TCRA

Latest Trends in Tech Support

May 12, 2006

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5L40E 258 mm Applications

Cadillac CTS, STS, SRX, XLR to 06
BMW X3, X5, Z4, 500, 300 series

Complaint:

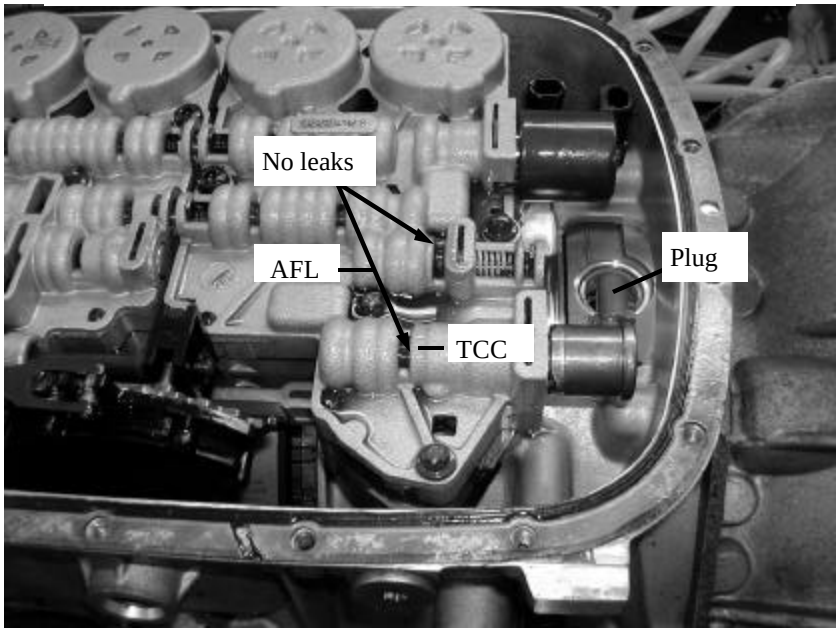
- TCC piston distortion
- Lining failure
- Cooler contamination, lube failures
- Loss of reverse

Current Issues/Cause:

1. Main pressure regulator bore wear along with it's boost sleeve
2. Actuator Feed limit bore wear
3. Converter clutch regulator bore wear
4. Critical TCC piston travel
5. Transmission pump alignment during re-assembly
6. Cooler flow restrictions affect/raise TCC apply pressures.
7. TCC PWM solenoid failure

5L40E (continued)

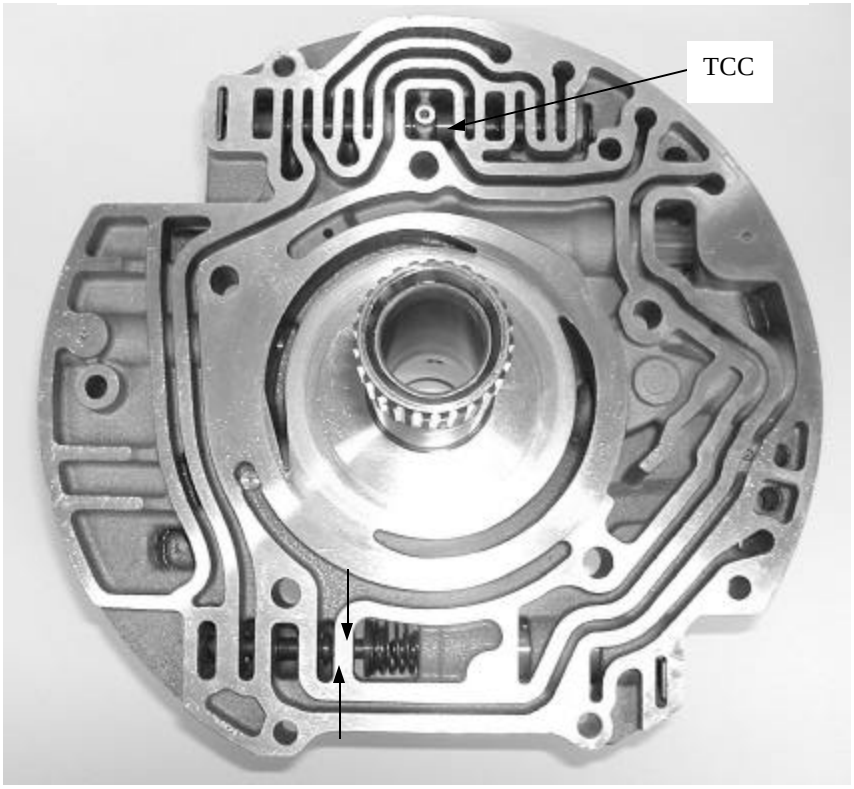
5L40E WAT



To isolate worn AFL bore and TCC regulator, a wet air test can be performed.

1. Unit **out of car**: Blow air into end of turbine shaft. Plug pump inlet hole. No leaks should be evident at either the TCC regulator or AFL. (photo)
2. Unit **in car:** Remove the line pressure tap. (passenger side front Torx head) Blow air into it. Plug pump inlet and place selector lever in reverse.

5L40E Pump pressure regulator



The bore for pressure regulator valve wears severely.

Prop the valve open approximately 1/32". It should not move in the bore.
Two known pump designs:

1. BMW measures 3.22" from body to end of stator tube.
2. Cadillac measures 3.37" from body to end of stator tube.

This will affect converter stator identification as well. Pump will have one or two TCC valves.
Picture illustrates two valve modulated TCC design.

5L40E

Piston Deflection Likely.
Two known pistons. Light weight/thinner pictured.
Look for loose rivets & cover contact. (above picture)

Check the impeller blades.
Noise and debris occur as the blades pull out.
This has been an issue on the BMW diesels.

