Introduction

Our TH700R4 / Early 4L60-E overdrive transmission to the Jeep New Process (or New Venture) transfer cases conversion makes for a very strong, and capable assembly both on-road and off-road. It is one of the most persistently popular transmission swaps into Jeeps, providing a very compact geartrain, compatiability with excellent engines and ease of installation.

The adapter kit is designed for compatibility with the Jeep NP207, NP231, NP242, NP249 & NP241OR "RockTrac" transfer cases.

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.

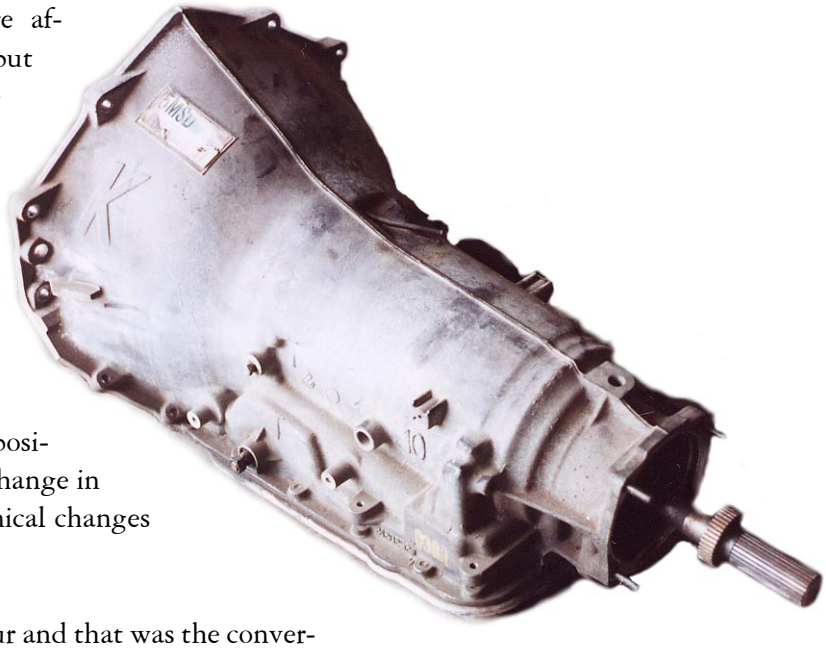
About the 700R-4 Transmission

The TH700R4 is an automatic shift, four-speed overdrive, longitudinally positioned transmission. It is now considered to be one of the finest overdrive automatic transmissions ever produced.

History

The Turbo 700 was introduced in 1982 as a response to fuel economy pressures, and to be phased in as the replacement for the TH350. The transmission was available for both car (RWD) and truck platforms. The transmission's principal new feature was its 30% overdrive. It also sported a lower-than-usual 3.06:1 first gear, popular for off-the-line acceleration as well as off-road torque.

Specifications for the 700R-4, 4L60 and 4L60-EThere were some initial bugs in the earlier versions. A feather in GM / Hydramatic's cap was the fact that they stuck with the 700R and followed through with improvements and upgrades. 1987 and newer transmissions are considered to be refined and very reliable, as indicated by their OEM installations against performance 350 V8s in sports cars and trucks. Earlier transmissions are affordably given all these upgrades to put them at the same high level of durable service and performance. Aftermarket building techniques and parts upgrades make this transmission very capable of Big Block power in race, street and off-road applications.



In 1990, the 700R4 was redesignated as the 4L60 (4-speeds, Longitudinally positioned, 6000 lbs. GVW). This was a change in name only with no significant mechanical changes associated.

In 1993, an important change did occur and that was the conver-

TH700R4 / 4L60 / Early 4L60E
Specs at a Glance

Make: GM / HydraMatic
Length: *23.4"
Weight: 155 lbs
Case: Cast aluminum, one piece
Gearing: 3.06, 1.63, 1, .70, R2.90

***Equivalent to a 16.9" manual transmission when adjusted for the bellhousing**

sion of the hydraulic logic shifting system over to an electronic one. Mechanically, the transmission's power transmitting core remained the same, but the valve body and actuation system for the clutches, bands, etc. became controlled by electronic actuators and solenoids. A Vehicle Speed Sensor (VSS) was used as the primary feedback sensor, which fed the PCM or ECM (vehicle powertrain computer) the data to make shift decisions. The engineering of this system is not regarded as a complication, but an elegant simplification and further improvement to this transmission. This version is called the 4L60-E (or Early 4L60-E for our purposes).

