Introduction

We hope that the installation of your new Novak adapter assembly goes smoothly and that you acheive the improved results with your Jeep® that you intend. This kit is for adapting the Ford T18 manual transmission to the Jeep® New Process Model 231 transfer case, as found in 1988 to 2004 Jeeps.

NOVAK CONVERSIONS
JEEP® POWERTRAIN SUPERIORITY

Despite whatever your experience with this type of work may be, we strongly advise you to read these instructions well and save them for future reference and parts numbers. Contained in these instructions are the requirements, tips, hints and tricks of years of performing these conversions, both in our own facility and information we've gained from discussing this swap with our customers. Put this information to good use.

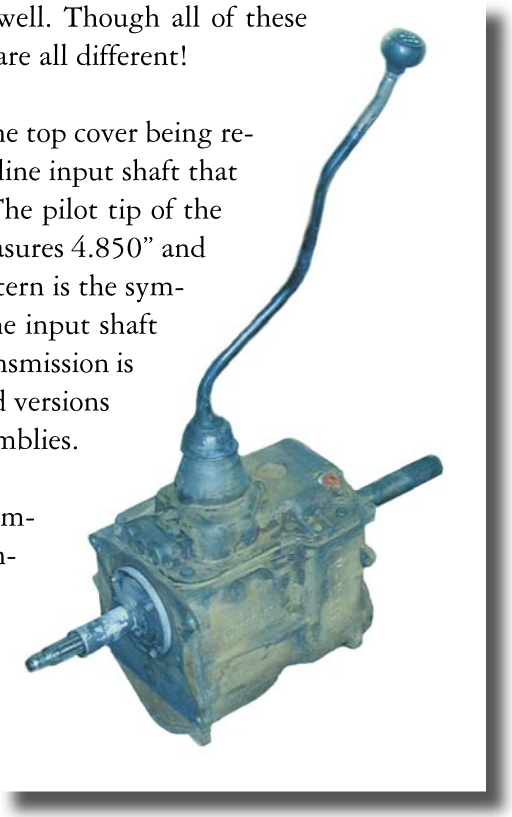
Note that we will refer to the T18 transmission throughout this guide. It will apply to the T19 and the T19 versions of our kits equally well.

About the Ford T18 Transmission

The T18 four-speed manual transmission was made by Borg-Warner from 1966 through 1986. It is a heavy-duty truck transmission designed for and used in such applications as ½, 3/4 and 1 ton trucks. It is the improved successor to the T98. The T18 is fully synchronized in the second through fourth gears. All gears are helically cut except first and reverse, which are spur gears.

Identification

Part of the battle in doing a T18 or T19 conversion is making sure you have the right one, especially if you did not actually witness the transmission's removal from the donor vehicle. Jeep used fourteen different T18s, International used three and Ford used three as well. Though all of these transmissions share many common parts and characteristics, they are all different!



For the Ford T18, the case and top cover are both cast iron, with the top cover being retained by six bolts. The T18 & T19 has a 1-1/16" diameter, ten spline input shaft that has a stickout of 6-1/2" from the front face of the transmission. The pilot tip of the transmission measures .668". The front bearing retainer flange measures 4.850" and the bearing retainer tube is 1.432" in diameter. The front bolt pattern is the symmetrical Ford "butterfly" pattern; 8-1/2" wide by 6-5/16" tall. The input shaft length is 6-1/2". Checking these dimensions will verify that the transmission is a 1966 or newer model, precluding it from being the T98. All Ford versions of the T18 are automatically compatible with Novak adapter assemblies.

The transmission can also be identified by its casting numbers, commonly "13-01", cast into the driver's side of the case. From 1966 until 1978, many T18s used a T98 shifter assembly. 1979 and newer T18s used a three fork shift cover assembly that shifts reverse gear directly. Because of this, reverse location is on the opposite side of neutral than the earlier version ('66 to '78). Earlier versions reverse gears shifts over and up - later versions shift over and down.

Additionally, the T18 has three bronze synchro rings. You will also notice the power-take-off port at the right side of the case.

If you can locate the production ID tag on your Ford T18 top cover, you will find a lettering code akin to "D7T3...". This may help identify the year of transmission, as Ford uses the first letter to designate the decade (C='60s, D='70s, etc.) and the year is called out by the second digit.

Compatibility

Interestingly, the bellhousing bolt pattern for the Ford T18 & T19 are the same as the Tremec 150 and the Tremec 176 transmissions. If the individual is installing a Ford T18 in a Jeep with the 258 or 4.0 engine, use of the above mentioned bellhousing will allow for a direct bolt-up. Use of a special pilot bushing is required, and is available separately from Novak or provided in our transfer case adapter assemblies if requested by the customer.

Ford T19's

Very much similar to the T18 in appearance and build is the T19. This four-speed transmission is different from the T18 and others in that it usually features taller gearing and a synchronized first gear. It was introduced in Ford trucks in the 1968 model year.

Three gearing options were available for the Ford T19. The T19 was available with a 6.32:1 first gear. These were only in rarer Ford 500-800 series HD trucks. The very most common T19 available in Ford applications was the T19A with the 4:02:1 first gear ratio. For two years (from 1983-1984) there was a Ford T19 with a 5.1:1 first gear. All ratios listed had a synchronized first.

We've learned that the 1983-1986 Ford T19's, as installed behind the 460 and diesel had the 4.02:1 first gear, in a 2wd application, or a diesel 4wd application. The 460 4wd truck got the 6.32:1 first gear, purportedly from 1983-1986 F250's.

The Ford T18 & T19 are also compatible with GM and AMC bellhousings, following some minor modifications. See Adapting Ford Transmissions to GM Bellhousings, and Adapting Ford Transmissions to AMC Bellhousings.

Contact us if you have Borg Warner T18 or T19 components. We have the full line available upon request.

