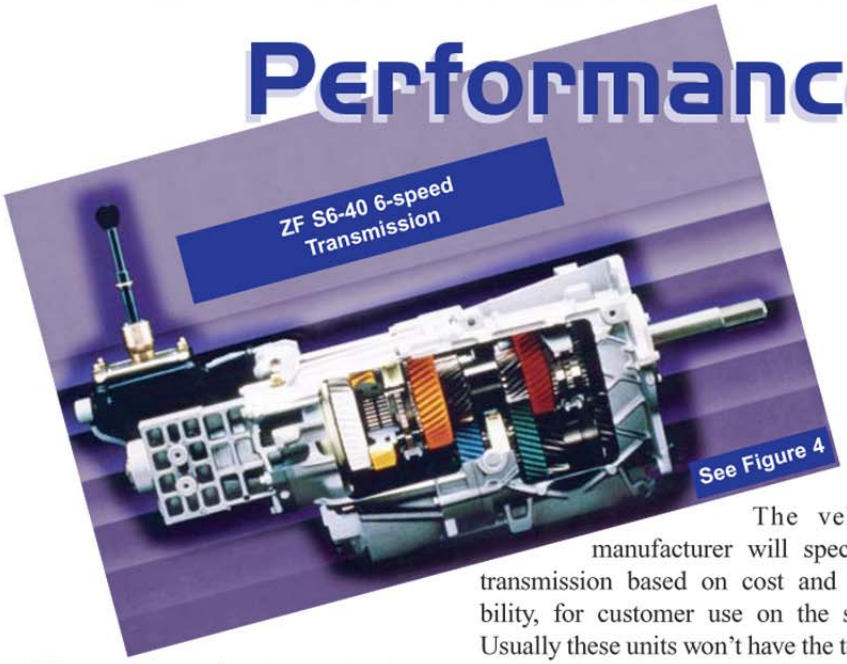
Stick Transmission, Performance = Profit

by Mike Weinberg



Sure signs of spring are in view: Robins are back up North, bulbs are pushing out of the soil, the tree sap is rising, and race season has begun. Actually, on the professional level, racing never stops. During the off-season — from October/ November until the end of January — testing and development continues at a fever pitch.

In the competitive world of pro racing, the season never ends and, being that pro racing is a self-contained industry, there isn't a lot of profit available for the average trans shop. There is, however, a huge market for the trans shop upgrading and replacing transmission for performance enthusiasts, hotrodders, and amateur racers. We will devote these pages to show you what's available and what's coming, so you can add these services to your business plan.

All of the transmissions and performance parts we'll discuss are for streetable vehicles. This is a vast market and is priced within range of the motor sport enthusiast. Outside of pro competition you won't find much of a market for non-synchronized, sequential shift racing gearboxes costing upward of $15,000. There are a variety of units that can be swapped for stock transmissions; units that provide large gains in performance and durability, while still being useable as a daily driver.

The vehicle manufacturer will specify a transmission based on cost and durability, for customer use on the street. Usually these units won't have the torque rating and durability to satisfy the owner who pushes the vehicle to its limits on a regular basis. Certain performance-oriented sports cars have enough torque rating to stand up well, but then the human factor comes into the picture.

These are the guys who want more than stock, or the latest and greatest, and they have money to spend. They're usually customers who are well versed in performance upgrades available through magazines and catalogs, and are looking for some one to do the work for them. It's important to become familiar with what's available and what'll work without becoming too expensive or too crazy for every day use.

The hardest part of performance upgrades is the development work needed to arrive at a complete package. It seems that most enthusiasts begin with the engine, believing more power is the answer. This inevitably leads to a series of driveline parts that get destroyed by an engine that is now turning much higher torque levels than it's spec'd for.

The usual trail starts with a hot engine setup, and the first victim is the clutch. After the clutch is upgraded, all that new power turns the gearbox into hundreds of useless souvenirs. Now the trans is swapped for a gearbox that handles the torque and shift loads, and the driveshaft and u-joints get scattered. The differential and axles become the next victims. After everything in the drive train is corrected to allow for the upgraded power plant, really sticky new rubber is added and we start all over again.

