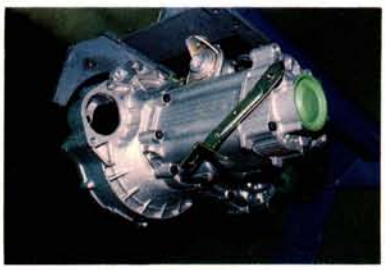
Volkswagen Transaxle Repair



The Volkswagen transaxle covered in this article has been with us in this basic form since it was used in the first VW Rabbit way back in 1975. It's been through some changes and modifications since that time, but old and new units are very similar in their basic design. And there sure are a lot of them out there.

Rolling Reverse Shifts

One of the biggest enemies the VW transaxle faces in its fight to survive is something we used to call a rolling-reverse shift. Maybe the driver thinks that reverse gear is made of rubber. Maybe he doesn't think at all. But he tries to force the shifter into reverse while the car is still rolling forward.

The fact that the driver pushed in the clutch pedal means nothing. The ring gear is still being driven by the axles which means the pinion is also turning—clutch in—clutch out. Trying to sneak that square cut reverse idler gear into place is an invitation to disaster.

The driver may realize the error of his ways and regroup for another try after completely stopping the vehicle. But if he ignores that grinding sound and decides to force the issue, he knocks a tooth off the idler gear, and Murphy's Law takes over. The missing tooth ends up (where else?) between the ring and pinion. And the pinion loses every time.

The noise from the damaged pinion tooth can be loud enough to lead you to the source of your problem. But a small nick on a pinion tooth can also result in a smaller clicking noise, especially noticeable at slow speeds. This clicking has resulted in the replacement of CV joints and wheel bearings in many futile efforts to eliminate the noise.

Replacement of the ring and pinion requires (what else?) complete disassembly of the transaxle, since the ring and pinion assembly are the last things uncovered during a teardown. There is no backlash adjustment to make, but as we'll see, there is a very critical adjustment to be made for pinion bearing preload.

Machine Shop Class

Another problem with this transaxle has to do with the retainers used to keep the side gear (pinion) shaft centered in the differential carrier. Volkswagen went away from the snap rings used on early units, and started using two cuplike retainers held by two of the ring gear bolts to keep the pinion shaft centered.

The problem with the cup-retainer design is that the shaft moves back and forth against the retainers in response to centrifugal force. The shaft acts like a battering ram. Gradually, it eats away at the cups until that same centrifugal force slides the shaft out far enough for it to hit the transaxle case. The chips fly as the differential carrier becomes a lathe.

The replacement pinion shaft kit from Volkswagen wisely replaces the new with the old and contains two snap rings that fit in machined grooves in the shaft, preventing a recurrence of this problem. Some of the transaxle cases have been eaten all the way through, requiring some serious welding, or replacement of the

case. We'll show you a photo of an extreme case, no pun intended.

Used Unit Cautions

Like we said, different variations of this transaxle are very similar in appearance. So be careful. Don't let the fellow at the salvage yard sell you any old transaxle just because it bolts up like the old one. There were any number of gear ratios hiding in those look-alike cases. Changes in final drive and top gear ratios can change engine speed at 60 mph by 750 rpm or more!

Aside from some very obvious changes in performance and fuel economy, the wrong ratios will also have a drastic effect on down the road emissions.

Mix-and-match becomes even more complicated when you add in an additional list of changes, like the addition of an upshift light in 1982, and changes in transmission mounts.

Quick Tips

Here are some quick tips that may make life easier for you when diagnosing transmission noise or shifting problems:

• **Transmission grinds only in first or reverse**. Check and adjust clutch free play as needed. Check the pedal and clutch cable assembly for wear or damage. Make sure the retainer clip holding the clutch cable to the clutch arm isn't binding on the case, limiting clutch arm travel. If the problem persists, check for a clutch disc that binds on the input shaft.

• **Transmission difficult to shift into first gear only on 1985-88 Golf models, and 1988 Jetta models**. These transaxles were originally equipped with a first gear synchronizer, P/N 020 311 247. A new synchronizer, P/N 014 311 295D, with a closer tolerance was introduced for a time, but since some difficulties were reported with hard shifting into first gear with the new synchros, the old part number has been put back into service.