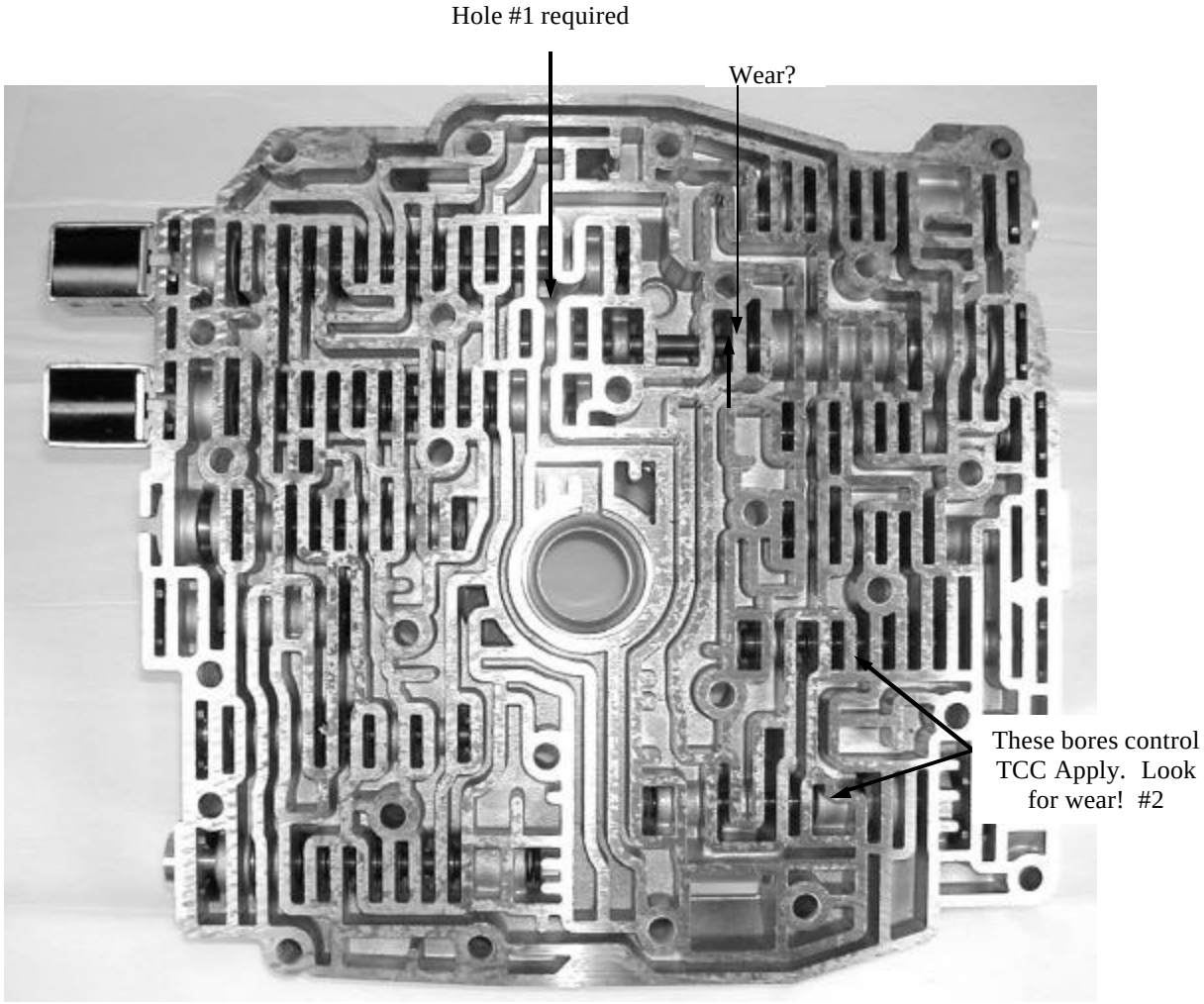
4T40E-4T45E

Complaint:

1. No move, no cooler flow, no converter fill, TCC codes
2. Converter piston deflection or lining failure

Cause:

1. Main pressure regulator bore worn
2. Mis-matched separator plate, regulator valve does not have a balance hole. (see arrows at #1)
3. Filter may be plugged from converter lining. TCC lining may come loose from piston over pressurization or a poor bonding process at OE. Piston deflection can be caused by arrows #2.



AX4S-AX4N-4F50N

Complaint:

- Excess TCC slip, Code 1741 or 1744
- RPM'S cycle during modulation
- No lockup hot, in 3rd, ok in 4th
- Delayed engagement, no cooler flow
- Often accompanied by harsh down shifts or slip 1-2

Cause: Converter regulator valve bore worn. (see Sonnax Volume 6 page 154)

Complaint: Harsh TCC apply after rebuild. Valve body was re-built at TCC By Pass area.

Cause: The by pass sleeve may be mismatched. The by pass valve and by pass sleeve spools sizes must be the same!

