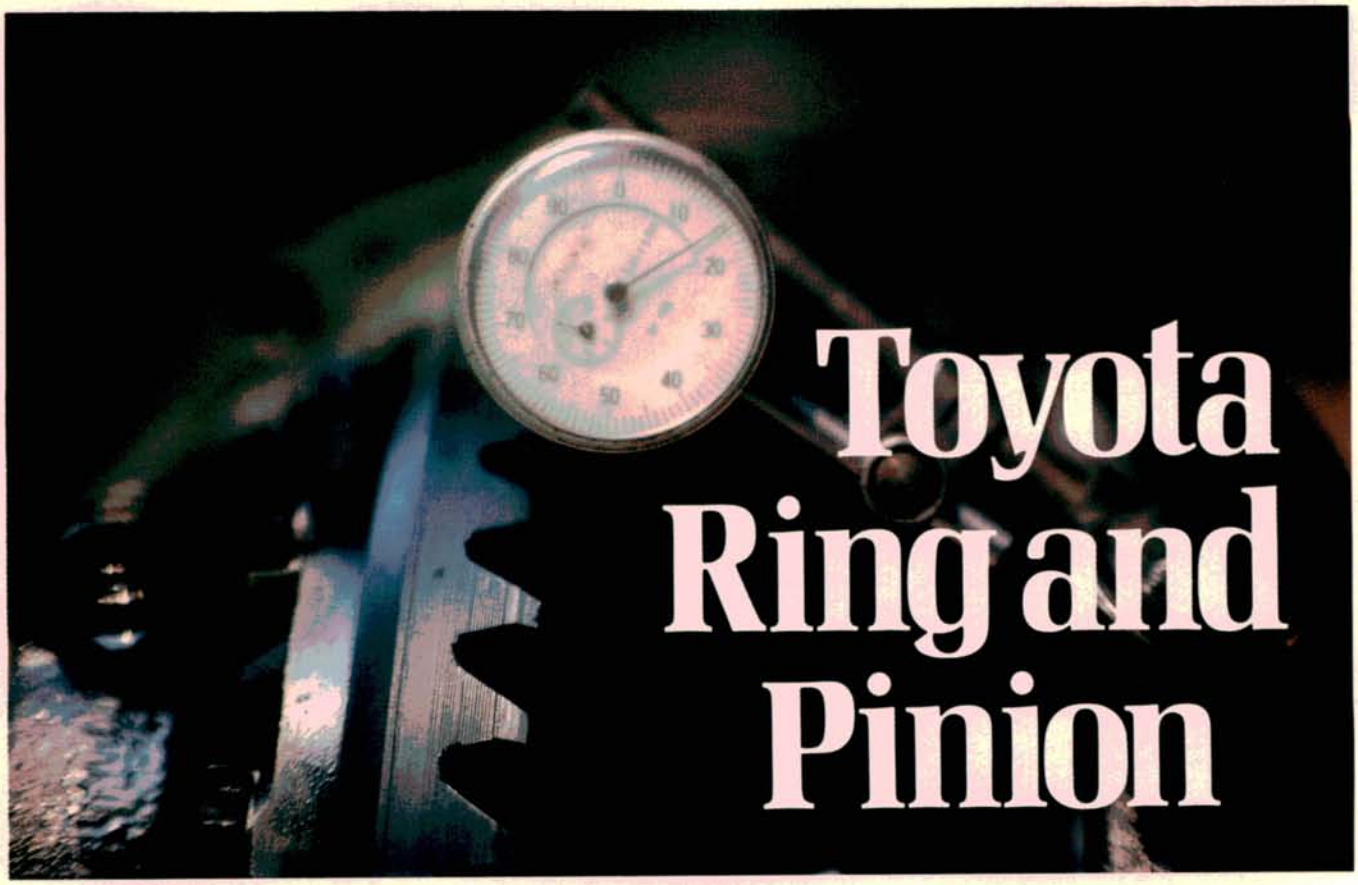


Toyota Ring and Pinion

There are still a lot of rear-drive vehicles on the road today in spite of front wheel drive mania. This traditional design has long been noted for its durability and reliability.