You might want to ask the customer if the hard shifting occurred after an overhaul as a clue.

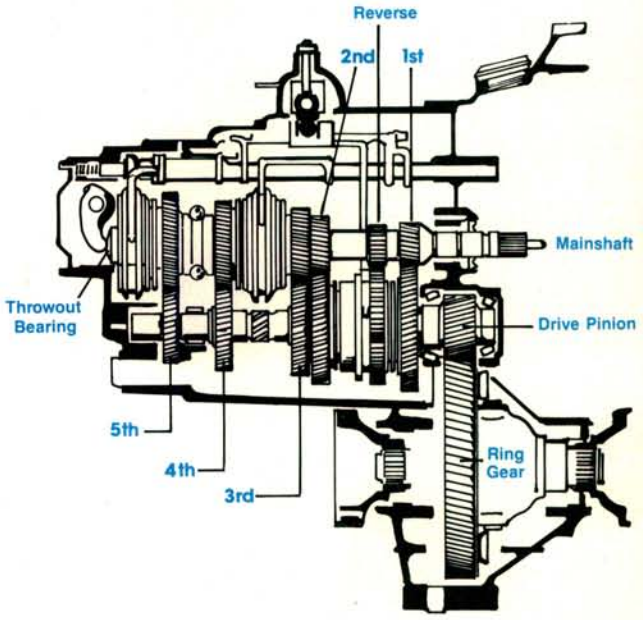
• **Transmission difficult to shift into all gears**. Check for a binding or misadjusted shift linkage.

• **Transmission difficult to shift when cold**. Substitute 80W gear oil for 80/90W.

• **Transmission gear noise at all times**. Check for chipped tooth or teeth.

• **Transmission gear noise goes away when a specific gear is selected**. Check the needle bearing on that gear. Selection of the gear locks it to the synchro hub and keeps it from turning on the noisy bearing.

• **Reverse gear can be engaged without overriding the lockout mechanism**. Wear or distortion of the shift linkage housing, or shifter ball and socket allowed the driver to select reverse without overriding the reverse lockout. Grab the shifter and try to move it up and down. There should be no more than one millimeter of up and down movement in the shifter. If there is more than one millimeter of up and down play, check the shifter ball and socket for excessive wear.



• **Filling the transmission**. On transaxles using new style mounts, the trans will sit at a slight angle (about 2 degrees). This requires a two-step procedure to properly fill the transaxle with gear oil.

Start by filling the transaxle through the oil filler plug until the oil is level with the base of the hole. This calls for about two liters of oil. Now replace the plug, and remove the speedometer drive cable from the trans. Add another half liter of gear oil through the speedometer drive hole.

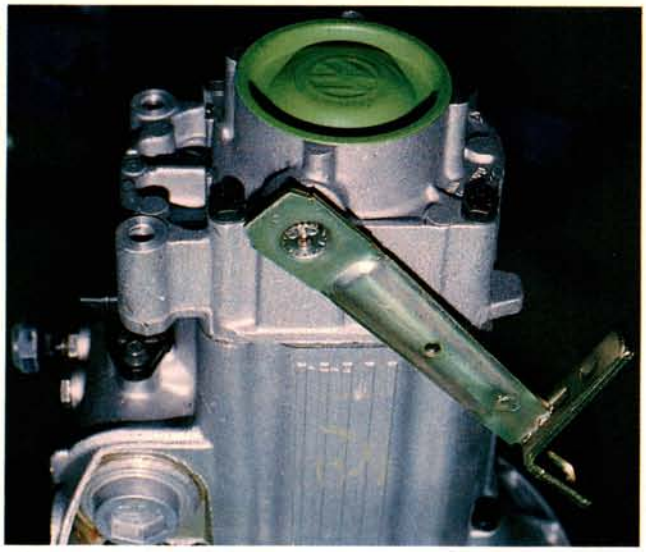
Special Tools

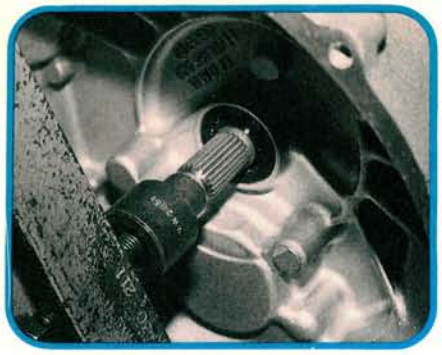
You'll need some special tooling to repair these transaxles. Many of the tools needed can be fabricated, although the factory approved tools are available from Zelenda Tool **(Circle No. 200).**

