



Northwest Fabworks Inc.

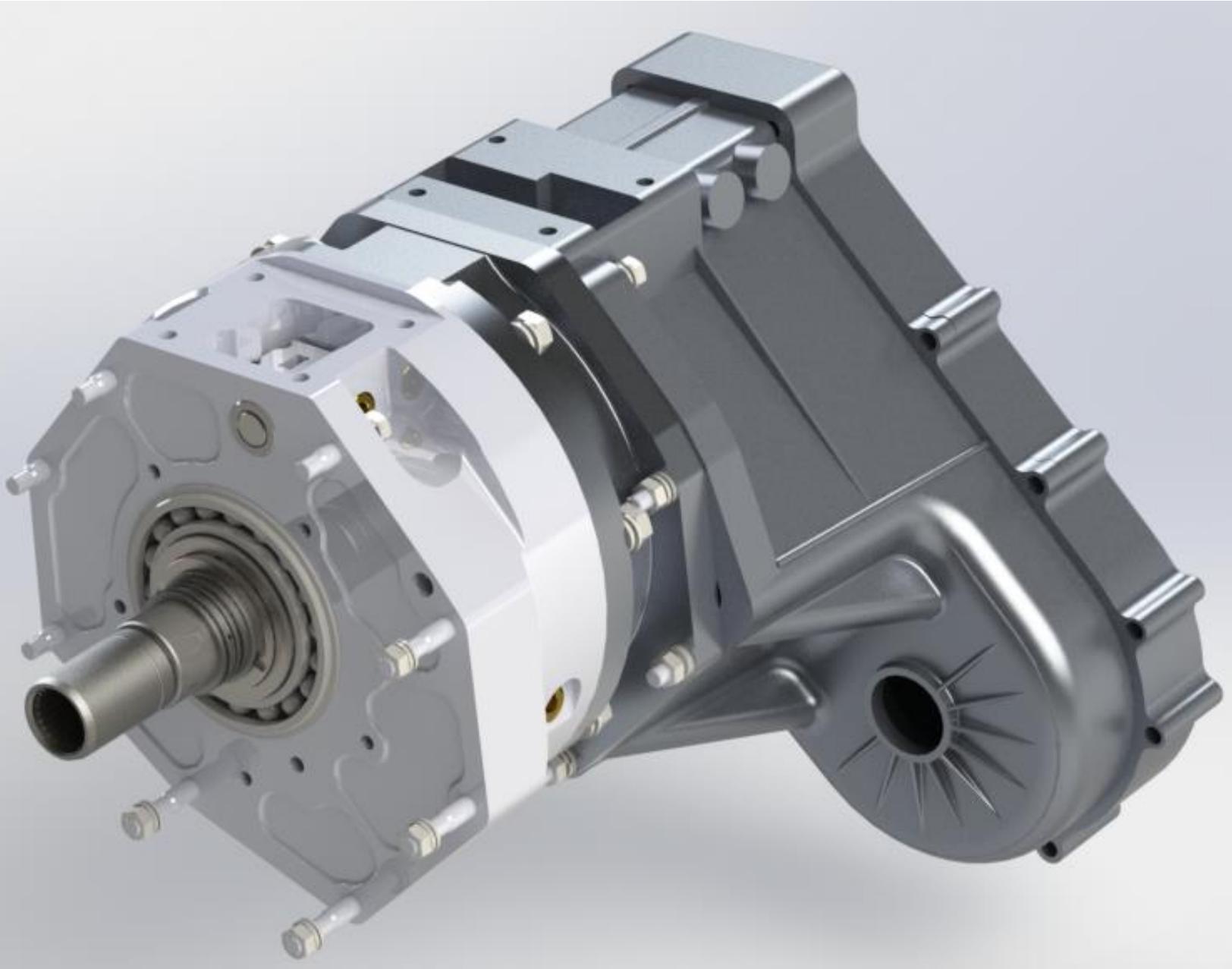
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Installation Manual for: VF2 Eco-Crawler





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DISCLAIMER

This product is for off road use only. The products supplied in this kit are manufactured and assembled specifically for this conversion type. Modification to components will void any possible warranty or returns unless said modifications have been approved and authorized by the company. Northwest Fabworks (NWF) is not responsible for damaged components that are not included in the purchased product. NWF is not responsible for damaged NWF products caused by the failure of non-NWF parts. NWF does not cover damage caused by incorrect installation and/or assembly. NWF does not warranty products that have been used outside of their intended use. **Installation of the following product may void automotive manufacturer warranty.** The following information is provided as a guide, it is strongly recommended to use the Factory Service Manual for your specific vehicle application.

IMPORTANT NOTES

IT IS HIGHLY RECOMMENDED THAT THE COMPONENTS USED INSIDE THE ECOCRAWLER ARE FROM THE ORIGINAL TRANSFER CASE OF THE VEHICLE WHENEVER POSSIBLE. THIS ENSURES THAT THE SEALING SURFACE AND COUPLER FROM THE ECOCRAWLER INPUT IS THE ORIGINAL PARTS MATING TO THE TRANSMISSION. IF THIS IS NOT POSSIBLE, BE SURE TO VERIFY THAT THE DONOR TRANSFER CASE USES THE CORRECT INPUT SHAFT FOR YOUR TRANSMISSION. USING NON-ORIGINAL INPUT SHAFTS MAY BE PRONE TO LEAKING.



