



The professionals at Nitro Gear & Axle have setup thousands of differentials and would like to share their methods with both the novice and professional installer. Differential building is not as mysterious as many people assume; however, there are strict tolerances and critical steps to ensure a reliable setup. This guide is a reference to help with installation, but remember it is ultimately the installer's responsibility to ensure a precise and complete installation.

In addition to ordinary sockets, wrenches, drifts, safety glasses, ear protection, etc. used for general auto repairs; differential work requires tools that are somewhat specialized.

**The following tools are recommended:**

- Dial indicator with magnetic base
- Dial calipers
- Bearing puller
- Hydraulic shop press
- Very strong impact gun
- Six point socket set
- Pry bars, short & long
- Steel hammer
- 4 lb. sledge hammer
- 4-5 lb. plastic dead blow hammer
- 12"-16" long brass drift
- Center punch or number stamp for marking caps
- Oil drain pan / tray
- Foot lb. torque wrench
- Inch lb. torque wrench (dial or beam style, not clicker)
- Die grinder with de-burr, cut off and sanding wheels



# INSTALLATION GUIDE

[www.nitro-gear.com](http://www.nitro-gear.com)



#### **DISASSEMBLY: Integral style with rear cover** (aka salisbury)

1. Support vehicle or rearend on suitable lift or stands.
2. Drain oil by removing differential cover.
3. Remove wheels, brake drums, rotors and/or calipers where required.
4. Remove axle shafts.
  - a. C-Clip: Remove cross pin shaft retainer bolt and cross pin shaft. Push axles inward to remove c-clips. Remove axles.
  - b. Bolt in: Remove axle nuts/bolts from backing plate. Slide axles out (may require slide hammer)
  - c. Full float: Remove axle nuts/bolts from hub. Slide axles out
5. Stamp carrier bearing caps as they must be installed in same position as removed. Remove caps.
6. Remove carrier, it may be necessary to use a large prybar or housing spreader. Keep track of shim locations.
7. Unbolt rear of driveshaft from pinion yoke. Rotate pinion to check for play or roughness. Remove pinion nut. Drive pinion out with large tapered drift, taking care to avoid damage to threads
8. Organize and inspect all parts for damage or wear.

#### **DISASSEMBLY: Banjo/ 3rd member/ Drop-Out style** (aka pumpkin, hogs head)

1. Support vehicle or rearend on suitable lift or stands.
2. Drain oil by removing drain plug. (If no drain plug is present, oil will be drained upon removal of 3rd member)
3. Remove wheels, brake drums, rotors, calipers and/or brakelines where required.
4. Remove axle nuts/bolts from backing plate. Slide axles out.
5. Unbolt rear of driveshaft from pinion yoke.
6. Remove 3rd member.
7. Stamp carrier bearing caps as they must be installed in same position as removed. Remove caps.
8. Remove pinion nut. Drive pinion out with large tapered drift, taking care to avoid damage to threads
9. Organize and inspect all parts for damage or wear.

#### **Critical Areas of Setup:**

Although there are many steps to differential repair, there are 4 critical areas of setup that all differentials share:

1. **Pinion Depth** – Is the depth of the pinion in relation to axle centerline, and is adjusted by adding or subtracting shims to move pinion in or out. Pinion Depth is verified by tooth contact pattern. Ideal pattern is centered between Face & Flank. It is important that pinion depth is set properly to avoid noise and/or gear failure.
2. **Pinion Bearing Preload** - Is the amount of rolling resistance on the pinion bearings. This is adjusted by adding or subtracting shims located between pinion bearings (more shim = less preload) Alternatively set by tightening nut with a crush sleeve in place, collapsing it until desired preload is achieved. Pinion Preload is verified by rotating the pinion with an inch lb torque wrench. It is important preload is within spec. Pinion bearings will fail quickly if overpreloaded.
3. **Backlash** – Is the free-play between the ring & pinion. Backlash is adjusted by moving the carrier left or right with shims or adjuster nuts on the sides of the carrier, and checked with a dial indicator by rocking the ring gear by hand. It is important backlash is within spec to allow smooth operation and proper lubrication.
4. **Carrier Bearing Preload** – Is simply how tight the carrier fits in the housing and is set simultaneously with backlash. On models with shims, carrier bearing preload is increased by adding overall shim thickness. On models with adjuster nuts, carrier bearing preload is increased by tightening the adjusters. Carrier bearing preload is important for a strong setup. If preload is too loose you will be more likely to spin bearings and/or break gear teeth.

