Introduction

We hope that your engine to transmission conversion goes very well, and that the installation of your Novak adapter works as well as it is designed to. This kit is for adapting the Jeep T90 transmissions to GM bellhousings.

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 your own good use.

Note to the Installer

This document and the use of any Novak products assumes a safe and adequate working knowledge of the automotive systems involved. We do not know and there is no way for Novak to determine the skill level of the customer and/or the installer of Novak products, or for Novak to publish all of the information on fundamentals that an individual should know before attempting these advanced procedures. Vehicular conversion work can be among the most difficult of automotive mechanical and electrical tasks and it is upon the customer to ascertain whether they are working within their expertise or whether they should acquire assistance.

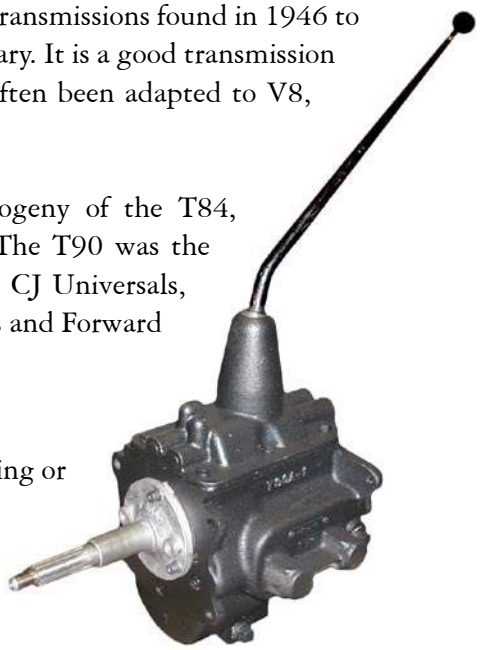
This guide is not intended to replace the service manual specific to your vehicle. It is not possible to document the wiring, routing and specific system details of every Jeep and the installer should obtain use both their vehicle's manual and the engines donor vehicle's manual in conjunction with these instructions.

Novak products and procedures are intended and recommended for off-road use only.

About the T90 Transmission

The Borg-Warner T90 transmission was one of the most common transmissions found in 1946 to 1971 Jeeps. Because of its long production span, it is nearly legendary. It is a good transmission when well maintained and has often been adapted to V8, V6 and I4 power.

The T90 was the improved progeny of the T84, of military MB & GPW fame. The T90 was the standard three-speed as found in CJ Universals, Utility Trucks & Wagons, J Series and Forward Control Trucks.



Features

The T90 is a top loaded, top shifting or side shifting transmission.

The T90 is fully synchronized in the second and third gears.

All gears are helically cut except first and reverse, which are spur gears.

Identification

The T90 transmission is 9" long and features a cast iron top cover that is retained by six bolts and a main case of cast iron. The case itself has a prominent bulge on the driver's side with two protruding bosses as provisions for side-shifting actuators.

All T90 transmissions have a 1-3/8" x 6 spline output shaft for mounting the transfer case input gear.

Preparation

Engine Mounting

Detailed engine mounting and other related information for the engine conversion itself are included with your Novak engine mounts.

The engine being adapted to the T90 must be equipped with all standard shift parts the same as if it were going to be used with a GM transmission, excepting the pilot bushing.

Installing the Pilot Bushing

Because our adapter is compatible with both Gen. I-II and Gen. III+ GM engines, the specially machined pilot bushing is sold separately. The Novak website catalog page or Sales Technician will have prompted you to select the proper one for your application.

