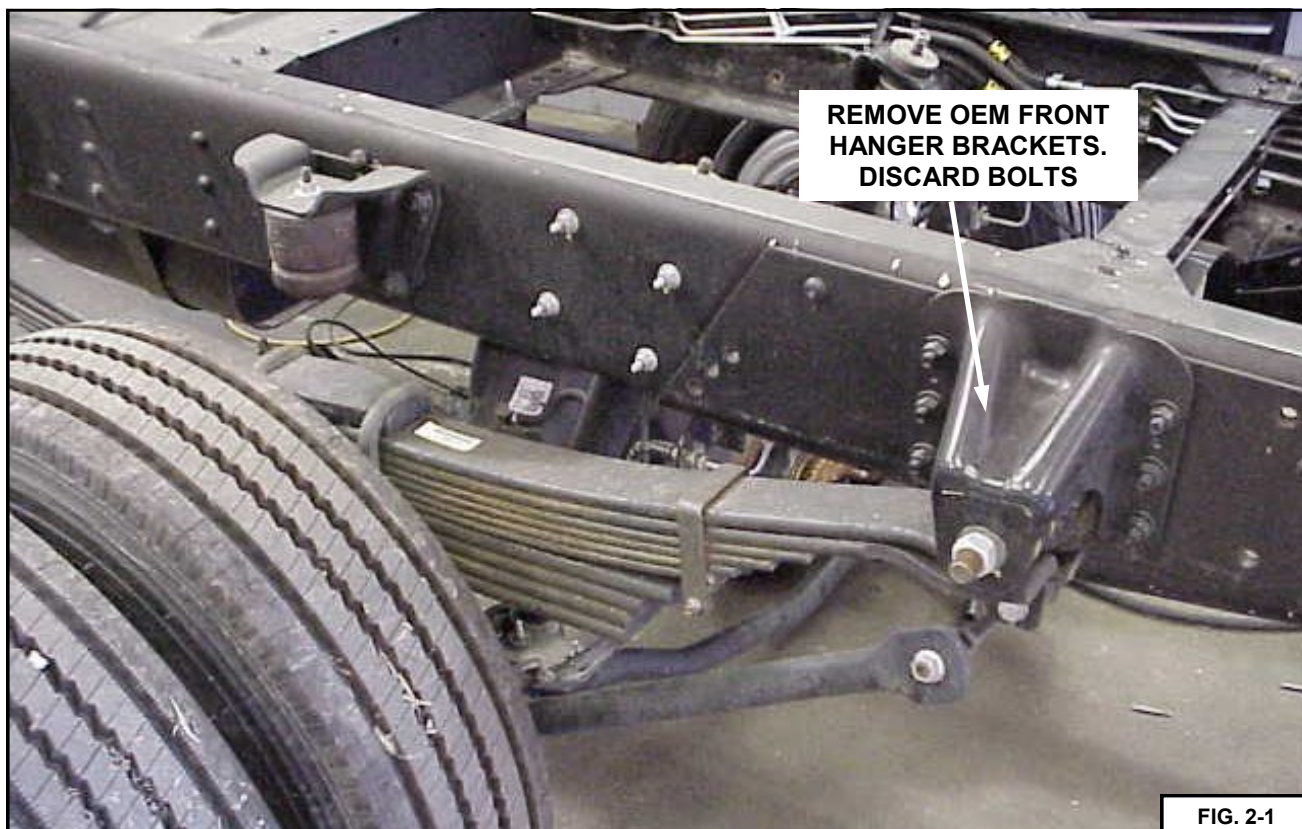
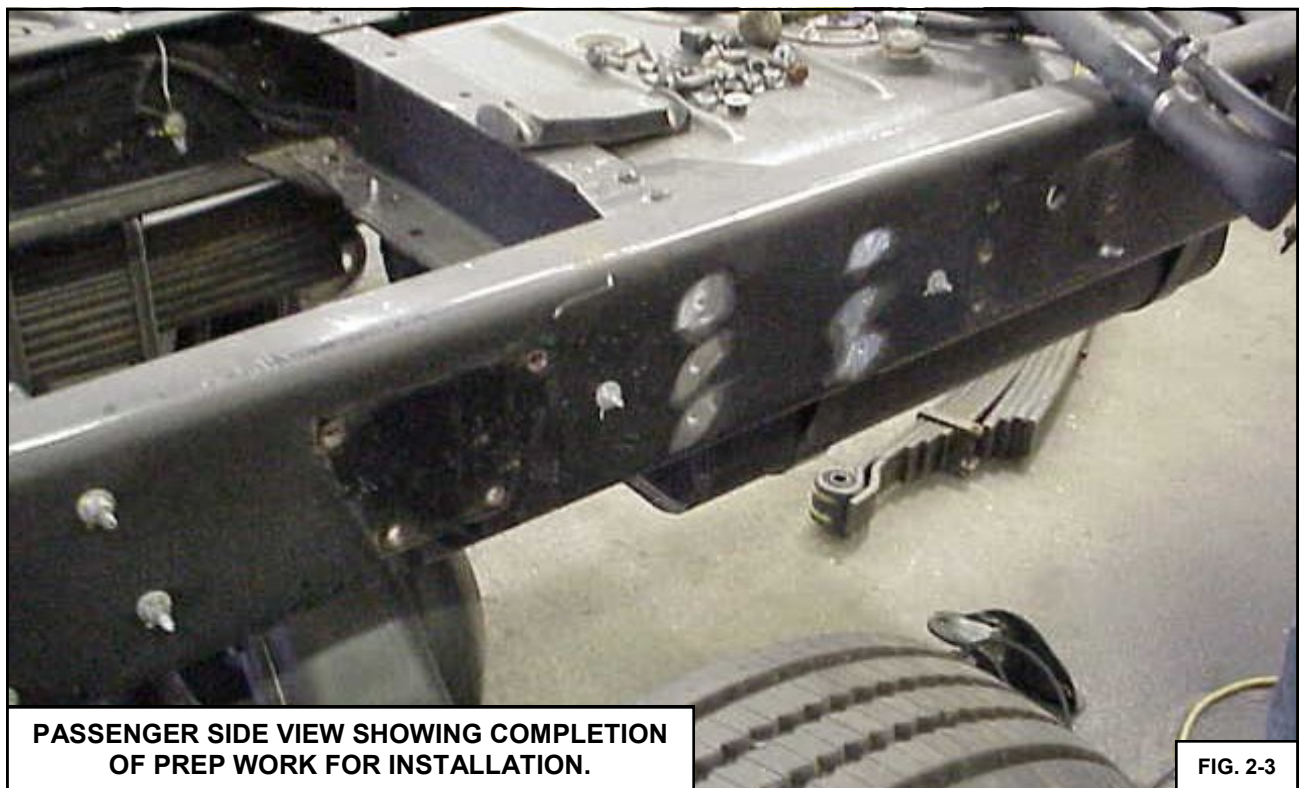
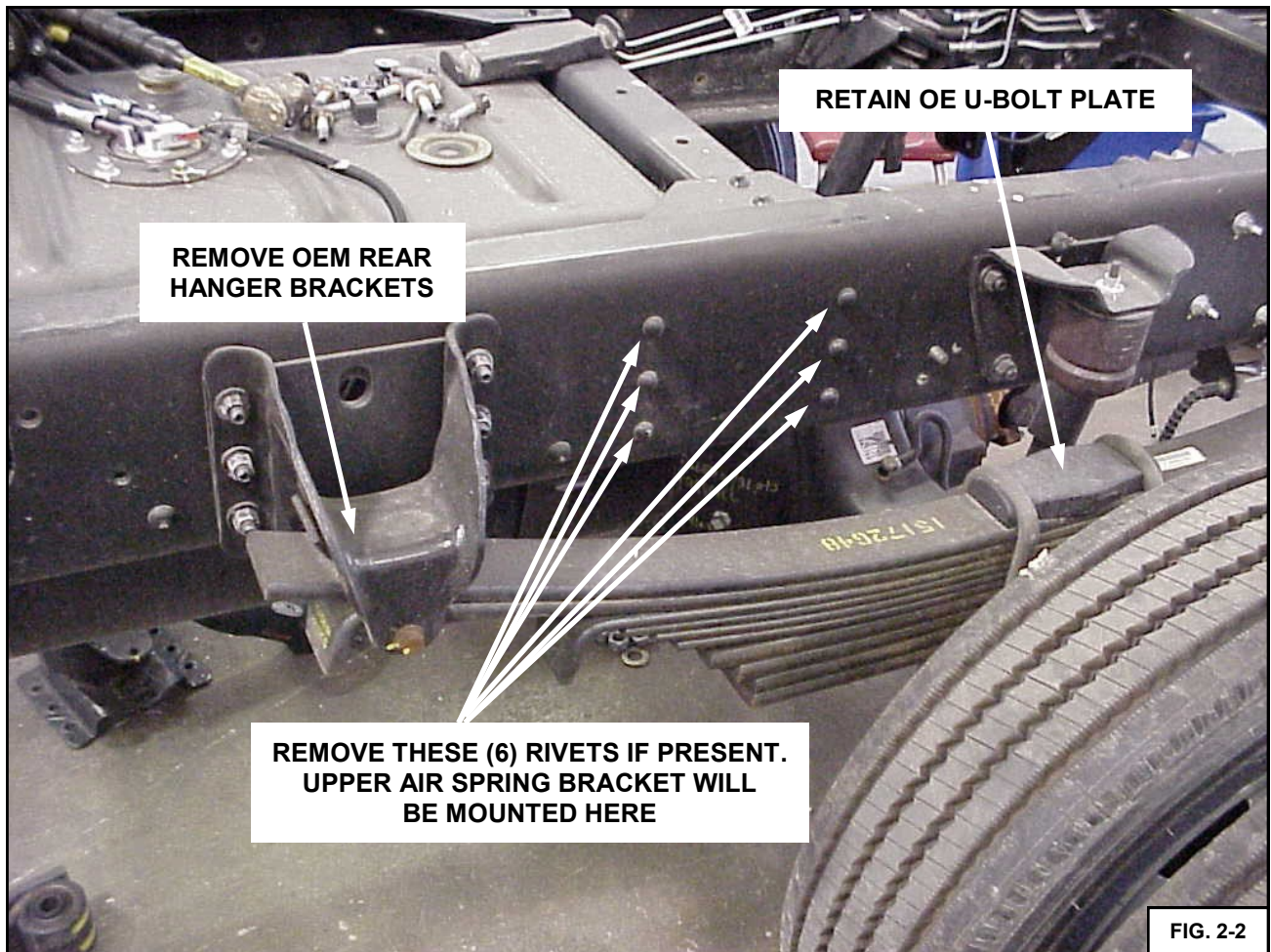