Carrier preload tip: If backlash is within spec, but preload is too loose you can add equal amounts of shim thickness to each side of the carrier, or on tighten adjuster nuts equally. This will increase preload, while maintaining backlash setting.

#### **ASSEMBLY:**

Prior to beginning assembly, clean housing, parts, and organize everything that is going to be installed. Verify the new parts are correct and double check any parts for wear that are being reused. Clean axle housing and remove any debris.

1. Flat file mounting surfaces of ring gear & carrier to remove any burrs or high-spots and wash Ring & Pinion even if new to remove cosmoline, etc. Mount ring gear on carrier. Do not use bolts to draw the ring gear on. It is better to start 2 of the bolts and use a large dead-blow hammer to drive ring gear on to carrier. Loctite and torque ring gear bolts to spec.



2. Install Bearing races in housing and press Pinion & Carrier Bearings. Make sure to keep track of the position & size of any shims, baffles, or slingers if/where applicable.

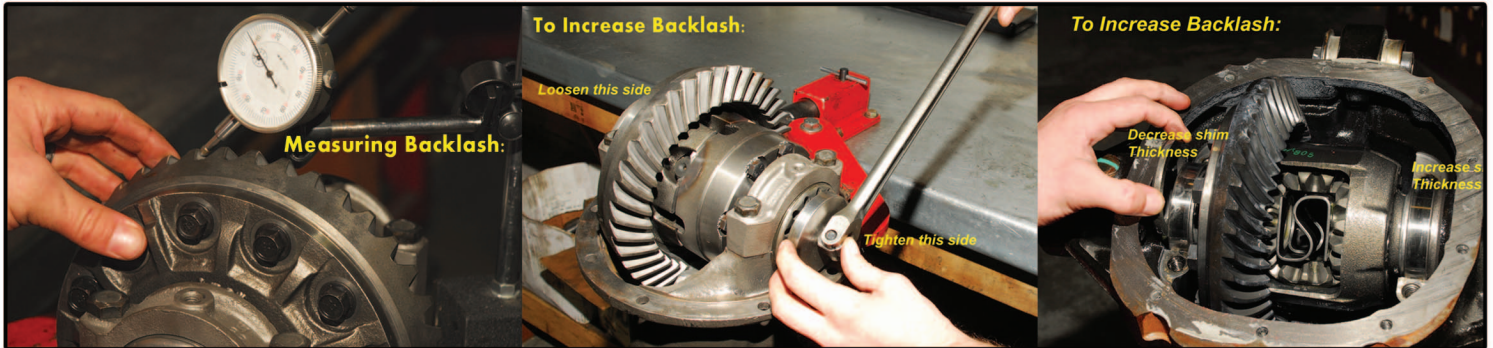




## INITIAL TRIAL ASSEMBLY:

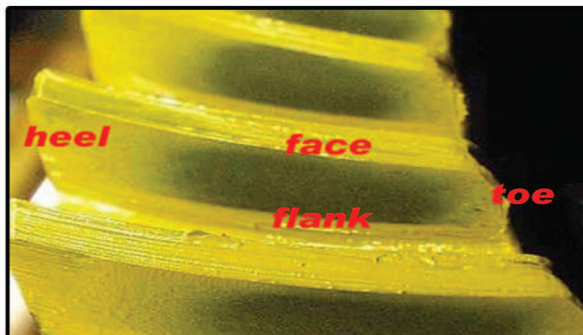
**Note:** It is usually best to use stock shim thickness for a starting point.

1. **Install Pinion & tighten nut** until there is no slop and a bit of preload. Actual preload will be set later during final assembly. It is recommended that the initial assembly be done without crush sleeve as they are a single-use item.
2. **Install carrier/ring gear assembly & set Backlash-** Carrier should be snug in order to obtain an accurate reading. It is best to measure with indicator needle perpendicular to the Drive side of the ring gear teeth. Backlash should be close to spec, even for trial assembly. Measure in a few spots to check for variance/run-out. Backlash is adjusted by moving the carrier left or right with shims or adjuster nuts on the sides of the carrier, and checked with a dial indicator. To increase backlash on models with carrier shims, shim thickness will be decreased on the ring gear side and added to the opposite side of the carrier and vice versa. To increase backlash on models with adjuster nuts, the adjuster on the ring gear side is loosened, and the opposite adjuster is tightened. Backlash tip: Shim thickness changes of 0.010" will generally effect backlash by roughly 0.007". For example, if backlash is measured at 0.002" and the desired spec is 0.006"-0.010" you would remove 0.010" from the ring gear side of the carrier and move it to the opposite side. This will move the ring gear away from the pinion and should increase backlash to about 0.009".

