



A New Wonder From Warner

By Mike Weinberg
Contributing Editor

There is no doubt about it, performance is back in today's cars and trucks. The "experts" who predicted the decline of the V-8 motor and performance cars are eating their words. The fierce competition for market share among manufacturers has put the P-for-Power back in performance. Car and truck buyers can choose from 4, 6, 8, 10 and 12 cylinder power plants. Current models are using turbo-charging, super-charging, a variety of fuel-injection systems, computer controls and electronically shifted automatic transmissions to make power, while attaining fuel economy and emissions goals. There are any number of new stock models that you can buy right off the showroom floor that are faster, stop and handle better than purpose-built race cars I drove 25 years ago.

To handle some of this new-found torque and horsepower, the

wizards at Borg-Warner Automotive have given us a wonderful new gear box – the T56. Big brother to the T5, this unit sports 6 speeds, two of which are over-driven. The T56 is found in regular production '94 Camaro and Firebird models, and in Chrysler's newest muscle car, the Viper. The T56 weighs 125 pounds dry and uses aluminum cases. Ratios for the Viper and F-body GM cars are as follows:

- 2.66-1 first gear
- 1.78-1 second gear
- 1.30-1 third gear
- 1.00-1 fourth gear
- 0.74-1 fifth gear
- 0.50-1 sixth gear
- 2.90-1 reverse gear

Reverse is fully synchronized and of constant-mesh design for quiet operation. As you can see, the steps in the ratio are close and provide for smooth gear-to-gear transitions. With these ratios, the T56 is rated at a strong 450 ft/lbs of torque, making it capable of handling really stout engines.

Looking like a T5 on steroids, the T56 shares many of the inno-

vative designs of its little brother. The main and counter shafts are supported by tapered roller bearings. All speed gears ride on needle bearings. Synchronizers use Warner's double-cone design with organic friction material as linings. Both 5th and 6th gears ride on the counter shaft. The T56 uses a single rail-shift system that is durable, smooth shifting and easy to work on. Warner designed the T56 with two integral shifter positions to make it easily adaptable to other vehicle applications. The centerline distance between shafts is 85mm, which makes room for some beefy gears.

There are some interesting electronics attached to the T56. The speedometer drive is an electronic speed sensor, and backup lights are operated conventionally with a switch on the reverse shift-rail linkage. There are two electronic solenoids to be found on the T56. One is the reverse lockout solenoid, which is powered when the vehicle is traveling under 5 mph, and decreases the reverse-shift restraint for smoother shift-

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GRAND CHEROKEE - ZJ, WJ, WK, NV140J, NV147J, NV231J, NV242J, NV245J, NV247J, NV249J

CHEROKEE/WAGONEER/J10 - NP208J, NP219J, NP228J, NP229J

Rockland Standard Gear can custom fit all of these transfer cases to any TJ, YJ, ZJ, WJ, XJ & KJ model

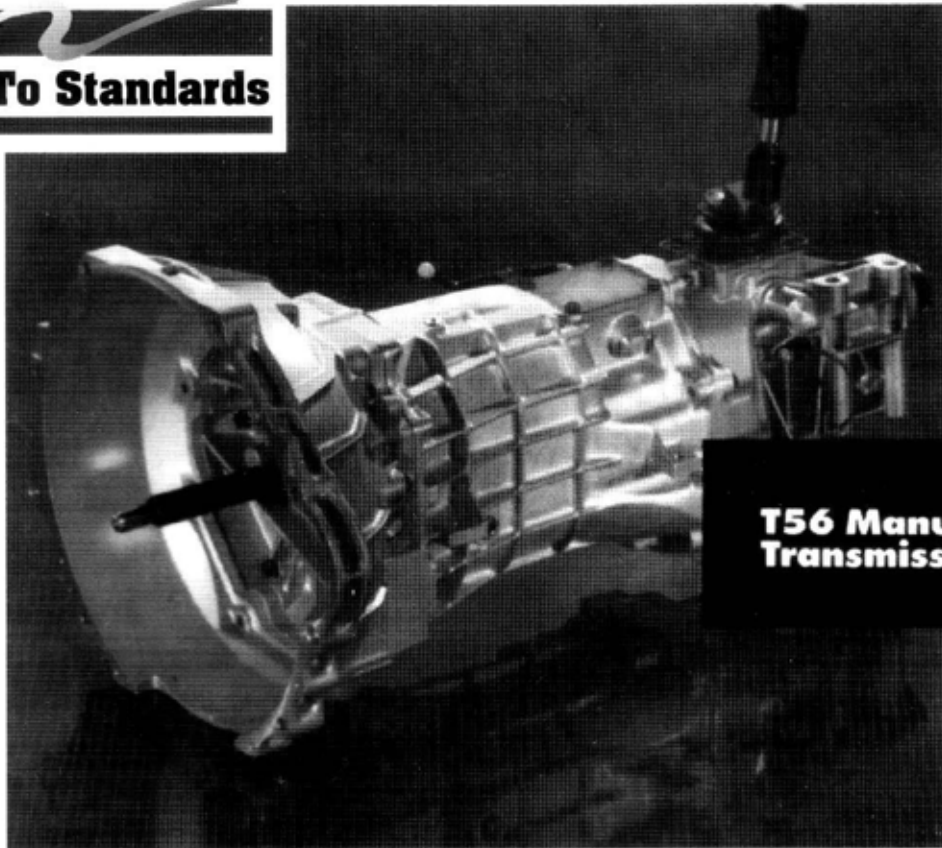
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Up To Standards



T56 Manual Transmission

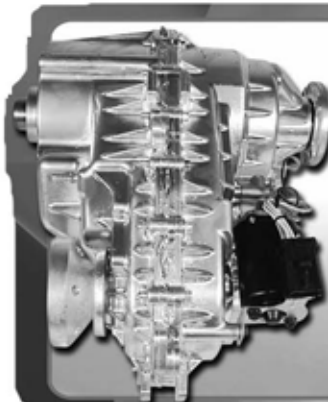
ing. If the power is interrupted to this solenoid, reverse still can be obtained but with more substantial effort on the shifter.

The other solenoid operates a "skip shift" function. Until recently, the only way to control shifting in relation to throttle opening and torque demand was with an automatic transmission. Models equipped with manual gear boxes left shift points and throttle opening to driver discretion, and created problems for car makers

meeting the Clean Air standard and the CAFE (Corporate Average Fuel Economy) rules. The skip-shift feature on the T56 enables the vehicle's ECU to measure throttle opening, torque demand and rate of acceleration and, under the right conditions, power up the solenoid to force a shift from 1st directly to 4th gear. If the skip shift activates, the driver can shift from 4th to a lower gear if necessary.

