Synchrotech Carbon Synchro Install

Installation Manual

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Approvals: P. Lucas

Document Revisions

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CONTENTS

1.1. **Overview:** Detailed instructions on installing Synchrotech Carbon Fiber Synchro Kit for the AZ6 manual transmission in the GT86/FRS/BRZ.

1.2. **Difficulty:** Difficult

1.3. **Time Required:** 6-12 hours

1.4. **Tools Needed:**

- Ratchet
- Flat head screwdrivers
- 10mm socket
- 12mm socket
- 14mm socket
- 27mm socket
- 10mm hex socket
- T40 torx socket
- T45 torx socket
- Magnets
- Steering wheel puller or gear puller
- Torque wrench
- 5mm Punches
- Hammers
- Snap ring pliers
- Sealant
- Lock-tite
- Monkey wrench
- Service manual helps significantly
- ***Patience***
- Press
- Gear removal tool
- Snap ring pliers
- Flat head screwdrivers
- Various cylinders to press components back on
- ***Patience again***

1.5. **Carbon Synchro Kit Components**

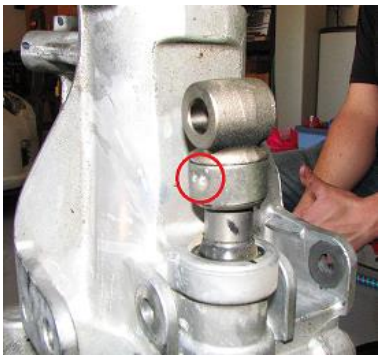
- 1st Gear Dual Cone Synchro
- 2nd Gear Dual Cone Synchro
- 3rd Gear Dual Cone Synchro
- 4th Gear Single Cone Synchro
- 5th Gear Single Cone Synchro
- 6th Gear Single Cone Synchro

2. Carbon Synchro Install

2.1. Verus Engineering is not responsible for damage to you or your vehicle by following this manual.

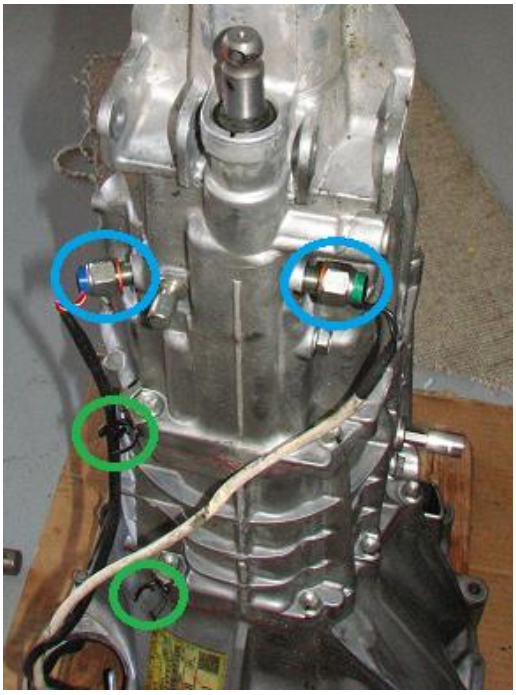
2.2. The installation begins at the transmission tear down phase. If you are attempting this install, it can be assumed that you can remove a transmission from the car as that is rather simplistic in comparison and is significantly more straight forward. This also starts with the shifter removed, which is merely a few clips and that section of the transmission comes off.

2.3. We begin with removing the sleeve that covers the shifter point. Circled in red below, you can see where this collar was staked to ensure the pin behind it does not come out. You can either order a brand new one and cut this sleeve off, or attempt to gently coax it off and re-use it for install.



2.4. We opted to try and re-use the collar (see below). Now using a long screwdriver, place the shifter into neutral. While rotating the shifter point, use a 90 degree pick or a screwdriver to push the retaining pin out (yellow circle). Use pliers to pull this out all the way.

2.5. Using 19mm wrench remove the reverse light sensor and neutral sensor in the side of the tail section of the transmission (blue circles) and undo the wire clips as well (green circles).

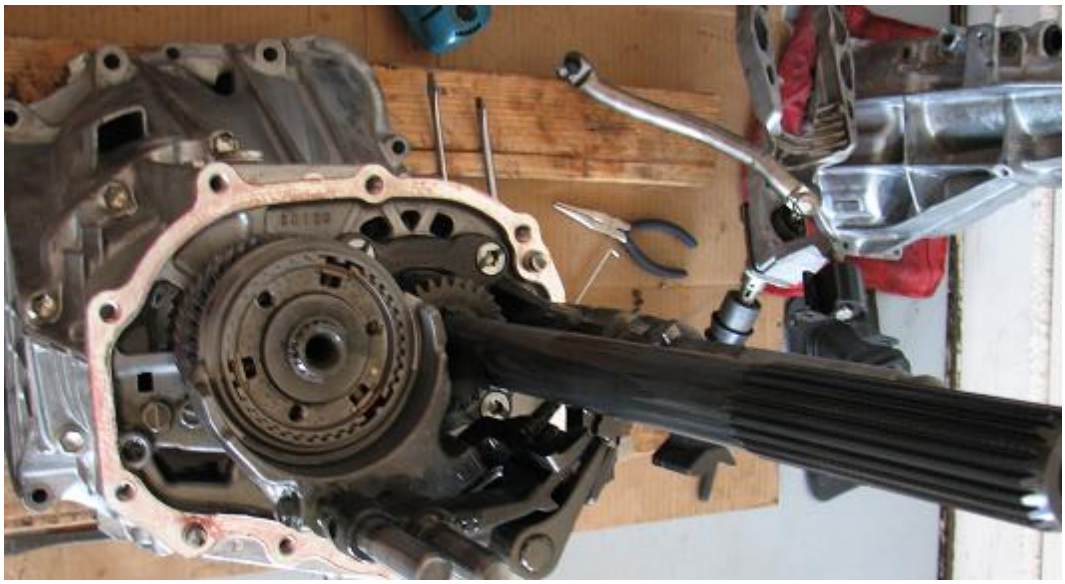


2.6. Simultaneously remove the large 27mm holder, spring, and retaining lock ball pin (circled in red). Note: not shown here is the spring and lock ball pin, use a magnet to remove these and keep them together.

