VOLUME 29, NO. 5 JANUARY 2010

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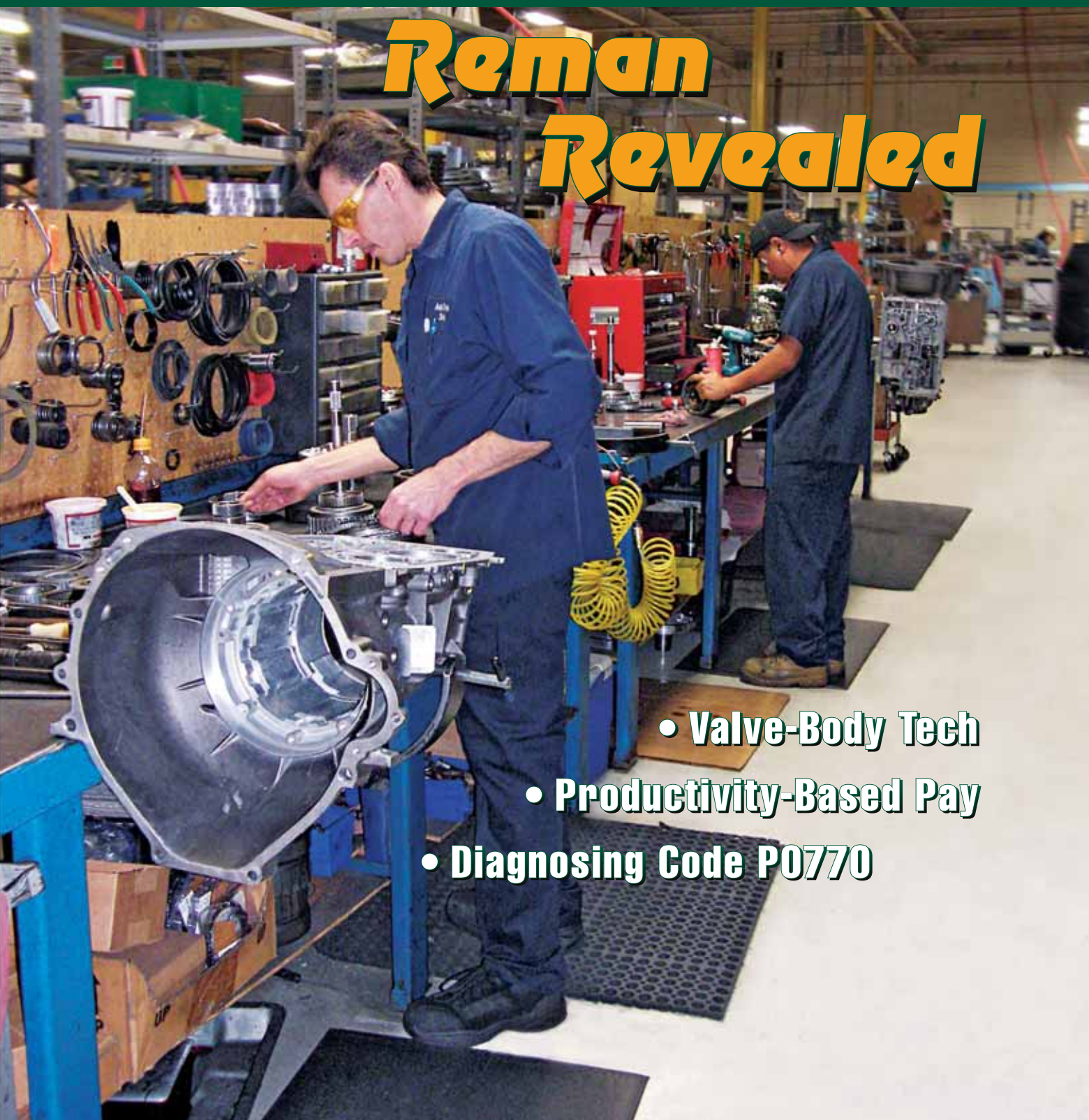
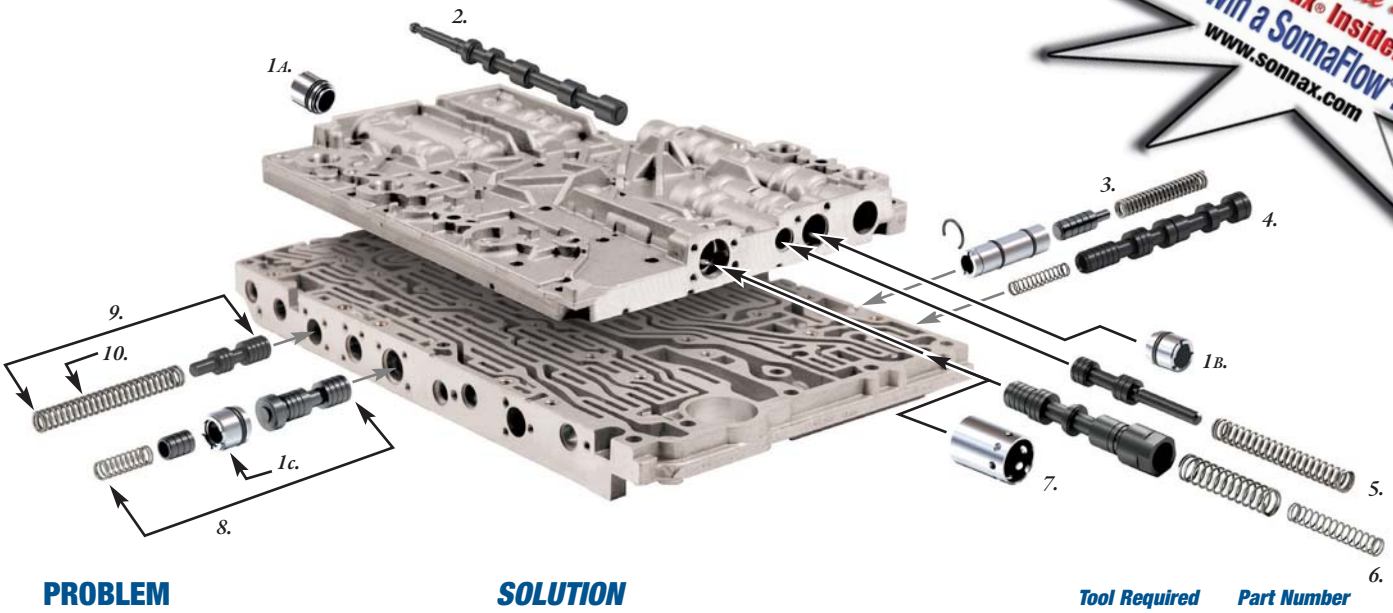


Reman Revealed

- Valve-Body Tech
- Productivity-Based Pay
- Diagnosing Code P0770

A518 • AW 6 • BW 4473 • E4OD • 4L60-E • 722.6/NAG1 • TF-60SN • T56 • 3650 • U341E/F

10 Kits from Sonnax for 722.6 Mercedes



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• Loss of 2-3 shift • 4-3 neutral on downshift	**7.** Outer Pressure Regulator Sleeve	F-68942-TL6 & VB-FIX	**68942-06**
• Harsh, bumpy or flare 1-2/4-5 Shifts • Slipping gears	**8.** 1-2 / 4-5 Overlap Valve Kit	F-68942-TL19 & VB-FIX	**68942-19K** *New!*
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VOLUME 29, NO. 5 JANUARY 2010

TRANSMISSION DIGEST

One-Stop Service

Apex Transmissions & Automotive Center provides a wide range of services to take care of its customers' needs in one place.

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On The Cover

Reman Revealed

Use of knowledge and technology to achieve a precise and rigorous standard of testing is combined with state-of-the-art remanufacturing processes at ETE Reman.

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Business

News & Previews

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From the Publisher

By Bobby Mace

Transmission Digest wishes our readers and sponsors a happy and prosperous new year, one and all.

I was saddened to hear just after the December issue was printed that a good friend, Ken Cluck, past president of the Torque Converter Rebuilders Association and longtime employee of Oregon Converter, was having health problems. Ken, with his phenomenal technical knowledge, has been a willing and active volunteer, supporting both transmission and torque-converter aftermarkets.

Ken's diagnosis and subsequent treatment required extensive travel and considerable expense. He has, at long last, returned home to recuperate, but the family has been left with staggering medical and travel bills. Ken's friends at TCRA have established a fund to help defray those expenses.

From TCRA: "The Ken Cluck Support Fund, PO Box 1011, Manchester Center, VT 05255-1011. Or, log onto the TCRA website at www.tcraonline.com where you can follow the link and make an electronic donation via credit card. Ken; his wife, Julie; and their family thank you for your support."

Showpower plans are evolving as well. With a newly opened Nashville warehouse, Transtar will be hosting the 2010 ATSG seminar March 20 in conjunction with Showpower in Nashville. ATSG's general seminar covers a wide variety of updates and tips for a large number of popular units. ATSG's participation in the separate Showpower seminar program focuses in-depth attention on units that present problems to rebuilders.

Those attending the Transtar/ATSG seminar will be provided with both time and complimentary passes so they may visit the exhibition hall. For more information on attending the Nashville Transtar/ATSG event, contact ATSG: 800-245-7722 or www.atsg.biz. TD

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Apex Transmissions & Automotive Center

One-Stop Service

Owners Danny and Angela Safon and their children, T.J., 16, and Arianna, 13. T.J. and Arianna work in the shop when they're out of school.

Danny scans a vehicle for diagnostic trouble codes.

When Danny and Angela Safon started Apex Transmissions & Automotive Center in Apex, N.C., 4½ years ago, they literally put all they had into the business.

"When we opened this shop we put our house up as collateral," Danny said. "We didn't lease anything. Everything was bought by refinancing our house, taking all our money out and just going for it. We put everything on the line. We put our whole life into this, and it worked out for us."

Angela is the principal owner of the family-operated business and was the driving force behind their opening a shop of their own. Starting with one full-time technician and Danny working evenings, she operated the shop for a month and half until there was enough business that Danny could quit his job at another shop in the area and work full time at Apex. He had been a transmission builder for 20 years, the past nine of

continues page 6

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Apex has five service bays plus a mobile lift.

John is a full-time general-automotive technician.

which had been in North Carolina.

"The last four years he was at a dead end," Angela said. "He was the top transmission rebuilder, and there were no more raises, nothing. We were at the stage where we were not going anywhere. So I started looking for a place for us to go into business. Unfortunately, it took us a year to find a place.

"I'd been in the accounting field for 20 years, and I've been in the tax field for 15 years, so it's a good flow. Danny does all the automotive end of it, and I make sure that everything accounting- and tax-wise goes smoothly."

Danny describes his function as the foreman overseeing service operations at the 5,000-square-foot shop in Apex, a town of about 27,000 north of Durham. He diagnoses vehicle problems, builds and installs transmissions, and helps manager Al Labriola with customer service as needed. "Whatever needs to be done in the shop, I'll pick it up and take care of it. I just do everything, and that's how it's always been and it always will be that way, because I've got to have my hands in it or else I'll go crazy."

In addition, Danny operates Peak Towing, a separate business he and Angela started two years ago. He has three tow trucks and is looking to add a fourth. "We started out with one truck to support Apex Transmissions, and it's blossomed into a full-blown towing operation."

Danny, who's from Long Island, N.Y., was working as a builder when he met Al, a New Jersey native, who came to work at Apex about $2^1/_2$ years ago. "I brought him on because I liked his style," Danny said. "He's a good salesman."

Since Danny's expertise was in transmission repair, the shop specialized in transmissions but also

continues page 8

Owner Angela Safon behind the counter

Manager Al Labriola handles customer service and assigns jobs to the technicians.

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Albert is the shop's full-time rebuilder.

One of three tow trucks operated by Peak Towing, a separate business Danny operates.

offered a wide range of general automotive repairs.

"As things evolved our customers asked us to do all the automotive. We started with a lot of transmission work, and the automotive has grown to be a big part of the business now. As we evolved we started doing major automotive. We do anything now, including diesel work."

"It has evolved," Angela said, "but from day one our philosophy was one-stop shop. The only thing we haven't done that is our philosophy, we're still trying to implement detailing, so that every car that comes into this shop will not only get any service that it needs done but it also will get cleaned and detailed and everything. But my problem is space and the economy, and we can't find a good detailer.

"We would like to expand and do another whole shop, and we want to do it right here in the local area with one building in front of the other." The front building would be general automotive and serve as the customer reception area, and the back building would house the transmission-repair operation. "We are still in the process of looking to find the right location for that."

"The way we see it," Al said, "the customer today is looking for convenience, and they don't want to go to five or six different shops to get their vehicle serviced.

"Some of these things, like tires, we don't look at them as profit centers; we look at them as convenience for the customers.

"The way we run this shop, when that customer comes in the door until the car leaves, we believe in a seamless flow. We don't like breaks in the action. We try to make it as efficient as possible."

If a technician can't continue with a specific job because he's waiting for a part to be delivered, for example, he moves on to another task until the part arrives. "We've just got to give everybody in here credit."

The shop also encourages technicians to make decisions instead of coming to the owner or manager every time there's a question.

"We're one team," Danny said. "If something happens, nobody gets the blame. We take care of it. Everybody's treated totally equally here."

"You know, you don't have to be afraid of the manager, you don't have to be afraid of the owner, and it works," Al said. "Our comeback rate here is 1% or less."

Close to 40% of Apex's business comes from customer referrals, and Danny spends a good part of his time on outside sales to land new accounts and keep existing ones.

For the past several months, Apex has been gathering an assortment of vehicle mechanical parts to put together a customer-education display in the office. "We're going to set up what we call kind of a learning center for the customers so when they come in, instead of having a bunch of posters on the board they can actually look at it and touch it," Al said. "We believe when that's set up we'll probably be the only shop in this area, at least that we know of, that has something like that for customers. We're always evolving. In this business you can't stay stagnant."

A repair shop has to communicate effectively to make customers feel comfortable, Al said. "We think one of the most-important things is you can't make them feel like they aren't knowledgeable. The customer is smart today. They go on the Internet, they go on blogs, they read, they call around, so our theory on things is this: Don't play games with them, don't try to mislead them; tell them the truth. Give them a premium job at a fair price." TD

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Shift Pointers

Author:
Wayne Colonna, ATSG
Transmission Digest
Technical Editor

Subject:
Code P0770

Unit:
Toyota U341E/F

Vehicle Applications:
Toyota Matrix, Pontiac Vibe

Essential Reading:
- ☑ Rebuilder
- ☐ Shop Owner
- ☐ Center Manager
- ☑ Diagnostician
- ☐ R & R

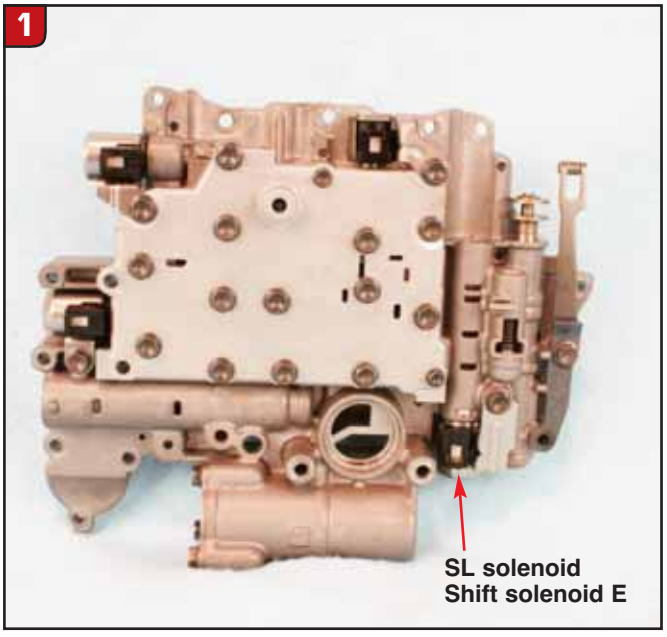
Toyota U341E/F

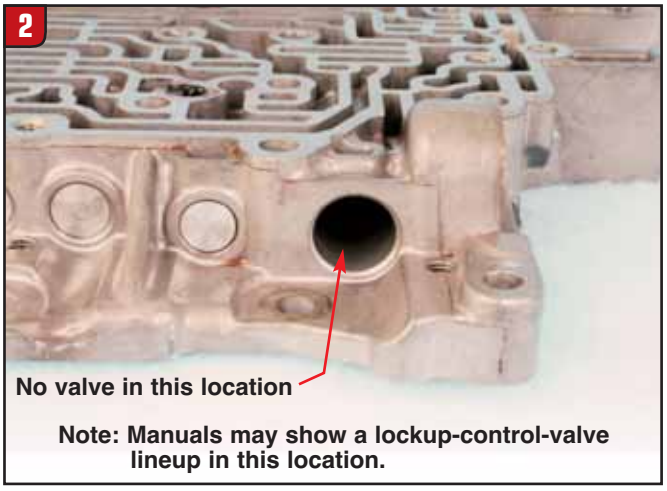
Diagnosing Code P0770

In the Import section of ATSG's "Shifting Great in 2008" training seminar, one subject that was handled in the Toyota U341E/F segment of the seminar was the elusive code P0770. What makes this code so elusive is that it points to a fault for shift solenoid E. The technician tries to determine which is shift solenoid E and cannot. Nor can the technician determine whether the code indicates an electrical problem or a mechanical one.

This still seems to be a problem, as evidenced by the calls that continue to trickle in on our technical hotline about this dilemma. Code P0770 is a mechanically generated code for the lockup solenoid, which Toyota calls the SL solenoid. The code basically represents anything that can cause the converter clutch to slip. If it were an electrical code indicating a problem with the wiring from the computer down to the solenoid, or the solenoid itself, code P0773 would be set.

Figure 1 shows the location of the SL solenoid. Some repair manuals, including the factory manual, show a lockup control valve in the location illustrated in **Figure 2**. Of all E and F valve bodies that were inspected, not one had this valve, so this bore being empty does not mean you have found your P0770 problem.

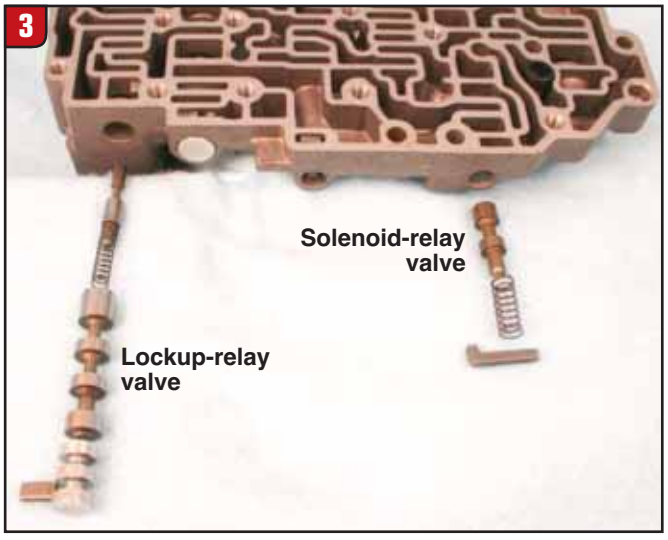




Note: Manuals may show a lockup-control-valve lineup in this location.