Remember to look at the vehicle as the sum of its parts. There must be a balance between the components if the owner is to enjoy his toy. You need to be the guiding hand to make sure that the project is planned carefully. Abuse is part of this equation, and *warranty* takes on a whole new meaning. In real racing, all engine, driveline, brake and suspension components are replaced or rebuilt after every race. On most street performance upgrades, warranties should be limited to the components working properly when the vehicle leaves the shop; driver abuse shouldn't be covered. Good communication will keep everyone on the same page, and prevent future hassles and over optimistic expectations.

The stock gearbox in most vehicles has a torque rating that will already be at the limit. There are many bolt-in replacement units that can be purchased for reasonable money that will raise the torque rating and shift durability to much higher levels than original equipment. We'll discuss these by transmission model.

General Motors Muncie 4-Speed

This aging war-horse won't go away. Original equipment in hundreds of thousands of muscle cars over the years, most of these units have been rebuilt many times. Up till now, a limited supply of OEM stock parts and a wide selection of aftermarket geartrain components were available.

A new "super" case for the Muncie series transmissions was released recently. Completely redesigned for added strength and durability, this is a welcome addition to the performance repair market. The flaw in these older aluminum-case transmissions is the case actually stretches over time. Helical cut gears are quiet, but generate thrust loads as power applies, and the gears try and push away from each other. When you're working on a trans that's 30 years old and behind a good old big block motor, the case will definitely have some stretch or deflection.

Also available are four different ratios for the Muncie M22 geartrain. The standard close-ratio gears are based on the factory ratios, which are:

1st gear — 2.199:1
2nd gear — 1.640:1
3rd gear — 1.274:1
4th gear — 1.00:1

These ratios work very well with 4.11 and 4.56 final drive ratios, and are good for drag cars and limited street use.

The custom wide-ratio set has these ratios:

1st gear — 2.559:1
2nd gear — 1.752:1
3rd gear — 1.366:1
4th gear — 1.00:1

This gearing will work well with 3.55 and 3.70 rears, and will be more economical for street use for folks who don't have shares in Mobil.

Competition ratio has these ratios:

1st gear — 2.199:1
2nd gear — 1.506:1
3rd gear — 1.174:1
4th gear — 1.00:1

This gear set was designed for road course racing with vintage cars, where most acceleration occurs in the upper gears, and acceleration from a dead stop is relatively unimportant.

An overdrive ratio set will provide overdrive in the original trans case. This is achieved by making 3rd gear direct drive instead of 4th, and adding an overdrive ratio for the third gear, similar to that found in the older RUG transmissions.

1st gear — 2.199:1
2nd gear — 1.506:1
3rd gear — 1.00:1
4th gear — 0.859:1 (overdrive)

This gear set will be noisier in 4th than in 3rd, since power flows through the countergear. It allows for highway driving with more radical cams or higher rears.

Tremec Transmissions

Tremec has been manufacturing transmission for OEMs for many years. They have a state-of-the-art facility in Mexico and offices in the United States. Tremec purchased the Borg Warner standard transmission line several years ago, which included the T5, T45 and T56 units. These transmissions are currently being built for OEM production and service parts are provided for most past models.

Tremec also designed a series of 5-speed transmissions for the performance market, which includes the TR-3550 and the TKO models. The object is to take advantage of these units' upgrade in torque and durability. The T5 had the largest production run of any standard transmission, but it was always right on the edge of its toque rating in Mustangs, Camaros and Firebirds. The gains in horsepower produced by better fuel injection and engine management systems caused the T5 to be redesigned several times, but it never had a torque rating above 330 ft/lbs.

The next step in performance was to substitute a Tremec TR-3550 for the venerable T5. These units can be purchased with a bell housing for direct bolt in and an increase in torque to 350-375 ft/lbs. The TKO variation of the 3550 boosts a torque rating of 425-475 ft/lbs, and can be used in numerous hotrods, kit cars and weekend warriors. The TR-3550 was the stock offering in the 1995 Ford Mustang Cobra R racing models.

The T45 came with the introduction of the 4.8-liter modular motor in 1996. This unit was a price compromise between the T5 and the T56 6-speeds. The T45 replaced the T5 in the Ford Mustang, and has a torque rating of 350 ft/lbs. In 1999, Ford again upgraded the horsepower and torque, and Tremec responded with the TR-3650, and upgrade of the TR-3550. This unit first appeared in the Mustang Cobra and Bulitt models, and has a torque rating equal to the TR-3550, but with redesigned and improved shift quality.

