

Shifting America's Sports Car:

# Corvette Gearboxes

By Mike Weinberg  
Contributing Editor

Spring has sprung, the flowers are blooming, race season is here, and everybody is taking the cover off their fast-lane toys for fun in the sun. I just got back from Bowling Green, KY, where Corvettes are manufactured and the National Corvette Museum is situated. I was representing ZF Industries at the 10th anniversary of the setting of the World Endurance record by a Corvette ZR-1 equipped with a ZF S6-40 six-speed transmission. There were a trade show, plant tours, product demonstrations and a banquet honoring my co-drivers, John Heinricy and Stuart Hayner, who were at the wheel for 24 hours at 175.885 mph. The previous record had stood for almost 50 years, with many manufacturers trying and failing to better the mark. With this in mind I thought it would be a good time to look at the development of recent Corvette manual transmissions.

From 1957 on, the Corvette had been equipped with the BorgWarner T-10 four-speed transmission. For the 1984 model year Chevrolet wanted a five-speed transmission with overdrive, but there was a scarcity of designs that could handle the horsepower and torque ratings of the

'Vette. Doug Nash had bought the rights to the T-10 design from BorgWarner and had added an overdrive section where the extension housing had been. This unit was called the 4+3. The T-10 was a strong design, and the overdrive unit gave it some flexibility for cruising and economy.

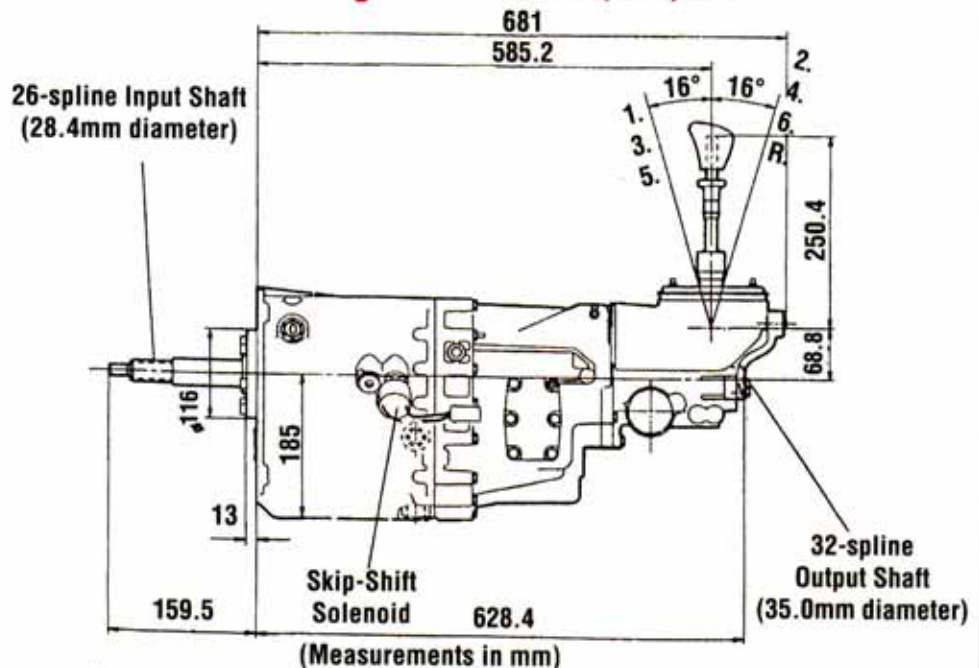
The 1984 model had the overdrive unit shifted by a throttle cable, with switches mounted on the shift forks to let the ECM know which gear had been selected. The shift linkage was external and prone to road damage and corro-

sion, and precise shifting was difficult. The overdrive cycled in and out with harsh, thumping efficiency.

For 1985 the overdrive unit was modified to be controlled electronically, and the throttle cable was eliminated. Durability problems with the Doug Nash design began to be commonplace, and the unit ate a lot of expensive parts.