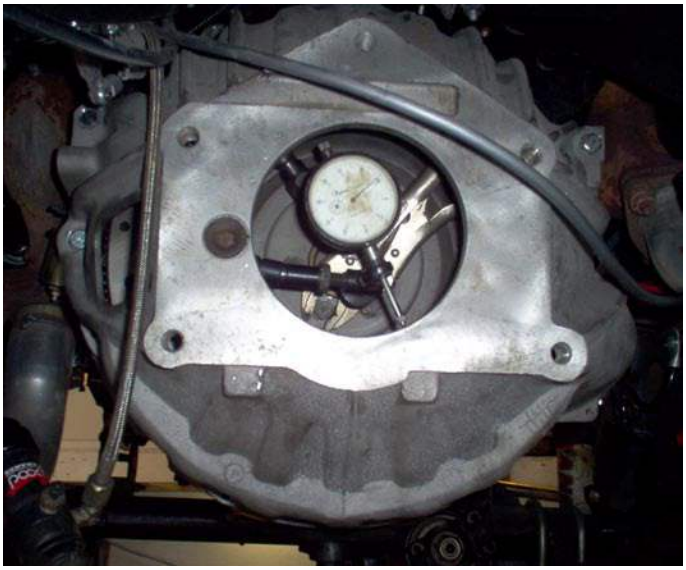
Before installing the transmission to the engine, the pilot bushing must be installed in the GM crankshaft. Ensure that the crank bore is clean and free of any particles, residue or burrs. It is advisable to soak the porous bronze bushing in clean motor oil at least overnight prior to installation. You may also choose to place the bushing in the freezer to shrink it very slightly, just prior to installation, to very lightly warm the crank flange with any safe method as you deem appropriate.

A wood drift such as a dowel or other driver can be used 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. Carefully and squarely drive the bushing into the crank flange bore until seated.

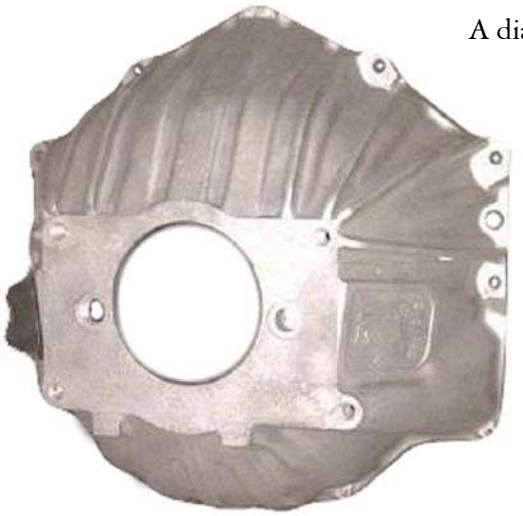
Do not use any kind of grease in the pilot bushing, as this will plug the pores that lubricate the transmission pilot tip from the oil soaked into the bushing.

Bellhousing Alignment

A misaligned block to bellhousing is more common than even professional mechanics know, and this situation can ruin your transmission and cause other damage.



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 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 achieved the least amount of needle movement throughout 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.

1. Install dial indicator base to the flywheel using a magnetic base, or use the crank bolts.
2. Remove the spark plugs from the engine. Have an assistant rotate the engine crank with a wrench.
3. Read the runout and mark the "high" and "low".
4. If runout exceeds .005" to .007", then you must install offset dowel pins, of the appropriate value and install them in the direction to correct the offset.
5. Check your work again with the indicator.

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 ones 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, parts houses and other specialty suppliers.

Use the pressure plate that is matched to your engine's flywheel. Choose a disc from a Jeep or Ford application that will provide a 10x1-1/8" spline, as is compatible with the T90J input shaft, or if in the case of a #G9N kit, a 10x15/16" spline (T90A & T90C).

Note that the Jeep pressure plate will fit most Chevy flywheels that are drilled for a 10-1/2" clutch, allowing you to specify the Jeep clutch assembly to your parts retailer.