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1. Required Parts to Purchase

If the donor case being used for the Eco Crawler is an electric shift, these are the requires parts and part numbers that are needed from Toyota. These must be purchased and are not currently supplied by Northwest Fabworks.

| Toyota Part Name | Toyota Part Number |
|------------------------------------|---------------------------|
| Transfer Gear Shift Fork No. 2 | 36312-35040 |
| Transfer Low Planetary Gear Spline | 36284-35021 |
| Compression Spring | 90501-16116 |

If the vehicle being used with the EcoCrawler has a manual transmission, it is recommended to upgrade to the stiffer detent spring for the EcoCrawler. If the donor case is an electric shift, the stiffer spring is found in either shift forks of the transfer case. If the donor case is not an electric shift, the part number for the recommended detent spring is:

| Toyota Part Name | Toyota Part Number |
|------------------------------------|---------------------------|
| Compression Spring, Electric Shift | 90501-18091 |

If the donor case has all time 4WD with a centre diff lock, the shift collar alignment and snap ring will not be in the case and the proper collar alignment and snap ring will need to be sourced or purchased.

| Toyota Part Name | Toyota Part Number |
|---|---------------------------|
| Hub, Transfer Clutch (Shift Collar Alignment) | 36237-35030 |
| Ring, Shaft Snap | 90520-39004 |

If a shaft oil seal is broken during disassembly or assembly, additional seals can be purchased from Toyota with the following part number: Transfer Input Shaft Seal No.1: 36216-35012



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2. Installation Instructions

2.1 Removal of Original Planetary Shaft and Install of NWF Shaft

NOTE: The pictures presented for the following installation process are from a VF2 manual top shift transfer case. While different years, makes and models have varying styles of cases, the internals and installation process are the same. Make sure to take photos throughout the install process in case there are important details that you may require upon re-assembly.

2.1.1 Remove the front drive shaft flange with an impact gun.



2.1.2 On the rear output, remove the 12mm bolt that holds the speed sensor in place. Twist and pull the sensor until it is free.





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- 2.1.3 If the transfer case has the locating sensors on either side of the shift rails, use an adjustable wrench and remove both.



- 2.1.4 Remove the twelve 12mm or 14mm case bolts. Use a chisel and hammer to work two opposite the case open. The front section of the case is seen on the left of the photo below, this contains the planetary gearset. The rear section of the case is seen on the right in the photo below and contains the rear output shaft, shift fork and shift collar. Set the rear section of the case aside, this will not be needed for the shaft install.



- 2.1.5 Remove the three 10mm bolts holding the oil filter plate. Remove the plate. Remove the three 10mm bolts holding the oil pump. Remove the oil pump. The planetary gearset and ring gear should be the only items left in the case.

NOTE: Now is a good time to clean the magnetic catch behind the plate and inspect for any metal shavings.



- 2.1.6 Remove the five M12 bolts that hold the bearing retainer on the front section of the transfer case. Break the silicone seal with a chisel and remove the bearing retainer.



2.1.7 Remove the bearing snap ring. The planetary gearset can now be pulled from the transfer case.



2.1.8 Remove the synchro from the shaft if it hasn't already fallen off. Remove the snap ring holding the low gear engagement and remove the low gear engagement.

NOTE: Toyota put the bronze synchro's in only some transfer cases, if your transfer case does not have a synchro, that is okay. Disregard the synchro details.



- 2.1.9 Remove the snap ring and spacer on the back set of the planetary housing. Remove the detent ball that is recessed into the shaft. The shaft can now be removed from the planetary set.



- 2.1.10 Remove the split bearing from the inside bore of the shaft. The thrust washer for the needle bearing should be stuck to the back of the gear on the shaft. Gently remove it with a flat head screwdriver (If the screwdriver is not catching the lip of the washer, feeler gauges can be used to get underneath the washer and bearing the suction from the oil).





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- 2.1.11 Remove the oil seals from the shaft. Gently press on the edge of the connection and run a second finger around the seal. This will press the split in the seal up and over the hooked connection.



- 2.1.12 Place the thrust washer, the oil seals, and the split bearing on the NWF shaft. Install the oil seals with the same process as removal but reverse. Be gentle with the seals as they are brittle. It is sometimes easier to install the NWF shaft into the planetary set prior to installing the oil seals.

NOTE: Heavy duty grease can be applied to the split bearing in order to keep it from falling out of the shaft.

- 2.1.13 Install the NWF shaft into the planetary set, install the detent ball, spacer, and snap ring. Install the low gear engagement and relating snap ring.
- 2.1.14 Install the planetary set into the front section of the transfer case and install the bearing snap ring.
- 2.1.15 Remove the seal from the bearing retainer. A flat head screwdriver should be enough to pop the seal out of the seat. Cleaning the seal seat of any dirt, debris or corrosion. Install the seal provided by NWF.





