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TECHNICAL SEMINAR



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The Automatic Transmission Rebuilders Association

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Dennis Madden
Chief Executive Officer

Welcome to the 2004 ATRA Technical Seminar! As you're probably already aware, this is ATRA's 50th year of serving the automatic transmission industry.

As with any major milestone, this year's anniversary has caused us to examine the changes that have taken place over the last half century. And nowhere are those changes more evident than in this, our annual technical seminar program.

This year — our 50th year — marks another milestone in the evolution of the ATRA technical seminar. Because this year, for the first time, the ATRA seminar manual has been developed and printed in full color!

Having worked on several seminar manuals myself I know what it takes to produce a seminar. Lance Wiggins and the ATRA Technical staff have really pull out all the stops this year; another sign of the new things coming out of the "New" ATRA.

This seminar, along with everything else at ATRA is a group effort, with a lot of effort in the background that nobody ever sees. I could not be more delighted with the staff here at ATRA.

ATRA is changing all the time: with the new items like the 3-year Golden Rule warranty, to give your customer that added peace of mind; point-of-sale items to make your shop look even more professional; Nation-wide advertising and referral services, getting more consumers into ATRA Members' shops. These are just a few of the changes you've seen in the past year, and it's only the beginning.

On behalf of the ATRA staff, and the ATRA Chapters that work so hard to bring you this seminar, welcome.

Sincerely,

A handwritten signature in black ink, appearing to read 'Dennis Madden'.

Dennis Madden,
ATRA, CEO

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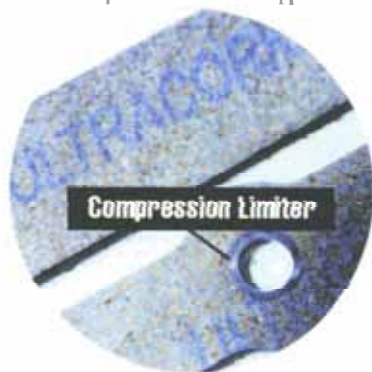
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820352	Chrysler	404 FWD Gear Box	1.83 ea.	5
820345	Chrysler	A604 Ultradrive Oil Pan	1.93 ea.	5
820353	Chrysler	A604 Diff Oil Pan	1.57 ea.	5
820354	Chrysler	A604 End Cover	1.43 ea.	5
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820362	Ford	ATX Oil Pan	1.90 ea.	5
820346	Ford	A4LD W/4 Notches	1.78 ea.	5
820289	Ford	AXOD Oil Pan (1986-96)	3.78 ea.	5
820323	Ford	AXOD Control Cover (1986-96)	2.56 ea.	5
820394	Ford	AX4S Oil Pan (1996 & up)	5.10 ea.	3
820395	Ford	AX4S Control Cover (1996 & up)	4.35 ea.	3
820364	Ford	Probe 4EAT	1.98 ea.	5
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820397	Ford	AX4N Oil Pan (1995 & up)	6.90 ea.	3
820368	Ford	AX4N Main Control CVR (Early)	3.58 ea.	5
820398	Ford	AX4N Main Control Cover (1995 & up)	5.90 ea.	3
820369	GM	Powerglide	1.98 ea.	5
820370	GM	TH-350, 350C, 250, 250C	1.44 ea.	5
820371	GM	TH-400	1.74 ea.	5
820372	GM	TH-180, 180C	1.82 ea.	5
820373	GM	TH-200, 200C	1.62 ea.	5
820374	GM	T-125, 125C	1.86 ea.	5
820375	GM	TH-125, 125C Sprocket CVR	1.50 ea.	5
820376	GM	TH-200-4R	2.18 ea.	5
820377	GM	TH-440 Side Case Cover	2.24 ea.	5
820349	GM	TH700R4	1.50 ea.	5
820378	GM	TH-440-T4 Oil Pan	2.28 ea.	5
820379	GM	4T60E	2.07 ea.	5
820182	GM	4T80E	2.70 ea.	5
820380	Mitsubishi	KM170 Combo	1.69 ea.	5
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820385	Subaru	4 Spd	2.24 ea.	5
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820387	Toyota	A-340	2.30 ea.	5
820388	Toyota	A-540-E	2.56 ea.	5
820389	Toyota	A540 93-ON	2.54 ea.	5

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Lance Wiggins
Technical Director



This year ATRA is proud to be celebrating its 50th year serving the automatic transmission repair industry. A lot of changes have taken place over five decades of transmission repair, and those changes are coming faster every year.

It's because of those changes that technical training has become an integral part of today's transmission repair industry. It's just not possible anymore to get by with a measure of common sense and a decent technical aptitude. To remain profitable, today's technicians need up-to-date training on an ongoing basis.

To that end, ATRA is pleased to present its 2004 Technical Seminar. Packed with countless hours of research and development, writing, editing, photography and layout, this year's seminar will stand out as one of the most demanding and useful technical training programs ever developed for this industry.

And, for the first time, this year's technical manual has been produced in *full color*. With over 300 pages of up-to-the-minute technical information, the 2004 Technical Seminar Manual will remain a valuable resource long after the seminar is just a memory.

We're confident that you'll find this year's seminar presentation and technical manual both informative and profitable. In fact, we're so sure you'll be satisfied with what you learn in this program, we guarantee it!

So, on behalf of the entire ATRA staff, the international board of directors, and all of the ATRA members worldwide, we'd like to thank you for helping to make our first 50 years memorable. And we're happy to welcome you as we ring in the next half-century of transmission repairs, by taking part in the 50th anniversary edition of the ATRA 2004 Technical Seminar.

A handwritten signature in cursive script that reads 'Lance Wiggins'.

ATRA Technical Team (continued)



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and Seminar Speaker



Steve Garrett
Technical Advisor, Seminar
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It's difficult enough getting the seminar book researched, written, pictured, edited, and printed let alone getting it out to the seminar attendees. This is where the ATRA Staff comes in.

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Without the ATRA team, it would be very hard to accomplish the task at hand. Please enjoy the seminar.

Lance Wiggins
ATRA, Technical Director

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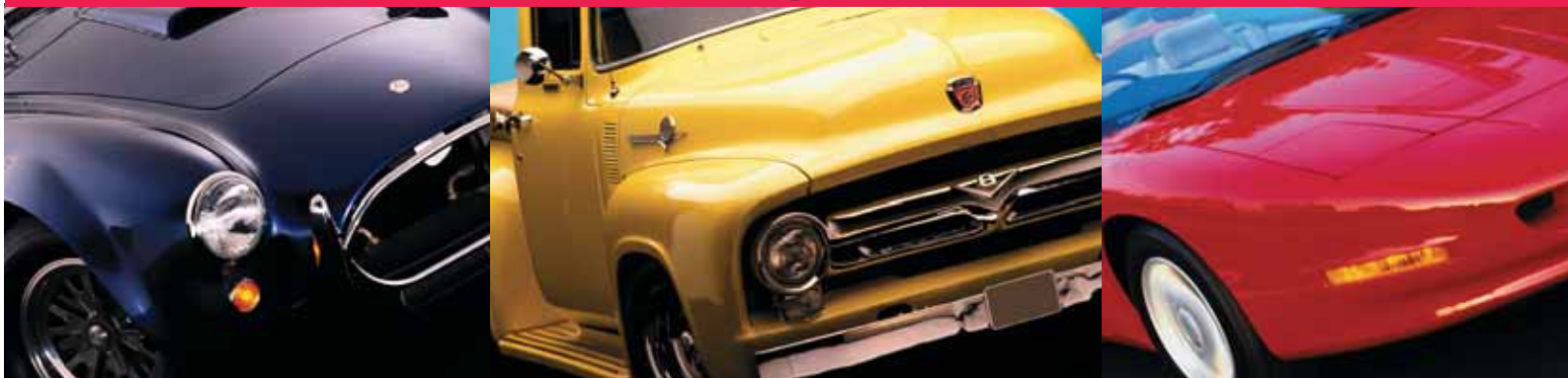
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ATRA AD

4L30E

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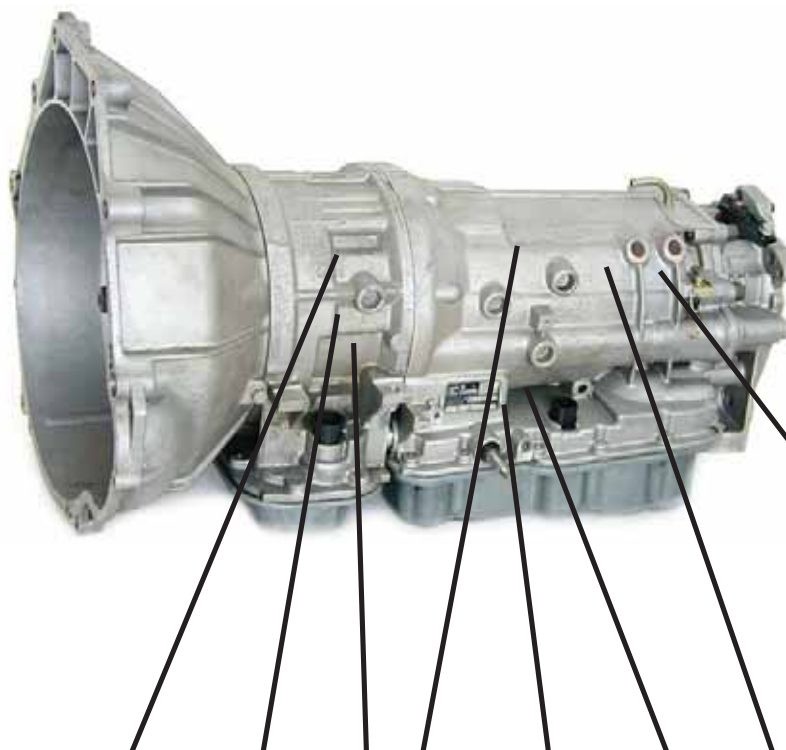
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Clutch and Band Application Chart



RANGE	GEAR	1-2/3-4 SOL. N.C.	2-3 SOL N.O.	OVERDRIVE ROLLER CLUTCH	OVERDRIVE CLUTCH	FOURTH CLUTCH	THIRD CLUTCH	REVERSE CLUTCH	SECOND CLUTCH	PRINCIPLE SPRAG ASSEMBLY	BAND ASSEMBLY	ENGINE BRAKING
P-N		OFF	ON		APPLIED							NO
R	REVERSE	OFF	ON	LD	APPLIED			APPLIED		LD		NO
D	1st	OFF	ON	LD	APPLIED					LD	APPLIED	NO
	2nd	ON	ON	LD	APPLIED				APPLIED	FW	APPLIED	YES
	3rd	ON	OFF	LD	APPLIED		APPLIED		APPLIED	NE		YES
	4th	OFF	OFF	FW		APPLIED	APPLIED		APPLIED	NE		YES
3	1st	OFF	ON	LD	APPLIED					LD	APPLIED	NO
	2nd	ON	ON	LD	APPLIED				APPLIED	FW	APPLIED	YES
	3rd	ON	OFF	LD	APPLIED		APPLIED		APPLIED	NE		YES
2	1st	OFF	ON	LD	APPLIED		APPLIED			LD	APPLIED	YES
	2nd	ON	ON	LD	APPLIED				APPLIED	FW	APPLIED	YES
1	1st	OFF	ON	LD	APPLIED		APPLIED			LD	APPLIED	YES

LD = LOCKED IN DRIVE

FW = FREEWHEELING

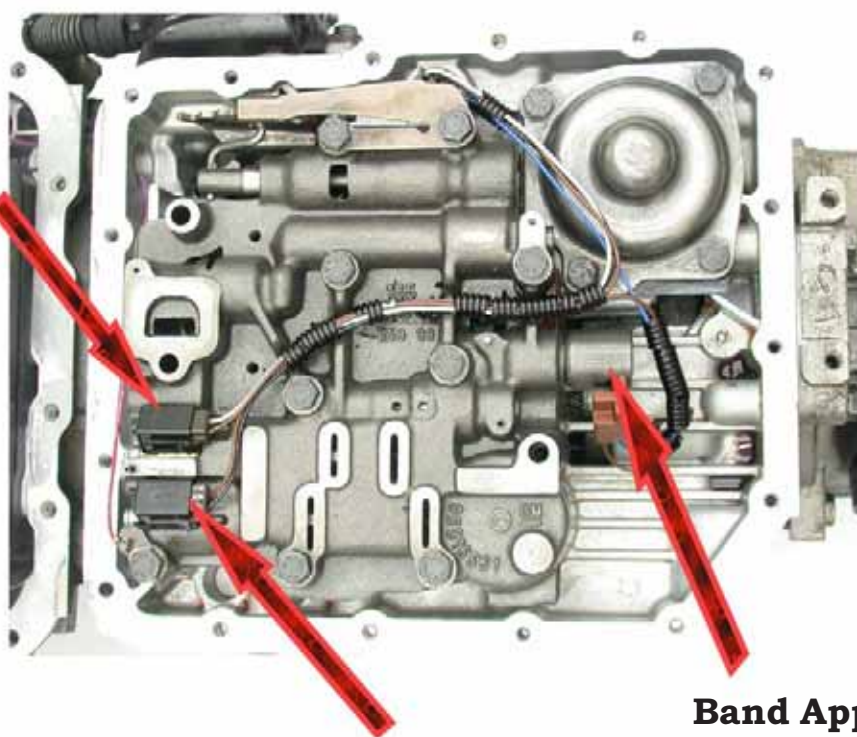
NE = NOT EFFECTIVE

4L30E

Solenoid Identification

Always check the resistance of the solenoids and visually check the wire harness for damage. Keep in mind, the 2-3 shift solenoid is “normally open” and the 1-2/3-4 shift solenoid is “normally closed”.