The puller for the bearing race for the lower pinion bearing is one purchase you may want to consider, even if you make the rest of your tools from bar stock and threaded rod. The race sits in a blind hole, so you can't get behind it to drive it out. The expandable puller we'll show spreads apart as it's tightened to grip the race for removal. It works like your starter bushing puller to grip the race. Anyone with an alternative method is encouraged to drop us a line.

Let's look at some key considerations and overhaul tips. Grab your shop manual or microfiche and fill in the empty spaces as we go. There isn't enough room here to cover a complete teardown procedure, so we'll concentrate on highlights.

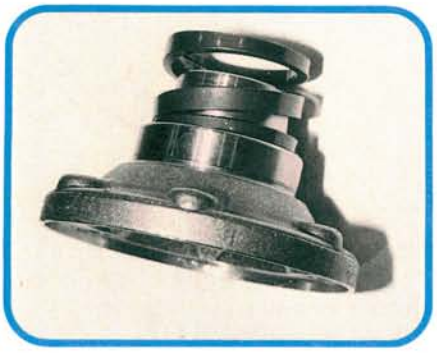
—By Ralph Birnbaum





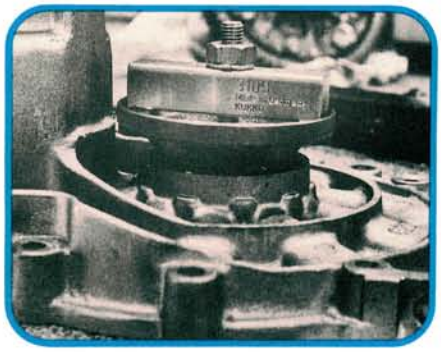
1

Remove the clutch push rod from the mainshaft. Bolt a bar across the bell housing that has an adjustable center bolt to support the mainshaft. Insert a spacer (copper or brass) between the end of the mainshaft and the adjusting bolt. Turn the bolt and spacer in until they just contact the end of the mainshaft.



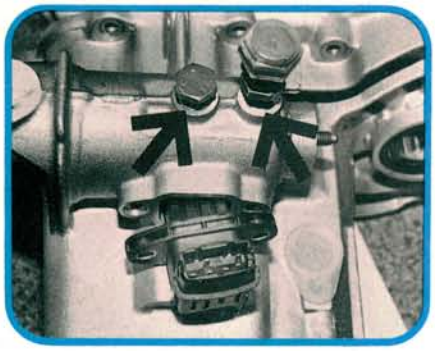
2

Now remove the final drive flanges. The noise reduction springs behind the flanges look like they once supported a small truck or a hay wagon. We'll need to compress the flanges against these springs so we can remove the circlips holding them to the final drive output shafts.



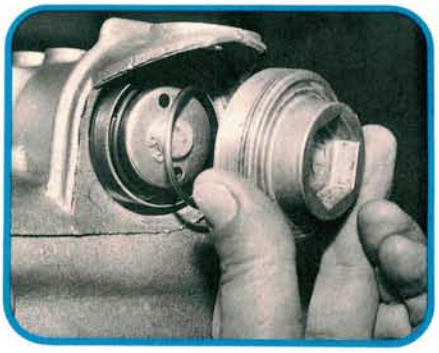
3

Use a tool like this one to compress the springs. Pry out the flange joint inner grease seal and thread the rod into the drive flange shaft. Tighten the nut on the cross bar to compress the springs. With the tension released, remove the circlip and spacers below, noting location. Remove the tool and the flange.



4

Remove the fifth gear detent plunger and shifter peg bolt. Also remove the back-up/upshift light combination switch. Check the plastic teeth on the backside of the switch to be sure none of them are missing or badly worn. Whenever possible, a test of the lights during the road test is a time saver.