FIG. 2-1



3. DRIVER SIDE ASSEMBLY

1. Review Figure 3-3 & Parts List/ Drawing (Section 10) to acquaint yourself with the various parts of the UltraRide suspension.



2. Fasten the FRONT HANGER to the frame using (6) 1/2 x 1 3/4 UNC FLANGE BOLTS and (6) 1/2 UNC TOP LOCK FLANGE NUTS, supplied with kit. (See Table 10-1 for appropriate Torque).



3. Place the frame mounted LATERAL CONTROL ROD BRACKET to the inside of the frame. Fasten this bracket to the frame using (4) 1/2 x 1 3/4 UNC FLANGE BOLTS and (4) 1/2 UNC TOP LOCK FLANGE NUTS, with bolts protruding through from the inside out. Place The OE Jounce Bumper back in place on the outside of the frame as it was. (See Table 10 -1 for appropriate Torque).

4. Position the DRIVER SIDE TRAILING ARM on top of the axle, with front bushing mounted to the front surface of the HANGER BRACKET. Secure loosely with (2) 3/4 X 3 UNC FLANGE BOLTS AND (2) 3/4 UNC FLANGE NUTS. See Fig. 3-3.



5. Fasten the UPPER AIR SPRING BRACKET , and AIR SPRING to the frame using (6) 1/2 X 1 3/4 UNC FLANGE BOLTS and (6) 1/2 UNC TOP LOCK FLANGE NUTS. Orient the bolts so that they point away from the vehicle. Tighten the 3/4 UNC JAM NUT on the lower AIR SPRING STUD that goes through the TRAILING ARM. (See Table 10-1 for appropriate Torque).



6. Install TRAILING ARM to axle using new supplied U-BOLTS. Use the OE upper leaf spring assembly plate and lower stabilizer bar plate as they were used in the original leaf spring setup. (See Fig 3-3) Tighten in a crisscross pattern. (See Table 10-1 for appropriate Torque).



7. Torque the (4) 3/4 X 3 UNC FRONT TRAILING ARM front pivot bolts. (See Table 10-1 for appropriate Torque).

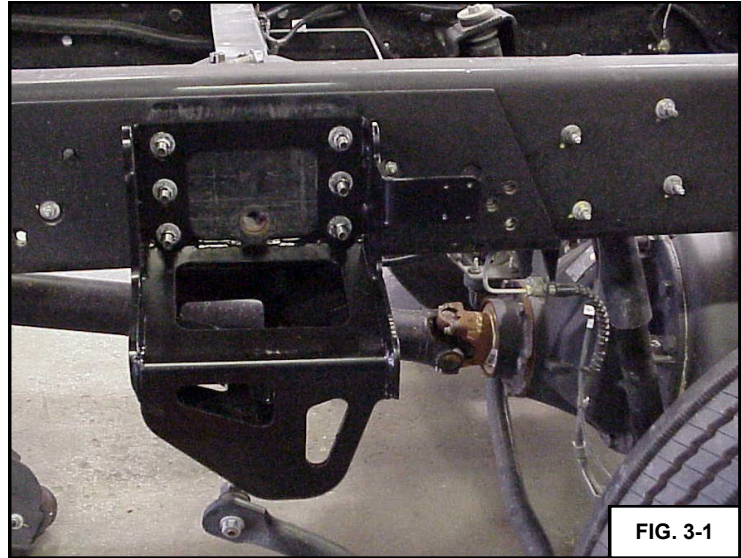


FIG. 3-1

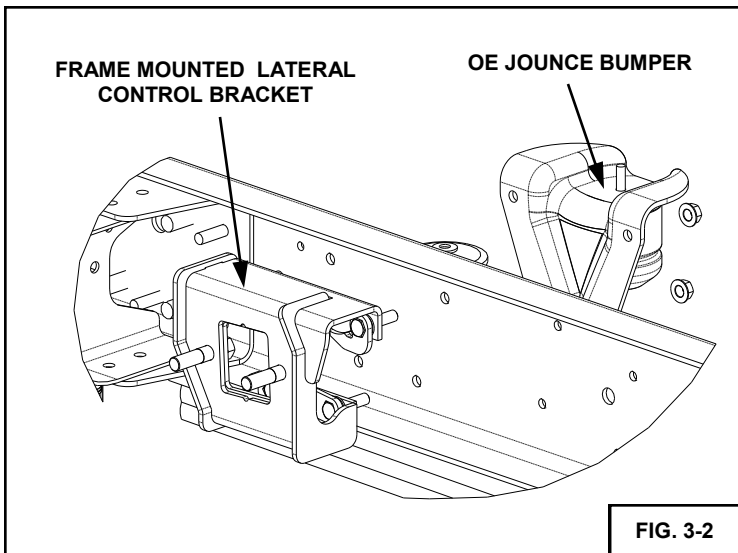
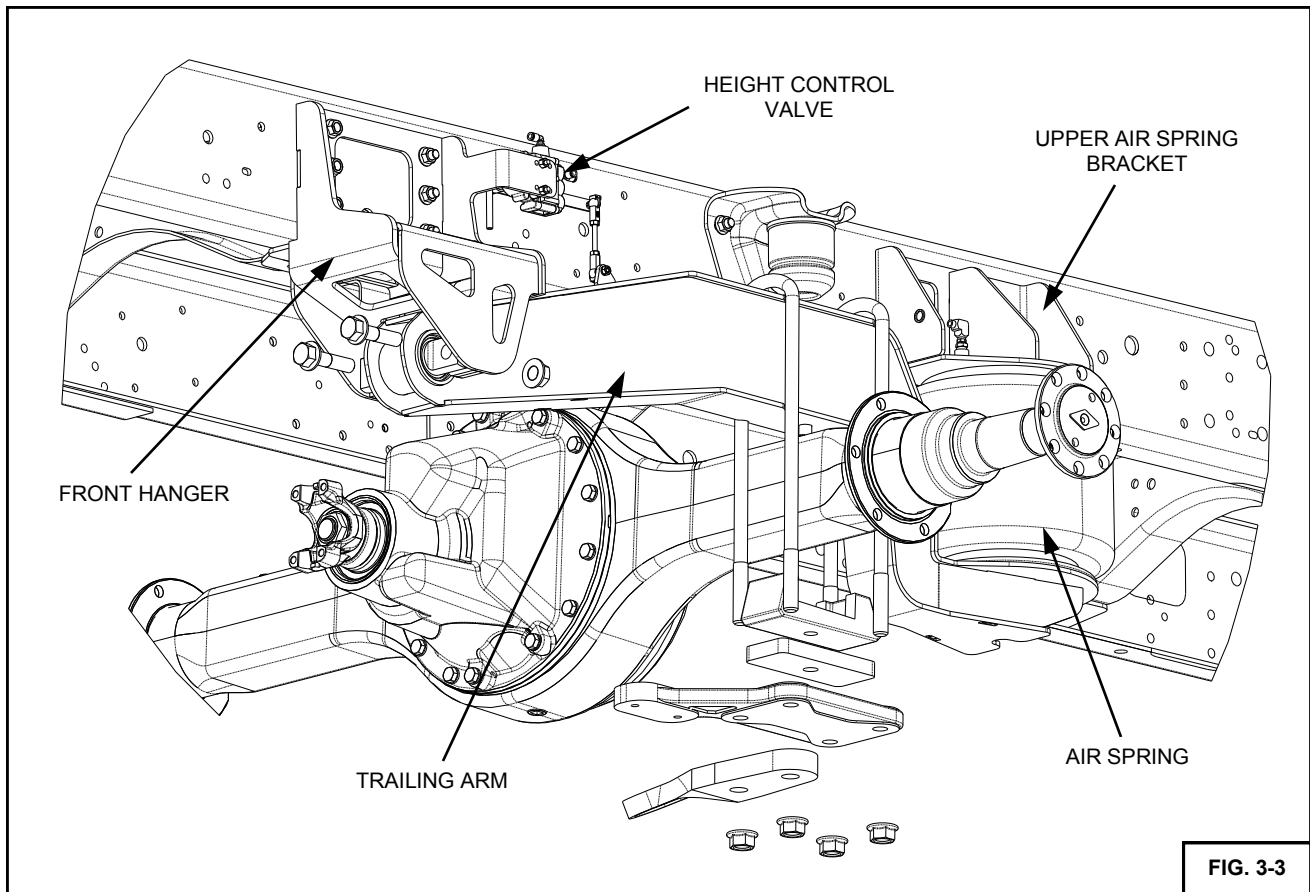