In 1997, the 4L60-E began to be released having received a redesigned case. This is the Later 4L60-E, discussed here.

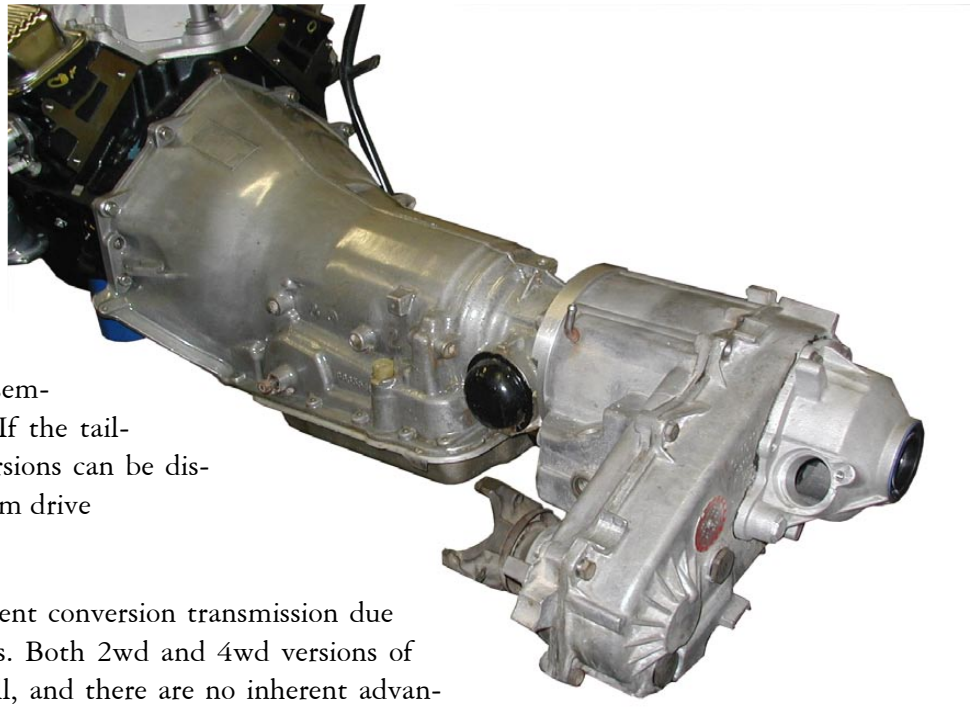
Identification

The 700 transmission has a main case of cast aluminum alloy with a length of 23-3/8" long. It is distinguished from the TH350 and TH400 in that it has a square oil pan, lacking the distinctive cut-off corner of the TH350 and the "Texas" shaped oil pan under the TH400.

Versions of the 700 transmission prior to 1984 had a 27 spline input shaft, changing later for a 30 spline input shaft. The transmission typically has a 1/4" pipe fittings on the passenger side for a cooling circuit. Later versions use a pinned flare and o-ring design for these fluid circuits.

The key distinction of the 700R4 / 4L60 / Early 4L60-E (from the Later 4L60-E) is the four bolt rear output or tailhousing / adapter pattern. The Later 4L60-E has a six bolt "hex" rear bolt pattern and a removable bellhousing.

There are three main castings of the 700R case. One is the standard car version. Another is cast slightly thicker, designated as the "K" case, as purposed for many trucks. The occurance of case breakage is very uncommon and most individuals swapping the 700R-4 into a Jeep probably will not be benefitted by one over the other. A third, rarer version was the "60 degree" version, as discussed below.



Two-wheel-drive versions have a tailhousing and typically a longer output shaft. Four-wheel-drive versions have various adapter assemblies and a shorter output shaft. If the tailhousing is removed, electronic versions can be distinguished by the absence of a worm drive

Transfer Case Adaptability

This transmission makes an excellent conversion transmission due to its adaptability into most Jeeps. Both 2wd and 4wd versions of the 700R can be used equally well, and there are no inherent advan-

The 700R4 and Mileage Benefits

A good part of GM's reasoning in developing the 700R was to allow more of their vehicles to meet ever stricter mileage and emissions requirements. It was an effective strategy.