To diagnose the P0770, you should start by checking two valves in the valve body and the SL solenoid. **Figure 3** shows the location of the lockup-relay and solenoid-relay valves. Check the bores for wear and to

continues page 12



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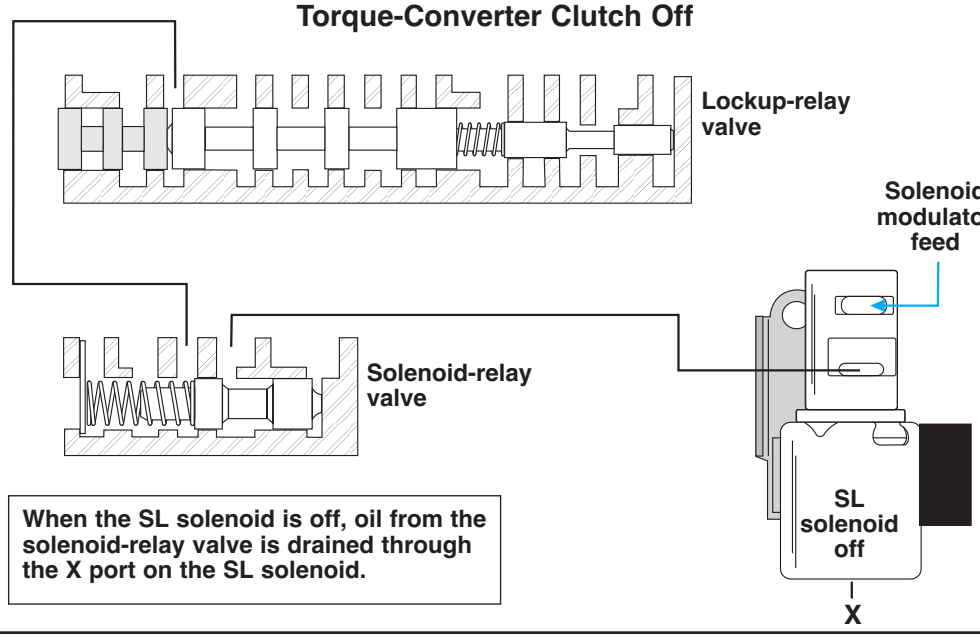

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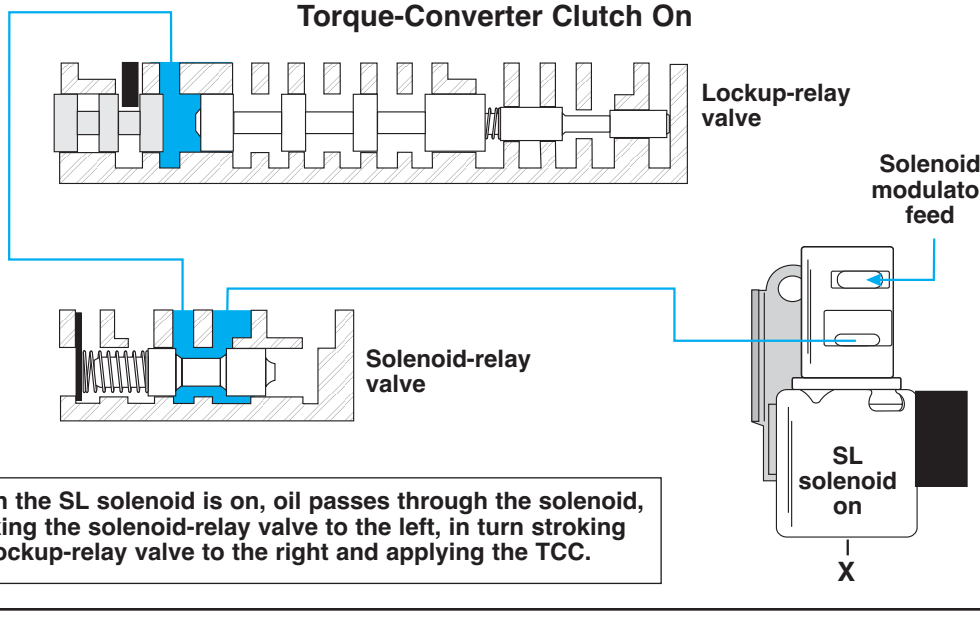

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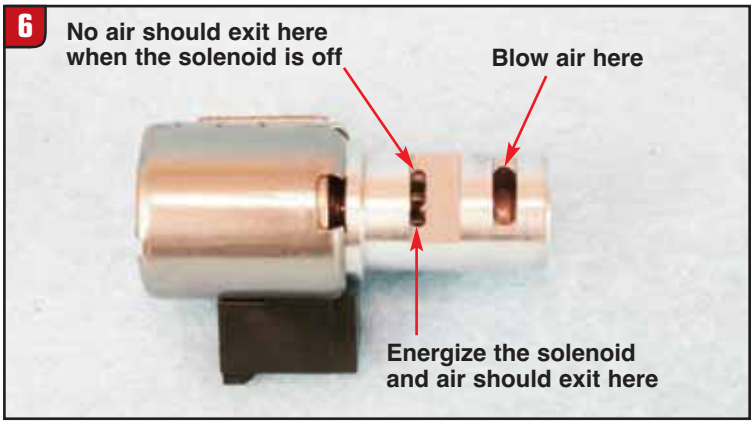

see whether those valves stroke correctly and easily.

Figure 4 illustrates the operation of the lockup system when the converter clutch is off. **Figure 5** illustrates the operation of the lockup system when the converter clutch is on.

Figure 6 explains how to check the SL solenoid with compressed air. Also be sure to check the exhaust circuit of the solenoid when the solenoid is off as explained in **Figure 4**. If all this checks out, the input-shaft rings, pump and converter will need to be inspected. TD

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Posed with ETE's original logo at its Milwaukee facility are Noah Rickun, Sam Loshak, Lawrence Loshak, Mikhail Shakhnovich, Bob Uszler and Jon Besherse. The new logo below reflects the company's shifted focus to exclusively transmissions.

Reman Revealed

The ETE machine shop splits its time between remachining parts and creating specialized tooling and fixtures for the plant.

"As a company, we are keeping the flexibility to adapt to any issue or change that the industry brings to us," says Sam Loshak, CEO and founder of transmission remanufacturer ETE Reman. Loshak's department leaders are gathered in the company's Milwaukee headquarters to share a glimpse of the company with *Transmission Digest* readers. In the 85,000-square-foot facility, the company's 150 employees remanufacture 20,000 automatic transmissions and transfer cases a year.

Sam reflects: "We are making sure that we keep pace with the evolution of the transmission itself and of our industry as well. Current technology brings us something better and faster every day. It's the same for transmissions, as we face new systems like the CVTs and CAN-bus systems now on more and more vehicles. These systems include protocols that the OEMs are not sharing with the aftermarket, so we have to find ways of cracking those codes on our own in order to be able to properly build and test these

particular units and support our customers."

"We are lucky to have a talented engineering staff that is dedicated to this evolving process," says Mikhail Shakhnovich, executive vice president of ETE Reman. "Now, high-tech is becoming the center of the business we do. It's no longer a case of putting nuts and bolts together, as our industry, like so many others, has become a high-tech industry."

"In the end, what we create has to be done in such a manner that we are always conscious of delivering or creating value for our customers," says Noah Rickun, vice president of sales of ETE Reman.

Each of the five dynamometers has been specifically enhanced to perform certain tests required by the ETE production team.

Production manager Jon Besherse concentrates his efforts on plant operations to support inventory requirements. "Our goal is to make sure we have the unit on the shelf, in our national distribution network, that allows next-day delivery anywhere in the country."

Jon adds: "Our remanufacturing process is best described as a hybrid system, because the volume and

ETE as a business goes back more than 25 years and always has remained flexible enough to react to changes in the market, technologies and customer demand.

Sam Loshak started in the salvage business in 1979. He saw a growing demand among his customers for engines and transmissions and realized they seldom planned to install the unit themselves. So in 1985, he opened his first engine- and transmission-repair facility in Milwaukee, eventually opening two more, with a total of 45 lifts. As the repair facilities became successful, more engines and transmissions were required on a daily basis and some customers wanted a more-reliable option other than used.

"In addressing that problem, I became one of the very first people to use the term 'remanufactured' to better describe the engines we sold. Taking a used engine and remachining the bores, valve seats and replacing all the worn components resulted in something that was virtually new but certainly couldn't be marketed as new; hence, remanufactured."

The business grew rapidly, and to increase efficiency and to fulfill the demand he opened his own factory, remanufacturing engines and transmissions just for his own repair facilities. Loshak then explained that the ETE factory became so efficient that it was producing more product than his shops required, which is when the sale of engines and transmissions to other retailers throughout the area began.

Over the years, transmission demand went up as engines became more complex and expensive. A rather low-volume transmission-remanufacturing operation that was on the second floor of the engine factory was replaced with an 85,000-square-foot transmission-remanufacturing facility with six distribution hubs across the U.S.

ETE founder Sam Loshak

Lawrence Loshak explained, "At some point it became obvious that people would be more prone to replace a transmission, but an engine failure usually led to trading in the vehicle."

The ETE installation facilities today, one with 20 lifts and the other with 15, continue to play a valuable role. The company notes that the ability to keep in touch with customer and market needs is vital. "After all, the shops are profitable and we want our customers to know they can become just as successful," Lawrence observed. ETE's product is often installed and researched in the company's own shops before it is offered for sale to customers across the country.

Lawrence Loshak adds, "There is definitely an advantage to getting firsthand experience with the vehicle, particularly in developing a product and support for installing them."

The valve-body department inspects, builds and tests the valve-body prior to installation.

A conveyor moves cores through the disassembly, cleaning, paint and case prep processes.

complexity of each transmission will determine how many people will be working a particular cell or area. The majority of the activity is team building; for example, our 604 area, where each person assembles a specific component and others complete the final assembly."

"And, as demand changes we are flexible as to the number of people working on a specific cell. Because we are constantly cross training, we may have six people working a line one month and only three the following month while the other three move to assist in the assembly of another type."

Loshak believes that an experienced and talented machine-shop team is one of the key assets ETE retained from its days as a remanufacturer of engines. Bob Uszler is the manager and a master machinist who supports the transmission production operation with multiple remachined parts as well as design/fabrication of unique tooling and fixtures. The goal has always been to minimize damage to components and maximize efficiency in the assembly process.

"I noticed builders had a difficult time holding parts, especially removing and installing bushings and seals during assembly," Uszler said. "Over the past three years we have created over 1,000 fixtures and tools. This investment in tooling along with our continuing efforts to improve product quality shows in our finished products."

"We have both great equipment and great people and are able to make just about anything we need. We have CNC machinery, Solid Works and Master CAM design software to be able to fabricate any tooling, fixtures or parts that come to mind. Our time is split; 70% of our time goes to machining parts for our transmissions, the remaining time being concentrated on tooling and fixtures."

Loshak adds: "Each one of our builders is expected to build a specific number of transmissions per day, meaning we require tools that will maintain the volume from both an efficiency and quality standpoint. That's where Bob and his department shine."

"Often it comes down to the old saying that if you want it done right you do it yourself," said Lawrence Loshak, vice president of manufacturing. "In many cases, the easy route doesn't give us the performance and quality that we require for our customers, so we depend on our skilled machining department for a solution. The same is true for every part we use. Every component, gasket or kit goes through an evaluation process before it gets introduced to a cell."

Shakhnovich acknowledges that hard parts are often difficult to source. He says ETE often turns to the machine shop rather than risk using an aftermarket replacement part. "We found many times that aftermarket parts are not as reliable. So we end up taking on the project in house and developing our own. In one instance, we pulled a unit out of produc-

Processing and tracking orders are the everyday focus of the sales and customer-support department.

One of ETE's transmission-remanufacturing cells at work

About 4,000 finished units are strategically warehoused at the main facility and five satellites throughout the country.

tion for three years because there wasn't a reliable planet set. Eventually we developed a reliable process to remanufacture those planets ourselves."

Sam Loshak continues: "What's important isn't whether or not we can buy or build that planet. What is important is that we rebuild the planet in such a way that it can withstand another 100,000 miles in the car. This is where our special process becomes a very big advantage."

Lawrence Loshak also explained that the company is very meticulous in its dynamometer testing. "Simply running a transmission through its gears and listening for noise is no longer sufficient. All of our dynamometers go through an extensive modification process, in house, incorporating data acquisition, numerous load cells, sensors, inertia wheels, heating elements for hot testing and much-more-powerful motors. Every test collects 1,000,000 bytes of information in real time. The program is then able to make the decision automatically if the transmission passes or fails. We call this system *CARS* – Computer Aided Road Simulation."

"The days of the basic four-speed hydraulically controlled transmissions with a few solenoids have passed," Besherse said. "The controlling of the transmission is so much more dynamic with pulse-width modulation and variable pressure switches etc. For our testing to be accurate and valid, we actually have to emulate all of that complexity here in house."

The dyno room contains five of ETE's highly modified dynamometers, each specifically modified to provide the tests ETE researched and developed for a given unit.

ETE transmission customers include retail transmission-specialty shops, general-repair facilities, dealerships, fleet maintenance contractors, and warranty and insurance companies.

"Over the past couple of years," Rickun says, "we've become more involved in creating customer solutions than in simply selling remanufactured transmissions. Our department is helping our customers discover ways to make more money by increasing efficiencies, eliminating problems and increasing their level of service to their customers.

After parts are machined they are carefully measured before being put to use.

"I think that in the future this industry is going to be less concerned about who builds in house or outsources. Today, the value and the buying experience are important to the end user. Shops are going to flourish because they're proficient at diagnosing problems and servicing the needs of their customers – ASAP. Retail shops are going to have to make the investment in equipment that will allow them to work on the more-complex cars that are being manufactured today."

The retail facilities (see sidebar) are a selling point for ETE's product line as well. The company-owned installation facilities face the same challenges that ETE Reman's customers face. "I believe that owning our own repair facilities lends credibility when we talk to retail shops about our products," Lawrence Loshak says. "We aren't just talking; we're involved in the very same day-to-day operations they face. We can, and do, share information that we've learned about making a successful business by using ETE remanufactured units."

Rickun adds: "This is how *Reman U* came to life. We have many custom-tailored presentations where we can train repair-facility owners and managers how to increase their revenue using ETE Reman. ETE doesn't just make a great product but offers excellent customer service as well." TD

Tech To Tech

Author:
Jeff Bach

Subject:
No start

Vehicle Application:
1993 Eagle Talon 2.0 turbo

Essential Reading:
- ☐ Rebuilder
- ☐ Shop Owner
- ☐ Center Manager
- ☑ Diagnostician
- ☐ R & R

Tough Times

Bring Out Creative Types

Diagnosing and repairing cars can take on a quirky and sometimes creative turn during tough economic times!

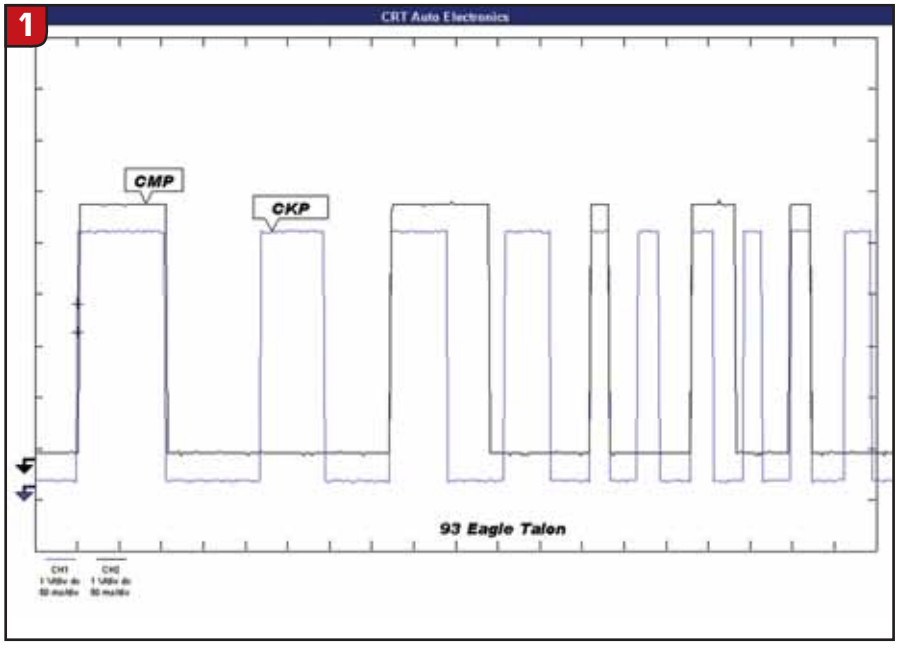
Tough economic times bring with them differing circumstances for different industries. For those of us in the independent automotive-service field, we may be seeing more and more repairs being attempted by less- and less-qualified technicians. It seems like there is an endless supply of advice to help automotive-service "newbies" figure out their car's technical woes, thereby saving them the time and trouble of taking a car to a "professional."

As our local mail-delivery guy once said, "If a mechanic can figure it out, surely I can do it." It's been my experience that there is a persistent absence of respect for the training, experience and equipment needed by today's technicians to be able to actually diagnose some of the problems encountered on modern automobiles.

Along with our normal percentage of problem jobs, we're also seeing those do-it-yourself (DIY) jobs that DIYers abandon after they have had no luck. These DIYers then turn to the mechanic working part time at home, and when that doesn't work they go to the cheapest shop they can find, and when that doesn't work their car finally arrives at our shop. As a result of economic times, we are seeing a new wave of problem cars with issues that we don't typically see.

