

The many different faces of the T5

Not all Borg Warner/TREMEC T-5's are the same. The first T-5 five speeds were introduced to market in 1980, in all things, an AMC Spirit/Concord. In 1983, T-5's were introduced to Fox body Mustangs and continued to be used in V-6 Mustangs until 2010.



World-Class T5

The T-5 is the longest running five speed overdrive, standard shift transmission spanning more than 30 years of production. While there are numerous configurations of the T-5, because of the large quantities of T-5's produced, many parts are interchangeable. There are now over 200 different T-5 transmission assembly part numbers and almost as many ways to customize them to fit just about anything whether passenger car or light duty truck.

World Class & Non-World Class

There are two basic kinds of T-5's, Non-World Class (NWC) and World Class (WC). Many of the first NWC T-5's were used in AMC, Jeeps, and even the 280X. For the purposes of this article, we will focus on Ford and GM which used both NWC and WC T-5 transmissions. Contrary to popular belief, WC has nothing to do with strength. Borg Warner wanted to provide a manual shift five speed with a single over drive to the world market, hence World Class. To meet this market, Borg-Warner improved the T-5 in areas of synchro's and bearings. The question is how do you tell them apart short of taking one apart? That is simple, on the main case just below the input shaft bearing retainer, is a bearing race. Photo below shows the difference in bearing races. The one on the left is a NWC, the one on the right is a Timken tapered race.



World Class bearing race



NWC

World Class

NWC

Ford picked up the T-5 in 1983 to improve the Mustangs performance and gas mileage. The T-5 provides a much improved gear ratio over the four speed SROD. (Single Rail Over Drive). GM picked up the T-5 in 1982 in the S-10 truck. Following in 1983, the Camaro was equipped with the T-5. Both Ford and GM V8 NWC T-5's had 2.95 first gear set with .63:1 overdrive.

Borg Warner also provided many other gear ratios in NWC T-5's to meet the needs of the application. Most were geared down to allow a small displacement motor to spin up. To do this the first gear ratios were in the range of 3.75 to 4.10:1, more on that later. All the main shaft gears, 1st, 2nd, 3rd, ride on a solid output shaft with deep oil grooves to provide lubrication. The lower counter gears spin on straight cylindrical bearings with a thrust washer in front to provide support when under load. All the synchronizer rings are made of solid bronze which are of different size than those found in a World-Class T-5. It is because there is no bearing under each gear and the bronze synchro rings that the NWC T-5 use the heavier Dextron II. Since Dextron II is no longer available the engineers at TREMEC now recommend using straight 50w gear oil. The lighter Dextron III weight can be used but may effect shifting and wear. Torque rating for the 2.95:1 NWC T-5 was 265ft/lbs. Four cylinder ratios are much lower due to the tooth count between gears.

Ford also used the T-5 in 2.3L cars through the years. While the 4 cylinder T-5 may appear to be the same, they are not. Most 4 cylinder T-5s received a 3.97 gear set with a .79 overdrive and smaller input pilot bearing shaft. Four cylinder T-5's should not be used behind a V-8, even when the pilot bearing id is decreased to match. Simply put, they will not hold up to the added torque and provide too low of a first gear ratio. Torque rating ~240ft/lbs.

WC

In 1985, Ford was one of the first companies to adopt the World Class T-5 by installing it in both the 2.3L and 5.0L Mustang, Fairmont, T-bird, and Cougar, to name a few. The 5.0L V8 received a 3.35 first gear set with a .68od while the 2.3L received a 3.97:1 first gear with a .79:1 OD. The main reason for the 3.35:1 first gear in the 5.0L was to give the 5.0L some punch with 2.73:1 or optional 3.08:1 rear axle gears. The 1986 SVO received a one year only, 3.50 first gear ratio, as the 3.97 gear ratio was too low for the added power of the turbo charged 2.3L. No longer were 1st, 2nd, and 3rd gears spinning on a solid output shaft as needle bearings were installed under each gear to reduce drag. The lower counter gears saw tapered bearings to replace the bronze thrust washer. All main shaft synchro's were fiber lined steel rings to improve rings friction surface while 5th remained bronze. Installing steel synchro rings with lining, improved two things, the rings don't stretch and break and the added friction slowed the gear faster allowing for higher shift points. The Ford WC transmission V8 gear set remained through 1989. Torque rating remained the same at 265ft/lbs.