Ford has used the T56 6-speeds — which have a torque rating of 400-450 ft/lbs — in two models: the new Cobra R race model and the Ford, owned Aston Martin luxury sport cars. GM, however, has used the T56 in its F body cars since the introduction of the LT1 motor in 1993. The T56 has been upgraded to handle increased horsepower and torque that was added with the LS1 engines in Firebirds and Camaros, and redesigned to be rear mounted in the C5 Corvette, introduced in 1997. The T56 was given a new set of ratios for use in the Z06 Corvette, to get the zero-to-60 MPH times down for bragging rights. Chrysler has always used the T56 as its transmission of choice for the powerhouse Dodge Viper top-of-the-line sports car (see story page 36).

There is a huge market for upgrading older units with later and improved gearboxes to enhance performance. The T56 comes in a variety of aftermarket models, which will replace T5, Muncie, Saginaw, and T10 in older vehicles. These swaps are relatively simple, with some driveshaft shortening and crossmember adjustments. We have these units running around in Impala SS models equipped with turbocharged motors for the ultimate sleeper car.

Ford isn't left out, and Tremec has aftermarket models available to replace the T5, Ford top-loader, and units that go behind the 4.6 liter Mustangs with mechanical and electronic speedometers. Refer to the installation chart for measurements, specifications, and model usage (figures 1-3, see page 48).

As with the top-priced T56, the less-expensive TR-3550 and TKO models provide additional five speeds that can be used to upgrade many Fords. There's something in the market for everybody's taste and pocketbook. As this goes to press, I received information that Lakewood Racing Products is marketing a scattershield/bell housing, which will permit using a TR-3550 or TKO behind Chevrolet motors. This will open new vistas for upgrading T5s in older Camaros and Firebirds.

There is also another legendary 6-speed gearbox available to the aftermarket, which can be used in kit cars, hotrods, and as a replacement for earlier units. This is the ZF S6-40 6-speed

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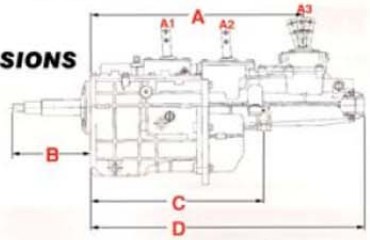
INSTALLATION DIMENSIONS
TREMEC TR-3550

Figure 1



Dimensional data shown in millimeters

MODEL	A	B	C	D
All Models	A1 = 178.20 A2 = 322.00 A 3 = 495.80	183.13	401.40	611.50

Note: STD II and TKO II have an upgraded steel and ratio change.

MODEL	TORQUE RANGE (lb. ft.)	DRY WEIGHT lbs.	SPLINE DATA Input	SPLINE DATA Output	GEAR RATIO CHART 1st	2nd	3rd	4th	5th	6th	Rev
Standard (260 0682R)	350 lb. ft.	100 lbs.	10T	28T	3.27	1.98	1.34	1.00	.68	N/A	3.00
Standard II (TCET 1376)	375 lb. ft.	100 lbs.	10T	28T	3.27	1.98	1.34	1.00	.82	N/A	3.00
TKO (260 0708)	425 lb. ft.	100 lbs.	26T	31T	3.27	1.98	1.34	1.00	.68	N/A	3.00
TKO II (TCET 1377)	475 lb. ft.	100 lbs.	26T	31T	3.27	1.98	1.34	1.00	.82	N/A	3.00

Features and Benefits:	
Five-speeds	Applicable for a wide range of passenger car and compact utility vehicles
Aluminum die cast housings	Lightweight, durable construction
Tapered roller bearings on shafts	Reduced noise and improved durability
Overdrive synchronizer placed on countershaft	Lower shift effort and reduced noise
Proven synchronizer technology... • Brass blocker rings • Patented strut-type design • Multi-rail linkage	 Improved durability Improved durability Improved durability
Range of shift lever positions	Application flexibility - 3 positions

transmission, (figure 4) used in the 89-96 Chevrolet C4 Corvettes, including the monster ZR1 models. Once only available through General Motors as complete units with a Tiffany's price tag, these units now come new, remanufactured, and all the parts are finally available. And the price has come way down from previous levels. This unit has a torque rating of 400-450 ft/lbs and is extremely smooth shifting and durable.