Some common problems we've seen lately are multiple modules blown or not communicating because someone worked on the car with the key on and disconnected the battery, hooking and unhooking a battery charger. I've even seen a recent resurgence in the charging-system quick check of disconnecting the battery while the car is running to see if it is charging. By the time we get these cars in the shop, in many cases there are multiple problems and possible modules replaced that aren't programmed, loose-fitting connector pins etc. I was recently asked to look at just such a car by a friend from another shop, who got the car

continues page 20



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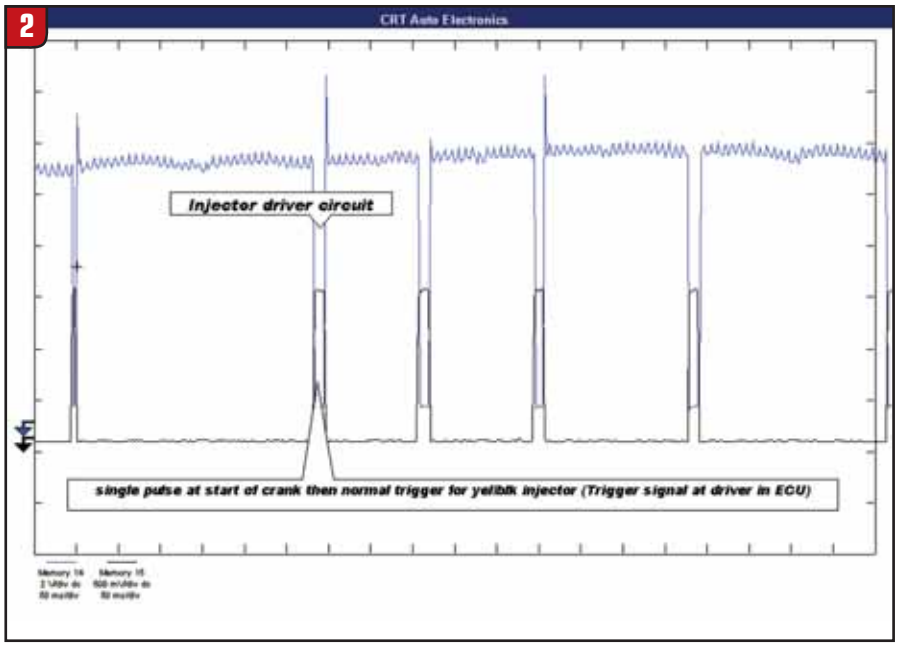
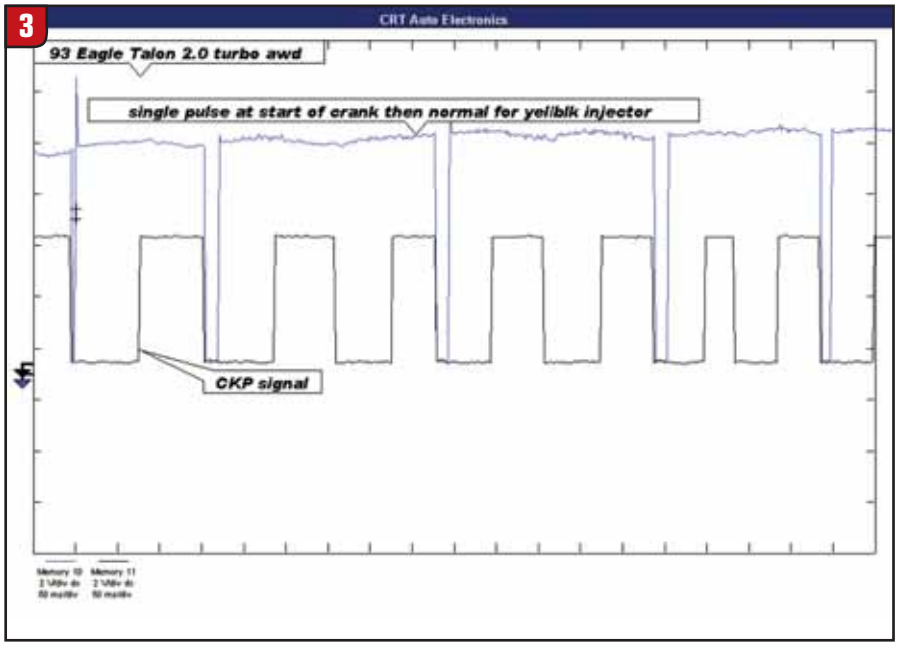
from the mechanic friend of the owner, who tried doing his own diagnostic work.

The car is a '93 Eagle Talon 2.0 turbo that will almost run. I did a few preliminary looks at power and grounds, then a code check, which turned up no ills so far. Two of the plugs looked slightly rich and two were lean. Compression and basics were good. I printed a pin chart of the electronic control unit (ECU) and started getting voltages and scope signals – beginning with the most basic – after verifying power and ground circuits. These would be the crank-sensor and cam-sensor signals. **Figure 1** shows those results captured on the scope.

I tried to find a known good signal in my database and couldn't. I then searched the iATN waveform library to no avail, which didn't surprise me in either case, since this car gets both of these signals from a Hall-effect distributor, which would be unaffected by cam/crank-phase relationship. I then checked the coil firing, which was good for all cylinders. The next check revealed that the injection system was working on only two cylinders. I used the current probe to verify that only two injectors (one group) were being triggered by the ECU. The voltage at the ECU for the injectors was present and the resistance check showed them to be correct. I thought possibly the ECU monitored the current level with a short test pulse and perhaps wouldn't allow injector current if it saw too rapid a current buildup, as happens on some later models, but this was not the case.

Figure 2 shows the waveform for the working injector group along with the trigger signal. I took the cover off the ECU to look for presence of the much-touted leaking capacitors that this particular generation of ECUs is known for. I then traced the trigger signal back to the chip on the board that triggers the driver for the injectors.





There is a single pulse at the beginning of the crank cycle, then the injectors begin pulsing regularly with the cam-position (CMP) signal on the working group. The ECU was supplying the first pulse on the non-working group and then nothing. My next shot was from the injector signal against the crankshaft (CKP) signal (**Figure 3**).

There was no pulse for the other injector group. Since this was a distributor system with both CMP/CKP signals present, all the power and grounds present, and injector circuits intact and resistances good, I made the call that the ECU must be at fault.

This was the dreaded diagnosis, since it was the most-expensive part in the "guess chain" and all the other parts had been tried. I found a rebuilt unit reasonable enough and ordered it. When the part arrived, I plugged it in and cranked the engine. Much to my dismay, it didn't start. I did a few

continues page 22

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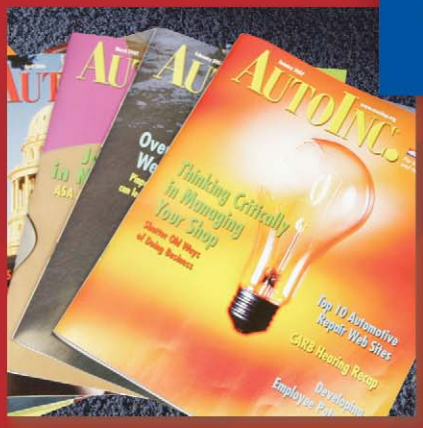

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initial checks and started to get that sinking feeling. The car was doing the same thing – firing only two injectors. I knew the odds of having a second ECU doing the same thing were not good. I started rethinking the possibilities.

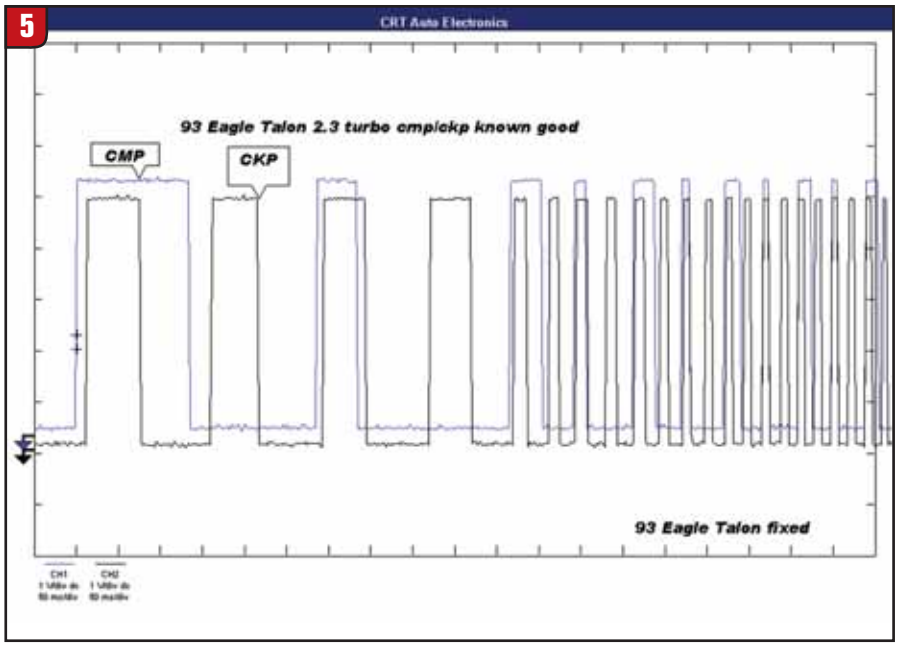
I decided that there was a possibility that the CMP/CKP correlation could have an adverse effect if, say, someone did not assemble the distributor correctly. I decided that it might be prudent to take a closer look into it. I pulled the cover off and took out the screw that held the trigger wheel. The trigger wheel is actually two separate wheels pinned together (**Figure 4**).

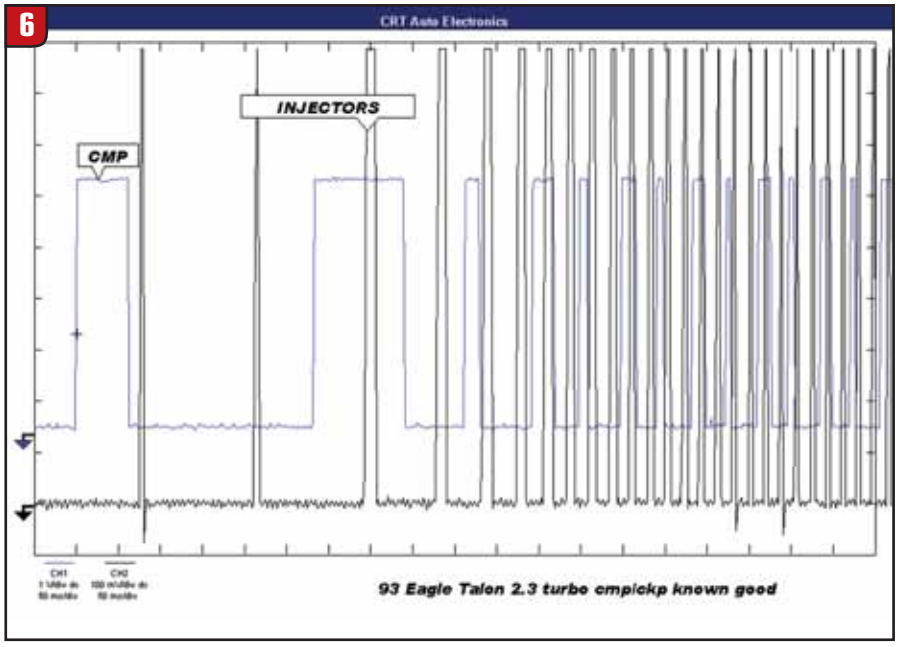
Turns out that the roll pin was not quite through the second wheel and it was slightly off from its original position. I moved it into the correct position and reassembled the distributor. The car fired right up as if it was just turned off. I was pleasantly surprised. I took another shot of the CMP/CKP-sensor signals for comparison and perhaps a reference. I doubt that another technician is likely to run across this problem, but who knows? The waveform is shown in **Figure 5** for the correct correlation between the CMP/CKP signals.

The difference is surprisingly slight, but it's enough to create a headache for a few people. I had to get one more shot of both groups of injectors working. **Figure 6** shows the CMP signal on Channel 1 with the injector current for both groups on Channel 2 as I went from cranking to running.

With the adventure that this car has been on, it's hard to say what the original problem was. I understand people trying to save money by doing things themselves in trying times, but most people who will try to tackle car problems wouldn't dream of taking apart their furnace or trying to put a belt on a washer or dryer. They call a furnace man or an appliance-repair guy.

Hopefully, someday automobiles will at least gain the respect that DIYers afford to their dishwasher. TD





Jeff Bach is the owner of CRT Auto Electronics, an ASA-member shop in Batavia, Ohio. For more information on this topic, contact Bach at (515) 732-3965. His e-mail address is jnabach@currentprobe.com and his Web site is www.currentprobe.com.

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Circle No. **8** on Reader Card

Technically Speaking

Author:
Wayne Colonna, ATSG
Transmission Digest
Technical Editor

Subject:
Problems caused by valve-sleeve and bore wear

Unit:
722.6/NAG1

Vehicle Applications:
Mercedes, Dodge, Jeep

Essential Reading:
- ☑ Rebuilder
- ☐ Shop Owner
- ☐ Center Manager
- ☑ Diagnostician
- ☐ R & R

722.6/NAG 1

TCC judder

With the large number of 722.6 transmissions being used in both Mercedes vehicles and in Dodge and Jeep vehicles, where it is called the NAG 1, it is virtually certain that this transmission will end up in your shop for repairs. It may be that your shop refuses to work on Mercedes but Dodge and Jeep vehicles are all too welcome. And so it is in this way that if you have not worked on this transmission yet, you will. And it is not a bad unit to work on.

One problem this transmission is known for is valve-sleeve and bore wear, such as the overlap-valve sleeves and the pressure-regulator-valve bore. Yet another bore-wear problem that is often overlooked causes TCC judder, as described by the folks across the pond in Europe. It is not quite what we might call

continues page 26

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Courtesy of European Exchange Inc. and Turbine Tech Converters

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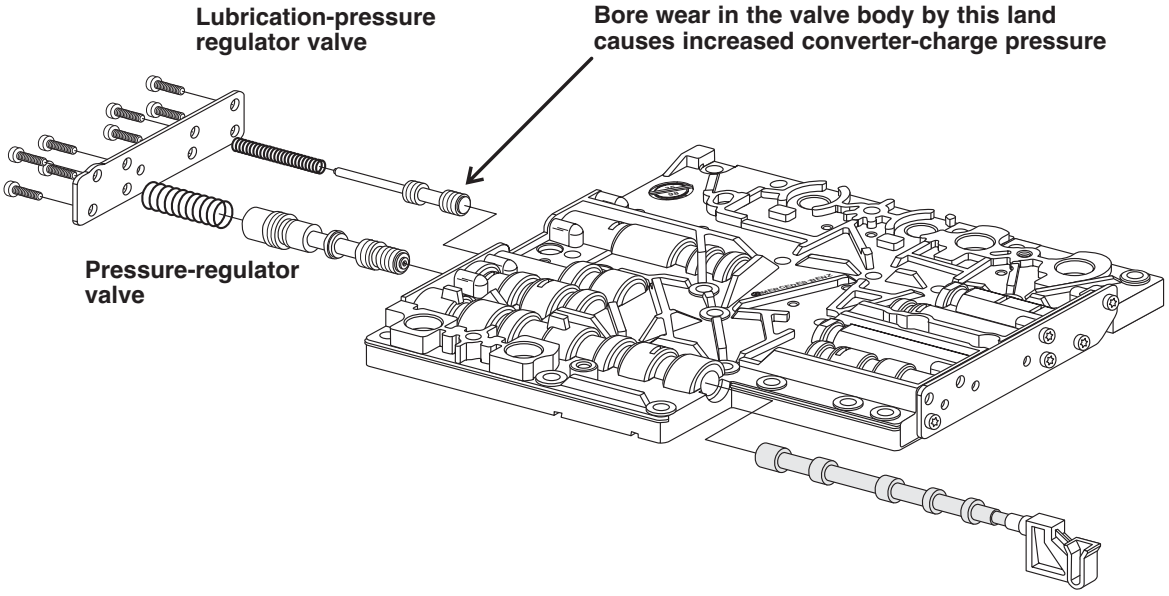

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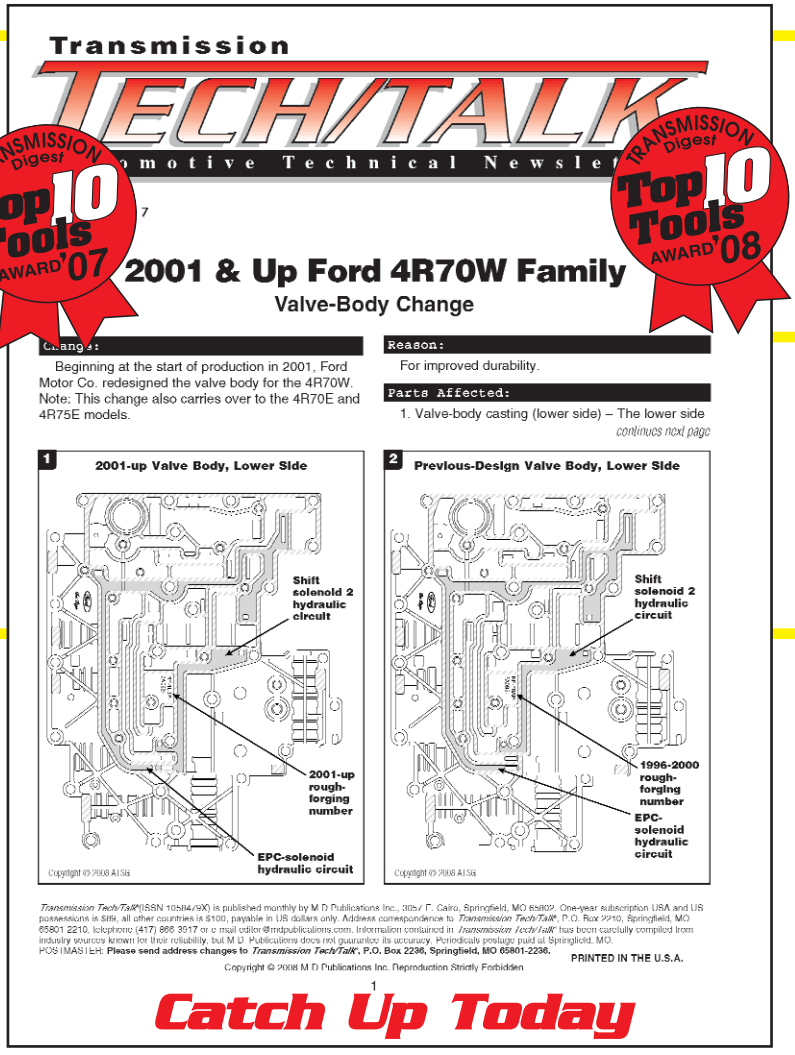

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Automotive Technical Newsletter

TRANSMISSION Digest Top 10 Tools AWARD'07

TRANSMISSION Digest Top 10 Tools AWARD'08

7

2001 & Up Ford 4R70W Family
Valve-Body Change

Change:

Beginning at the start of production in 2001, Ford Motor Co. redesigned the valve body for the 4R70W. Note: This change also carries over to the 4R70E and 4R75E models.

Reason:

For improved durability.

