TransPlant

I've always enjoyed hanging around the "skunk-works" research lab at Freudenberg NOK in Milan, Ohio, as different automatic transmissions are torn down, diagnosed, and evaluated. My old friend John Wozniak eats, breathes, and sleeps automatic transmissons. He studies seals and gaskets, pumps and clutch packs, and pours ATF on his corn flakes in the morning.

This month, he's taking us on a guided tour through a common transaxle used in many Mazda and Ford vehicles. With the constant cross pollination of vehicle brands increasing, it's getting harder and harder for

any of us to know which components will be hiding in a given vehicle's powertrain—regardless of the name on the hood.

Ford and Mazda have had this kind of symbiotic relationship for many years. Remember the Ford Courier? More recently, the edges of the two corporate product lines have been getting even fuzzier. Examples include: Ford's Probe and Mazda MX-6 and 626 models (which roll off the same assembly line in Michigan), and the Mercury Tracer which is based on the Mazda 323. Even the new Mazda pickup truck is a Ford Ranger in sheep's clothing.

It's not too surprising to find the same transaxle being used in some Ford and Mazda vehicles. Mazda labels the trans as a G4A-EL (or G4A-HL if it's a hydraulic version). Ford calls it the 4EAT-G. Call it what you will, it's a four-speed automatic with a lockup torque converter. Since fourth gear has a ratio less than one-to-one, it is also referred to as an overdrive unit.

This transaxle has gone through two major redesigns since it was first installed in the 1987 Mazda 626. The original design was then modified in 1988, at the same time it first appeared in Ford Probe models. A more recent redesign occurred in 1993.

This trans is also interesting in that it has appeared in both an electronically-controlled and hydraulic version. An example is the 1988-89 Mazda 323 version which uses a conventional hydraulic governor. In another twist, hydraulic versions came after the original electronic design.

The most current incarnation of this trans has seven solenoids in the valve body, and it uses the fuel system's throttle position sensor to determine throttle opening to control line pressure.

A smaller model of this trans was developed for compact cars. These can be found in later 323s, Tracers, and Ford Escorts.

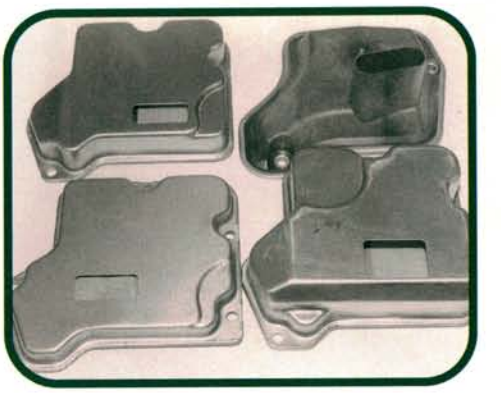
The G4A-EL on the bench today is an electronic unit used in 1988-92 Probe, MX-6 and 626 models. Its valve body contains five solenoids, although a conventional throttle cable is used to control line pressure based on throttle position.

Now we realize that many of you don't normally overhaul automatic transmissions in-house. But it sure doesn't instill a lot of confidence in our customers when we have to stand palms up with shrugged shoulders each time a question pops up about a shiftless transmission. We hope the general info presented here will help many of you better understand various problems you may see with these units.

For those of you more inclined to tackle an overhaul, we've included some specific tips about potential problem areas, repair cautions, and parts updates which can get you into trouble if you're not careful.

If you want more information about overhaul kits, you can contact **Freudenberg-NOK, Circle No. 140.**

— By Ralph Birnbaum



1

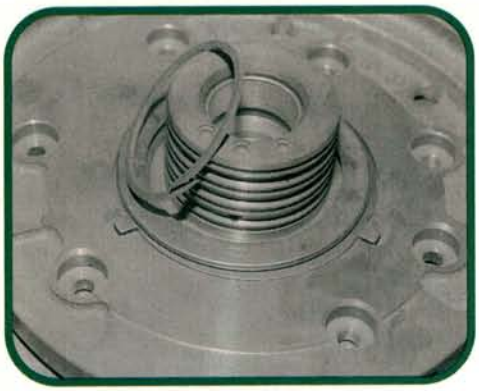
Filter and fluid changes became more important when they started using solenoids in valve bodies, so you'd better know the four filter options. Reading clockwise from top left: 1988-92 regular and turbo models; the new plastic-bodied filter used in 1993 versions; all hydraulic trannys; and 1986-87 versions.