Complaint: Transmission overheat, converter TCC slip codes

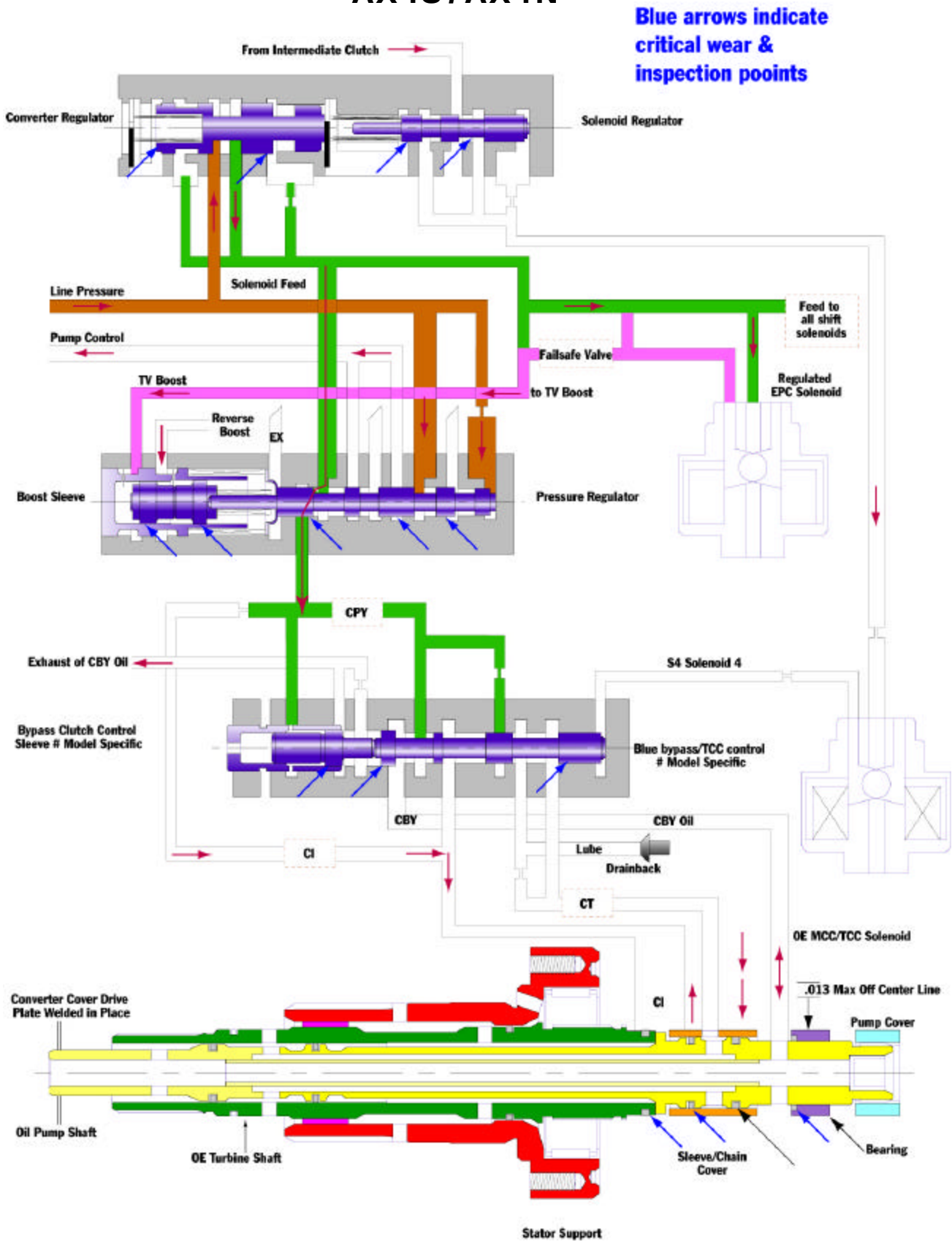
Cause: In '99 later AX4S, the lube and converter relief valves were changed. The converter relief must have the heaviest of the two springs.

Complaint: TCC cycle or surge, Code 1728, 1741 or 1744

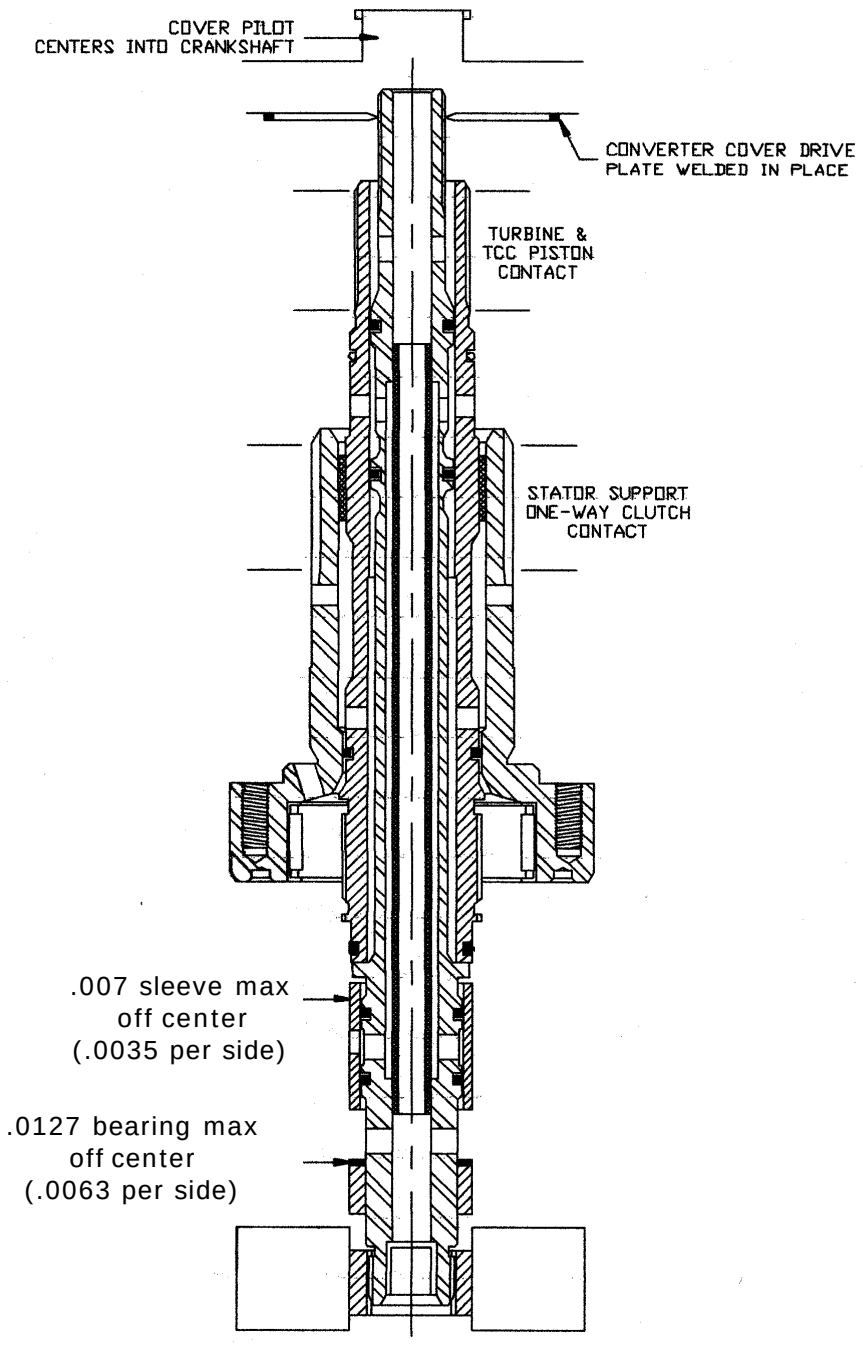
Cause: Solenoid or converter mis-match.