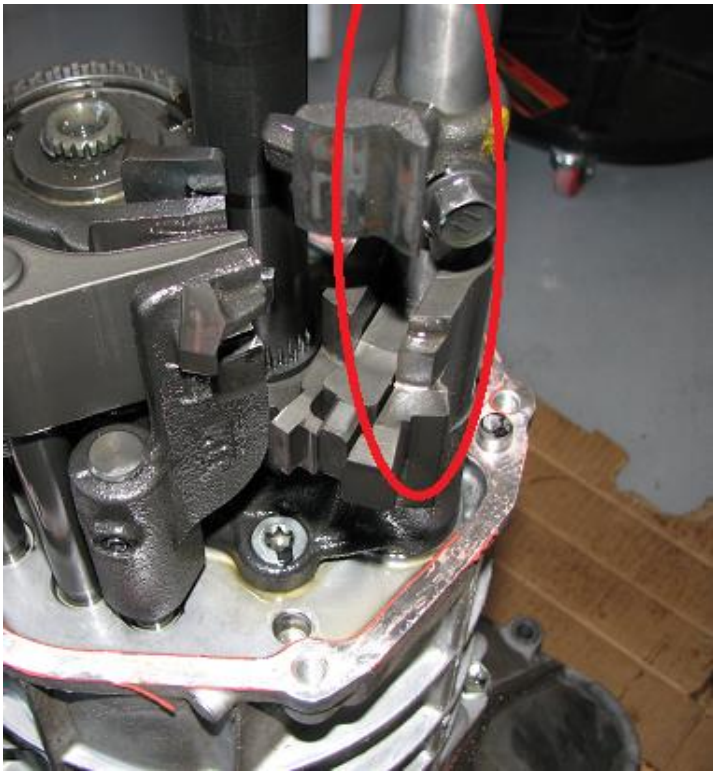
2.7. Using a 10mm allen hex socket, remove the head straight screw pin, compression spring, and lock ball pin (circled in yellow). Also remove the retaining bolt (circled in blue).

2.8. Remove the (8) 12mm bolts holding the tail section assembly on, circled in orange below.

2.9. Using a hammer and/or a pry bar, tap up on the tail housing gently until the silicone holding it together breaks free.



2.10. Rotate the shift shaft and inter lock block counter clockwise and pull up to remove from the transmission. Component is circled in red and is already rotated in picture.

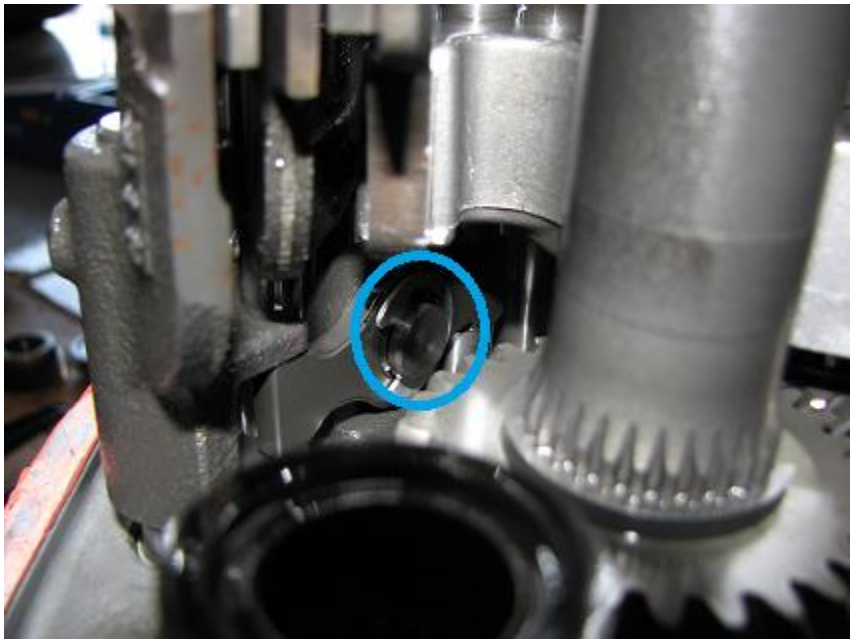


2.11. Using a T40 torx socket, remove the 3 detent bolts. The green two, you will want to use a magnet to remove the spring and detent ball as well from the hole.

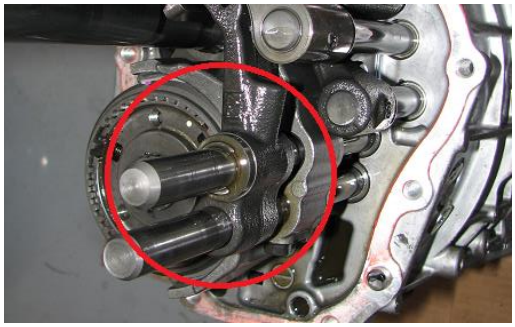
2.12.

2.13. Below is the picture of the detent balls, bolts, and springs removed from the case.

2.14. Using a screwdriver and a towel to block the E-Ring from flying, remove the E-Ring from the shift arm (shown in blue) and then remove the shift arm bow-tie.



2.15. Remove the shift shafts shown below circled in red. You will need to retrieve a detent ball from the hole below circled in green again.

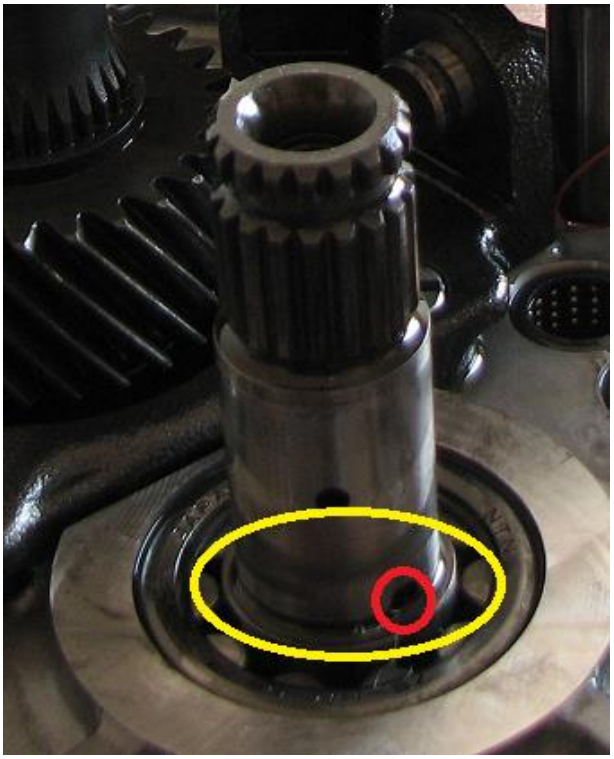


2.16. Remove the snap-ring (circled in blue) using 2 screwdrivers and a cloth to prevent it from flying when it breaks free.

2.17. Using a steering wheel puller (aka Toyota/Subaru's SST), remove 6th gear's synchro hub from the countershaft assembly.

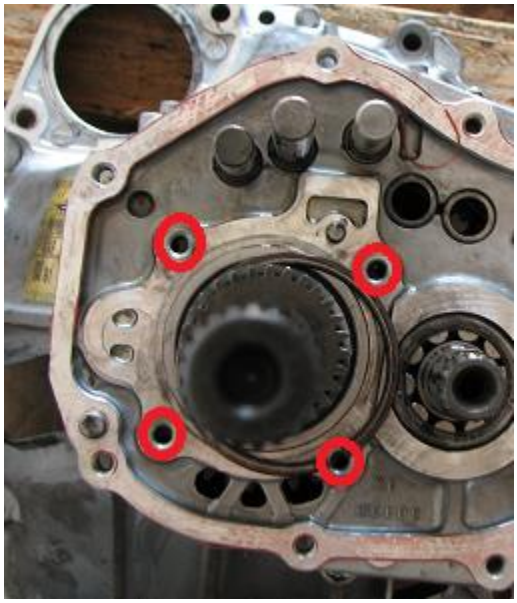
2.18. Remove 6th gear synchro and 6th gear after synchro hub has been pulled off. Remove the need bearings that 6th gear rides on as well.