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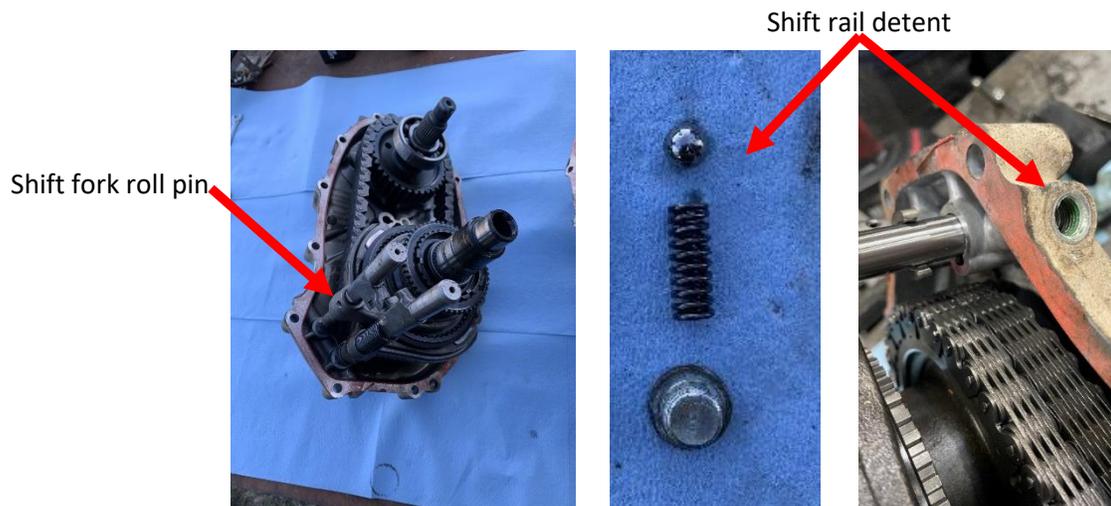
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2.1.16 Grease the seal lip, the sealing surface on the shaft, and the oil seals. Apply silicone gasket maker to the bearing retainer sealing surface. Install the bearing retainer and bearing retainer bolts. Apply some standard strength (blue Loctite) thread locker to the bearing retainer bolts.

IMPORTANT: If the retainer doesn't mate perfectly to the case face, it is likely due to the oil seals not being sprung into the retainer bore. **DO NOT** force the retainer. Rotate the shaft back and forth while also rotating the bearing retainer in the opposite direction and gently press the retainer into place. When the oil seals seat themselves inside the retainer bore, the retainer will easily slide up against the face of the transfer case.



2.1.17 If a **TRIDENT TRIPLE SHIFTER KIT** is being installed on the Eco Crawler and transfer case, the low gear shift rail needs to be ground down for clearance on the double shift legs. Remove the shift fork pin and shift rail detent and pull the shift rail from the rear section of the case. Grind the overhang flush to the clearance surface of the fork on the side and the top, see photos below. Reinstall the rail, the detent and the shift fork roll pin.





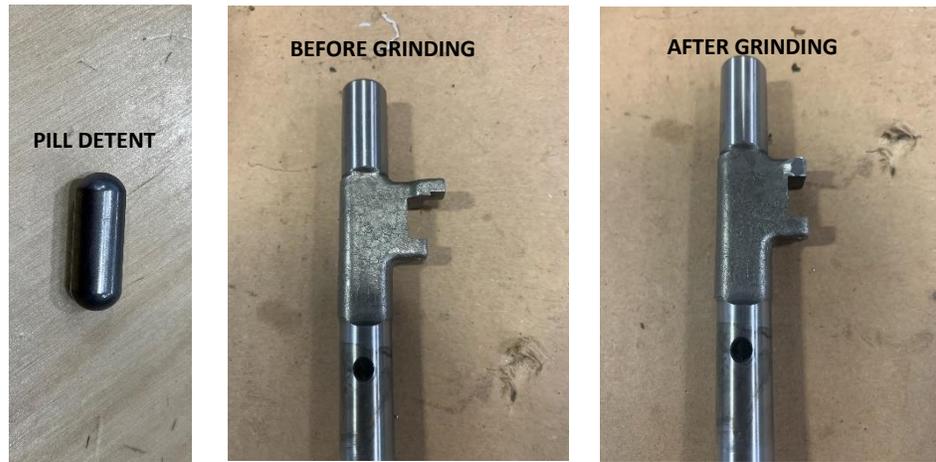
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When the shift rail is removed, tip the case so that the hole where the shift rail detent ball and spring are located towards the work bench. A pill shaped detent will fall out. This detent prevents the case from shifting into 2WD – Low Range. If you want full shifting capabilities in your vehicle, then remove the pill detent from your case. We recommend **KEEPING** the pill detent installed if you are using a **STOCK** transfer case shift stick. We recommend removing it if you are going to a triple shift setup.

Reinstall the rail, the detent, and the shift fork roll pin.





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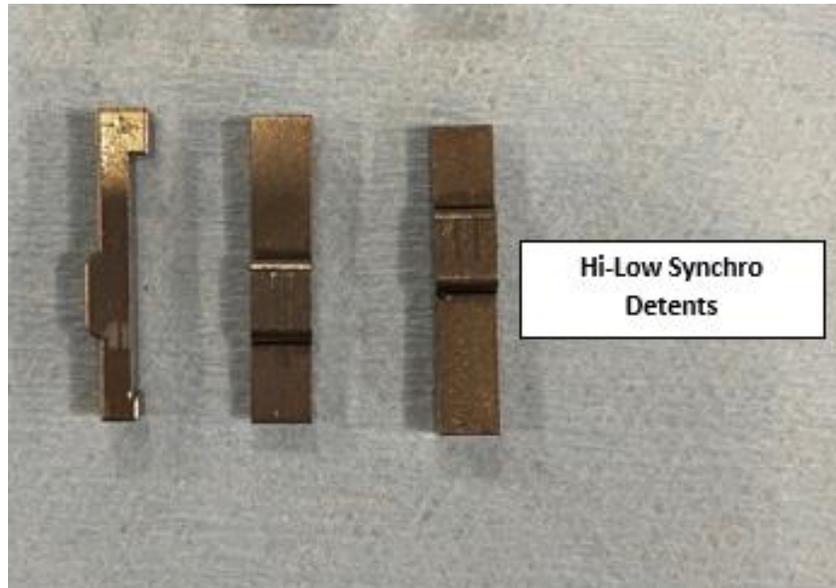
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IMPORTANT: The following section will explain how to assemble the two halves of the transfer case. we **RECOMMEND** removing both the synchro and synchro detents from the transfer case. Toyota only installed these synchro's in the first few years of the VF2 chain drive transfer case. They then removed these parts with their newer version of the J shift transfer case that was installed in the FJ Cruisers (The entire case is identical, except for the bolt pattern and the lack of synchro gear). Through testing, we have found no benefit to keeping the synchro installed.