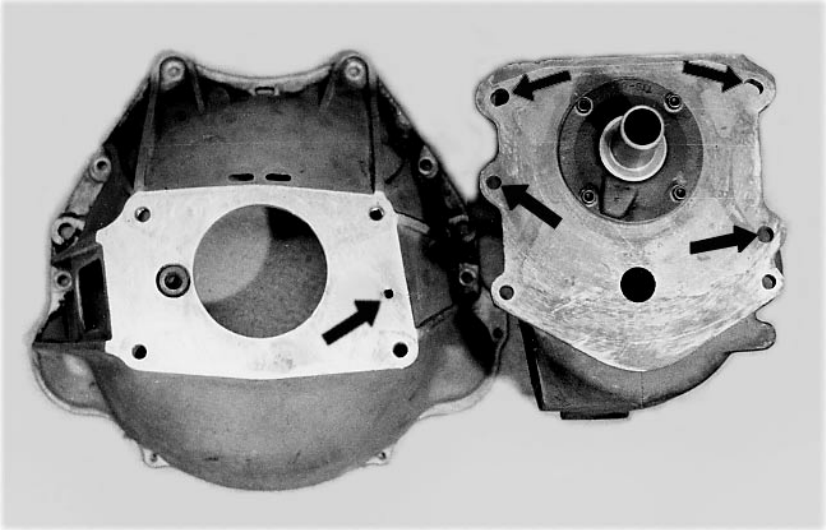
The Conversion Procedure

Installing the Pilot Bushing

Before installing the transmission to the engine, the special pilot bushing provided (if applicable) must be installed in the AMC or GM crankshaft. A piece of broomstick makes a good drift punch to install the pilot bushing. Never hammer directly on the bushing as it is quite soft, an it will surely be damaged by such a technique. If the tolerances are tight between the crank and bushing, you may wish to set the pilot bushing in the freezer for an hour and then very lightly warm the end of the crank with a torch before assembly. This facilitates some installations and provides for a secure fit.

Adapting the T18 to a GM Bellhousing

If the Ford transmission is being adapted to a Chevy or GM engine it is most easily done while the transmission case is empty. No adapter for the GM engine bellhousing to the Ford transmission is required. With a few simple and cost-saving modifications, 1966 and newer Ford T18 transmissions can be used with most GM bellhousings, including full-circle or open-bottom types. Using this method will also allow you in the future to remove the transmission without having to remove the bellhousing like you would with some GM applications. Here is the method:



For the first step the services of a machinist may be recommended. The front bearing retainer from the Ford transmission is removed and simply machined down around the large diameter to where it will slip-fit into the bearing retainer hole in the back of the GM bellhousing. This will typically be 4.681". Take an accurate measurement (and with the proper tools -- calipers work best) from the hole in your own bellhousing before doing this. The small diameter of the Ford bearing retainer is also machined down so it will slip-fit the GM clutch release bearing. This diamter will usually be 1.375" to allow grease clearance for the 1.382" bearing. Next, the retainer is then shortened by 7/16". Following this is some fairly straightforward work on the Ford transmission case.

Novak can provide a new, machined T18 retainer (in cast iron - factory aluminum one pictured) or machine yours if you send it to us. The pilot bushing is standard issue in your 183G kit, or available seperately.

On the front face 1966 and newer Ford four-speed transmissions, the upper two mounting holes are each about 1/4 of a bolt hole off from the upper two holes in a GM bellhousing. If the holes in the Ford transmission ears are slightly elongated, they will match up with their mountings to the GM bellhousing. It may be recommended at this point that you test fit the transmission to the detached bellhousing, which will facilitate the next step.

On the lower front face of the Ford transmission are two ears that, if stock, are undrilled. The lower left ear can be drilled to easily match the hole in the lower left of the GM bellhousing. The right ear can then be drilled. It will not meet up with any hole in the GM bellhousing, so it is necessary that you drill and tap one to match. Use the same size bolt as you do for the other three. If you are not equipped with the tapping tools or the disposition to tap a good, clean set of threads, you may take this to a machinist as well.

For the clutch disk, use a Ford unit of the same diameter as the GM pressure plate. This ensures that the splines on the input shaft of the transmission match the disc. The Ford input shaft is 6-1/2" long which is nearly the same as the GM input shaft would be.

This procedure may seem complex and involved, but it is actually quite simple and intuitive. The results are very worthwhile and the cost savings over a special bellhousing or bellhousing adapter is significant.

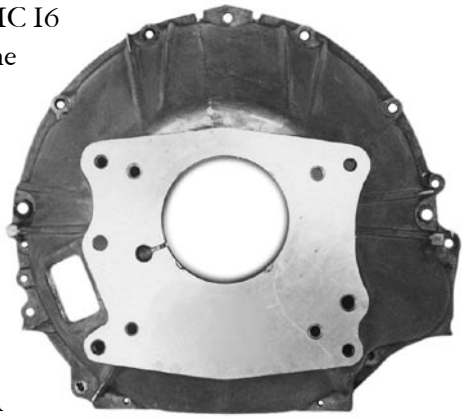
About Your Novak Adapter

The Novak #181 adapter kit is built to high standards of design, materials and build. The adapter housing is cast of 356-T6 aluminum and is gusseted for remarkable strength. Our adapter shaft is machined of a triple-alloy gear steel, specially hardened and precision ground for strength and longevity.

Novak warranties your adapter and shaft against defects of workmanship and materials for the life of the vehicle. This warranty is non-transferable and requires a copy of your invoice as documentation. These components are not warrantied against damage or defects resulting from improper installation, including misalignment, improper assembly, improper mounting, or incorrect driveshaft lengths, and miscalculated driveshaft geometry on shackle reversal setups. Because we have no control over how the parts are handled or installed, we are not liable for any problems or failures of this product unless it is a defect of design, materials or workmanship. Determination of this warranty is at the fair discretion of Novak, Inc.

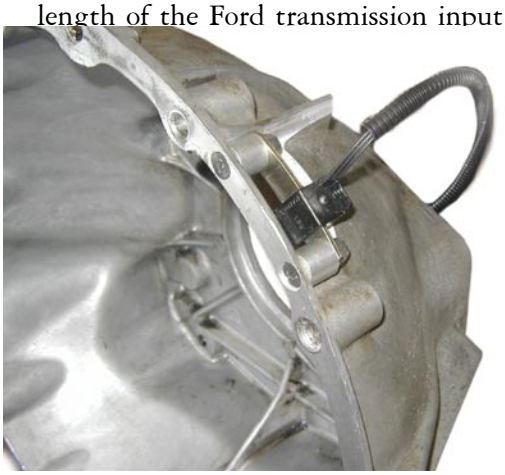
Should you have any questions concerning this conversion or these components, we welcome you to contact us.

