



INSTALLATION MANUAL

LOCK-RIGHT BY POWERTRAX

AUTOMATIC POSITIVE-LOCKING DIFFERENTIAL

LOCK-RIGHT™ Performance Locker Installation Manual

Four-pinion differential; split case

Typical of Toyota V6, Nissan V6, G.M. 14-bolt, Spicer 70, etc.

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Introduction

Welcome to the growing family of **LOCK-RIGHT** owners! This manual will help you install your new **LOCK-RIGHT** automatic 100% full-locking differential. When the installation is complete, your vehicle will have *extreme* traction! We trust that you will be pleased with its performance and thank you for your confidence in our products.

LOCK-RIGHT installation simply involves disassembling and re-assembling the existing differential case, replacing a few parts in the process. These instructions are detailed so that a person who is reasonably familiar with automotive work can install a **LOCK-RIGHT** in about three to four hours; please read them carefully before you start to be sure that you thoroughly understand them. Do not attempt shortcuts unless you know exactly what you are doing. These instructions also assume that you have the proper shop manual for reference to instructions about axle shaft removal, torque values, settings,

clearances, etc. that apply to your particular vehicle. Our manual is a general guide to operations but does not repeat all the shop manual details.

This manual describes the assembly of the **LOCK-RIGHT** into a four-pinion two-piece differential case that is held together by bolts. Some references may be made to the front axle or to 4x4 operation; if your vehicle is a 4x2, ignore them. Note that most of the photos are of a Toyota assembly; however, the installation of the **LOCK-RIGHT** itself into the differential case is the same for **Nissan, G.M. and Spicer** differentials and for others as well.

We suggest that your **first installation be done in the rear axle**. This is because the weight of the engine over the **front axle is reduced** by weight transfer to the rear as your vehicle climbs a hill, meaning that more and more weight is being applied to the axle with the locker in it as more **traction** is needed. If the locker is in the front, tractive weight becomes less as the hill becomes steeper.

Remember: This instruction manual is provided for your convenience to assist you or your mechanic with the installation of your new **LOCK-RIGHT**. However, the ultimate responsibility for the success of your installation and the subsequent proper operation of your vehicle rest with you, the vehicle owner.

When your installation is complete, you will have a vehicle with significantly increased capabilities that will be hard to believe. For continued “fun in the sun,” operate it in a safe and responsible manner. *Be sure to read and understand the driving information* in the **LOCK-RIGHT** Vehicle Owner’s Manual!

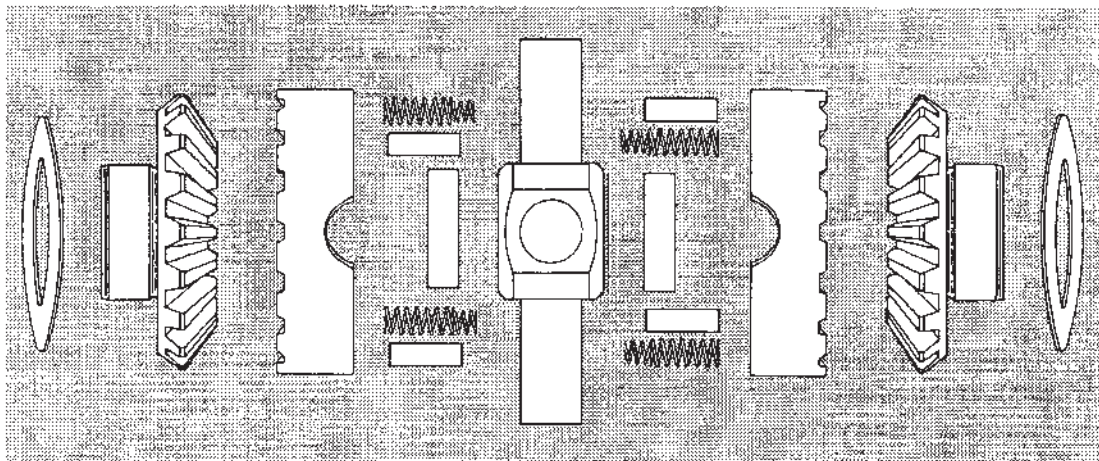
Background Information

The differential **case** is the round housing inside the rear axle assembly to which the ring gear is bolted and which contains the differential spider and side gear assembly. It is installed in the differential **carrier**, which is the housing that

holds the case, drive pinion gear, bearings, etc. The carrier may be removable (as part of a “drop-out” unit, or third member), or it may be integral (as a permanent part of the axle assembly, mounted in the vehicle). This manual covers the removable third member (drop-out) design with a split differential case.