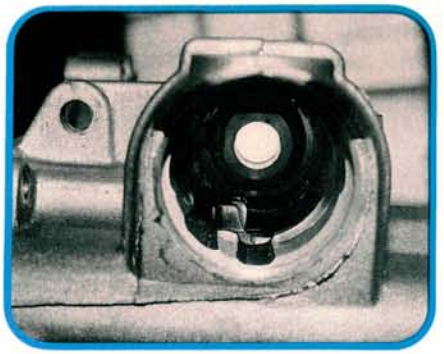


5

If possible, shift the trans to neutral. Unscrew the selector shaft retainer with a 27 mm hex head. Careful, there's a big bad spring hiding behind the cover. On 1985-86 models there was a small vent hole in the case above the plug. Make sure it's not full of debris or the tranny won't breathe.

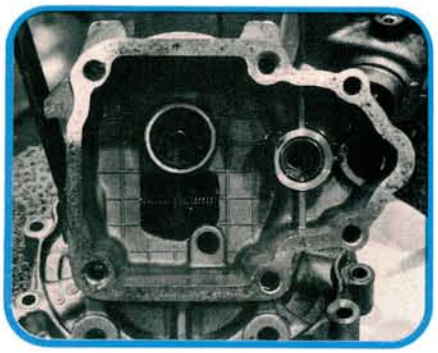
6

If the trans won't shift to neutral, you'll have to remove the selector in pieces. Carefully remove the snap ring on the retainer cup. We repeat, be careful! There's an even bigger, even badder set of springs in there that will send the cap and snap ring into never-never land. Trust me on this one.



7

Remove the selector lever. Check the shaft seal at the opposite end of this hole for damage or heat-hardening. Replace if necessary. See how all the selector fingers are aligned? That's neutral. The finger closest to you is reverse. Remember that, we'll need it in a few moments.

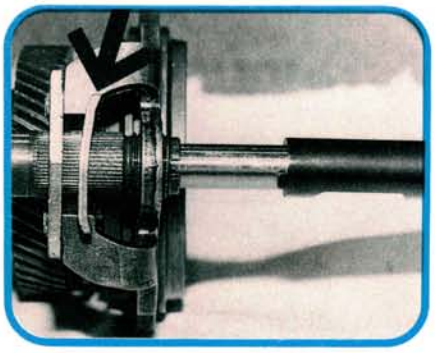


8

You don't need to remove that pretty green cap from the end cover unless you're replacing the release bearing. Removing the cover means piercing the cover and prying it off like a coffee can lid, so have a new one handy. Otherwise, just remove the six bolts and the entire end cover, cap and all.

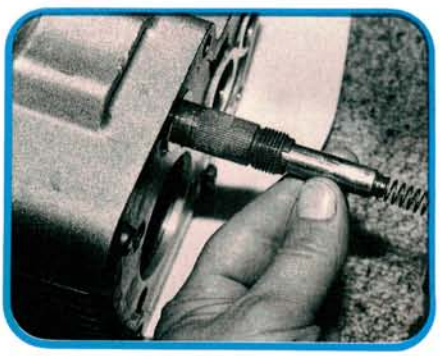
9

A 12 mm spline socket nut holds the fifth gear synchronizer hub to the mainshaft. It's torqued to 150 Nm and there's D6 locking compound on the threads. Select fifth gear at the synchro hub, and reverse gear by pressing downward on the selector finger pointed out in step 7. This locks the mainshaft.



10

Finish removing the fifth gear assembly by prying up on this locking tab until it's free of the splines on the tube. Use a slotted tool to unscrew the tube from the selector fork (left hand thread). Lift the fifth gear assembly from the mainshaft and shift tube as an assembly.

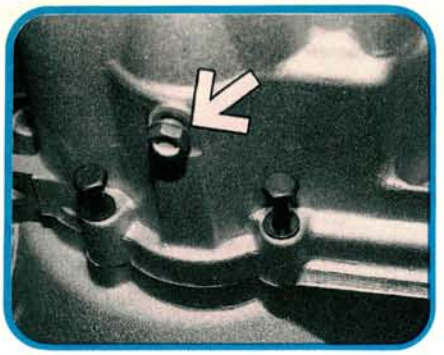


11

Note the position of the spring and the shaft that slides through the tube. Do not remove the shaft yet. Pull it out now and the shift forks inside the trans will fall every which way and may jam. Leave the tube in place until the case is split and then remove the shaft and forks as an assembly.