As a result, actual replacement of the ring and pinion combination itself may be something you don't do too often. Many, if not most, of these rear-drive cars and trucks will still have the original ring and pinion in place when they go to the crusher.

Besides, unless you get your hands on the special pinion depth measuring fixtures needed to set the proper pinion depth when replacing the ring and pinion set, you may choose not to do an actual pinion replacement in the first place.

Replacement of bearings and seals is an entirely different matter, however. Lack of fresh lubricant, heat, and just plain normal wear take their toll on pinion seals and bearings, and carrier bearings. This article will emphasize bearing and seal replacement, pinion preload adjustment, and backlash adjustment.

As usual, we encourage a test drive before you begin disassembly. Listen for, and try to isolate, the potential causes of noise or vibration during your drive. We don't want to be replacing pinion bearings when all the vehicle needs is a wheel bearing.

We chose a differential from a rear-drive 1983 Toyota truck. This procedure applied to ½ ton and ¾ ton trucks. Cab and chassis and four-wheel drive trucks called for a different, but similar procedure for setting pinion bearing preload that required selection of a separate preload shim. But that's a story for another day. The important thing to remember is that the differential covered is representative of those used in other Japanese imports.

If you use the general principles and techniques we cover and then refer to specific manuals covering different makes, models, and years, bearing and seal replacements are a snap.

Two Approaches

The Toyota shop manual suggests that rather than remove the brake shoes and emergency brake cables from the backing plates, you disconnect the brake cables at the emergency brake centering pivot and remove the bolts holding the cables to the frame.

This gives you enough slack in the cables to unscrew the brake lines and remove the entire backing plate assemblies with cables and shoes still attached.

On the other hand, if the vehicle needs new brake shoes, you may choose to unbolt the cables from the backing plates since the shoes are coming off anyhow. Either way, we caution you against simply unbolting the backing plates, sliding the axles out far enough to clear the differential, and letting them rest on the axle seals for several reasons:

• The weight of the axles on the seals, plus the hassle of trying to realign the axle splines in the differential while the brake lines and cables fight you, may cause you to damage the axle seals without your ever knowing it.
• Secondly, the area where the outer seal (the large rubber o-ring) rides on the axle tube, gets rusted and crusted. You really want to get the axles and backing plates all the way off the car. Then you can clean that entire area and install new sealing rings. (We all know how we find the time to do the job right the second time around.)
• Finally, it's not a very good idea to be twisting and stretching those brake lines into weird shapes. Soak the fittings at the wheel cylinders with penetrating oil and use the proper line wrench to gradually free them. Pull the rubber bleeder caps off the wheel cylinders and put them over the open brake lines. This will keep the dirt out, help save you from suffering with an eyeful of brake fluid, and keep the lines full of fluid. (We found that bleeding the brakes was a snap with the lines and wheel cylinders still full of fluid.)

Special Tools

We experimented a little when it came to press tools for bearing removal and replacement. Noting the similarities between the differentials on Toyotas and Mitsubishis, we contacted Miller Special Tools and asked them to send out the tools they supply for Mitsubishis. Then we played a bit. The tools we show did a swell job of removing pinion and carrier bearings. The bearing remover also did a good job of installing the new pinion bearings. We just flipped it over and used it to pull the new bearings into place.

We especially liked the installer ring that pressed against the inner race of the bearing. It did not press on the bearing cage and as a result did not damage it.

Purist or Practical

All the shop manuals suggest that when it comes to setting pinion bearing preload, you use a companion flange holder and a large torque wrench to tighten the pinion nut. If you don't have such a holder, you can make one from a sturdy piece of flat steel with holes drilled to catch two of the companion flange bolt holes.

It takes a lot of torque to get that crush spacer to start compressing, so don't be surprised if you need a long handled wrench for leverage.