The **LOCK-RIGHT** is designed to fit into **standard open differential cases only**, not into limited-slip (clutch-pack) type cases. If your vehicle contains a limited-slip unit you will need to purchase a standard open differential case and thrust washers before proceeding.

A word about side gear thrust washers: All differentials originally had a thrust washer under each side gear. Thrust washers are large in diameter and between about 1/32-inch (.031, or 0, 76-mm) and 1/16-inch (.062, or 1,52-mm) thick. If either one or both are missing from the original differential, **obtain new one(s) before proceeding!** The **LOCK-RIGHT** is designed to be used with a correct thrust washer under **each**



Thrust
Washer

Side
Gear

Driver

Stop
Pins

Pinion Shafts
& Shaft Block

Spacer &
Springs

Driver

Side
Gear

Thrust
Washer

Figure 1. LOCK-RIGHT Exploded View

side gear, and failure to use this washer is easy to observe during inspection and will void the warranty.

NOTE: The parts shown in the various figures are typical and may not exactly depict your particular model.

LOCK-RIGHT Installations Covered in This Manual

Third member (drop-out) differentials with a differential case that is split along the center line of the spider (in the middle). Typical of this design is the Toyota V6, Nissan V6, G.M. 14-bolt H.D. full-floater, Spicer 70 H.D. full-floater, etc.

Differential Removal Preliminary Steps

The following steps are only a general guide to preliminary operations used for preparing your vehicle for **LOCK-RIGHT** installation. For detailed information, refer to your shop manual. In general, the preliminary steps include:

a) Blocking the vehicle, putting transmission in neutral

- b) Loosening the wheel lug nuts** (tire removal may be optional; see shop manual)
- c) Jacking up the axle**; securely resting it on jack stands;
- d) Removing the tires** (some axles)
- e) Disconnecting the brake lines** and emergency brake cables (some axles)
- f) Disconnecting drive shaft**
- g) Pulling out one or both axles** a few inches.
- h) Removing the third member** from the vehicle.

Summary of steps in this section:

- a) Remove third member from vehicle
- b) Observe ring gear backlash amount and check differential condition
- c) Mark carrier, bearing caps and adjusters
- d) Remove adjuster locks, bearing caps and adjusters
- e) Mark one bearing race
- f) Remove differential case from carrier



Figure 2

Mark carrier, caps & adjusters at lock hole.

Removal of the Differential Case from the Carrier

1. Remove the third member from the vehicle as outlined above and described in the shop manual. **Follow all safety precautions.**

2. Check to be sure that the gears are in good condition and that nothing is loose, worn or scored. Rock the ring gear back and forth to get a “feel” for the backlash and check to see that it appears to be set up properly. If any out-of-spec conditions exist, be sure to correct them before subsequent re-assembly.

3. The differential can be removed and re-assembled without changing the ring and pinion settings if you are careful. **Mark everything** with a center punch! Don't touch a bolt until you have done so. We suggest placing the whole assembly upright (the same position as when in the vehicle), looking at the ring gear end. Mark the carrier and bearing cap

on the **ring gear side with one punch mark** and on the **other side with two marks (Figure 2)**. The caps are *not* interchangeable! Also mark each bearing adjuster directly under the lock with this same mark to note its side and rotational position. *This mark is very important to correct re-assembly!*

4. Remove the adjuster locks. Be sure that each adjuster is marked at the lock hole with the correct number of punch marks for each side. The adjusters are not interchangeable after they are marked for position! (In general, the adjuster locks themselves are interchangeable.)