By converting to the 700R, your Jeep may realize significant mileage benefits as well. It is not uncommon for swappers of this transmission to see a 30% drop in fuel consumption if the Jeep sees highway use.

Additionally, the transmission features a lock-up torque converter to allow a direct, non-slip connection through the transmission. This has the benefit of further fuel savings and cooler transmission operating temperatures. However, it is crucial that this lockup mechanism be properly connected to the ECM and brake lamp circuit. Stand-alone computers are available on the aftermarket for its control. Some control units even allow for the lockup to occur at a given speed. Lock-up converters in automatic transmissions give the advantage of direct engine lockup through the otherwise fluid-coupled transmission. This function works either by the ECM or a vacuum switch. Earlier versions without ECM use a vacuum switch connected to ported vacuum. The transmission receives the signal and applies fluid pressure to the clutches in the lock-up converter. The system switches off due to a signal from the brake pedal.

If you run the transmission with the converter unlocked all the time it will run a little hotter. Keeping it cool is important. The advantage of this lock-up converter is increased fuel economy and decreased heat at cruising speeds.

If you would like to simplify the stock setups, torque converter controls are available through racing supply retailers in a variety of styles. These facilitate the proper installation of the TH350 and 700R4. The on-road advantages are obvious. For the off-roader, the ability to manually switch the torque converter on is excellent in that it allows for compression braking.

tages to either one once you have installed our adapter assembly.

2wd transmissions feature conical shaped tailhousings and an output yoke, which are replaced with the included output shaft in your kit.

Engine Compatibility and Adaptability

GM

The front face TH700 is natively compatible with either the Chevrolet 90 degree "Small Block" & "Big Block" patterned engines (image, left), including the V6, V8, I6 & Iron Duke I4. Another version, the GM 60 degree pattern version, can be mated to 60 degree style engines, such as those in the 3800, 3.4, and other engine families. These transmissions are fairly rare as they were only produced for a few years in the Chevy S10 and Camaro with the 2.8L V6, prior to GM's upgrade to the 4.3L V6.

These differences only affect the front bell of the case, and all Turbo 700 cases are similar from that point back.

AMC/Mopar Jeep

The 700R-4 can be made compatible with AMC I6 & V8 engines. See our Kit #437AMC for details. This conversion can help make for an improved Jeep powertrain.

Transmission Summary

GM's commitment to the 700R4 is apparent in its strength, quality and broad usability. It is hands-down one of the most respectable transmissions of our era, and a very compelling Jeep conversion transmission. The 700R is a very attractive swap option for nearly all Jeeps.

About the Conversion

The Adapter

The Novak 700R to Jeep New Process transfer cases adapter is very compact at only 1.1" long for a combined transmission and adapter length of 24.6" (equivalent to a 18.1" manual transmission). Especially important for short wheelbase YJ & TJ Wrangler Jeeps, the Novak kit provides an excellent and popular transmission conversion combination.

700R-4 Versions

These kits are for the square, four-bolt tailhousing 700R-4 / 4L60 or 4L60-E, typically made through 1995. Some 1996 and later versions have a hex, six-bolt pattern tailhousing and removable bellhousing.

You have received one of two adapter kits, according to your order:
Option I is for the 700R4 (aka, 4L60), which is the conventional, hydraulically controlled transmission.

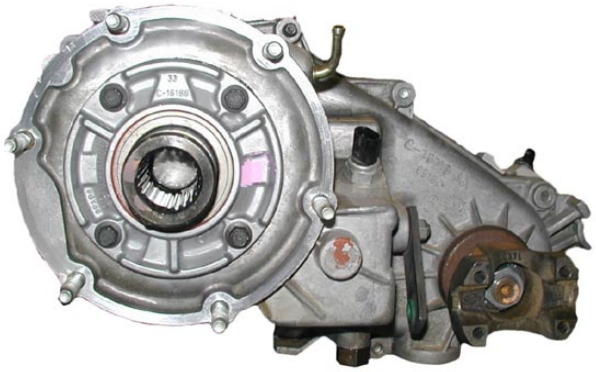
Option II is for the 4L60-E, which is the electronically controlled version of the 4L60. This version permits you to use the electronically controlled 4L60-E (four-bolt version) with your NP / NVG transfer case. Note that you will need to mildly modify the 4L60-E tailhousing (instructions are on the final page) to install the

included vehicle speed sensor (VSS). Also, make sure to plan on connecting your transmission to the GM ECM (if doing a GM engine swap) or get a standalone electronic transmission controller, available from GM, TCI, Jet, B&M and others.