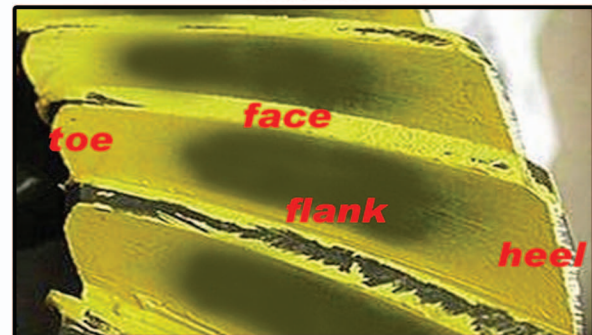


3. **Check Pinion Depth-** Apply marking compound to ring gear and rotate back and forth through the pinion to obtain a contact pattern. The contact pattern will indicate the depth of the pinion in relation to axle centerline, and is adjusted by adding or subtracting shims to move pinion in or out. On models with depth shim located under pinion bearing or pinion race: Adding shim will move pinion deeper causing pattern to approach Flank. Subtracting shim thickness will move pinion further away, causing pattern to approach Face. See Pattern Example photos. NOTE: On models with removable pinion support like GM 14T, Ford 8", 9", subtracting shim will move pinion deeper and VS. VS.

Drive Side



Coast Side



## FINAL ASSEMBLY:

Upon obtaining an acceptable contact pattern it is time for final assembly.

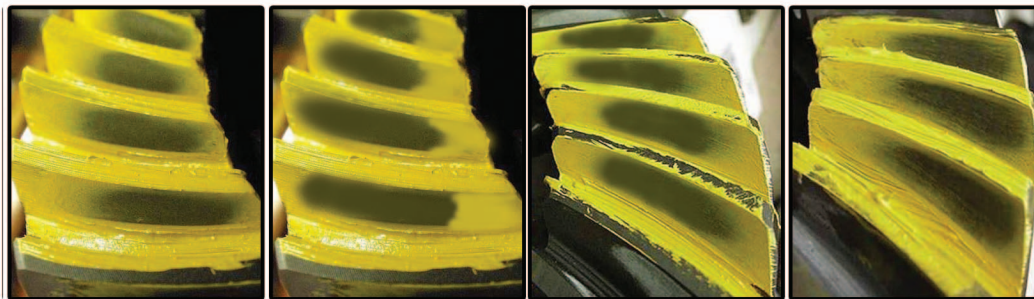
1. **Set pinion bearing preload:** Ensure threads are clean with no oily residue, Use red loctite on pinion nut, and a bit of oil on the washer surface. Also apply grease to seal.
  - A. **Models with Preload shims:** Pinion preload is adjusted by adding or subtracting shims located between pinion bearings (more shim = less preload) and vs. vs. Reading should be taken with nut all the way tight.
  - B. **Models with Crush sleeve:** Pinion preload is adjusted by tightening nut with a crush sleeve in place between bearings, collapsing it until desired preload is achieved. NOTE: Do not exceed preload spec or you must use a new crush sleeve.
- Pinion Preload is verified by rotating the pinion with an inch lb torque wrench. For accurate reading use dial or beam type. (not clicker). After checking preload, knock pinion from each side to ensure races are seated properly in housing, then recheck preload.
2. **Install carrier assembly.** For final assembly it is important that there is preload on the carrier. Follow the same steps detailed above for checking & setting backlash. TIP: On models with carrier shims – If carrier preload was loose but backlash was within spec add an equal amount of shim to each side prior to installing. The carrier should be very tight. On models that use shims, it should require a pry-bar to remove the carrier, if the carrier simply slides out, you need more preload.
  3. Re-check contact pattern to ensure proper changes have been made
  4. Torque carrier bearing cap bolts to spec.
  5. Reassemble in reverse order of disassembly.
  6. Follow break-in procedure.