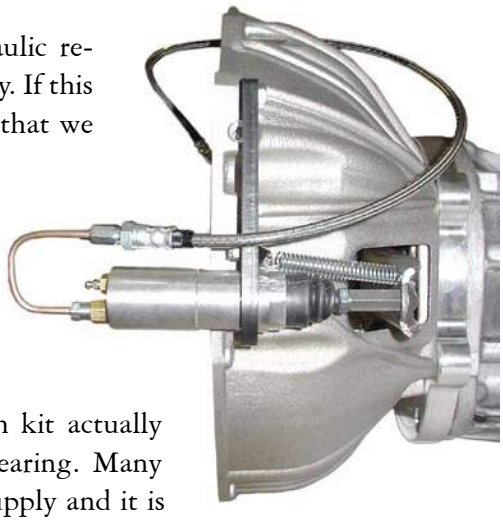
Clutch System

Clutch Release

Many individuals will choose to retain their mechanical clutch release linkage as found on these 1976-1979 Jeep CJ's. As such, the installer will need to fabricate a simple plate to bolt to the GM engine as an anchor for the bellcrank pivot. Nothing need be elaborate here, just geometrically straight and strong.

This Jeep / Buick release arm is 6" long with a ratio or 2:1. This will provide proper geometry for the Jeep mechanical release linkage. It is listed at Novak part #RAV6.

Some installers will opt to convert to hydraulic release, using a Jeep CJ master cylinder assembly. If this is the case, a very easy clutch release system that we offer for use with most Chevrolet bellhousings is our #HCR kit, shown.



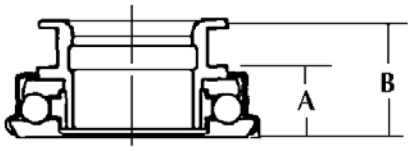
Throwout Bearings

One of the most significant mistakes made in the setup of factory and conversion clutches is the wrong choice of release bearing, and the assumption that the clutch kit actually comes with the right length of throwout bearing. Many clutch kit suppliers err in the bearing they supply and it is the installer's responsibility to verify or choose the right one to ensure optimal clutch release system geometry.

Use the proper clutch release bearing for the clutch being used, to achieve ~1/8" air gap between the bearing face and pressure plate fingers with the clutch pedal at rest. There are six different length release bearings for GM clutches. Which bearing to use depends entirely on the pressure plate being used. See the chart below. A very detailed discussion of the procedure to determine this is at the Novak website Knowledge Base, under Clutches, Linkages & Bellhousings.

GM Clutch Release Bearings
This chart shows the length of the bearing in inches. Most auto parts stores only stock a couple of these release bearings and they may not be the best ones for your swap. More on ths topic is on the Novak website Knowledge Base under the topic of Clutches.

-A- length	-B- overall length	Part number
3/4	1-17/64	N 4068
15/16	1-5/8	N 1741
1	1-41/64	N 2001
1-1/16	1-11/16	N 1466
1-1/4	1-7/8	N 1086



Clutch Assembly

Use the Jeep clutch disc in the GM clutch as this will match the 1-1/16 10-tooth spline on the input gear of the transmission. The Jeep pressure plate will fit a Chevy flywheel drilled for 10-1/2" clutch.

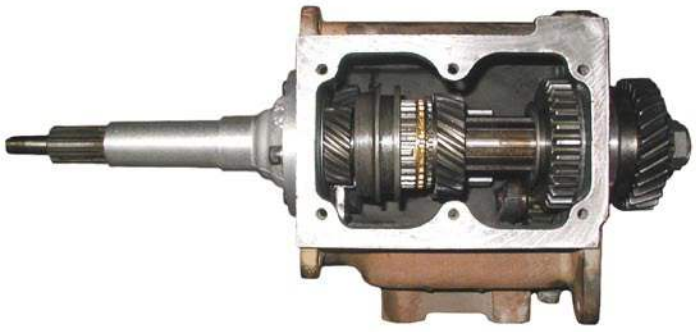
Adaptation

Preparation

Clean the front face area of your T90 in preparation to remove the front bearing retainer, such that no contaminants can enter the front bearing or transmission.

Disassembly

Disassembly specific to the bellhousing conversion is limited only to the removal of the factory input bearing retainer. Once its bolts are removed, a few light side taps with a soft mallet to the retainer may be necessary to break it loose from its gasket and bore.