2.19. Directly below the need bearing, there is a thrust washer (circled in yellow) and a straight pin (circled in red). Remove both of these.

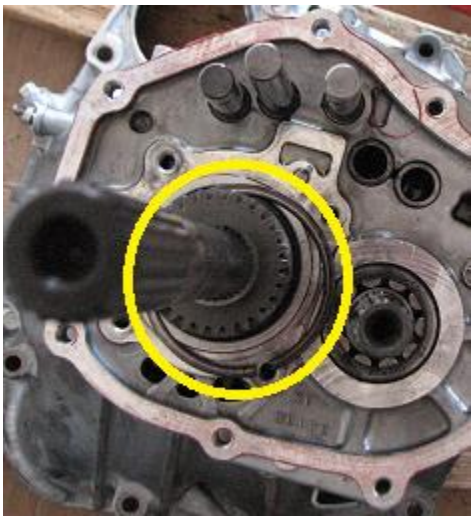


2.20. Using a 5mm punch, begin to remove the gear shift heads shown below. Remove the blue two springs and gear shift heads first, then the yellow one can be removed.

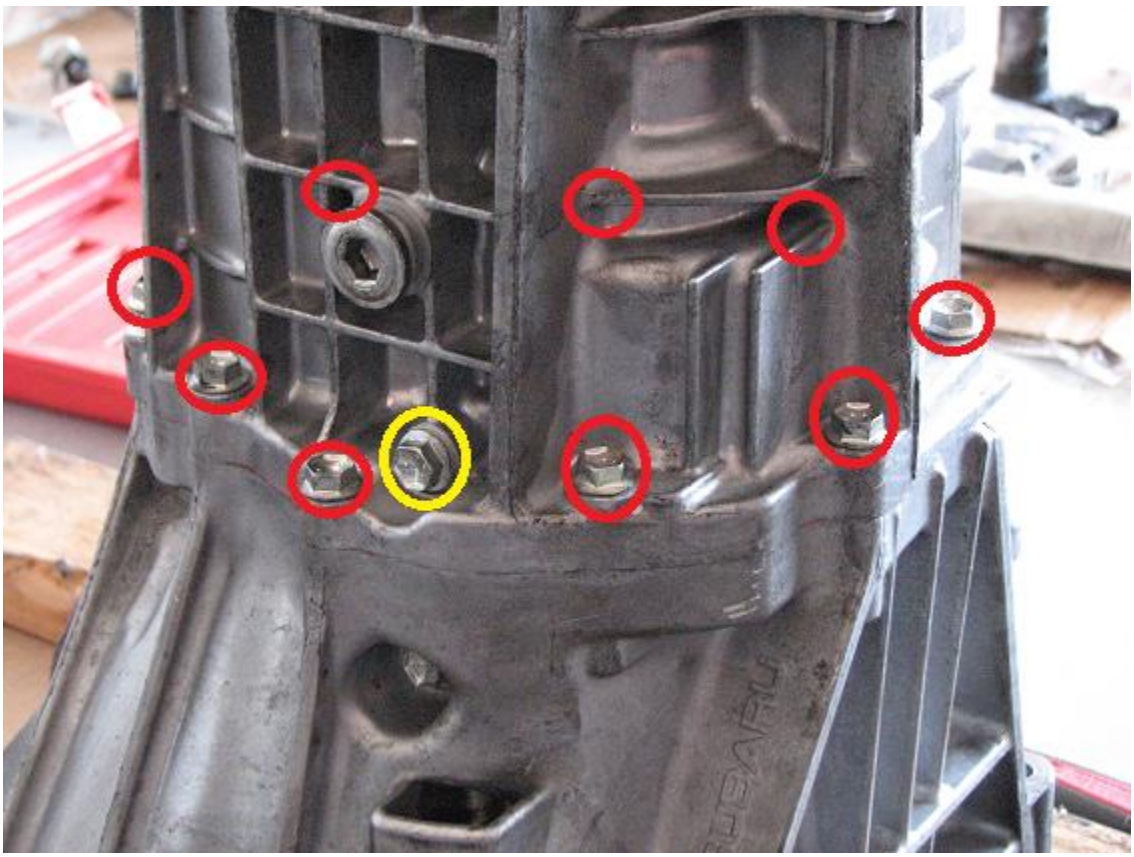
2.21. Remove the (4) bolts holding on the rear bearing retainer with a T45 torx socket. *It is highly recommended to use an impact in the removal of these bolts to avoid stripping them.*



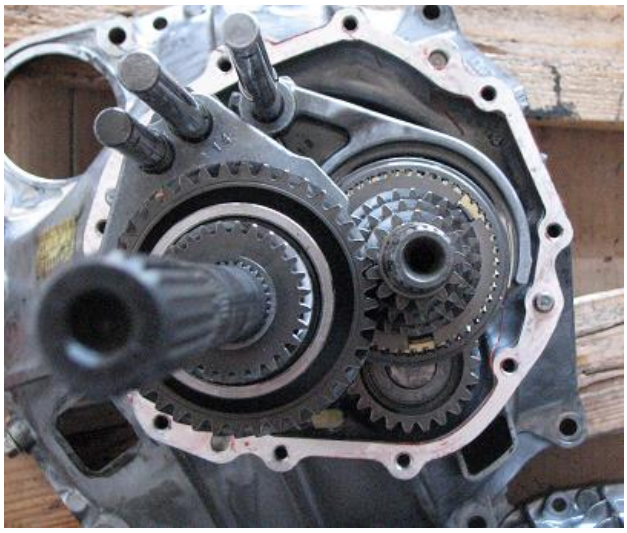
2.22. Using snap ring pliers, remove the snap ring below the rear bearing retainer plate.



2.23. Remove the 12mm reverse gear idler bolt and gasket (circled in yellow) and then the other 9 12mm holding the mid-case to the front case/bellhousing (circled in red).



2.24. Using a similar technique for removing the tail housing, use a hammer and pry-bar to work the mid-case off. This requires some finesse as the bearings on the rear side of the case is near press fit. It will come off though.

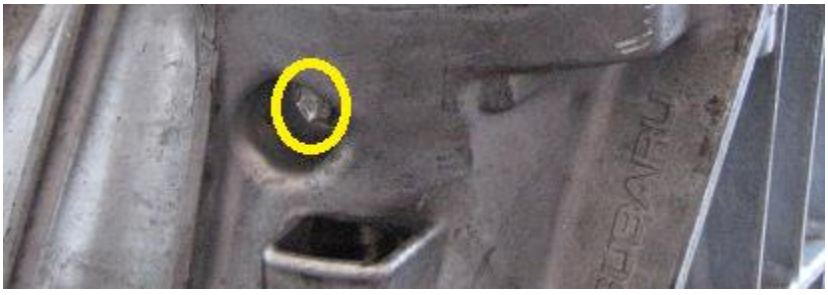


2.25. We're almost there, pat yourself on the back. This is not a fun or easy job.

2.26. Time to flip the trans over on its side and work from the snout of the unit. Remove the (7) 12mm bolts holding the front bearing retaining plate down, circled in green below.