The guys at Borg-Warner didn't forget about us when they brought the T56 to market. There also is an aftermarket version of the T56 that can be used to replace the T5 in older pony cars. The aftermarket unit ratios are:

- 2.97-1 first gear
- 2.07-1 second gear
- 1.43-1 third gear
- 1.00-1 fourth gear
- 0.80-1 fifth gear
- 0.62-1 sixth gear
- 3.28-1 reverse gear



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- BRONCO - NP208F, BW1356F, RANGER-BW1350F, BW1354F, BW4405F
- BRONCO II - BW1350F, BW1354F
- AEROSTAR - RA28F
- PICKUP - NP208F, BW1345F, BW1356F, BW4406F, BW4407F, BW4416F, NV271F, NV273F
- EXCURSION - NV271F, NV273F



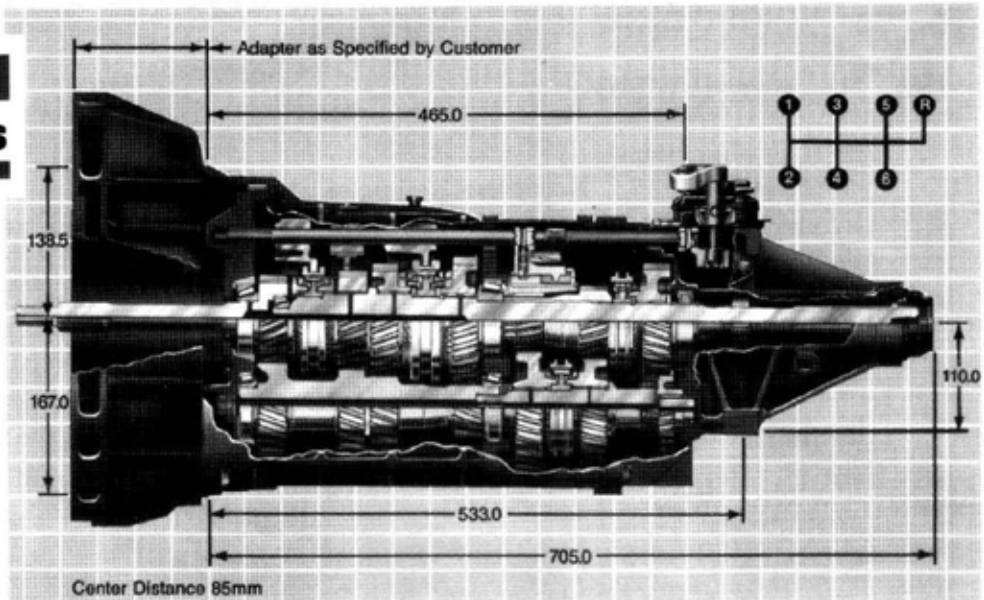
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- DURANGO - NV133D, NV144D, NV231D, NV233D, NV242D, NV244D
- DAKOTA - NV231D, NV233D, NV242D, NV244D
- RAM PICKUP - NV241DL, NV241DH, NV271D, NV273D
- RAM QUAD CAB - NV231DHD, NV241DL, NV243D, NV244D
- RAMCHARGER - NP208D, NV241D

Up To Standards

These ratios match up with the T5 ratios in the earlier Camaro, Firebird and Mustang models. Both models of the T56 have a detachable bellhousing, and Borg-Warner provides an adapter ring to make this unit a direct bolt-up to an earlier model T5 bellhousing. Some minor modifications to the driveshaft, cross member and shifter may be necessary. The aftermarket version has an extension housing machined to accept a gear-driven speedo. The racers and hotrod guys already are using the T56, and Advance Adapters of Paso Robles, CA is hard at work developing adapter kits to enable this bad boy to be transplanted



where T10s, Saginaws, Muncies and Ford Top Loaders used to be. This is better than sliced bread.

Well, Borg-Warner did its part, and now we can only hope that the Big Three will wake up and smell the coffee and put the T56 where it really would fulfill its po-

tential – in trucks. The T56 has the right torque rating, good ratios, would make trucks more fuel efficient and would require minimal chassis changes. Maybe GM is tired of its generally disastrous fling with the German-designed HM290...■

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Getting a Handle on Half a Dozen Speeds

By Mike Weinberg
Contributing Editor

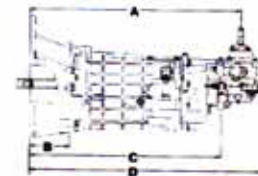
In the 1993 model year GM introduced the T56 six-speed transmission in the F-body cars (Camaro/Firebird). The transmission was designed and manufactured by BorgWarner Automotive and was an evolution of the earlier T5 design. Larger and capable of handling more torque and horsepower, this trans became an instant hit with performance enthusiasts, race teams and hot rodders. This transmission was equipped with the following ratios:

- 1st gear – 2.97-1
- 2nd gear – 2.07-1
- 3rd gear – 1.43-1
- 4th gear – 1.00-1
- 5th gear – 0.80-1 (overdrive)
- 6th gear – 0.62-1 (overdrive)
- Reverse – 3.28-1

This unit is equipped with die-cast aluminum housings, a single-rail shift system, tapered roller bearings on all shafts, double-cone synchronizers and a constant-mesh synchronized reverse. The T56 easily handles 450 lbs.-ft. of torque and high-horsepower applications. The secret to keeping the transmission alive in high-horsepower situations is to make sure there is a high-enough differ-

Installation Dimensions (5) Tremec T56

Dimensional data shown in millimeters.

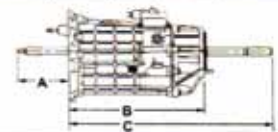


Application	Model #	A	B	C	D
Camaro Aftermarket	1386-000-011	549.2	N/A	547.2	682.6
5.0 Mustang Aftermarket	1386-000-012	671.5	135.0	669.5	840.0
1993-1997 Camaro/Firebird	1386-717.016	717.9	124.0	658.5	793.9
1998 Camaro/Firebird	1386-000-017	746.6	140.0	674.5	809.9
Viper	1386-000-018	636.1	129.0	651.8	818.7
1999 F-Car	1386-000-020	746.6	140.0	674.5	809.9
Aston Martin	1386-000-021	662.0	154.9	677.7	844.6
4.6L Mustang w/Gear-Driven Speedo	TUET 1259	671.5	135.0	669.5	840.0
4.6L Mustang w/Electronic Speedo	TUET 1260	671.5	135.0	669.5	840.0

Model	Torque Range (lb.-ft.)	Dry Weight lbs.	Spline Data		Gear Ratio Chart						
			Input	Output	1st	2nd	3rd	4th	5th	6th	Rev
1386-000-011	450	115-129	26T	27T	2.97	2.07	1.43	1.00	0.80	0.62	3.28
1386-000-012	450	115-129	10T	31T	2.97	2.07	1.43	1.00	0.80	0.62	3.28
1386-000-016	450	115-129	26T	27T	2.66	1.78	1.30	1.00	0.74	0.50	2.90
1386-000-017	450	115-129	26T	27T	2.66	1.78	1.30	1.00	0.74	0.50	2.90
1386-000-018	450	115-129	26T	30T	2.66	1.78	1.30	1.00	0.74	0.50	2.90
1386-000-020	450	115-129	26T	27T	2.66	1.78	1.30	1.00	0.74	0.50	2.90
1386-000-021	450	115-129	25T	30T	2.66	1.78	1.30	1.00	0.80	0.62	2.90
TUET 1259	450 lb.-ft.	115-129	10T	31T	2.97	2.07	1.43	1.00	0.80	0.62	3.28
TUET 1260	450 lb.-ft.	115-129	10T	31T	2.97	2.07	1.43	1.00	0.80	0.62	3.28

Installation Dimensions (6) Tremec T56 (Corvette)

Dimensional data shown in millimeters.



Application	Model #	A	B	C
Corvette	TUET 1452	185.15	490.01	739.33
Corvette Euro	TUET 1453	185.15	490.01	739.33
Corvette Z06	1386-000-025	185.15	490.01	739.33

Model	Torque Range (lb.-ft.)	Dry Weight lbs.	Spline Data		Gear Ratio Chart						
			Input	Output	1st	2nd	3rd	4th	5th	6th	Rev
TUET 1452	385	115	26T	27T	2.66	1.78	1.30	1.00	0.74	0.50	2.90
TUET 1453	385	115	26T	27T	2.66	1.78	1.30	1.00	0.74	0.50	2.90
1386-000-025	385	115	26T	27T	2.97	2.07	1.43	1.00	0.84	0.56	2.90

up to standards

ential ratio. This way the driver will get wheel spin instead of a twisted transmission. Chrysler also chose this transmission for the mighty Dodge Viper models, and it has lived well in this powerful sports car.