FIG. 3-2



8. **AFTER BOTH SIDES HAVE BEEN INSTALLED (SECTIONS 3, 4, 5, 6), COMPLETE THE FOLLOWING STEPS:**
9. Install the new SHOCK ABSORBERS in the same orientation as factory, using hardware provided.
10. **IMPORTANT: Route all brake cables away from the air spring and other moving components.** It may need to be tied, or slightly repositioned in order to accommodate this.

4. PASSENGER SIDE DISASSEMBLY

1. Repeat Section 2 for the passenger's side of the truck.

5. PASSENGER SIDE ASSEMBLY

1. Repeat Section 3 for the passenger's side of the truck.
2. Check all clearance points and all alignments. See Figure 5-1 for details.



IMPORTANT: Double-check all fasteners for proper torque.

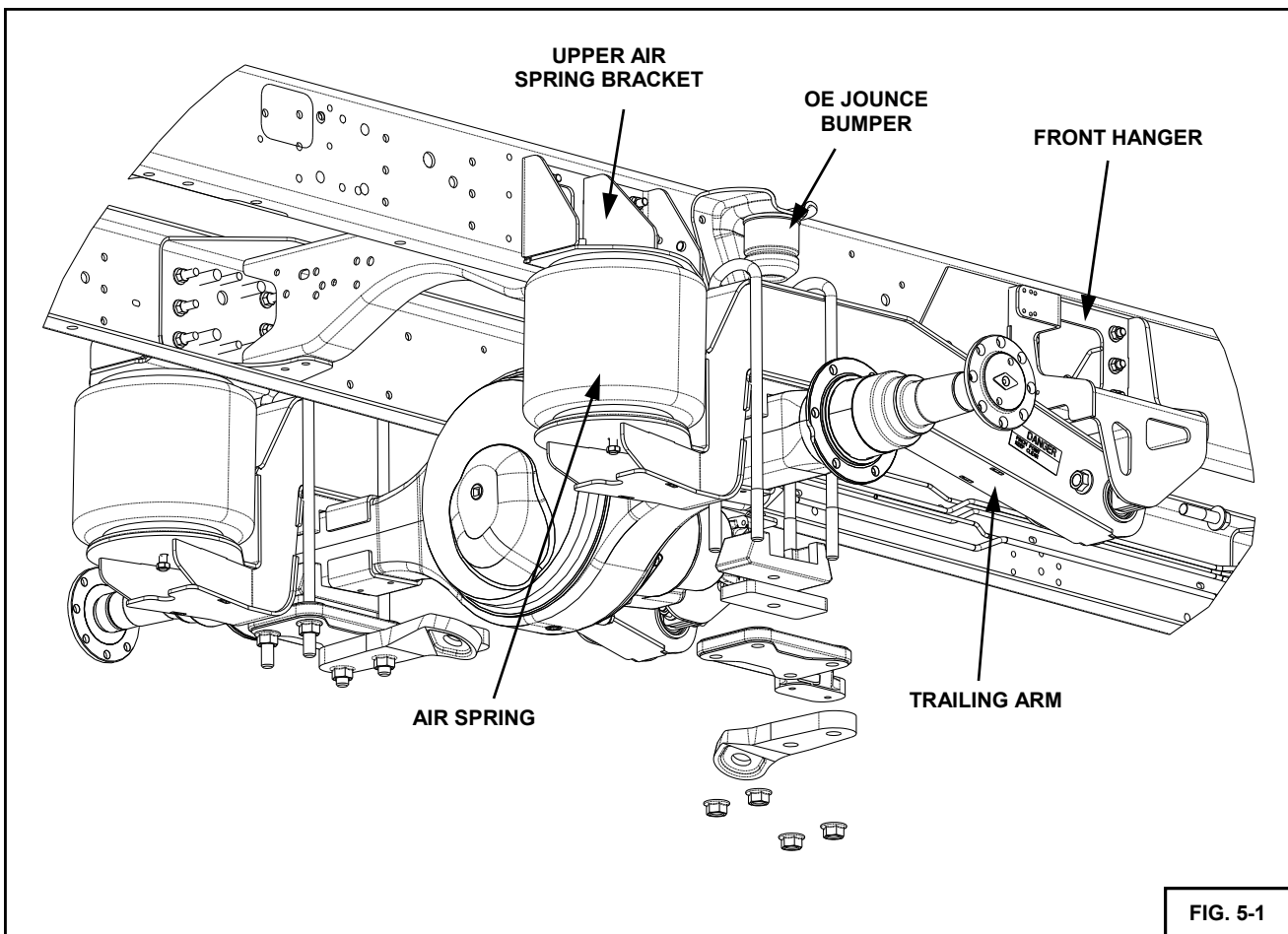


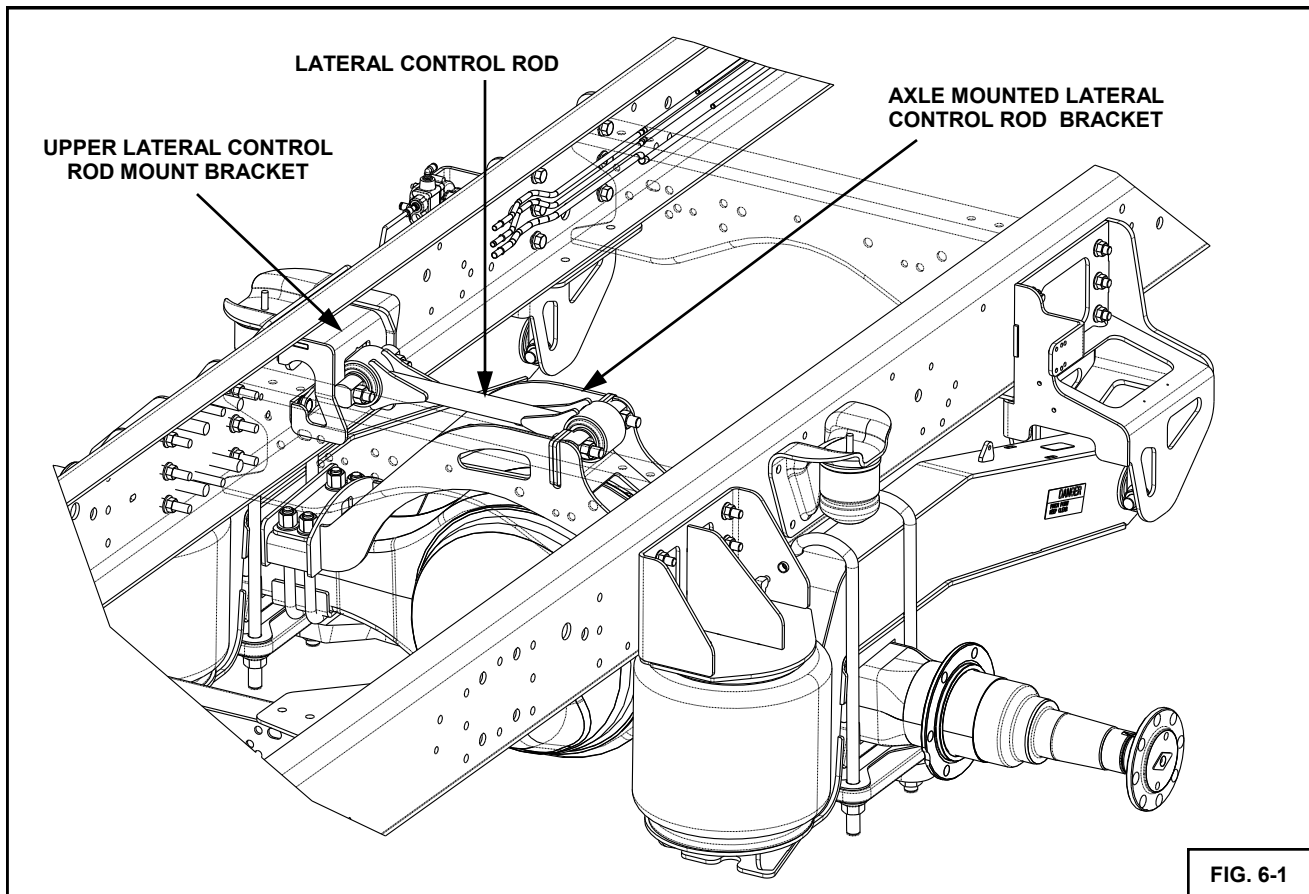


FIG. 5-1

6. LATERAL CONTROL ROD

1. Position AXLE MOUNTED LATERAL CONTROL ROD BRACKET onto axle as shown in Fig. 6-1. Mount Loosely to axle using (4) 5/8 UNF SQUARE U-BOLTS, (8) 5/8 SAE HARDENED WASHERS, and (8) 5/8 UNF HIGH NUTS. Note: If Truck uses Dana S150 axle (22k GVW truck), (4) SPACERS (Part No. 80001035) will be needed between this bracket and the axle itself as shown in the Parts List.
2. Check to make sure that the axle itself is centered between the frame rails by measuring from the outside of the driver and passenger side frame rails to the inside of the wheel hub, or tire.