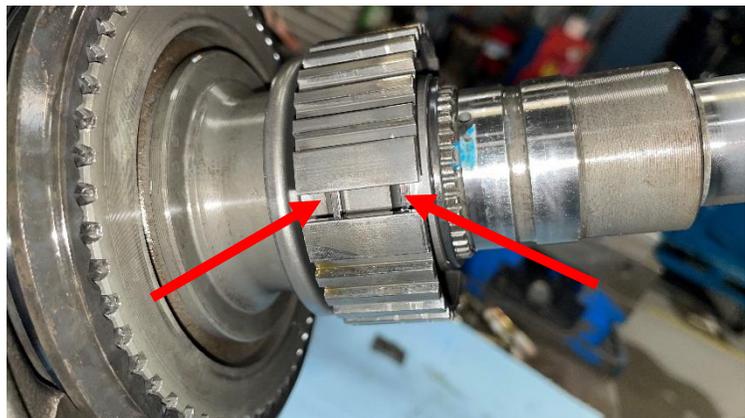
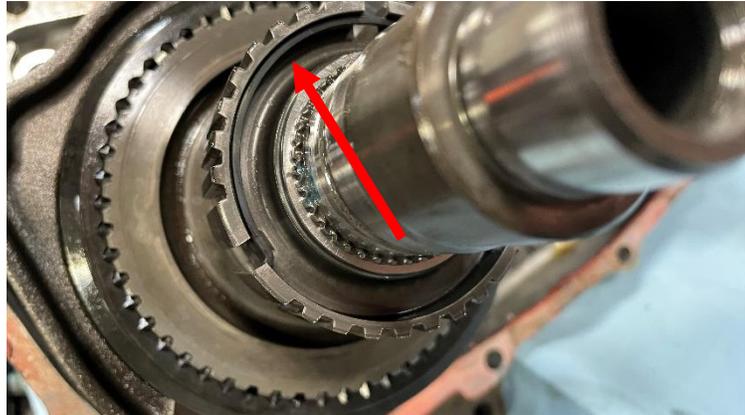
If you want to keep the synchro in the transfer case, the following steps will show you have to assemble the case with the synchro in. If your case doesn't have any synchro's or synchro detents, following through and disregard the synchro related steps.

IF YOU ARE REMOVING THE SYNCHRO:

- 2.1.18 Remove the shift rail, shift fork, and shift collar. The three synchro detents will fall out of the case. Remove these and set them aside.



2.1.19 There are TWO spring rings on the inside of the shift collar alignment piece, remove both of these from the shift collar alignment piece.



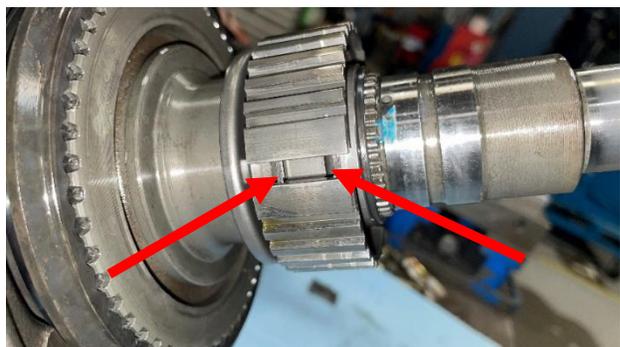
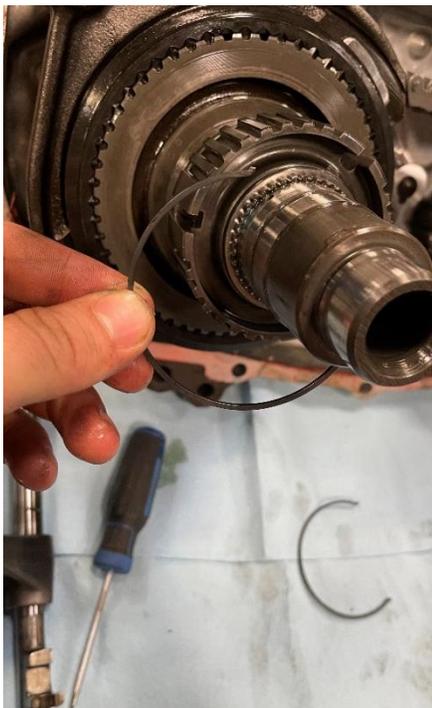
2.1.20 Reinstall the shift collar, shift fork and shift rail. Proceed to step 2.1.27.

IF YOU ARE KEEPING THE SYNCHRO:

2.1.21 Did your synchro detents fall out and need to be reinstalled? If they are fine, proceed to step 2.1.27. If they need to be reinstalled, start by removing the shift fork, shift collar and shift rail.