Adapting the Ford T18 to an AMC Engine



The 1966 and new Ford T18 four-speed can be used with 1972 and new AMC I6 or V8 engines using AMC parts. Three AMC bellhousings will accept the the transmission, two as a direct bolt-up. These two are from a 1976 to 1979 CJ (I6 or V8; three-speed or four-speed) or a bellhousing from a 1980 to 1983 CJ that was factory equipped with a Tremec 170 series four-speed. A third bellhousing can be modified to work by drilling and tapping the Ford pattern into it. This bellhousing is from a 1980 to 1986 CJ that originally had an SR4, T4 or T5 transmission. The clutch release fork and release bearing from any of these three housings must also be used.

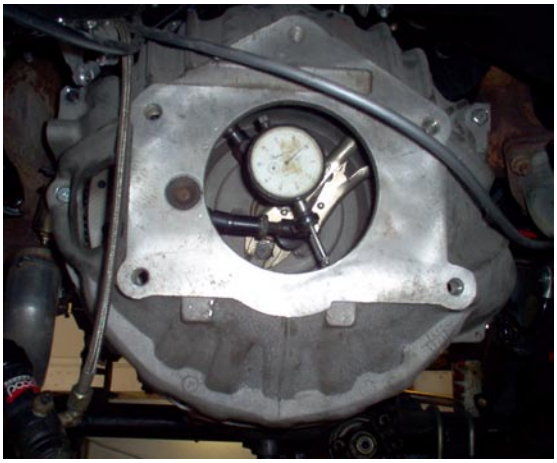
A 1976 to 1979 Jeep CJ clutch disc will match the Ford input spline. A special pilot bushing will be required to compensate for the slightly shorter length of the Ford transmission input shaft. This bushing is provided with our adapter kit if indicated.



Note that the 4.0L engine has the same block pattern as the 258's found with the above bellhousings. However, these bellhousings will require a provision for the Crank Position Sensor unless you are relocating this function to the front of the crank. Novak has developed a way to precision drill and bore a port into your AMC style bellhousing for the 4.0 CPS.

Bellhousing Alignment

On any engine using a standard shift transmission, with or without an adapter, it is important to check the bellhousing locating bore location relative to the crankshaft. The potential for transmission failure or premature wear is so great, due to misalignment at this point, that no engine should be assembled without being checked. The checking procedure is quite simple. Correcting misalignment is not so simple but must be done to insure normal service from the transmission. A dial indicator is required, as well as a suitable means to mount this instrument on the engine crankshaft.



A dial indicator (right) is a device that has an arm or contact point, suitably connected to a pointer, that moves in front of a dial with markings on its face. These markings usually represent .001" each. The purpose of a dial indicator is to measure in thousandths of an inch that can be read directly on the dial of the indicator.

To check a bellhousing, mount it on the engine it's going to be used with, make sure there are no burrs or dirt on the block or bellhousing. All bellhousing to block bolts should be in and tight. Mount the dial indicator on the crankshaft of the engine using a suitable magnetic base attachment or mechanical clamping means. The contact point of the indicator should be touching the bore of the bellhousing. The indicator must be mounted rigidly enough so it does not move on its mounting to prevent false readings. Rotate the engine by hand with the spark plugs removed and observe the reading on the dial. Keep adjusting the dial assembly until the needle moves the least amount per rotation. When you have acheived the least amount of needle movement throught he 360 degree sweep of the indicator, this is your runout. You can then determine the direction it is offset by the movement of the needle.

The total number of thousandths misalignment of the bore relative to the crankshaft is read directly on the dial.

Total runout should not exceed .007", with .010" being maximum. The greater the misalignment, the sooner transmission problems and failure will occur. A symptom of misalignment is unusual wear of the pilot bushing. We have checked stock Chevy bellhousings on engines that were out more than 1/32" (.032"). Some Ford one are reportedly worse. Anything over .010" runout must be corrected before the engine and bellhousing are put in service or you can count on pilot bushing, transmission, and clutch problems, followed by transmission failure. The simplest way to correct misalignment is to try another bellhousing or bellhousings. Machining the bellhousing is the best cure but offset dowel pins are simpler. Shims between the block and bellhousing will also work if you have the patience to use this method. Offset dowel pins are sometimes available from speed shops locally or online.

Clutch System

The clutch is not so much dependant on the transmission being used as is the engine, but a general guideline is to use the flywheel and pressure plate as prescribed for your year and model of engine. The clutch disc must have a 1-1/16" x 10 spline hub to match the Ford input shaft. These come in both the Jeep (1976-1979) versions and most Ford applications.

You should retain your hydraulic master cylinder and then use a slave setup like the original Jeep version (with the exception of the integrated internal hydraulic release bearings) that use an external slave and pivoting release arm. A more in-depth discussion can be had at the Novak Knowledge Base, www.novak-adapt.com, or with a tech at Novak who may also be able to configure a clutch system that is most appropriate for your combination.

Transmission to Transfer Case Conversion Procedure

Disassembling the Transmission

You may wish to do a full rebuild of your transmission while you are replacing the mainshaft, as this constitutes a major portion of an otherwise master rebuild. As such, we are including our full rebuild instructions below. If you choose to simply replace your mainshaft, concentrate on the passages that apply.

Remember throughout your installation/rebuild, that you are dealing with hardened metals in this transmission. Hammering, pressing or shocking any surface with any tool that is not significantly softer than the steel being serviced will chip or break parts. Always use brass, aluminum or wood drifts to drive parts. Do not use screwdrivers alone to pry off snap rings.

The three tools that transmission disassembly requires that may not be in your tool chest already are:

1) Heavy duty external snap ring pliers
2) Bearing puller/splitter set
3) Hydraulic shop press and various arbors/sleeves

These tools can be rented, borrowed or even purchased for prices that should not be too shocking.