2

The filter used in 1993 versions incorporates an "American" style filtering element. Earlier versions used a screen-type filter we've seen on Japanese transmissions for years. But the screens weren't always fine enough to keep tiny bits of metallic debris out of the electro-magnetic solenoids.

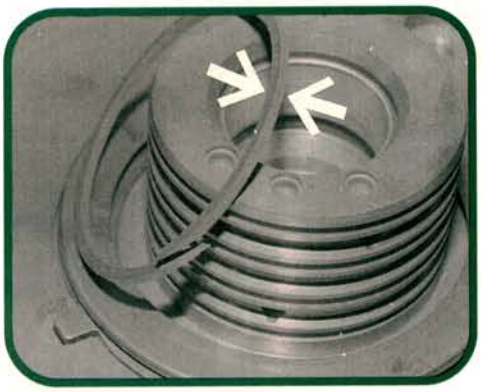
3

Pan gaskets on turbo and non-turbo applications are slightly different. There are two pans on each trans, one for the valve body and an access pan for filter changes. You probably wouldn't get the wrong gasket installed since some of the holes don't line up, but who wants to return an oily gasket?



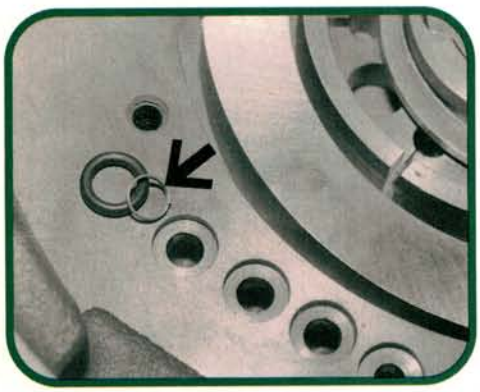
4

This brings us to some internal sealing problems which have resulted in failed 3/4 and reverse clutches. There are several possibilities to consider which may cause "cross-over" leaks between clutch fluid feed lines. Leaking seal rings on the pump are one possible cause of cross-over leaks.



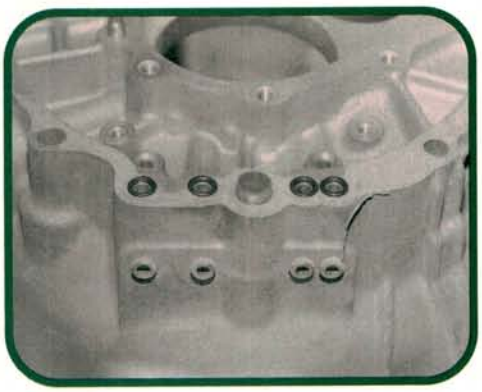
5

One thing John emphasized during our meeting, was the importance of using OE seals on the pump. Tolerances are critical here, and some aftermarket seals may leak. If you buy an aftermarket gasket set, make sure the pump seals in the kit are OE, or purchase them individually from either Ford or Mazda.



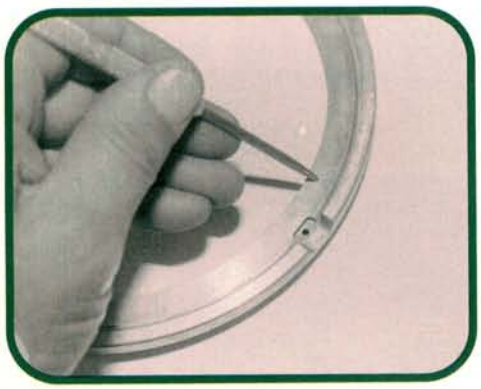
6

Another possible cause of cross-over leaks can be found at these o-rings between the case and pump body. Each of the tiny rings has a metal spreader which must be installed. These seals were enlarged on 1988 and later models to reduce the possibility of cross-over leaks.



7

If you're splitting the case for any reason, always replace the o-rings between the case halves. Then seal the rest of the case halves with an approved sealer. This is one more place where cross-over leaks can occur. Don't let the cake decorator in the group apply the sealer. Excessive sealer can clog the ports.