2.27. Remove the two snap rings below the retaining plate.

2.28. Remove the 12mm reverse gear idler bolt (circled in yellow).



2.29. Using the wooden end of a hammer or a plastic hammer, hit shafts from the clutch/bell housing side until the entire assembly frees itself from the bellhousing.

2.30. The shafts should be free at this point and we can continue with the gear set disassembly next.

3. **Counter Shaft Disassembly/Assembly**

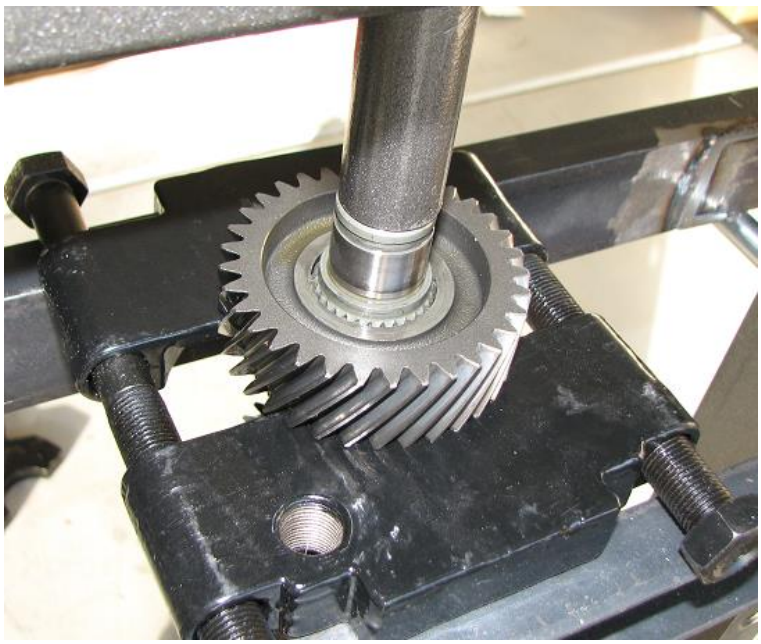
3.1. We start with the counter shaft.

3.2. We will begin by removing the counter shaft gear bearing. Remove the snap ring shown below.

3.3. Using a special service tool (or 90 degree 1/8" L-brackets), press the bearing off. The fit is fairly snug.

3.4. Remove counter drive gear's snap ring located below this bearing.

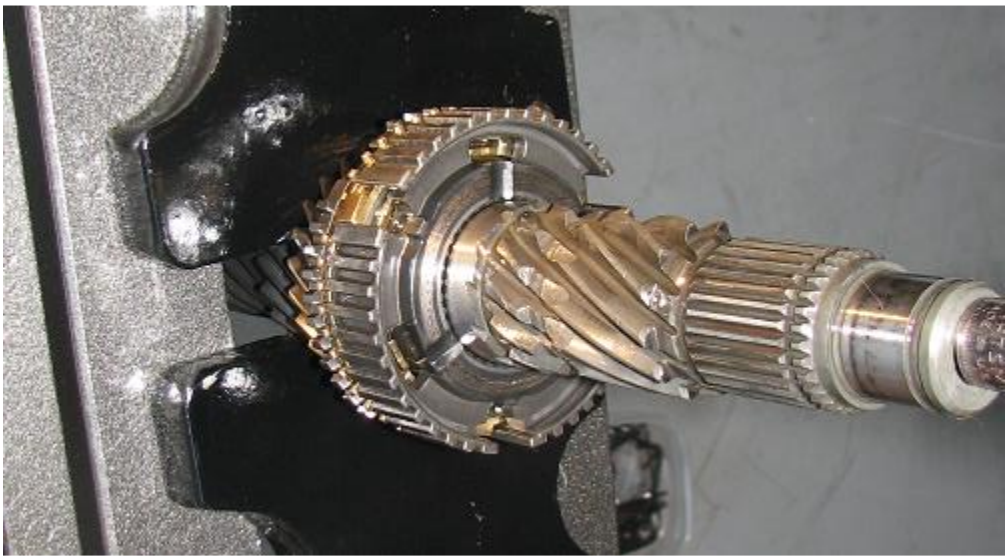
3.5. Remove counter drive gear from counter shaft.



3.6. Remove counter gear 4th gear retaining snap ring, clips, and washer.

3.7. 4th gear can now slide off the shaft. The inner portion rotates on the gear and 4th gear/synchro will come off as well. This does not require a press! A screwdriver may need to be used to get the inner portion to begin to turn.

3.8. Using a press, remove 3rd gear and the shift selector.



3.9. There are needle bearing beneath 3rd gear, oil these and place them on the shaft along with the OEM gear.

3.10. Oil the carbon synchro and install it on the gear.

3.11. Place the transmission clutch/shift hub assembly on the shaft as well with the two rings on the shift hub facing up as shown below. Press this assembly onto the shaft. ***Ensure that the synchronizer ring fits into the hub assembly while pressing this on, damage may occur to the synchronizer if it is pressed on incorrectly.***

3.12. Install an oiled 4th gear carbon synchro and 4th gear onto the shaft.

3.13. Oil the inner 4th gear bearing and install that by twisting it down 1st gear's teeth.

3.14. Install the thrust washer, half-moon washers, and the snap ring. The above steps are shown below.

3.15. At this point, ensure both 3rd and 4th gear rotate freely. If they do not, you will need to disassemble and figure out what is binding and why.

3.16. Press on the counter drive gear as shown below.

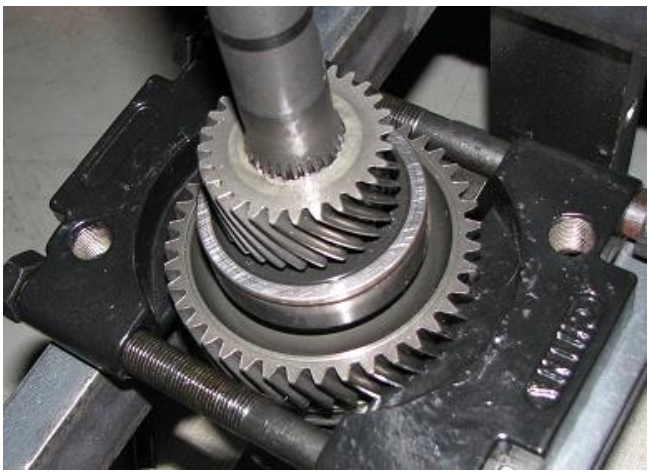
3.17. Install counter drive snap ring as shown below.