Above: Tools common to a gearbox rebuild. Bearing and gear pullers will vary. Below: A set of large, bevel tipped, external snap ring pliers is indespensable for removing the large Eaton type retaining rings you'll encounter. These shown are under the Blue Point brand.

T18 Shift Cover Removal

Begin by removing the transmission shifter stick by pressing downward and rotating counter-clockwise the domed bezel. The bezel will release and allow the shifter to be removed. Now unbolt the eight top cover bolts and remove the top cover assembly. It may require a few firm blows with a soft-faced mallet to break the gasket's hold. If you must pry with a screwdriver, keep it out towards the edge so as not to mar the gasket sealing surfaces.

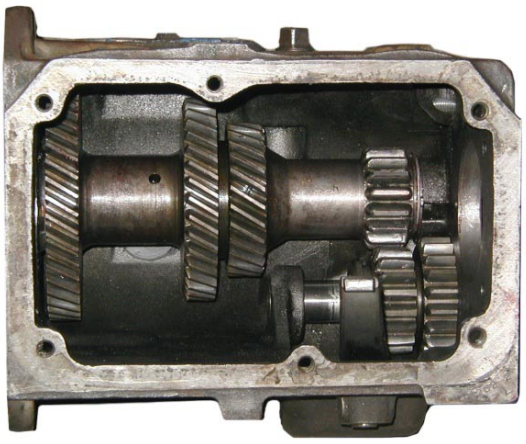
This style of snap ring plier is more universal, with a dimpled and knurled flats. They are great for smaller snap rings.

Tailhousing Removal

Lock the transmission in first and fourth by sliding the first to second clutch sleeve rearward, and the third to fourth sleeve forward. This will allow you to remove the yoke nut (2wd models) or gear nut (4wd models) from the rear of the original mainshaft. On 2wd models, a large crescent or pipe wrench works well to hold the yoke. Now slide the gear hubs back into neutral position and remove the rear tailhousing or adapter. On pre-1979 Ford and all Jeep versions of the T18, reverse is actuated by a case-mounted pivot arm. The pivot can be removed by driving the taper pin rearward. On some T18 and T19 models, a snap ring or locking washer is used. Follow by removing the tailhousing.

Bearing Removal

Move to the front of the transmission and remove the input bearing retainer. Using a good set of snap ring pliers, remove the snap ring on the input shaft. You would be wise to wear safety goggles during this and every use of snap ring pliers. Remove the input bearing o.d. snap ring. Using a bearing puller locked into the slot of the input bearing, pull the front bearing off the input shaft. Note here that all Jeep and pre-1979 Ford T18's used a thinner front bearing. Do not mix it up with the rear bearing. Later versions have the same width bearing. Now, remove the large bearing washer. Next, remove the pilot rollers spacer from the hub.



The T18 case. You've come this far, you may as well drive the countershaft out and check your countershaft thrust washers and roller bearings.

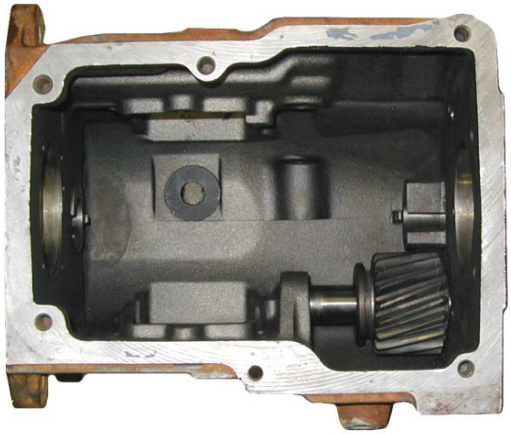
Now, repeat the bearing removal process using the same methods on the rear of the mainshaft. You may need to tap the mainshaft rearward to expose the groove of the outer race.

Mainshaft & Input Shaft Removal

With both bearings now removed, pull the third-to-fourth clutch sleeve rearward to separate the input and mainshaft assemblies. Do this slowly, so as to not drop the mainshaft pilot roller bearings. Once separated, you may now remove the mainshaft assembly by tilting its nose upward and pulling it from the case. The input shaft will now easily be removed from the case. In the event they didn't all fall into the bottom of the transmission case, take out the pilot rollers from the input shaft bore.