BorgWarner Automotive sold its manual-transmission line to Tremec, a state-of-the-art transmission manufacturer based in Mexico. This left BorgWarner more capacity and people to grow its transfer-case business, which is now the main core of its gearbox manufacturing. Tremec has continuously modified and improved the BorgWarner design in conjunction with the growing list of vehicle manufacturers using this transmission in high-end performance cars. In the 1998 model year GM began to use the more-powerful LS1 engine in the Camaro/Firebird line and the newly introduced C5 Corvette models, and Tremec redesigned the T56 with new ratios and a rear-mounted design for the C5 Corvette. The new ratios are:

- 1st gear – 2.66-1
- 2nd gear – 1.78-1
- 3rd gear – 1.30-1
- 4th gear – 1.00-1
- 5th gear – 0.74-1 (overdrive)
- 6th gear – 0.50-1 (overdrive)
- Reverse – 2.90-1

As usual, every new variation of the transmission required new refinements to perfect an already good design. When GM decided to mount the transmission directly to the differential in the C5 Corvette, providing much better weight distribution, it linked the clutch to the transmission though a torque tube. This design forced engineering changes to the T56 synchronizers, because of the change in inertia during the shifts. With no driveshaft to absorb some of the driveline inertia during the shift sequence, Tremec added triple-cone synchronizers to the 1st- and 2nd-gear synchronizer and double-cone synchronizers to the other forward speed gears. The 3rd-gear synchro ring was increased in diameter for greater holding power, and the synchro rings, which originally were paper lined, were changed to carbon-fiber material. On the F-body cars the synchronizers remain the same in design, but the lining material was changed to carbon fiber.

Also introduced were two aftermarket units for the GM and Ford "muscle cars." The aftermarket units were designed to be bolt-on replacements for the T5 transmission in older models. The input shaft on a T56 is 1/2 inch longer than a T5, and on the GM models Tremec produced an adapter plate that bolted to the front of the T56, which made up that difference. The Ford model came complete with its own bellhousing. These units are direct bolt-ons with modifications

continues next page



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necessary to the cross member and exhaust systems, and a shortening of the driveshaft by 1.9 inches.

These aftermarket units became an instant hit with enthusiasts and hot-rodders. The double overdrive made it possible to run these cars with more-radical cams and maintain highway speeds without the valves climbing out of the engine. We have installed these units in everything from '70s to late-model Impalas equipped with twin turbos, with great results.

The next designs introduced by Tremec were for the Aston Martin luxury grand touring models. These are equipped with paddle-type shifters mounted on the steering wheel as in the Formula 1 race cars. The extension housing is modified to use a series of solenoids to shift the unit electrically.

The next designs introduced by Tremec were two new models designed to fit the 4.6-liter Ford modular engines in the later Mustang models. The difference between the two units is in the speedometer drive. One has a gear-driven speedometer, and the other uses an electronic unit. Ford now is using the T56 to replace the anemic T45 on the Mustang Cobra.

GM, in the never-ending quest for market share, developed the Z06 model for the C5 Corvette, and this brought another design change for the T56 Corvette models. The Z06 ratios are:

- 1st gear - 2.97-1
- 2nd gear - 2.07-1
- 3rd gear - 1.43-1
- 4th gear - 1.00-1
- 5th gear - 0.84-1
- 6th gear - 0.56-1
- Reverse - 2.90-1

The main reason for the ratio changes was to get the Z06 model's 0- to 60-mph times down for bragging rights. The two units are interchangeable as complete assemblies in any C5 Corvette, and

we have many requests for these changes. Most of the World Challenge Teams and the Grand-Am cup series endurance teams interchange these units depending on track configuration. The Corvette geartrain is not interchangeable with F-body units. The Z06 units use carbon-fiber synchro rings as in the LS1 Corvette units.

A new problem arose with the Viper units: breakage failure of the 3-4 shift fork. The fork is the same as in the F-body and C5 Corvette models, and the original was made of aluminum. Tremec designed a new fork made of steel, which has solved that problem. The fork, part number TNEC0843, should be used to replace the 3-4 forks on any T56 rebuild. Although GM did not have a breakage problem with the 3-4 fork, we have seen many wear problems. The aluminum fork would wear at the point where the steel Z bracket retains it to the shift rail. Enough wear to just feel with your fingernail will cause these units to hop out of 3rd or 4th, so we replace every fork with steel, with excellent results.

The T56 is a strong, excellent-shifting unit that enables the average shop to upgrade customers' cars and create new profits. Through our experience with hundreds of units we rebuild for race teams worldwide, this is a dependable, well-designed, smooth-shifting unit that offers tremendous potential for anyone to upgrade a vehicle to the latest and greatest or to create a hot rod or kit car. **TD**



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2.98	1.99	1.35	1-1	.86	.73
2.71	1.79	1.30	1-1	.89	.75
2.62	1.73	1.35	1-1	.86	.73
2.29	1.60	1.21	1-1	.85	.76*

*(Close Ratio)

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Author:

Mike Weinberg,
Rockland Standard Gear
Contributing Editor



The Tremec T56 Six-Speed: Revolution and Evolution

The T56 has been around for more than a decade. It originally was designed by BorgWarner as a six-speed evolution of the T5, with greater torque and horsepower capacity and 5th and 6th gears being over-driven. BorgWarner subsequently sold its manual-transmission division to Tremec in Mexico.

Tremec, also known as Transmission Technology Corp., is a major producer of manual-transmission and drivetrain components. Tremec operates a world-class plant that is producing transmission products for many of the world's major auto and truck manufacturers.

Tremec has taken the T56 to new levels of production and development, and this unit is now the six-speed of choice for many of the popular sports and performance vehicles on the road today. As such, this unit offers opportunities for repairs in your shop and for performance upgrades that you can offer your customers to add to your profits.

The T56 was used first in GM's F-body Camaro and Firebird models behind the LT1 engine and later coupled to the LS1 and LS6 engines. GM later had Tremec develop the T56 for use in the C5 generation of Corvettes. This unit was mounted behind the

Part No.	Customer	Application	Engine	Spline		Torque lb.-ft.	Gear Ratios						Weight Lbs.	Install Inches	Lube/ Pints	
				1	0		1	2	3	4	5	6				Rev
T-56																
1386-000-011	Aftermarket	F-Car		26	27	400	2.97	2.07	1.43	1	0.80	0.62	3.28	110	26.26	8.13
1386-000-012	Aftermarket	Mustang	5.0L V-8	10	31	400	2.97	2.07	1.43	1	0.80	0.62	3.28	129	32.47	8.13
1386-000-016	GM	F-Car 1993-97	5.7L LT1	26	27	350	2.66	1.78	1.30	1	0.74	0.50	2.90	129	29.81	8.13
1386-000-017	GM	F-Car 1998	5.7L LS1	26	27	350	2.66	1.78	1.30	1	0.74	0.50	2.90	129	29.81	8.13
1386-000-020	GM	F-Car 1999 (Hurst Shifter)	5.7L LS1	26	27	350	2.66	1.78	1.30	1	0.74	0.50	2.90	130	29.81	8.13
1386-000-023	GM	Corvette C5	5.7L LS1	26	27	375	2.66	1.78	1.30	1	0.74	0.50	2.90	115	19.29	7.31
TUET1259	Ford Aftermarket	Cobra-R (Mech. Speedo)	4.6 2V	10	31	400	2.97	2.07	1.43	1	0.80	0.62	3.28	115	32.47	8.13
TUET1260	Ford Aftermarket	Cobra-H (Elec. Speedo)	4.6 2V	10	31	400	2.97	2.07	1.43	1	0.80	0.62	3.28	115	32.47	8.13
TUET1694	Ford	Cobra	4.6L 4V	10	27	425	2.66	1.78	1.30	1	0.80	0.62	2.90	115	32.47	8.13
TUET2062	DCX - Service	Viper (One piece C/S)	V-10	26	30	550	2.66	1.78	1.30	1	0.74	0.50	2.90	110	27.15	8.13

continues page 66

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driver and mated directly to the differential to give the 'Vette better balance and weight distribution. It is the transmission used in the new generation of C6 Corvettes.