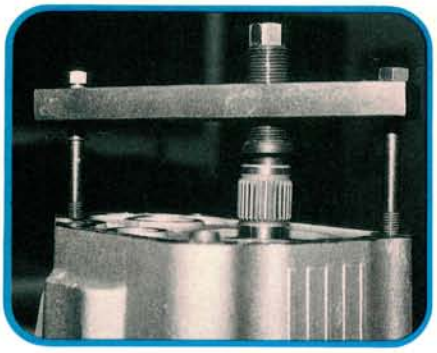
12

Remove the fifth gear synchronizer assembly. Then you can remove the four 5 mm internal hex head bolts directly beneath it that hold the clamping plate to the trans case. Also remove the circlip, washer, and fifth gear from the pinion shaft. You'll probably need a gear puller to remove fifth gear.



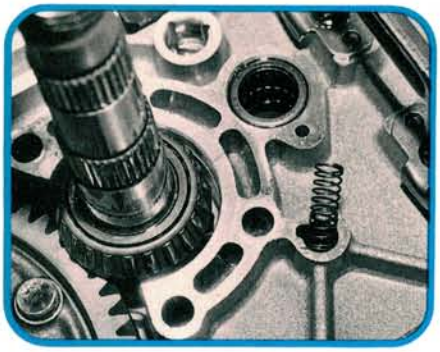
13

Before we split the transmission case halves, we'll remove this bolt that screws into the reverse idler shaft inside the trans. Always replace the aluminum washer behind it. Now remove the ring of bolts holding the case halves together.



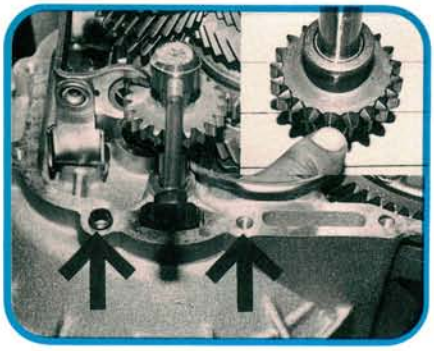
14

You'll need a press tool like the one shown to press the mainshaft through the case bearing. Now you understand why it was important to support the mainshaft with our bridge tool way back in our first step. (Normally the pinion shaft and selector would be seen, but we removed them so you could see where to press.)



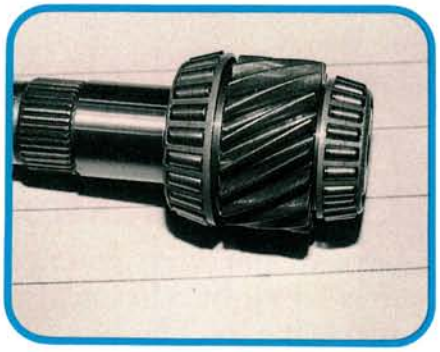
15

Disassemble the trans following the procedures in the repair manual. As you remove the shift fork pivot from its bore in the lower case half, keep track of this spring. If you put it somewhere for safekeeping, don't forget to reinstall it later.



16

Check the tapered gear faces on the reverse idler gear for damage. When reinstalling the shaft and gear, use a long bolt to center the threaded hole in the shaft head between the two case holes we marked with arrows. That way, the threaded hole will line up with the case hole. See step 13.



17

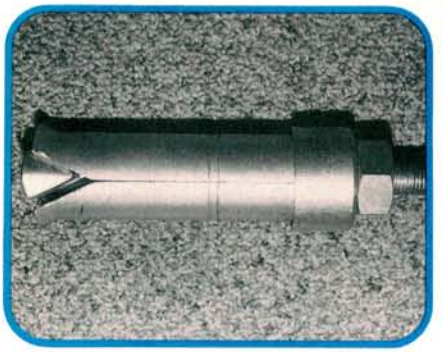
If any teeth or parts of teeth are missing from the reverse idler gear, check the teeth on the pinion with a fine-toothed comb. It doesn't take a big nick in one of these teeth to make a noise. If you replace the pinion, you have to replace the ring gear as well. They are a matched set.