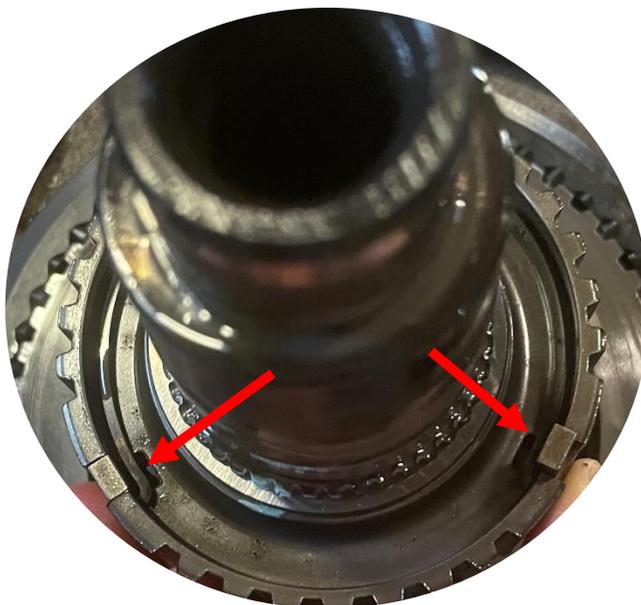
2.1.22 Notice that there are three slots on the Shift Collar Alignment, this is where the three detents sit. There is a spring ring on the front and back of the collar that give the detents the preload to lock in place. Make sure these rings are seated at the inner wall of the alignment piece.



2.1.23 The detents for the Hi-Low shift collar **ARE** directional. Notice that there is a larger step on one end than the other. The larger step sits closest to the 2WD-4WD shift collar. Apply some heavy-duty grease to keep the detents from falling out during the install and place them in the three slots on the Shift Collar Alignment piece.



2.1.24 **IMPORTANT:** The spring rings sitting in the Shift Collar Alignment have a substantial gap. Make sure that the ring is aligned with the three detents so that each detent is spring loaded. If this is not completed, there is a risk that the detent could dislodge itself and damage the internals of the transfer case. Be sure to check the back side ring as well



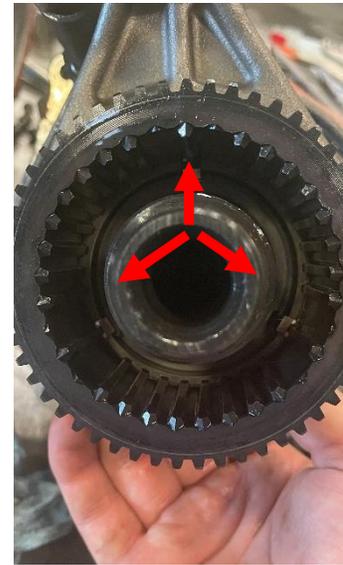


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- 2.1.25 Place the Shift Collar and Shift Rail in position to reinstall. The Shift Collar has three spots on the inside teeth that are spaced out with a single tooth in the center of the space. These three center teeth are what run along the detents. Align the Shift Collar with the detents and start the Shift Collar engagement. You should notice that the detents will lift in the rear, that is okay. Look to the front of the detents and make sure they are still sitting on the spring ring and not tucked in front or underneath it.



- 2.1.26 This part takes some finesse and patients. Start working the shift collar back into place. The shift rail can sometimes be sticky going back in, so greasing the end of the shift rail will help. As you work the shift collar back into its seated position, you will need to make sure the detents are still sitting roughly center in the Shift Collar Alignment. They can move back and forth, as long as they don't pop off the spring rings. They can also compress and tilt as you work the shift collar into place, but again, you need to make sure they are not falling out of position. You will have to compress the detents with your fingers in some areas as they start to get tight, but once you pass the bump on the detents the shift collar will snap into place. It will take some good force to get it back into position but should not require excessive force (hitting the collar or shift rail with a hammer, etc.). A rubber mallet or dead blow can help tap the collar back in, but this should be doable by hand. The shift collar will sit flush with the shift collar alignment when fully seated





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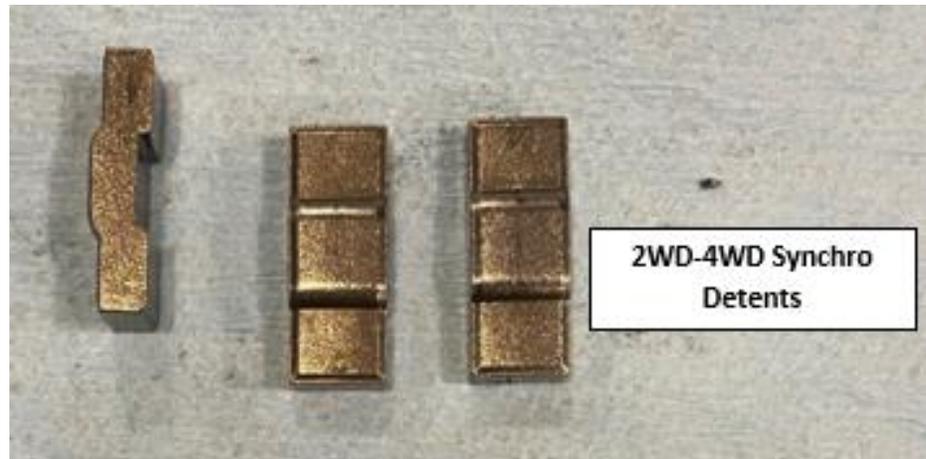
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NOTE: ALL transfer cases have a synchro for the 2WD-4WD engagement. DO NOT REMOVE the synchro or synchro detents from this section of the case. The following steps show how to reinstall the detents if they fall out.