(Refer to ATSG '04 Seminar material pgs. 22-24)

AX4S / AX4N


Blue arrows indicate critical wear & inspection pooints
From Intermediate Clutch
Converter Regulator
Solenoid Regulator
Line Pressure
Solenoid Feed
Feed to all shift solenoids
Pump Control
Failsafe Valve
TV Boost
to TV Boost
Regulated EPC Solenoid
Reverse Boost
EX
Boost Sleeve
Pressure Regulator
CPY
Exhaust of CBY Oil
S4 Solenoid 4
Bypass Clutch Control Sleeve # Model Specific
Blue bypass/TCC control # Model Specific
CBY
CBY Oil
Lube
Drainback
CI
CT
OE MCC/TCC Solenoid
.013 Max Off Center Line
Converter Cover Drive Plate Welded in Place
Pump Cover
Oil Pump Shaft
OE Turbine Shaft
Sleeve/Chain Cover
Bearing
Stator Support

AX4S



Inspect the oil pump shaft for wear at the sealing ring grooves. Visible wear indicates the shaft is not running true. Insure the oil circuit flowing around the inner pressed tube is not restricted. Restriction here will increase converter pressure, which if severe enough will increase back-pressure on the seal. Restricted oil flow will also cause delayed engagement and TCC problems.

5R55E 97 to current

Complaint:

- Repeat 741, Slip code
- Transmission temp code 1783

Cause:

There are many conditions that create the complaints.
Number 1 being most common to 8 being least common.

1. Worn TCC regulator bore. (see Sonnax Vol. 6 pages 104-115 and obtain Sonnax kit instructions for extensive service details)
2. Wrong spring calibration in the TCC regulator. 2.3 ltr. may only have one spring. 2.9-4.0 ltr. will have two. Going to the double spring in 4.0 ltr. tension will increase apply pressure.
3. Low line pressure, caused by pump wear. Suggest pump update to YLZZ-7A-103AA
4. Poor line rise due to valve body wear in EPC circuit.
5. Wrong TCC solenoids or bent bracket. Do not use 95-96 TCC solenoid or 97-latter.
6. Dirty mass air flow sensor, or bad ECM grounds.
7. Wrong valve body application or improperly modified for TCC.
8. Converter internal leaks or pump stator seal leaking.

5R55W/S/N

Complaint:

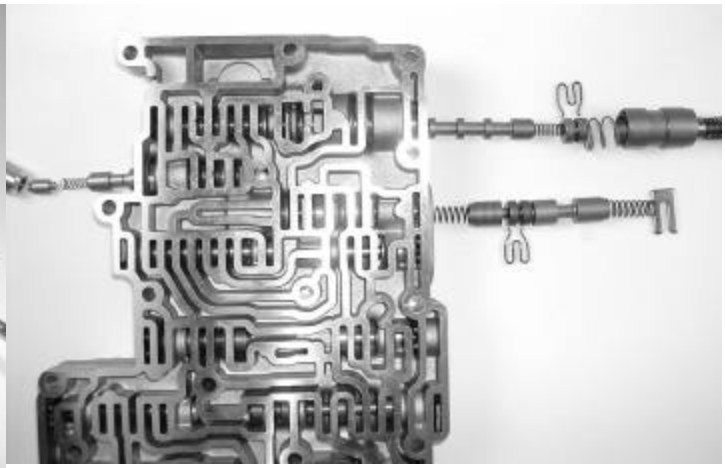
- TCC piston deflection
- TCC Slip
- Code 741

Cause:

Valve bodies are known to wear at comparatively low Mileage. (50,000 mi.)

For TCC slippage, look at the TCC modulator bore, inner valve. This controls TCC slip rate via the outer sleeve & TCC solenoids. Inspect outer sleeve for wear.

For TCC over-pressurization, look at pressure regulator bore wear or altered/stronger main regulator spring.



'00 Jaguar– Runs poor after transmission installation. Note: 5R55N-Vehicle has to relearn flywheel position if replaced. It may run rough for awhile during this relearn.

The keep alive memory, should be drained on any Ford after '01. This will bring (adapts) programming back to initial calibration.