18

Here's a better view of a damaged retainer cup. Once the pinion shaft has eaten through the cup as it's done here, centrifugal force throws the pin out far enough for it to come in contact with the case. You can see all the aluminum chips thrown up as the shaft ate at the case.

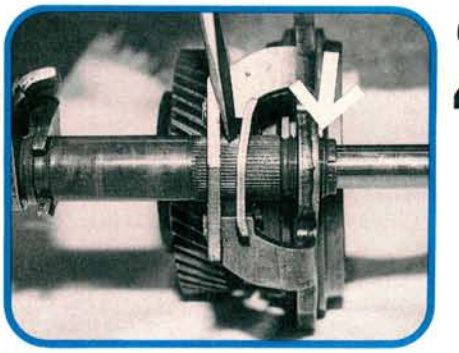
19

We promised you a photo of a case that was severely damaged by a runaway pinion shaft. Our host shop gives the customer the option of welding a hole like this, or of replacing the case. As bad as this is, they said they've welded a number of cases with damage this bad, and put them back in service.



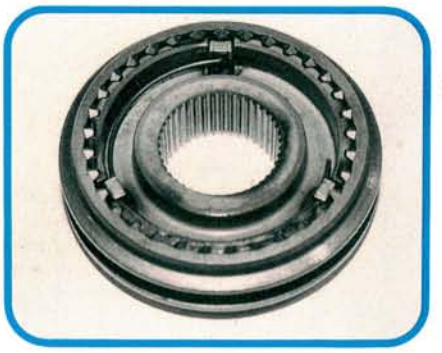
20

This is the puller for the lower pinion bearing race. As you tighten the nut, the wedge is pulled up tight against the two legs of the compressor, spreading them apart and wedging them against the lower lip of the bearing race.



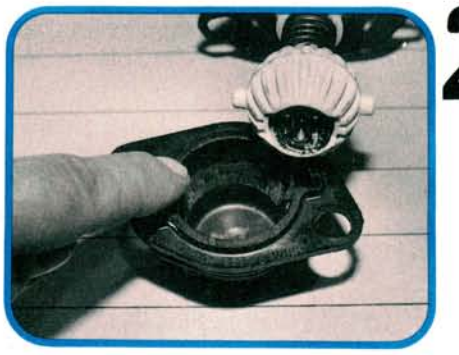
21

When reassembling the fifth gear synchro assembly, there's another adjustment. Put the assembly on the mainshaft. Thread the selector tube into the fork until about 5 mm of the tube extends through the top of the fork as shown. Reinstall the spline nut on the main shaft with locking compound and retorque to 150 Nm.



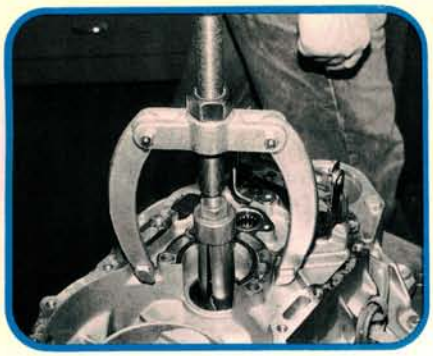
22

Engage fifth gear. Lift up on the operating sleeve just enough to take out any free play in the assembly. The inner edge of the operating sleeve should be 1 mm below the bottom face of the synchro hub. Adjust it by turning the threaded sleeve. Install a new lock clip and squeeze it tight to lock the adjustment.



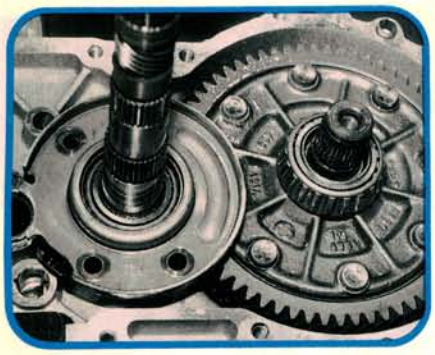
23

No transaxle overhaul is complete without a careful examination of the shifter ball and socket. Normal wear and lack of lubrication result in these chatter marks in the socket. This one was so loose that it was possible to select reverse gear without overriding the lockout mechanism.