Adapter Installation

Fit the adapter to the front of your T90 transmission. Use the four supplied 7/16-14 hex bolts through the T90's flange to fasten the adapter to the transmission case. Final torque will be to 40 ft. lbs. There are also 3 5/16-18 x 7/8, hex socket that will go through the adapter and be mounted in the stock retainer location. Torque to 10 ft. lbs.

Replacing the Retainer

We have provided a new front retainer to replace your factory style retainer. This will mount onto the Novak adapter with the 3 5/16-18 x 1 stainless hex socket bolts. We have installed a seal into this retainer as an upgrade to the original felt style seal. Slide the retainer down the input shaft and seat it onto the adapter.

Checking Your Work

Before your threadlocker and gasket sealant grab, you should turn your transmission input and output shafts to verify smooth and unbound operation while shifting through the gears. Once you're content with fitment and trans-mission operation, move forward.

Transmission to Bellhousing Installation

If you are installing this kit against a Chevy bellhousing with a 5-1/8" bore, you should have ordered our #BR4 sizing ring, which we'll have pressed onto your adapter. Do not install this kit onto a 5-1/8" bellhousing bore without this precision locating ring or damage to your transmission will occur.

The adapter will now marry to the bellhous-ing using the supplied 1/2-13 bolts, passing through the adapter ears and using the sup-plied lockwashers. Final torque will be to 60 ft. lbs. Make sure the adapter is a snug fit and that it assembles without interference, Do not, in any scenario, use the adapter bolts to pull the adapter up to the bellhous-ing.

The adaptation of your transmission to GM engine is now complete.

Notes on Novak's #G9N Variant

This adapter is simlar to our #C Series kits, but is only 3/4" thick, instead of 2-5/8". This kit does not require a new input shaft or cluster gear. It utilizes the factory input gear and works with the 2.79:1 first-gear T90A or the 3.34:1 first-gear T90C. This version will not work with the T90J, long input shaft transmissions.

It is required to move the T90 & Dana 18 transfer case forward ~2" in the Jeep to avoid engine interference with the firewall. This will require a floor/tunnel cover modification.

Our included retainer is configured for the standard 4-11/16" bore bellhousing. If you have a truck style, 5-1/8" bore bellhousing, add our #BR4 sizing ring to your order.

Installation

The adapter is easily and quickly installed onto the T90. Disassembly of the transmission is not required. Having followed the other steps in this installation guide as to transmission preparation, you will remove the factory retainer entirely and clean the transmission front gasket face. Use a fresh gasket and/or RTV sealant sparingly around the bearing area between the adapter and the transmission face.

The #G9N adapter will install as the input bearing retainer using the supplied socket head bolts. These bolts will torque to 20 ft. lbs. in crossing, sequential pattern. After installation of the adapter, install the supplied front bearing retainer which will act as the centering register to your GM bellhousing, torqing these four bolts to 17 ft. lbs.

The #G9N will now be ready to mate to your GM bellhousing, and assembly can occur as described in the rest of this instruction pacakge.

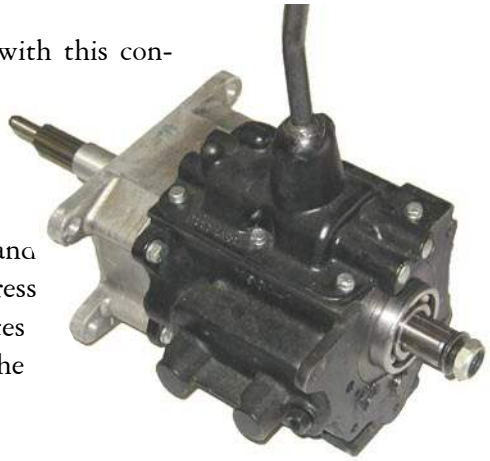
This #G9N kit requires the use of a 10-1/2" diameter, GM style clutch disc with a 15/16" x 10 spline drive hub to match the T90 input shaft. These discs are available singly at Novak and can be used in GM 10-1/2" and 11" pressure plates.