Mainshaft Disassembly

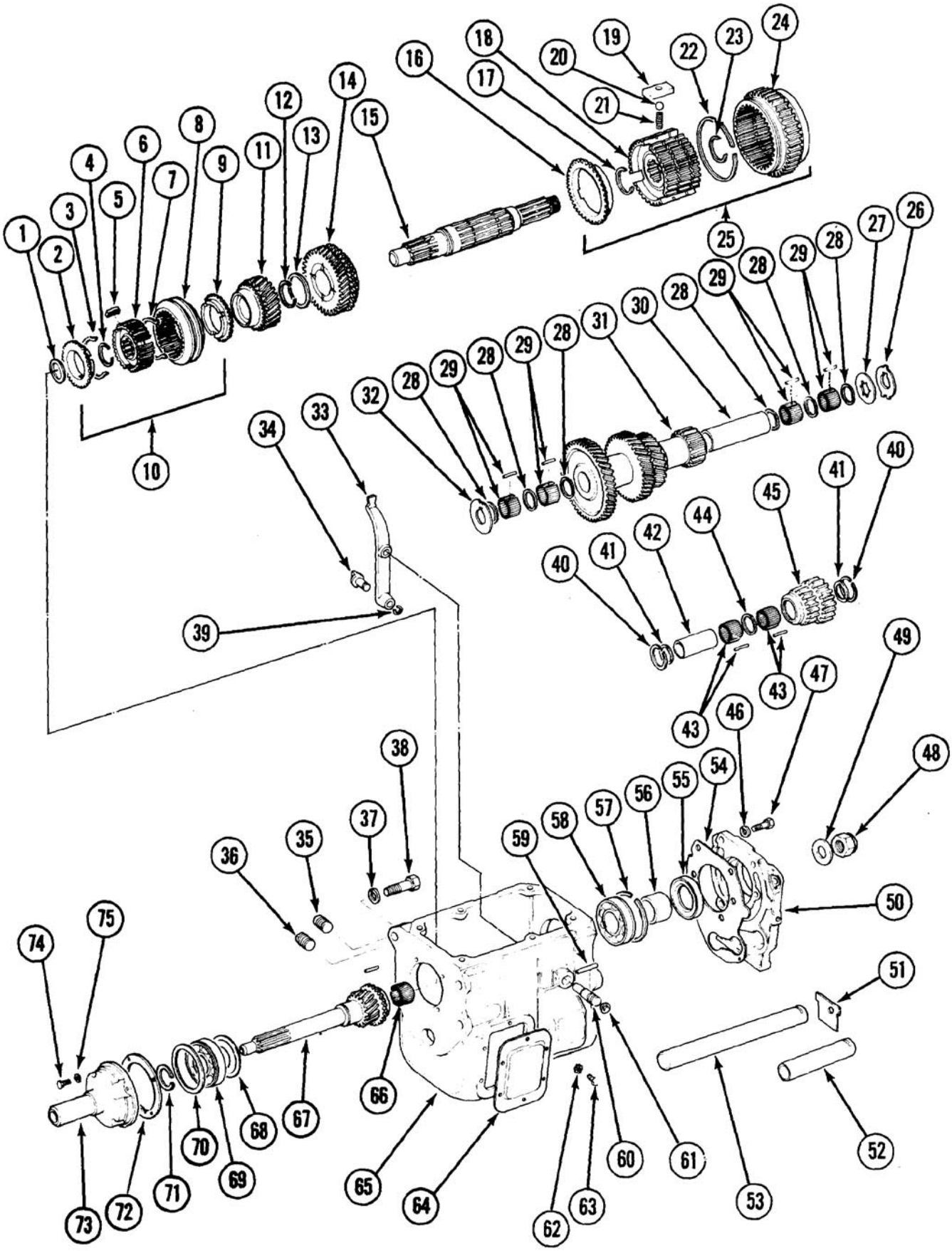
You are now ready to disassemble the mainshaft assembly. Remove the pilot rollers spacer from pilot tip of the mainshaft. Remove the third-to-fourth hub front snap ring (goggles, again). The hub assembly now slips off the shaft. We should mention here that it is a very good idea, especially for the uninitiated transmission builder, to place all components in their proper order and orientation on a secluded (and clean) section of the workbench. This will assist in making reassembly easier.



The T19 case, shown here emptied and cleaned to perfection. Note the different style of reverse idler here. Reverse gear bushing or bearing wear is usually negligable, but worth checking as we've seen some instances of unusual wear.

Moving to the back of the shaft, remove first-to-second gear hub snap ring. If working with the T19, you may have to press first gear off rearward with a press. Remove second gear snap ring, washer and second gear. Note here that it is advisable to be careful if removing the first gear from the synchronizer hub. The detent balls and springs will fly out and into the next dimension if you let the hub slide too far off the gear. You may wrap them in a rag to prevent this

T18 Exploded View



Legend

1. Mainshaft pilot bearing roller spacer
2. Third to fourth synchro ring
3. Third to fourth retaining ring
4. Third to fourth synchro snap ring
5. Third to fourth shifting plate (3)
6. Third to fourth clutch hub
7. Third to fourth retaining ring
8. Third to fourth clutch sleeve
9. Third to fourth synchro ring
10. Third to fourth gear synchronizer assembly
11. Third gear
12. Mainshaft snap ring (see instructions)
13. Second gear thrust washer (see instructions)
14. Second gear
15. Mainshaft
16. Second gear synchro ring
17. Mainshaft snap ring
18. First to second clutch hub
19. First to second shifting plates (3)
20. Poppet balls (3)
21. Poppet springs (3)
22. First to second insert spring
23. Mainshaft snap ring
24. First to second clutch sleeve
25. Second gear synchronizer assembly
26. Countershaft gear thrust washer (rear, steel)
27. Countershaft gear thrust washer (bronze, rear)
28. Countershaft gear bearing washer
29. Countershaft gear bearing rollers (88)
30. Countershaft gear bearing spacer
31. Countershaft gear
32. Countershaft gear thrust washer, front
33. Reverse shifting arm
34. Reverse shifting arm shoe
35. Filler plug
36. Drain plug
37. Lockwasher
38. Transmission to bellhousing bolt
39. C-clip
40. Reverse idler gear snap ring
41. Reverse idler gear thrust washer
42. Reverse idler shaft sleeve
43. Reverse idler gear bearing rollers (74)
44. Reverse idler gear bearing washer
45. Reverse idler gear
46. Lockwasher (6)
47. Adapter plate bolts (6)
48. Drive gear locknut
49. Washer
50. Adapter plate
51. Countershaft reverse idler shaft lockplate
52. Reverse idler gear shaft
53. Countershaft
54. Adapter plate gasket
55. Adapter plate seal (spring faces transmission)
56. Speedometer gear spacer
57. Rear bearing locating snap ring
58. Rear bearing
59. Reverse shifting arm pivot pin
60. Reverse shifting arm pivot
61. Reverse shifting arm pivot o-ring
62. Washers (6)
63. PTO port cover bolts (6)
64. PTO port cover
65. Transmission case
66. Mainshaft pilot bearing rollers (22)
67. Clutch shaft
68. Front bearing retainer washer
69. Front bearing
70. Front bearing locating snap ring
71. Front bearing lock ring
72. Front bearing retainer gasket
73. Front bearing retainer
74. Front bearing retainer bolts (4)
75. Lockwashers (4)

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if you are going to disassemble them.

Countershaft Removal

The countershaft is a press fit into the front and rear bores of the case. However, the shaft is larger at the rear than the front. As such, drive the countershaft toward the rear (!) of the case using a brass or aluminum drift. You will need an arbor tool just undersized of the countershaft to hold the bearings, spacers and sleeves together during reassembly.

Once the shaft is out, you will be able to easily lift the cluster gear straight up out of the case for inspection.