5. Remove the bearing caps.

6. Slide (tap) the adjuster up and out and remove the bearing race on the ring gear side first and put a very small grind mark on the outside of the race to mark it. Scraping it on a cement floor also works, or you can use a tag. Be sure that you can identify it for proper re-assembly on the same side!

7. Remove the differential case and ring gear assembly from the carrier along with the other adjuster and bearing race.

Disassembly of the Differential Case

NOTE: It is important to re-assemble the differential case halves in their original relative positions. Place punch marks near each other on each half before disassembly. Note that some cases may already have been marked at the factory (as shown in **Figure 8**).

1. Remove the bolts holding the case together. In general, the ring gear will not need to be removed. If it does need to be removed, mark its location so that it may be replaced in the same rotational position.

2. Tap apart the case.

3. Remove the internal parts. Note which side gear is located in the top of the case—it will be placed in the bottom of the case upon re-assembly so that the former reverse sides of the teeth (less used) will be the new forward sides.

Inspection of the Parts

NOTE: These steps are important. The **LOCK-RIGHT** uses your case, side gears, thrust washers and spiders, and they must be in excellent condition. The four spider gears and their thrust washers are not used. If the following inspection shows that anything is bad, buy new parts from your dealer!

1. Thoroughly wash the differential case and remaining parts in solvent, then dry them.

2. The most important parts are the side gears. **Carefully inspect** them for chips, cracks, broken teeth, etc. Each tooth must be smooth and without any gouges or other defects. Polishing as a result of normal operation is acceptable as long as the wear is not excessive. If the sides of the teeth near the top are highly polished and rounded over, the gears should be replaced.

3. Inspect the spider for any galled areas or grooves. If it is not in excellent condition, obtain a new one from your dealer.

4. Inspect the side gear thrust washers. They are important to the correct positioning of the **LOCK-RIGHT**. If they are excessively worn or are cracked, obtain new ones. Several thicknesses may be offered; try to obtain the same size as the old ones.

5. Inspect the case for any chips, cracks or similar damage. Also inspect the bearings. If the case or bearings look bad, replace them. However, if you do, remember that the marked bearing adjuster positions no longer will be correct; the ring and pinion backlash and bearing pre-load will need to be reset with a dial indicator as described in the shop manual.

Assembly Prepare the Parts for Assembly

Coat the teeth of the drivers and side gears and both sides of the thrust washers with medium grease. The grease will help hold things in place and assist with functioning until the gear oil circulates.

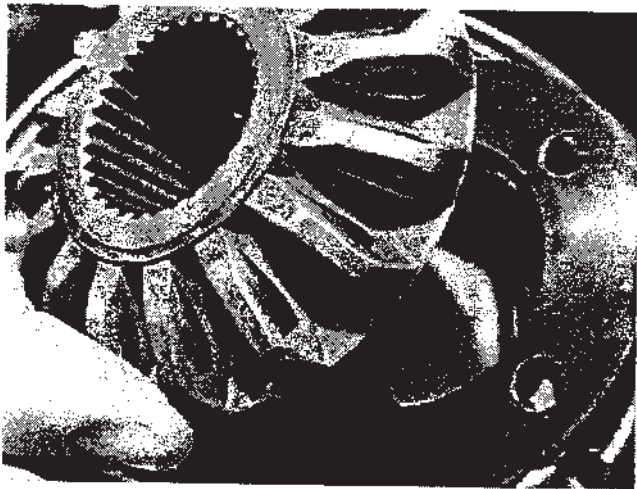


Figure 3

Install thrust washer, former top side gear

Assembly of the LOCK-RIGHT Parts into the Differential Case

1. Place a correct thrust washer in the bottom of the case and install the former top side gear. Note that the smoothest side of the washer is placed next to the side gear.