Did these detents fall out of your case? If they are fine, proceed to step 2.1.35.



2.1.27 Make sure the Hi-Low shift rail is in the Hi position. Remove the 2WD-4WD shift rail detent cap, spring, and detent ball.





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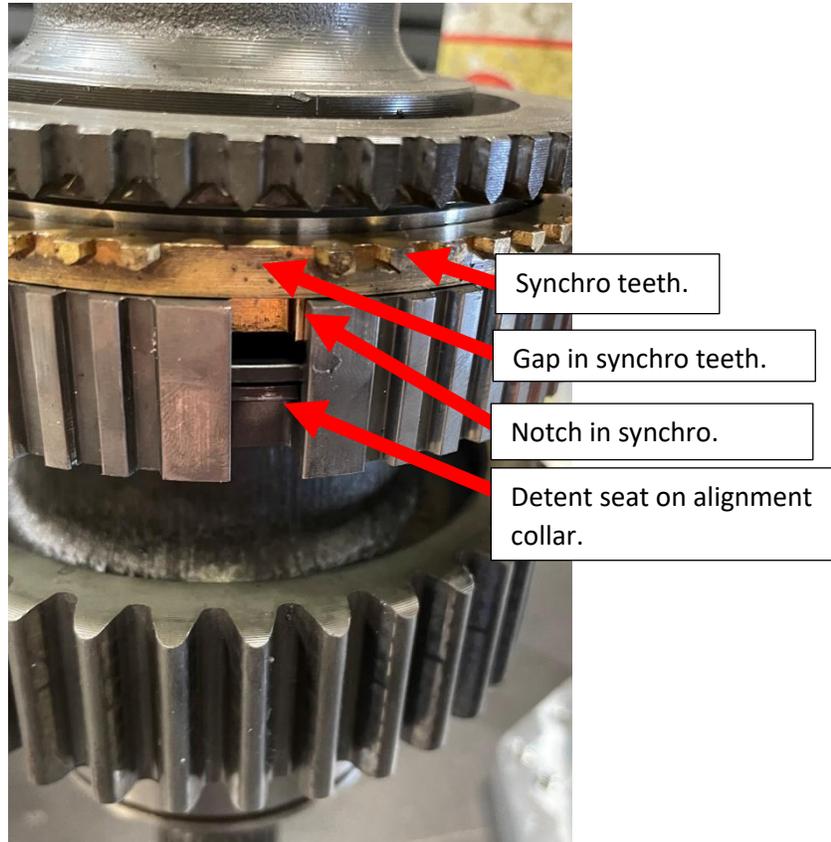
2.1.28 Remove the rear output flange and bearing retainer. Remove the rear output bearing snap ring and pull the output assembly from the transfer case housing.



2.1.29 Remove the Shift Collar.



2.1.30 The detent pieces are bidirectional so there is no right side up to installing them. If the bronze synchro is rotated, a notch can be found where there is a gap in the synchro teeth. Align this notch and gap with the seat for the detent.



2.1.31 Grease the back side of the detent with some heavy-duty grease to help hold it in place.





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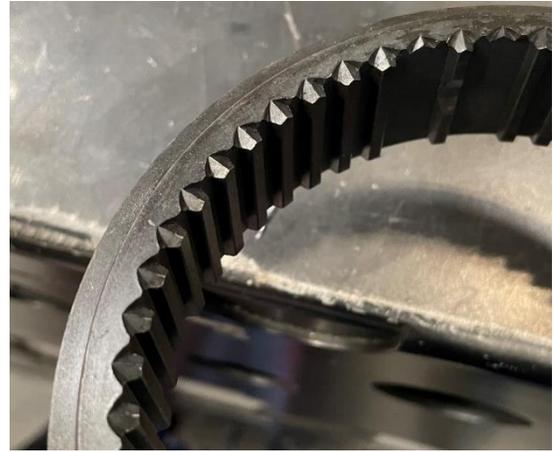
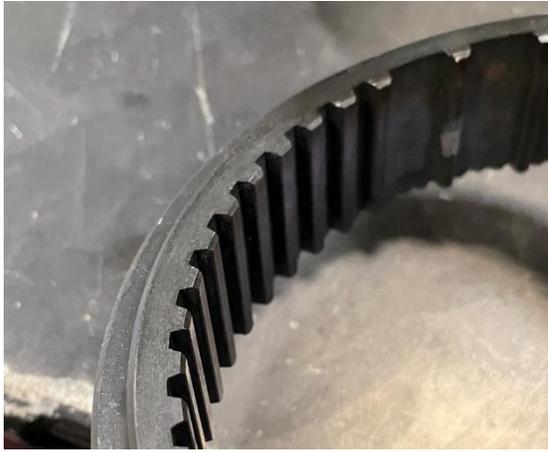
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2.1.32 The shift collar **IS DIRECTIONAL**. One side has teeth that are pointed and the other has teeth that are flat. Face the pointed teeth up (or away from the flange side of the shaft).



2.1.33 There are gapped sections in the teeth of the shift collar. Align the three spaced teeth with the detent pieces and slide the collar onto the shaft. The detents ride on the spaced teeth with the notch in them.