Reverse Idler Shaft

After removing the lockplate, the reverse idler should be driven rearward with the assistance of a drift. This is tricky, but the shaft is usually not too tight in the case bore. Inspect the reverse idler and its bushing. This constitutes the end of the main disassembly process. You will now reassemble in reverse manner.

Inspection Tips

Inspect all parts for discoloration, warpage, brinelling, breakage and wear. We get several questions as to whether the first and reverse gears should be replaced if nicked or otherwise damaged. This wear is usually limited to the lead-ins and not the actual pressure faces of the teeth. As a general rule, if the gear tooth can be reasonably smoothed back to its proper shape with a stone or fine file, it can usually be reused. Gear breakage, excessive rust (pitting) and

other damage that extends to the pressure faces of the gear teeth themselves are grounds for replacement. Should you need such components, call us. We keep on hand (or can quickly special order) any manual transmission parts, new or used. In the shifter, assembly detent springs should be checked for collapse or damage.

It is difficult to judge the real condition of synchros. Note that the sharpness of the teeth and the integrity of the striations on the cone side. To eliminate come-backs, most professional rebuilders won't open a gearbox without replacing them. Again, as with other components in the transmission, replace them since you are into it this deep.

Reassembly

During the assembly process, be sure to grease all the components and their mating parts with petroleum jelly or an appropriate assembly lube. This is crucial during the initial spin of the rebuild. Be especially generous with coating each gear bore and their journals. Use of wheel bearing or other greases is counterindicated as these may not dissolve in the gear oil, leaving crucial oil passages plugged during operation. The stickier the assembly lube, the better, as it greatly aids the installation of loose rollers.

Countershaft Assembly

Install new roller bearings along with their spacers into the cluster gear using a sticky lubricant as mentioned earlier. The last needle will snap in firmly. If the grease is sticky enough you can sometimes skip using an arbor or dummy shaft while the countershaft is being driven into the cluster gear. Remember the new thrust washers, and to stick them to the machined faces of the lower case bores. Tap the cluster shaft in with care, from back to front. Once in place, spin the gear assembly and verify its proper functionality. Check endplay with feeler guages between the cluster gear and its thrust washers. We recommend .006" to .012". This is seldom an area that requires adjustment.

Install the reverse counter and its idler shaft in opposite manner of its removal.

Mainshaft Assembly

Assemble the mainshaft in reverse order that you disassembled it. Note here that the latest versions of the T18 used a shouldered mainshaft. Novak's conversion mainshafts use this same design. You will consequently shelve your snap ring and its encompassing thrust washer if you are working with a transmission that used the earlier style mainshaft that does not have this integrated shoulder. If you are not replacing the mainshaft, note that the step relief of this thrust washer faces forward an encompasses the snap ring (parts #12 & 13).

Images of the mainshaft assembly prior and after poppet installation.

Installing the first/reverse slider gear can be a real poser if you fully disassembled it. We recommend you pour your neighbor a cold one and request their help. The three sprung poppets and their keys will need to be reinstalled, and pressed into place with your thumbs and fingertips as an assistant slides the slider forward into position. It is usually helpful to position the mainshaft pilot tip on your work bench. Wear goggles during this step. The author once had the experience of getting one of these poppets launched into his forehead. A similar impact with your eyeball could bring your day to a quick end, not to mention your stereoscopic sight.

As you are installing the gears and syncrho hubs, make sure they fit well and spin on their journals without resistance. While installing the snap rings, make sure they don't provide a source of resistance. Once the sliders are installed, make sure they slide

without hitch. Note that on the third gear hub, the chamfered side faces frontwards.

Input Shaft Assembly

Place the new needle rollers included in the small parts kit into the bore of the input gear. Again, think sticky grease. Place the new synchro onto the cone of the input shaft and insert it nose first through the front bore of the transmission. It will rest there.

Final Transmission Assembly

With the mainshaft now together insert it, tail end first, into the transmission case. With both shafts tilted upward, gently install the pilot tip of the mainshaft into the packed bearings while lowering the shafts together. Be careful that no needles dislodge. This would ruin the mainshaft pilot during initial spin-up. Watch the 4th gear synchro also, that the keys and slots line up.

Place the roller bearings on both the input and output shafts. Note now that pre-'80 T18's had a thinner front bearing than rear. Don't mix them up. Later versions use the same bearing front and rear. With the bearings square on the shafts, place the transmission on end in a press and with the appropriate plates, tubes or other jigs, press the two bearings on simultaneously. There is a really swell chance of screwing up here. Don't let the synchros and keys get crooked or misaligned. The press will bring their service days to an unhappy end. When the transmission comes out of the press, the shafts should spin with minimal resistance and all synchro rings should have some axial and longitudinal play.

Trial fit (hold the RTV for now) the front bearing retainer and gasket and its pre-lube its new seal. Torque the input retainer bolts to 13/17 ft. lbs. (oiled/dry).

Adapter Installation

The adapter will replace the original 2wd or 4wd extension housing with the following notations: First, lube the adapter seal and transfer case input shaft before installing adapter. This adapter is machined to a median of factory specifications and is designed to be used with a 1/64 to 1/32" thick gasket between the transmission and adapter, as supplied. Note that gasket thicknesses from varying manufacturers vary, as will your endplay when using them.

The two studs supplied in the kit must be screwed into the two top holes in the back of the T18 case. The flat end of these studs have oversize threads and go into the T18 case. The domed end of the studs have standard fit threads. Put the nuts on the domed ends. These studs can be screwed into the casting without damaging them by "locking" two nuts together on a stud and wrenching on the nuts rather than using Vise Grip pliers or similar tools that damage and weaken the stud. Now, look into your transmission case and check for clearance between the lower drivers side adapter bolt and the reverse gear inside the transmissions. Using a lockwasher on the lower bolts will usually provide proper clearance but check it anyway.

Check the adapter for clearance between the end of the cluster shaft and the face of the adapter.

With the adapter in place, tighten the nuts while working the adapter up to the face of the transmission. It is a wise idea to cross tighten the bolts and in three successive steps until all are tight. *Do not use the bolts to press the adapter into place!* If it does not slide easily into place, find and diagnose the source of the bind before tightening the bolts. Torque the bolts to 35/50 ft. lbs (oiled/dry).