3.18. Install front counter gear bearing as shown below. The snap ring groove points upward.

3.19. Install counter bearing snap ring on the freshly installed bearing. The counter shaft is finished and ready to go back in the transmission. Next up, output shaft!

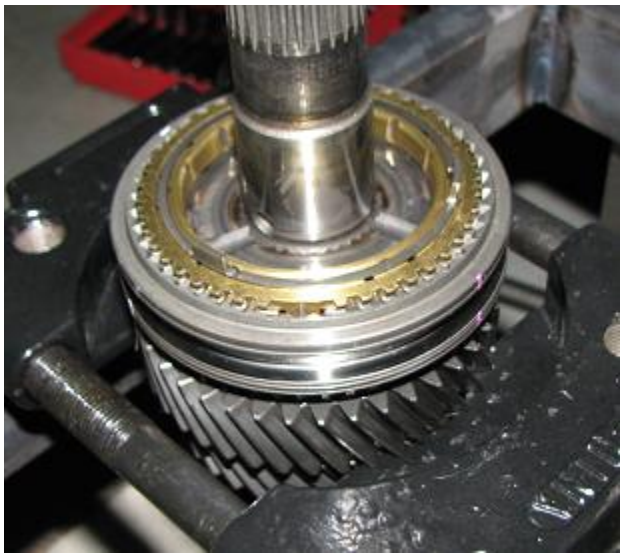
4. **Output Shaft Disassembly/Assembly**
   4.1. Remove 6th gear's snap ring, shown below, with two screw drivers and a hammer.

   4.2. We remove 6th gear, output bearing, and 1st gear in one step. This requires a bit more force from the press but all three can come off at the same time.



4.3. There is a needle bearing below 1st gear, remove this and keep it with 1st gear.

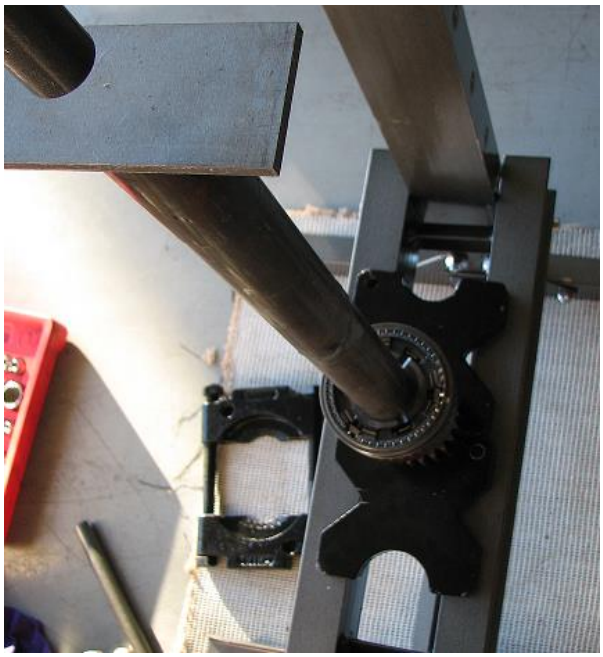
4.4. Remove 2nd gear and 1st/2nd clutch/shift hub assembly by pressing it off as shown below.



4.5. Below is a picture of the output shaft fully apart (reverse does not need to come off, but it is off below).

4.6.

4.7. Time for re-install. Place 2nd gear's needle bearing (oiled) on the shaft, slide 2nd gear down on the shaft, **2nd gear carbon synchro**, and then the 1st/2nd gear shift/clutch hub. This requires a long special service tool as shown below.



4.8. Note the orientation of the clutch/shift hub assembly is installed and how the synchro is placed on the gear. The synchro also needs to sit into clutch/shift hub, spin this until it all goes together well while slowly pressing the unit together.

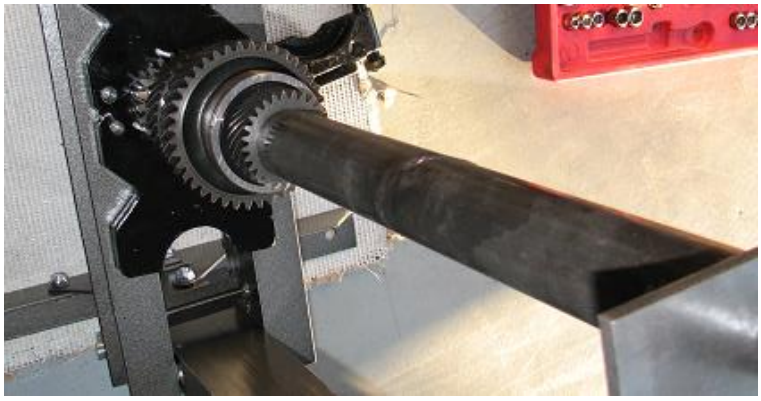
4.9. Below shows a picture of 1st gear's synchro properly installed into the shift/clutch hub assembly, you need to do this for all synchros!

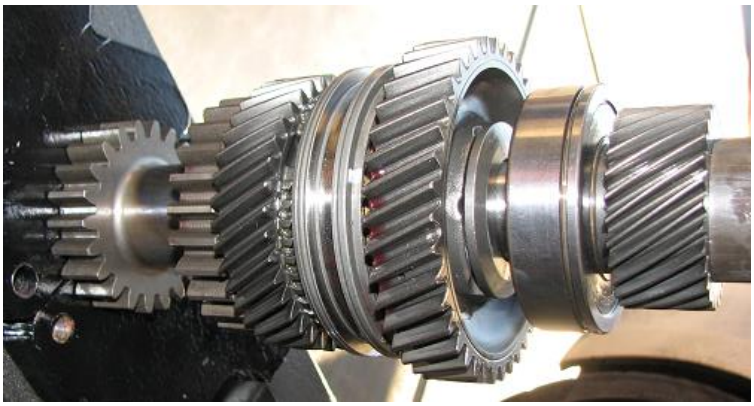
4.10. Install the carbon synchro, oiled, onto 1st as shown below.

4.11. Install the 1st gear's shift restrict ball as shown below.

4.12. Install 1st gear by sliding it onto the shaft with the bearing assembly going on the inside. This will have to be spun to the correct location due to the shift restrict ball.

4.13. Install the output bearing and 6th gear by pressing them on.





4.14. Ensure 1st and 2nd gears rotate freely at this point. If they do not, disassemble and figure out why they are binding.

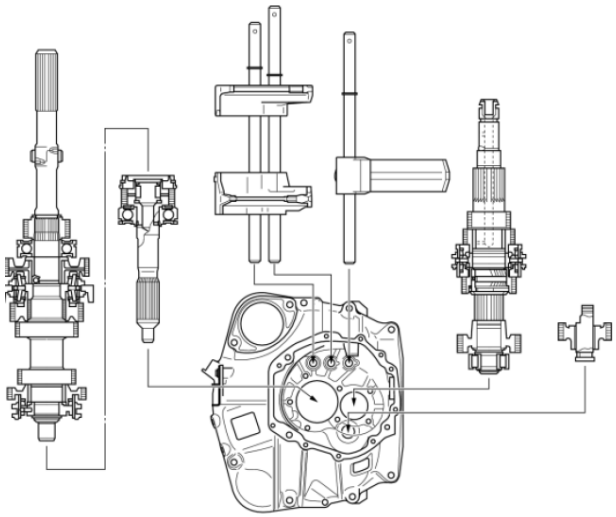
4.15. Install the snap ring on the end of 6th gear.