-  3. Once both sides of the air suspension and both LATERAL CONTROL ROD BRACKETS are installed, mount the LATERAL CONTROL ROD between the two sides using (2) 5/8 X UNF BOLTS and (2) 5/8 UNF TOP LOCK NUTS (See Table 10-1 for appropriate Torque). See Figure 6-1 for details. Make sure when tightening that the lateral control rod connection maintains its transverse orientation.
-  4. With Truck set at Design Height (See Fig. 9-1), tighten (8) 5/8 UNF HIGH NUTS that were assembled loosely in step 1 (See Table 10-1 for appropriate Torque).

NOTE: Inspect Lateral Control Rod for any interference with other components, paying close attention to clearance with any flexible components such as brake and fuel lines.



7. AIR CONTROL SYSTEM ASSEMBLY

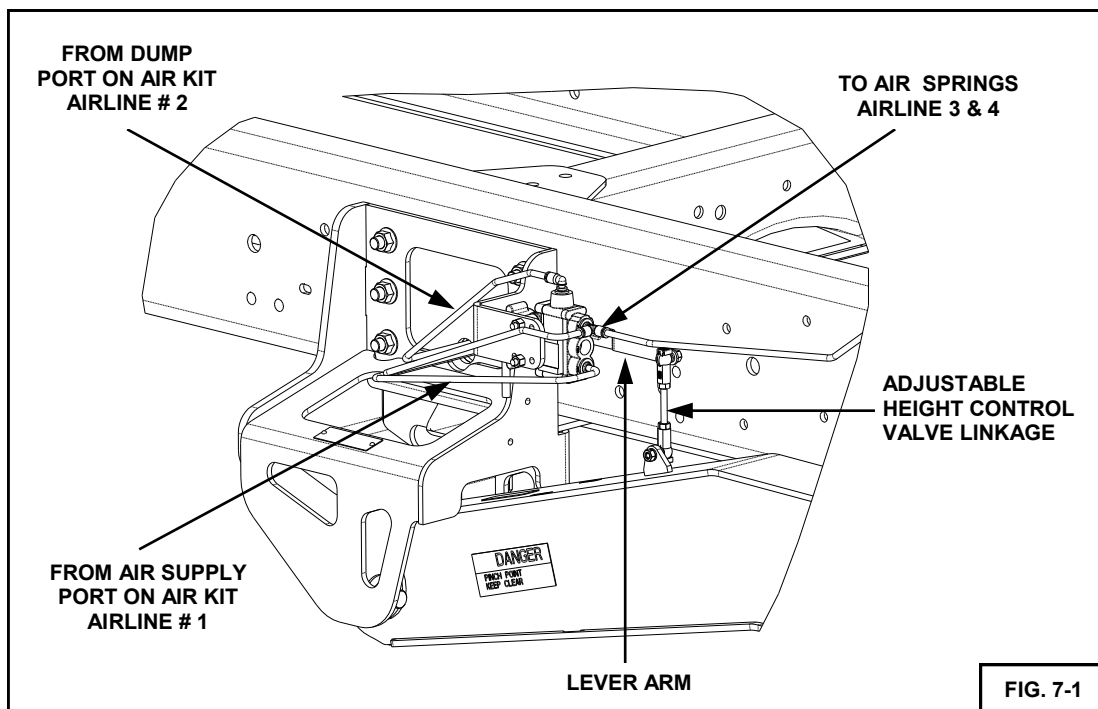


CAUTION! Route all airline away from exhaust, moving parts, and sharp objects. Be careful not to crimp the edges of the tubing. When installing the airline, fully insert into fitting and give a slight pull to seat properly and to be sure airline will not pull out.

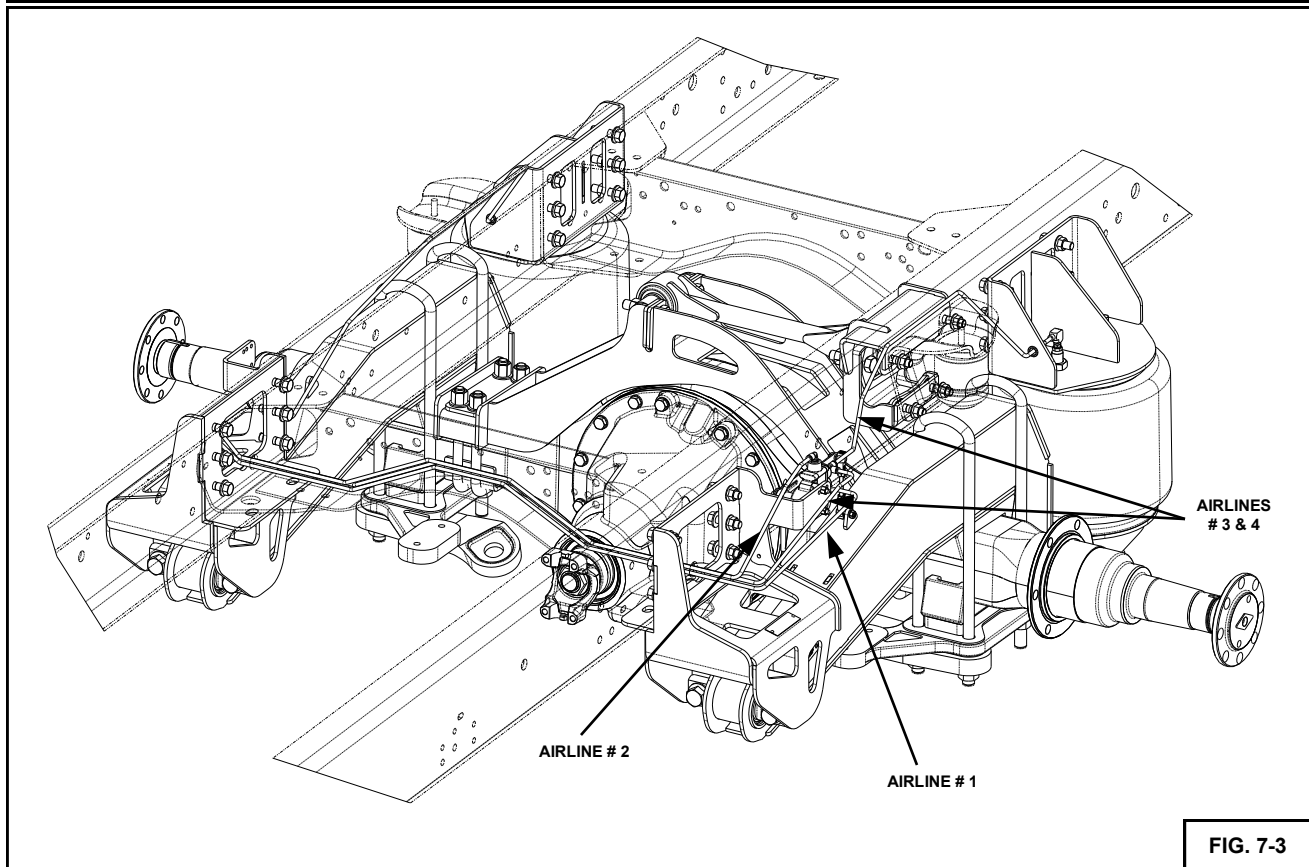
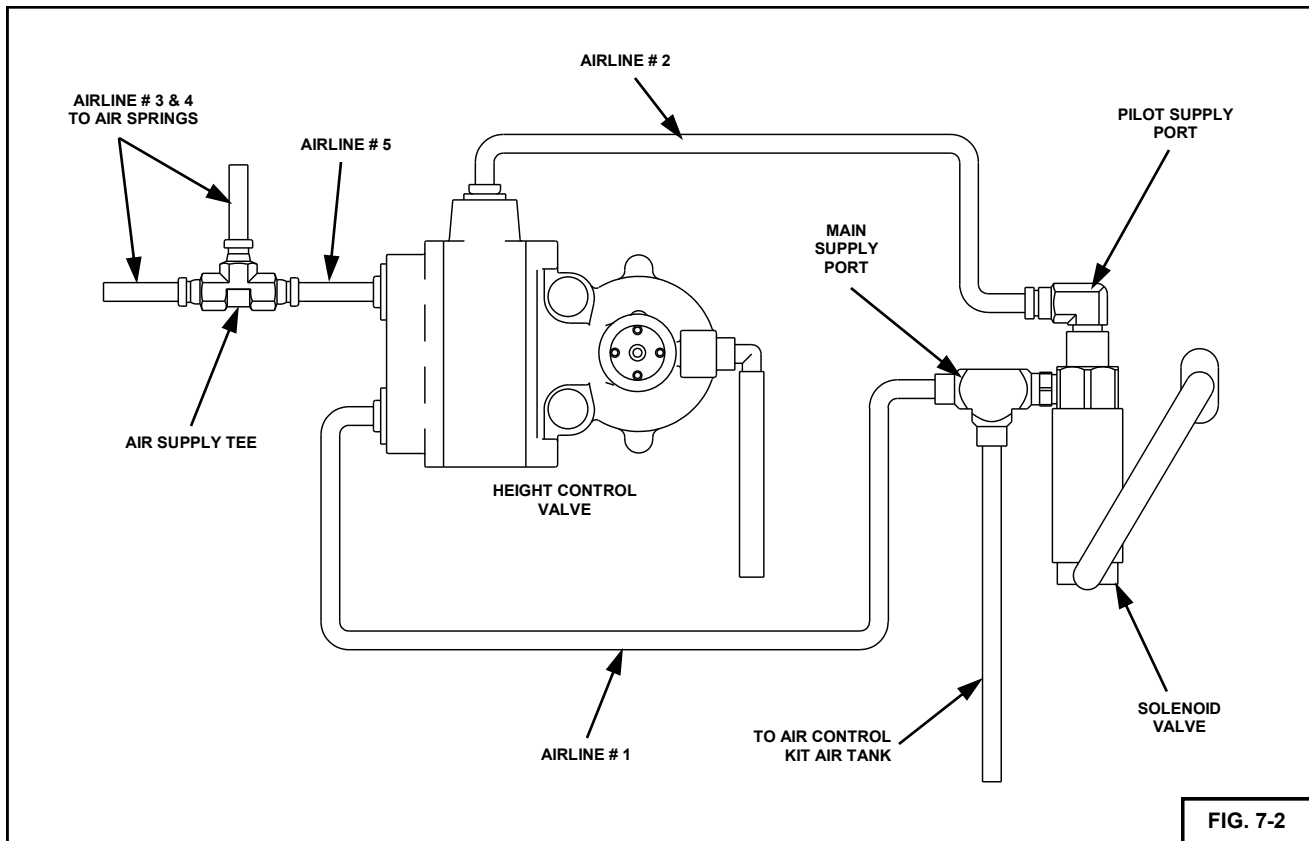
Note: If your vehicle has a frame body that does not allow the air control system box to be located as shown, you will need to determine another location for mounting and then drill the necessary holes. If installing on the frame underneath the cab, make sure it is mounted as high on the frame as possible to allow for ground clearance below the tank.