Tighten the pinion nut just far enough to take the free play out of the bearings. Then start turning the nut about five or ten degrees at a time until the proper turning torque is reached. Some folks use an impact gun to tighten the nut and swear they never have a problem with damaging the pinion bearings with impact gun vibration. We got some spirited differences of opinion on this point, however. Some swore by the impact. Some swore at it. Pay your money and take your choice.

Stop now and then to check total torque on the nut to make sure you haven't exceeded the maximum tightening torque specification for the pinion nut. It is possible to tighten the pinion nut to a point where you exceed the specification for turning torque without exceeding the maximum tightening torque on the pinion nut.

If this happens, don't—we repeat DO NOT—simply back the nut off to get the proper turning torque. An initial turning torque reading higher than specifications means you've over-crushed the sleeve. Get a new sleeve and start again.

Oh, by the way, some of you may call this a third member. Some may call it a differential carrier, which is what we'll call it. Just so we have our signals straight.

—By Ralph Birnbaum

1

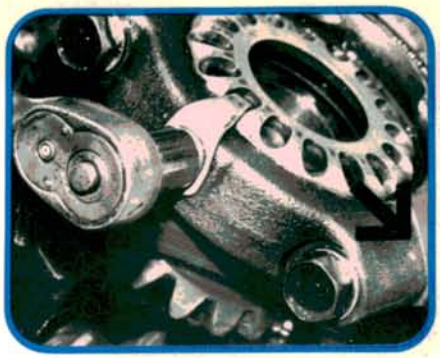
This is a good time to grab the drive shaft and check for play in the universal joints. Take a can of spray paint or a punch and mark the driveshaft and companion flange for index. Remove the four bolts and the driveshaft. Pull the drain plug and let the oil start to drain.

2

Raise the vehicle and remove the rear wheels and brake drums. Remove the brake lines. Remove the bolts that hold the bearing retainer on the axle housing. Disconnect the brake cables using one of the methods mentioned in our introduction. Slide the axle assemblies out of the differential.

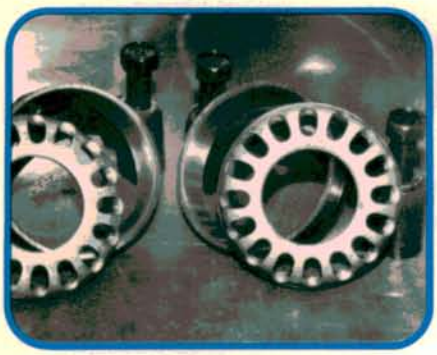
3

Now remove the ring of nuts and lockwashers that hold the differential carrier to the rear axle housing. Be careful not to bang any gear teeth as you remove the carrier from the axle housing. If this is your first try at one of these, also be aware that this carrier is fairly heavy.



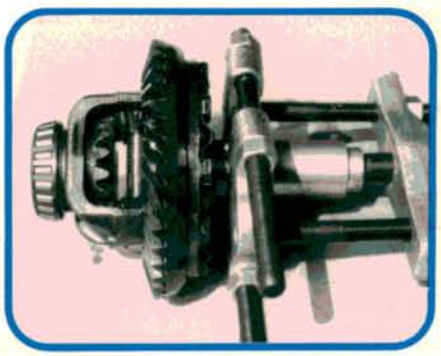
4

Remove the differential carrier and unbolt the lockplates that hold the carrier bearing adjustment collars. Match the bearing retainer caps and the bearing cradles with sharp punch marks. That way you'll be sure to get them back together as a matched set. Don't laugh, it's easy to get them confused.



5

Remove the bearing caps, adjusting collars, and bearing races. Match them as sets in two separate piles. We want the races and bearings to go back together as matched sets if we plan to reuse the carrier bearings. Inspect the bearings and races as usual and replace as necessary.