4.16. The shafts are both now fully assembled. Onto reinstalling the shafts into the transmission.

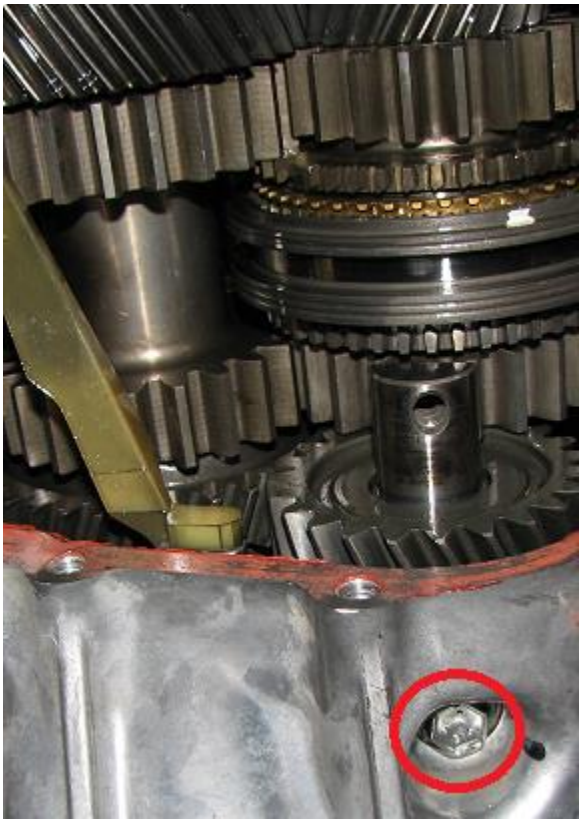
5. **Transmission Reinstall**

5.1. *During re-install, it is recommended to lightly oil any exposed bearings, synchros, seals, etc. Use your best judgement, it is not overly critical but it is recommended.*

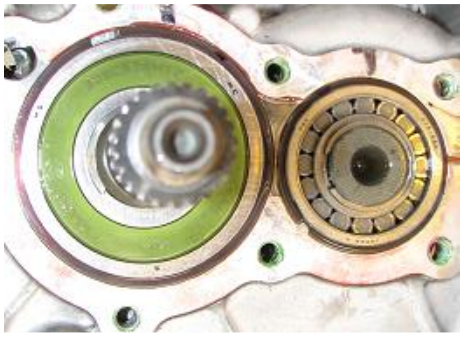
5.2. This step is hard, patience is necessary yet again and a clear mind or you will end up accidentally breaking something. We started with the output shaft (input shaft on the snout) and the respective shift forks then placed the counter shaft in with its respective shift fork, and finally slid in reverse gear. With all of these pieces approximately where they need to be, we wiggled the entire assembly down into the bell housing. Again, not an easy step. See the below pictures from the service manual and real life install.



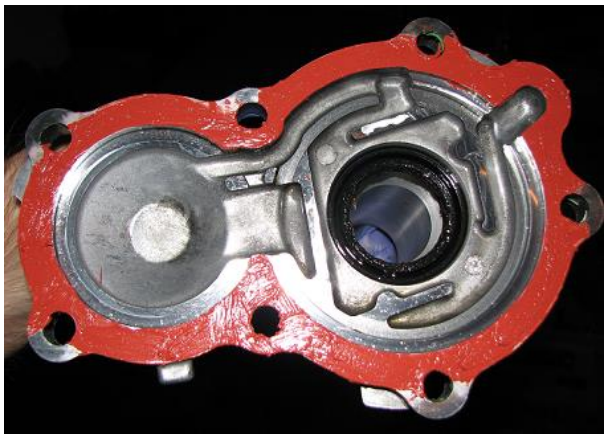
5.3. Temporarily install one of the 12mm reverse idler bolts with a gasket and install the oil receiver tube insuring it is correctly in all the necessary grooves. Use of a flashlight will be necessary. These are shown below.



5.4. Flipping the transmission on its side and working from the engine side, install the two snap rings as shown below.



5.5. Using Toyota's Transmission Sealant (orange), apply sealant to the front cover as shown below. Use grease or generously apply transmission oil on the seal to decrease the chance of ruining the seal.



5.6. Install this cover with the (7) 12mm bolts using thread sealant on the threads. Torque to 13 ft-lbs.

5.7. Flip the transmission back over on the bellhousing cover and install the oil tray.

5.8. Using the same orange Toyota FIPG sealant, spread a nice even sealant ring to the transmission case as shown below.

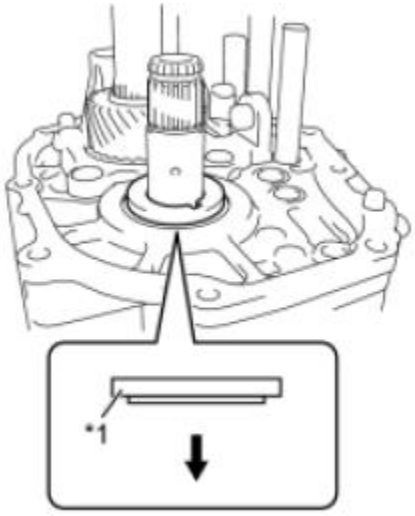
5.9. Push the mid-case down onto the dowel pins. Using an adhesive (blue Loctite is appropriate) to resist the bolts backing out, tighten the (9) 12mm bolts. Torque spec is 21 ft-lbs. Place the bolt with the wire harness ring on the top side (shown below in red).

5.10. Install the other reverse idler bolt with a gasket on. Torque both of these to 21 ft-lbs as well.

5.11. Install the output shaft snap ring with a snap ring expander.

5.12. Grab the rear bearing retainer and re-install that over the output shaft's bearing. Using Loctite on the T45 torx bolts, tighten the (4) bolts to 22 ft-lbs.

5.13. Apply gear oil to 6th gear's thrust washer and needle bearing. Install the thrust washer with the lip facing down (towards the front) and **install the small lock pin**. Place the needle bearing on top of the thrust washer.



5.14. Remove the shift selector from 6th gear and remove the shaft from the selector by punching out the spring pin as shown below.