Any version and year of the TH700R-4 can be adapted to the NP transfer cases, including "90 degree" (Gen. I, II, III V6 & V8 Small Block or Big Block engines) and "60 degree" (early S10 Blazer 2.8L engine style) versions of the 700, as determined by your choice of engine.

Transmission Output Shaft Replacement

This #171 kit comes with a new output shaft for the Turbo 700, whether for 2wd or 4wd transmissions. 2wd versions work equally well as 4wd versions. The Novak output shaft is of an alloy steel, precision splined and hardened for a superior interchange. This shaft connects the 700R output directly to the existing 21 or 23 spline NP / NVG input shaft for the strongest combination.



Transfer Case Input Gears

The included 700R-4 output shaft splines in directly into the OEM Jeep input gears, and transfer case disassembly is not typically required. Transfer case input gear styles vary.

NP 231

The NP231 may have 21 or 23 splines. For more information about these variations of the 231, jump here.

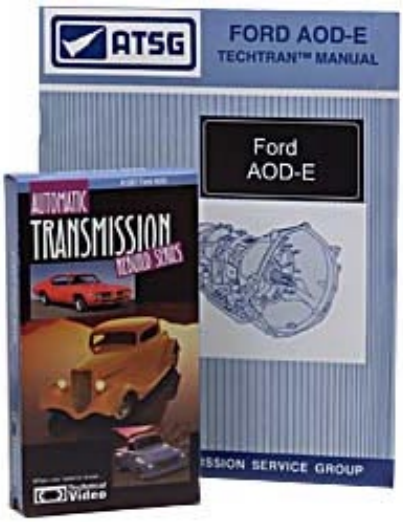
NP 242, 249 & 241OR

The NP242 may have 21 splines for the 1987-1990 versions. When connected to the 4.0L HO engine (1991-) the 242 will have 23 splines.

The NP249 and NP241OR always have 23 spline input gears.

NP207

The NP207 may have 21 or 23 splines. Many versions feature extra-long input gears whose stick-out lengths (as measured from the front edge of the input gear to the transfer case front mounting face) is longer than 2.2". These will require shortening with a cut-off saw and/or lathe and finished with edge breaking chamfers.



Technical Video has rebuild videos and manuals that will guide you through the process of installing your output shaft, and reconditionaing and updating your transmission.