**2-3 Shift
Solenoid
17-24 ohms
normally
open**



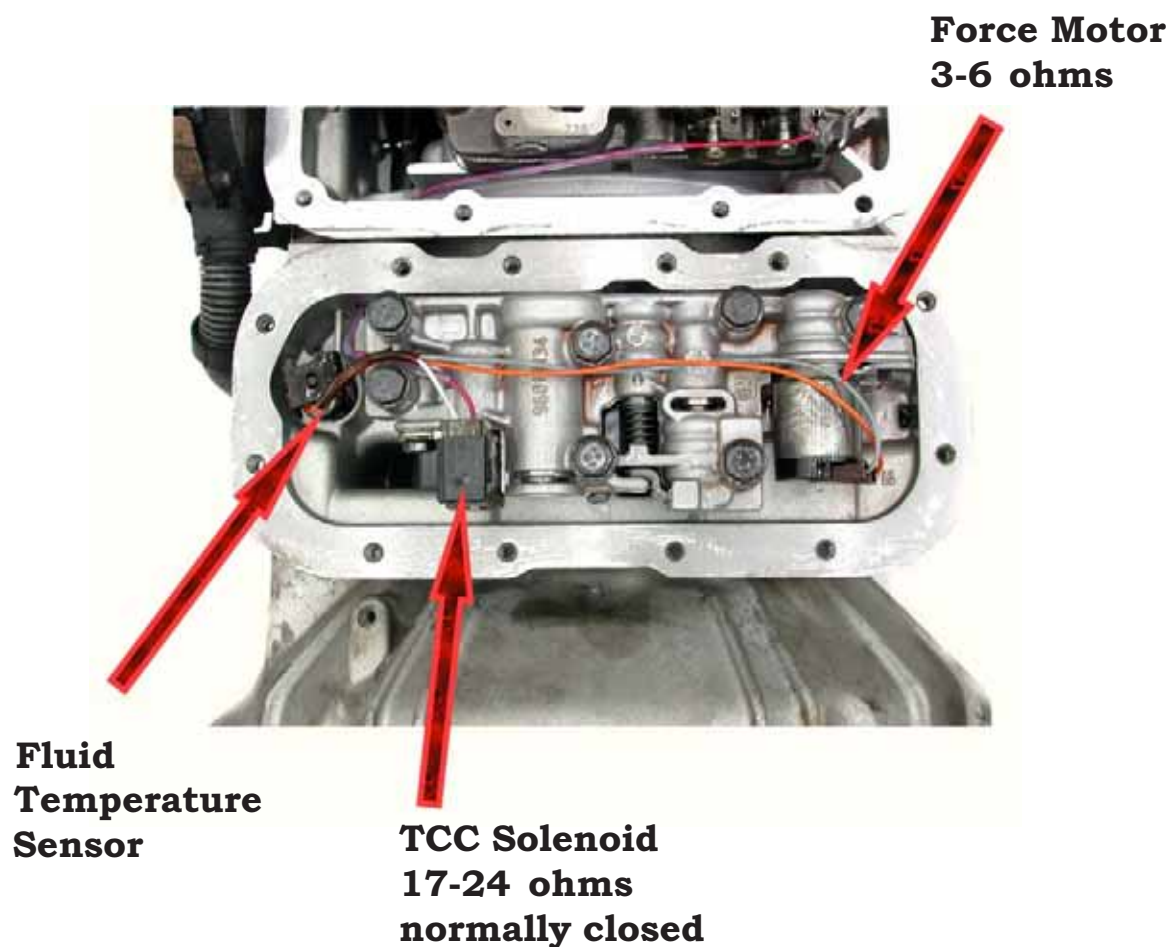
**1-2/3-4 Shift
Solenoid
17-24 ohms
normally
closed**

**Band Apply
Solenoid 9-14
ohms PWM**

4L30E

Solenoid Identification (continued)

Always check the resistance of the solenoids and visually check the wire harness for damage.



4L30E

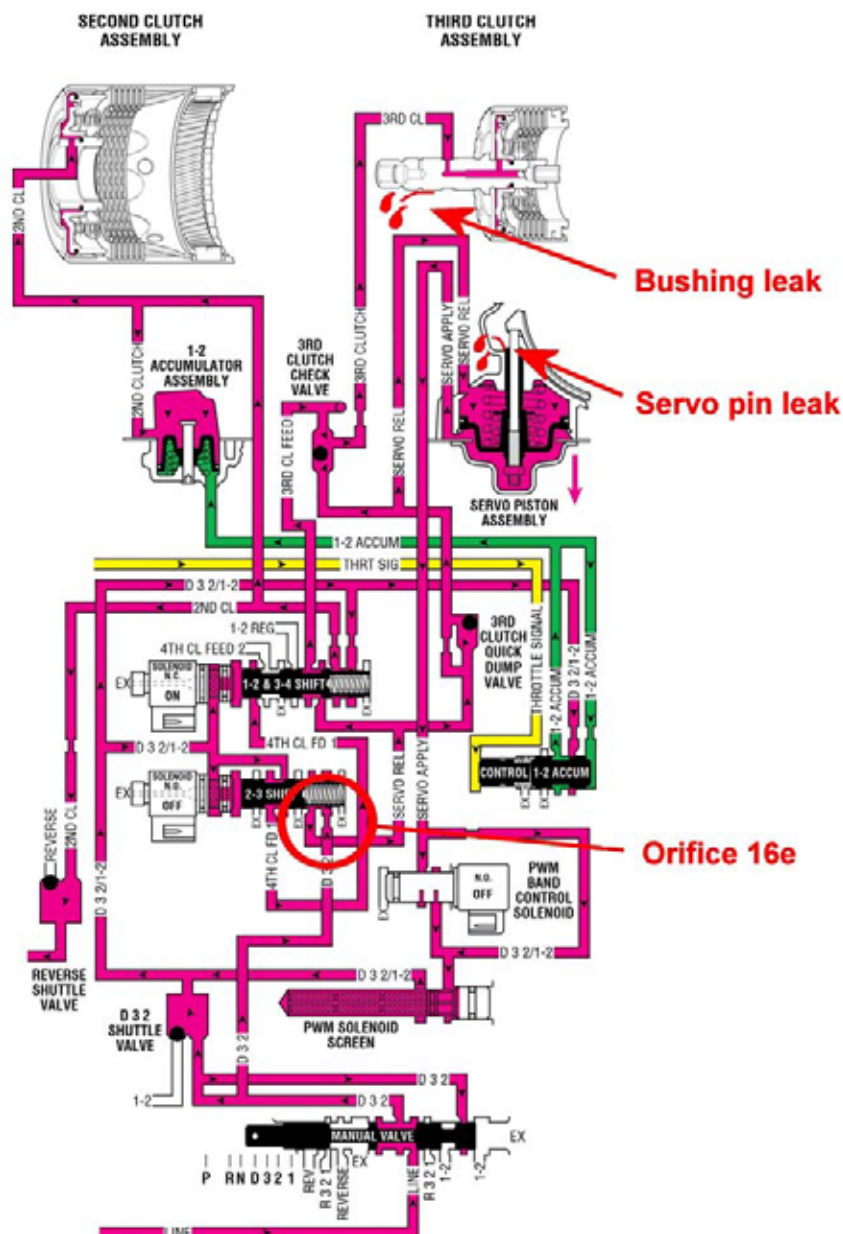
Band Failure, Binds In 3rd or 4th, Dragging Sensation

A common cause for the Band failure is the band being partially applied and dragging in 3rd or 4th gear. This is usually caused by insufficient servo release pressure, which can be the result of leaks in the 2nd clutch and/or 3rd clutch circuits. In this section we are going to review the servo release and related oil circuits, as well as what you need to check on every overhaul to prevent band failure.



Band Failure, Binds In 3rd or 4th, Dragging Sensation (continued)

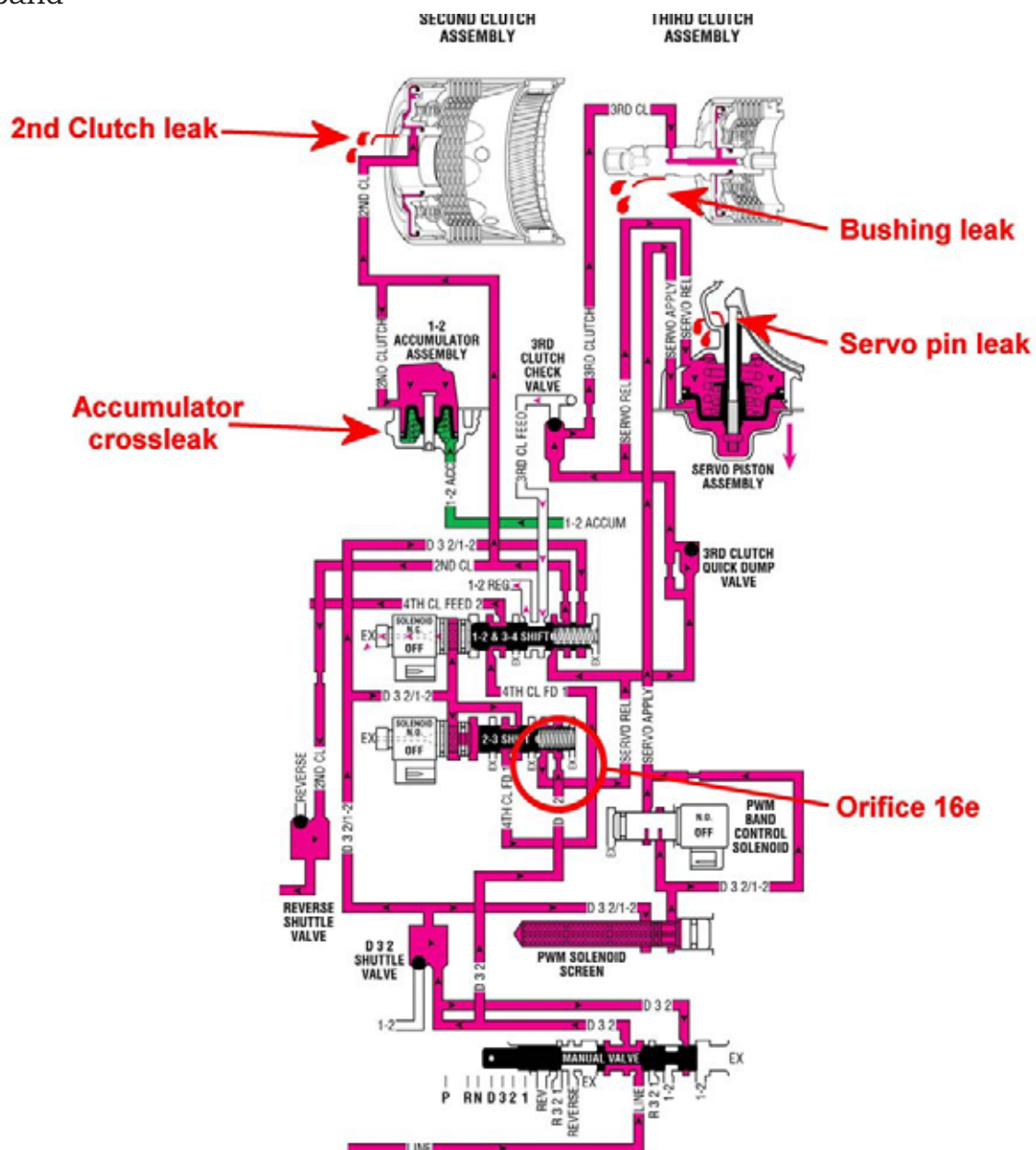
In third gear, the servo release and 3rd clutch are being fed through the #16 orifice.