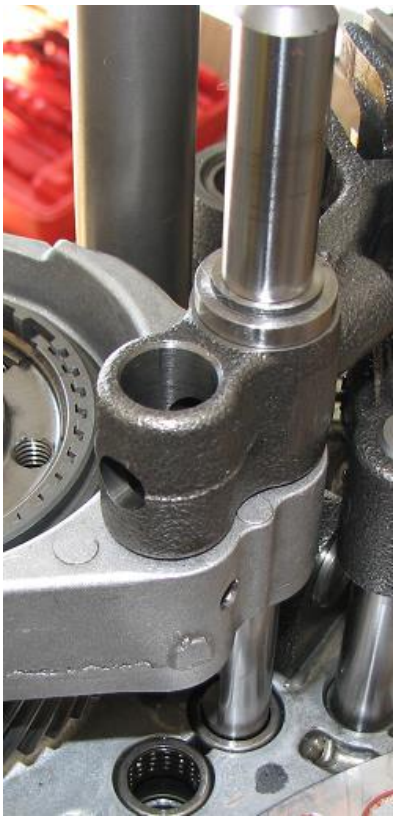
5.15. Place 6th gear, synchro, shift hub, and shift selector on the counter shaft and press the hub on. If you do not possess a press, you can hammer it on slowly but this is not recommended.

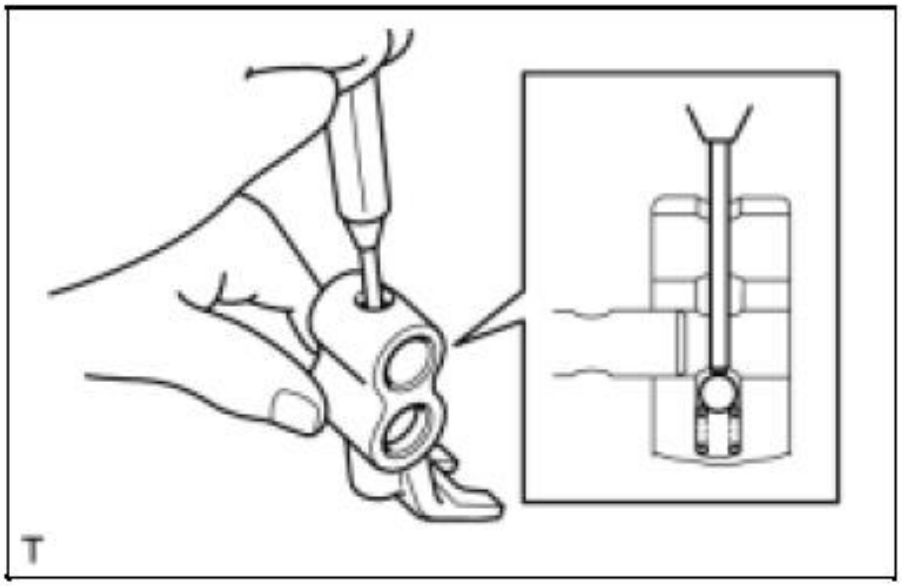
5.16. Install the snap ring on the top of the counter shaft.

5.17. Place the shift head shown below on the shaft and drive the spring pin in flush (circled in red).

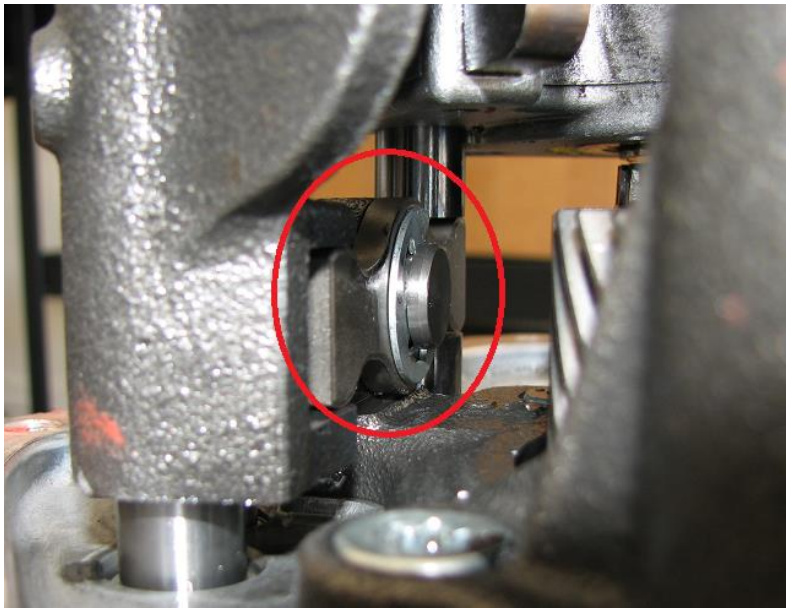
5.18. Install the remaining two shift heads shown below and drive the spring pins flush (circled in yellow and blue).

5.19. Install the below shift shaft. This unit should have a washer and snap ring on it already with a shift head on it as well. If it does not, you will need to install the detent ball on the spring per the service manual (and shown below).

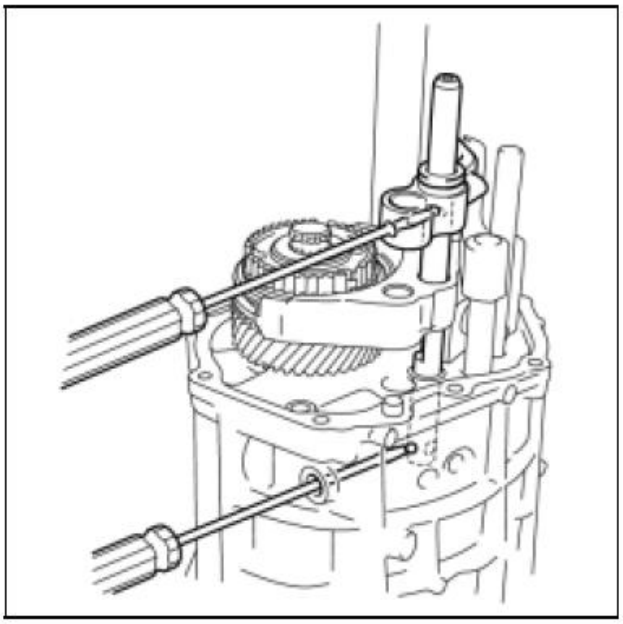




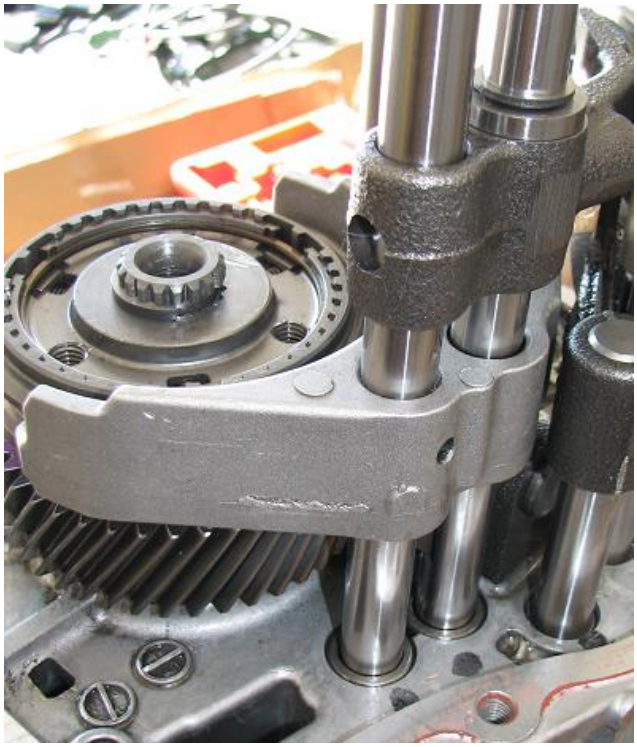
5.20. Install the shift arm and the e-clip as shown.