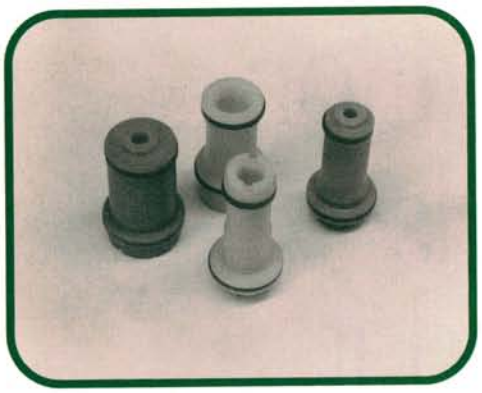


8

Cross-feed pressure problems caused reverse clutches to apply just far enough to drag when forward gears were selected. This caused overheating and premature reverse clutch failure. Some enterprising trans techs drilled a .030 hole in the reverse piston (pointer) to vent any cross-over pressure.

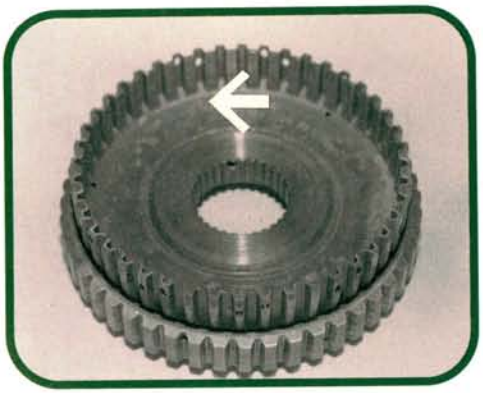
9

The original aluminum accumulator pistons were pretty, but they had a tendency to stick. You have two repair options here: either reuse the old pistons with new seals; or replace them with improved accumulator pistons and seals. We strongly suggest that you choose the latter option.



10

The valve body contains four separate accumulator pistons. These new, improved pistons come in four different designer colors! But be careful, the width of the scarf cut sealing rings for the plastic pistons is thinner than those used on the original aluminum pistons. Don't mix and match.

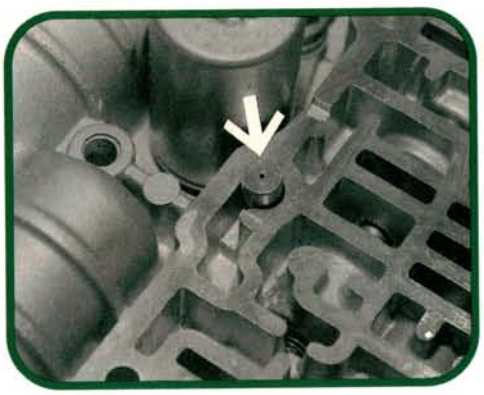


11

If you see a trans that won't move unless you select manual 1st or 2nd gear, suspect a bad input sprag. Be careful when you install a new one — it's possible to install it upside down. The sprag should freewheel in a counterclockwise direction (arrow) when it's properly installed.

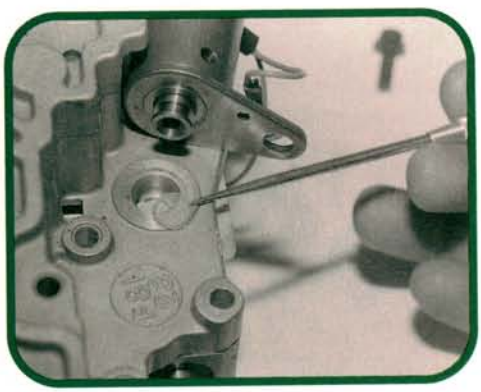
12

This stack of valve body gaskets is another possible cause for confusion. Each valve body uses six separate gaskets. You'd need a total of 24 gaskets to cover all applications. Some kits will have enough gaskets to cover more than one application, so be sure you have an exact match!



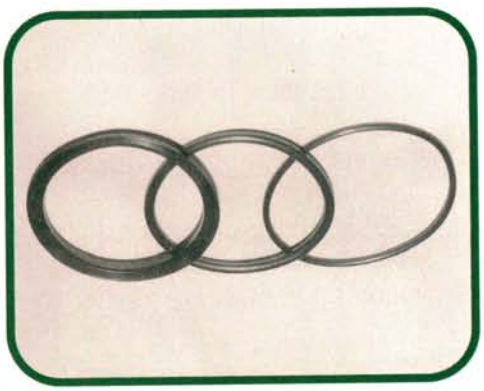
13

Those of you accustomed to seeing the pressure metering orifice holes in the valve body separator plates may find this wrinkle interesting. Tiny orifice cups on springs (arrow) have taken the place of precision drilled orifice holes in the separator. Don't lose, mix, or relocate these caps.