www.technicalvideo.com

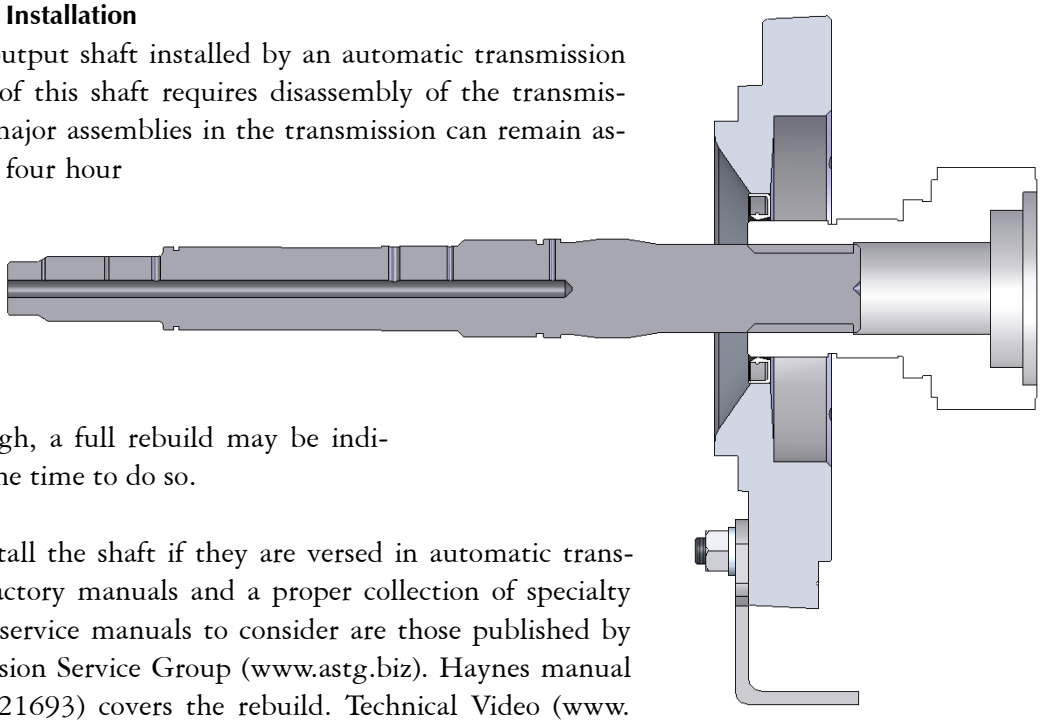
Conversion Procedure

It is very important that you heed the rules for absolute cleanliness while working with any automatic transmission while it is open. Do not allow debris, particles or greases to come in contact or proximity to internal transmission parts, or with parts that will be in contact with the internals of the transmission. This applies to automatic transmission cooler lines and their circuits. A significant number of initial failures in automatics are due to contamination. Wrap open areas with plastic and make sure fluid ports are plugged.

Now, remove the original Hydramatic tailhousing or adapter (in the event that it came with the transmission).

Transmission Output Shaft Installation

You can have your new output shaft installed by an automatic transmission professional. Installation of this shaft requires disassembly of the transmission itself, though most major assemblies in the transmission can remain assembled. We anticipate a four hour bench job based on our work with these units. You may wish to have seals, gaskets, filters, etc. replaced during this process. If the transmission miles are high, a full rebuild may be indicated and this would be the time to do so.

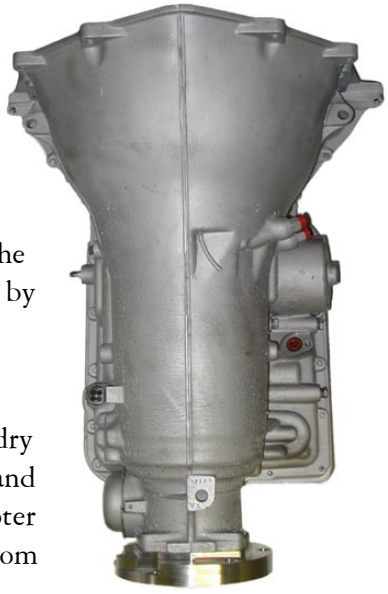


A cross-section view of the adapter assembly. This shows this short style input gear and that full spline engagement is acheived.

Home mechanics can install the shaft if they are versed in automatic transmission repair, but the factory manuals and a proper collection of specialty tools are required. Some service manuals to consider are those published by the Automotive Transmission Service Group (www.astg.biz). Haynes manual #10360 (ISBN #1563921693) covers the rebuild. Technical Video (www.technicalvideo.com) offers an excellent rebuild video and manuals for this and other automatic transmissions.

Adapter Installation

The adapter will now replace the original extension housing. Assemble the adapter to the transmission as follows: install the transmission seal ring (square cross-section o-ring) onto the shoulder and against the face of the front of the adapter. Orient the adapter such that the wrench clearance pocket is at the 9 o'clock position. Screw the four 10mm Allen socket head bolts supplied with the kit into the back of the transmission case. Use a thread locking compound, such as Locktite™ Blue. Tighten to bolts 1/4 turn at a time in alternating crossing patterns until the adapter pulls up evenly to the transmission case. Tighten to 35-40 foot-pounds. It is a good idea to cross-tighten the nuts to torque in three sequential stages.



You should lightly lubricate the splines for initial protection during startup. Use automatic transmission fluid as other lubricants and greases may not dissolve and cause trouble in your valve body. Once the assembly is in operation, the splines will automatically be flooded and lubricated by the transmission fluid.