24

Whenever you replace a final drive housing, ring/pinion, or pinion bearings you'll need to check and adjust the pinion bearing preload. Preload is adjusted by changing the thickness of the shim beneath the lower pinion bearing race. Start by removing the bearing race with a set up like this.

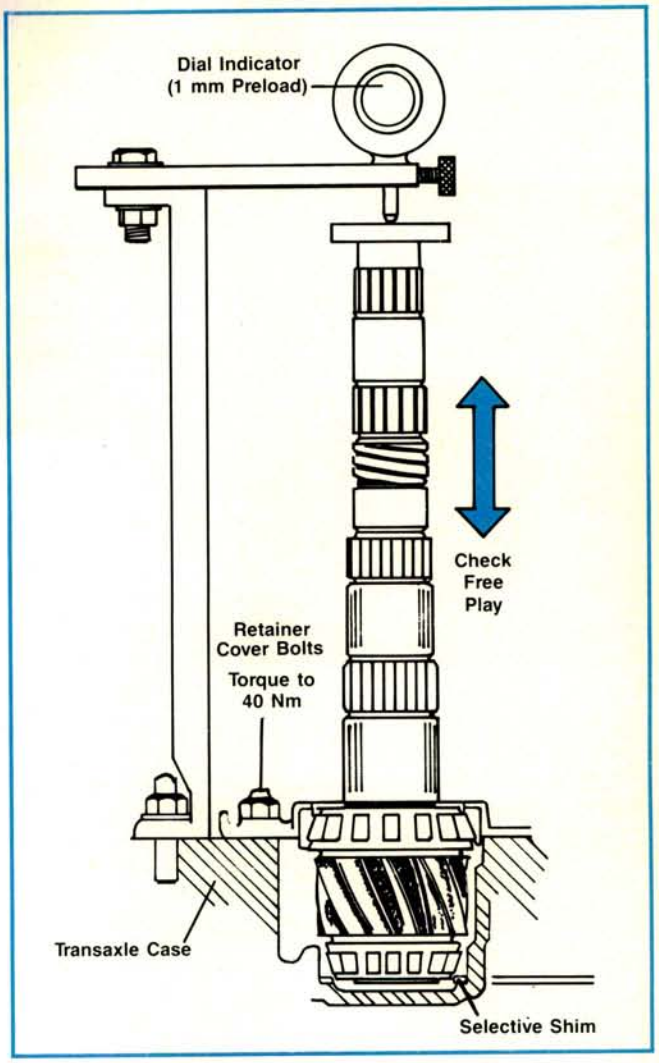


25

Remove the original shim beneath the race and install a 0.65 mm "starter shim." Reinstall the race until it bottoms tightly on the shim. Reinstall the pinion (bearings installed) and the upper bearing retainer. Torque the four retainer bolts to 40 Nm (30 ft-lb).

26

Rig your dial indicator as shown. Preload the gauge about 1 mm. Move the shaft straight up and down (do not turn the shaft or the reading will be inaccurate). Record the total travel (free play). Add the amount of free play plus 0.20 mm to the original thickness of the installed shim.



BEARING PRELOAD ADJUST

Figuring which selective shim to install is really very easy. Let's say we got a reading of 0.40 free play with our 0.65 mm starter shim installed. That means that a shim 1.05 mm thick (0.65 plus 0.40 mm) would eliminate all free play.

But we still wouldn't have any preload on the bearing at this point. Since the factory recommends 0.20 mm bearing preload, we need a shim 0.20 thicker than 1.05 mm, or a shim 1.25 mm thick.

If you have no free play at all with the thinnest 0.65 mm shim installed, go back and check to be sure the bearings on the pinion are pressed all the way on. Also check the lower race to make sure it was pressed tight against the shim.

Sixteen shims are available from 0.65 to 1.40 mm in 0.05 mm increments. Remove the bearing race again, and the 0.65 mm starter shim. Install the proper shim, and reassemble pinion and retainer. Same torque as before on the retainer bolts.

Turning torque on the pinion bearings should be 50-150 Ncm (4.4-13.3 in-lb) for new bearings, and 30 Ncm (2.7 in-lb) for used bearings.