4L30E

Band Failure, Binds In 3rd or 4th, Dragging Sensation (continued)

In fourth gear the 2nd clutch, is also fed through the #16e orifice. A leak in the second clutch circuit will cause a loss of servo release oil, resulting in a dragging band



4L30E

Band Failure, Binds In 3rd or 4th, Dragging Sensation (continued)

The 2nd clutch drum is a common failure. Closely inspect the drum for cracks in the ring bore chamfer.

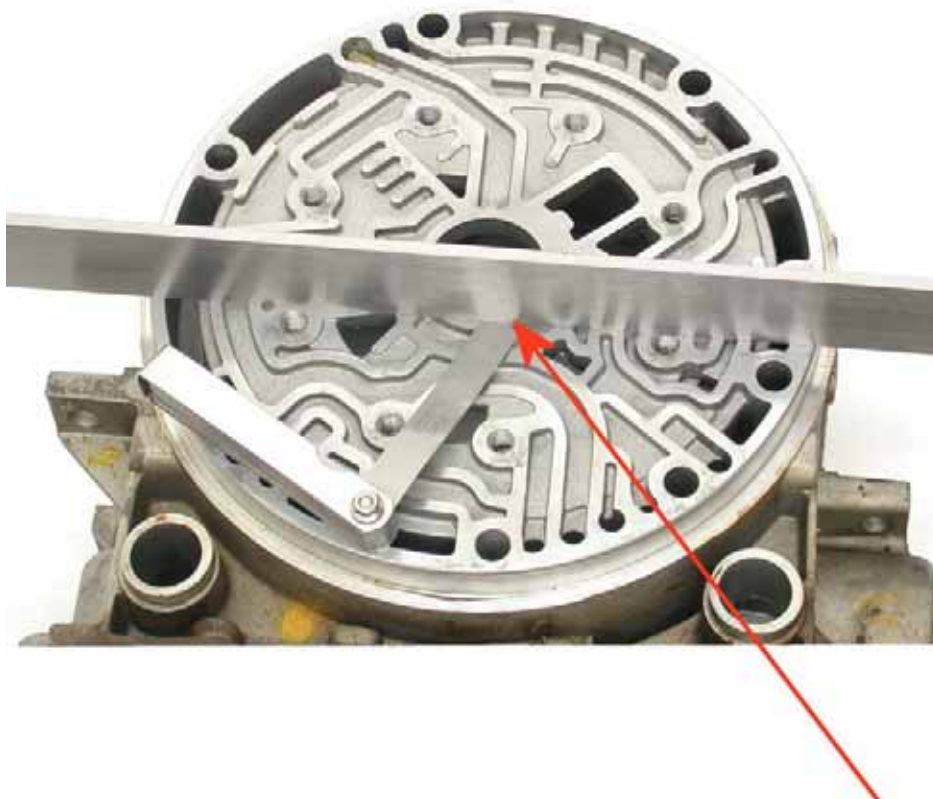


Check here for cracks

4L30E

Band Failure, Binds In 3rd or 4th, Dragging Sensation (continued)

Always use a straight edge and a feeler gauge across the adapter case in several places to check it for possible warpage. The bolt holes are usually the high spots. You should not be able to fit a 0.0015" feeler gauge under the straight edge surface. If you can, your adapter case is warped.



Any gap under the straight edge should not exceed 0.0015"

4L30E

Band Failure, Binds In 3rd or 4th, Dragging Sensation (continued)

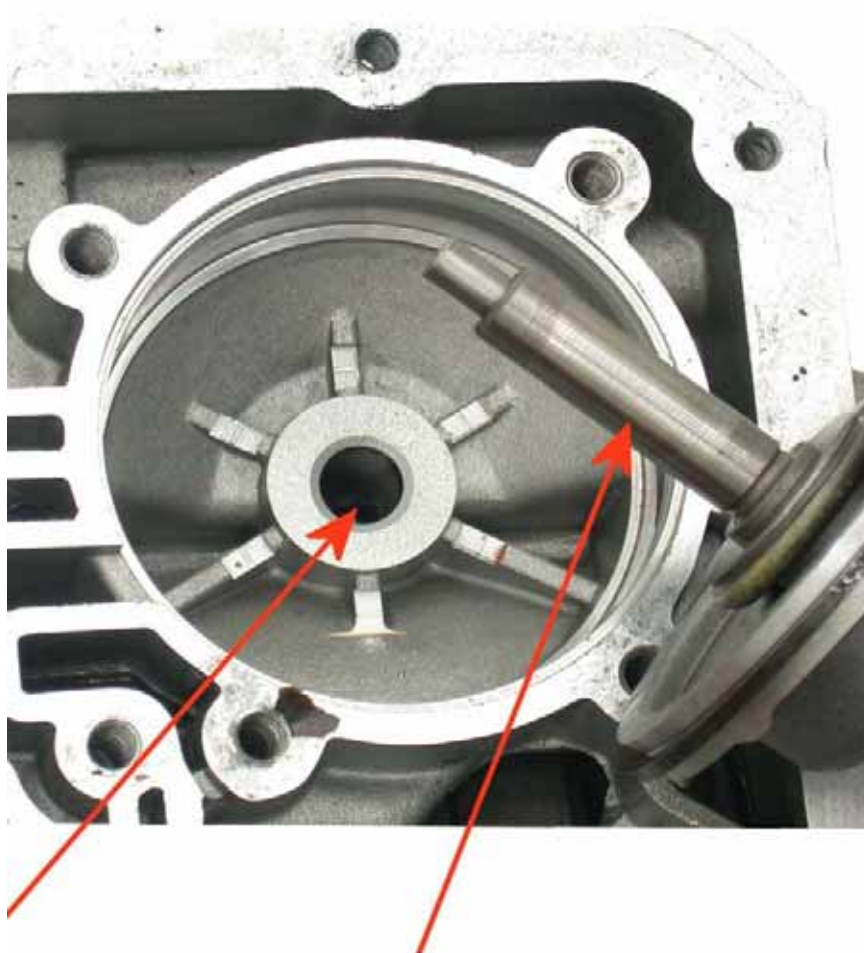
When checking the center support for warpage, use the same technique as the adapter case. Center support warpage should not exceed 0.0015". Check the 3rd clutch drum shaft and center support bushing for wear or scoring. Keep in mind, the bushing seals the apply circuit; there are no sealing rings in this location.



4L30E

Band Failure, Binds In 3rd or 4th, Dragging Sensation (continued)

After removing the servo from the bore, check the inside area for wear.



Check for wear in these locations

4L30E

Band Failure, Binds In 3rd or 4th, Dragging Sensation (continued)

The servo release pressure port should always be drilled and tapped in the location shown below. Servo release pressure should be checked after every rebuild. There should be no more than 10 psi difference between the servo release pressure and main line pressure in 3rd and 4th gear.

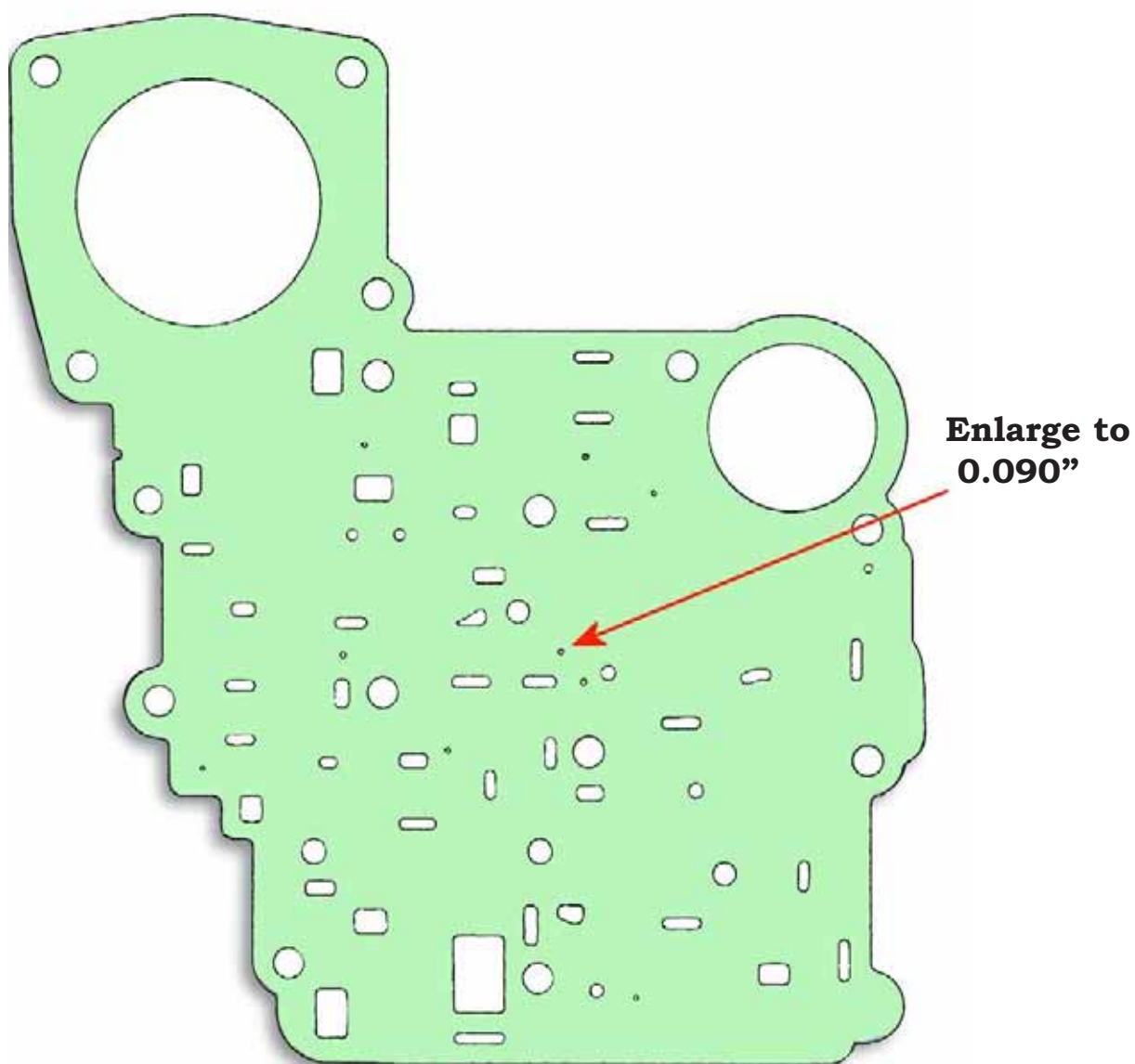
**Drill and Tap
the hole with an
1/8" pipe tap**



4L30E

Band Failure, Binds In 3rd or 4th, Dragging Sensation (continued)

As a preventative measure you can enlarge the feed orifice hole #16e to 0.090”.