Bolt Up the Transfer Case

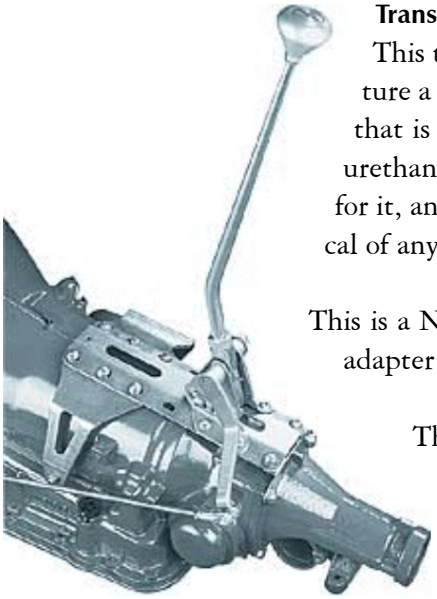
As with the factory configuration, our adapter to transfer case interface features a dry cavity, and this should remain true so long as your oil seals in both the adapter and transfer case are doing their jobs. As such, match the aluminum face of the adapter to the transfer case front face. You may wish to lightly face any mars or debris from

the transfer case input face with a fine abrasive paper. You can skin the transfer case face with RTV if you would like. We have provided a high-quality gasket for this location for your optional use. If using the gasket, forego the silicone sealant.

Secure the transfer case with 3/8" Allen socket head bolts provided. You may need to remove four 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. Torque to 35 foot pounds.

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.



Transmission Rear Mount

This transfer case adapter's design is based on Novak's Universal Series adapters that feature a modular mounting and support system. Included with the adapter kit is a steel base that is a highly configurable mounting foot, and is ready to accept our industry standard urethane isolator mount. This is our preferred rear mount unit. Our #171 kits are designed for it, and its usage is essential to protect powertrain components from the flex and jar typical of any automobile, but especially Jeeps.

This is a Novak #RMU (urethane) or a Borg Warner part #31-2268 and will mount on the adapter assembly using the supplied bolts, nuts and lockwashers.

The crossmember itself can be the factory unit. Customers often ask if they must use a specially fabricated crossmember to accomodate a conversion. The answer is, no. By drilling the crossmember for the above mentioned flexible mount, the transmission can be very cleanly mounted. Note that installation to a rigid crossmember risks breakage of the transmission, adapter or transfer case. Your adapter's warranty will be voided in this scenario. Note that a metal spacer can be used under the rear mount to acheive the proper transmission height.

Installation of this transmission will usually be in conjunction with a GM engine swap in most cases. This engine will usually be centered in the drivetrain, an not offset like many other Jeep applications.

Transmission Shifters & Linkages

The transmission shift control unit can be cable operated with detent positions for all functions and should include a lockout so reverse cannot be accidentally engaged when moving. Several console type shifters of this type are made by B&M and are widely available. Models Z Gate, Star, and Sportshifter are good choices. Hurst Performance makes a similar line of shifters for automatic transmissions. Direct linkage stick shifters like the Gennie (1.626. 337.2536 or www.hotrodhotline.com/gennie) or Lokar (1.865.966.2269 or www.lokar.com) are excellent choices, especially where a manual transmission is being replaced and the transmission tunnel is configured for the manual. The look and feel of the latter style shifters is often preferable.

When replacing an automatic transmission, you will find that the factory linkage can be retained and adapted without difficulty. Your factory shifter

may lack one position required for full functionality with the 700R4.

The reliefs in your adapter at the 1:30 & 3 o'clock positions are to accomodate our #SK2X shifter kit, which can simplify the overall conversion some, and provide a really excellent upgrade to the factory unit.

Transfer Case Shifter

This transmission conversion will allow for the retention of the factory shifters, or allow you to upgrade to the Novak #SK2X shifter assembly for a simpler conversion and a clean shifting, direct linkage system.

Driveshafts

Driveshaft length changes are often required, as this geartrain combination is typically longer than factory Jeep combinations. However, some GM engine installations will allow for the transfer case to remain in its OEM location.

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.

Since driveshaft modifications may be indicated for the conversion, it may be a good time to convert the transfer case to a heavy duty mainshaft and ultra-short tailhousing assembly. The #231XS Slip-Yoke Eliminator is the ideal solution to capture 7" of driveshaft length, significantly reducing u-joint strain and vibration.