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2.1.34 This is where you must play with it until it pops in. Press the top of the detents in so they are tucked under the shift collar. Start pressing the shift collar down. As you work the shift collar into place you will need to press and shift the detents and work on tucking them into the shift collar. They are spring loaded so you will feel some resistance. At about halfway down it will give and pop into place. Feel with your fingers that the detents are sitting flush in the seats. You can install the shaft back into the case.



REMAINDER OF CASE ASSEMBLY:

2.1.35 On the rear section of the transfer case, shift the shift collar to the LOW position. Place the synchro on the collar alignment (only if you are keeping the synchro). The synchro should be above the shift collar.





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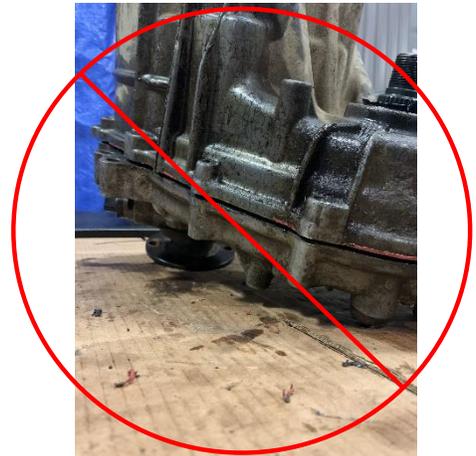
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- 2.1.36 Apply generous amounts of grease to the synchro mating surface (only if you are keeping the synchro) on the shaft and also to the grooved surface of the synchro. Apply silicone gasket maker to the mating surface of the transfer case.



- 2.1.37 Place the rear section facing up and drop the front section onto the rear. Make sure that the shift rails, rear output shaft and front output shaft are all properly aligned to their respective seats in the front section of the case. If the case does not drop flush to the mating surface, something is improperly aligned. DO NOT force or use an impact gun to pull the case closed. Tap about the case and wiggle it until it falls nicely into place.



- 2.1.38 Once the case is seated together, install 4 of the housing bolts spaced evenly around the transfer case. Mount the shift lever and shift through 2HI 4HI and 4LOW. All gears rotate smoothly by rotating the input shaft with your hand. If any of the gears lock up and don't rotate, or have a difficult time rotating by hand, it is possible that the synchro didn't seat itself correctly or a component is out of alignment. Remove the four housing bolts and open the case. Inspect for any signs of pinching or misalignment and repeat step 2.1.35 – 2.1.37 until the transfer case shifts and rotates smoothly through all gears.



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2.1.39 Install the shift locating sensors. Install the front and rear driveshaft flanges with some regular strength thread locker. Be sure to research your specific vehicles torque specifications. The shaft install is now complete.



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2.2 Removal of Required Components from Donor Transfer Case and Installation into the EcoCrawler

NOTE: Please read the IMPORTANT NOTES on page 2.

Complete steps 1-7 in section 2.1 in order to remove the planetary gearset.

IF YOUR DONOR TRANSFER CASE IS AN ELECTRIC SHIFT:

Make sure the Low Range Spline Connection on the planetary housing is from a manual shift transfer case or has been purchased (P/N 36284-35021 from Toyota) as described on page 3 of this manual. The electric shift transfer case part has a recessed tooth profile and does not allow the EcoCrawler to fully engage with the low range splines (see photos below). Only use the Low Range Spline Connection from a manual shift transfer case.



- 2.2.1 Remove the ring gear detent plug, spring and detent pin. These parts will be used in the Eco Crawler lid so be sure to not misplace them.



- 2.2.2 Remove the ring gear snap ring and ring gear from the front section of the transfer case.



- 2.2.3 Remove the shift rail detent cap, spring and detent ball from the rear section of the transfer case. These parts will be used in the Eco Crawler lid so be sure to not misplace them. Only one spring, cap, and detent ball is needed. If the donor case is an electric shift, pull the detent cap and ball from the shift fork. DO NOT use the electric shift spring. While it may fit, it is not designed to be in the Eco Crawler Lid.



- 2.2.4 Remove the shift rail, fork and collar for the low range engagement. Use a punch to remove the shift fork roll pin and pull the shift fork off the shift rail. It is likely that three synchro detents seen in the left-hand photo will spring out of the case when it is fully pulled apart. These will not be used in the Eco Crawler. The synchro will have fallen out from the case as well, this also will not be used in the Eco Crawler.



- 2.2.5 On the rear section of the case, remove the snap ring holding the shift collar alignment. Use a set of jaw pullers to remove the shift collar alignment. Remove the snap rings sitting on each side of the shift collar alignment.





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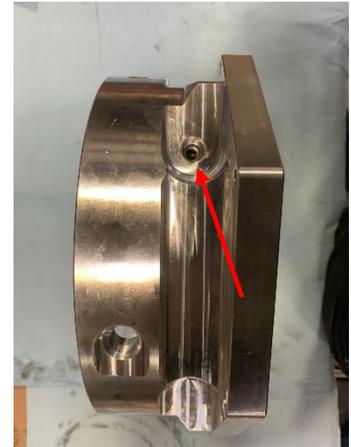
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- 2.2.6 Grab the Eco Crawler Lid and place facing up. Install the ring gear and ring gear snap ring into the case. Locate the ring gear detent hole in the case and install the detent pin, spring, and cap.

NOTE: The ring gear can be a tight fit with some Eco Crawler Lids. Align the ring gear and start it by hand. Use a large flat punch and tap around the ring gear until it is fully seated if required.