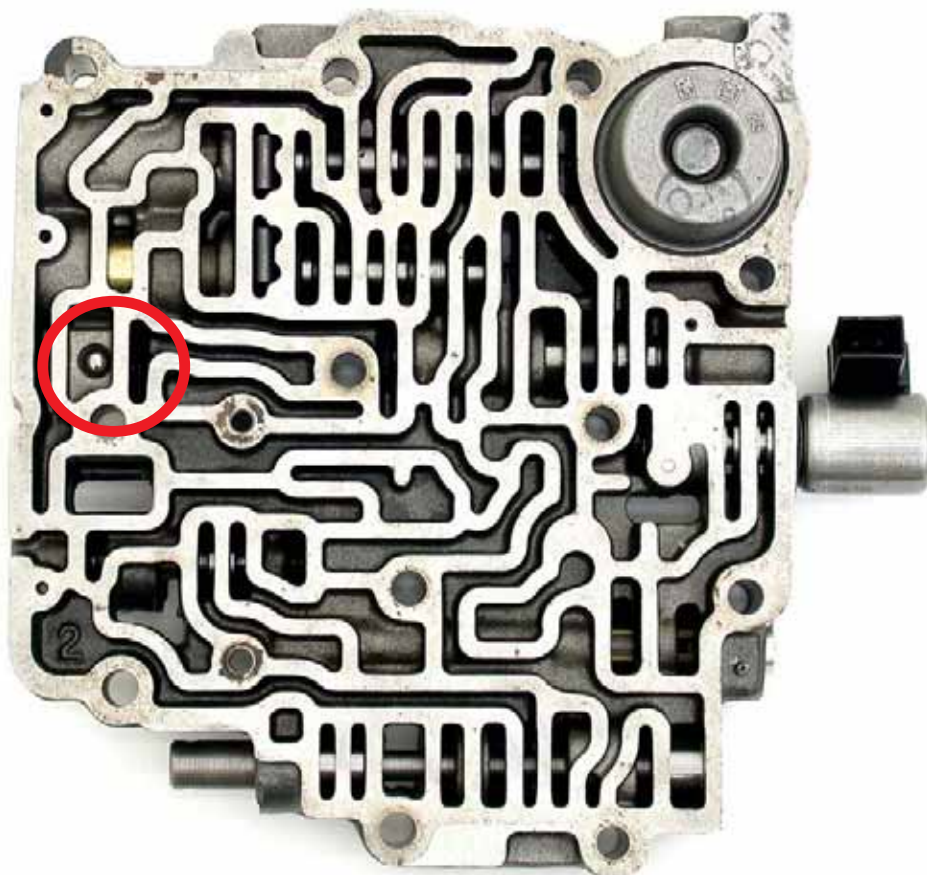


4L30E

Band Failure, Binds In 3rd or 4th, Dragging Sensation (continued)

A bindup condition in 4th gear may be caused by a missing or leaking 3rd clutch checkball. When this checkball is missing, 1-2 servo release pressure can leak in 4th gear causing the 1-2 band to apply.

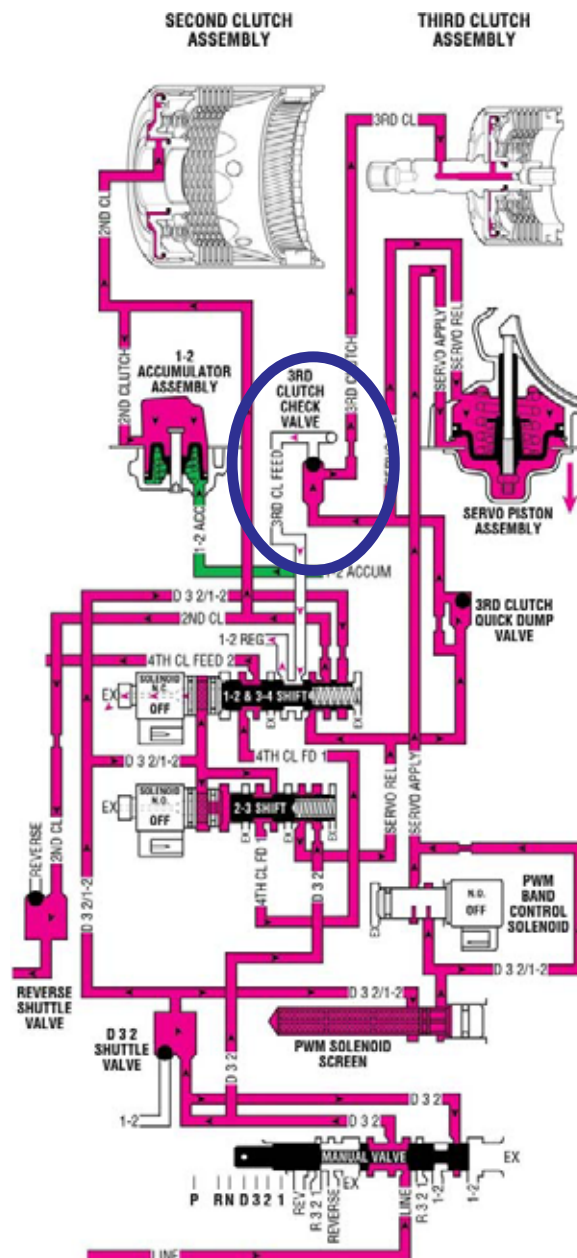
**3rd clutch
checkball**



4L30E

Band Failure, Binds In 3rd or 4th, Dragging Sensation (continued)

A missing or leaking 3rd clutch checkball can cause the 1-2 servo release pressure to leak in 4th gear causing the 1-2 band to apply.



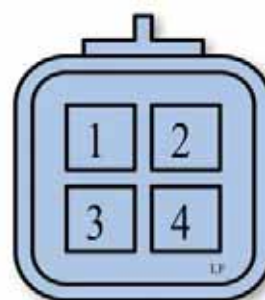
4L30E

Case Connector ID

4 Pin Main Case Connector

Pin	Function
1	2-3 Shift solenoid
2	Band apply solenoid
3	1-2/3-4 Shift solenoid
4	Ground from computer (Type 1 only)
	B+ from computer (All others)

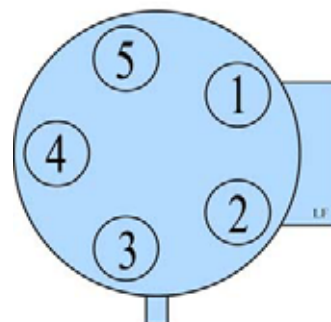
Solenoid	Pins	Resistance
2-3 Shift solenoid	1 and 4	17-24ohms
Band apply solenoid	2 and 4	9-14 ohms
1-2/3-4 Shift solenoid	3 and 4	17-24 ohms



5 Pin Adapter Case Connector

Pin	Function
1	Fluid temperature sensor
2	TCC solenoid
3	Force motor (+)
4	Force motor (-)
5	Fluid temperature sensor

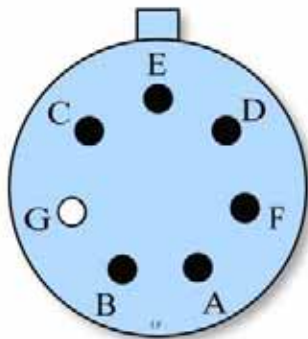
Solenoid	Pins	Resistance	
Force motor	3 and 4	3-6 ohms	
TCC solenoid	2 and ground	17-24 ohms	
Fluid temperature sensor	1 and 5	-40°F (-40°C)	672K ohms
		32°F (0°C)	65K ohms
		68°F (20°C)	25K ohms
		176°F (80°C)	2.5K ohms
		248°F (120°C)	780 ohms
		302°F (150°C)	370 ohms



4L30E

Case Connector ID (continued)

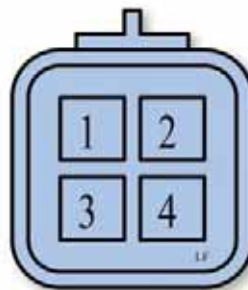
7Pin Main Case Connector



Pin	Function
A	2-3 Shift solenoid
B	Band apply solenoid
C	1-2/3-4 shift solenoid
D	B+ from computer
E	Fluid temperature sensor (-)
F	Fluid temperature sensor (+)
G	Not used

Solenoid	Pins	Resistance
2-3 Shift solenoid	D and A	17-24 ohms
Band apply solenoid	D and B	9-14 ohms
1-2/3-4 Shift solenoid	D and C	17-24 ohms
Fluid temperature sensor	E and F	-40°F (-40°C) 672K ohms
		32°F (0°C) 65K ohms
		68°F (20°C) 25K ohms
		176°F (80°C) 2.5K ohms
		248°F (120°C) 780 ohms
		302°F (150°C) 370 ohms

Solenoid	Pins	Resistance
Force motor	2 and 4	3-6 ohms
PWM TCC	1 and 3	9-14 ohms



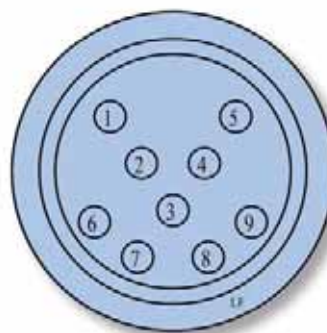
Pin	Function
1	PWM TCC (+)
2	Force motor (+)
3	PWM TCC (-)
4	Force motor (-)

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Case Connector ID (continued)

9 Pin Main Case Connector (BMW)

Pin	Function
1	Force motor
2	Fluid temperature sensor
3	Force motor
4	Fluid temperature sensor
5	2-3 Shift solenoid
6	B+ from computer
7	TCC solenoid
8	Band apply solenoid
9	1-2/3-4 Shift solenoid



Solenoid	Pins	Resistance
2-3 Shift solenoid	6 and 5	17-24 ohms
Band apply solenoid	6 and 8	9-14 ohms
1-2/3-4 Shift solenoid	6 and 9	17-24 ohms
Force motor	1 and 3	3-6 ohms
TCC solenoid	6 and 7	17-24 ohms
Fluid temperature sensor	2 and 4	-40°F (-40°C) 672K ohms
		32°F (0°C) 65K ohms
		68°F (20°C) 25K ohms
		176°F (80°C) 2.5K ohms
		248°F (120°C) 780 ohms
		302°F (150°C) 370 ohms

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Computer Types

Asian models

Type 1

1990-1993 Isuzu Rodeo and Trooper

Type 2

1994-1995 Isuzu Rodeo, Trooper, Amigo and Honda Passport

Type 3

1996-1999 Isuzu Rodeo, Trooper, Amigo, Vehicross, Honda Passport and Acura SLX

German models

Type 5

1997-1998 Cadillac Catera

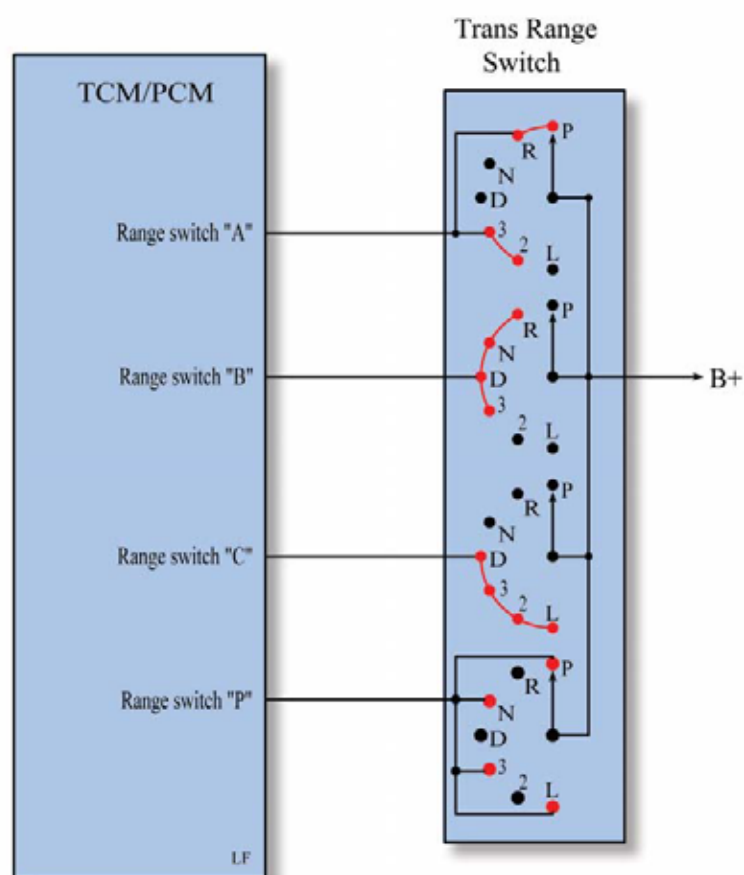
Type 6

1996-2001 BMW

1999-2001 Cadillac Catera

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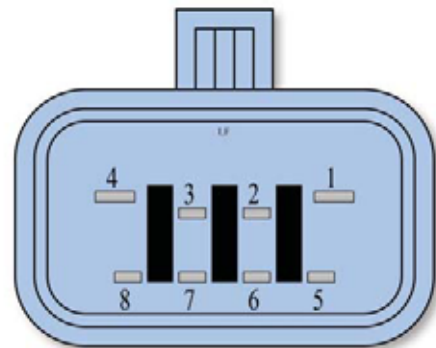
Range Switch All (except BMW)