Got Ice? Our padded bracketry radiators are built for engines up through 400 horsepower! The transmission cooler is built-in.

Transmission Cooling

For every ten degrees cooler you can keep the transmission, you can add 25,000 miles to its service life. Therefore, use of a transmission oil cooler is advisable for this automatic transmission.

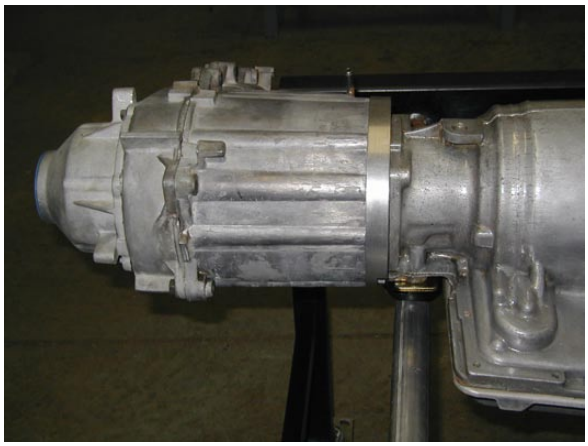
Use of a transmission temperature gauge is also a good idea. These are widely available and generally inexpensive.

We will suggest the use of our RadLock high-performance conversion radiators, which can include an integrated transmission fluid cooler. You may also use a standalone / supplemental transmission cooler depending on your driving style and climate conditions.

Engines & Engine Mounting

A Turbo 700R-4 installation is typically done in conjunction with an engine conversion into the Jeep. These engines include

the Chevrolet Small Block V6 & V8, from Generations I, II, & III, 1955-2006.



Novak offers what we have found to be the most intelligent engine mounting system for Jeeps available, allowing the installer to make an easy and satisfying decision as to powertrain placement with the TH700 and the Jeep transfer case both considered.

Axles

Use of factory axles is completely acceptable with this conversion. Axle upgrades are not necessary, but they may be chosen for reasons external to this transmission upgrade.

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.

American Made

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.

Air pollution laws vary from state to state. Changing an engine or transmission in your vehicle may change its pollution status. It is the customer's responsibility to determine that their vehicle conforms to whatever state and federal regulations that may apply to their vehicle. Neither Novak, Inc. nor its directors are responsible for any changes made to your vehicle.

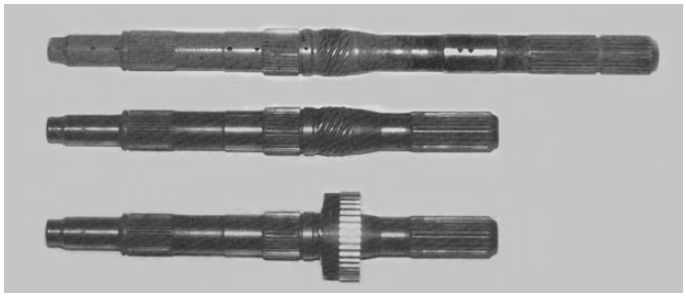
www.novak-adapt.com
support@novak-adapt.com
877.602.1500

Novak Speed Sensor & Reluctor Ring Installation

The Novak speed sensor reluctor ring is to be used on the 4L60-E transmission which requires relocating the reluctor ring to run the necessary Vehicle Speed Sensor (VSS) in your transmission conversion.

The 4L60-E is the electronic version of the 700R4 used in 1994 and newer rear drive passenger cars (Caprice, Impala SS, Camaro, and Corvette). The 4L60-E is also used in 1993 and newer full-size trucks, and some 1993 S-10 trucks. This unit will not work on previous transmissions which have a governor. The speed sensor is smog legal in California and has been issued E.O. #D-371.

The reluctor ring must be installed in the governor area because when the transfer case is in low range, the ECM would get an erroneous speed signal if the reluctor ring was located on the output shaft of the transfer case. Most stock GM transfer cases that have the speed sensor in the transfer case have a switch built into the shifter that signals the ECM to remap the functions of the transmission in accordance with being in low range. The VSS and reluctor ring are relocated to the rear of the main case, where the governor gear was used on non-electronically controlled transmissions. The original wiring for the VSS will plug into the relocated VSS. This will connect directly to the ECM or to the DRAC module (or buffer).