The General also used the T56 in the new Cadillac CTS-V performance model, which uses a Corvette Z06 engine and drivetrain, and in the new Pontiac GTO. Chrysler uses the T56 behind its Dodge Viper V-10 and in the new sport pickup truck that uses the same engine. Ford uses the T56 in the Cobra R Mustangs and the later-model Mustangs, and Aston Martin uses a version of the T56 equipped with an extension housing that contains a number of shift solenoids to enable "paddle-shift" capability from the steering wheel.

This transmission is available in several ratios:

2.97 1st, 2.07 2nd, 1.43 3rd, 1-1 4th, 0.80 5th, and 0.62 6th, 3.28 reverse

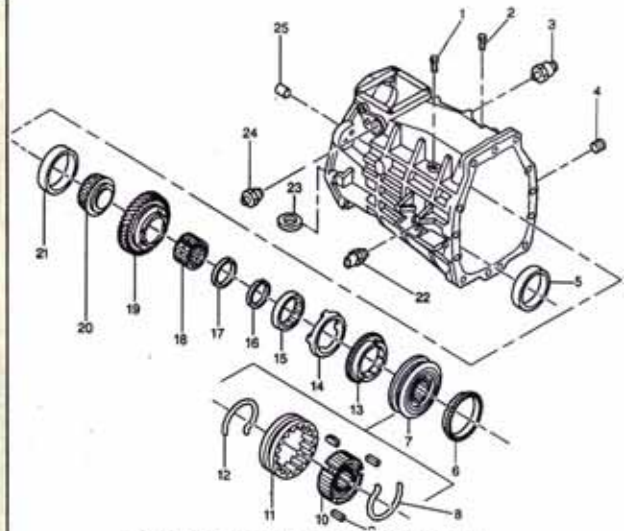
2.66 1st, 1.78 2nd, 1.30 3rd, 1-1 4th, 0.74 5th, and 0.50 6th, 2.90 reverse

Equipped with an aluminum case, extension housing and bell-housing, the T56 uses advanced synchronizer technology and a single-rail shift system. The synchronizers are double-lined rings using steel inner and outer cones on 1st and 2nd gears. The linings on the synchro rings were paper clutch material on early production units, and Tremec has upgraded that to carbon-fiber linings. The shift forks are aluminum for 1-2 and 3-4, and reverse is synchronized for smoother engagement. This unit is specified to use synthetic ATF for lubricant.

There are two solenoids on the transmission. The reverse-lockout solenoid is by the shift tower. The shift pattern locates reverse to the right of the 5th-gear slot on the shifter. Reverse has a 45-lb. spring load on the gate to keep the driver from catching reverse when mak-

Legend

- 1 5th/6th lever guide bolt
- 2 Interlock guide bolt
- 3 Computer-aided gear-select solenoid
- 4 Oil-fill plug
- 5 Countershaft-bearing race
- 6 2nd-gear synchronizer blocking ring
- 7 1st/2nd synchronizer assembly
- 8 1st/2nd synchronizer spring
- 9 1st/2nd synchronizer key
- 10 1st/2nd synchronizer hub
- 11 1st/2nd synchronizer sleeve
- 12 1st/2nd synchronizer spring
- 13 1st-gear synchronizer blocking ring
- 14 1st-speed drive gear friction cone
- 15 1st-speed drive gear inner cone
- 16 Synchronizer retainer ring
- 17 1st-speed drive gear bearing spacer
- 18 1st-speed drive gear needle bearing
- 19 1st-speed drive gear
- 20 Mainshaft rear bearing
- 21 Mainshaft rear-bearing race
- 22 Backup-lamp switch
- 23 Magnet
- 24 Shift-detent switch
- 25 Case rear-extension pin



ing a shift to 5th. During a shift to reverse, the solenoid will activate, overcoming the spring tension and allowing reverse to be reached with fingertip effort.

The other solenoid, on the transmission main case, is the "skip-shift" feature. This is an attempt to meet stricter environmental and pollution regulations. Automatic transmissions shift at open-throttle position; manual gearboxes always shift at closed throttle. Since closed-throttle positions generate more pollution, the skip-shift solenoid was added to try to control throttle opening and shift position. If you drive the vehicle at normal rates of acceleration or beyond, the skip-shift solenoid will not function. At very light throttle, the computer will activate the solenoid in 1st gear, forcing the driver to shift from 1st to 4th, which shuts down the fuel in the engine-management system to prevent an over-rich condition. The only people who will see the skip-shift activate have to be driving like the proverbial "old lady."

On the C5 generation of Corvettes, Tremec developed triple-ring synchronizer technology. This consists of an inner lined steel cone that rides on the cone of the speed gear, a double-lined synchro ring and an outer steel cone. This effectively triples the friction capacity of the syn-

chronizer and makes for very smooth shifts at high engine speeds. This was necessary in the C5 and C6 Corvettes because of the high driveline inertia generated by connecting the differential directly to the transmission.

Without the conventional drive-shaft and mounts to absorb some of the torque, synchronizer capacity had to be raised to overcome the driveline inertia prevalent during downshifts.

New for the C6 Corvettes is an internal oil pump that is driven by the front of the countershaft.

A positive-displacement pump provides pressurized feed to a transmission cooler and then back to the unit, similar to cooling for automatic transmissions.

The T56 is an excellent transmission for the performance cars it was designed for, but it is easily adaptable for a variety of other performance uses. With two overdrive gears it provides excellent fuel economy, which at current gas prices is a big plus. Also, this unit is adaptable to a wide variety of cars for which it was never intended. The double overdrive gives the hot-rodder with a radically cammed engine the ability to cruise without the valves climbing out onto the hood. There are any number of kit cars, hot rods and older muscle cars that the T56 can be used in to replace the four-speeds and T5s that they were built with.