1. Mount the Air Control Box to the side of the frame in the specified location. Use (4) 5/16 X 1 3/4 UNF FLANGE BOLTS and (4) 5/16 UNF TOPLOCK FLANGE NUTS to fasten the Air Control Box to the frame, placing the rubber isolators between the box and frame. Do not tighten the fasteners so tight that back of the Air Control Box contacts any bolts protruding from the frame. (See Table 10-1 for appropriate Torque).
2. Route the (6) airlines as shown in Figures 7-1, 7-2, & 7-3.
 - 2.1. Route AIRLINE 1 from the supply port of the Height Control Valve to the lower outlet port of the Air Reservoir Solenoid.
 - 2.2. Route AIRLINE 2 from the top Elbow in the Height Control Valve to the elbow in the Air Reservoir Solenoid.
 - 2.3. Route AIRLINE 3 & 4 from the Run Tee on the del port of the Height Control Valve to the Air Springs.
3. Place supplied corrugated loom onto all airlines. Use supplied cable ties and airline clips to secure airline and to keep it away from all hazardous objects. See Figure 7-4 for details.



AIR CONTROL KIT AIR CONTROL SCHEMATIC



8. ELECTRICAL SYSTEM

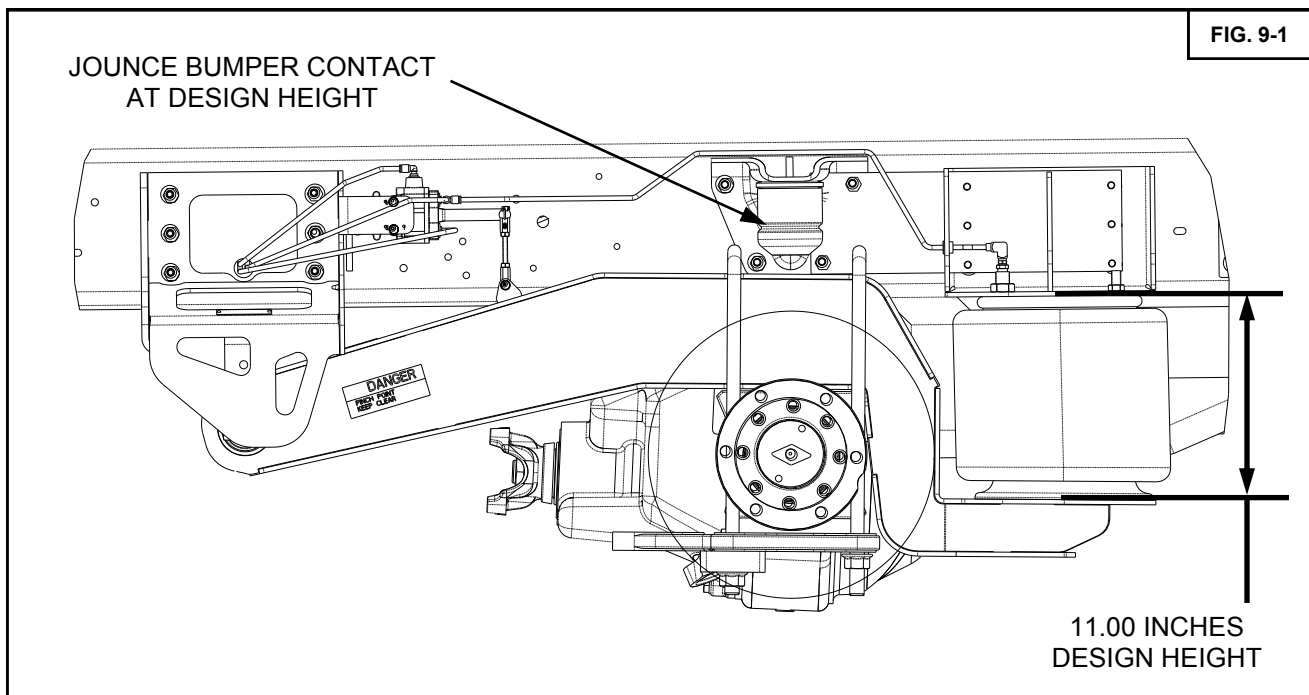


CAUTION! All wiring should be routed and secured neatly to avoid any functional or visual issues. Under-hood and under-body wire routings should be clear of sharp edges (3/4 inches minimum) and direct sources of heat (4 inches minimum). Wiring located in the passenger compartment should be routed away from high temperature areas over the muffler. Wiring should not be routed through wheel well areas where it may be damaged by tire or road debris, and it should not be routed over the exhaust system. Wiring should not contact the brake lines or fuel lines. Disconnect the battery cables before servicing any electrical components. See *GM Documents 173237 and 173165*. Refer to the *GMT560 Best Practices Manual* for more information on tying into electrical components.

1. Refer to **AIR CONTROL KIT OWNERS MANUAL** for further details on electrical system installation and parts list.

9. FINAL INSPECTION & OPERATION

1. Recheck all fasteners for specified torque.
2. Double-check all electrical connections and wire routings.
3. Remove all jacks and air system up by either using the fill valve on the air tank or by starting the vehicle and switching the compressor switch to "ON". Note: the maximum allowable pressure in the air tank is 120 psi. It is recommended to fill the air tank using the supplied Schrader valve so that the compressors are not taxed too much by running for a long period of time.
4. Check for proper operation of the height control valves. With one end of the valve linkage disconnected rotate the valve arm down 45°, air should exhaust from the air springs. Rotating the valve arm up 45° should cause the valve to fill the air springs.