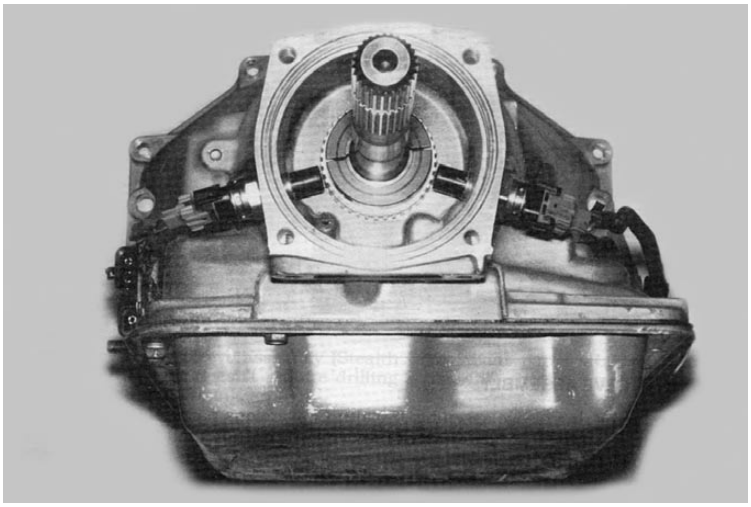


In the picture on the right a two-wheel-drive output shaft is shown on top. With 4wd applications, and the Novak conversions, a short output shaft is used. Note that with Jeep applications, the speedometer cable or speed sensor normally attaches to the back of the transfer case, as per stock.

4L60-E Reluctor Ring Relocation

Depending on the type of shaft you have, you will install one of two reluctor rings. Shafts with spiral threads for the governor gear require a 1.42" i.d. reluctor ring and clamp. The later shafts that are smooth, with no spiral gear gut into them, require the 1.30" i,d, reluctor and clamp assembly. 4wd transmission shafts that still have a governor gear require the clamp to be mounted forward of the reluctor ring because the governor gear profile is not flat, and the reluctor ring will form around the profile of the gear when the installation clamp is tightened. This will insure that the reluctor ring will not come loose in service. Access to the Allen head bolts is through the rear of the transmission case, but to see the Allen head bolts, you must look through the 3/4-16 hole. This is inconvenient, but it only takes a couple of minutes to securely tighten the bolts.

When relocating the reluctor ring to the governor gear location, the speed sensor can be mounted on the driver's side or the passenger's side (shown on both sides in the photo, left). On many Jeep applications, the shift linkage to the transfer case may interfere with the sensor if it is installed on the passenger's side, so mounting the sensor on the driver's side is the obvious solution.



Sensor Installation

Installing the sensor requires drilling and tapping a 1/2"-20 thread hole into the transmission case. Use a 29/64" bit or follow the tap manufacturer's recommendation. The wall thickness of the case is 5/16" in the areas shown, which gives at least six full threads of engagement. Some people fear drill-

ing and tapping a hole into the transmission case. This is not a problem. The case is aluminum, and it is an easy job to drill and tap. The positioning of the hole is not that critical, and the drilling can be done with a hand-held electric drill. Do remember to remove the reluctor ring as you drill for the sensor, so as not to damage it with the bit or tap.

To keep aluminum chips from getting into the transmission, put a piece of tape over the oil return hole (about 1/2" diameter), and put a piece of tape over the oil spray hole. After drilling and tapping the hole, wipe the area clean with a paper towel and remove the two pieces of tape. Now, verify that the ouput shaft is centered in the case. You can measure this with calipers or a very precise machinist's ruler using the transmission case rear index ring as a reference point. Next, coat the threads of the VSS with LockTite Blue and tighten it down until it just touches the reluctor ring. Now, back off 1/8 to 1/4 turn, and let the LockTite set-up. The gap is now .012" to .016" which is about ideal. After the LockTite has set-up. Spin the provided sealing jam nut onto the sensor and snug it against the transmission case.

Now, wire the non-polar wire leads as per your diagram and harness. You should now be ready to continue with the installation of your transfer case adapter.