2. Place one of the drivers on the side gear with the teeth meshed and place a spacer in the center (**Figure 4**).

3. Place the spider in the recesses in the case. Tap it lightly to seat it (see **Figure 4**).

4. Place a spring assembly into each spring hole and place a pin into each of the round pin holes (**Figure 5**).

5. Place a small amount of grease into each pin hole of the second driver and then insert a pin.

6. Place a small amount of grease into each spring hole of the second driver and then insert a spring assembly. Place a little more grease on the top of each spring to act as "glue" for the next step.

7. **Hold the second driver** upside-down and carefully place it on top of the first driver so that the pins fit into the spring holes (**Figure 6**).

8. **Carefully push the top driver** up and down to be sure that the springs and pins are in their proper positions. Use a light to look and be sure that everything is properly in place.

9. **Place the second spacer** in the center of the top driver.

10. **Carefully place the former bottom side gear** on the top driver with the teeth meshed (**Figure 7**). Be sure not to lift it back up or a spring may become dislodged.

11. **Place the second thrust washer** on the top side gear with the smoothest side toward the gear (see **Figure 7**).

12. **Line up the alignment marks** on the top and bottom halves of the case and carefully lower the top half over the side gear hub onto the bottom half (**Figure 8**). Install the bolts. If the bolt holes are in the opposite end of the case, hold it tightly together to turn it over. Torque the bolts to their correct

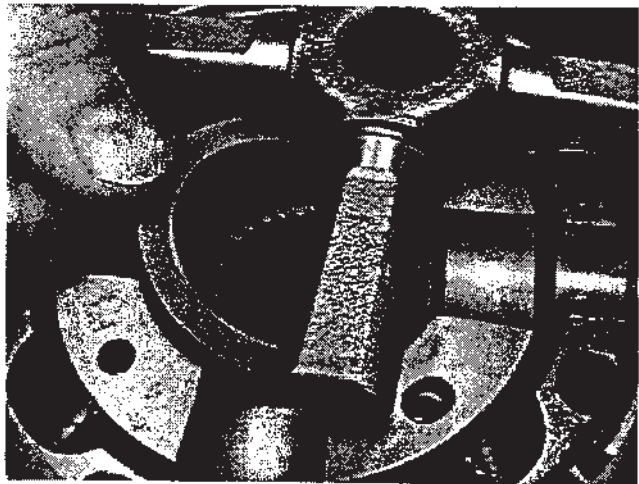


Figure 4
Install thrust washer, side gear, driver, spacer

value. If the ring gear has been removed, also install it in its previously-marked rotational position then torque the bolts.

13. Inspect your work. Look for anything that is not correct. Be sure that the drivers rotate back and forth smoothly, stopping at the spider. Use a light to see that the spacers are in place and that the pins and bias springs are in place and functioning properly.

Because of the spacers, the side gears cannot be pushed in to test the springs; however, the drivers may be pushed up and down with a screwdriver by reaching in through any of the holes in the case. Proper operation of all the parts at this point is *very important!*