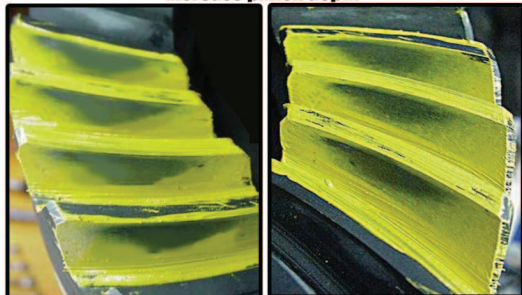
## CONTACT PATTERNS:

Acceptable pattern examples- Pattern is centered between face & flank, not necessary to be centered between toe & heel.

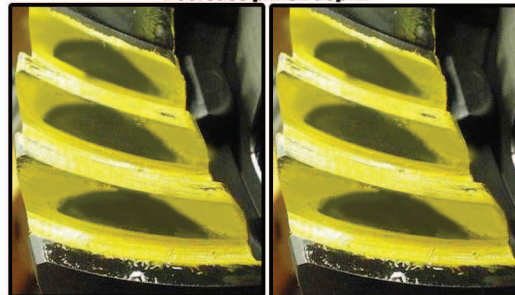


## Patterns Indicating the need for adjustment:

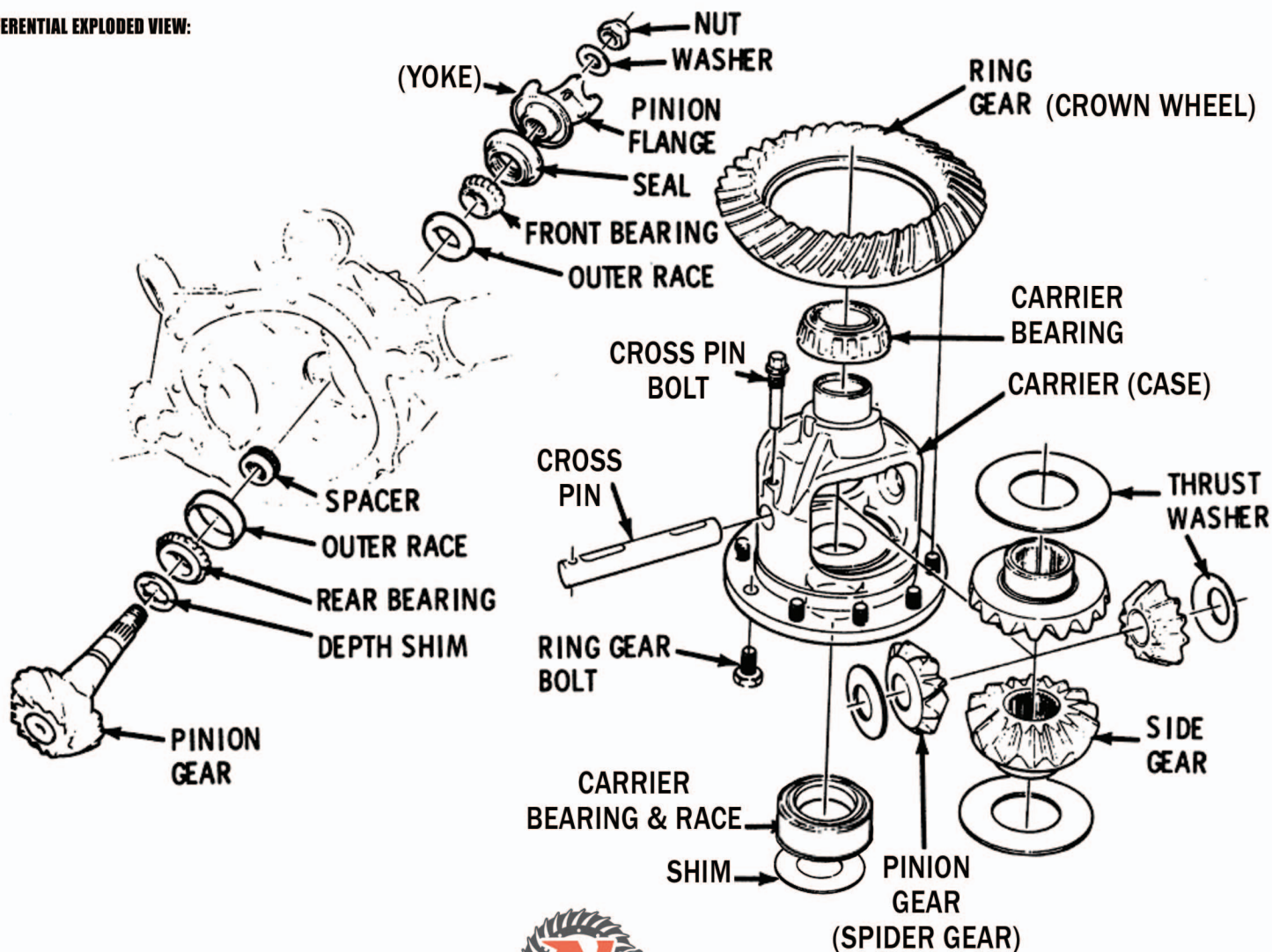
Increase pinion depth



Decrease pinion depth.



## DIFFERENTIAL EXPLODED VIEW:





## FREQUENTLY ASKED QUESTIONS:

### DE-BURRING RING & PINION:

It is fairly common for a new or used Ring & Pinion to have some minor cosmetic blemishes. These could be small burrs or chips on the teeth. For this reason, we recommend looking over the gear set before installing. These blemishes are not cause for return, simply de-burr the chip, ding, or burr with a small sanding disc. This will ensure that rough edges will not erode further and that there are no high spots to affect the gear sets operation.



### CLEARANCE GRINDING FOR CROSS PIN:

It may be necessary to clearance grind one or more ring gear teeth to allow removal of the cross pin shaft. This is typically the case with numerically higher gear ratios, as the ring gear gets thicker and blocks the shaft from removal. With the ring gear installed on the carrier, site the area that is interfering and make marks. Don't remove more than necessary, and be sure to de-burr the edges with a small sanding disc to remove any sharp edges. As with any cutting or grinding process, be sure to keep clean parts of debris thoroughly before installation.

### PINION HEAD CLEARANCE GRINDING:

Sometimes aftermarket carriers / lockers can interfere with the pinion head. If this is the case, the end corners of the pinion teeth can be ground at a small angle to avoid contact. The material removed is outside the contact patch, and will not compromise strength. As always, de-burr the modified teeth, and clean your parts.