Check Your Work and Seal it Up

Check the shafts for endplay with a magnetic dial gauge. You should have .008"-.015" and the shafts should turn freely in neutral and all gears. If end play needs to be adjusted, your small parts kit contains snap rings of varying thicknesses which you may use to adjust this number. It is tedious to pull the bearings off and try again, but it is far more tedious to have the transmission break down prematurely.

Once satisfied with your transmissions operation, remove the adapter and the front input retainer. Use RTV silicone (we like Permatex® Gray) in thin layers on each side of each of the transmission gaskets. Install the bolts and torque them lightly until the silicone begins to squeeze out. Return and tighten the bolts to final spec (in an incremental crossing pattern) in a few hours after the sealant has solidified.

Transmission Lubrication

Fill the transmission with the right gear, usually 85W-140 for most climates. Use a GL-4 rated oil, not GL-5, as the latter has an increased amount of sulphur, which is lower in PH and acidic towards the bronze synchronizer rings in your transmission. StaLube and Redline make gear oils that match the GL-4 rating. We like to fill through the top cover, as it's a good opportunity to douse the gears and shafts, not to mention the speed to fill.

Put the top cover on, making sure to line up the shifters with their sliders. Test shift through the gears. Some installers like to spin the input shaft pilot tip with a drill (read, Large Chuck) and listen for any noises. Once satisfied with the operation, RTV the shifter gasket like any other. Torqe the shifter bolts to 25 ft. lbs. in a crossing pattern.

Transfer Case Installation

231 Input Gears and Compatibility

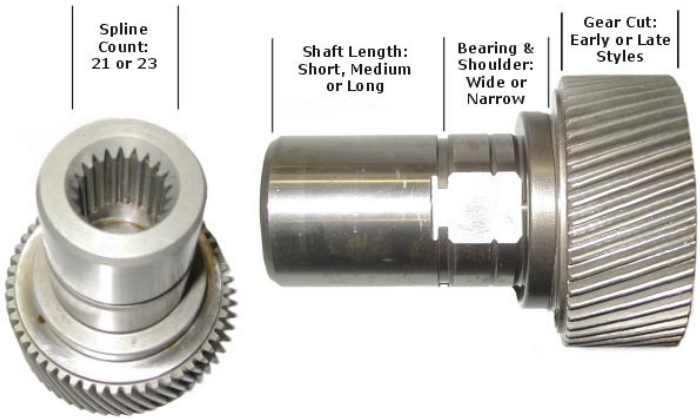
The important variations to look for in this transfer case when planning a conversion lie in the input gear. It comes in 21 spline and 23 spline versions with long, medium (rare) and short variations.

	21 Spline	23 Spline
Short Input	AW4 (through 1990) AX4 AX5	Earlier (pre-'95) AX15 AW4 (post-'90)
Long Input	Peugeot BA 10/5	Peugeot BA 10/5 Later (post-'94) AX15 TF904 TF999
Medium Input		Jeep ZJ's '93 to '95 only

The long shafts protrude 2.1" from the front mounting face of the transfer case. The short version protrudes 1.2". The rare medium shafts protrude 1.7". You should be careful when swapping any of these gears due to different bearing widths and gear teeth. The following chart shows how to determine which input gear you should have by transmission. It is always good to verify first hand if possible.

Because of differences in the cut of the gear, as a general rule; one should not interchange pre-'95 gears with post-'94 gears. These years are not hard and fast delineations. If one is not absolutely certain, disassembly and inspection is required.

Note that some transmissions change spline count. The AW4 had 21 splines through 1990. In 1991, the same year the 4.0 HO was introduced, the AW4 splines increased to 23.



We work closely with our customers, and our website assists them in making an informed decision about which adapter kit to buy in terms of spline count and input gear length. It is possible that not every varia-

tion that Jeep has will not match the documentation available. Check these features early in the process, noting that your adaptation will require a seal spacer sleeve if you have the short version of the input gear. This ensures that the actual adapter seal reaches the transfer case seal journal. If installing our spacer sleeve, lay a light fillet of RTV into the machined shoulder of the spacer where it meets the adapter seal bore. Gently press or drive this part into place.

Wire brush your transfer case input gear splines if necessary. Grease your transmission shaft output splines and transfer case input splines with a heavy black or synthetic grease. This adds to the life and long-term longevity of the hardened spline faces that transfer so much power through your drivetrain. Trial fit the transfer case. It should slip readily into place.

Bolt Up the 231 Transfer Case

As with the factory configuration, our adapter to transfer case interface features a dry cavity, and this should remain true so long as your oil seals in both the adapter and transfer case are doing their jobs. As such, match the aluminum face of the adapter to the transfer case front face. You may wish to lightly face any mars or debris from the 231 transfer case input face with a fine abrasive paper. The aluminum faces will conform to each other and provide a dustless cavity, though you are free to apply a thin bead of RTV to this face if you wish.

Install the transfer case with 3/8" bolts or studs (studs may be easier) and lockwashers. You may need to remove two of the odd-ball factory studs. Note that four-cylinder applications may have one of the six bolt holes plugged with a plastic stop that is easily removed. As with any other operation, do not use the transfer case bolts to press the adapter and transfer case together. If they bind, check for alignment or obstructions.

Mounting the Drivetrain Assembly

Based on our discussions with our callers, this is one topic that receives an inordinate amount of worry. Reinventing the wheel here is usually completely unnecessary. Most installations very successfully use the factory crossmember / skidpan for mounting the gearboxes. Every installation, without exception, must use a flexible, compressible transmission mount, also referred to as a rear motor mount. This mount will sit directly under the adapter, for which a cast-in pad and drilled holes are available. There are only rare instances where the base of your adapter need be modified.

This popular rear mount is what we design our adapters to. It is a common Jeep/Chevy application and well supported by the aftermarket. This one pictured is our favorite, under the Novak #RMU designation.

You will need to drill two holes in the factory crossmember for the lower (narrower) portion of the mount base. A block or box spacer under this mount is sometimes required to acheive the right tilt and tunnel clearance to the powertrain. In some cases, you may wish to relocate the crossmember forward on the frame, especially if you are working with a conversion engine that sits further forward than the factory Jeep options.