5.21. Using screwdrivers and magnets, install two more detents in the locations shown below (once in rea life, once from the service manual.



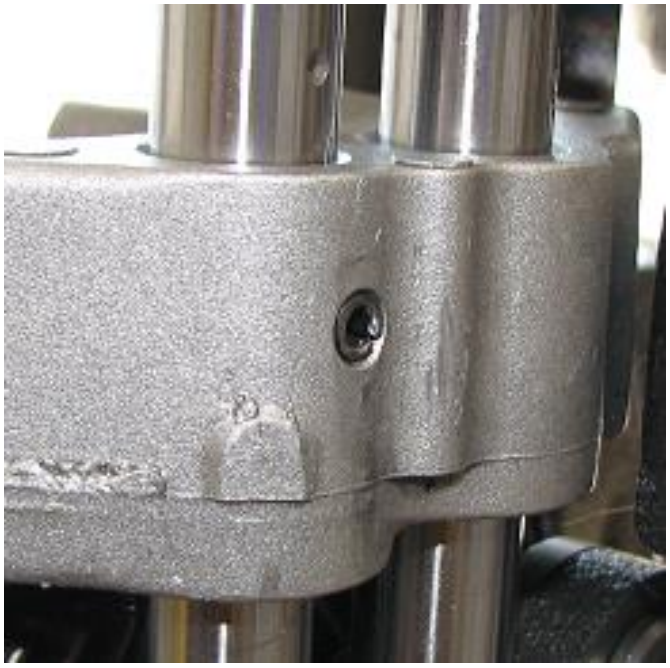
5.22. Install the final shaft into the transmission as shown below.



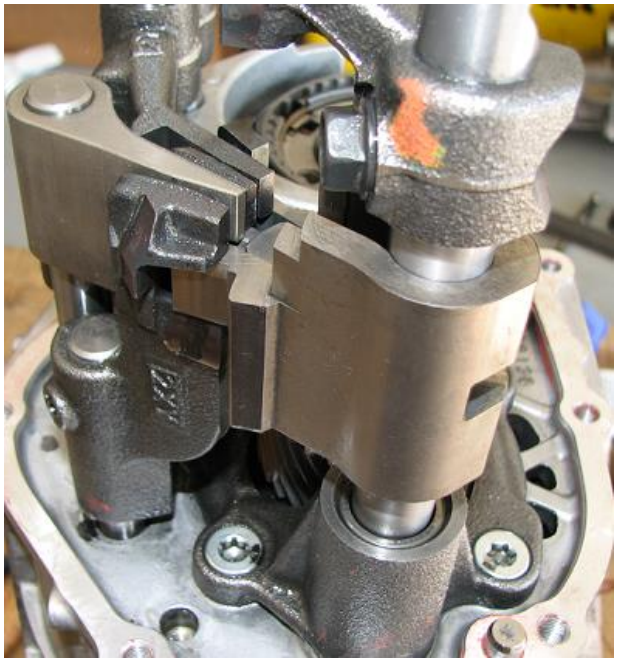
5.23. While the identification mark is facing as shown (circled in red below), install the final (2) detent balls and springs (circled in blue) in the transmission case. If you look down these holes before installing, you can see a divot for these balls to sink into.

5.24. Install the T40 torx with a dab of sealant in the (3) transmission case points. Torque to 14 ft-lbs.

5.25. Install the final spring pin in 6th gear's aluminum shift selector, flush with the outside of the selector.



5.26. Install the shift shaft by placing it in the transmission case and then rotating it clockwise. The installed view is below.

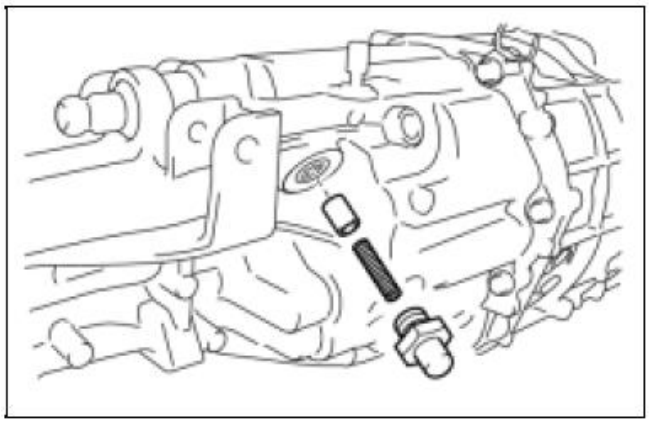


5.27. Place a nice even layer of Toyota FIPG sealant on the transmission tail as shown.

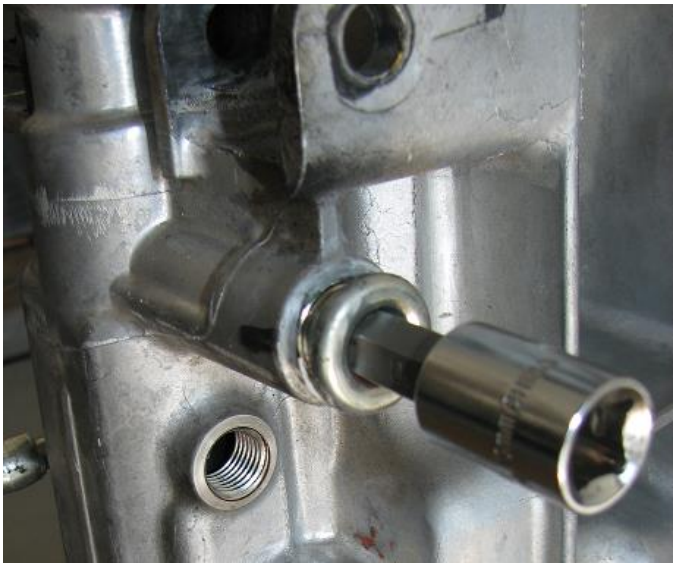
5.28. Install the tail section and install the (8) 12mm bolts to 21 ft-lbs.

5.29. Install the bolt with a long tail in the hole shown below circled in red. Torque to 23 ft-lbs.

5.30. Install the 27mm holder with a spring and detent inward in the trans as shown below. Torque to 29 ft-lbs.



5.31. Install the final lock ball pin in the transmission with the 10mm hex bolt as shown below. There is a lock ball pin and spring similar to the 27mm bolt above. Torque to 18 ft-lbs.



5.32. Install the neutral position switch and the back-up light switch as shown below, with the wire stay as well. Sensors should be installed to 24 ft-lbs.

5.33. The transmission is now ready to be installed back into the engine once you add the shifter and clutch fork/TOB.