### LIMITED SLIP DIFFERENTIALS (LSD):

Some chatter is normal for limited slip / positraction differentials. Both rear tires must measure the same height from the ground to the top of the wheel in order for the differential to function properly without premature wear. Most LSD units require an LSD/Friction Modifier additive to be used with the gear oil. Synthetic oil is not recommended for most LSD Units.

### MECHANICAL LOCKERS:

Mechanical locking differentials will pop & clunk during normal operation. This is most noticeable on/off the throttle, and during sharp maneuvering / 3 point turns. There will also be a large amount of rotational slop in the rearend. Both rear tires must measure the same height from the ground to the top of the wheel in order for a locking differential to work properly.

### GEAR NOISE:

While Nitro Gears are among the quietest aftermarket gears available, there still is potential for some gear noise. While the most common reason for Gear whine is improper setup, even a properly installed ring & pinion can sometimes make some noise. If the ring & pinion is setup properly yet makes some gear whine, it does not generally mean a defective gear. There are many factors that contribute to the potential for noise such as vehicle type, harmonics, tire sizes, lower gear ratios, etc. Gear noise is not a warrantable condition.

### GEAR NUMBERING:

As with any aftermarket gears, Nitro gears may or may not have numbers etched on them. These numbers are generally part of the manufacturing process, and are not meant for use in the installation process. As mentioned in the installation guide, we recommend starting with the original pinion depth shim thickness as a starting point, and adjusting if necessary based on the contact pattern.