IMPORTANT: Notice how the ring gear has a chamfered edge, this **MUST** be facing down and into the ring gear seat. The non-chamfered edge interacts with the ring gear snap ring.



- 2.2.7 Install the planetary gearset and bearing snap ring. NWF uses a tighter tolerance with the bearing case, this makes the bearing slightly more difficult to press through the bearing bore. Line up the bearing and start the install by hand or until the planetary gear engage with the ring gear. After that, using a deadblow hammer and tapping around the low range engagement will adequately press the gearset into place.





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- 2.2.8 Grease the seal in the bearing retainer and place it onto the Eco Crawler Lid. Use the mounting bolts from the transfer case. Apply regular strength thread locker to the bolts and silicone gasket maker on the sealing surface.



- 2.2.9 Grease the shift rail and shift rail slot. Place the shift block in line with the shift rail slot and insert the shift rail. The holes for the shift for roll pin should be on the inside of the case. Align the shift block and shift rail roll pin holes and begin pressing the roll pin into the shaft. Rotate the shaft so that the bottom of the shift block is visible and DO NOT press the roll pin passed the bottom of the shift block. The pin must sit flush with the bottom face.





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2.2.10 Use a grinding wheel and grind down the ridge on the shift fork from casting.



2.2.11 Place the shift collar and the shift fork and install the shift fork and collar into the Eco Crawler. Align the shift fork and rail roll pin holes and press a roll pin in to lock it in place. Make sure that the roll pin is flush with the top of the shift fork.





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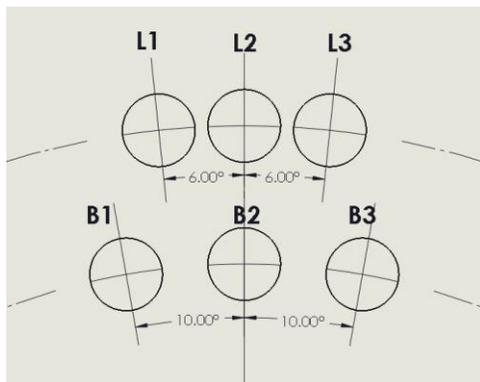
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2.2.12 Install the four 3/8 NPT bronze plugs. Install seven M10-1.25 studs into the top of the Eco Crawler Lid. Install three M8-1.25 studs into the back of the Eco Crawler Lid. Install the O-ring if it isn't already in the case.



NOTE: The M10 studs define the amount of clocking. The threaded holes on the Lid are spaced by 6° and the clearance holes on the Base are spaced by 10°. This gives a clocking range of 0°, 4°, 6°, 10°, and 16° in the clockwise or counter clockwise direction. The diagram below gives the stud location angles.



| | |
|-------|------------|
| L3-B1 | 16° CCW |
| L2-B1 | 10° CCW |
| L3-B2 | 6° CCW |
| L1-B1 | 4° CCW |
| L2-B2 | 0° (STOCK) |
| L3-B3 | 4° CW |
| L1-B2 | 6° CW |
| L2-B3 | 10° CW |
| L1-B3 | 16° CW |

2.2.13 On the NWF Eco Crawler Shaft that has been installed into the transfer case, place the shift collar alignment and snap ring. Note how there are a short edge and tall edge, place the short edge facing the bearing retainer so that the tall edge interacts with the snap ring.



2.2.14 Install four of the M8-1.25 studs into the threaded holes on the transfer case. Install the other four M8 studs into the Eco Crawler Base. If there are dowels in the transfer case, remove them and place them back into the transmission mounting surface. Apply silicone gasket maker to the mating surface between the Eco Crawler Base and the transfer case. Using the M8 washers, lock washers and nuts, bolt the Eco Crawler Base to the transfer case. Refer to your vehicles torque





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2.2.15 Make sure that the split bearing is in the internal bore of the planetary gearset shaft. Use some grease to hold it in place during assembly. Place the transfer case and Eco Crawler Base face up and drop the lid into place. Be sure to line up the desired clocking holes. In some configurations, the M10 and M8 studs will interfere with each other. Use a cut off wheel to shorten the M8 stud. Bolt the Eco Crawler Lid onto the Base with the M10 washers, lock washers and nut. Some Lids are unable to fit the M10 washers. If the washers do not fit, use only the lock washer and nut.



2.2.16 By hand, shift the Eco Crawler from low range to high range. Ensure that the Eco Crawler is fully engaging from low to high. Feel for any points of high friction. If there are points where it feels like the shifting is “sticking” or being held up, open the Eco Crawler case and inspect the shift fork, it will likely need to be ground down for further clearance in step 4.2.10. If the Eco Crawler is not engaging, it could be that the shift fork was placed backwards, refer to step 4.2.11.





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2.2.17 Install the shifting detent ball, spring and cap.



2.2.18 Place the remaining five M8 studs on the transmission. The Eco Crawler and transfer case build is now complete.

IMPORTANT: If your vehicles transfer case has completely internal shift rails (electronic transfer cases) ensure that there is clearance for the Eco Crawler shift rail on the transmission side. This area may need to be ground down to give clearance for the shift rail when the rail protrudes from the case.

3.0 Oil Filling Procedure

Recommended Oil: Redline MT90

While all Eco Crawler cases vary in oil capacity, the cases will take around 2qt of oil.

3.1 Remove the left or right 3/8 NPT plug from the lower side of the case. This plug represents the “full” indicator, fill the Eco Crawler until the oil reaches the NPT hole. Install 3/8 NPT plug.