The 4+3 unit's control system was further advanced with more computer control for 1986, and the 1st-gear switch was eliminated. The ECM calculated engine speed and throttle position to recognize

## S6-40 Transmission - Engine Model L 98/LT1/LT4



### Gear Ratios

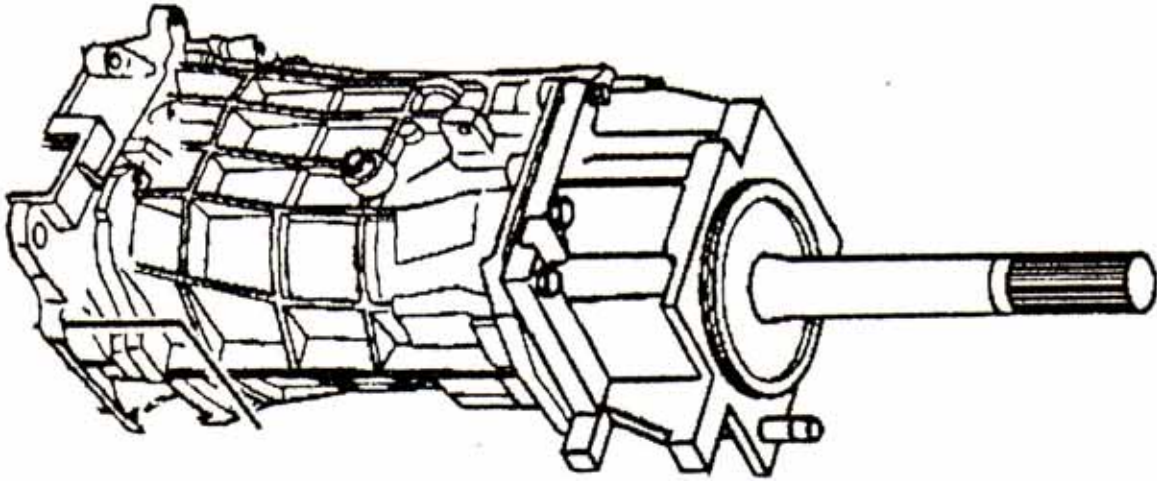
Input Torque (ft./lbs.)	1st Gear	2nd Gear	3rd Gear	4th Gear	5th Gear	6th Gear	Rev. Gear	Mass (lbs.)	Oil Capacity (L)
400	2.68	1.80	1.29	1.00	0.75	0.50	2.50	160	2.2
450	2.68	1.80	1.29	1.00	0.75	0.50	2.50	160	2.2

All units must use ZF-recommended GM Oil (GM Part #1052931) or Castrol Formula RS 10W60.

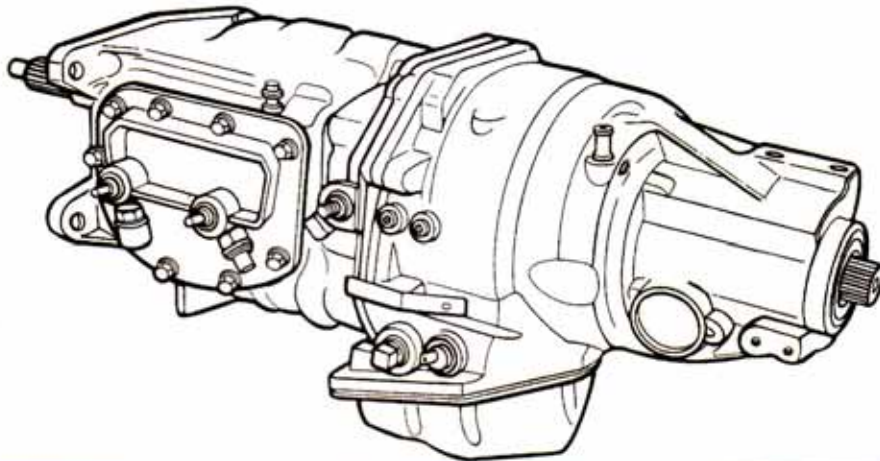
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Transmission Digest

**T-56 – Corvette '97 up**



**1984-87 Doug Nash 4+3 Transmission**



1st-gear operation. The Corvette, the only true American sports car and the flagship of the GM fleet, still lacked a sophisticated, smooth-shifting transmission. During this period, Doug Nash was in financial trouble, and GM was forced to provide cash for the struggling company.