5. Measure the "Design Height" of the air springs. The height should be as shown in Figure 9-1, and **measured at the middle of the air spring**. To adjust the design height (see Figures 9-2, 9-3) disconnect one end of the valve linkage and adjust accordingly. Turn the plastic ball end joint to change the length of the linkage (increasing the length will increase the Design Height, and vise-versa). Tighten the lock nuts on the valve linkage when complete. See Figure 10-3. **Set the design height by the following sequence:** 1) Deflate the passenger side air bag by disconnecting the linkage from the arm. 2) With the driver side linkage connected, measure the design height and adjust accordingly by the methods mentioned above. 3) Once the design height is set for the driver side, repeat the same steps for the passenger side, including deflating the driver side air bag. Once the design height is set, reconnect the linkages. Jostle the suspension up and down and then allow it to come back to design height. Recheck the initial measurement and adjust if needed. **Note: this procedure to set design height can only be done when empty or under light load.**
6. Move the suspension through its entire range of motion by inflating and deflating the air springs to achieve full travel. Check for any interferences with the lateral control rod, axle, shocks, exhaust, frame, brake lines (**especially on the driver side**), fuel lines, etc. Reconnect the valve linkage to the lever. **Note: if contacting the brake lines, hand caulk the line to make clearance at least 1/4" between the brake line and the axle brackets.**
7. **IMPORTANT!** Check all fittings and airlines for air leaks.
8. Reinstall the chassis body (if applicable).
9. **IMPORTANT!** During servicing, check tightness of all fasteners and for any air system leaks. See Table 10-1 for torque specifications. Immediate corrective action should be taken if malfunctions occur.
10. After all final checks are complete, it is recommended to complete a full four-wheel alignment and drive line angle check. The pages following the installation instructions describe the proper method for checking driveline angles. Note: improper driveline angles may have a detrimental effect on ride, u-joints, and transmission. If any driveline vibration (or out of spec. angle measurement) occurs, use factory axle seat shims to modify driveline angle.
11. Kneeling Operation: Moving the switch "ON" to Dump will exhaust all air from the air springs and lower the rear of the vehicle approximately 3-4 inches. Air springs will inflate when the switch is returned to the "OFF" position. **WARNING: Do not drive the vehicle while the Dump Switch is on and the air springs are deflated.**



TORQUE TABLE (Table 10-1)		
LOCATION	FASTENER	TORQUE
FRAME MOUNTED FRONT HANGER	1/2 UNC NUTS	90-120 FT-LBS
FRAME MOUNTED UPPER AIR SPRING BRACKET	1/2 UNC NUTS	90-120 FT-LBS
FRAME MOUNTED LATERAL CONTROL ROD BRACKET	1/2 UNC NUTS	90-120 FT-LBS
AXLE MOUNTED LATERAL CONTROL ROD BRACKET	HIGH NUTS FOR 5/8 UNF U-BOLTS	130-170 FT-LBS
LATERAL CONTROL ROD	5/8 UNF NUTS	180-240 FT-LBS
AIR SPRING STUD	3/4 UNC JAM NUTS	40-50 FT-LBS
TRAILING ARM	FLANGE NUTS FOR M20 U-BOLTS	250-325 FT-LBS
FRONT TRAILING ARM PIVOT BOLTS	3/4 UNC NUTS	280-375 FT-LBS
AIR CONTROL BOX	5/16 UNF NUTS	15-20 FT-LBS

10. SERVICE & MAINTENANCE

The UltraRide suspension needs no lubrication and little maintenance. The following components should be checked at the time the truck is being serviced. However, immediate corrective action should be taken if a serious malfunction occurs. See Exploded Assembly on following page for details.

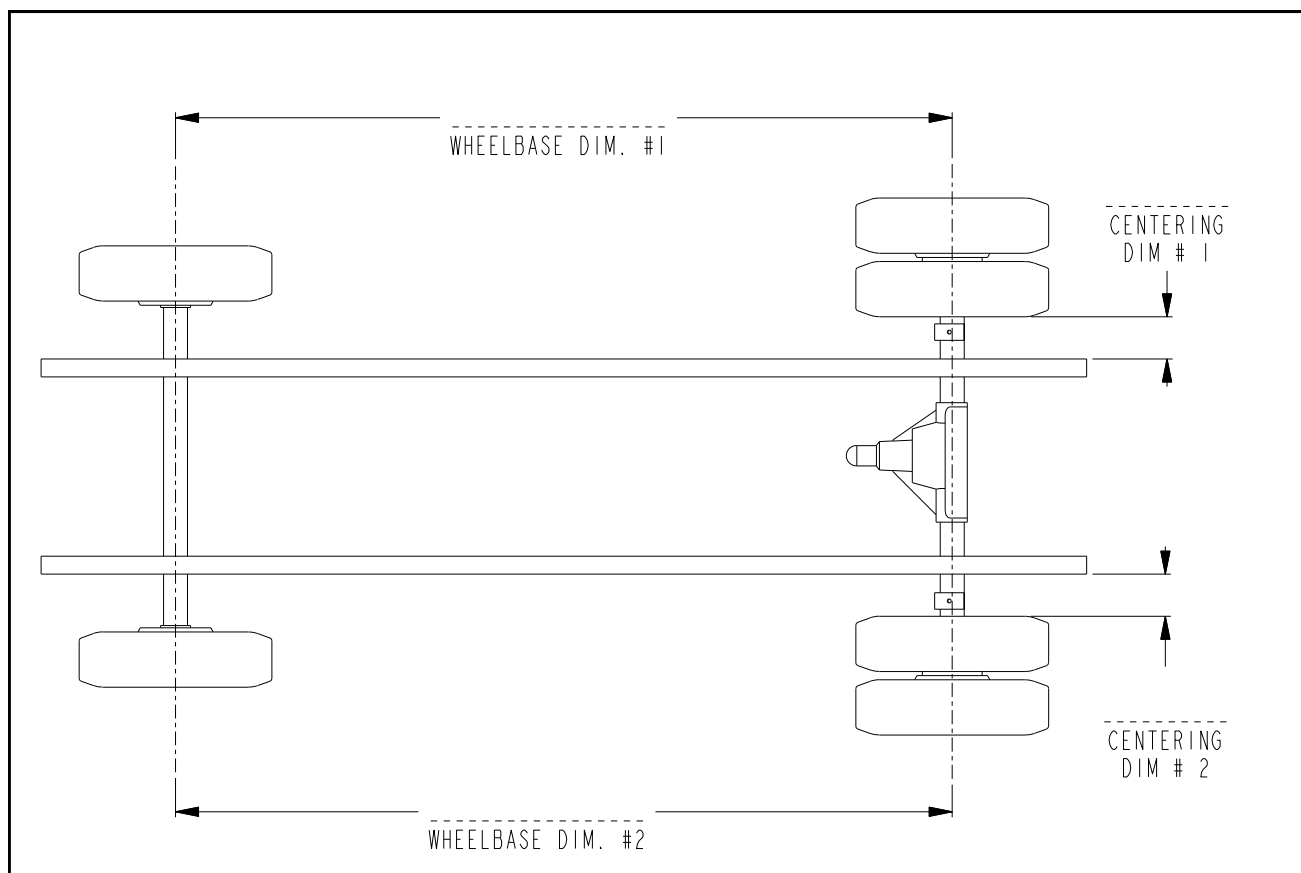


CAUTION! If maintenance or service is to be done on the air system, be sure to drain **all** air from system. Serious injury could occur if components are removed while system is full of air.

Note: It is important to release any moisture contained within the air reservoir on a daily basis. This can be done by pulling on the cable attached to the drain valve. See Figure 7-3. Not releasing the moisture on a regular basis will cause the drain valve to not operate properly, and may cause the valve to malfunction. Excess moisture in the system can also cause premature failure of other components, as well as the tank itself.

INSTALLATION & MAINTENANCE CHECK LIST

- ☐ Check and document OE rear axle alignment
- ☐ Set Design Height to 11.0 inches
- ☐ Verify suspension function via dump and re-inflation
- ☐ Check for air leaks and system integrity
- ☐ Check clearances throughout suspension motion range
- ☐ Check driveline angle
- ☐ 4 wheel alignment
- ☐ After installation, measure and record wheelbase and centering dims below (Fig. 10-2)