Many hotrods and kit cars have used this epic 4+3 overdrive from 1984-1988. The owner of one of these Vettes will rebuild the 4+3 overdrive at least three times during the life of the car, and put up with horrific clunking shifts in and out of overdrive.

The S6-40 is a very clean swap to replace those old Nash units, and when your customer drives one, be prepared for tears, hugs and kisses. The difference in vehicle driveablity is like night and day.

Remember, older Corvettes and muscle cars never get thrown away. As we speak, there are all kind of vehicles in varying states of disrepair being restored, modified and customized all over the country. This is a market that you can take advantage of with a minimum of research and planning.

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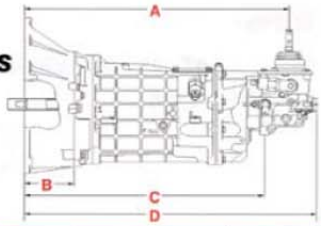
INSTALLATION DIMENSIONS
TREMEC T-56

Figure 2



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	1386-000-016	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 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 Input	SPLINE DATA Output	GEAR RATIO CHART 1st	2nd	3rd	4th	5th	6th	Rev
1386-000-011	400 lb. ft.	115-129 lbs.	26T	27T	2.97	2.07	1.43	1.00	.80	.62	3.28
1386-000-012	400 lb. ft.	115-129 lbs.	10T	31T	2.97	2.07	1.43	1.00	.80	.62	3.28
1386-000-016	450 lb. ft.	115-129 lbs.	26T	27T	2.66	1.78	1.30	1.00	.74	.50	2.90
1386-000-017	450 lb. ft.	115-129 lbs.	26T	27T	2.66	1.78	1.30	1.00	.74	.50	2.90
1386-000-018	450 lb. ft.	115-129 lbs.	26T	30T	2.66	1.78	1.30	1.00	.74	.50	2.90
1386-000-020	450 lb. ft.	115-129 lbs.	26T	27T	2.66	1.78	1.30	1.00	.74	.50	2.90
1386-000-021	450 lb. ft.	115-129 lbs.	25T	30T	2.66	1.78	1.30	1.00	.80	.62	2.90
TUET 1259	400 lb. ft.	115-129 lbs.	10T	31T	2.97	2.07	1.43	1.00	.80	.62	3.28
TUET 1260	400 lb. ft.	115-129 lbs.	10T	31T	2.97	2.07	1.43	1.00	.80	.62	3.28

Features and Benefits:	
Six-speeds	Applicable to a wide range of vehicles 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/adapter ring	Increased driveline bending strength with mounting flexibility
Overdrive synchronizers placed on countershaft	Lower shift effort and reduced noise
Advanced synchronizer technology - • Powered steel formed blocker rings • Organic friction material • Double cone design • Patented strut-type design	 Consistency, high quality Improved durability Lower shift effort Improved durability

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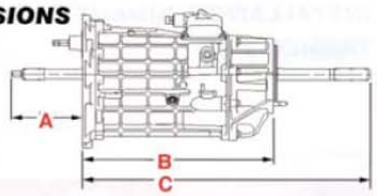
INSTALLATION DIMENSIONS
TREMEC T-56
(Corvette)

Figure 3



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 Input	SPLINE DATA Output	GEAR RATIO CHART 1st	2nd	3rd	4th	5th	6th	Rev
TUET 1452	370 lb. ft.	115 lbs.	26T	27T	2.66	1.78	1.30	1.00	.74	.50	2.90
TUET 1453	370 lb. ft.	115 lbs.	26T	27T	2.66	1.78	1.30	1.00	.74	.50	2.90
1386-000-025	385 lb. ft.	115 lbs.	26T	27T	2.97	2.07	1.43	1.00	.84	.56	2.90

Features and Benefits:	
Six-speeds	Applicable to a wide range of vehicles 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 - • Powered steel formed blocker rings • Organic friction material • Triple cone design • Patented strut-type design	 Consistency, high quality Improved durability Lower shift effort Improved durability

ZF S6-40 Gear Ratios

	1st	2nd	3rd	4th	5th	6th	Rev.
Performance 400 (400 ft./lb.)	2.68	1.80	1.29	1.00	0.75	0.50	2.50
Competition 450 (450 ft./lb.)	2.68	1.80	1.29	1.00	0.75	0.50	2.50

Figure 4