Range switch voltages (all except BMW)							
	P	R	N	D	3	2	L
Switch "A"	B+	B+	0v	0v	B+	B+	0v
Switch "B"	0v	B+	B+	B+	B+	0v	0v
Switch "C"	0v	0v	0v	B+	B+	B+	B+
Switch "P"	B+	0v	B+	0v	B+	0v	B+

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Range Switch All (except BMW) (continued)

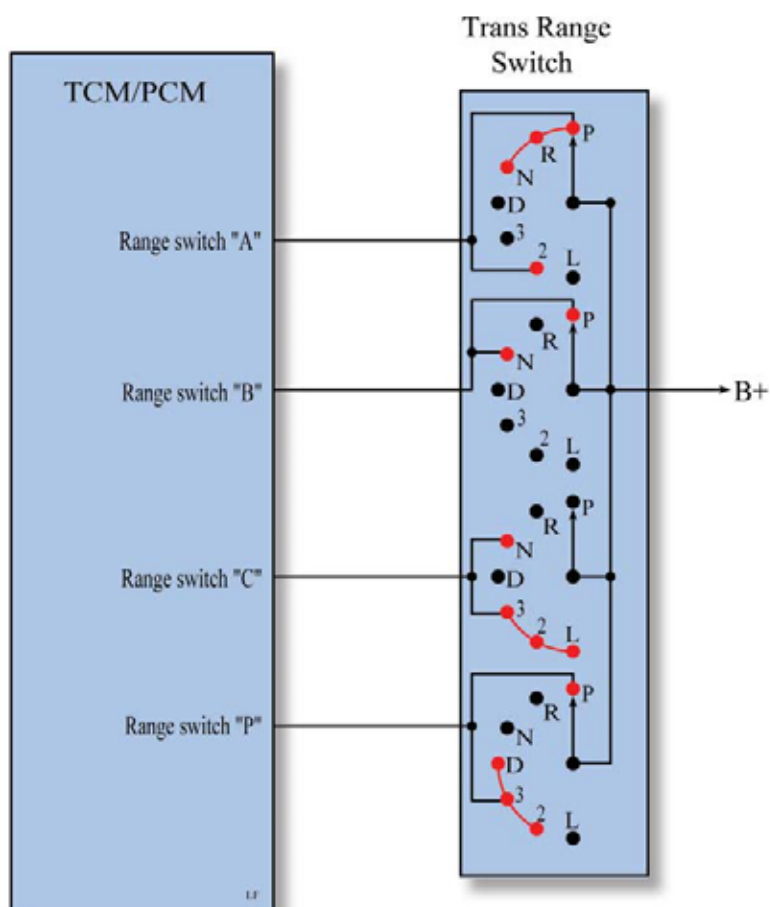


Range switch continuity (all except BMW)							
	P	R	N	D	3	2	L
Pins 5 to 8	•	•			•	•	
Pins 5 to 7		•	•	•	•		
Pins 5 to 6				•	•	•	•
Pins 5 to 3	•		•		•		•

Note: • =continuity

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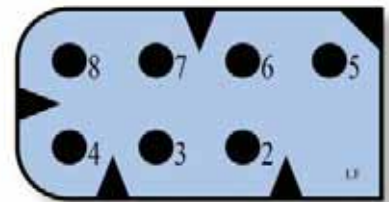
Range Switch BMW (only)



Range switch voltages (BMW)							
	P	R	N	D	3	2	L
Switch "A"	B+	B+	B+	0v	0v	B+	0v
Switch "B"	B+	0v	B+	0v	0v	0v	0v
Switch "C"	0v	0v	B+	0v	B+	B+	B+
Switch "P"	B+	0v	0v	B+	B+	B+	0v

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Range Switch BMW (only) (continued)



Range switch continuity (BMW)							
	P	R	N	D	3	2	L
Pins 5 to 4	•	•	•			•	
Pins 5 to 7	•		•				
Pins 5 to 6			•		•	•	•
Pins 5 to 8	•			•	•	•	

Note: • =continuity

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VSS (Pulse Generator)

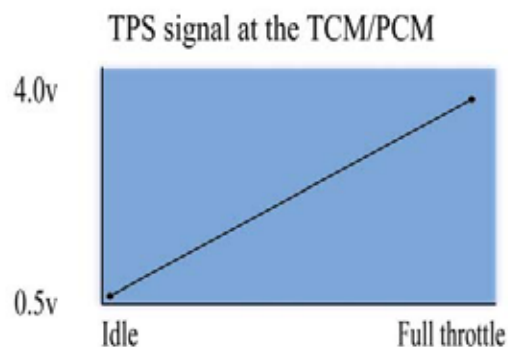
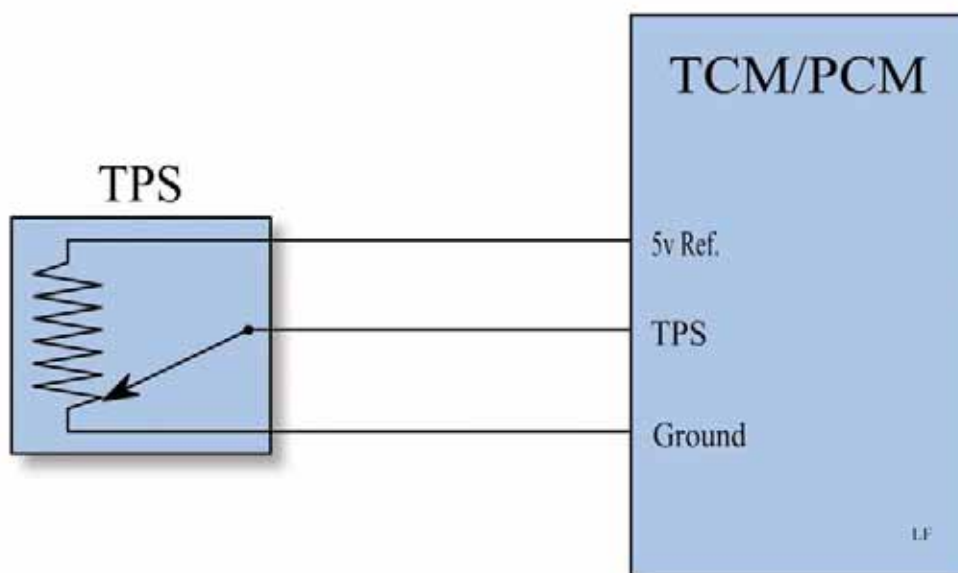
The VSS voltage output is 1-30 volts AC when the output shaft is spinning. The resistance is 2.8-3.0K ohms.



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TPS Circuit Types 1-3

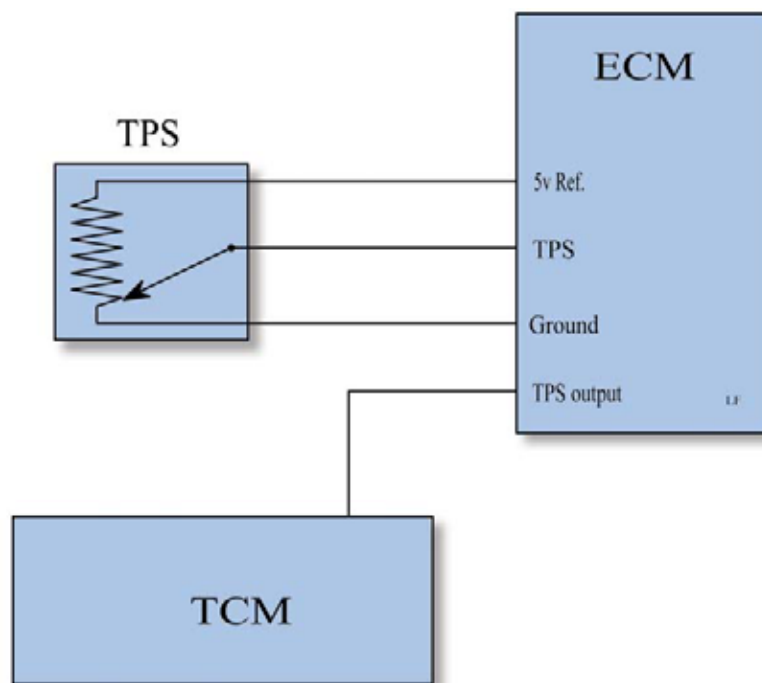
When working on vehicles with either type 1, 2, or 3 computer system, the TPS voltage can be monitored at the TPS and/or the TCM/PCM.



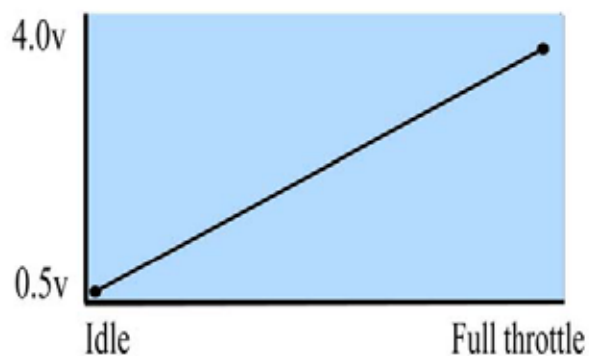
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TPS Circuit Type 5

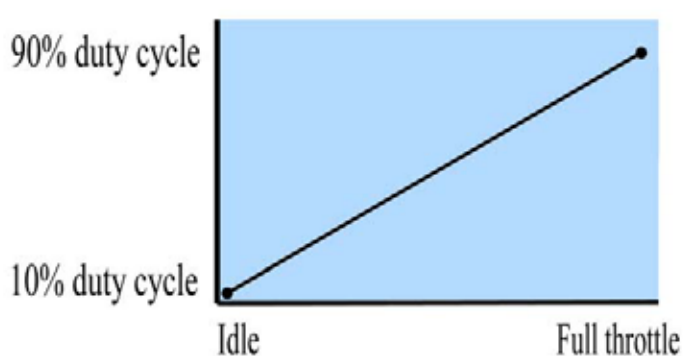
When working on a vehicle with a type 5 computer, the TPS voltage can be monitored at the TPS only. The ECM converts the TPS signal to a varying duty cycle and sends this signal to the TCM. Therefore, when monitoring the TPS signal at the TCM, you must set your voltmeter to read duty cycle.