5R110W (Torqueshift)

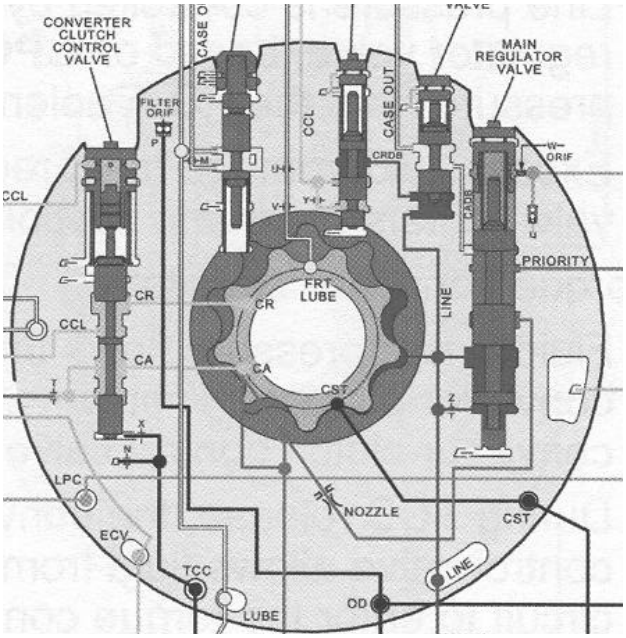
Complaint:
- TCC slippage
- Code 1744

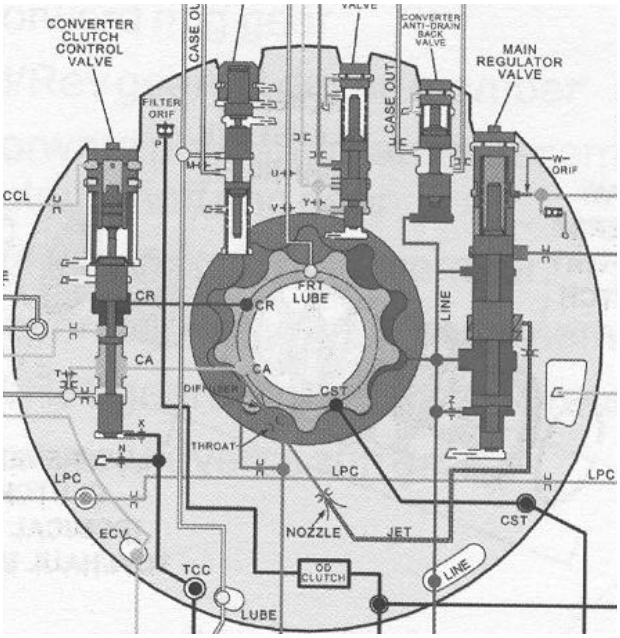
Cause:
- Pump capacity low
- Sticking thermal cooler by-pass valve
- Worn converter regulator sleeve
- Excessive flow restriction within converter cooler restrictions.

Note: The pumps have gone through several revisions. Suggest using the '05 or latter pump assembly.

OE cooler flow requirements are tested warm and hot, at idle in park.
- 110 degrees F = 1 gal. per minute or 8 ozs. 15 seconds.
- 180 degrees F = 2 gal. per minute or 64 ozs. 15 seconds.

(Spec's courtesy of John Parmenter)





4R100
Repeated Converter Failure

A good sub-title for this article could be “Pain in the bottom line’. You may have heard the phrase, No Pain, No Gain, which could be true in physical conditioning or education, but we prefer it not relate to transmission rebuilding.

In this field, both pain and education come in the form of a C.B. (comeback). The education occurs because it hurts the bottom line to rework or repetitively give up expensive parts. We are referring to both the cooler line and profit line.

In this lesson we will hear of a 4R100 in a ’00, 7.3 diesel with repeated (x4) converter failures.

This is an experience once learned and never forgotten. During final test drive you notice the TCC apply seems longer and softer than normal to a 4R100. If you deliver the vehicle it may return due to overheated fluid, converter codes 1728 or 1744. Avoiding further diagnosis and swapping converters or coolers can increase the anxiety, as the vehicle returns to the shop after another week.

This starts to get your attention. HD converters, new fluid and labor have dissolved the initial profit, so now it’s time to figure out what’s causing this.

What is the problem?

There is not enough pressure at the TCC piston to reduce the slip as the engine input torque increases. Any circuit restriction is more critical on a modulated TCC in 4R100, verses the on-off E4OD, due to the size and position of the TCC control valve orifices.

To explain the problem we could compare the converter to a hydraulic jack. The cylinder will only move as fast as the fluid fills or is allowed to exhaust. With a jack, the handle or bleed screw is the control.

In the 4R100 converter example, the exhaust of fluid past the turbine hub controls the piston travel. If too close/ restrictive, the release oil will slowly exhaust as the TCC piston forces the oil out. *(ill. #1 4R100 multi-plate converter with bearing turbine hub)*

There can be other issues affecting the apply and release of the TCC piston. In descending probability, they would include; the by-pass check-ball leaking or stuck open (which is external of the transmission), pump volume poor or modified pump orifices.

Why does this occur on the 4R100?

On the modulated converter circuit of the 4R100, the fluid coming from the TCC regulator valve goes unrestricted to the converter apply piston. (*ill. # 2, Modulated 4R100 circuits)* As the TCC solenoid modulates the control valve, the release oil between the piston and the cover, exhausts without an orifice. The apply oil now gets priority toward the piston and is restricted toward the cooler direction.

To illustrate the theory, we could use a river’s spillway gate, controlling the water to take an easier path toward a generating turbine. Another example could be the garden water hose. You can see a head pressure spike from a leakage point, as you step on the hose.

In the 4R100 converter the piston gets priority pressure due to the orifice and the cooler receives less pressure and flow. If the orifice hole was increased, the TCC piston gets less pressure, but the cooler receives more flow. In this case, less pressure to an over-taxed TCC piston is not a good practice. Likewise, making the orifice smaller increases pressure at the TCC piston, but reduces flow to the transmission lube circuit. The E4OD by comparison, has an exhaust orifice and apply orifice with it's on-off control of the torque converter clutch.