6

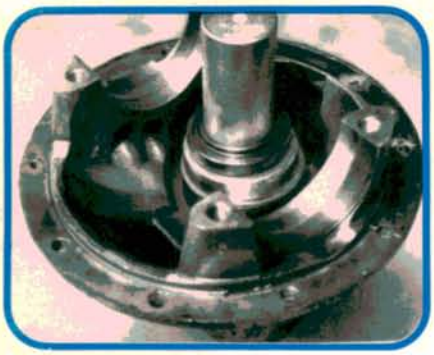
Use a setup similar to the one shown to remove the carrier bearings. Make sure the puller grabs the inside race, not just the cage. When you press or drive the new bearings back on the assembly make sure the press tool bears only on the inner race or you'll ruin the new bearing installing it.

7

Use a soft mallet to drive the pinion through the front bearing. Remove the pinion seal, oil slinger, and the front pinion bearing. Clean the bore where the new seal will ride. A thin film of sealer on the outside of the seal will help seal any small imperfections in the bore caused by rust.

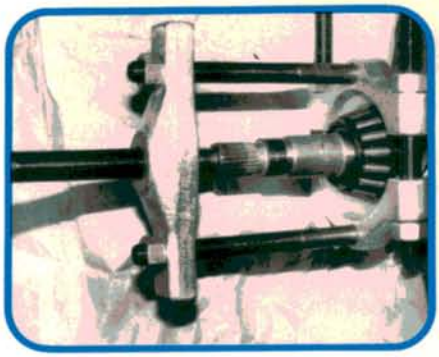
8

Take the companion flange and inspect the sealing surface for any nicks, cuts or gouges that might ruin the new pinion seal. Minor imperfections, or nasty accumulations of surface rust and dirt can be removed with fine emery. Replacing the pinion seal without this step is a waste of time.



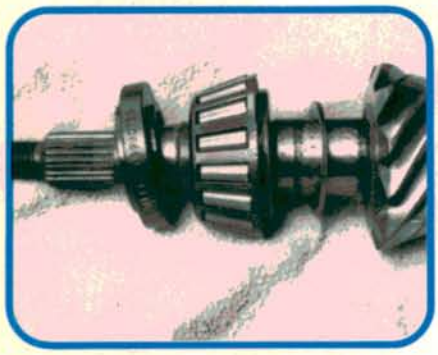
9

Thoroughly clean the differential carrier housing. Inspect the bores into which the pinion bearing races fit. Make sure you didn't raise any burrs with the punch when you drove the old races out. If you're replacing bearings, the old races make great drivers. Safety glasses, please.



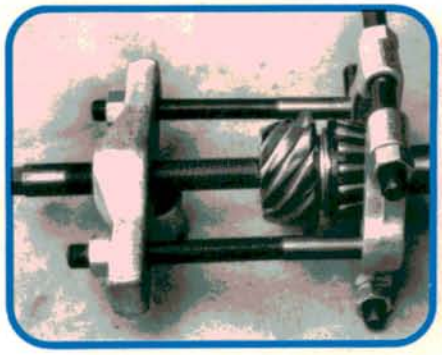
10

Now we're ready to pull that inner pinion bearing if it's bad. It's on there, believe me. You want a puller that gets under the inner race. A puller that grips the bearing cage may simply disassemble the bearing and leave the inner race on the pinion shaft. Bummer.



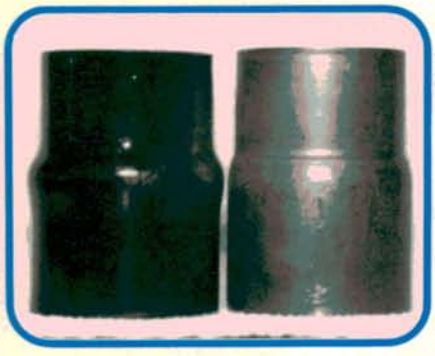
11

When replacing the old with the new, don't forget the pinion depth adjusting shim or there'll be big trouble in River City. A spacer like this one from Miller has a collar that rides on the inner bearing race but misses the cage. Do not press on the cage of the bearing or you'll trash it.