Parts Affected:

1. Valve-body casting (lower side) – The lower side

continues next page

1 2001-up Valve Body, Lower Side

2 Previous-Design Valve Body, Lower Side

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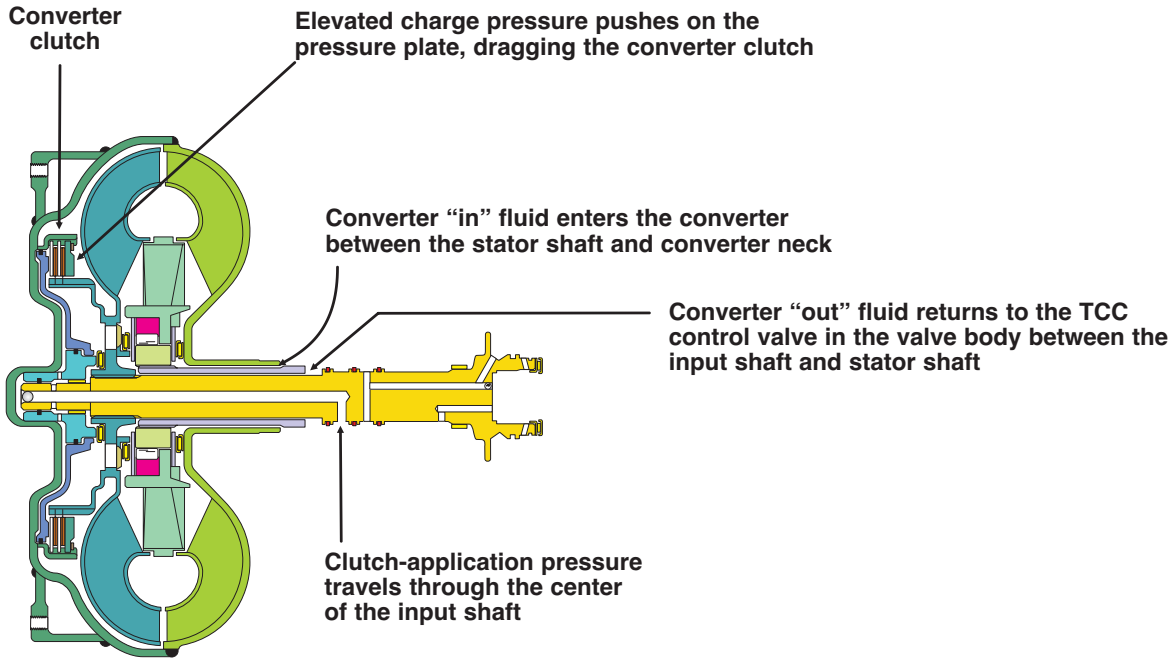

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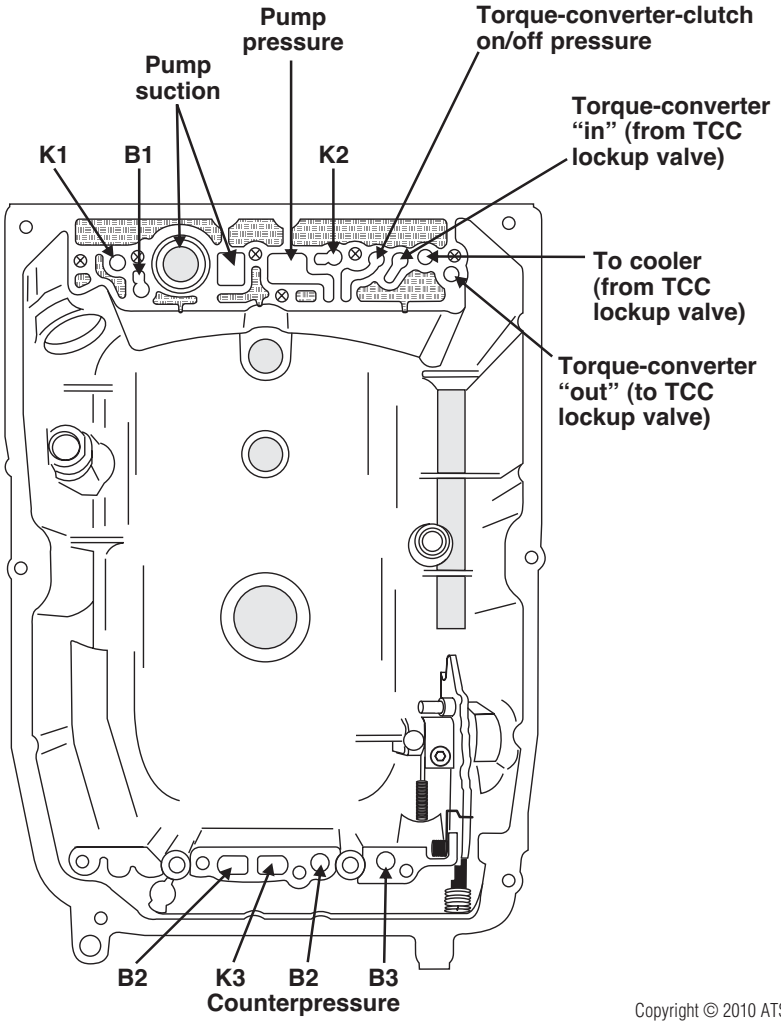

a chatter or shudder; it is more like a vibration. And depending on how good the main line-pressure system is, the problem could be described as a vibration followed by a very harsh engagement.

The valve we are talking about that is often overlooked is called the lubrication-pressure regulator valve (**Figure 1**). Why would you look at the lubrication valve for a TCC issue – and especially so if the transmission doesn't have a lubrication problem? But here is why: If you have never seen the inside of this converter you may not be aware that it actually has a clutch pack in it (**Figure 2**).

To turn the converter clutch on, pressure is supplied to the clutch drum through the center and out the tip of the input shaft. Take the pressure away and the clutch releases (**Figure 3**). This means that this style of converter has three circuits: (a) the circuit we just mentioned that applies and releases the clutch pack in the converter, (b) a converter-charge or "in" pressure and (c) converter "out" to-cooler pressure. It is the lubrication-pressure regulator valve that regulates the converter "in" pressure, which

becomes converter "out" pressure to the cooler (see identification of case and converter-housing passages in **figures 4 and 5**).

When the inboard land of this valve begins to wear the bore (**Figure 1**), unregulated line pressure is able to get into the converter-charge or "in" circuit, increasing the pressure inside the converter (**Figure 6**). The clutch-drum assembly inside the converter used for converter-clutch apply has a typical clutch pack, pressure plate and retaining snap ring (**Figure 2**). The pressure-plate end of this clutch-drum assembly is open to the converter-charge or "in" circuit (**Figure 7**). With elevated pressure inside the converter due to a worn lubrication-valve bore, this pressure pushes on the pressure plate, partially applying the converter clutch and causing this vibration complaint (**Figure 3**). When the converter clutch is commanded on, the vibration stops, and depending on the integrity of the main line-pressure circuit this application can be very abrupt. This also explains why there is not a lubrication problem when this bore wears, as it is not starving the circuit but rather increasing the pressure in that circuit.

Another complaint this worn-bore condition causes is a stall into drive when cold. The reason is that the lockup solenoid is pulsed at about 40% in Park or Neutral and is pulsed off with a slight "on" time overlap when drive is selected. With increased pressure inside the converter

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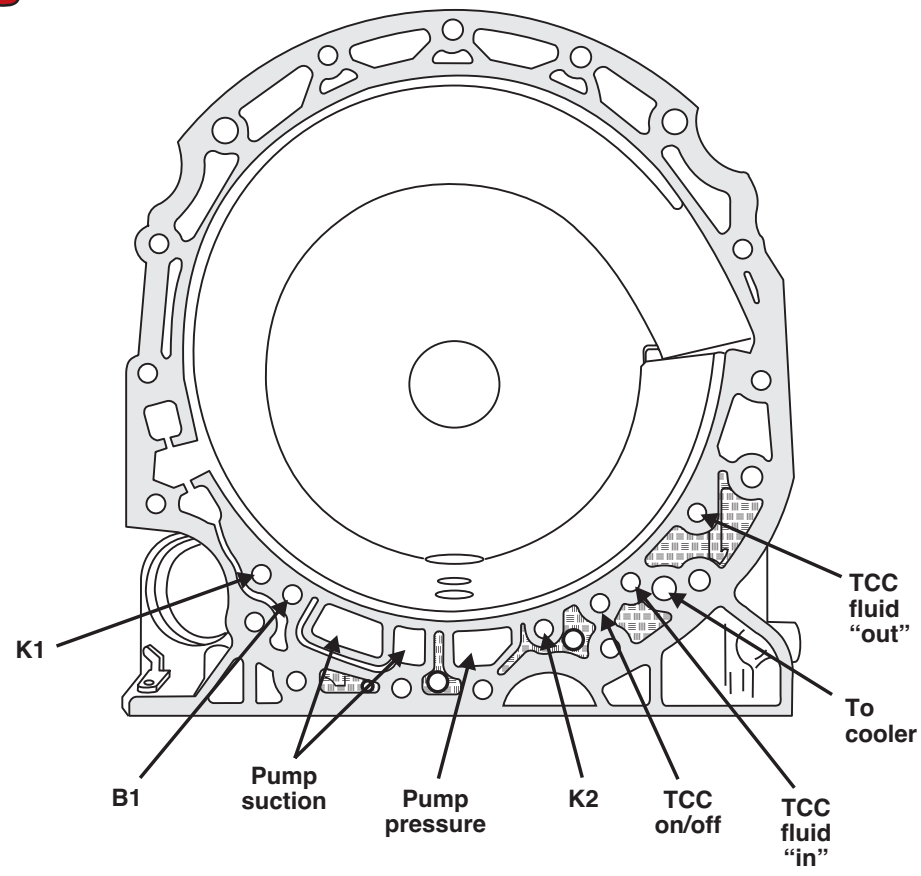

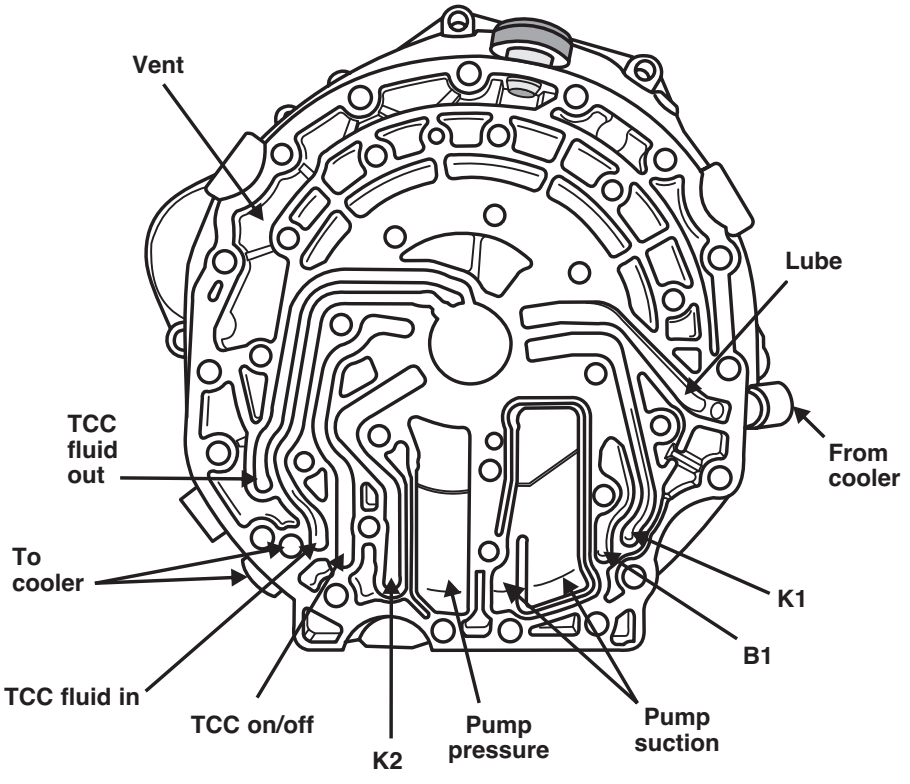

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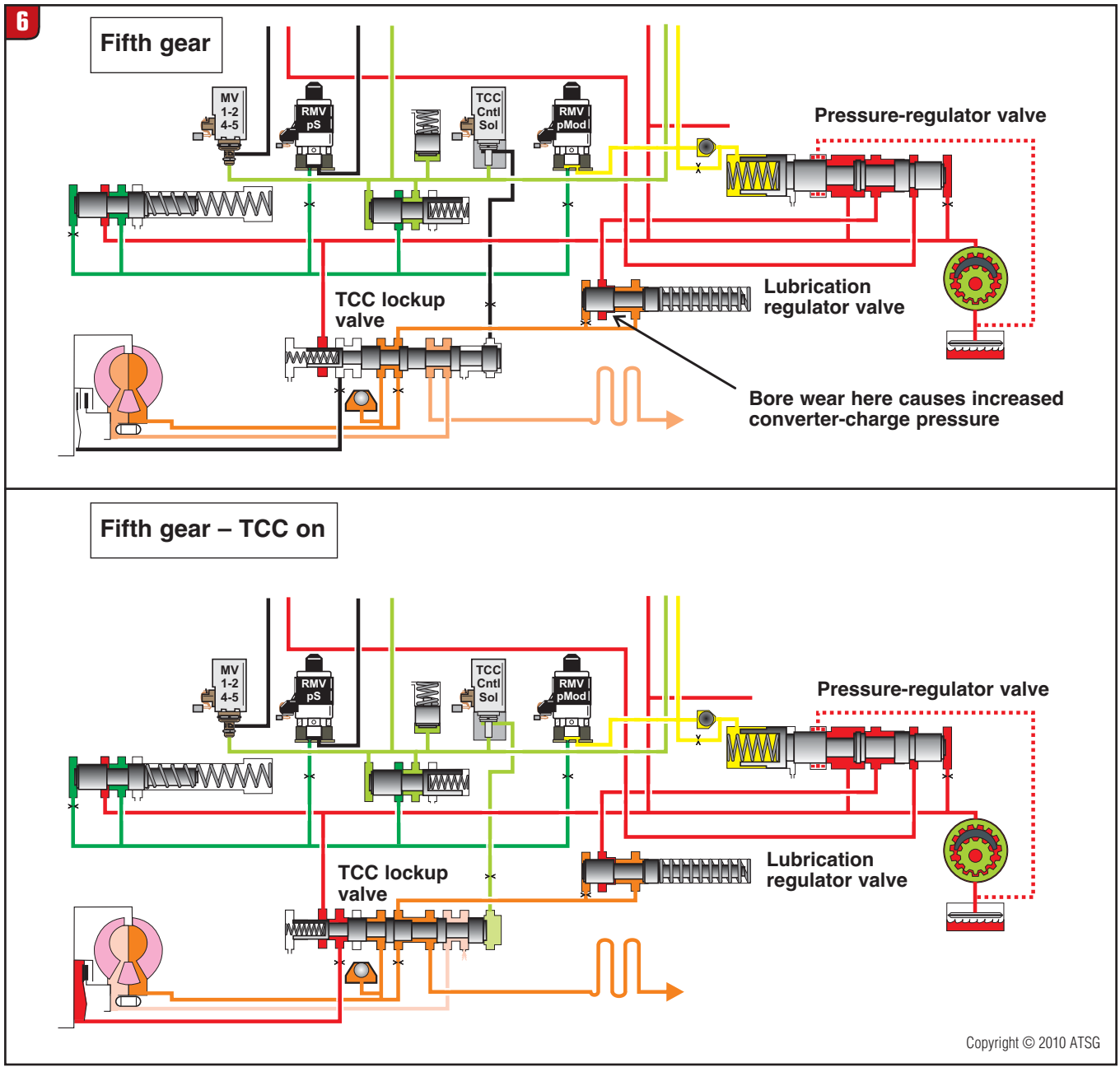


7 **Shown here are the turbine shell and hub. The hub fits into the TCC assembly mounted in the cover as shown in Figure 2. The turbine shell splines onto the input shaft so that when the clutch applies the shaft is driven at engine speed. This configuration also allows for both the clutch-pack assembly and converter-charge pressure to be in the same space. The pressure plate provides enough of a surface area that increased charge pressure in the converter can press the plate down onto the clutch-pack assembly, causing a slight application and producing a vibrating sensation.**

Courtesy of European Exchange Inc. and Turbine Tech Converters

pushing on the pressure-plate side of the clutch pack in combination with a slight amount of apply pressure in the piston side of the clutch pack, there is enough of an application of the clutch with cold oil to stall the engine. It is another bore that needs to be inspected, and word has it that a repair kit for this is on its way. TD

Many thanks to Nino Luongo from Beds Automatic Transmissions, England.

Up To Standards

Author:
Mike Weinberg,
Rockland
Standard Gear
Contributing Editor

Subject:
Using the correct lubricant in transmissions, differentials and transfer cases

Units:
Tremec T56 & 3650, BW 4473

Essential Reading:
- ☑ Rebuilder
- ☐ Shop Owner
- ☐ Center Manager
- ☑ Diagnostician
- ☐ R & R

Lubrication:

The squeaky wheel does not always get the grease

The massive, never-ending change in automotive technology has been making our daily routines more complicated. This has been going on for many years and will never stop. If you don't spend at least a couple of hours a day reading up on the new units and various fixes, you will rapidly be left behind.

One of the things often neglected is lubrication of the transmission, transfer case and differential. As with the automatic transmissions there are now dozens of specified lubricants that a professional shop must have available. What used to work no longer does, and putting the wrong lube into a late-model unit will result in spoiling a good rebuild. You must use the correct fluid for the unit you are working on. It sounds logical, but if you understand why, it will go a long way toward preventing shift complaints and outright failure under warranty due to incorrect lube fill.

In the past most manual transmissions used brass or bronze synchronizer rings for smooth, clash-free shifting. Those materials are still in use, but new technology has been developed using synchro rings that are paper lined, carbon fiber and sintered metal. For the ring to work correctly, it must be matched to a specific fluid fill.

At one time transfer cases were simply mechanical power dividers that were manually shifted. We now have a variety of transfer cases that are "intelligent," active, electronically controlled units that can operate without driver input. Many of these units are operated by an internal clutch pack, similar to those found in automatic transmissions. Just as in automatics, these clutches will slip or generate a lot of heat and chatter if the unit is not filled with the correct fluid.

The differentials in most vehicles also have changed in their manufacture and design. There are now rear ends equipped with locking carriers that can use clutches, viscous couplings or gear-driven differentials to limit wheel slip in various driving conditions. Again, the correct fluid here is critical to proper operation and long life.

There are different advances in gear technology in manufacture that have come into the market. There is the five-cut manufacturing process that has been around for a long time in the production of ring-and-pinion sets. Now we are seeing the two-cut Phoenix design, which results in different setups when a rear is being built. The five-cut process usually demands a backlash adjustment of 0.008-0.010 inch; the two-cut should be set to 0.004-0.006 inch for proper operation.

The different materials used in the limited-slip differentials demand a specific additive to have the correct coefficient of friction for the clutch to grab and release without slippage or chatter. You will find carbon fiber and sintered metal in many of these applications, and they all require the correct fluids. Typically a rear end will generate the most pressure in the gear train, as the overall ratios of the transmission and differential are very high in the lower gears. Overall ratio for each gear is achieved by multiplying the specific gear by the rear-end ratio. The accompanying chart will show you the overall ratio generated by a typical Corvette Z06 with a 3.73 rear-end gearing.