Other Considerations

Axles

GM bellhousings typically feature either a 4-11/16″ rear face bore or a 5-1/8″ rear face bore, the latter typically only from Chevy / GM trucks from 1968-1991. Our #BR4 precision sizing ring must be used on large bore bellhousings.

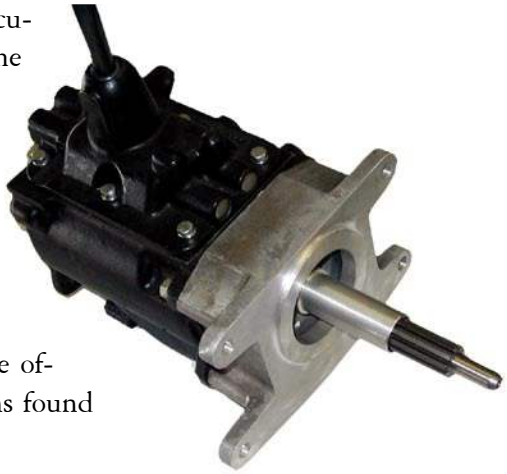
Use of factory axles is completely acceptable with this conversion. Axle upgrades are not necessary, but they may be chosen for reasons external to this engine upgrade.



You will, of course, use the basic mechanical procedures associated with gearboxes, axles and engines; such as preventing contaminant ingress into the transmission, keeping mating surfaces clean and observing general respect and for the parts you are installing.

Disclaimer & Liability Limitations

The information contained in these instructions is for guidance only, and does not guarantee or constitute a warranty of fitness, applicability or compatibility with the customer's particular project. Suitability of parts or information for an application is fully the responsibility of the reader or buyer.



These components and instructions applying to them are for Jeeps being used for off-road use only. It is the responsibility of the installer to be qualified to safely and correctly perform this or any other work on a vehicle.

These instructions and the products and procedure described herein are offered only in accordance with the Novak policies and liability limitations found at: http://www.novak-adapt.com/about/policies.htm

Conclusion

We strongly suggest that you keep these instructions for future reference. For questions concerning your conversion, contact us. We'll be pleased to answer your questions.

There is no final word to our instruction packages. If you have a question you feel this information should have covered and didn't, please let us know about it. You are also welcome to submit your suggestions, ideas and images that you think we should include here which may help future conversion installers. Note our contact information below.

Novak Kit #G9N shown

Novak Kit #C1 shown

Bill of Materials for Novak Kit #C3

- (1) Adapter, casting, 1, Jeep T90 to GM bellhousings
- (1) Retainer, front input bearing, T86 & T90 transmissions to GM bellhousings
- (1) Seal, oil, input bearing retainer, Jeep T86 transmission
- (1) Nut, 7/16-14 x 1-3/4, hex, coupling
- (1) Stud, 7/16-14 x 1-1/2, fully threaded, plain steel
- (4) Bolt, 7/16-14 x 1-1/4, hex socket, standard head
- (3) Bolt, 5/16-18 x 7/8, hex socket, standard head
- (3) Washer, lock, split, 5/16, zinc plated
- (4) Washer, lock, split, 7/16, zinc plated

Bill of Materials for Novak Kit #C1

Same as above, plus:

- (1) Adapter, casting, 1, Jeep T90 to GM bellhousings

American Made

Bill of Materials for Novak Kit #C2

Same as above, plus:

- (1) Shaft, input, T90J transmission, 18 tooth, long

Bill of Materials for Novak Kit #G9N

- (1) Adapter, #G9N, billet aluminum
- (1) Bearing, 643721-S, bearing, deep groove ball, single row
- (3) Bolt, 5/16-18 x 7/8, hex socket, standard
- (8) Bolt, 7/16-14 x 1-1/4, hex head
- (1) Retainer, bearing, input, 4-5/8", GM saginaw car style
- (4) Washer, split lock, 7/16, zinc plated

Changes to your vehicle may be restricted by varying local laws. It is the installer's responsibility to verify these laws and regulations as applicable to their vehicle. These components provided are made for off-road use only.

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.

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