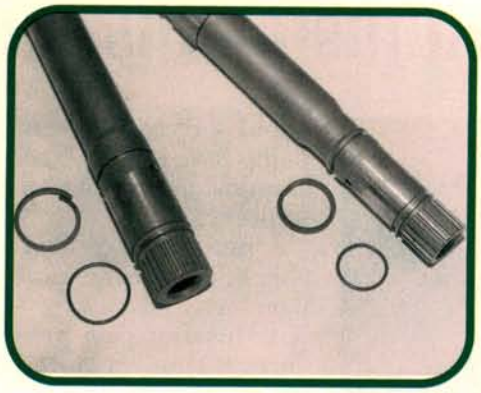
14

We mentioned plugged solenoids. The windings in the solenoids act as small electro-magnets, and attract any wandering metallic debris. When servicing or replacing solenoids, remove, clean, and reinstall the tiny filters in the bores where the solenoids fit and install new o-rings on the solenoids.



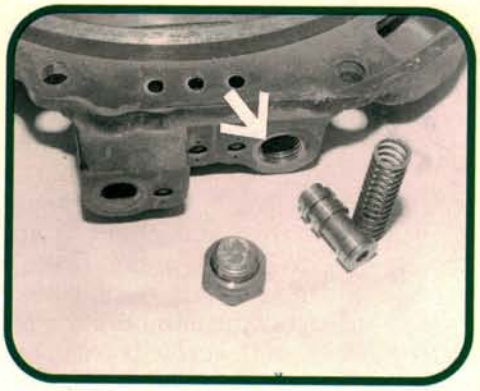
15

The 3/4 clutch piston inner seals can also cause confusion and an embarrassing comeback. This photo shows the different seal options, and a kit may contain all three. Choices include a lip seal and two o-rings. Use the wrong one, and you'll burn up the 3/4 clutch pack when it starts slipping.



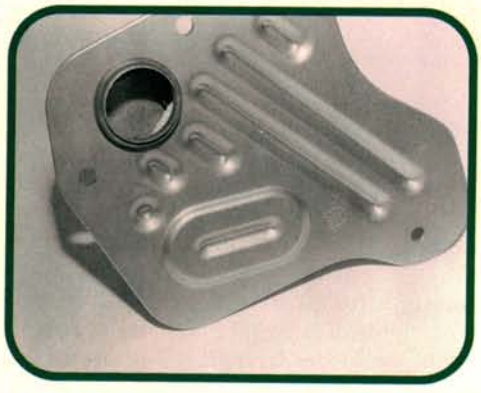
16

Another design change has to do with the input (turbine) shaft design. The early style shaft was meatier than the revised shaft. A Ford bulletin suggests that you always check the shafts for breakage, and replace the shaft and seals on any transaxle built before VIN#161020.



17

This is the early spool-type pressure control valve. It had a tendency to stick in the bore in the oil pump housing. The spring/piston assembly would stay open, causing erratic pump output pressures, even though the pump was just fine. A modified piston with a centering snout is available as a fix.



18

Even if you don't do automatic transmission internal repairs, this article should convince you and your customers of the importance of regular transmission maintenance. Your customer may have ignored the old Jatco in his '84 Mazda 626 for 200,000 miles, but fresh fluid and a clean filter mean more now.