The 4R100 pump and converter are the easiest of the issues to diagnose for cause and affect.

Now we add the external pressure bypass circuit. The ball, seat and spring are designed to open at about 60 psi. of cooler head pressure, to insure lube flow around a restricted cooler. All the charts, text and graph's aside, just think of the radiator and bypass as another person standing further down the garden hose.

How to isolate the problem:

Checking cooler flow and head pressure at the same time is the best method to isolate if there is a problem. If you cannot monitor flow, at minimum check head pressure. (*ill#3, illustration of where head psi. is obtained*)

On the 4R100 cooler test graph, note the two units Alt1 and Alt2. Both had restricted converters. (*ill#4 Excel graph*) There is minimal difference in flow (left side) during lockup and head pressure (right side) does not rise to normal. Normal specifications are shown on far right. The Lot test OE example is from pre-repair, with unrelated problem. The Alt4 test is using converter from Alt I and improving the oil flow, then installed into the same truck. Alt3 is a used OE converter installed into same Alt 1 truck. The other bar graphs are testing various stages with bypass closed or open to isolate it.

Can we apply this information to the E4OD?

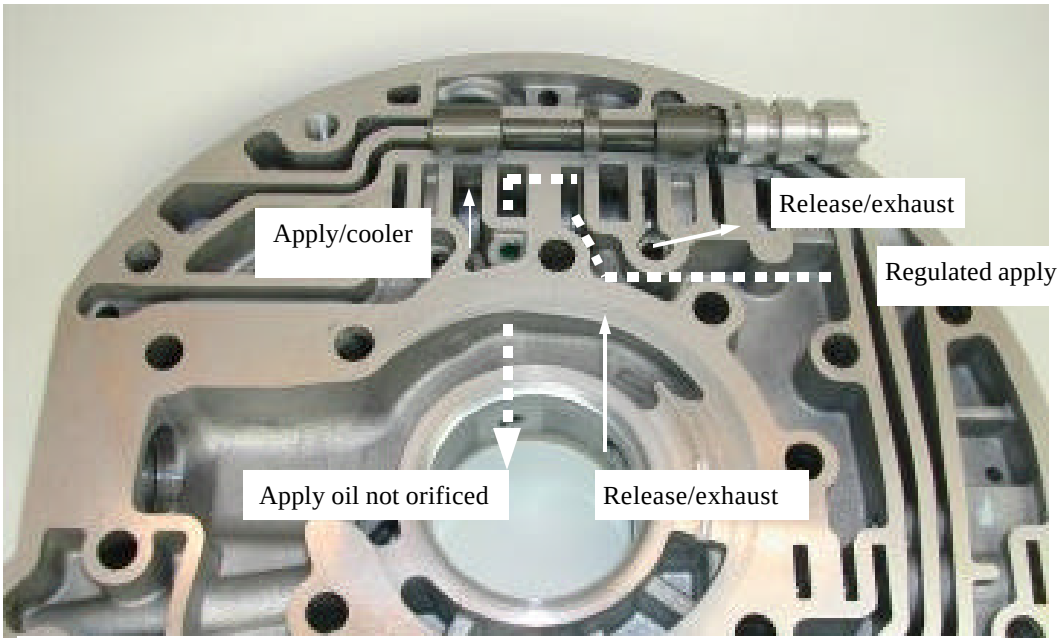
Even though the converters can be similar or the same, the hydraulic control is different. The orifices that control the flow to cooler verses the converter apply differ between the two units. You can verify this by comparing cooler flow on both types of units.

The E4OD will have less cooler flow when TCC is not applied and rise sharply with TCC command. Average E4OD cooler flow, in 3rd TCC not applied is 1.2 to 1.4 and at time of TCC command goes to 1.8 to 2.0
GPM. It is almost an opposite of the 4R100.

The 4R100 with modulated converter control drops during TCC apply and is greater before lockup. (refer to chart) The E4OD does not have the external pressure bypass either. This makes the E4OD much easier to diagnose. You can identify when the TCC solenoid commands apply, by looking for a rise in flow or pressure. You then know the apply valve has stroked.

