INSTALLATION MANUAL

POWERTRAX®
GRIP LS

EXTREME TRACTION SYSTEM

- The Latest Design in Traction Systems
- Carbon Fiber and Steel Friction Plate Technology
- Easy to Maintain and Rebuild
- Fully Forged, Machined Steel Case

BEFORE YOU BEGIN!

These instructions are intended as an aid for the experienced automobile mechanic in properly installing this GRIP LS limited-slip differential. It is expected that the installer is equipped with the proper tools, equipment, and experience before attempting this installation. You may be required to have an extensive selection of shims or adjustable shim packs available in order to properly install this differential. (Threaded adjuster applications do not require shims.)

Check these before pressing in bearings or installing ring gear:

1. Ensure that your axle shaft splines mate with your differential side gears.
2. Check that the differential bearing shoulder to flange face (flange position) is correct. Compare it to the one that is currently in your vehicle.

The differential flange position may change at certain gear ratios. Note that some aftermarket ring gear and pinion sets require a differential case “series” that is different than what came with the vehicle. If you feel that you have the wrong differential for your application, contact the company you purchased it from, and make the necessary arrangements to exchange the differential for the correct one. It will be much more difficult to return this product, after it has been installed.

OIL & LUBRICANT NOTE

The Powertrax Grip LS limited-slip differential is a clutch-style limited slip differential that uses carbon fiber clutches and steel discs. Always use an 80W-90 non-synthetic gear oil with at least a GL-5 rating and 4 oz of friction modifier/additive per 1.5 quarts of gear oil.

We recommend: Richmond Gear RICHGL5 and Powertrax additive part# PTL001

PINION SHAFT MODIFICATION

Certain 'C' clip axle applications with high gear ratios will require pinion shaft modification due to the thickness of the ring gear. The thick ring gear will prohibit the pinion shaft from being removed making 'C' clip installation impossible.

First, we recommend trying to index the ring gear on the differential until a tooth space is directly in line with the pinion shaft. In many cases, this will allow the pinion shaft to be removed without modification.

If that fails, use the following procedure to modify the pinion shaft:

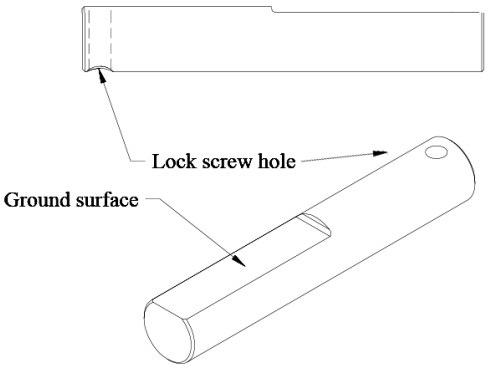
1. Any modification must be opposite of the pinion shaft lock screw hole, as shown below. It is recommended that this be accomplished through grinding.
2. Remove any sharp edges prior to installation.
3. Do not attempt to re-harden the pinion shaft after modification.

Reinstall the pinion shaft prior to installing the ring gear.

With the ring gear installed, rotate the pinion shaft so that the ground flat section is parallel to the ring gear face.

Pull the pinion shaft outward as far as possible.

Install an axle shaft and check that the end of the axle will pass the end of the pinion shaft.



IMPORTANT NOTES

Ford® 8” GRIP LS# LS108028 applications require the use of open type ring gear bolts part# D8OZ4216B and the following carrier bearings:

LM102949 Cone
LM102910 Cup

Ford® 9” GRIP LS# LS109031 applications require the use of open style ring gear bolts part# D8OZ4216B and the following carrier bearings:

2.8910” 3rd Member LM102949 Cone
2.8910” 3rd Member LM102910 Cup
3.0625” 3rd Member LM603049 Cone
3.0625” 3rd Member LM603011 Cup

GM® 8.5” GRIP LS# LS201028 applications require the use of the following carrier bearings:

LM102949 Cone
LM102911 Cup

GM® 8.5” GRIP LS# LS201030 1988-1998 applications require the use of the following carrier bearings:

LM102949 Cone
LM102911 Cup

BACKLASH & CARRIER BEARING PRELOAD

Ring & pinion backlash and differential carrier bearing preload are typically adjusted by threaded adjusters or shims. When installing a differential, measure the original backlash setting prior to disassembly. This will be the base setting for the new installation.

To increase the backlash, adjust the shim packs or threaded adjusters to move the ring gear further away from the drive pinion gear.

To decrease backlash, move the ring gear closer to the drive pinion gear.

Bearing preload refers to the amount of interference (press) fit of the differential case and bearings into the carrier housing. Adjust the bearing preload by adding or removing shim pack thickness or by tightening or loosening the threaded adjusters.

Too much bearing preload will cause premature bearing failure. Insufficient bearing preload will allow the differential to 'walk' in the housing causing damage to the ring and pinion set and other components.

MAINTENANCE NOTE

It is recommended that the axle lubricant be changed as required by your vehicle's service schedule. Lubrication breakdown can lead to accelerated wear to all rear axle components.