Again in 1987 the Corvette was saddled with the 4+3, which had been modified again with the first-gear switch brought back. Chevrolet, in the meantime, had been hard at work designing the next-generation Corvette that would feature the breakthrough ZR-1.

Designed in cooperation with ZF Industries, a premier German

transmission manufacturer, the manual-transmission option now was a six-speed unit designated the S6-40. This new model was equipped with dual-cone synchronizers and provided excellent, precise shifting while being stout enough to handle the increased horsepower and torque of the 1988 model. The S6-40 option made the new model live up to its design capabilities. The difference between the new unit and the older 4+3 was as night and day.

Now Nash's financial position had brought his company to rock bottom, and, as misery loves company, a tornado severely damaged the plant. The rights to the T-10 and 4+3 transmissions were

bought by Richmond Gear. Parts for the 4+3 overdrive unit began to dry up, adding to the problems of the '84-87 Corvette owners and the transmission shops that were trying to make the repairs.

The owners of the 1988 Corvettes were enjoying their new models, and the cars began to set records on race tracks around the country. GM SPO (Service Parts Operations) decided that because of the relatively low production numbers for the Corvette and the need for some expensive precision tooling to repair the S6-40 trans, they would not stock service parts for the trans at regional warehouses and instead would offer remanufactured exchange units through

*continues page 48*

the dealerships. Although this probably was the right decision from a cost standpoint, it was a public-relations nightmare for the brand. Through the entire model run 1988-96, service parts were not made available.

1997 brought to market the new Corvette design, the C5. It featured a new LS1 engine, a BorgWarner T-56 six-speed transmission and a Getrag rear end. The T-56 was coupled to the rear differential, and power was transmitted from the clutch to the transmission through a torque tube. This gave the C5 model almost 50/50 weight distribution and the best handling of any Corvette. The T-56 has been used in the GM F-body cars (Camaro and Firebird) since 1993 and in the Dodge Viper and has proved to be an excellent-shifting, strong trans-

mission for which service parts are available.

As a postscript to this story, ZF now has made all the parts available for the S6-40 six-speed transmission. The long drought is over, and with a production of about 47,000 units – most of which are still on the road – parts and complete units now are readily available.

For owners of the '84-'87 4+3 Doug Nash units, there also is an answer. With the overdrive units all but gone, it is possible to swap the ZF S6-40 unit to replace the Nash box. If anyone is interested in the retrofit, please circle number 111 on the reader service card between pages 20 and 21 in this magazine, and I will send you all the information you will need. Although the cost is more than a 4+3 repair, it is well worth the

price. Corvette owners finally will have the performance and reliability they deserve. People who have made this swap have told me that it is like owning a new car. **TD**

**THE BOTTOM LINE:**

**Tell us your opinion of this article:**  
Circle the corresponding number on the free information card.

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

**as seen in Transmission Tech/Talk**

**Chrysler Rear Drive: Premature Planetary Failure**

**Complaint:**

Before or after overhaul, some 1994 and later Chrysler or Jeep vehicles equipped with rear-wheel-drive or four-wheel-drive transmissions may exhibit premature planetary failure.

**Cause:**

The cause may be that the one-way ball and spring in the return cooler hose (See Figure 12) may be sticking and inhibiting cooler flow to the return cooler fitting, which is the rear cooler fitting on the transmission.

**Correction:**

Locate the return hose, which is near the radiator as shown in Figure 13. The threaded fitting will have an arrow and the word *flow* identifying the one-way ball and spring. Remove and discard the hose shown in Figure 12 and reconnect the existing lines with a suitable hose. After making the repair, ensure that there is a minimum of 1 quart of fluid flow in 20 seconds when the rear cooler line is placed into a container and the transmission selector is in Neutral.