TPS signal at the TPS



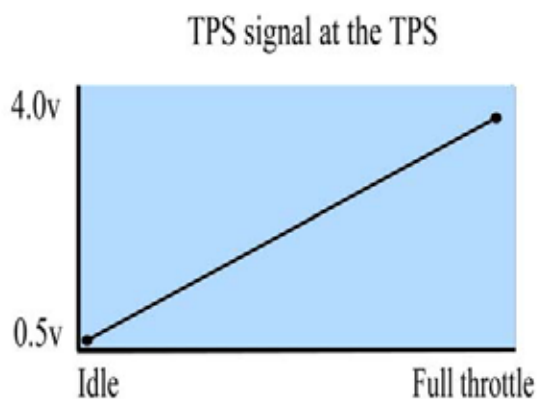
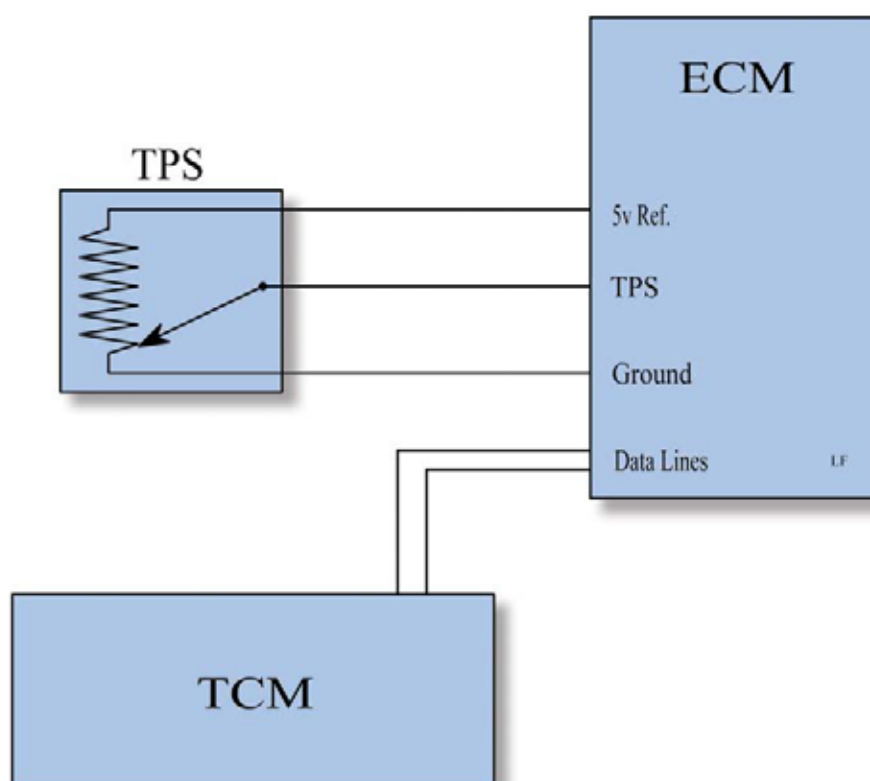
TPS signal at the TCM



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TPS Circuit Type 6

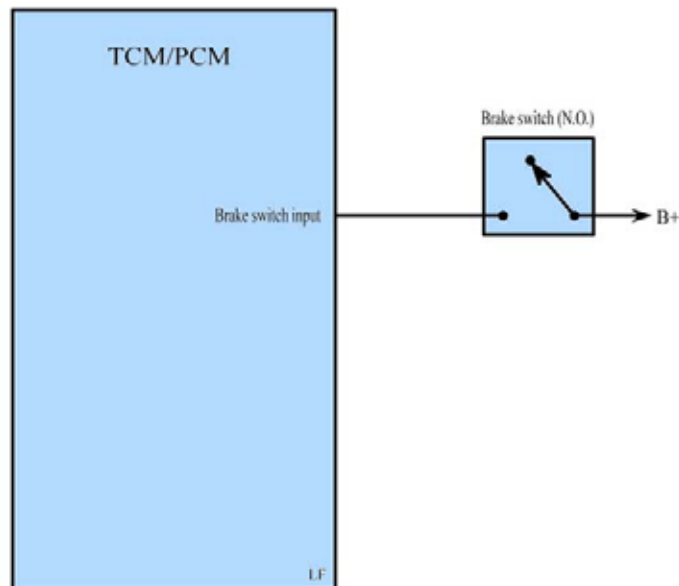
When working on a vehicle with a type 6 computer, the TPS voltage can be monitored at the TPS only. The ECM transmits the TPS signal to the TCM through the data lines and CAN NOT be monitored at the TCM with a voltmeter.



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Brake Switch Circuit All (except Type I)

With the exception of the type 1 computer system, the brake switch simply sends a signal to the TCM/PCM when the brake pedal is depressed. The computer uses this input to decide whether or not to command lockup.



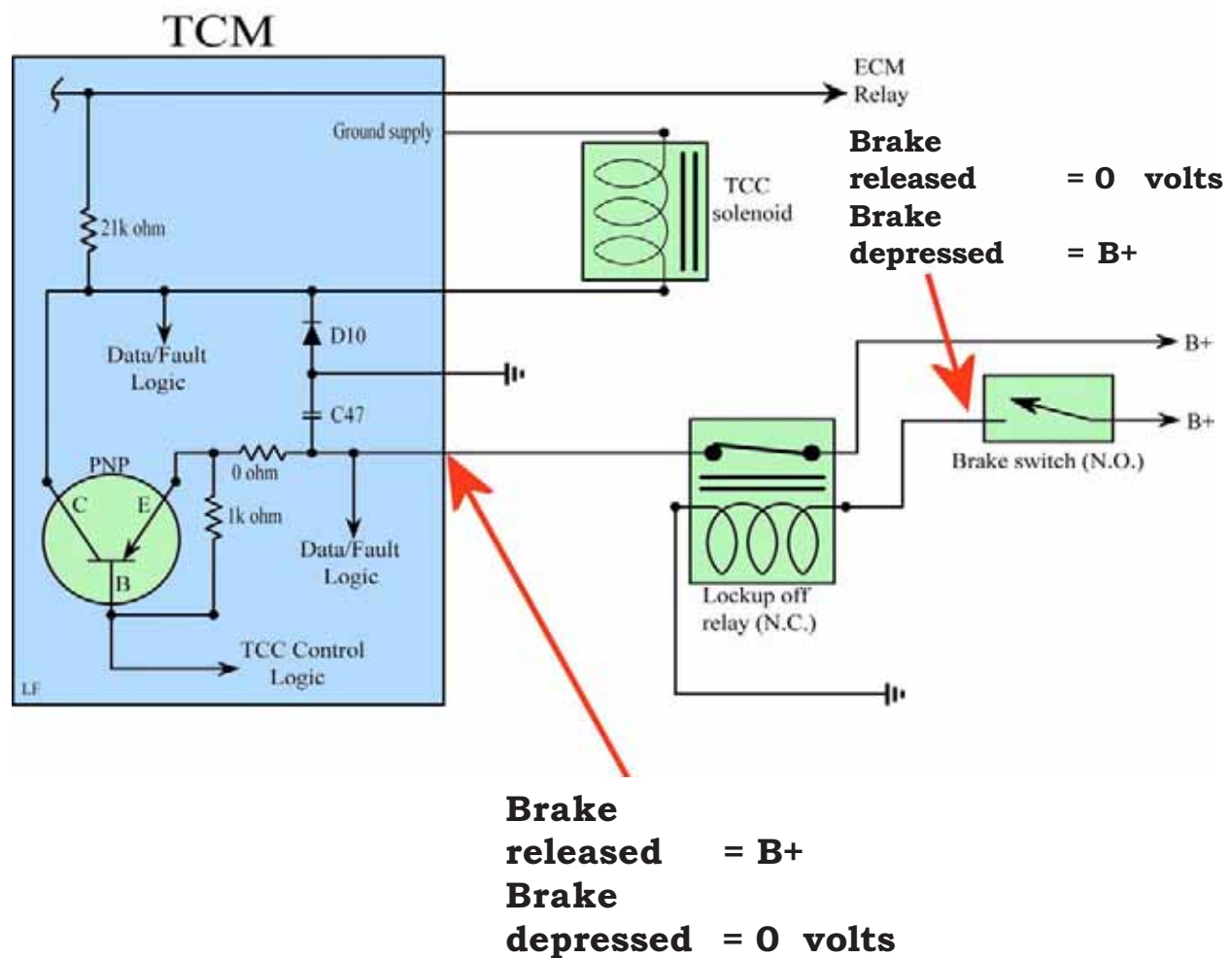
Brake released = 0 volts

Brake depressed = B+

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Brake Switch Circuit Type I

Although the computer decides whether or not to command lockup, the type 1 computer actually uses the voltage from the lockup off relay to turn the TCC solenoid on. A bad brake switch or a bad lockup off relay can cause a “no TCC apply” without setting any trouble codes.



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Diagnosing at the TCM

Removing the shield from the TCM (type 1, 5 and 6 connectors)

Remove the screw from the connector shield.



Remove the tape and/or tie from the harness.



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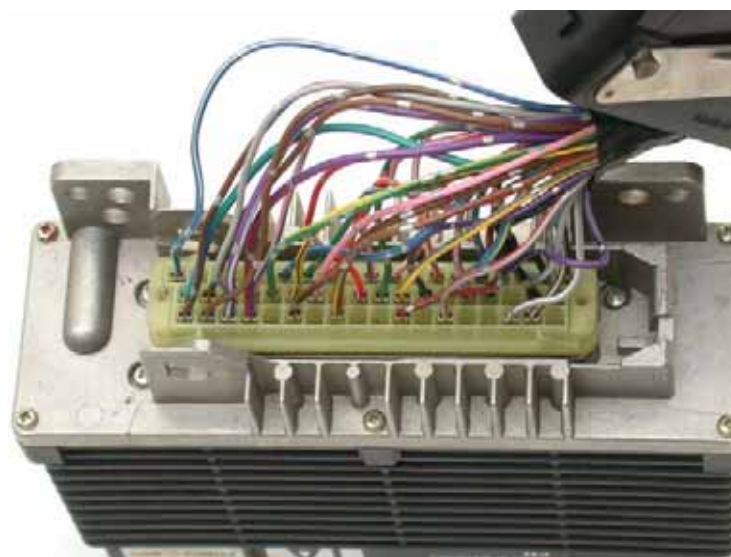
Diagnosing at the TCM (continued)

Removing the shield from the TCM (type 1, 5 and 6 connectors)



Slide the shield up the harness and away from the connector

Reconnect the computer connector



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TCM Pin Charts (Type I)



Pin	Function	Condition	Signal
1	A/C request	Compressor off	< 1v
		Compressor on	B+
2	Cruise control		
3	N/A	-	-
4	N/A	-	-
5	N/A	-	-
6	TPS (varying voltage)	Idle	0.5 v
		Full throttle	4.0 v
7	Power mode indicator	Light off	B+
		Light on	< 0.1v
8	Range selector pin C	Manual D, 3, 2 & L	B+
		All others	0v
9	N/A	-	-
10	Winter mode indicator	Light off	B+
		Light on	< 0.1v
11	Engine RPM (some models)	Engine running	DC frequency
12	N/A	-	-
13	Diagnostic	-	-
14	VSS ground	Always	< 0.1v
15	Kickdown switch	Full throttle	< 0.1v
		All others	B+
16	Ground	Always	< 0.1v
17	Ground	Always	< 0.1v
18	Ground	Always	< 0.1v

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TCM Pin Charts (Type I) (continued)

Pin	Function	Condition	Signal
19	Ground	Always	< 0.1v
20	VSS signal	Vehicle stopped	0v AC
		Vehicle moving	Above 1v AC
21	A/C cut relay		
22	Fluid temp	32° F (0° C)	65K ohms
		68° F (20° C)	25K ohms
		176° F (80° C)	2.5K ohms
		248° F (120° C)	780 ohms
23	Range selector pin A	Manual P, R, 3, 2	B+
		All others	0v
24	5 V reference voltage	Key off	0v
		Key on	5v
25	Diagnostic enable	Normal	B+
		During code retrieval	0v
26	Range selector pin B	Manual R, N, D, 3	B+
		All others	0v
27	N/A	-	-
28	Keep alive power	Always	B+
29	Check trans indicator	Light off	B+
		Light on	< 0.1v
30	Coolant temp	Engine temp cold	5v
		Engine temp warm	< 0.1v
31	Winter mode switch	Switch released	B+
		Switch depressed	< 0.1v
32	N/A	-	-
33	Range selector pin P	Manual P, N, 3 & L	B+
		All others	0v
34	Power mode switch	Switch released	B+
		Switch depressed	< 0.1v
35	N/A	-	-
36	Ground	Always	< 0.1v
37	Ignition	Key off	0v
		Key on	B+