See OIL & LUBRICATION NOTE on page 2 for oil and additive requirements.

INSTRUCTIONS

1. Lift the vehicle and ensure that it is properly supported.
2. Take off wheels, brake drums, and rotors.
3. Drain all oil and take off the differential cover.
4. Take off both axle shafts from the axle housing.

   C-clip Axles

   1. Remove the pinion shaft, lock screw, and pinion shaft.
   2. Push the flanged end of the axle shaft toward the center of the housing.
      Remove the C-clip from the ends of each axle shaft.
   3. Take both axle shafts out of the housing.
      Take care to not damage the oil seals.

   Non-C-clip Axles

   1. Unscrew nuts from the axle shaft bearing retaining plate, then remove the retaining plate.
   2. Remove the axle shafts using a slide hammer.
      Take care to not damage the oil seals.

NOTE: Some axles use shims or adjuster nuts to set the axle shaft end play. Consult the vehicle's service manual for the proper removal and installation.

5. For removable carriers: disconnect the drive shaft from the pinion yoke and remove the third member from the axle housing.
6. Before going continuing, take care to measure and write down the ring and pinion backlash. While holding the drive pinion still, turn the ring gear in clockwise then counterclockwise to measure the amount of backlash. Make sure to mark this. See **Figure 1.** Do this at three to four points around the ring gear, taking care to write down the backlash of each for later.
7. Write R and L on the corresponding bearing caps in order to ensure correct reassembly.
8. If equipped, remove adjuster nut locks before loosening the adjuster nuts. These tools may be helpful:

   Chrysler® tool C-4164

   Ford® tool T70P4067-A

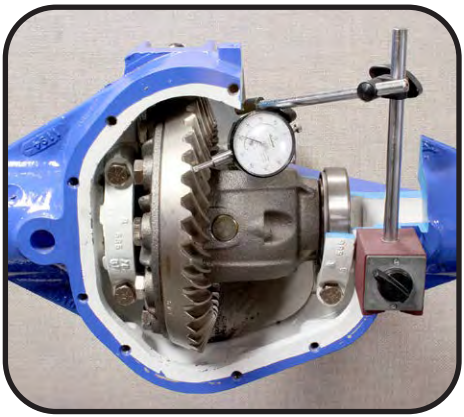


Figure 1

Figure 2

9. Loosen and remove bearing cap bolts and bearing caps.

10. Removing the differential case: A pry bar may work well. See **Figure 2.** Take care while prying on the carrier to not damage the axle housing gasket sealing surface. While removing, take care to organize the shims, adjuster nuts, and bearing cups with their respective R or L bearing cap to ensure correct reassembly.

Note: In some axles, the adjuster nuts will remain in the housing.

11. Remove the ring gear bolt using a non-metallic hammer or brass drift punch to loosen the ring gear bolt from the differential case pilot. Dispose the ring gear bolts properly.

12. If it applies, remove the anti-lock brake tone wheel. To do this correctly, consult the vehicle service manual for correct procedure.

13. Utilizing the correct bearing puller and adapter, remove the differential bearing cones from the differential. See **Figure 3.**

14. Using a proper cleaning solvent, wash the axle housing and all parts and dry. Using a clean rag, wipe clean the inside of the housing.

WARNING: Do not use compressed air to spin-dry the bearings, as this may cause serious injury.

15. Take care to identify and remove any burrs from all machined surfaces of the axle housing, bearing cap, and ring gear. Smooth surfaces mean less friction.

16. Take care to identify wear and tear of the axle shaft bearing surface, bearings, and seals. If necessary, change these with new ones.

17. Take care to identify wear and tear on the differential bearings and change these if necessary. Remember, if changing both the cup and cone bearing, change these together with parts from the same manufacturer.
18. Take care to clean the differential bearing hubs and ring gear mounting flange before installation of the bearings and ring gear.
19. Utilizing the correct tool, install the differential bearing cones onto the bearing hubs of the differential case. See **Figure 4.**

Figure 3

Note: Most Dana® applications utilize shims between the bearing cone and the differential case bearing hub shoulder. It is important to remove these bearing cones in order to make necessary adjustments to the thickness of the shim pack.

Note: For adjuster nuts, skip to step 22

20. Assemble the differential, bearing cups, shims into the differential housing. Slide in the thickest shim pack that fits by hand with a slight resistance. When changing shim thickness, turn the differential case each time to seat the bearings.
21. In order to measure the differential with the shims, remove the differential from the differential housing. Measure this before adding preload to the bearings. Write down the measurement.
22. Using a heat lamp or dunking in hot water, heat the ring gear and anti-lock tone wheel (if necessary).

Figure 4

WARNING: Do not exceed 300º F. Do not use a torch!