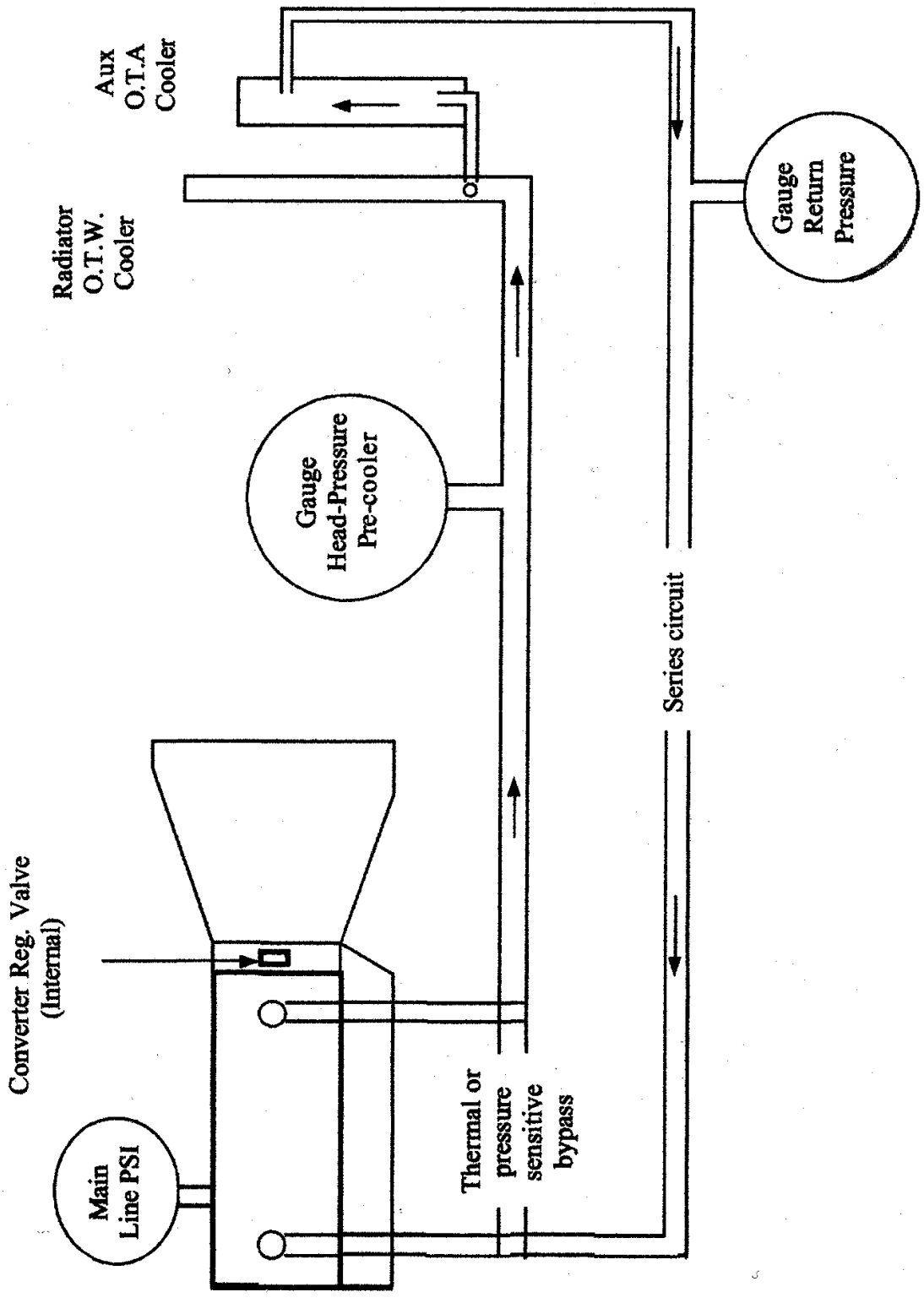
Knowing how these circuits are interrelated is comparable to having the answers for a geometry exam, before you enter the class. For this lesson, the 4R100 TCC test answers have been compiled here, so all you need are gauges and your garden hose as a reminder.

Multiplate converter with bearing turbine hub (ill. 1)