1st	2.97 X 3.73 = 11.08 overall ratio
2nd	2.07 X 3.73 = 7.72 overall ratio
3rd	1.43 X 3.73 = 5.33 overall ratio
4th	1.00 X 3.73 = 3.73 overall ratio
5th	0.80 X 3.73 = 2.98 overall ratio
6th	0.62 X 3.73 = 2.31 overall ratio

continues next page

It is easy to see from the numbers that there is a lot of pressure on the gears in mesh in the differential in the lower gears and that the pressure of the gears meshing together declines in the higher gears. Rear-end lubricants contain EP (extreme-pressure) additives to lessen the impact on the gear train. The American Petroleum Institute (API) has designated six classifications of gear lubes that are based on the amount of extreme-pressure additives in the oil.

GL1	Straight mineral gear oil
GL2	Very mild EP gear oil
GL3	Mild EP gear oil
GL4	Medium EP gear oil
GL5	High EP gear oil
GL6	Very high EP gear oil

Again, using the correct lube in the unit you are working on is the difference between success and comebacks.

For some reason there is a great mystique about lube oils. Perhaps it is not properly explained in the manuals, or the massive amount of advertising hype done by the lube producers adds to the confusion. Oil is oil; the devil is in the details of what is added to the oils to make them suitable for use in a specific application. Although the viscosity (essentially thickness) of the oil varies by application, it is the additive package in the oil that creates suitable performance for the intended use. You hear a lot about synthetic oils. What is the difference between synthetic and natural oil? Again, oil is oil; it all comes out of the ground.

When crude oil goes from the well to the refiner, it is catalytically "cracked," a process of heat and chemical reaction that separates the various components into usable form. Toluene, benzene, kerosene, gasoline and many other compounds are separated and sold off. The remaining petroleum then is made into lubricants of various types.

Forgive me for making a very complex process sound so simple, but for the purposes we need it will do. How the oil is cracked creates basic oil or synthetic oils. The difference in the synthetic process is that this form does not occur naturally. The cracking process for the synthetic versions rearranges the molecular chains in the oil into longer, stronger bonds. Now the refinery adds a package of compounds to the oil to make it work for a specific use. Friction modifiers, stabilizing agents, EP additives, cling-enhancing agents, detergents and anti-foaming agents are added at this point to create a product that will work correctly for the intended use.

What makes synthetic oils worth the extra cost to you is the fact that the longer, stronger molecular chains will tolerate more heat before the additive package breaks down. The oil will always survive, as we can see by recycling our waste oil. The additives are dead or badly damaged through heat and contamination, but the oil can be purified and reused, with a new group of additives added.

Manual transmissions, for the most part, are "splash lubricated." There are a few models, such as the Tremec late-model T56 line, that have internal oil pumps driven off the counter gear for pressurized lube. ZF has units that contain the same setup, but most units are simply lubricated by the gears splashing the oil around inside the transmission case.

In many designs there will be shields, troughs, scoops or other devices internal to the transmission to direct this oil to the parts not easily reached by the splashing lube. An instant recipe for disaster is to leave these items out during repairs.

If the gear splash is lubricating the unit, it is easy to see how failures occur because of towing or low oil levels. I am sure you have all seen the mess created by a tow-truck driver who tows a front-wheel-drive automatic with the front wheels on the ground. The pump is not providing pressurized lube, and by the time you see the planetaries they are melted. When a stick vehicle is being towed, the transmission is in neutral and the driveshaft is turning through the rear wheels. The driveshaft will turn the mainshaft, but the counter gear and input gear are stationary. How much splash does this generate for the lube? In low-oil conditions, transmission operating temperatures rise dramatically, additive packages die, and hard-to-reach places like the pilot bearing on the nose of the mainshaft in the input bearing go to the great junkyard in the sky.

Drivetrain lubricant levels are always a problem for the vehicle owner to check. Rarely are there dipsticks to check the levels, and most owners are lax on preventive maintenance and complain only when things are past the point of no return. The correct fluid level is a must for long life. Encourage your customers to come in for routine lube changes. It adds to your bottom line and protects the unit with fresh new lube that has the additive package intact.

Overfilling is just as bad as underfilling. Overfilled units will puke some oil out the vent, but you will have windage and overheating issues. Windage is the increased effort that rotating parts require to run through the extra oil. In the racing world, they run what is known as dry-sump motors. There is little or no oil in the engine oil pan. As the oil returns to the pan it is sucked out by a scavenge pump and returned to the lubrication inflow. This boosts horsepower and torque considerably, as the crankshaft never has to run through oil. Try running on the tide line at the beach, and then try running two feet into the water. Moving the

water will triple your effort to make forward progress.

Another side effect of windage from too much oil is a change in gear synchronization and hard or notchy shifting. When you dip the clutch to shift, the excess oil slows the gear train faster and changes the timing of the synchronization. A classic example of this is the Tremec 3650 transmission in the Ford Mustangs. The design has the fill plug too high in the case. If you "fill to spill" one of these units, it will not shift properly. The fix is to drain out oil until the level is $^1/_2$ inch below the fill plug.

Other designs have low-oil conditions built in. Early models of the BW 4473 transfer case have the oil fill plug too low in the case. The fix here is to fill until it runs out the fill-plug hole, tighten the plug and then add an additional quart through the speed-sensor hole. GM has a tech bulletin out on this problem, finally.

Always check all vents in units to make sure they are not plugged, broken or obstructed.

We make and sell a very high quality of lubricants for all the transmissions and transfer cases we sell. We did not do this to be in the oil business, but as self-defense. Because of the great number of special lubes now needed to operate profitably in these times, shipping the right oil with the unit prevents a lot of phone traffic that occurs after someone dumps the wrong lube in a unit to get the customer back on the road on a Friday afternoon.

If you do a steady business with a specific unit the proper lube should be in your inventory along with the other common repair parts. There are a number of lubrication guides available that will help you put the correct lube in any unit you are working on.

TD

It's Your Business

Author:
Terry Greenhut,
Transmission Digest
Business Editor

Subject:
Paying technicians on the basis of productivity

Essential Reading:
- ☐ Rebuilder
- ☑ Shop Owner
- ☐ Center Manager
- ☐ Diagnostician
- ☐ R & R

Productivity-Based Compensation

Many of our younger technicians are the product of trade schools that are sponsored in part by automobile manufacturers. As such they are exposed to the concept of becoming line mechanics in dealerships after they graduate. Many are promised the opportunity to make a really good living, but for a significant number that never materializes.

Dealerships pay on the basis of productivity. Although there is nothing wrong with that – and, in my estimation, everyone working almost anywhere should be paid on that basis – when a job is advertised to make candidates believe they can make a certain amount of money, the opportunity needs to actually exist. Many shops and dealerships that advertise for help quote the amount their highest earner makes to entice technicians. There may be only one technician in the entire shop earning that much. He or she would no doubt be an "A" technician given the opportunity and having the capability to flag 70 or more hours a week. Younger, less-experienced technicians are given the small jobs that don't allow them to pile up hours.

If technicians come out of trade school, heads full of promises, and go to work in an environment that doesn't pay as promised and isn't providing a reasonable chance for advancement, it will be difficult to get them to accept another job that pays on the same basis. They will be looking for some kind of a set salary or at least a guaranteed minimum.

I like the concept of paying on the basis of flat-rate hours flagged, but I also understand how people feel about security and the need to bring home a real paycheck. I know that if they can't crank out a decent living their minds won't be on their work and they will continually be looking for other positions, so any money invested in additional training will be wasted when these employees leave.

When I interviewed new prospective employees, one of my questions – to make sure what I was about to offer them was in the right ballpark – was, "How much do you have to take home in order to live?"

I learned early on that if an employee can't possibly survive on the amount he or she makes they can't stay. The problem is that when people are looking for a job they won't tell you what they have to make for fear you won't give them a tryout. They tend to accept almost any amount to get a foot in the door, hoping they will be recognized for their good work and offered an increase shortly after being hired. If that doesn't happen they have to go. Since going through the hiring process again in another month or two to replace those employees costs way too much in time, money and emotional stress, I figured it was better to find out up front what the minimum number really was and see whether I wanted to meet it.

If a prospect gave me an outrageously high number, one that was way out of sync with the job classification and/or the area, or if this person came off like a know-it-all prima donna, it would indicate that I shouldn't go too much further with the interview. Having had some of that type of employees in the past I knew that nothing good could come of it. If the number was something I could live with, I would continue. If the number was on the high end of the acceptable scale I would then ask: "What makes you feel you deserve that much? What can you do for me?" I would then let the prospect tell me exactly how he or she was going to make me enough money to justify the salary request.

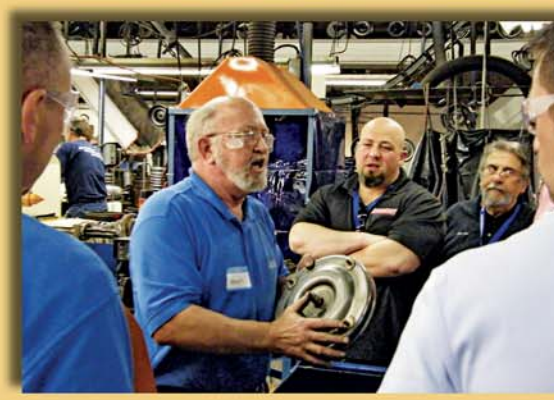
I tried several different methods of compensating technicians over the years, but the only one that has ever made sense and could be counted upon over the long term was and still is the "flat-rate-hour" method. It can be tweaked or modified somewhat to suit individual or group circumstances, but in all it makes far more sense than any other type of incentive program. That isn't to say that it is the only compensation a technician can receive. There can be incremental bonuses for reaching certain plateaus or additional spiffs for finding and/or selling supplementary repairs and services, but it is an excellent base and a plan that you don't have to keep changing.

continues page 34

Join us on Thursday morning, March 18, for a unique experience.

Thanks to Dacco for putting itself on display during Showpower '10. Buses pick us up in downtown Nashville for a 90-minute drive east through the Smokeys to Dacco's torque converter manufacturing facility in Cookeville, Tenn.

At a tremendously busy factory you'll see all aspects of the converter remanufacturing operation including teardown, machining, assembly, welding and testing. Tour group leaders will answer your questions. During the past several years, Dacco has applied cutting-edge manufacturing concepts to create a more efficient plant that will result in consistency and quality of the products.



Before we return to Nashville in time for all Thursday afternoon seminar sessions, our hosts at Dacco will treat us to lunch.

DACCO TRANSMISSION PARTS

SHOWPOWER NASHVILLE TRANSMISSION/UNDERCAR EXPO

There's a lot that I like about the "flat-rate" method, but mostly it's that the technicians set their own pay by the amount of work they produce, which means I never have to give anyone a raise just for being with the company a certain amount of time and I don't have to concern myself with how high their pay goes. In fact, the more they make on that basis the happier I am, because it just means that they are making me more.

It all sounds very easy, but there are control factors to be considered, such as: How much per flat-rate hour should you pay? What actions would allow a technician to get an increase in the hourly rate? At what point would any bonus money kick in? What shop rules would apply so that the technician has to act as a part of the team and not simply bury his or her head in their own work without a concern for other technicians or the shop in general? What would a technician's minimum pay be if there weren't enough work to allow for flagging a full week's worth of hours? Does the service adviser sell the proper number of hours for each job? Does he or she assign the right job to the proper technician? Are the normally replaced parts for any job preordered or in stock to enhance productivity?

The service adviser has a much more integral role in this type of pay process than if the technicians were salaried or on an hourly wage. He or she has to answer to not only the boss for the hours they sell but also to all the technicians. If the service adviser doesn't sell on the basis of the book time, adding any degree-of-difficulty time noted in the book or on account of the technician's experience with the hassles of a particular job, then he or she is cheating the shop and the technician. If the service adviser is scared of the customer and deducts time, thinking the customer wouldn't pay that much or can't afford it, everyone is likewise being cheated. Service advisers need to communicate well with technicians to ensure that the right amount of time is sold and that parts are ordered correctly. Nothing slows production more than having incorrect parts delivered, and it's especially silly when it could have been avoided by a 30-second conversation.

So how would a technician get a raise? That's the best part of the plan. Technicians receive increases in their hourly flag rate for performing certain actions that make them more valuable to their employers. The actual amount of money they make depends on how many hours they can flag, so any increase means only that they have an opportunity to make more if they maintain a good production level.

A raise in the hourly flag rate should be given when the technician can demonstrate mastery of a new skill that will make the shop more profitable. The transmission business easily lends itself to that scenario because there is a lot to be learned at all technical levels. For example, an installer can demonstrate better or faster ways to perform certain difficult installations and repairs or can increase diagnostic skill by attending and passing classes. A rebuilder can learn to do another type of transmission or two and become more skilled at diagnosing comebacks and "never-leaves." A diagnostician can demonstrate faster and more-accurate techniques for finding causes and cures. All technicians can take and pass ASE certification tests; that was one of my favorite things on which to base increases in flat-rate hour.

To get my guys to pass the certification tests I would bet them significant amounts of money that they couldn't, but I wouldn't set them up for failure. Instead, I would try to make them succeed by studying with them using old tests and any literature I could find. I wanted them to win for their benefit and mine as well.

Bonus levels can be set for the number of hours flagged. For example, a base amount can be used as the multiplier up to the first 40 hours, then a higher amount for hours between 40 and 60, and yet an even greater bonus amount for hours over 60.

Since this plan basically makes technicians think as owners who have to be responsible for productivity and doing the job right the first time, they have to be made responsible for their own comebacks, because you can't have technicians racing through jobs sloppily with no fear of recrimination. Owners will be responsible for providing technicians with good and reliable information systems and parts, for removing bottlenecks from the shop's activities, and for training service advisers to assign the proper job to the right technician on the basis of skill level and to price properly without fear.

All this taken into account, the "flat-rate-hour" pay method is simple, it tracks easily, it gives technicians a feeling of purpose, and it makes service advisers sharpen their skills. Looks like a win-win-win to me.

One caution: Check the labor laws in your state before initiating this type of program. There may be issues with employees working past 40 hours a week without being paid in the traditional method for overtime. TD

Dodge-to-Allison Conversion

Switch improves drivability, increases towing capacity

By Howard Johnson

Since 1989 Dodge has offered a diesel-engine option, the Cummins B series. This engine series originally was developed for agriculture and commercial trucking. Some of its great features were long life, economy of operation, simple design and the ease of modification to increase power output.

Transmission-repair shops have noticed that the stock transmission design has not always been able to handle the power of this engine. From the 727 Torqueflite to the electronically controlled 48RE, all these Chrysler transmission designs have their roots in the early 1960s. Chrysler has tried various upgrades for this style of transmission, but these efforts have been nearly futile to match the increased horsepower output of the engine. Engine-performance modifications that have been popular with owners of Dodge diesel trucks can easily offset Chrysler's attempts to improve transmission durability.

Some owners have expressed a desire for a transmission that's much more durable and has better gear ratios, including reverse. The Allison 1000 is such a transmission. One day I decided to install an Allison 1000 transmission in my own Dodge truck, so I sat down and put together a list of parts that would allow the installation to look as if it had been done at the factory.

The truck's major structure was not to be altered. This included no body lift, no floorboard cutting, no re-welding and no starter repositioning. Also, I wanted to be able to reuse the stock column shifter. Another item on my list was being able to read and troubleshoot any transmission codes by using the Allison DOC program.

How could I accomplish this? First, I needed an Allison transmission, and through exhaustive search-

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This photo from the driver side of the truck shows the room for fitting the Allison transmission.

Even with a 5-inch exhaust system, there's room for the Allison unit, as this view from the rear shows.

A view of the installation from the passenger side

ing I found a suitable unit: a Gen 4, a six-speed-capable transmission. Its bellhousing was similar to that of a seven-bolt Chevy 4L60-E.

One drawback to this direct-mount design is that it created a lot of space between the torque converter and flywheel. I did some checking and found that the No. 3 SAE diesel bellhousing offered a mounting flange with a $2^{5}/_{8}$-inch difference from the direct-mount Chevy type in where the torque converter sits. This would put the transmission farther from the floorboard and firewall, providing the needed space so that a body lift wouldn't be necessary.

Unlike the No. 3 SAE bellhousing, some of the required parts were unavailable and would have to be made. These included a spacer between the engine and bellhousing, a pilot bushing and a converter drive ring. The No. 3 SAE bellhousing has a mounting on the side providing a place to install a "Z" support, which also had to be fabricated, for the shifter shaft.

The truck I selected for the conversion is two-wheel-drive, so there was no need for a transfer-case attachment. Most of the Dodge trucks on the road are four-wheel-drive, and a lot of engineering time has been spent in making Allison-to-Dodge transfer-case adapters and an Allison transmission output shaft splined to accept a Dodge transfer case.

Another area that needed some engineering thought was the cooling system. Allison uses $^{5}/_{8}$-inch steel tubing to feed a cooler, so I had to find a cooler with at least $^{1}/_{2}$-inch pipe fittings. The search resulted in finding an industry number H7B cooler. The biggest problem with this cooler was its size, which limited where it could be installed. With the limited amount of grill space in a Dodge truck, the only place I found room to mount the cooler was in front of the fuel tank. That area has a reduced amount of air flow, requiring attachment of an electric fan to the cooler and a thermostatic control for on-demand cooling.

One of the most-puzzling parts of the conversion was the wiring – in other words, how to make the Allison shift. The Allison 1000 is completely electronically controlled; poring over books studying wiring schematics can consume a lot of time. With help from the Allison dealer, I obtained wiring diagrams showing wire colors and terminal-to-terminal numbering.

One approach to avoid is trying to reuse wiring and plugs from a wrecked donor Chevy truck. This may be tempting, but these trucks use GM LAN diagnostic protocols along with GM LAN wire colors. The Allison that is going to be installed in a Dodge truck will not have those types of communication. It is best to use commercial-truck plugs, wiring colors and computer controls.