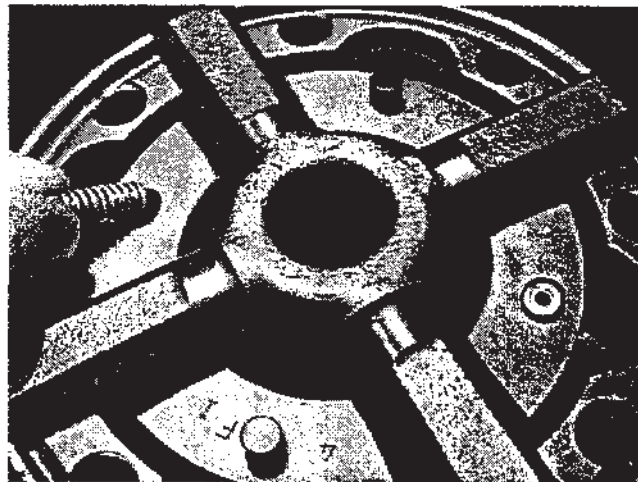


Figure 5

Place pins and springs into holes in lower driver

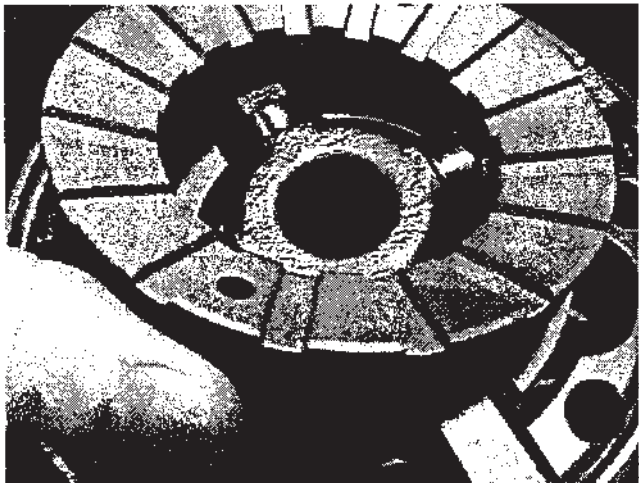


Figure 6
Place top driver onto bottom driver



Figure 7
Place spacer, gear and washer onto top driver

NOTE: Because of the many vehicles into which the **LOCK-RIGHT** can be installed, we do not give exact torque values for the various bolts. Different thread sizes and materials mean that the values for each vehicle will probably be different from the others. However, as a general guide, we will give some **TYPICAL** values here. Also note that some manufacturers recommend the use of thread locking material where appropriate.

Torque Values (lbs-ft)

- | | |
|---------------------|----------|
| 1. Ring gear | .58 - 80 |
| 2. Case cap | .27 - 49 |
| 3. Bearing caps | .51 - 95 |
| 4. Adjuster locks | .7 - 25 |
| 5. Carrier mounting | .14 - 40 |
| 6. Housing cover | .15 - 25 |
| 7. Oil filler plug | .25 - 50 |
| 8. Oil drain pug | .29 - 55 |

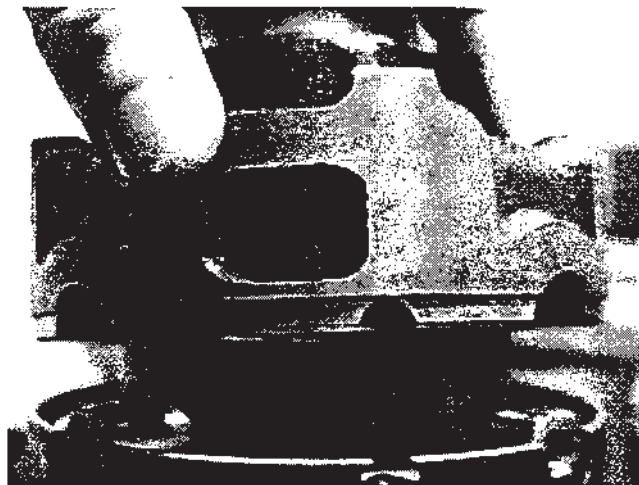


Figure 8
Line up marks and install case top half

Third Member Final Assembly

1. Position the carrier vertically, with the drive shaft flange pointing down. It can be held in a vise or even stood on its nose in a coffee can if a vise is not available.

2. Place the bearing races on the differential case bearings. Be sure to place the marked one on the proper end.

3. Set the differential case (and bearing races) into the carrier. Install it with ring gear pushed all the way into the pinion gear— that is, with *no* backlash, and with the bearing races pushed *all the way* onto the bearings.

4. Check the punch marks on the adjusters and determine which one goes on the side nearest the ring gear. Hold it so that the mark is at its final position (where the adjuster lock will be installed, with the mark located away from the carrier). Push the adjuster against the race and slide it down into the threads in the carrier. They should mesh easily, with no space between the parts.

5. Install the correctly-marked cap. Use the bolts as guides by turning them in two threads or so and then sliding the cap down to meet the case. Be sure that the cap threads fit into those in the adjuster. Do not force anything. The cap should slide down very close to the carrier surface. Tighten the bolts until they are snug.