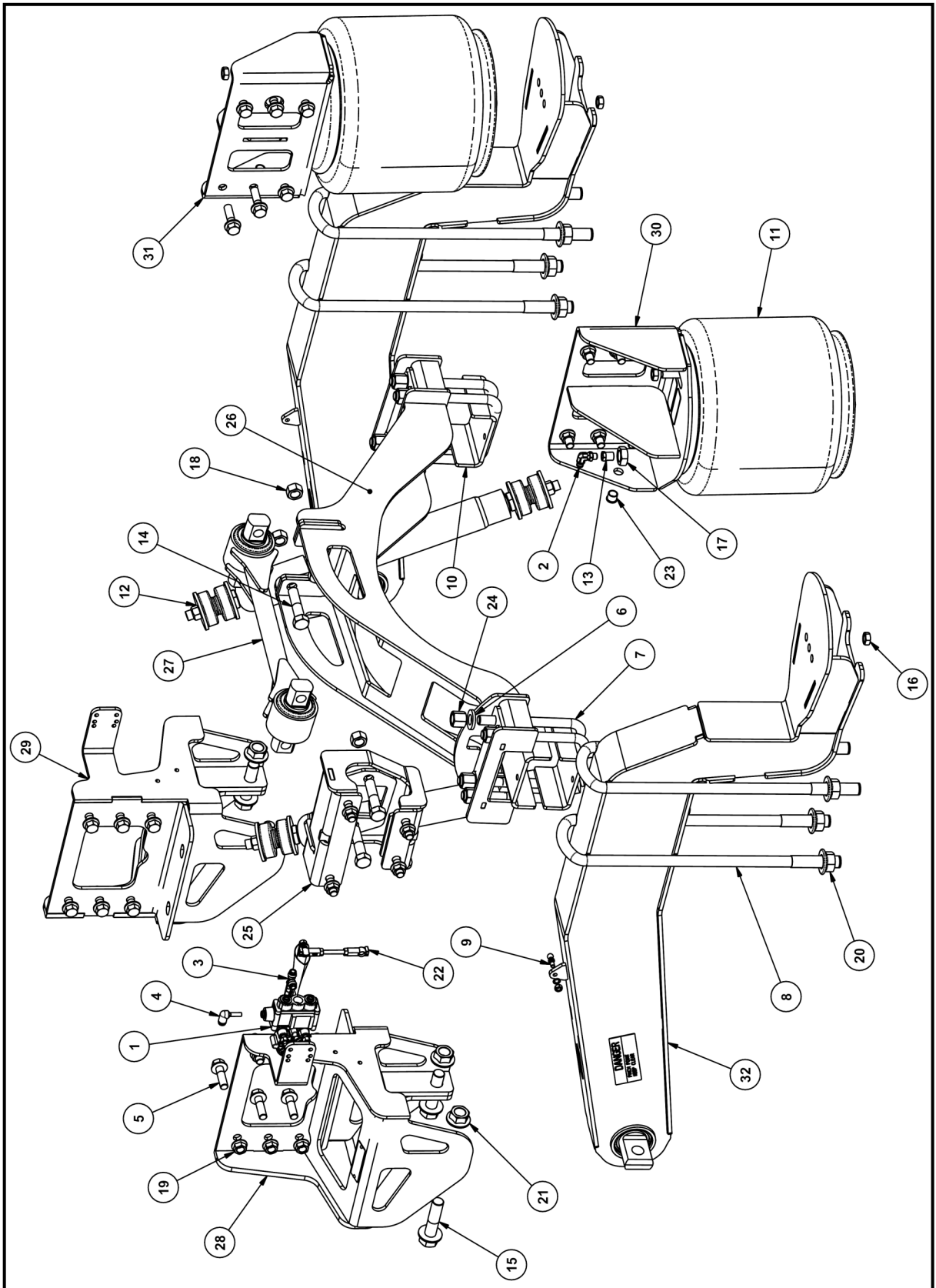


***UltraRide* – GMC C5500**

PARTS LIST

ITEM	PART NO.	DESCRIPTION	QTY
1	13010062	VALVE-CONTROL, HEIGHT	1
2	13025090	ELBOW, 1/4 TB 1/8 M-NPT, PUSH-IN DOT	2
3	13025497	RUN TEE-PLUG IN, 1/4"	1
4	13025499	ELBOW-PLUG-IN, 1/4"	1
5	14111614	1/2 X 1 3/4 UNC FLANGE BOLT (GRADE 8)	28
6	14882002	5/8 HARDENED WASHER, ZINC PLATED	8
7	14950029	U-BOLT-SQUARE, 5/8 UNF, 5.06 X 7.00	4
8	14950030	U-BOLT, M20 X 2.50, 79 X 465	4
9	29910024	PIVOT BALL KIT	2
10	80001035	ADAPTER-AXLE, GM5500HD, 15K	4
11	1103-0505	SPRING-AIR	2
12 *	SEE NOTE	SHOCK ABSORBER	2
13	1302-2014	REDUCER, 1/8 F-NPT 1/4 M-NPT	2
14	140D-2022	5/8 X 2 3/4 UNF HEX CAP SCR (GR 8) O&P	4
15	141A2424	3/4 X 3 UNC FLANGE BOLT (GR 8) O&P	4
16	1474-1600	1/2 UNC HEX JAM NUT	4
17	1475-2402	3/4 UNF HEX JAM NUT, O&P	2
18	1477-2006	5/8 UNF HEX TOP LOCK NUT (GR C) O&P	4
19	1480-1604	1/2 UNC TOP LOCK FL NUT (GR G) O&P	28
20	1480-2002	HEX TOP LOCK FLANGE NUT, M20 X 2.5, CLASS10	8
21	1480-2404	3/4 UNC TOP LOCK FL NUT (GR G) O&P	4
22	1500-0245	LINKAGE-VALVE, HEIGHT CONTROL (3.88)	1
23	1500-0303	SNAP BUSHING (.250 MAT'L)	2
24	1506-0016	5/8 UNF HEX HIGH NUT	8
25	800M0086	BRACKET-MOUNT, LCR, UPPER	1
26	800M0087	BRACKET-MOUNT, LCR, LOWER	1
27	800M0088	LATERAL CONTROL ROD	1
28	810M0025	HANGER	1
29	810M0026	HANGER	1
30	810M0028	BRACKET-MOUNT, AIRSPRING	1
31	810M0029	BRACKET-MOUNT, AIRSPRING	1
32	820M0011	ARM	2
* - THE 15K AXLE USES SHOCK ABSORBER 1210-0506 AND THE 19K AXLE USES 1210-0511.			

UltraRide – GMC C5500



***UltraRide* - TROUBLESHOOTING GUIDE**

COMPONENT	POSSIBLE PROBLEM	CORRECTIVE ACTION
Airlines	Air leaks	Replace airline
Fittings	Air leaks	Remove fitting and apply fresh joint compound. Reinstall fitting, but Do Not Over tighten. Do not use Teflon tape.
Air Springs	A. Improper height B. Air leakage	A. Adjust valve linkage to maintain proper air spring height. B. Replace air spring.
Height Control Valve*	Air spring(s) will not inflate when weight is added to the chassis. OR Air spring(s) will not deflate when weight is removed from the chassis.	A. Inspect valves to insure drive bearing notch is located correctly. The driver side valve notch on " SUPPLY " port side of valve, passenger side on " SUSP " port side. If not, loosen lever screw (but do not remove completely) and pull lever loose from drive bearing, rotate drive bearing until the drive bearing notch is in the correct position and re-secure lever by tightening lever screw. See Fig. 11-3 & 11-4 for orientation details B. Replace valve.
Shock Absorber	Insufficient damping effect	Replace shocks
Lateral Control Rod	A. Loose nuts on lateral control rod bolts B. Worn bushings	A. Tighten securely. B. Replace lateral control rod.

GMC C5500 OWNERS GUIDELINES

The UltraRide suspension needs no lubrication, and little maintenance. However, immediate corrective action should be taken if a serious malfunction occurs.



CAUTION! If maintenance or service is to be done on the air system, be sure to drain all air from the system. Serious injury could occur if components are removed while system is full of air.

PRODUCT OWNER RESPONSIBILITIES

- ❑ Owner is solely responsible for pre-operation inspection, periodic inspections, maintenance, and use of the product as specified in the particular LINK MFG. instructions available by product model, except as provided in this warranty, and for maintenance of other vehicle components. Of particular importance is the re-torque of fasteners including axle u-bolts, torque rod bolts, and track rod bolts. This re-torque must be performed within 90 days of the suspension being put in service.
- ❑ Owner is responsible for “down time” expenses, cargo damage, and all business costs and losses resulting from a warrantable failure.
- ❑ The UltraRide Chassis Air Suspension is fully automatic in controlling the height of the chassis. No manual intervention to control air pressure or ride height is needed during the course of operation.
- ❑ The Compressor Switch must be on for the compressors to operate. During difficult starting circumstances, (i.e. extremely cold weather) it is recommended to turn the compressor switch off until the vehicle is running, so it will not draw current from the battery. The compressors are controlled by the pressure switch located in the Air Control Box. This switch automatically turns the compressors on when the tank pressure falls below 100 psi, and turns them off at 120 psi.
- ❑ The Low Pressure Warning Light indicates a severe drop in tank pressure (below 60 psi). Immediate corrective action should be taken to determine the cause of air loss. Compressor switch should be turned off if Low Pressure Warning Light is on, and remains on even after the compressors have run for a normal period of time. **NOTE:** The Low Pressure Warning Light could come on briefly when the “Dump” feature is being used.
- ❑ It is important to release any moisture contained within the air tank on a daily basis. This is done by pulling on the attached release cable for approximately 5 seconds. See Air Control Kit Owners Manual for location of this cable. Not releasing the moisture on a regular basis will cause the drain valve to not operate properly.

CHECK AT EVERY VEHICLE SERVICE INTERVAL:

- ❑ Check Design Height $\pm\frac{1}{4}$ ”.
- ❑ Check for air leaks around fittings.

CHECK AFTER THE FIRST 1000 MILES:

- ❑ Recheck & tighten any loose fasteners.
- ❑ Check for any loose or worn components.

CHECK AFTER EVERY 30,000 MILES:

- ❑ Check arm pivot bushings and lateral control rod bushings for wear; replace if worn

Guideline - Driveline Angles

After vehicle build is complete, the driveline angles must meet the following "rules", both at unloaded, and fully-loaded, vehicle attitudes.

Rule #1: The NET OPERATING ANGLE, at any individual joint, must be at least 1/2 degree, and not to exceed 3 degrees. The net operating angle at any individual joint on an F Super Duty (F250, F350, F450, or F550) must not exceed 4 degrees. The preferred maximum angle is 2 degrees.