In 2006 Allison did some minor changes to the 1000, some of which greatly simplified the wiring: The range switch was moved inside the pan, the transmis-

continues page 46

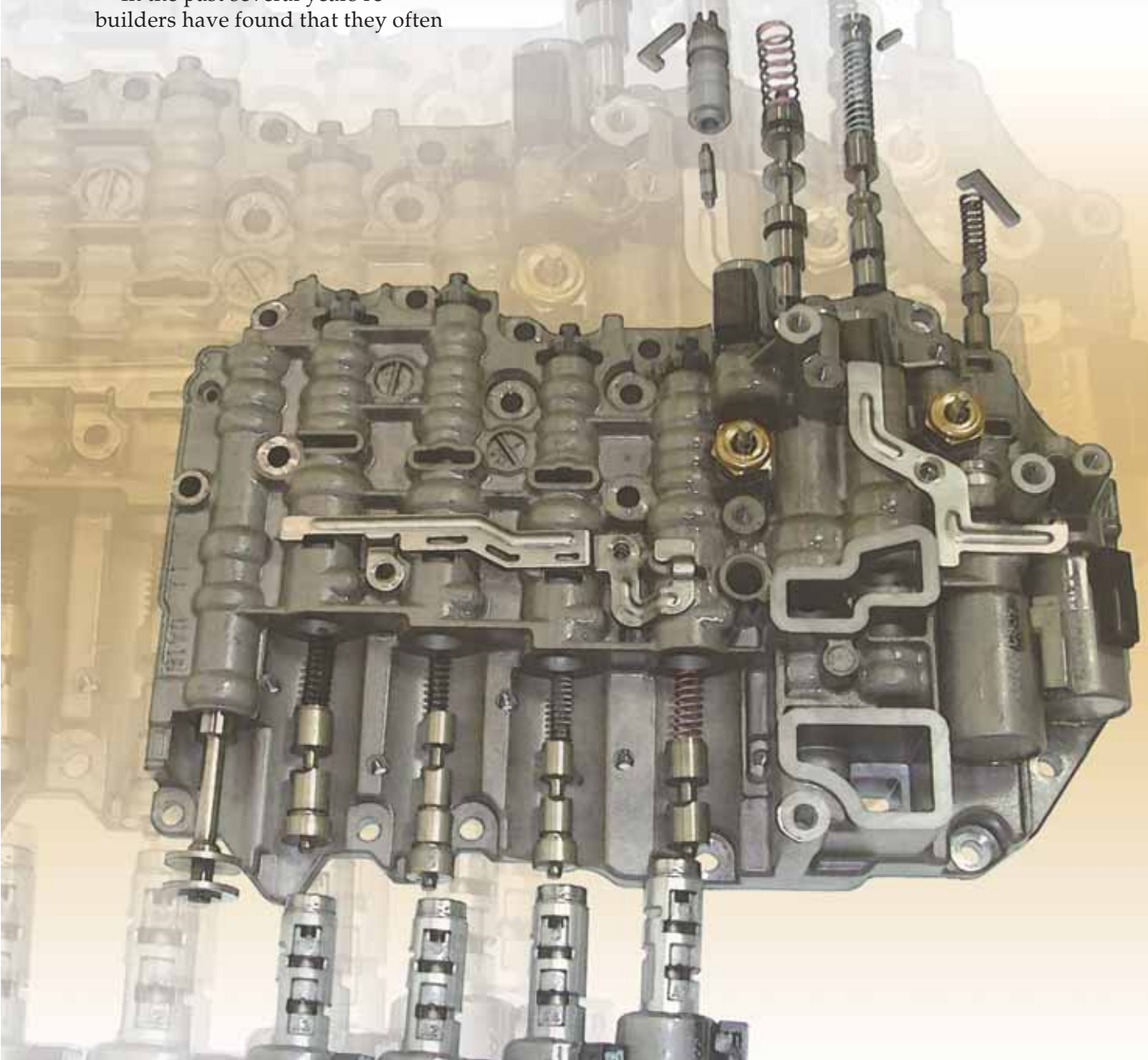
Valve Bodies

The Most-Challenging Issue to Rebuilders

As complex as modern automatics have become in general, it is still the case that the most-challenging issue to rebuilders is the repair and testing of the valve body. These subassemblies are equivalent to the heart of the system and must serve as a link between the desired shift functions and the vehicle's digital control-module brain.

In the past several years rebuilders have found that they often can be more profitable from a time versus expense standpoint by buying a remanufactured valve body rather than trying to rebuild one on the bench. At the same time many wear problems have been addressed by a handful of aftermarket suppliers that research valve-body issues and develop parts to address such issues.

Bob Warnke, vice president of technical development for Sonnax, contributes recently garnered knowledge beginning on the next page. Also in this section you'll find a listing of companies that supply remanufactured valve bodies, valve-body cores, valve-body components, testing equipment, specialty tools and assembly aids.



AW Six-Speed

Valve-Body Diagnosis

By Bob Warnke

Here in the northern Midwest, we are experiencing the determined hammering of pileated woodpeckers. If you are not familiar with what a pileated woodpecker looks like, you may recall the "Woody the Woodpecker" cartoon on TV back in the day. For animation, add the audio effects of an air chisel on a metal bench!

Once male and female birds have paired, they will fiercely protect their territory from competitors, even if it is only their own reflection in windows or vehicle mirrors. And they won't leave until they peck hard enough to break the pane! Once the competitive threat has disappeared, they move on to discover another bird in another window or mirror. For property owners, one solution is to cover the window with paper so the birds can't see their reflection.

You may be asking, 'What does a woodpecker have in common with an AW 6 transmission?' Every window is an opportunity for a woodpecker, every AW 6 an opportunity for service. You need paper to resolve the pileated problem, and you will need paper to diagnose the AW 6. Forgoing the paper when handling either problem can result in wasted time and money.

Chances are you may already have some experience with the AW 55-50. A good way to begin understanding the AW 6 is to compare the main operating difference between it and the AW 55-50.

The AW 55-50 uses three linear solenoids to control clutch pressure (SLS), line rise (SLT) and TCC (SLU). The SLT and SLS solenoids are multipurpose and depend upon the valve position of five on-off shift solenoids.

In the AW 6 each clutch has a designated linear solenoid, reacting on a clutch-control valve. The control valves regulate each clutch circuit independently. The two on-off solenoids are cycled at the beginning of each upshift or downshift from third to sixth to interrupt oil flow to the clutch. Controller-area-network (CAN) control, adaptive learning, hill hold, forward/reverse engagement and converter-clutch operation are all more refined in the AW 6 than they were in the 55-50.

Aisin has designed the hydraulics so that one TCM program can be used in multiple vehicles. This reduces development time for AW. It also benefits us. Although transmission and valve-body parts do not interchange, the diagnostic routine explained here will apply to all the AW6 FWD units.

Transmission identification

TF-60SN/09G in VW: Oil pan is on the bottom.

TF-81SC in Ford/Mazda: Wide oil pan facing radiator; longer case.

TF-80SC/AF-40 in Volvo/PSA/Saab: Narrow, deeper oil pan facing radiator; shorter case.

Use the power-flow chart (**Figure 1**) and the valve-

1 Solenoid-Power Flow — AW6 FWD

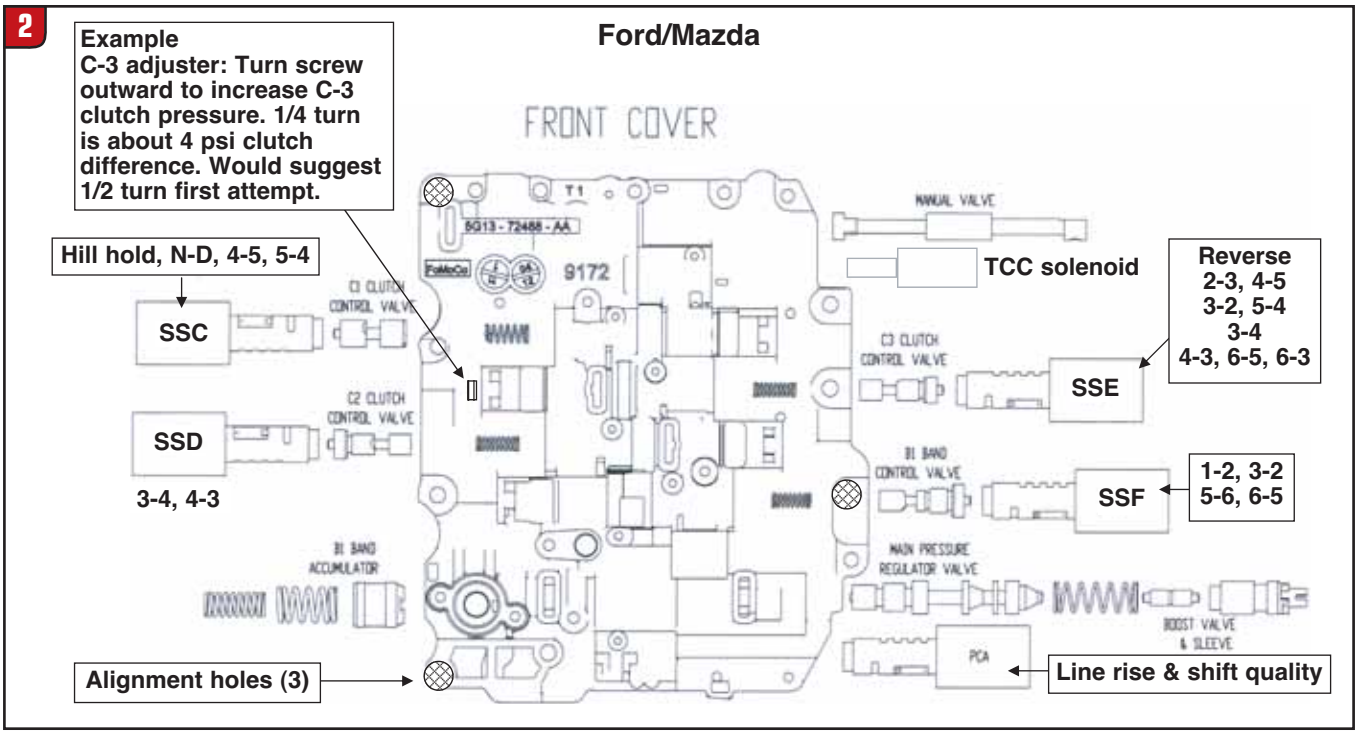
Range		Solenoid						Clutch			Brake		O.W.C.
Ford/Volvo/PSA		SSC SLC1	SSD SLC2	SSE SLC3	SSF SLB1	SSA S1	SSB S2	C-1	C-2	C-3	B-1 Band	B-2 Clutch	F-1
VW		N92#5	N282#9	N90#3	N283#10	N88	N89	K-1	K-2	K-3	B-1 Clutch	B-2 Clutch	F-1
P		X	X	X	X								
R		X	X		X					X		X	
N		X	X	X	X								
Neutral control		X			X			X			X		X
D S	1st		X	X	X	Z	Z	X				Z	X
	2nd		X	X				X			X		
	3rd		X		X	Cy	Cy	X		X			
	4th			X	X	Cy	Cy	X	X				
	5th	X			X	Cy	Cy		X	X			
	6th	X		X		Cy	Cy		X		X		
		SSC & SSE solenoids have residual clutch pressure feeding back to the opposing clutch-control valve											

X=On =Off Z=On during engine braking Cy=Cycled during upshift/downshift

Solenoid for Clutch	C-1	C-2	C-3	B-1	TCC applies after 2-3 shift, modulated slip during upshift/downshift.	
Resistance – Ohms	4.0-8.0	4.0-8.0	4.0-8.0	4.0-8.0	10-16	10-16
Solenoid Flow	N.O.	N.O.	N.O.	N.O.	N.C.	N.C.

Linear solenoids operate at 300Hz

N91/TCC/SLU is N.C.; N93/EPC/SLT is N.O.



body illustrations (**figures 2 and 3**) to begin diagnostics.

One of the focal points for diagnostics should be monitoring C-2/N282 and C-3/N90 solenoid activity. Common complaints with this valve body include 2-3 flare, loss of or slip on 3-4, and harsh coast 5-3 or 4-3 downshifts. Each linear solenoid reacts on a clutch-control valve, which then affects clutch application and release. Having one solenoid for each clutch allows for "skip-shift" upshifts and downshifts. Without a scan tool or pressure gauge, identifying which solenoid, clutch or clutch-control valve is being activated becomes very difficult.

As the torque-converter clutch generally applies after the 2-3 shifts, TCC application can easily be confused with a 3-4 shift. The TCM modulates TCC slip or releases the converter briefly during upshifts and downshifts. The TCM can use lockup to control engine braking in certain applications.

Test drive

To begin, you will need the power-flow chart to help identify which solenoid or clutch valve requires

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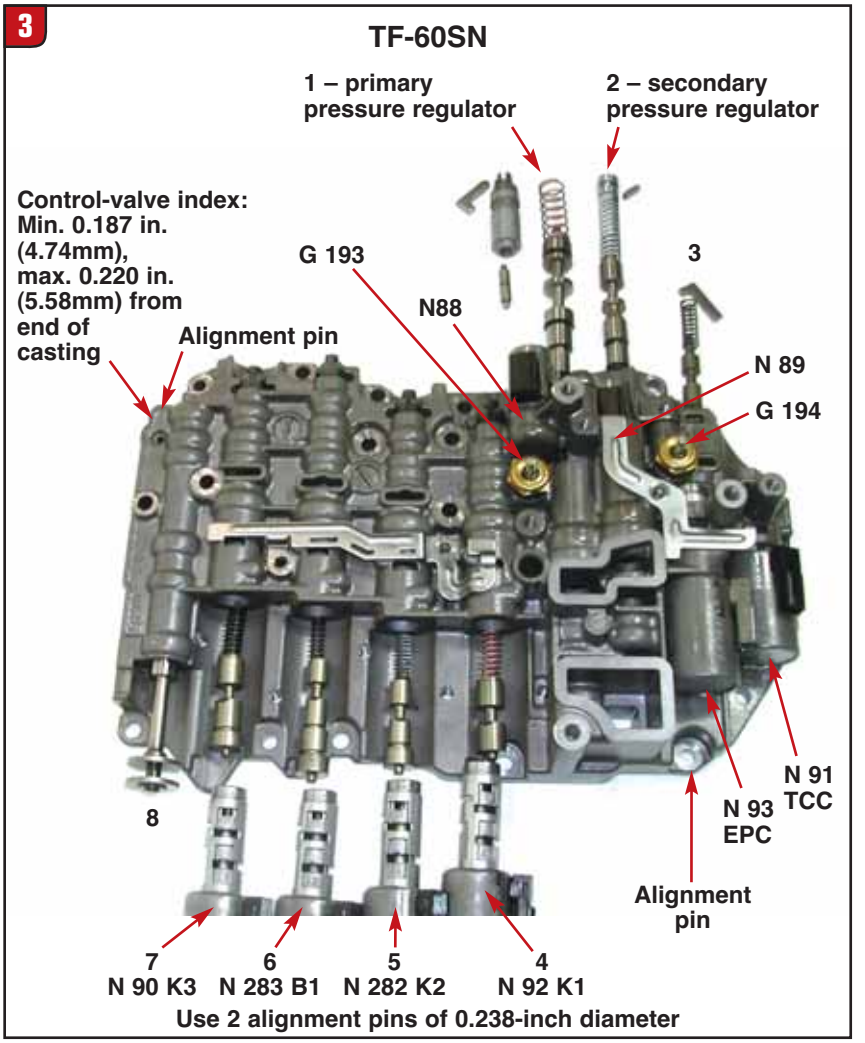
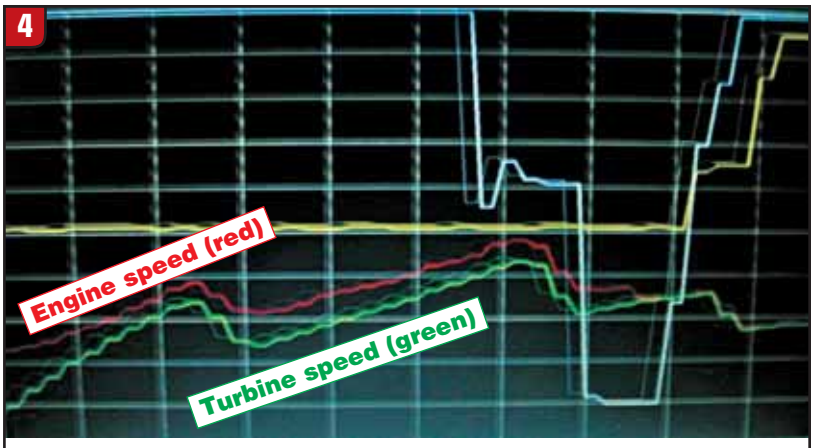




AW 6 Input Speeds

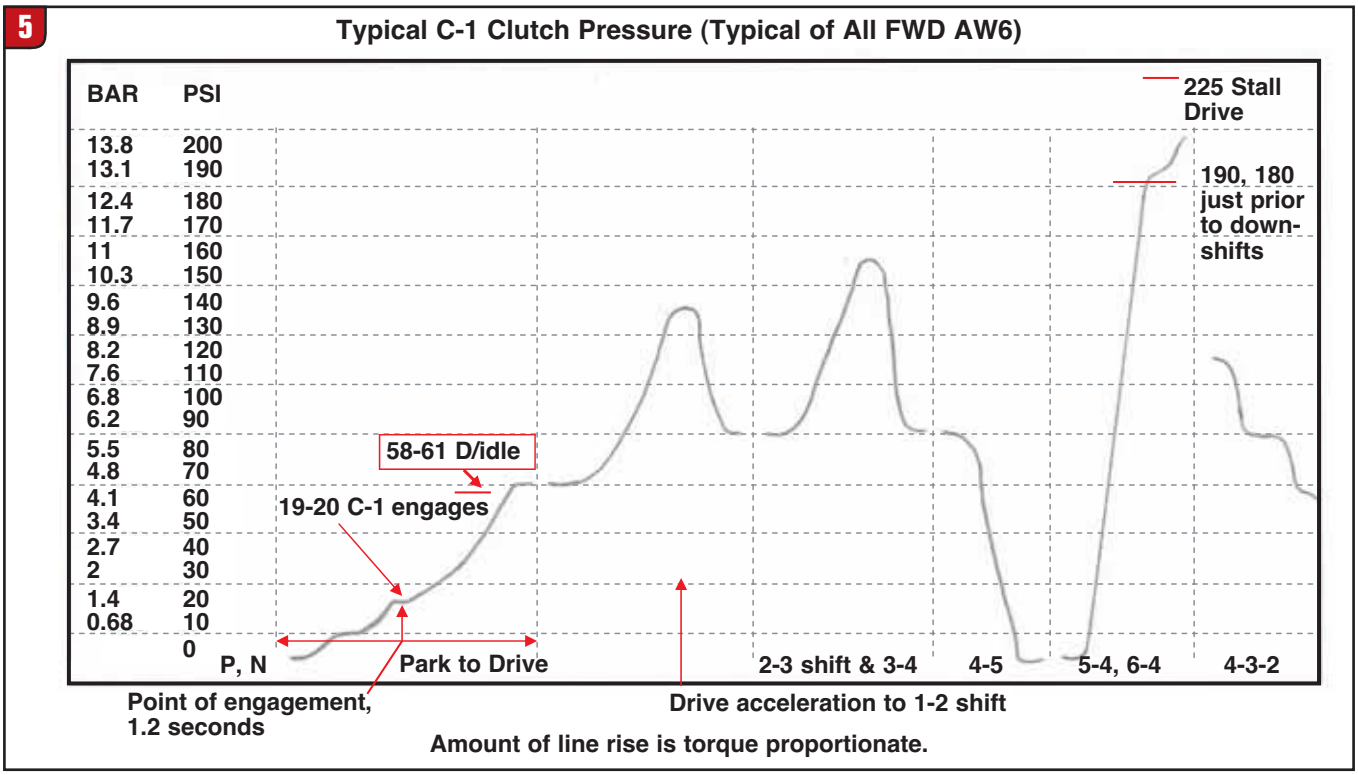
attention. A scan tool with graphing capability is the second of three requirements for that drive. The third requirement is unusual: If possible, have the vehicle owner drive and duplicate the concern, or at least provide a detailed description of how to duplicate the problem. Because this is a six-speed with skip-shift capability and a modulated converter clutch, duplicating and isolating the driver's complaint can be very difficult. Operator driving habits, TCM adaptability and terrain will all greatly affect the shift strategy.