We have seen certain instances of customers or their fabrication shops making custom, bar style crossmembers whose outer portions are anchored by step bushings and bolts on the frame. These bars are then bolted directly to the adapter base. This is usually done for the sake of ground clearance. This is a bad idea. While these side bushings may offer some lateral absorption, they offer virtually no longitudinal give. This risks breaking your transfer case, your adapter or your transmission. Stick with a mount as illustrated. If you must use a highly custom solution, make sure it is thoughtfully engineered to generously absorb shock and twist along every axis, including recoil.

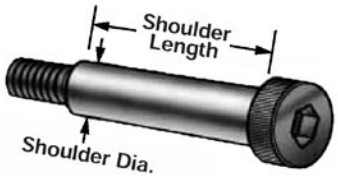
Transmission Shifter

Because of varying engine positions and different shifter stick configurations, you will likely need to bend your T18 shifter to match your Jeep's tunnel and your own ergonomics. Removal of the stick is easily done by pressing down

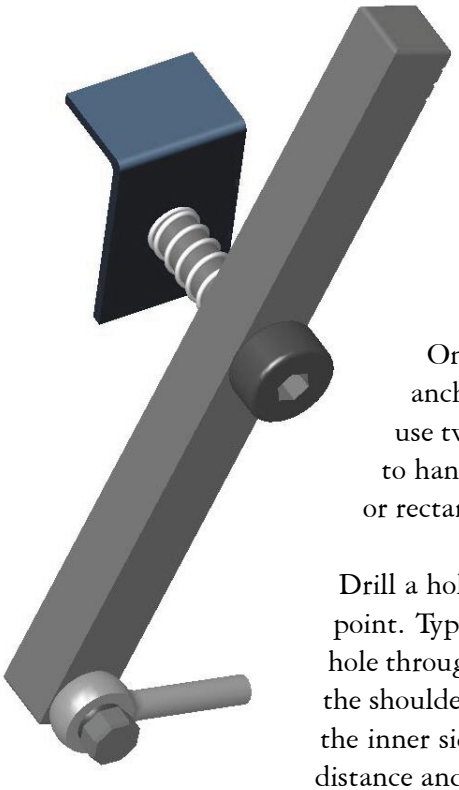
and rotating the sprung hold down bezel surrounding the base of the shifter. You can then remove the shifter from the housing and heat it to acheive the proper bends. Follow up with a light sanding and a coat of enamel.

Transfer Case Shifter and Linkages

The OEM 231 transfer case shifter assembly can be difficult to work with, and we recommend that you simplify this. There are four known different versions of these shifters, adding to the variation. The installer can make a very useful shifter assembly with the use of standard, on-the-shelf materials and components. Getting rid of the dummy-proof gated shifter plate is appropriate for an individual clever enough to do a transmission swap. We have found that the TJ versions of these shifters is a little easier to retain than their YJ predecessors, as they mount to the body and have a simple rod actuation system.



A shoulder bolt makes for a perfect pivot. They are commonly available through industrial and fastener suppliers.



One suggestion is to drop an angle bracket off the side of the transmission as an anchor point. Use of two of the top cover bolts is excellent for this. You may also use two of the adapter bolts in some situations. The bracket should be rigid enough to handle the leverage the shifter generates. Use of a steel or aluminum rod (square or rectangular) for a new shifter lever is recommended.

Drill a hole through the rod that will be used as a pivot. Use a shoulder bolt as a pivot point. Typically, you will use a shoulder bolt with a 1/2" diameter shoulder. Your drill hole through the rod will be just larger than this for easy insertion, but not too loose. Run the shoulder bolt through the hole in the rod and secure it with a nut and lock washer on the inner side of the bracket you've made. A spring on the side will set your side-to-side distance and offer rigidity to the lever.

Driveshafts

Most factory transmission and adapter combinations to the Jeep transfer case vary. As such, it is often that driveshaft lengths will need to be changed to accomodate the swap. Also, consider that there multiple ways to install a conversion engine (often used with this transmission) and the following will be of note:

Shackle Reversal Caveats

If a shackle reversal has been or will be performed on the Jeep, it is crucial that you calculate the suspension geometry's effects on the front driveshaft. Shafts that are too long or do not have enough compression slip will cause the driveshaft to ram your transfer case, causing damage to your axle, driveshaft, transfer case, adapter or transmission.

It is seldom a good idea to allow the driveshafts to make the decisions as to where the powertrain will be placed. Some of our customers, fearful at the perceived expense of new or modified driveshafts, attempt to let the existing driveshafts dictate engine, transmission and transfer case location, sometimes to the detriment of the project. Driveshaft modifications are usually inexpensive when performed by driveline, RV or tractor implement specialists. New driveshafts are an option but seldom a requirement in regards to the actual successful conversion. Jeeps that require extensive travel or specialty-built driveshafts have this option available through several fabricators across the nation.

Finish mounting the transmission and engine and have the weight of the Jeep on the wheels when measuring the length to modify the driveshafts. Any changes in driveshaft length must be determined after the engine and transmission have been mounted. The Jeep must be sitting on the ground with its full weight on the wheels to make the best determination. Our experience has shown that some stock Jeep drive shafts are not quite the correct length from the factory to begin with. This can be corrected if the driveshafts are modified.

Conclusion

While reading through these instructions, and especially while performing the transmission swap, it is often recognized that it is not the swap itself that provides the greatest difficulty, but in the ancillary things like linkages, mounts, clearances, and the like. Any good installation should consider all the points in this article and also allow for time, energy and funds for the dozens of variations in drive train conversions that cannot be anticipated. When executed with care, this conversion can be a strong, enjoyable and reliable upgrade to your Jeep.

We strongly suggest that you keep these instructions for future reference. For questions concerning your conversion, contact the 4wd retailer or technician you bought the kit from. If you bought your conversion kit directly from us, contact us and we'll be pleased to answer your questions.

There is no final word to our instruction packages. We update them often and invite our customers to offer any suggestions, images or questions they may have that can make the process easier for any to follow. Note our contact information below.

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