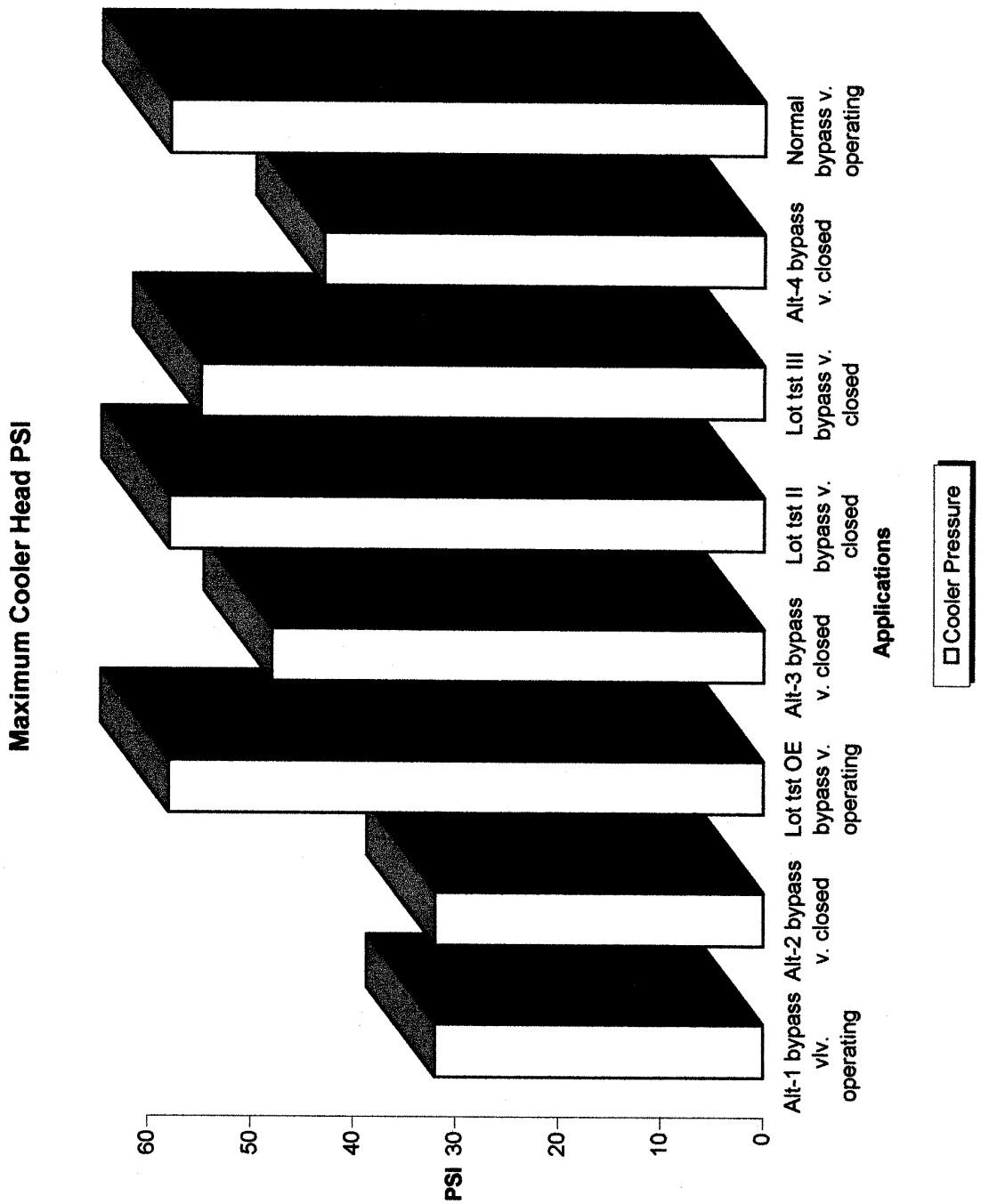


TCC modulated control valve (ill. 2)

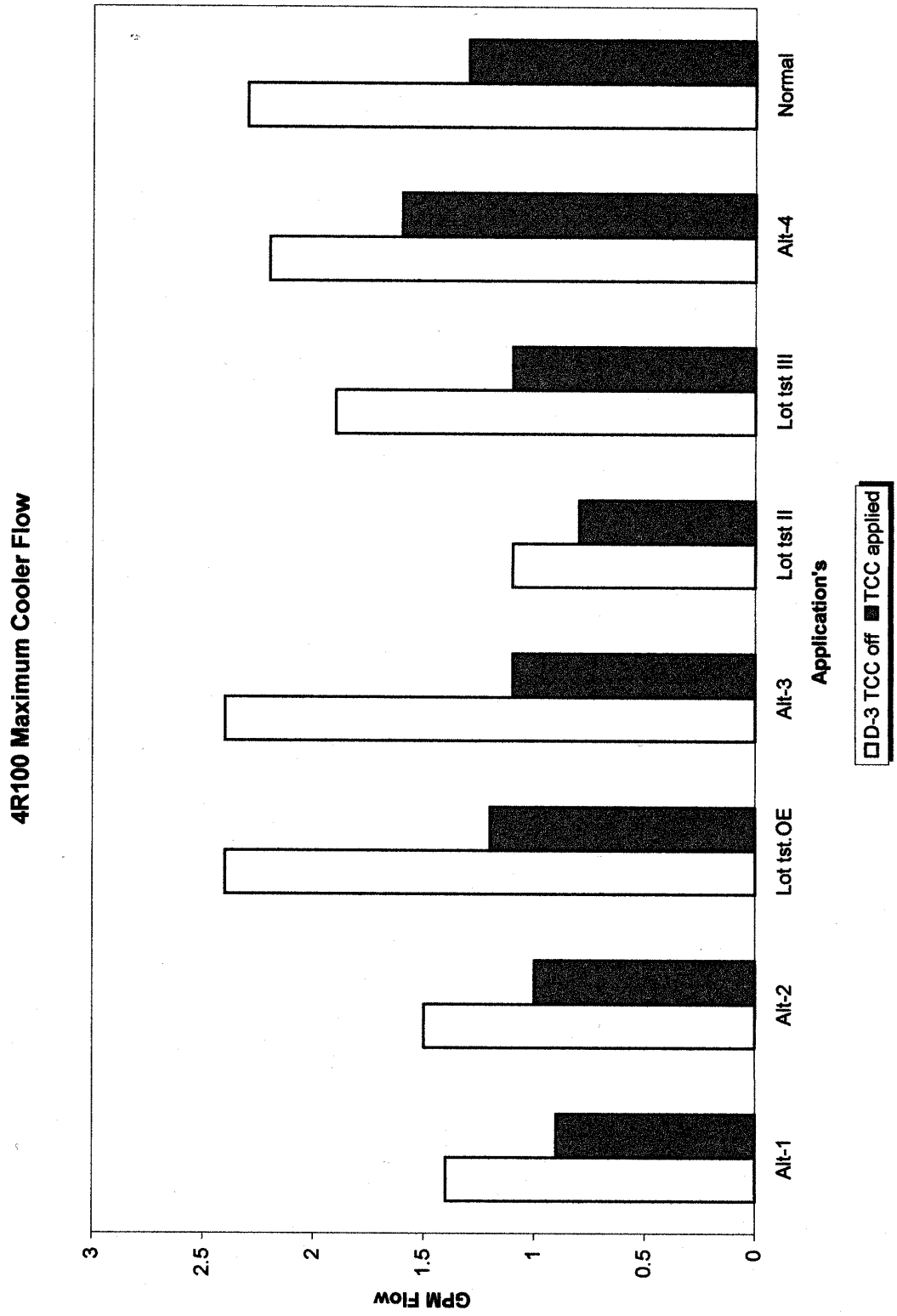
4R100 Cooler Pressure (ill. 3)



4R100 PSI (ill. 4)



4R100 Maximum Cooler Flow (ill.4)



Graph Explanation:

Vehicles

Alt-1:
First test after code 1728
Original pump with TCC valve modifications
OE by-pass operational
Same converter type

Alt-2:
New OE pump, no valve modifications
By-pass welded to prevent opening
Hotflush machine had 3.6 G.P.M.
Same converter type

Lot test OE:
Similar truck tested without condition
All OE

Alt-3:
Installed OE converter from Lot test OE into problematic vehicle.
By-pass welded closed
TCC apply very good

Lot test II:
Lot truck transmission rebuilt
By-pass welded closed
Installed Alt-2 converter
Cooler flushed

Lot test III:
A different (3rd) lot truck tested.
All OE

Alt-4:
Installed converter from Alt-1 opened and modified to increase flow.
Installed into a 3rd truck
By-pass welded closed