6. Hold the other adjuster so that the mark is in the same relative position as the other one (with the mark away from the carrier) and slide it down the bearing race into the threads. As it meshes, it should shift outward and be positioned slightly away from the race

7. Install the other cap. Again, use the bolts as guides by turning them in two threads or so and then sliding the cap down to meet the case. Turn the bolts until they are barely snug. Be sure that the cap threads fit into those in the adjuster. Do not force anything.

8. Use a spanner wrench or a blunt punch and a hammer to turn the second adjuster (the one away from the ring gear) one turn inward (clockwise) until the marked hole reaches its final position (in the middle of the cap just below the lock). The last part of the turning should be difficult because pre-load is being applied to the bearings by spreading the caps apart as the adjuster is being turned in.

9. Insert an axle shaft or bar into one of the axle shaft holes in the differential case to help with holding the assembly, and torque the cap bolts to their correct value (see the shop manual).

10. Install the adjuster locks and torque the bolts. Be sure that they are located in the marked holes in the adjusters.

Third Member Assembly Inspection

When the above installation steps are completed, all the parts should be in exactly the same positions as they were when the installation began. The backlash and pre-load

settings should therefore be unchanged from before and no further adjustments will be needed. To be certain, **rock the ring gear back and forth** to see if the backlash appears to be the same as it was prior to the installation. If not, it will need to be reset with a dial indicator as described in the shop manual. Rotate the ring gear one revolution to be sure that nothing is binding.

Third Member Installation

1. Clean the mating surface of the axle housing and the mounting surface of the differential carrier.

2. Clean the inside of the axle housing to remove all foreign material. This step is very important because metal chips can interfere with the operation of your new **LOCK-RIGHT**.

3. Remove metal chips from the drain plug if it is magnetic.

4. Install a gasket and/or sealant as appropriate.

5. **Lift the third member** into the axle housing.
6. **Install and torque** the mounting hardware.

Vehicle Final Assembly

1. **Finish the assembly** of the remaining parts by reversing the order of disassembly – in general, the axles/backing plates, brake lines, emergency brake cables, drive shaft, tires and gear oil. Note that in some designs the last 1/8-inch or so of the backing plate installation is a light press fit and the axle shaft may appear to be hitting something. Tap the outside end of the axle shaft and it should go in. If baffles are used inside the axle housing, check to be sure that they are in their correct positions. Refer to the shop manual for specific instructions. Your LOCK-RIGHT installation should now be complete. As a preliminary test, rotate the tires back and forth (transmission out of gear and drive shaft free). The drivers should randomly unlock and “click” as the tires

move. Note that the tires will NOT lock together.– This easy-unlocking characteristics a unique feature of the LOCK-RIGHT and is perfectly normal.

2. **Add gear oil.** Note that we recommend **medium-weight oils** as recommended by the manufacturer unless the vehicle will be used in very cold weather. Thicker oil reduces the “clicking” noise sometimes heard during tight turns and provides adequate lubrication when the assembly becomes hot. **Also see** the section in the **Vehicle Operator’s Manual** regarding temperature.

Tire Diameters

To help assure a long life for your new **LOCK-RIGHT, tire diameters should be as nearly equal as possible.** Contrary to instructions that you may have read elsewhere, **DO NOT** change the inflation pressure to vary the rolling radius of the tires! This practice can be dangerous if one of the tires is

under inflated, producing excess heat, faster tire wear and more difficult vehicle control. The best way to equalize the rotation is to measure the circumference of all the tires, including the spare. Choose ones that are within about 3/8-inch or less of each other (do not change from side-to-side if they are radials). If one tire is much more worn than the other one, they both should be replaced for safety reasons.

Testing Your Installation

1. Be sure that the vehicle is safely blocked. Leave the axle assembly on the jack stands, with both tires free to rotate and the emergency brake off.

2. Put the transmission and transfer case in gear to lock the drive shaft.

3. Rotate one of the other tires in the forward direction with your hand until it stop, then hold it. That side of the **LOCK-RIGHT** is now locked.