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TCM Pin Charts (Type I) (continued)

Pin	Function	Condition	Signal
38	TCC Solenoid	Lockup off	0v
		Lockup on	B+
39	Brake switch	Brake released	B+
		Brake depressed	< 0.1v
40	Force motor (+)	Idle	0.7-0.9 Amps
		Full throttle	0.1-0.2 Amps
41	Force motor (-)	Idle	0.7-0.9 Amps
		Full throttle	0.1-0.2 Amps
42	N/A	-	-
43	2-3 solenoid	Solenoid off	0v
		Solenoid on	B+
44	N/A	-	-
45	Band apply solenoid	During drive engagement	Approx. 75% duty cycle
		After engagement	0% Duty cycle (sol off)
		During a 3-2 or 3-1 kickdown & 3-2 coast down	25%-75% Duty cycle
46	N/A	-	-
47	N/A	-	-
48	1-2 / 3-4 solenoid	Solenoid Off	0v
		Solenoid On	B+
49	N/A	-	-
50	Barometric sensor (some models)		
51	N/A	-	-
52	N/A	-	-
53	Reference voltage	Key off	0v
		Key on	5v
54	Solenoid ground	Normal operation	< 0.1v
		W/solenoid codes	B+
55	Engine RPM (some models)	Engine running	DC frequency

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TCM Pin Charts (Type 2)



Pin	Function	Condition	Signal
A1	N/A	-	-
A2	1-2/3-4 Solenoid	Sol on	< 1v
		Sol off	B+
A3	2-3 Solenoid	Sol on	< 1v
		Sol off	B+
A4	Keep alive power	Always	B+
A5	N/A	-	-
A6	N/A	-	-
A7	Power from ECM main Relay	Key off	0v
		Key on	B+
A8	Power from ECM main Relay	Key off	0v
		Key on	B+
A9	Band apply solenoid	During drive engagement	Approx. 75% Duty cycle
		After engagement	0% Duty cycle (sol off)
		During a 3-2 or 3-1 kickdown & 3-2 coast down	25%-75% Duty cycle
A10	A/T fluid temp light	Light off	B+
		Light on	< 0.1v
A11	Winter mode indicator light	Light off	B+
		Light on	< 0.1v
A12	Output speed sensor	Wheels stopped	0V
		Wheels spinning	Above 1v AC
B1	N/A	-	-
B2	N/A	-	-
B3	Fluid temp	32° F (0° C)	65K ohms
		68° F (20° C)	25K ohms
		176° F (80° C)	2.5K ohms
		248° F (120° C)	780 ohms

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TCM Pin Charts (Type 2) (continued)

Pin	Function	Condition	Signal
B4	Cruise control	Button depressed	< 1v
		Button released	B+
B5	Kickdown switch	Full throttle	< 0.1v
		All others	B+
B6	Winter mode switch	Button released	B+
		Button depressed	< 0.1v
B7	N/A	-	-
B8	Power switch	Button released	B+
		Button depressed	< 0.1v
B9	Power indicator light	Light off	B+
		Light on	< 0.1v
B10	R&L output to antilock brake system (some models)	-	-
B11	VSS shield ground	Always	< 0.1v
B12	VSS signal ground	Always	< 0.1v
C1	Ground	Always	< 0.1v
C2	N/A	-	-
C3	Sensor ground (some vehicles)	Always	< 0.1v
C4	N/A	-	-
C5	TPS (varying voltage)	Idle	0.5v
		Full throttle	4.0v
C6	Ground	Always	< 0.1v
C7	TCC solenoid	Sol off	0v
		Sol on	B+
C8	Data link	Key off	0v
		Key on	5v
C9	N/A	-	-
C10	Check trans indicator light	Light off	B+
		Light on	< 0.1v
C11	N/A	-	-
C12	Power relay output to main case solenoid	Key off	0v
		Key on	B+
C13	N/A	-	-

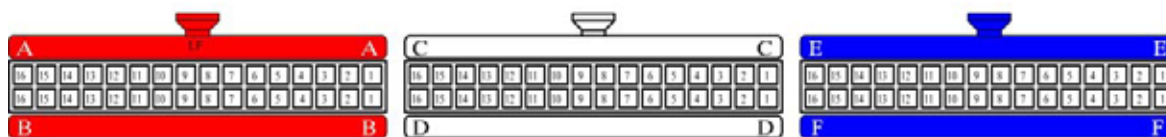
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TCM Pin Charts (Type 2) (continued)

Pin	Function	Condition	Signal
C14	Fluid temp sensor ground	Always	< 0.1v
C15	Force motor (+)	Idle	0.7-0.9 Amps
		Full throttle	0.1-0.2 Amps
C16	Force motor (-)	Idle	0.7-0.9 Amps
		Full throttle	0.1-0.2 Amps
D1	Ground	Always	< 0.1v
D2	BARO sensor		
D3	5 volt reference (some vehicles)	Key off	0v
		Key on	5v
D4	Trans range position "P"	P, N, 3, L	B+
		All others	0v
D5	Trans range position "C"	D, 3, 2, L	B+
		All others	0v
D6	Trans range position "B"	R, N, D, 3	B+
		All others	0v
D7	Trans range position "A"	P, R, 3, 2	B+
		All others	0v
D8	A/C on input	Compressor off	< 1v
		Compressor on	B+
D9	Brake input	Brake released	0v
		Brake depressed	B+
D10	N/A	-	-
D11	N/A	-	-
D12	Engine RPM signal	Engine running	DC frequency
D13	N/A	-	-
D14	Coolant temp switch from ECM	Cold	5v
		Warm	< 0.1v
D15	N/A	-	-
D16	Diagnostic input	During diagnostics	0v
		All others	5v

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TCM Pin Charts (Type 3)



Pin	Function	Condition	Signal
A1	5v reference to TPS	Key off	0v
		Key on	5v
A2	Knock sensor		
A3			
A4	Keep alive power	Always	B+
A5	Idle air control valve		
A6	Idle air control valve		
A7	Idle air control valve		
A8	Idle air control valve		
A9	Fluid temp light	Light off	B+
		Light on	< 0.1v
A10	Winter mode indicator light	Light off	B+
		Light on	< 0.1v
A11	Power mode indicator light	Light off	B+
		Light on	< 0.1v
A12	EHCUC		
A13	Malfunction indicator lamp		
A14	Check trans indicator light	Light off	B+
		Light on	< 0.1v
A15	VSV duty solenoid		
A16	Band apply solenoid	During drive engagement	Approx.50-75% Duty cycle
		After engagement	0% Duty cycle (sol off)
		During a 3-2 or 3-1 Kickdown & 3-2 coast down	25%-75% (-) Duty cycle
B1			
B2	Ignition coil #4		
B3	Ignition coil #2		

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TCM Pin Charts (Type 3) (continued)

Pin	Function	Condition	Signal
B4	Ignition coil #6		
B5	Fuel tank sensor		
B6	Vapor sensor		
B7	EGR		
B8	Intake air temperature sensor		
B9			
B10	Power steering pressure switch		
B11			
B12	Tail relay		
B13	Class 2 data		
B14	A/C compressor relay		
B15	Low fuel warning light		
B16	Fuel gauge		
C1	Injector #4		
C2	2-3 shift solenoid	Solenoid off	B+
		Solenoid on	< 1v
C3	Injector #6		
C4	Ignition coil #1		
C5	Crank position sensor		
C6			
C7	Ground	Always	< 0.1v
C8	Ground	Always	< 0.1v
C9	Ground	Always	< 0.1v
C10	Tachometer		
C11	VSV intake air		
C12	AC generator		
C13	Canister purge		
C14	O2 B		
C15	O2 B		
C16	O2 D		
D1	Injector #2		
D2	TCC solenoid	Solenoid off	< 1v
		Solenoid on	B+
D3	Injector #1		

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TCM Pin Charts (Type 3) (continued)

Pin	Function	Condition	Signal
D4	Serial data	Key on	5v
D5	Ignition coil #5		
D6	Ignition coil #3		
D7	VSS (meter)	Wheels turning	DC frequency
D8	Ground	Always	< 0.1v
D9	Ground	Always	< 0.1v
D10	Mass air flow		
D11	Cam position sensor		
D12	O2 C		
D13	O2 C		
D14	O2 A		
D15	O2 A		
D16	O2 D		
E1	VSS (+)	Wheels stopped	0V
		Wheels spinning	Above 1v AC
E2	VSS (-)	Always	< 0.1v
E3	Force motor (-)	Idle	0.7-0.9 Amps
		Full throttle	0.1-0.2 Amps
E4	Force motor (+)	Idle	0.7-0.9 Amps
		Full throttle	0.1-0.2 Amps
E5	Ignition	Key off	0v
		Key on	B+
E6	EGR		
E7	Trans range position "B"	R, N, D, 3	B+
		All others	0v
E8	TPS	Idle	0.5v
		Full throttle	4.0-4.3v
E9	Coolant temperature	Operating temp	Approx 2.0-2.5 v
E10			
E11			
E12	Trans range position "A"	P, R, 3, 2	B+
		All others	0v
E13	To fuel pump relay		

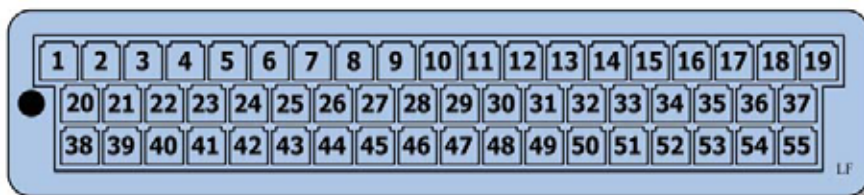
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TCM Pin Charts (Type 3) (continued)

Pin	Function	Condition	Signal
E14	Power relay output ok to excep TCC Solenoid	Key off	0v
		Engine running	B+
E15	A/C thermo relay		
E16	Power from PCM main relay	Key off	1.0-2.0v
		Key on	B+
F1			
F2	Trans range position "C"	D, 3, 2, L	B+
		All others	0v
F3	Trans range position "P"	P, N, 3, L	B+
		All others	0v
F4	Brake switch	Brake released	0v
		Brake applied	B+
F5	Power switch	Switch released	B+
		Switch depressed	< 0.1v
F6	Winter mode switch	Switch released	B+
		Switch depressed	< 0.1v
F7	Fluid temp	32° F (0° C)	65K ohms
		68° F (20° C)	25K ohms
		176° F (80° C)	2.5K ohms
		248° F (120° C)	780 ohms
F8	MAP sensor	Idle	1.0-1.4 v
		Full stall	4.5-4.9v
F9			
F10	Cruise control	Off	B+
		On	< 1v
F11	Kickdown switch	Full throttle	< 0.1v
		All other	B+
F12	Serial data		
F13	Injector #3		
F14	1-2/3-4 shift solenoid	Solenoid off	B+
		Solenoid on	< 1v
F15	Injector #5		
F16	Power from PCM main relay	Key off	1.0-2.0v
		Key on	B+

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TCM Pin Charts (Type 5) (continued)



Pin	Function	Condition	Signal
1	P/N out	In Park or neutral	< 0.1v
		All other ranges	9.0-13.5v
2	N/A	-	-
3	VSS (+) (between pin 3 & 5)	Wheels spinning	Above 1v AC
4	Torque control output to ECM	During upshift	Varies duty cycle 3-4 pulses
5	VSS (-) (between pin 3 & 5)	Wheels spinning	Above 1v AC
6	N/A	-	-
7	Sport mode indicator	Light off	B+
		Light on	< 0.1v
8	Trans range position "C"	D, 3, 2, L	B+
		All others	0v
9	Traction control torque reduction request input (always 100 Hz)	Normal	80-90% duty
		Active	30-40% duty
10	N/A	-	-
11	Engine RPM signal	Engine running	DC frequency
12	Winter mode indicator light	Light off	B+
		Light on	< 0.1v
13	Serial data		
14	N/A	-	-
15	Kickdown switch (some models)	Full throttle	< 0.1v
		All other	B+
16	Fluid temp sensor ground	Always	< 0.1v
17	N/A	-	-
18	VSS shield ground	Always	< 0.1v
19	Ground	Always	< 0.1v
20	N/A	-	-