23. While the ring gear is hot, assemble the anti-lock tone wheel (if necessary) onto the outside diameter of the differential ring gear flange. Consult the vehicle service manual. Then assemble the ring gear to the differential. Utilize pilot studs to align the ring gear to the differential. See **Figure 5.**

24. Utilizing new ring gear bolts, alternately tighten each ring gear bolt to the proper torque:

    3/8" Bolts = 50 lb ft
    7/16" Bolts = 80 lb ft
    1/2" Bolts = 100 lb ft

For adjuster nuts, skip to step 30

25. Choose two equally sized shims which, when measured, equal the thickness of the shim pack thickness recorded in Step 21.

26. Put the differential assembly, ring gear, bearing cups, and shims in the differential housing. Place bearing caps and bolts in correct positions and tighten each bolt taking care to continuously rock the ring gear clockwise and counterclockwise to ensure correct backlash.

Note: If the backlash becomes zero, take off the bearing caps and remove .010" from the ring gear side then add .010" to the other side of the shim pack. To increase backlash, decrease shim thickness from the ring gear side and add an equal amount to the other side. To decrease backlash, add shim thickness to the ring gear side and decrease an equal amount of shim thickness from the other side. Repeat as necessary until both bearing caps can be torqued to the correct torque value.

Figure 5

Note: .001" shim = .001" backlash.

27. Seat the bearings by rotating the differential case . Refer to the backlash amount written down in Step 6. Adjust if necessary.

28. When the backlash is correct, add .004" of shim thickness to both shim packs, preloading the differential bearings. Gently force the shims into place.

WARNING: Do not hit the bearing cups. Utilize a case spreader to install the differential.

29. Torque the bearing cap bolts to the correct value and turn the differential case several whole turns to seat the bearings. Recheck the backlash to make sure it is still correct.

For axle installation, skip to step 40

30. Install the differential assembly, ring gear, and bearing cups into the differential carrier.

31. Lightly coat bearings and adjuster nut threads with axle oil.

32. Place the bearing caps in their correct position, then hand tighten the bearing cap bolts.

33. If not still in the differential housing, place and tighten the adjuster nuts to their correct position, taking care to not cross thread and cause thread damage.

34. Torque the bearing cap bolts to the correct torque value.

For Chrysler® 8-1/4 & 9-1/4, skip to step 39

35. Unscrew the right-hand adjuster nut (opposite the ring gear) almost completely from the bearing cup. Tighten the left-hand adjuster nut (ring gear side) pushing the ring gear into the drive pinion with zero backlash. Turn the differential a few turns to check for binding. Check the right-hand adjuster nut is not against the bearing cup.

36. Referring to Figure 6, place indicator. Tighten the right-hand adjuster nut until it measures between a case spread of .008 to .012. Turn the drive pinion several times clockwise and counterclockwise to seat the bearings and ensure binding doesn't happen. Tighten the right-hand adjuster nut, if necessary, to readjust the case spread.

37. Measure the backlash again, according to Step 6, adjusting the backlash until it matches the pre-installation measurement.

Note: To increase the backlash, loosen the left-hand adjuster and tighten the right-hand adjuster the same amount.

To decrease backlash, loosen the right-hand adjuster nut and tighten the left-hand adjuster nut the same amount. When adjusting, take care to make the final adjustment in the tightening direction, e.g.: if adjusting to one notch, loosen it two notches and tighten back one.

When the correct backlash is reached, add and tighten the adjuster nut locks.

38. Install the third member into axle housing utilizing a new gasket or silicone sealer before tightening the nuts. Reinstall the drive shaft.

For axle installation, skip to step 40

39. For Chrysler® 8-1/4 and 9-1/4" applications, using tool C- 4164, Set the correct backlash (refer back to Step 6 for directions), then tighten each adjuster nut before turning the differential case a few times to seat

the bearings. Taking care not to change the backlash, repeat this step until each adjuster nut has been tightened to 70 lb./ft. Recheck backlash, correct if needed, then install and tighten the adjuster nut locks.

40. Axle Installation - Install axle shafts into housing taking care to keep the oil seals intact.

<u>For C-clip Axles:</u>

1. Loosen and remove the pinion shaft lock screw and pinion shaft.
2. Push flanged end of axle shaft toward the center of the housing and install the 'C' clip onto the button end of the axle shaft. Pull axle shaft outward so the shaft and washer seat in the counter bore of the side gear. Repeat for other axle shaft.
3. Install pinion shaft through the case and pinions, aligning the hole in the shaft with the lock screw hole. Install lock screw and torque to 20 - 25 lb./ft.

<u>For non-C-clip Axles:</u>

1. Install axle shaft bearing retaining plate before tightening all nuts to the correct torque.

Note: Some axles use shims or adjuster nuts to set the axle shaft end play. Consult the vehicle's service manual for the proper removal and installation.

41. Re-install the axle cover utilizing a new gasket or silicone sealant, then tighten all bolts.
42. Re-install the brake drums, rotors, and wheels.
43. Level the vehicle.
44. Fill housing to the correct level with the lubricant Richmond Gear RICHGL5 and the Powertrax additive part# PTL001 described on Page 2.
45. Carefully lower the vehicle to the ground before testing the axle.