**INSTALLATION SPECIFICATIONS:**

	PINION BEARING PRELOAD			BACKLASH (.001" inch)	R.G.BOLT TORQUE (Foot lbs)	BEARING CAP TORQUE (Foot lbs)
	DIFFERENTIAL	NEW	USED			
	MODEL	(Inch Pounds)	(Inch Pounds)			
AAM	9.25"	15-22	7-9	6-10	75	80
	10.5" (Dodge)	22-28	7-9	6-10	90	90
	11.5"	25-35	7-9	6-10	110	110
AMC	MODEL 20	14-19	6-8	6-10	65	65
	MODEL 35	12-15	6-7	6-10	55	55
GM	OLDS/PONT D/O	14-19	6-7	6-10	55	60
	63-79 CORVETTE	14-19	6-8	6-10	55	60
	55 Chevy	14-18	6-8	6-10	55	60
	7.2" IFS	11-14	6-7	6-10	55	60
	7.5"	12-15	6-7	6-10	65	60
	7.75"	12-15	6-7	6-10	65	60
	8.2"	12-15	6-7	6-10	55	60
	8.2" OLDS/PONT	12-15	6-7	6-10	55	60
	8.25" IFS	14-19	6-8	6-10	65	55
	8.5" & 8.6"	14-19	6-8	6-10	65	60
	9.5" & 9.25" IFS	15-22	7-9	6-10	75	80
	12 bolt 8.875" Car	14-19	6-8	6-10	55	60
	12 bolt 8.875" Truck	13-15	6-7	6-10	55	60
	14T 10.5"	20-35	8-11	6-10	120	135
	HO72 12.25	PRESET		6-10	120	175
	CHRYSLER	7-1/4"	12-14	6-7	6-10	55
8-1/4"		12-15	6-8	6-10	55	60
8-3/4" '41'		13-15	6-8	6-10	55	90
8-3/4" '42'		15-25	7-10	6-10	55	90
8-3/4" '89'		14-19	6-9	6-10	55	90
9-1/4"		14-19	6-9	6-10	65	75





**INSTALLATION SPECIFICATIONS:**

DIFFERENTIAL  MODEL	PINION BEARING PRELOAD		BACKLASH  (.001" inch)	R.G.BOLT	BEARING CAP
	NEW	USED		TORQUE	TORQUE
	(Inch Pounds)	(Inch Pounds)		(Foot lbs)	(Foot lbs)
DANA					
DANA 28	10-13	5-6	6-10	55	50
DANA 30	12-15	6-8	6-10	55	55
DANA 35	12-15	6-7	6-10	55	55
DANA 44	14-19	6-9	6-10	55	60
DANA 50	14-19	6-9	6-10	65	60
DANA 60,61,70U	17-30	8-10	6-10	110	80
DANA 70 & 70HD	20-35	8-10	6-10	110	80
DANA 80	25-40	9-11	4-10	175	90
FORD					
7.5"	14-19	6-8	11-16	60	60
8.0"	12-14	6-7	10-15	60	60
8.7"	14-19	6-8	10-15	60	60
8.8"	14-19	6-8	11-16	60	60
9" OEM R&P	13-15	6-7	10-16	70	60
9" NON OEM			7-10		
9" DAYTONA	14-16	6-8			
9-3/8"	14-16	6-8	10-15	70	60
10.25 & 10.5"	20-35	6-8	11-16	95	80
TOYOTA					
Passenger	11-13	5-6	6-9	55	60
7.5, 8" 4cyl	12-15	5-6	6-10	65	70
8" V6, 8" Rev	14-17	5-6	6-10	65	70
8" clamshell	14-17	5-6	6-9	70	n/a
8.4" Tacoma	15-18	5-6	6-10	70	70
9" Clamshell	15-22	5-6	6-10	70	n/a
9.5" LC	12-15	5-6	6-10	70	70
10.5"	20-25	5-6	6-10	100	100

**BREAK-IN PROCEDURE:**

In order to prevent damage to differential components it is essential to follow the break-in procedure after installation of a new ring & pinion. New ring & pinions will generate more heat initially after installation and can cause gear oil to break down, leading to premature failure. On your first drive, stop after the first 15 or 20 miles and let the differential cool for 20-25 minutes before proceeding. Drive conservatively for the first 500 miles following installation (avoid hard acceleration & towing). After completing standard break-in, tow for very short distances (less than 15 miles) and let the differential cool before continuing during the first 45 towing miles. Change the gear oil after the first 500 miles. This will remove any metal particles or phosphorus coating that has come from the new ring & pinion.

Premature overloading/overheating will cause gear oil to breakdown, and may result in parts failure.







REPAIR & PERFORMANCE PARTS - RING & PINION - AXLES - TOOLS - GEAR PACKAGES - YOKES - LIMITED SLIP - INSTALL KITS

[www.nitro-gear.com](http://www.nitro-gear.com)