1990 to 1993 the stock Ford production V-8 WC T-5 was upgraded with stronger 3.35 gear set by increasing the nickel content to produce a harder, stronger gear. 2nd and 3rd gear ratios were decreased slightly to provide more torque to the rear wheels. Synchro linings on 3rd & 4th were improved by changing from fiber linings to carbon fiber to further improve the friction surface resulting in better high rpm shifts. A longer throw shifter was installed to "make shifting easier". The speedo drive gear was changed from 7 tooth to 8 tooth. The 8 tooth was a step backwards when installing lower rear axle ratio greater than 3.55 as the driven gear is limited to 21tooth count. Yes, 23 tooth gears are available but do not last long as the teeth are thin and do not mesh correctly. Torque rating jumped to 300ft/lbs.

GM WC About this time GM entered the WC T-5 with the S-10 and Camaro T-5. Borg Warner produced both a 2x4 and 4x4 T-5 for the S-10 with different gear ratios depending on motor type. The 4x4 model was connected directly to the transfer case with a short main shaft and tail shaft housing. GM used the T-5 in both the V6 and V8 Camaro's, but the gear ratios were different, as well as, the bellhousing to transmission bolt pattern. The V8 Camaro received the same bolt pattern as earlier four speeds but with a 22 degree rotation to place the shifter closer to the driver. It is believed that GM changed the bolt pattern of the V6 T-5 so that it couldn't be installed behind V8 motors. From looking at the outside of a Camaro T-5 it is difficult to tell them apart. GM used the WC T-5 2.95 gear set only in 92-93 IROC Z Camaro's. In 1994 GM switched to the new T-56.

In 1993 Ford installed a new WC T-5 in the limited Cobras later nicknamed "Cobra Spec" T-5. It was the first T-5 with a front tapered bearing and aluminum/steel front bearing retainer. The Cobra boxes also received a reverse gear brake and synchro assembly where there was none before. Just about everything else remained the same. Torque rating was increased to 310ft/lbs.

1994-95 were the last two years Ford used the T-5 behind a V-8. With the introduction of the SN95 Mustangs, the bell housings in both 3.8L and 5.0L were made deeper to place the T-5 shifter in the correct location to the body. This in turn made the input shaft longer by an extra 5/8" The neutral safety switch was eliminated, as it was no longer needed. The GT 5.0L Mustangs received the standard input shaft bearing and aluminum bearing retainer, where the Cobras continued with the tapered or "cupped bearing" input shaft and aluminum/steel front bearing retainer. Torque ratings for both remained the same as the 93 T-5 models. 4 cylinder T-5s were no longer needed when the 3.8L V6 motor came along and was replaced with 3.35 first gear ratio and either a .73:1 or .68:1 overdrive ratio. Changing out the input shaft of the 94-2004 T-5 with 93 input shaft, will result in ability to use these transmissions for conversion in 65-93 Mustangs or other projects. Everything else remained the same.

1996-98 Ford dropped using the T-5 in the V8 4.6L Mustang, but kept them the 3.8L V-6 Mustangs. The T-5 behind the 3.8L is a 3.35 first gear set with a .68 over drive. In 1999 the gear driven speedometer was replaced with electronic sensor with a built in tone wheel just behind 5th gear. While it is possible to convert the housing and install a speedometer gear, some machining is required.