12

Reinstalling the pinion bearing was just a matter of using that shouldered spacer we just mentioned and the same gear puller. Only this time we used the pinion as our leverage point and used the puller to pull the bearing over the pinion shaft. It's just a matter of leverage.

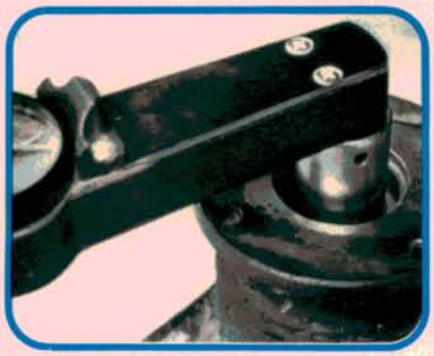


13

The crush spacer at left is the old one. If you look closely, you'll notice that it's slightly shorter than the new one at right. It's already been compressed once. Never reuse the old one. That's asking for trouble. We have to properly preload the inner races to make the bearings last.

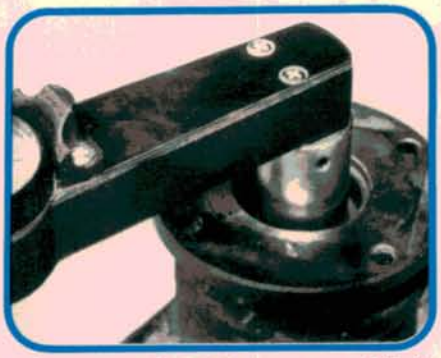
14

Install the front pinion bearing, slinger, and pinion seal. Push the pinion through the bearing and flange. Torque the pinion nut to an initial torque of 110 Nm (80 ft-lb). Turn the flange several times. Check initial turning torque. Slowly tighten the nut to get proper turning torque.



15

You have to keep checking initial turning torque each time you tighten the pinion nut. New bearing 1.17-1.87 Nm (10.9-16.5 in-lb). Old bearing 0.56-8.7 Nm (5.2-8.7 in-lb). This is the force needed to get the bearing moving. This is the amount of torque needed to get the shaft STARTED turning. Never mind what it reads AFTER it's turning. This is preload.

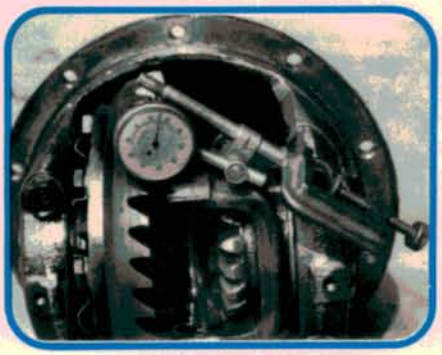


16

Believe me, this is important. We just can't leave the pinion bearings too loose. At the same time, we have to strike a delicate balance between too loose and way, way too tight. Tighten to get proper preload without exceeding the maximum torque for the pinion nut of 234 Nm (173 ft-lb).

17

Reinstall the ring gear carrier. Set the carrier bearing races in place. Screw the bearing cap bolts down finger tight and start screwing in the adjusting collars. Alternately tighten the collars until you get zero bearing end play but have a slight backlash between the ring and pinion.



18

Mount a dial indicator as shown. Make sure the dial indicator is at a right angle to the ring gear tooth being measured. Preload the gauge and zero the dial. Hold the pinion so it can't turn and rock the ring gear back and forth against the pinion, measuring total gauge travel.

19

If you don't have the proper tool, you can turn the collars with punches as we did. Adjust the collars for zero bearing clearance, then alternately screw one collar out and the other collar in—in equal amounts—to get the correct backlash. In this case it's 0.13-0.18 mm (0.005-0.007 in).

20

Tighten the collar away from the ring gear 1 to 1½ notches to preload the bearings. Recheck backlash. Install the lock clips. Tighten the bearing cap bolts to 69-88 Nm (51-65 ft-lb). Add 3.5-5.2 in-lb to the initial preload spec and check total preload (turning torque) of the ring and pinion.