The NET OPERATING ANGLE (e) at any one joint is the combination of the joint angles in both the side view and the plan (top) view. This NET OPERATING ANGLE (e) equals:

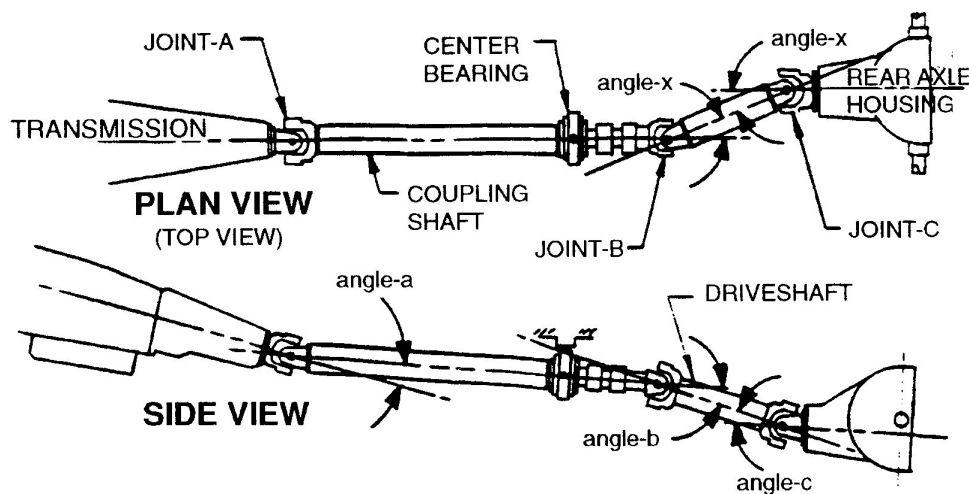
By example, using Figure 1:
The NET OPERATING ANGLE at **JOINT - A** = (ea) =

The NET OPERATING ANGLE at **JOINT - B** = (eb) =

The NET OPERATING ANGLE at **JOINT - C** = (ec) =

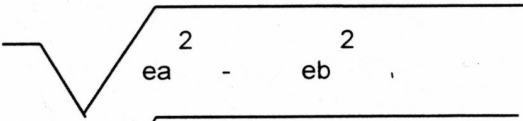
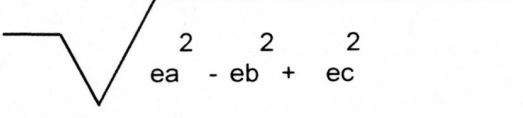
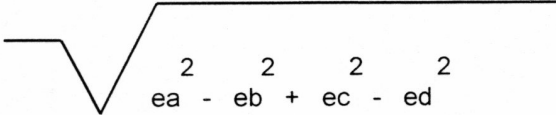
$$\begin{array}{l}
 \left[\begin{array}{c} \text{Plan View} \\ \text{Angle} \end{array} \right]^2 + \left[\begin{array}{c} \text{Side View} \\ \text{Angle} \end{array} \right]^2 \\
 \hline
 (0)^2 + (\text{angle} - a)^2 \quad \geq 0.5^\circ \quad \leq 3.0^\circ \text{ or } \leq 4.0^\circ \\
 \hline
 (\text{angle} - x)^2 + (\text{angle} - b)^2 \quad \geq 0.5^\circ \quad \leq 3.0^\circ \text{ or } \leq 4.0^\circ \\
 \hline
 (\text{angle} - x)^2 + (\text{angle} - c)^2 \quad \geq 0.5^\circ \quad \leq 3.0^\circ \text{ or } \leq 4.0^\circ
 \end{array}$$

Fig. 1



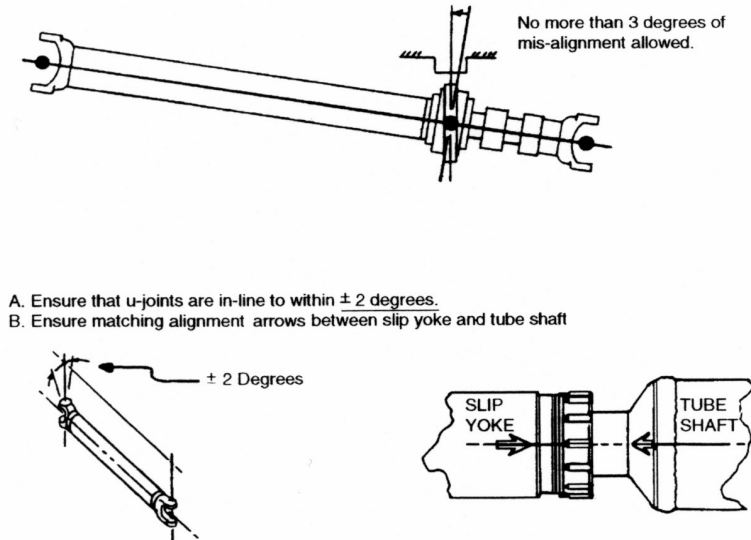
Guideline - Driveline Angles (Continued)

Rule #2: The combination of NET OPERATING ANGLES, throughout the whole driveline, **must** "cancel". It is preferred that the NET OPERATING ANGLES at either end of a shaft be within 1 degree of each other. However, at a minimum, the following formulas must be satisfied for sufficient "cancellation" to occur:

For a 1-shaft driveline: (2 - joint)		$\leq 3.0^\circ$ or $\leq 4.0^\circ$
For a 2-shaft driveline: (3-joint) (as exemplified in Figure-1)		$\leq 3.0^\circ$ or $\leq 4.0^\circ$
For a 3-shaft driveline: (4-joint)		$\leq 3.0^\circ$ or $\leq 4.0^\circ$

Rule #3: The center bearing mounting bracket, surrounding the rubber insulator, must be **90 ± 3 degrees** to the center bearing. In other words, no more than 3 degrees of mis-alignment can be absorbed by the rubber surrounding the center bearing. See Figure 2.

Fig. 2



Observe alignment arrows stamped on parts. If there are no alignment marks, then add them before disassembly to ensure proper phasing alignment of shaft and yoke.

GUIDELINE - DRIVELINE COMPONENT PHASING

MINIMUM UNIVERSAL JOINT OPERATING ANGLE:

A slight angle is required to prevent universal joints from brinelling. Therefore, a minimum operating angle of ½ degree is required.

MAXIMUM UNIVERSAL JOINT OPERATING ANGLE:

Universal joint operating angles can be quite high, sometimes as high as 12 degrees. But to get a vehicle to operate successfully above 3 degrees often requires larger universal joints, double cardan or constant velocity joints, or restrictions on operating speed. A reduction in universal joint life becomes noticeable when they are operated at more than 3 degrees if precautions are not taken. That having been stated, the F Super Duty series of trucks (F250, F350, F450, and F550) can tolerate angles up to 4 degrees. However, maximum angles of 2 degrees are preferable for all vehicles.

Two shafts connected with a single cardan joint and turning at a constant speed with no joint angle, have no angular acceleration that could cause a vibration. When there is an angle between them and the input shaft is turning at a constant speed, the driven shaft is forced to continuously accelerate and decelerate, twice per revolution, creating a vibration. If the speed changes are small, the vibration is not objectionable. The guidelines in this appendix limit driveline angular acceleration to a maximum of 400 radians per second per second. This is the requirement for all Ford light trucks. (SAE specifies 500.) Some modified drivelines have been measured at over 11,000 radians per second per second causing driveline failures at very low mileage.

DRIVELINE ANGLE MEASUREMENT:

Driveline angle measurements should be made with the vehicle supported by the tires and resting on a level surface. Avoid hoisting a vehicle by the frame since this will distort the chassis enough to make any measurements inaccurate.

MATCH MOUNTING DRIVESHAFTS TO THE REAR AXLE:

Runout is measured on OEM rear axle input shafts and the maximum measurement is marked with a yellow dot on the yoke or pilot bearing flange. The OEM driveshafts are also marked with a yellow dot on the "light" side. When the parts are assembled, the marks are aligned to aid the overall system balance. Vehicle modifiers should look for these dots and maintain this match when the drivetrain is reassembled after modification. Remanufactured or modified driveshafts should also have their "light" sides matched to the yellow dot.

DRIVELINE VIBRATION DAMPERS:

Driveline vibration dampers are sometimes added to driveshafts or axles to reduce noise, vibration, and harshness (NVH). If the chassis has these devices when it is received, they should be retained on the modified chassis.

USE OF DOUBLE CARDAN UNIVERSAL JOINTS FOR GREATER DRIVE ANGLES:

In general, the use of these joints can allow increased drive angles up to as much as 8 degrees. However, when used at the rear of a coupling shaft a double cardan universal joint will prevent cancellation from occurring at the forward end of the shaft. Therefore the single cardan joint must still be maintained at less than 3 degrees (or 4 degrees for the F Super Duty series).

GENERAL COMMENTS:

It is good practice, for any chassis that will have a driveline modification, to measure and record the driveline angles in each of the following conditions for later comparison.

- a. The chassis as first received from Ford (note that the drive angles may not conform exactly to this bulletin in this incomplete condition).
- b. The completed vehicle, unloaded.
- c. The completed vehicle loaded to GVWR with maximum front GAWR.
- d. The completed vehicle loaded to GVWR with maximum rear GAWR.