2005-2010 4.0L Mustang T-5. This T-5 underwent many changes to fit into a S-197 body. The shifter was no longer attached to the tailshaft housing. It was mounted to the body and connected by rods. Many refer to this as a remote shifter. Another change came in the way the clutch was released. The clutch cable was replaced by an internal hydraulic bearing also known as a CSC. (Concentric Slave Cylinder). Also gone was the standard slip yoke. It was replaced by a counter balanced flange that the drive shaft bolts to. The gear ratio of this S-197 spec T-5 is 3.75:1 first with a .73 overdrive. While this is great in getting the 4.0L Mustang rolling down the road it doesn't have a lot of strength or performance. Many owners of the 4.0L Mustang upgrade the clutch only to find the T-5 with broken gears or wishing for a closer ratio gear set. The answer to this problem is to install a 2.95:1 first gear set with either a .73:1 or a .80:1 overdrive. This will allow the owner of a 4.0L Mustang to add twice the power without the fear of breaking the gears. Torque rating after the 2.95:1 gear set is installed is 350ft/lbs or about 450hp. This type of T-5 works very well in Shelby's Terlingua Mustangs.



S197 Mustang T-5

The "Z" Spec T-5

In 1993 Ford started offering a new service unit to the Ford Motorsport crowd. The nick name T-5z comes from Ford's part number, 7003Z. This Ford Motorsport T-5 is also sometimes referred to as "World Class T-5". While it is a World Class T-5, as it has all the upgrades, having a 2.95 first and "Cobra pocket bearing does not make it "World Class". The T-5z is a 1993 Cobra T-5 with 2.95 first gear set and .63 over drive. It has the best of everything. Hardened gears, short throw factory shifter, steel front bearing retainer, and tapered output shaft bearing and a seven tooth drive speedometer gear. Best of all it has a torque rating of 330ft/lbs. based on 100,000 mile usage. The stock T-5Z can handle up to 450hp with a soft locking clutch and is not shock loaded like in drag racing.

Aftermarket Super Heavy Duty T-5's

There are a few companies out there that offer Super Heavy duty T-5 gear sets. Some companies claim 600ft/lbs of capacity. Our experience has been different. What makes these gears different is the alloy of the steel and the shape of the gears. By changing to a harder alloy will provide more strength, the problem is making sure the gear has some give to it. Too hard and the gears break off. Other way of increasing torque levels is to take some of the helic out of the gear and make the gear thicker but making it more cog like. While this will make the gear stronger, it also makes it much noisier. Many of these aftermarket gear set are very expensive and require aftermarket main cases and main shaft to get the specified torque ratings they claim. By the time the aftermarket gear and supporting parts are purchased, one should consider other options for the same money.



T-5 Gearset

Borg Warner and TREMEC

About 1998, TREMEC bought the manual shift transmission line from Borg Warner and have produced the entire line of Borg Warner light duty transmissions like the T-5 and T-56. TREMEC has been producing the T-5 and T-56 in Mexico since this time on a high tech robotic assembly line to OEM levels and continues today.

So as you can see not all T-5's were created equal. T-5's are a smooth shifting, strong, light weight transmission that can be used for daily driving, spirited driving, or all out racing. How you set up your T-5 is important so you get the most from it.

One last piece of important information. ALL World Class T-5 use ATF (Dextron III) oil and **NOT** heavy gear oil or Redline MTL! All NON-World Class T-5 use 50 wt gear oil. (The original Ford/Borg-Warner recommendation back in 1984 was Dextron II. As this is no longer available, we and TREMEC recommend the 50 wt gear oil.) We recommend high quality Synthetic oil as it lasts a long time and over a larger operating temperature. It is important to change the oil in your transmission based on how you use the vehicle. If the vehicle is your daily driver then changing the oil every two to three years is fine. However, if the transmission sees regular track duty and pushed hard, then once or twice a year is in order. When we rebuild transmissions, we can tell when the oil has been changed often as the parts are much cleaner with less over all wear. There is no filter inside the manual transmission only a magnet at the bottom to pick up the metallic particles in the oil, the only metallic parts in a transmission is the gears or bearings. Oil is cheap, transmissions are not!