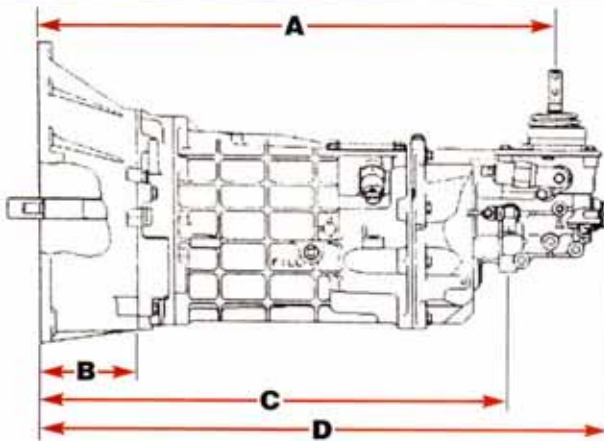
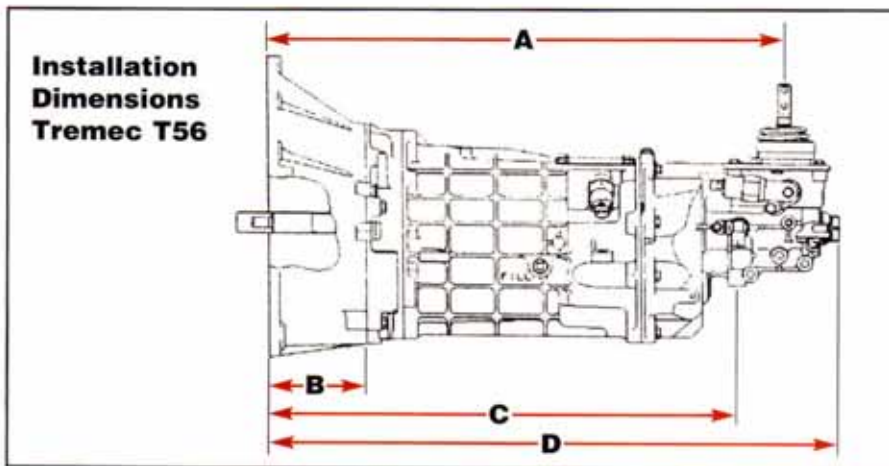
The T56 is capable of handling

up to 550 lb.-ft. of torque as it comes from the factory. We have modified many of these units to handle up to 800-900 lb.-ft. of torque.

The performance aftermarket in this country generates \$67 billion a year. As you fight your daily battle for repair business in your market, it might be wise to study this market and see where you can find yourself some extra sales. Tremec has designed two aftermarket units that will replace T5s and four-speed Saginaws, Muncies and T10s with a minimum of engineering work. If you have a customer with a late-model Mustang with a 3650 trans, the T56 can be a direct replacement offering a six-speed and better performance. You can up your customer's performance and fuel economy at the same time, all the while dealing with people who are eager to spend money on their toys.

continues page 70

Installation Dimensions Tremec T56



Dimensional data shown in millimeters					
Application	Model #	A	B	C	D
Camaro aftermarket	1386-000-011	549.2	N/A	547.2	682.6
5.0 Mustang aftermarket	1386-000-012	671.5	135.0	669.5	840.0
1993-97 Camaro/Firebird	1386-000-016	717.9	124.0	658.5	793.9
1998 Camaro/Firebird	1386-000-017	746.6	140.0	674.5	809.9
Viper	1386-000-018	636.1	129.0	651.8	818.7
1999 F-car	1386-000-020	746.6	140.0	674.5	809.9
Aston Martin	1386-000-021	662.0	154.9	677.7	844.6
4.6L Mustang (gear-driven speedo)	TUET 1259	671.5	135.0	669.5	840.0
4.6L Mustang (electronic speedo)	TUET 1260	671.5	135.0	669.5	840.0

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 LIBERTY - KJ-NV231J, NV242J
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 CHEROKEE/WAGONEER/L10 - NP206J, NP219J, NP228J, NP229J

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 EXPEDITION, NAVIGATOR - BW4405F, BW4410F
 AVIATOR - BW4410F, BW4411F
 BRONCO - NP208F, BW1358F, RANGER-BW1359F, BW1354F, BW4405F
 BRONCO II - BW1359F, BW1354F
 AEROSTAR - RA23F
 PICKUP - NP208F, BW1345F, BW1359F, BW4405F, BW4407F, BW4410F, NV271F, NV272F
 EXCURSION - NV271F, NV272F



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 DAKOTA - NV231D, NV233D, NV242D, NV244D
 RAM PICKUP - NV241DLD, NV241DND, NV271D, NV273D
 RAM QUAD CAB - NV231DHD, NV241DLD, NV243D, NV244D
 RAMCHARGER - NP208D, NV241D



Model	Torque Range (lb.-ft.)	Dry Weight (lbs.)	Spline Count		Gear-Ratio Chart						
			Input	Output	1st	2nd	3rd	4th	5th	6th	Rev
1386-000-011	450	115-129	26	27	2.97	2.07	1.43	1.00	0.80	0.62	3.28
1386-000-012	450	115-129	10	31	2.97	2.07	1.43	1.00	0.80	0.62	3.28
1386-000-016	450	115-129	26	27	2.66	1.78	1.30	1.00	0.74	0.50	2.90
1386-000-017	450	115-129	26	27	2.66	1.78	1.30	1.00	0.74	0.50	2.90
1386-000-018	450	115-129	26	30	2.66	1.78	1.30	1.00	0.74	0.50	2.90
1386-000-020	450	115-129	26	27	2.66	1.78	1.30	1.00	0.74	0.50	2.90
1386-000-021	450	115-129	25	30	2.66	1.78	1.30	1.00	0.80	0.62	2.90
TUET1259	450	115-129	10	31	2.97	2.07	1.43	1.00	0.80	0.62	3.28
TUET1260	450	115-129	10	31	2.97	2.07	1.43	1.00	0.80	0.62	3.28

Features and Benefits	
Six-speeds	Applicable to a wide range of vehicle requirements
Double overdrive	Provides extended ratio coverage and allows for closer ratio steps
Aluminum die-cast housings	Lightweight, durable construction
Internal, single-rail shift system	Enhanced shift feel, improved durability
Tapered roller bearings on shafts	Reduced noise and improved durability
Constant-mesh, synchronized reverse	Positive engagement, improved durability and reduced noise
Integral clutch housing w/adaptor ring	Increased driveline bending strength with mounting flexibility
Overdrive synchronizers placed on countershaft	Lower shift effort and reduced noise
Advanced synchronizer technology:	
• Powdered-steel formed blocker rings	Consistency, high quality
• Organic friction material	Improved durability
• Double-cone design	Lower shift effort
• Patented strut-type design	Improved durability

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Jeep Transfer Cases



- 231J Command Trac
- 242J Select Trac
- 247J Pump Coupler AWD
- 249 J AWD

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Dodge Transfer Cases



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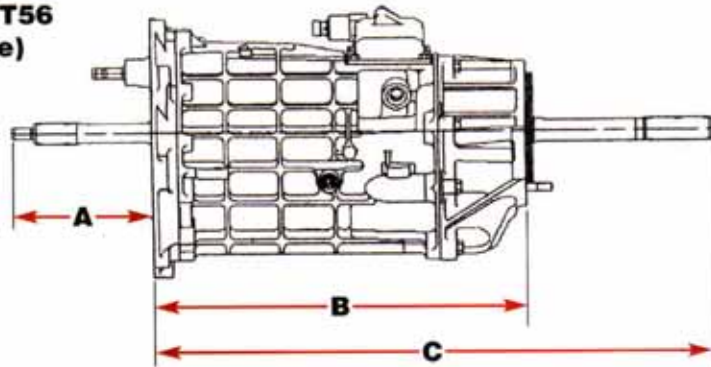
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The GM T56 units are designed with 27-spline output shafts that match the 700-R4 and 4L60-E. We routinely retrofit a 30-spline Viper output shaft into the F-body cars for weekend warriors who want to be able to drag-race their street cars. The Viper shaft is a much beefier unit capable of much greater torque and abuse than the stock shaft.