4. Rotate one of the tires in the opposite (reverse) direction. The **LOCK-RIGHT** should “click” as the coupler attached to the axle rotates.

5. Rotate the first tire in the reverse direction and hold it; repeat step 3, rotating the other tire in the forward direction.

6. Repeat steps 2 - 4, rotating and holding the second tire to lock the second side.

Driving Your Vehicle

If the foregoing measurements and tests have been successfully completed, apply the emergency brake and remove the vehicle from the jack stands. Your vehicle should now be ready to drive.

*Carefully read and understand the driving information contained in the **LOCK-RIGHT** Vehicle Owner's Manual! Safe and effective use of your new **LOCK-RIGHT**-equipped vehicle depends on knowledgeable operation, and this can only be*

done by understanding its characteristics before you start. Be careful, and have fun!

NOTE: If an axle snaps repeatedly under power when driving on the street (as opposed to lightly clicking in a turn), the teeth on the used side gears may be too worn to function properly. Sustained operation under these conditions is quite easy to observe and will void the warranty. Replace the side gears immediately to eliminate the problem or contact your dealer for assistance.




IMPORTANT INFORMATION


Please Read Carefully



The following  and  information is supplied to you for your protection and to provide you with many years of trouble free and safe operation of your Richmond Gear product.

Read **ALL** instructions prior to operating transmission and/or ring and pinion. Injury to personnel, transmission or ring and pinion failure may be caused by improper installation, maintenance or operation.

 **DANGER** • **It is dangerous to get under a jacked-up vehicle.** The vehicle could slip off the jack and fall on you. You could be crushed. Never place any part of your body under a vehicle that is on a jack. Never start or run the engine while the vehicle is on a jack. **If you need to get under a raised vehicle, take it to a service center where it can be raised on a lift.**

 **WARNING** • Hot oil can cause severe burns. Use extreme care when removing lubrication plugs and when working close to a unit that has been in operation.

- Check lube level between scheduled lube changes to insure that proper lube level is maintained. Inspect vent plug to insure it is clean and operating. Inspect the tightness of mounting bolts, misalignment of connecting shafts, lube leakage, excessive heating, or any unusual noise or vibration.
- Serious personal injury may occur as a result of improperly performed maintenance, adjustments or repairs.
- Do not attempt any of the maintenance, checks or repairs described on the following pages if you are not fully familiar with these or other procedures with respect to the transmission, or are uncertain as to how to proceed. Have the necessary work done by a properly equipped and qualified workshop.
- Always be extremely careful when working on the transmission. Always follow commonly accepted safety practices and general common sense. Never risk personal injury.

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- Do not operate the transmission or ring and pinion without proper lube and correct amount.
- For safe operation and to maintain the unit warranty, when changing a factory installed fastener for any reason, it becomes the responsibility of the person making the change to properly account for fastener grade, thread engagement, load, tightening torque and the means of torque retention.
- Mounting bolts should be periodically checked to ensure that the unit is firmly anchored for proper operation.
- These instructions are not intended to cover all details or variations in equipment, nor provide for every possible contingency to be met in connection with selection, installation, operation, and maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the Buyer's purpose, the matter should be referred to Richmond Gear.

In the event of the resale of any of the goods, in whatever form, Resellers/Buyers will include the following language in a conspicuous place and in a conspicuous manner in a written agreement covering such sale:

The manufacturer makes no warranties or representations, express or implied, by operation of law or otherwise, as to the merchantability or fitness for a particular purpose of the goods sold hereunder. Buyer acknowledges that it alone has determined that the goods purchased hereunder will suitably meet the requirements of their intended use. In no event will the manufacturer be liable for consequential, incidental or other damages. Even if the repair or replacement remedy shall be deemed to have failed of its essential purpose under Section 2-719 of the Uniform Commercial Code, the manufacturer shall have no liability to Buyer for consequential damages.

Resellers/Buyers agree to also include this entire document including the danger, warnings and cautions above in a conspicuous place and in a conspicuous manner in writing to instruct users on the safe usage of the product.

This information should be read together with all other printed information supplied by Richmond Gear.