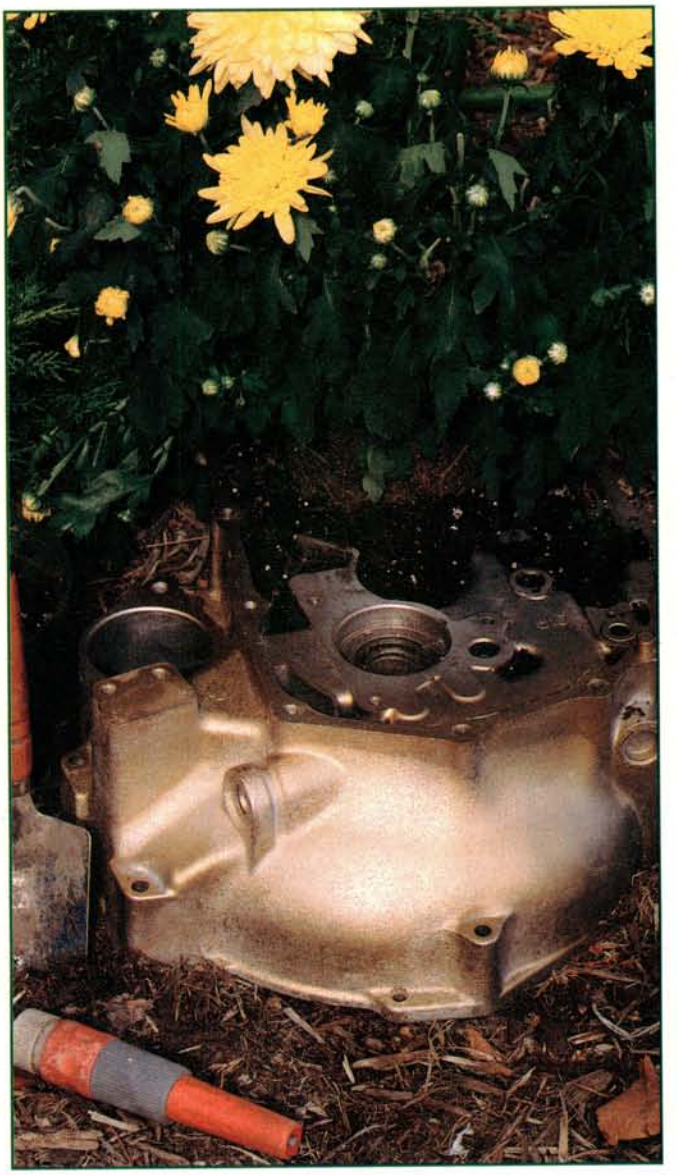
General Tips and In-Car Adjustments

The best time to check a trans is while it's still in the car. Some shift quality problems with this transmission do not require a complete overhaul.

If fact, some of these tests are quite simple to perform, and may save a lot of lost time for you and your customer.

We can't fit all the tech bulletin information into this limited space. There have been many modifications and parts changes. The following is intended to eliminate some of the more obvious problems you may see.

Be aware that there is a lot more information available for more complicated problems. There is a lengthy list of TSB information offered on this transaxle family.



Always start by checking the fluid level. In early 626 models (built before December 1986), the ATF level should be .47 to .63 inch above the full mark with the fluid at 149°F (65°C) with the engine running and the gear selector in Park. An improper fluid level may result in chatter between D1 and D2.

Later valve bodies were modified to correct this.

Line pressure is very important to shift quality. A slip or flare in the 2-3 shift may be the result of uneven oil pump delivery pressures in 1988-90 versions.

To test line pressure, idle the engine with the trans in Park and the fluid warm. Line pressure should be 57-66 PSI (4.0-4.6 kg/cm2).

Now raise the engine speed to 2000 RPM and pull the transmission throttle cable to its wide open position. Line pressure should rise to 115 PSI (8.0 kg/cm2). Then release the cable.

Repeat the test, only this time, pull the cable in a smooth, even motion to the midpoint of its travel and watch the gauge. The pressure should increase smoothly and evenly as you pull the cable. If the pressure rises, drops off, and then rises again, the spool valve in the oil pump may be sticking. It should be removed and inspected.

A new valve is available to correct this problem. (See Photo 17.)

Adjusting line pressure. If line pressure is not within specs, it may be the result of an improperly adjusted throttle cable. A common symptom is D1-D2 shift shock or shift flare at quarter throttle during warm up.

Always test drive the car first. Verify the customer's complaint, and try to get a feel for shift quality. Then check line pressure at warm idle.

Disconnect the throttle cable and check it for free movement. There's no sense in readjusting a sticking or binding cable.

If the cable is okay, use the locknuts on the cable tube to adjust the line pressure to specs.

If pressures are uniformly low, don't forget to check for a plugged filter or low fluid level before proceeding.

Here are some added notes about adjustment to the throttle cable:

1) Always start by checking and adjusting the engine idle speed to the recommended spec on the underhood sticker.

2) While the recommended starting point for cable adjustment calls for zero free play, it is possible to fine tune the cable adjustment depending on the type of shift problem you're experiencing.

The recommended line pressure specs at idle will be given as an acceptable range, not an absolute number. For example, if the trans has a tendency to flare between shifts, and the recommended range is 57-66 PSI, favor the high limit. This will increase apply pressure and reduce flare.

On the other hand, if the customer complains about shift shock, try favoring the lower limit of the spec to reduce apply pressure and minimize the shock.