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Installation Dimensions Tremec T56 (Corvette)



Dimensional data shown in millimeters				
Application	Model #	A	B	C
Corvette	TUET 1452	185.15	490.01	739.33
Corvette Euro	TUET 1453	185.15	490.01	739.33
Corvette Z06	1386-000-025	185.15	490.01	739.33

Model	Torque Range (lb.-ft.)	Dry Weight (lbs.)	Spline Count		Gear-Ratio Chart						
			Input	Output	1st	2nd	3rd	4th	5th	6th	Rev
TUET 1452	385	115	26	27	2.66	1.78	1.30	1.00	0.74	0.50	2.90
TUET 1453	385	115	26	27	2.66	1.78	1.30	1.00	0.74	0.50	2.90
1386-000-025	385	115	26	27	2.97	2.07	1.43	1.00	0.84	0.56	2.90

Features and Benefits

Six-speeds	Applicable to a wide range of vehicle requirements
Double overdrive	Provides extended ratio coverage and allows for closer ratio steps
Aluminum die-cast housings	Lightweight, durable construction
Internal, single-rail shift system	Enhanced shift feel, improved durability
Tapered roller bearings on shafts	Reduced noise and improved durability
Constant-mesh, synchronized reverse	Positive engagement, improved durability and reduced noise
Overdrive synchronizers placed on countershaft	Lower shift effort and reduced noise
Needle bearings under speed gears	Improved high-speed performance and reduced shift effort

Advanced synchronizer technology:

- Powdered-steel formed blocker rings Consistency, high quality
- Organic friction material Improved durability
- Triple-cone design Lower shift effort
- Patented strut-type design Improved durability

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superchargers or nitrous. You can furnish ratio changes, upgraded steel 3-4 forks, billet-steel solid synchro keys and even a gear set capable of handling 1,000 horsepower engines. Performance sells, and you can get a piece of this action without a huge investment. Adding niche markets to your cus-

tomers will generate more of the business you want to have. **TD**

The Bottom Line:

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87 Useful information.
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SIX-SPEED MANUAL TREMEC T56 (MM6/MZ6//M10/M12) CAR TRANSMISSION

2006 model year summary

- One-piece countershaft added for durability (MM6)
- 32-spline output shaft added for durability (MM6)
- Rear extension housing bolt pattern change (MM6)
- DEXRON® VI compatible
- Stepped clutch teeth on synchronizer sleeves (M12)
- High-density carbon blocker rings (M12)
- Stronger snap rings on synchronizer hub (M12)
- Carbon reverse synchronizer (M12)
- Revised shift precision (M12)

Full descriptions of new or changed features

One-piece countershaft added for durability (MM6)

On the new optional Corvette Z06 package, a stronger single-piece countershaft replaces the two-piece countershaft. The 505-hp LS7 creates 470 lb.-ft. of torque, which required the stronger shaft for durability.

32-spline output shaft added for durability (MM6)

The output shaft was enlarged to a 32-spline unit, which is more durable than the 27-spline unit used in the standard Corvette applications. The rear differential was also increased in size from an 8.25-inch ring gear to a 9-inch ring gear and a larger pinion gear. The bias ratio on the limited-slip differential was increased to 2.5:1 from 2.0:1, and the differential side-cover mounting arms were made stiffer, as well.

Rear extension housing bolt pattern changed (MM6)

The bolt pattern for the rear of the case extension of the Six-Speed was changed for Corvette applications to match the same bolt pattern as the new six-speed 6L80-E automatic.

DEXRON® VI compatible

Until the mid-2006 model year, all six-speeds will be produced filled with DEXRON III fluid, although the transmission has been validated for used with new DEXRON® VI. In mid-2006, the six-speeds will come filled with DEXRON® VI, which was developed to behave more

consistently during temperature and other environmental variations, as well as to provide even lubrication of the moving surfaces of the transmission.

Stepped clutch teeth on synchronizer sleeves (M12)

Stepped clutch teeth on the synchronizer sleeves are now added to the LS2-powered CTS-V application. These staggered teeth sequentially engage the gears, which makes engagement feel lighter and more positive to the driver. This modification originally appeared on the 2005 Corvette.

High-density carbon blocker rings (M12)

More durable carbon friction material is used on the synchronizers.

Stronger snap rings on synchronizer hubs (M12)

For the first-second gear hub, a stronger snap-ring is used to increase durability.

Carbon fiber reverse synchronizer (M12)

To reduce efforts to engage reverse, the synchronizer friction surface is changed to a carbon fiber material. Reverse-inhibit mechanism to block the shifter from going into reverse when the driver is aiming toward fifth or sixth gear gate with the shifter is also modified to make it easier to engage reverse.

Revised shift precision (M12)

Tolerances for the shifter mechanism for the Cadillac CTS-V application have been tightened to make the shifter feel more precise.

Low maintenance

The six-speed uses DEXRON III fluid and is certified "fill-for-life," requiring no fluid changes. The clutch is activated hydraulically, which automatically compensates for clutch disc wear, eliminating manual adjustments. The six-speed was originally designed to require virtually no maintenance. The M10 for the SSR is validated at a higher gross vehicle weight for greater durability.

Overview

Originally, the Tremec T56 evolved as a higher-torque capacity, six-speed version of the proven M49 five-speed manual transmission, and was introduced in the 1993 Chevrolet Camaro and Pontiac Firebird. It was also added to the 1997 fifth-generation Corvette.

Further applications included high-performance models, such as the Cadillac CTS-V in mid-2004, which used the 400-horsepower LS6 engine mated to the M12 version of the six-speed, and the Pontiac GTO, which used the 340-horsepower LS1 engine with the M12 but with a higher ratio fifth gear to maximize acceleration in that gear.

The sixth-generation Corvette with Z51 option uses the MZ6 version of the six-speed, with ratios from the M12, which are higher ratios in first, second, and third gears than the MM6, which is the standard gearbox, as well as a lower-ratio fifth gear to increase top speed in fifth gear with the 400-horsepower LS2 engine.

In 2005 a new version of the six-speed was added, with an RPO of M10. It is a version of the M12 but with a more robust first gear, and it is used in the Chevrolet SSR, a convertible pickup truck roadster based on the midsize SUV platform. The first gear is a higher ratio, and is made stronger and with fewer teeth than the first gear in an M12, which is necessary due to the higher weight of the SSR truck. For the first-second gear hub, a stronger snap-ring is used to increase durability. To reduce efforts to engage reverse, the synchronizer friction surface is changed to a carbon fiber material. Reverse-inhibit mechanism to block the shifter from going into reverse when the driver is aiming toward fifth or sixth gear gate with the shifter is also modified to make it easier to engage reverse. In addition, the temperature sensor for transmission fluid is removed, and the Computer Aided Gear Selection (CAGS) system is not used. The CAGS system is used on car applications to increase fuel efficiency in low-speed city driving conditions.

One revision made for 2005 Corvette applications is the addition of stepped clutch teeth on the synchronizer sleeves. These staggered teeth sequentially engage the gears, which makes engagement feel lighter and more positive to the driver. Combined with bearings in place of bushings, which lower the friction of the shift rail movements, the feel of the Corvette shifter is lighter and more direct. Corvette applications also use carbon for the reverse gear synchronizers for improved durability. Also, because the Corvette uses a keyless entry and starting system that requires the transmission to be in reverse position to start and to lock after the engine is shut off, a redundant reverse switch is used to ensure complete reliability. To

enable even quicker shift throws for both the standard Corvette and Z51 option, side-to-side and fore-aft shift rail detents have been moved closer to their stops.

The synchronizer sleeves have been lengthened for applications in the SSR and CTS-V, which effectively shortens the distance the synchronizers travel when engaging a gear. This reduces the shift throw distance at the shifter, for quicker gear changes.