I would suggest graphing in real time, monitoring engine speed and turbine speed. When shift quality is smooth and correct, turbine speed will parallel engine speed. With a flare/neutral condition, the engine speed spikes up. With a bind or bumpy shift caused by an overlap issue, the turbine speed will dip at the beginning of the shift. Generally one shift will have the problem, so you could compare a good rpm ramp with a poor rpm ramp.

Comparing two rpm inputs will identify each shift, as well as TCC full application/zero slip or partial modulation. The test drive should identify the complaint as being related to a specific clutch or to all shifts. If only one clutch is involved, focus on the linear solenoid and clutch-control valve that exhaust and charge that clutch. The AW6 input-speed graph (**Figure 4**) shows engine speed in red and turbine speed in green. Two shifts have been captured in this graph, showing a compatible ramping of the two signals throughout.

Pressure testing

Figure 5 shows typical C-1 clutch pressure. With harsh upshifts and downshifts, it is common to have elevated line pressure, which can be caused by a worn main pressure-regulator bore or PCA solenoid. To isolate this, tap into C/K-1 pressure, clear the codes and monitor N93/PCA amperage. With elevated line pressure, engagements become harsh and downshifts bumpy, and the 2-3 develops a flare under light ac-



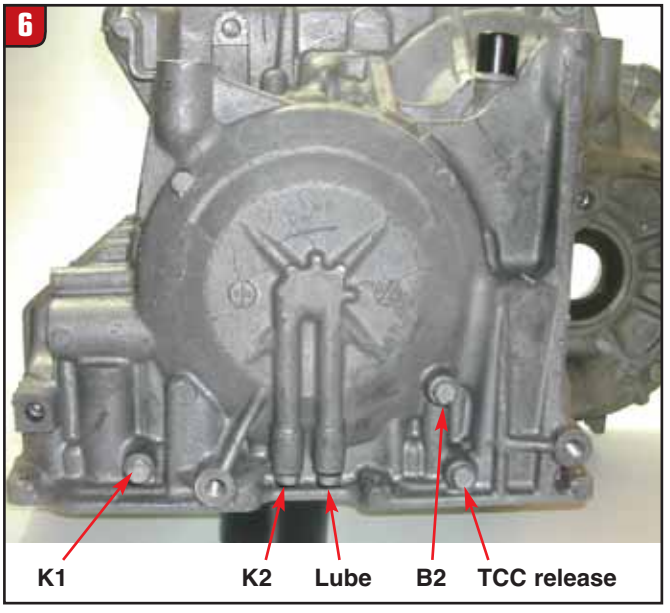
celeration. Elevated line pressure may not set or be caused by codes.

With the complaint of harsh shifts from 3 to 6 and 6 to 3, and C/K-1 pressure has not been elevated, you should tap TCC release (**Figure 6**). As mentioned, the TCM strategy brings the converter clutch on directly after the 2-3 shift. It will go to full application at light load. If you are graphing engine and turbine speed, lines should be overlaid at full application. TCC will be modulated off to disconnect the turbine shaft during subsequent upshifts and downshifts. If this control is not evident on your graph and release-pressure test, inspect the TCC control bore (**Figure 7**) for wear. The scan tool will indicate an amperage change, but the TCC release pressure will not be affected.

If the vehicle is driven in this condition for too long, the converter lining can be damaged.

Clutch-circuit testing

Transmission circuits can be tested in the vehicle as explained earlier or with the valve body removed. For a wet air test (WAT), prime the circuit with ATF, then follow by applying 40-60 psi of air. The familiar "dull thud" of a piston stroke confirms a good circuit. During the WAT, if the pressure drops and the clutch does not apply, or vents, you have identified a leak. On the 09G, for example, if the K-2 piston does not stroke or fluid exhausts from another port, the K-2 case sleeve may have rotated.



Valve-body inspection

If you determine that the valve body is at fault, or you are inspecting a valve-body core for future use, inspect the bores mentioned previously. Exploded view, vacuum-testing locations for each bore, and relief and spring identification are available at the Sonnax Web site, www.sonnax.com.

As mentioned, the TCC control tends to wear first, then solenoid modulators, followed by K-2/K-3 clutch control and then main or secondary regulator valves. If your test drive indicated a harsh shift in one gear and line pressure is good, focus on the specific clutch-control valve identified in the power-flow chart. Bore wear in this type of valve body is similar in appearance to that found in AW 55-50 or other units. Wear appears as a polished half-moon area, typically on the loaded side of the bore and at the ends of the valve travel. The valves themselves rarely have witness marks or evidence of a problem.

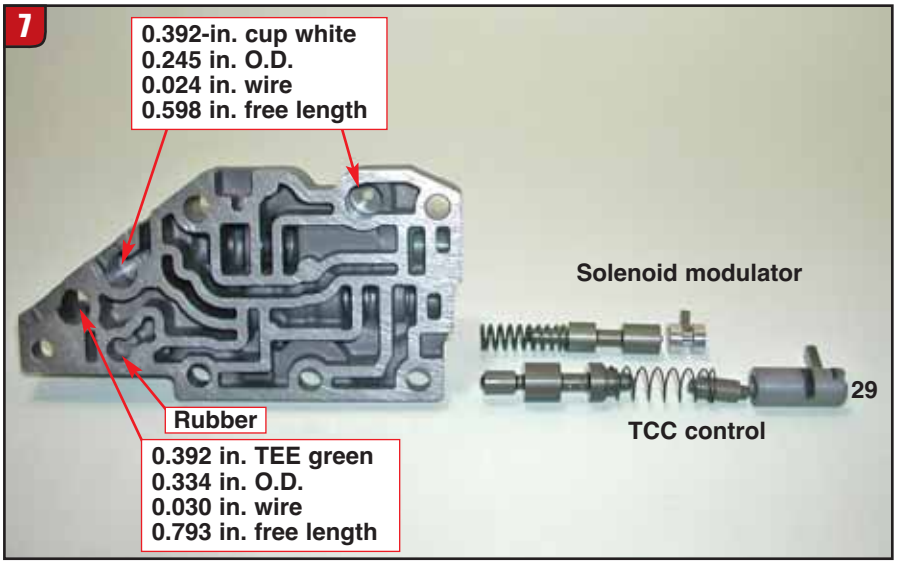
Diagnosis and the pileated problem

At this point you should realize that this transmission offers a large window of opportunity. The fact is that paper can help you isolate a problem in the AW 6; being hasty in your evaluation could cost money by unnecessary transmission removal and misdiagnosis.

For those of us with a pileated woodpecker breaking windows, we should remember the following:

Cover the windows with paper for at least two weeks, allowing time for the birds to find another territory. Taking the paper down too early will result in the woodpecker coming back to finish the job. This results in time and money to repair damage.

To examine the valve bodies, their vacuum-test locations and other problems refer to www.sonnax.com. TD



Bob Warnke is vice president of technical development at Sonnax.

Valve-Body Suppliers

01 Manufacturer of Valve Body Test Equipment
02 OE Manufacturer of Valve Body Components
03 Manufacturer of Aftermarket Valve Body Components
04 Distributor of OE Valve Body Components
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‡Allomatic Products Co., Street: 609 E Chaney St, Mail: PO Box 267, Sullivan, IN 47882-0267, PH:812-268-0322, TF:800-568-0330, FX:812-268-0417, WEB: www.allomatic.com, apcsales@allomatic.com
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‡Alto Products Corp., Mail: 1 Alto Way, Atmore, AL 36502-1018, PH:251-368-7777, FX:251-368-7774, WEB: www.altousa.com, sales@altousa.com
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ATI Performance Products Inc., Mail: 6747 Whitestone Rd, Baltimore, MD 21207-4103, PH:410-298-4343, TF:877-298-5031, FX:410-298-3579, WEB: www.atiracing.com, info@atiracing.com
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Automotive Wholesalers Inc., Mail: 9345 Penn Ave S, Bloomington, MN 55431-2320, PH:952-884-2336, TF:800-231-3011, WEB: www.uslink.net/~jurkovsj/index.htm, awi@tds.net
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Dan Maddox Transmission Parts, Mail: 1532 Reeves St, Dothan, AL 36303-2842, PH:334-794-6416, TF:888-762-3369, FX:334-794-6027, transmaddox@peoplepc.com
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FB Performance, Mail: 85 Cleveland Ave, Bay Shore, NY 11706-1228, PH:631-242-0008, TF:800-769-1118, FX:631-243-3054, WEB: www.fbperformance.com, fbp@fbperformance.com
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JP Transmission Salvage Inc., Mail: 436 Thorne St, Wilmer, TX 75172-1232, PH:972-225-9586, TF:800-443-8135, FX:972-525-3049, john@jptransmission.com
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Midwest Hard Parts, Mail: 4930 Highway 44, Hamlin, IA 50117-7509, PH:712-563-2313, TF:877-799-4783, FX:712-563-2514, WEB: kathy.mhpi@hotmail.com, midwesthard-parts@lycos.com
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Midwest Performance Converter, Mail: 4225 Hiawatha Ave, Minneapolis, MN 55406-3329, PH:612-724-3295, TF:800-262-2063, FX:612-724-3314, scott@midwestconverter.com
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Mustang Advanced Engineering, Mail: 2300 Pinnacle Pkwy, Twinsburg, OH 44087-2368, PH:330-963-5400, TF:888-468-7826, FX:330-425-3310, WEB: www.mustangdyne.com, dave@mustangdyne.com
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RatioTek, Mail: 15902A Halliburton Rd # 272, Hacienda Heights, CA 91745-3505, PH:626-968-2754, FX:256-961-8563, WEB: www.ratiotek.com, info@ratiotek.com
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Superior Transmission Parts Inc., Mail: 3770 Hartsfield Rd, Tallahassee, FL 32303-1121, PH:850-574-2369, TF:800-451-3115, FX:850-575-9097, WEB: www.superior-transmis-sion.com, superiortransmission@comcast.net
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‡TPS Transmission Parts, Street: 1713 Milam, Texarkana, TX 75505, Mail: PO Box 7589, Texarkana, TX 75505-7589, PH:903-792-1354, TF:800-527-8782, FX:903-792-1052, WEB: www.tpsautoparts.com, sales@tpsautoparts.com
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Trans-Tool, Mail: 110 Connelly St, San Antonio, TX 78203-1706, PH:210-225-6745, TF:800-531-5978, FX:210-225-2114, WEB: www.atec-trans-tool.com, sales@atec-trans-tool.com
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‡Whatever It Takes Inc.(WIT), Street: 4282 E Blue Lick Rd, Louisville, KY 40229, Mail: PO Box 547, Hillview, KY 40129-0547, PH:502-955-6035, TF:800-940-0197, FX:502-955-6077, WEB: www.wittrans.com, sales@wittrans.com
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TD

continued from page 36
sion connector increased from 20 to 24 pins, and the main transmission control went from a red-and-gray two-plug type to a single 80-pin controller. This 80-pin controller has four diagnostic outputs. The most-common commercial-truck output communication is known as J1939 CAN bus. J1939 is the communication that Allison DOC uses. A CAN-bus antenna was fabricated and a nine-pin J1939 plug was installed in the cab, allowing a portable laptop computer to be plugged in, and the truck can be driven with a passenger watching the laptop.

Note the difference in size between the Allison and 47RE planetaries.

The transmission-to-engine adapter

The converter-to-flex-plate adapter ring

One of the Allison's $^{5}/_{8}$-inch cooler-line fittings

The test drive demonstrated some of the more-prominent improvements over the truck's original 47RE transmission. One is a lower reverse gear with nearly a 4.49-1 reduction; backing heavy trailers requires little or no throttle. The forward gears also offer an improvement over those of the 47RE. With a 3.10-1 ratio in first gear, the truck takes off with little throttle help. With overdrive in fifth (0.71-1) and sixth gears (0.61-1), highway operation requires less engine speed, offering possibilities for increased fuel economy.

Another unknown was how the Allison torque converter's stall speed would feel behind a Cummins engine. With a larger reaction area in the turbine and extreme positive impeller, the Allison converter feels much tighter. There is no harsh shift as the converter locks up; the transition nearly goes unnoticed.

With superior drivability and 22,000-pound towing capacity, the Allison 1000 makes a welcome addition to the Dodge diesel truck.

TD

Howard Johnson has been repairing transmissions and torque converters since 1981. This year he started the company howards-conversions-allison.com, which makes parts that enable a transmission shop to install an Allison automatic in a Dodge diesel truck.

THE INFORMATION SOURCE

ATSG Techtran Manuals & Update Handbooks

$28 each, except where noted. Manuals cover assembly & disassembly, diagnosis & troubleshooting. Update Handbooks cover changes, parts affected by the change, interchangeability & part numbers.

GENERAL MOTORS
125C
125C Update Handbook
200C
200-4R
325-4L
350C
400
440-T4
440-T4 Update Handbook Vol. 1
440-T4 Update Handbook Vol. 11
700-R4 (82-86)
4L60 (700-R4 [87-93])
700-R4 Update Handbook
Saturn TAAT Transaxle
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N4A-EL (Mazda,)
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KM-171(Mitsubishi)
KM-175 (Mitsubishi)
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RL4FO3A-V (Nissan)
RE4FO2A (Nissan)
RE4FO4A/4F20E (Nissan)
RL4RO1A (Nissan)
RE4RO1A (Nissan)
TN35-TB37(SAAB)
Subaru 3-Speed
Subaru 4-Speed (4EAT)
A40 (Toyota)
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A540-E (Toyota)
VW Passat 096
722.3.4 Mercedes
722.5 Mercedes 5-Speed
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Subaru 4-Speed

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Torque Converter Tech Tips

Author:
Ed Lee

Subject:
Checking torque-converter covers and pistons for cracks

Units:
E4OD, 518

Vehicle Applications:
Ford, Chrysler, Honda

Essential Reading:
- ☑ Rebuilder
- ☐ Shop Owner
- ☐ Center Manager
- ☑ Diagnostician
- ☐ R & R

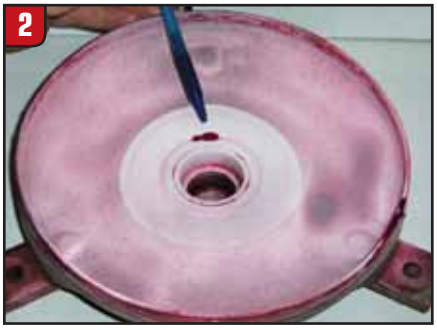
Checking for Cracks

Attendees at the 2009 Torque Converter Rebuilders Association (TCRA) seminar in Tennessee were introduced to a couple of interesting methods of checking torque-converter covers for cracks.

Ken Kelly of Transmission Specialties in Aston, Pa., talked about one conventional method during the roundtable discussion at the seminar. His method also appeared as a Tech Tip in the July 2009 edition of the TCRA Newsletter. Ken's method is called Dye Penetrant Inspection or Liquid Penetrant Inspection.

You can buy the materials needed to conduct this test as a three-part kit from your local welding supplier for less than $20. The kit consists of a cleaner, a penetrant and a developer. The cleaner is used to ensure the clean, dry, contaminant-free surface necessary for good results. After cleaning, you apply the penetrant to the surface of the part being tested (**Figure 1**).

After allowing the penetrant 15 to 30 minutes to soak into all the crevices of the part, you can remove the excess penetrant by wiping with a lint-free cloth that has been lightly soaked with a cleaning solvent. The last step in the process is to apply the developer to the surface of the part. The developer will highlight any areas that the penetrant was able to get into (**Figure 2**). Allow the developer about 10 minutes for its blotting action to work fully. A visual inspection will now reveal any cracks or defects in the part.



The TCRA seminar attendees also learned about a less-conventional method on their tour of the DACCO torque-converter rebuilding facility. Robert Cravens, a longtime rebuilder, showed attendees his tap method to check for cracks in torque-converter covers. To illustrate his method, Robert held an E4OD cover by the pilot and lightly tapped the front of the cover in several places. He explained that a crack-free cover will emit a crisp, bell-like sound, but the area of a cover with a crack will have a dull thud sound.

The method appeared to be very simple and straightforward, but Robert cautioned that there are several important elements of the test that must be done correctly, beginning with how the cover is held. Holding the pilot lightly by your fingertips will yield the best results. Holding the cover firmly at its outer edge will muffle the sound and make it more difficult to identify a crack. The second element is where the cover is tapped. Robert taps the outside of the front of the cover directly over the torque-converter clutch (TCC) reaction surface (**Figure 3**).

The value of checking for cracks is not limited to converter covers. Josh Bynum of Buffomatic in Glenmont, N.Y., uses a similar tap method to check his 518 TCC pis-

tons for cracks. The 518 pistons are notorious for cracking, and the cracks are equally well known for being difficult to find because they are usually in the crease at the bottom of the pocket that houses the inside-diameter sealing ring (**Figure 4**). Although converter shops commonly discard 518 TCC pistons that are noticeably burned, they often mistakenly reuse pistons that appear sound but are actually cracked.

Josh's technique for checking the pistons is quite similar to Robert's method. Josh places the tips of his index and middle fingers into one of the spring pockets and lightly holds the piston by clamping his thumb onto the friction-material surface of the piston (**Figure 5**). He then taps on the front of the piston in four places (12, 3, 6 and 9 o'-clock). Josh's tapping tool of choice is a lathe chuck key, but a small ball-peen hammer also will work. When one or more of the taps produces a dull tinny sound, Josh verifies the leak by either holding the piston up to a high-intensity light or by using solvent and an air nozzle.

Many other pistons and covers have cracking issues. The late-model Honda piston shown in **Figure 6** is a good example.

This piston was cleaned and was being prepped for rebonding before the crack was found. The location of the crack indicates that it was caused by the flexing action of the piston. Remembering what the industry experienced with cracks caused by flexing of E4OD or 4L80-E pistons, it is likely we will see many more Honda pistons cracking. TD

Ed Lee is a Sonnax Technical Specialist who writes on issues of interest to torque converter rebuilders.
Sonnax supports the Torque Converter Rebuilders Association. Learn more about the group at www.tcraonline.com.

R&R Tech

Author:
Larry (LJ) Porter

Subject:
2-3 slip/flare

Unit:
4L60-E

Vehicle Application:
1999 Chevrolet Suburban 4WD

Essential Reading:
- ☑ Rebuilder
- ☐ Shop Owner
- ☐ Center Manager
- ☑ Diagnostician
- ☑ R & R

Don't Overlook the Basics

Our carry-out customer was working with a 1999 Chevrolet Suburban 4WD equipped with a 4L60-E transmission. Their technician was able to re-create a slip/flare condition on the 2-3 shift. The fluid was full but a little burnt. A quick hookup of the scan tool revealed no codes existing in the system. Pressure gauges were attached for testing and indicated around 75 psi at idle, and 125 psi at the half throttle position.