For the 2002 model year, the 6-speed received carbon blocker rings on its synchronizers, increasing the durability of the transmission. The Z06 Corvette model was added for model year 2001, featuring a high output LS6 V-8 engine. To get maximum performance from this model, a variation of the Tremec T56 (the basis for the Six-Speed Manual) with a higher ratio first gear was used (M12 - see specifications page). This variation of the Six-Speed is used on the CTS-V model, while the Six-Speed with the lower ratio first gear is used on the base Corvette (MM6).

Design features include a combination of double-cone and triple-cone synchronizers on all forward gears. Synchronizers act like clutches to speed up or slow down a gear that is being shifted to. Double-cone synchronizers have two friction surfaces to effect this gear acceleration, and triple-cone synchronizers have three friction surfaces. The greater the friction surface, the easier the transmission is to shift. In addition, double-cone and triple-cone synchronizers are smaller in diameter than a single-cone synchronizer with the same friction area allowing the transmission to remain more compact.

Refinements common to the design of all Six-Speed Tremec T56 products include needle bearings on all forward gearsets and 5th and 6th gear synchronizers located on a countershaft. The countershaft location of the 5th and 6th gear synchronizers allow those gears to be selected without affecting the 1st through 4th gearsets, contributing to ease of shifting.

Subject:

Design and operation

Unit:

Tremec 6060 6-speed manual

Vehicle Applications:

Ford Mustang, C5 and C6 Chevrolet Corvette, Pontiac GTO, Cadillac CTS-V, Dodge Viper and Sidewinder, Aston Martin Vanquish

Essential Reading:

- Rebuilder
- Shop Owner
- Center Manager
- Diagnostician
- R & R

Author:

Mike Weinberg,
Rockland Standard Gear
Contributing Editor



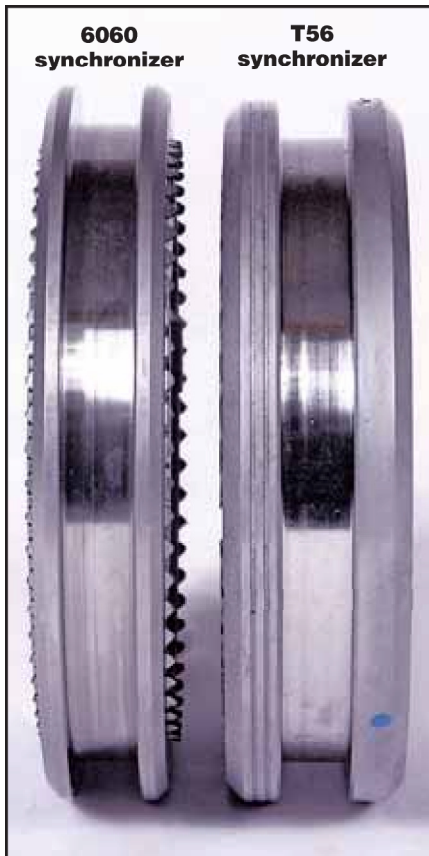
Tremec's New 6060 Six-Speed

The T56 six-speed transmission has been around for many years now. Originally designed by BorgWarner for the GM F-bodies (Camaro/Firebird), the design has been refined since Tremec bought the BorgWarner manual-transmission business. The T56 is now the six-speed of choice for the Ford Mustang, Chevrolet C5 and C6 Corvettes, Pontiac GTO, Cadillac CTS-V, Dodge Viper and Sidewinder, and Aston Martin Vanquish.

Tremec also manufactures aftermarket versions of the T56 for use in earlier cars to replace a T5, Muncie, T10, Saginaw or Toploader. The T56 is enjoying huge success because of its ability to handle high torque loads, its smooth shifting and its quiet gear train. With fifth and sixth being overdrives, there is the benefit of smooth highway cruising at low engine speed to conserve fuel.

Early units used paper-lined synchro rings that were dual-cone technology for low shift effort. Tremec then redesigned the synchronizers for the Corvettes, Cadillacs and GTOs to use triple-cone technology on first and second gears and double-cone on the third and fourth gears. The paper-





lined rings were replaced with carbon-fiber-lined rings. These changes increased the torque-handling capability of the T56.

As time marches on, new models mean new design changes, and Tremec has now brought out the new 6060 version of the T56. As horsepower and torque levels increased, Ford selected the 6060 design for the 2007-and-up Shelby GT 500 Cobra model. If my sources are correct, the 6060 also will be found in the 2009 Camaro, Dodge Challenger and Corvette.

The 6060 is an evolutionary design change to the very successful T56. They look the same externally, and to a great degree internally, but there are definite changes that make parts swapping impossible between the two designs. The 6060 was designed to improve shift effort as automakers compete with globalization of the higher-end and performance markets, and to carry

higher torque loads to match the new power plants.

The 6060 transmission uses triple-cone synchronizer technology for the first and second gears, and dual-cone synchronizers for third, fourth, fifth, sixth and reverse. The previous Cobra T56 unit used dual-cone synchros for first, second, third and fourth, with single-cone synchros for fifth, sixth and reverse. By increasing the surface area of the synchro rings by two or three times, you get much higher torque capability along with smoother shifting, particularly on downshifts. This is done without increasing the centerline distance between the mainshaft and the countershaft. Along with the increased surface area on the synchros, there has been an increase in the diameter of the synchronizer assemblies. Carbon-fiber-lined synchro rings have been upgraded to sintered bronze material for more durabili-

ty and consistent manufacture.

Although the synchronizer diameter has been increased, the synchro hubs have been narrowed to shorten the amount of travel fore and aft required to complete a shift. Gone are the T56 synchro keys and hoop-type springs; these have been replaced by struts with encapsulated balls and springs to further smooth the shift effort.

The speed gears are also redesigned with a two-piece assembly, where the plate bearing the clutch teeth is laser welded to the gear. The T56 design uses one-piece forged gears, which although durable do not allow the precise machining found on the 6060 gears. The gear-face width of the speed gears has been increased for higher torque capacity. The narrower synchro assemblies provide for more gear thickness. The clutch teeth on the 6060 speed gears have positive stops to prevent over-shifting, and this eliminates the

need for stops on the shifter assembly.

As computer programs, cams, induction and fuel injection have improved, the new engines generate more horsepower and torque, putting increased demand on other driveline components. The T56 10-spline input shaft has been upgraded to a 26-spline input shaft on the 6060. The main (output) shaft has increased diameter and a fixed flange for the driveshaft connection. The T56 countershaft was a two-piece design, which has been replaced by a one-piece countershaft on the 6060 for increased strength. A slight redesign of the main transmission case eliminates the previous T56 adapter plate with the bellhousing, increasing torsional rigidity for the case assembly.

The T56 is a great design that continues to provide smooth, quiet operation for a great variety of models. Tremec has put a lot of effort into this design evolution creating the 6060, and we will start to see these coming into our shops, as performance cars are good for business. No matter how good the manufacturers make the drivelines, there is no way to improve the drivers. **TD**



Subject:

Design and operation

Unit:

Tremec T56 Magnum
6-speed

Essential Reading:

- ✓ Rebuilder
- ✓ Shop Owner
- ✓ Center Manager
- Diagnostician
- R & R

Author:

Mike Weinberg,
Rockland Standard Gear
Contributing Editor



Tremec T56 Magnum

A new six-speed for the aftermarket

BorgWarner designed and manufactured the T56 six-speed transmission, which is the premier six-speed on the market today. BorgWarner sold its stick-shift-transmission line to Tremec, and Tremec has continued to manufacture and refine the T56 design.

The T56 is original equipment on the Chevrolet Camaro, Pontiac Firebird and GTO, Chevrolet C5 and C6 Corvettes, Mustang GT, Cadillac CTSV, Dodge Viper, Dodge Sidewinder truck and Aston Martin. The unit is rated at 450 lb.-ft. of torque and was updated by Tremec to carbon-fiber synchro rings for very smooth shifts. New products from the car manufacturers over the years have increased horsepower and torque ratings, and the T56 design needed an upgrade to handle more torque.

In 2005, Tremec introduced the 6060, a design variation of the T56, for the Ford Mustang. The face width of the gears was substantially increased to handle more power, but the case size remained the same. Tremec did this by redesigning the synchronizers. The slider and hub were narrowed, making room for the increased face width on the gears, and sintered-metal synchro rings were used. The synchronizer engagement teeth on the slider and the speed gears were redesigned for a positive stop and quicker shifting.

Tremec is now releasing a T56 six-speed gearbox for the aftermarket called the T56 Magnum (figures 1 and 2). This unit is based on the 6060 design with further improvements and the ability to be adapted to replace earlier T56 units for car owners who have increased their torque and horsepower beyond the stock T56 levels. The T56 Magnum will handle 700 lb.-ft. of

torque, almost double the stock T56 capacity. Models will be available for replacement of all the earlier T56 models as well as new designs that will enable you to install the transmissions into any vehicle equipped with a small- or big-block Chevy engine, or a 4.6- or 5.0-liter or Windsor Ford engine. In this economy, these units will be one more added service you can bring to your performance-minded customers. There always seems to be money for the toys.

The specs for the T56 Magnum follow:

- Centerline distance – 85 millimeters (the distance between the center of the input shaft and the center of the countershaft)
- Torque capacity – 700 lb.-ft.
- Weight – 130 lbs.



- Fluid fill – 3.65 quarts of Dexron 3 ATF or GM Synchronmesh fluid
- Dual speedometer pickups allow use of this unit with either mechanical or electronic speedometers.
- Triple-cone synchronizer technology on gears 1-4; double-cone synchronizers on 5th, 6th and reverse.
- High-rpm shift capacity
- Fully reversible shifter to allow changing position of the shift lever in the car simply by reversing the shift cover.
- Built-in mid-shift provisions under the inspection plate for simple forward placement of the shifter for earlier cars with bench seats.

Gear design

The T56 Magnum uses the 6060 gear design. The face widths of the gears (Figure 3) have been significantly widened to handle more



torque. The original-design T56 speed gears were one-piece forgings that were subject to machining limitations because of the lead angles of the gears and the shaping of the engagement teeth. The Magnum gears are forged, with the plate containing the engagement teeth laser-beam welded to each gear. This enables much more precise shaping of the engagement teeth with better pitch and angle control and the placement of a positive stop on the gear to prevent over-travel of the slider on hard shifts.



Countershaft

Earlier T56 designs used a two-piece countershaft that was torque limited because of the splines connecting the two sections. The one-piece shaft was first used in the Dodge Viper. The Magnum model uses a much-stronger one-piece shaft with thicker journals and widened gear faces. Larger bearings are used in all the support areas to zero out shift deflection and live through the increased thrust loads. A look at Figure 4 gives you a feel for the much-beefier new design.

Input shaft

The input shaft (Figure 5) has a larger face width on the gear and increased shaft diameter. Clutch splines are lengthened to enable use of twin-disc clutches, and there are 26 clutch splines for added strength. For better handling of higher thrust loads the input bearing is upgraded to a larger size.

Synchronizers

The widened gear train called for narrower synchronizers (figures 6, 7 and 8). The engagement-tooth angles were changed on the slider to shorten engagement travel and further smooth out the shifts. Earlier designs used stamped-steel shift keys with circular retaining springs. As heat and wear changed spring tension it was common for the keys to break, trapping the slider in a gear. We have for years replaced the stamped keys with solid billet keys on performance units. Tremec has changed the design to spring-

continues next page

loaded ball-type inserts to reduce friction and prevent notchy shifting. This results in very short, smooth shifts.

Shift forks

One of the design flaws of the T56 was the cast-aluminum forks with a removable steel shift link (Figure 9). As wear and tear oc-



curred the steel link would wear into the aluminum, creating a float in the fork that resulted in incomplete shifts and gear jump-out. The new shift fork, at the rear of Figure 9, has the shift link permanently mounted in the fork so there is no

contact with the rail bore in the fork for precision shifting and reduction of fork wear. The new forks also have an enhanced cross section for better rigidity and zero deflection.

Snap rings

One of the weak points in any high-torque-load transmission is the snap rings (Figure 10). It is



hard to keep the snap rings in perfect dimensions, and distortion of the shaft grooves during machining and service work results in snap rings jumping out of the groove, with usually expensive results. The Magnum units have been redesigned using split-ring technology. The rings are held in place by an outside sleeve that prevents any movement or possibility of the retainer leaving the shaft groove.

The transmission case has been beefed up with added webbing and thicker front and rear faces to

handle the increased thrust load of high-horsepower usage. The front plate also has been strengthened to accept the bigger input-shaft bearing. Figure 11 shows all applications and the specifications and ratios.

This new design will make it possible for you to get into the high-dollar performance aftermarket with no investment. All the difficult engineering has been done for you. The transmission-mounting and clutch setups remain the same, two options exist for speedometer application, a common 31-spline yoke fits all units, and you can tailor the shifter position from stock to forward or offset to allow installation in cars never before equipped with a six-speed. There are two overdrive gears for easy cruising in cars with hot cams or numerically high-ratio rear ends. The object here is to find a niche market in your area to bring in dollars instead of just waiting for the phone to ring. **TD**

The Bottom Line:

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Circle the corresponding number on the free information card.

- 87 Useful information.
- 88 Not useful information.
- 89 We need more information.

Application	Part #	Engine	Torque Capacity (lb.-ft.)	Includes Clutch Housing	Clutch Type	Speedo Type	Spline Count		Gear Ratios						
							Input	Output	1st	2nd	3rd	4th	5th	6th	Rev
GM	TUET7477	LS	700	No	Hyd	Mech/Elec	26	31	2.66	1.78	1.30	1.00	0.74	0.50	2.90
GM	TUET8277	LS	700	No	Hyd	Mech/Elec	26	31	2.97	2.07	1.43	1.00	0.80	0.62	3.28
GM	TBA	SBC/BBC	700	No	Mech	Mech/Elec	26	31	2.66	1.78	1.30	1.00	0.74	0.50	2.90
GM	TBA	SBC/BBC	700	No	Mech	Mech/Elec	26	31	2.97	2.07	1.43	1.00	0.80	0.62	3.28
Ford	TUET7478	Modular	700	No	Mech	Mech/Elec	26	31	2.66	1.78	1.30	1.00	0.74	0.50	2.90
Ford	TUET8274	Modular	700	No	Mech	Mech/Elec	26	31	2.97	2.07	1.43	1.00	0.80	0.62	3.28
Ford	TUET8272	Modular	700	No	Hyd	Mech/Elec	26	31	2.66	1.78	1.30	1.00	0.74	0.50	2.90
Ford	TUET8275	Modular	700	No	Hyd	Mech/Elec	26	31	2.97	2.07	1.43	1.00	0.80	0.62	3.28
Ford	TBA	5.0/5.8L	700	No	Mech	Mech/Elec	26	31	2.66	1.78	1.30	1.00	0.74	0.50	2.90
Ford	TBA	5.0/5.8L	700	No	Mech	Mech/Elec	26	31	2.97	2.07	1.43	1.00	0.80	0.62	3.28

Courtesy of Tremec Transmissions