Watching the parameter identification data (PID) during the road test indicated that the PCM was commanding each shift properly, but the unit was sluggish to respond on the 2-3 shift. There was nothing that would indicate an electrical-control or sensor-input issue, so the shop ordered a remanufactured unit from us and installed it the next day.

Shortly after the installation, our warranty department received a call from the shop with the same complaint as experienced with the original transmission. After receiving the information from the shop about the problem, we decided it would be best to bring this vehicle back to our own shop, because the installer was nearly positive that the issue was inside the unit we built. Things weren't adding up, and we figured that it would be a disservice to both our customer and his if we simply sent a warranty replacement as he was asking us to do.

Once I gained possession of the vehicle, I road-tested it and found that there was indeed a slip on the 2-3 shift. The installing shop had reported that the shift quality was better since the replacement unit was installed but the slip was still there. A code scan showed no codes, and all pressures were normal. No warning lights were illuminated, either. I decided to take the vehicle on the road to see what the PID might tell me.

Everything on the PID screen appeared normal, with one exception: The 2-3 shift was occurring about five seconds after the PID showed third gear commanded on by the PCM. Since I had no codes to indicate that there was anything I should be concerned about electrically, I decided to check some of the hardware first.

The first thing I did was pull the 2/4-band servo for inspection. This servo applies the band in second gear and releases for third gear, so if it wasn't releasing properly it could cause a delayed shift or other shift abnormalities. The servo checked out just fine, so I pulled the pan to make sure everything was clean and also to take a look at the solenoids. Visually, everything appeared to be in perfect condition. Not sure about what to do next, I determined that I would have to test the electrical integrity of the solenoids and wiring, as there wasn't much left to check.

Individual resistance checks of the solenoids proved that they were all within specification. Additionally, all the wiring between the PCM and the main transmission connector showed no opens, shorts or high resistance. I expected these results, because there were no codes indicating any electrical issues. Usually the PCM is quick to flag these items if there is any fault – back to square one.

I re-checked all the chassis and engine grounds, and all the power feeds to the transmission and PCM. There was nothing to indicate a problem in any of these areas. I checked the PCM-calibration revision and found that there was an update available, so in desperation I decided to reflash the PCM to the latest available software. A quick road test afterward was discouraging; the issue was still there.

At this point I was convinced that the issue was somewhere on the vehicle and not inside the transmission. There was something I was missing, but what could it be? I began to think about everything I had learned in my years as a diagnostician and some of the odd things that I could remember about the characteristics of electricity that instructors had taught me in the past. It was then that I remembered something that the books don't always have you check, and something that the ohmmeter won't always catch: the ability of a circuit to carry electrical load.

I believed that my focus should be on the solenoid circuits. A crude, yet effective, way I had

learned to test the ability of a circuit to carry a load was to use an ordinary 12-volt light bulb wired in series with the circuit being tested. Anything less than full brightness would indicate a potential fault. The only thing that made me skeptical was the fact that both shift solenoids are commanded off in third gear, so a problem in the circuit itself seemed unlikely. I wanted to check the circuits anyway.

A forced ground on each circuit with the PCM disconnected showed a full, bright light on all of them, and that proved that the wiring and solenoids themselves were in fact capable of supporting the proper electrical load. Next, I needed to reconnect the PCM and manually make the shift commands with the scan tool to see whether the PCM drivers also had the ability to carry the load. It was this test that finally revealed a fault that I needed to look at.

Although each of the circuits I tested produced a full, bright light, the test revealed something really odd: When third gear was commanded it took nearly five seconds before the ground for the 2-3 shift solenoid was turned off (as commanded) by the PCM. I also noted that the light "faded" to dark instead of immediately going off. Aha! Somehow the PCM wasn't releasing the ground immediately when commanded to do so, and this made perfect sense in regard to the delay and slip condition of the unit, since we weren't releasing second gear in a timely and smooth fashion.

I'm no engineer, so I wasn't really interested in knowing what was actually happening inside the PCM; I just knew that what it was doing was wrong. I also knew that no input I was aware of could cause this condition, so I ordered a replacement PCM and installed it.

Monitoring the PID again on the final road test showed that the shifts were occurring exactly when commanded, and the 2-3 slip/flare was gone. The truck was now ready to go back to our customer.

Scan tools are great for telling us what the PCM sees for input values, but they can't always detect or tell us what the outputs are doing. There are many diagnostic tools available for a technician to buy, but they are no substitute for a technician's ability. In the end, sometimes instinct, common sense and some crude test equipment are all we need to make those pesky diagnostic nightmares disappear and get the vehicle back to a pleased customer. TD

Larry Porter has been with Certified Transmissions for 20 years. He is the lead diagnostician at Certified's Maple Street store in Omaha, Neb.

Tasc Force Tips

Author:
Tory Royce

Subject:
Differences between early- and late-design accumulator bodies

Unit:
TF-60SN (09G, 09K, 09M, 6F21WA)

Vehicle Applications:
VW, BMW/Mini

Essential Reading:
- ☑ Rebuilder
- ☐ Shop Owner
- ☐ Center Manager
- ☑ Diagnostician
- ☐ R & R

TF-60SN Accumulator-Body Caution

So you've got it figured out. The cause of that TF-60SN converter issue you've been fighting has finally been narrowed down to wear in the lockup-clutch control bore. Well, before you reach for that pot of gold at the end of the rainbow, here are a couple of things you should know.

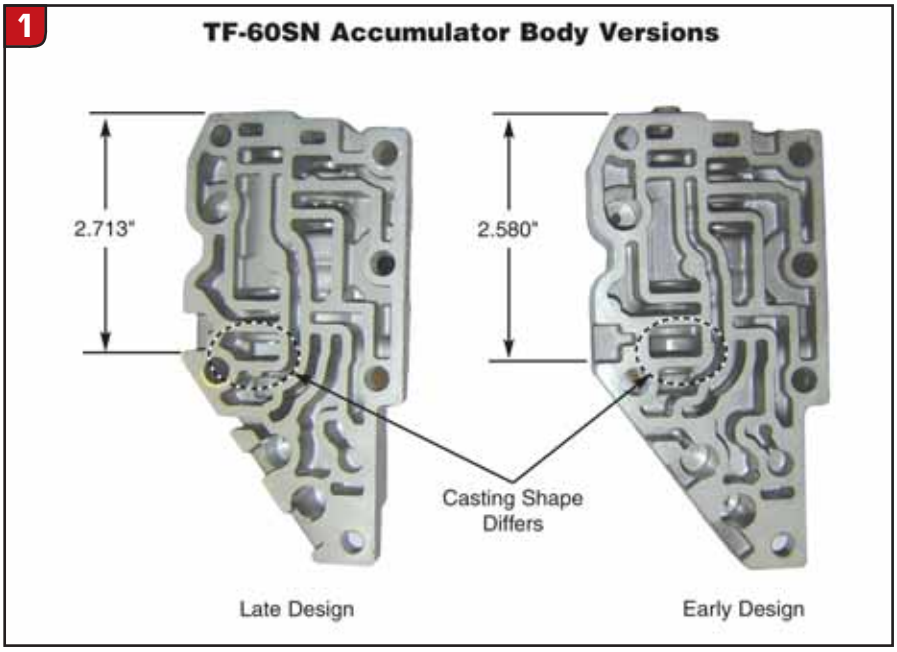
There are actually two different versions of the TF-60SN accumulator body in circulation. **Figure 1** shows the visual differences between the two castings. This is the simplest way to identify which style you have.

Figure 2 shows, although it is not as obvious, that there is a difference between the parts used in the two versions. Look closely at the spring end of the valve.

The good news is that the same valve repair kit for the lockup-clutch control bore can be used to repair either version. The catch is that the installation procedure is not the same, because of the difference in bore length.

Why is the installation procedure so critical? If the late-body installation procedure is used in an early body, the mistake will be frustrating but obvious: It will not all fit in the bore. At least you will know you have a problem. However, if an early-body installation procedure is used in a late body, you will be able to install the parts, re-assemble the unit and re-

1



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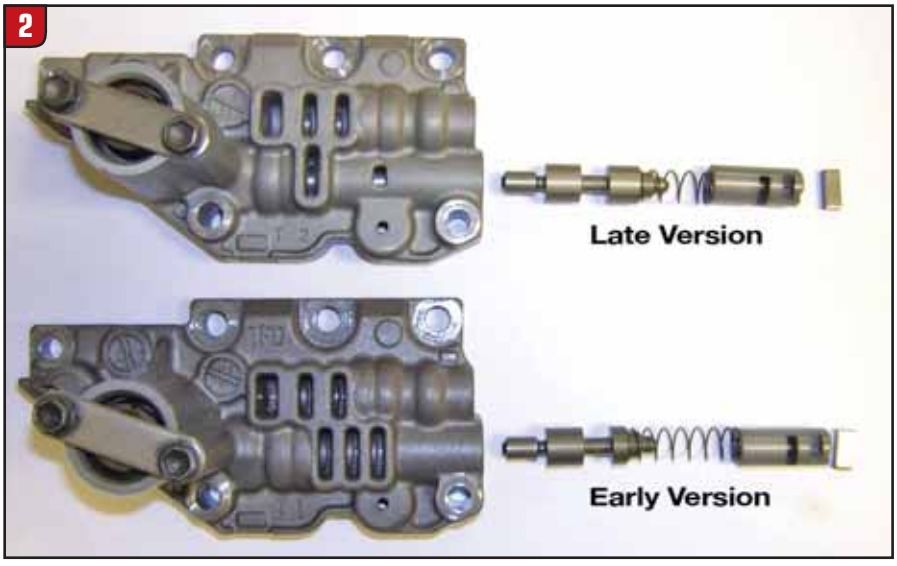
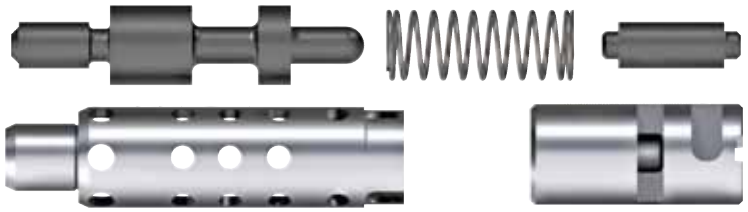


3 Early-Style Installation



4 Late-Style Installation

install it into the vehicle. You may not discover that you do not have lockup until the road test.

Figures 3 and 4 show the lineup difference between the two installation procedures. Early-style accumulator bodies, having the shorter valve-body bore length, use the valve/sleeve, spring and plunger/sleeve combination. Later-style bodies, because of their longer bore length, use all the same components plus a valve-stem cap and a spacer to make up the length difference.

Remember that TF-60SN is the AW designation but you may see and recognize this unit under a variety of names. VW 09G, 09K and 09M are common to many of you, with 09G often used to refer to any of the three. BMW/Mini builders know this unit as the 6F21WA. Regardless of the label or designation, the other thing you should remember about this unit is that the accumulator body is extremely small and not easily secured for reaming. You should buy or fabricate an adapter plate (**Figure 5**) that will allow you to securely mount and accurately position this valve-body section for reaming.

5 Adapter plate

Once you have identified and used the appropriate installation procedure, you will be on your way to that pot of gold and a happy customer. TD

Tory Royce is a Sonnax Technical Support Specialist and a member of the Sonnax TASC Force (Technical Automotive Specialties Committee), a group of recognized industry technical specialists, transmission rebuilders and Sonnax Industries Inc. technicians. E-mail Sonnax Tech Support at info@sonnax.com or call 800-843-2600.

POWERTRAIN PRODUCTS

48RE Oversized PR Valve & Line/TV-Pressure Plug

An oversized version of **Sonnax**'s lube regulated PR valve is now available for the Chrysler 48RE. Until now, improving converter charge without converter drain-back and correcting worn-out line/TV-pressure plug bores was not an option on a 48RE because of its unique pressure-plug design, the company said. Kit 22771A-16K includes the same oversized PR valve found in other Sonnax kits and a specially designed oversized pressure-plug lineup to replace the worn-out OEM design. It can be installed using a VB-FIX reaming fixture and the same F-22771A-TL7 tool kit used for other Chrysler RWD valve bodies.

Circle No. **101** on Reader Card

Hyundai W4A42, W4A51, W5A51

Corteco has announced the availability of the right axle seal for 1996-up AWD W4A42, W4A51 and W5A51 transmissions. The new seal has been added to **TransTec**® overhaul kits 2416, DP2322 and DP2323, the company said. The seal is also available separately by ordering TransTec part number B37133. The corresponding OEM reference number is 47452-39000.

Circle No. **103** on Reader Card

Mechanical Locking Differential

Yukon Gear & Axle® has released the Grizzly™ locker for a variety of street and off-road applications. These mechanical locking units feature an 8620 chrome-moly case and 8620 chrome-moly internals for added strength, and the patent-pending design reduces common locker failures, the company said. Applications include Ford 9-inch in 28- and 31-spline, Chrysler 11.5-inch, GM 11.5-inch, D44, Toyota four-cylinder and V-6, GM 14-bolt truck and Rockwell 2.5-ton, with more applications coming soon. All units are assembled in the U.S.

Circle No. **102** on Reader Card

722.6/NAG-1 LPR Valve-Bore Repair Package

This kit from **Superior Transmission Parts** repairs a lubrication-pressure regulator-valve bore in the Mercedes 722.6, Chrysler NAG-1, Jeep W5A/J series and Jaguar W5A units and addresses the excessive bore wear in the lubrication-pressure regulator circuit that causes a "judder" or, as some describe, a "vibration, shudder/bump/bang" when the torque-converter clutch is applied. The patent-pending kit, Part # K093, includes a reamer guide, alignment tool, reamer, necessary hardware and five hardened-steel replacement valves to repair five units, the company said.

Circle No. **104** on Reader Card

Line-Pressure Booster

An easy-to-install line-pressure booster that increases clutch clamping force and torque capacity in select Jeep and Dodge truck transmissions is now available from **Sonnax**. Chrysler 45RFE, 545RFE and 68RFE transmissions use a full-range line-pressure sensor mounted on the outside of the transmission for "closed-loop" line-pressure control. The line-pressure booster installs between the transmission pressure sensor and vehicle harness using OEM-style connectors. Installation typically takes less than five minutes, the company said.

Circle No. **105** on Reader Card

Universal CVT Fluid

International Lubricants Inc.'s new LUBEGARD Universal CVT Fluid (P/N 67032) is a universal formula for use in any belt-type continuously variable transmission. More than 80% of CVTs use belts, the company said, and the fluid is designed to help shops and service centers eliminate the need to stock multiple fluids for the various units. The fluid is not for use in chain-operated CVTs.

Circle No. **108** on Reader Card

Bearing Puller

Because of increased overseas competition over the past year, **Yukon Gear & Axle**® has re-sourced its U.S. supplier for bearing pullers. It still offers the same high-quality tool with handy bench-top stand, the company said. These pullers remove carrier bearings safely and easily, saving them for reuse, and handle applications from import car up to one-ton truck.

Circle No. **106** on Reader Card

1/2-Inch Impact Wrench

The **Snap-on** MG725 $^{1}/_{2}$-inch impact wrench provides 1,190 lb.-ft. of bolt breakaway torque and 810 lb.-ft. of working torque. The single-chamber motor provides greater power and speed to remove stubborn bolts. The one-piece precision-machined magnesium housing yields an extremely durable, lightweight, balanced unit with minimal vibration, the company said, and superior control results in less user fatigue. A muffler kit reduces noise for quiet performance.

Circle No. **109** on Reader Card

Ford C4 Billet-Steel Forward-Clutch Drum

TCS Products' new Ford C4 forward-clutch drum is precision machined from 4140 heat-treated, stress-relieved billet steel. This drum is an ideal replacement for the OEM drum, providing superior strength and durability for drag racing and off-road applications, the company said. The drum is a 100% drop-in product; no modifications are necessary. It's also available with a TCS input shaft made from 300 Maraging billet steel.

Circle No. **107** on Reader Card

Drivetrain Protection Device

Sonnax Power Train Savers mount into an existing driveshaft and feature patented Torque Fuses® that protect the drivetrain by shearing if harmful over-torque occurs. Maintenance and driveline shops can profit from the device by becoming an authorized installer, the company said. Each set of Torque Fuses is engineered and calibrated to shear just prior to the powertrain breaking point. Once this occurs, the driveshaft remains in place, supported by an internal system. The drivetrain is repaired by replacing the Torque Fuses.

Circle No. **110** on Reader Card

Industry News

Equipment and Tool Institute Launches Redesigned Web Site

The Equipment and Tool Institute has launched its new Web site www.etools.org. The completely redesigned site provides members with the ability to update their own member profiles, contribute to blogs and forums, and access ETI event details, key documents, reports and forms.

The new site also features streamlined site navigation and access to ETI sub-sites including the TEK-NET Library and the State-by-State I/M Program site. There is also a section dedicated to prospective members where they can find essential information about joining ETI and what becoming a member means.

"The new Web site showcases ETI information and the resources available to our members," said Jessie Korosec, marketing manager. "We strive to continually add to our member offerings, and our new Web site is a big step toward enhancing the ETI membership experience. This is our communication tool aimed at establishing a closer relationship with our membership."

Founded in 1947, the institute is a trade association of automotive tool and equipment manufacturers and technical-information providers. ETI's mission is to advance the vehicle-service industry by providing technical data and open dialog between the manufacturers of transportation products, government regulators and the providers of tools, equipment and service information.

Engine Remanufacturer in Minnesota Joins Certified Distributor Network

Tri Star Engines, an engine remanufacturer in the Minneapolis metro area, has become a distributor of Certified Transmissions.

"For over two decades our customers have depended on Tri Star for high-quality remanufactured engines," said Dave Steine, president of Tri Star Engine. "With the addition of Certified Transmissions we can now offer the same quality in our transmission line."

Tri Star offers the full line of Certified products – transmissions and transfer cases – along with Certified's trademarked Road Ripper series designed for heavy-duty and high-performance applications. The Road Ripper units complement Tri Star's heavy-duty and high-performance applications, said Certified President Peter Fink.

TEMCO Recognized for Supportof Marine Helicopter Squadron One

TEMCO President Russ Godfrey recently received a citation of appreciation from Marine Helicopter Squadron One, which operates the U.S Marine Corps helicopters that provide transportation for the president of the United States.

The squadron recently bought TEMCO's model T5 parts-washing cabinets for its fleet maintenance division. Godfrey said he was recognized for his efforts to answer all questions and provide information in a timely and professional manner.

"I was just doing my job presenting our products, answering questions," he said, adding that he was surprised and proud to have received the citation. TD

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