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TCM Pin Charts (Type 5) (continued)

Pin	Function	Condition	Signal
21	A/C request input	Compressor off	< 1v
		Compressor on	B+
22	Fluid temp	32° F (0° C)	65K ohms
		68° F (20° C)	25K ohms
		176° F (80° C)	2.5K ohms
		248° F (120° C)	780 ohms
23	Trans range position "A"	P, R, 3, 2	B+
		All others	0v
24	N/A	-	-
25	N/A	-	-
26	Trans range position "B"	R, N, D, 3	B+
		All others	0v
27	N/A	-	-
28	Keep alive power	Always	B+
29	Check trans indicator light	Light off	B+
		Light on	< 1v
30	N/A	-	-
31	Winter mode switch	Switch released	B+
		Switch depressed	< 0.1v
32	Data output to ECM		
33	Trans range position "P"	P, N, 3, L	B+
		All others	0v
34	Sport mode switch	Switch released	B+
		Switch depressed	< 0.1v
35	Ground	Always	< 0.1v
36	N/A	-	-
37	Ignition	Key off	0v
		Key on	B+
38	TCC solenoid	Solenoid off	B+
		Solenoid on	< 1v

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TCM Pin Charts (Type 5) (continued)

Pin	Function	Condition	Signal
39	Brake switch	Brake released	< 1v
		Brake depressed	B+
40	Force motor (+)	Idle	0.7-0.9 Amps
		Full throttle	0.1-0.2 Amps
41	Force motor (-)	Idle	0.7-0.9 Amps
		Full throttle	0.1-0.2 Amps
42	N/A	-	-
43	2-3 shift solenoid	Solenoid off	B+
		Solenoid on	< 1v
44	Torque reduction signal	Varies with TPS	25-60%
45	Band apply solenoid	During drive engagement	Approx. 75% Duty cycle
		After engagement	0% Duty cycle (sol off)
		During a 3-2 or 3-1 Kickdown & 3-2 coast down	25%-75% Duty cycle
46	N/A	-	-
47	N/A	-	-
48	1-2/3-4 shift solenoid	Solenoid off	B+
		Solenoid on	< 1v
49	N/A	-	-
50	N/A	-	-
51	N/A	-	-
52	N/A	-	-
53	N/A	-	-
54	Power relay output to 1-2/3-4, 2-3, band apply and TCC solenoids	Key off	0v
		Key on	B+
		W/solenoid codes	0v
55	TPS signal from ECM (always 100 Hz)	Idle	9-10 % duty
		Full throttle	88-90% duty

4L30E

TCM Pin Charts (Type 6)



Pin	Function	Condition	Signal
1	N/A	-	-
2	Shifter lock solenoid (some models)	Solenoid off	B+
		Solenoid on	< 1v
3	N/A	-	-
4	Band apply solenoid	During drive engagement	Approx. 75% Duty cycle
		Above 8-10 MPH	0% Duty cycle (sol off)
		During a 3-2 or 3-1 kickdown & 3-2 coast down	25%-75% Duty cycle
5	Force motor (-)	Idle	0.7-0.9 Amps
		Full throttle	0.1-0.2 Amps
6	Ground	Always	< 0.1v
7	N/A	-	-
8	Trans range position "B"	(Catera) R, N, D, 3	B+
		(BMW) P, N	B+
		All others	0v
9	Trans range position "P"	(Catera) P, N, 3, L	B+
		(BMW) P, D, 3, 2	B+
		All others	0v
10	Brake switch (some models)	Brake released	0v
		Brake depressed	B+
11	N/A	-	-
12	Sport mode switch (some models)	Sport mode off	B+
		Sport mode on	0v
13	Manual (winter) mode switch	Manual mode off	B+
		Manual mode on	0v
14	VSS (-) (between pin 14 & 42)	Wheels spinning	Above 1v AC

4L30E

TCM Pin Charts (Type 6) (continued)

Pin	Function	Condition	Signal
15	VSS shield ground	Always	< 0.1v
16	N/A	-	-
17	Sport mode indicator light (some models)	Light off	B+
		Light on	< 1v
18	Kickdown switch (some models)	Full throttle	0 v
		All other	B+
19	ABS/ASC signal (some models)		
20	Auto mode switch (some models)	Auto mode off	B+
		Auto mode on	0v
21	Fluid temp ground	Always	< 0.1v
22	Fluid temp	32° F (0° C)	65K ohms
		68° F (20° C)	25K ohms
		176° F (80° C)	2.5K ohms
		248° F (120° C)	780 ohms
23	N/A	-	-
24	N/A	-	-
25	Check trans indicator (some models)	Light off	B+
		Light on	< 1v
26	Keep alive power	Always	B+
27	Manual (winter) mode indicator	Light off	B+
		Light on	< 1v
28	Ground	Always	< 0.1v
29	N/A	-	-
30	1-2/3-4 shift solenoid	Solenoid off	B+
		Solenoid on	< 1v
31	N/A	-	-
32	TCC solenoid	Solenoid off	B+
		Solenoid on	< 1v
33	2-3 shift solenoid	Solenoid off	B+
		Solenoid on	< 1v
34	Ground	Always	< 0.1v
35	N/A	-	-
36	Trans range position "A"	(Catera) P, R, 3, 2	B+
		(BMW) P, R, N, 2	B+
		All others	0v

4L30E

TCM Pin Charts (Type 6) (continued)

Pin	Function	Condition	Signal
37	Trans range position "C"	(Catera) D, 3, 2, L	B+
		(BMW) N, 3, 2, L	B+
		All others	0v
38	N/A	-	-
39	N/A	-	-
40	Engine RPM signal (some models)	Engine running	DC frequency
41	N/A	-	-
42	VSS (+) (between pin 14 & 42)	Wheels spinning	Above 1v AC
43	N/A	-	-
44	N/A	-	-
45	Auto mode indicator	Light off	B+
		Light on	< 1v
46	A/C compressor on signal (some models)	Compressor off	B+
		Compressor on	0v
47	N/A	-	-
48	Brake switch test signal (some models)	Brake released	B+
		Brake depressed	0v
49	CAN LOW (some models)		2.5v
50	CAN HIGH (some models)		2.5v
51	Serial data (some models)		
52	Force motor (+)	Idle	0.7-0.9 Amps
		Full throttle	0.1-0.2 Amps
53	Power relay output to 1-2/3-4, 2-3, band apply and TCC solenoids	Key off	0v
		Key on	B+
		W/solenoid codes	0v
54	Ignition	Key off	0v
		Key on	B+
55	Ignition (some models)	Key off	0v
		Key on	B+
56	N/A	-	-
57	Cruise control signal (some models)		
58	N/A	-	-
59	N/A	-	-
60	Program voltage from data link (some models)		
61	N/A	-	-

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TCM Pin Charts (Type 6) (continued)

Pin	Function	Condition	Signal
62	N/A	-	-
63	N/A	-	-
64	N/A	-	-
65	N/A	-	-
66	N/A	-	-
67	N/A	-	-
68	N/A	-	-
69	N/A	-	-
70	N/A	-	-
71	N/A	-	-
72	N/A	-	-
73	N/A	-	-
74	N/A	-	-
75	N/A	-	-
76	N/A	-	-
77	N/A	-	-
78	N/A	-	-
79	N/A	-	-
80	N/A	-	-
81	N/A	-	-
82	Connected to pin 83 (some models)		
83	Connected to pin 82 (some models)		
84	N/A	-	-
85	CAN LOW (some models)		2.5v
86	CAN HIGH (some models)		2.5v
87	RXD Data Link (some models)		B+
88	TXT Data link (some models)		B+

NOTES:

ATEC Import

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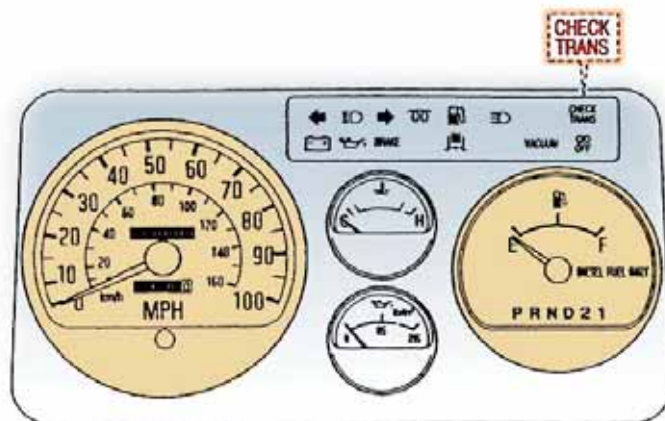
450-43LE

Self-Diagnostic Information

NPR, FUSO

There are only 13 components that will cause the “Check Trans” light to illuminate.

1. Vehicle Speed Sensor #1
2. Engine Speed Sensor
3. Transmission fluid sensor
4. Inhibitor Switch
5. Throttle Position Sensor
6. Vehicle Speed Sensor#2
7. SS#1
8. SS#2
9. Timing Solenoid
10. TCC Solenoid
11. EPC Solenoid
12. Exhaust Brake Solenoid
13. Engine Warming sensor



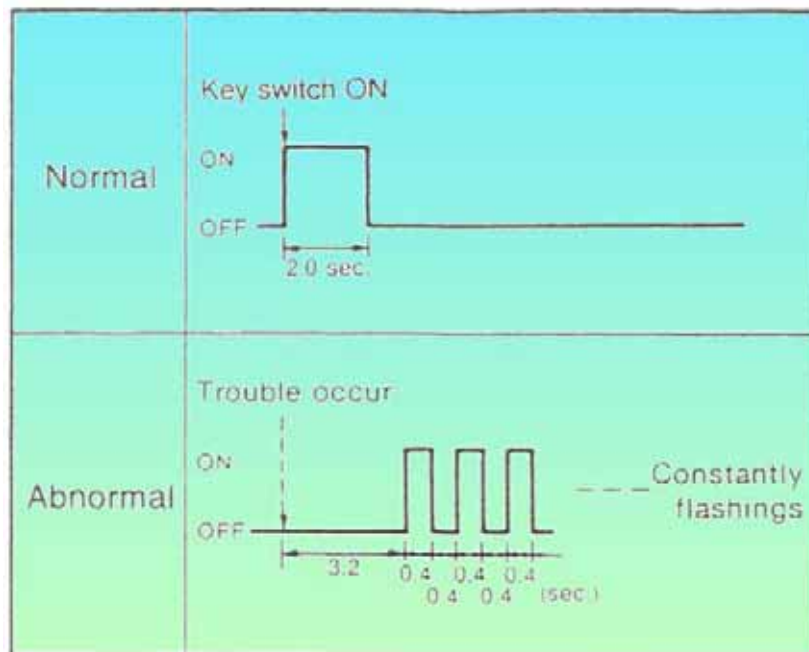
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Checking for Codes

As a pretest procedure, the “Check Trans” light will come ON when the ignition key is turned to the ON position. This tests the operation of the light bulb and connection from the TCM to the check engine light.

When the Throttle Position Sensor, Vehicle Speed Sensor, Solenoids, or any one of the 13 components start to malfunction when the vehicle is running, the “Check Trans” light will start to blink to warn the driver.

The “Check Trans” light begins to blink as soon as a problem occurs during driving conditions and keeps blinking until it is corrected.

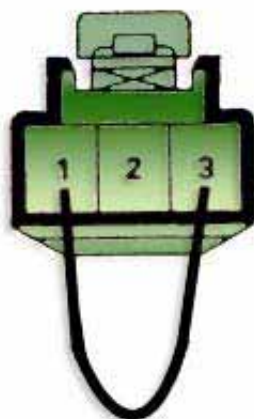


450-43LE

Self- Diagnostic Results

The DLC (Data Link Connector) is a Green three-pin connector and it is tied to the support bracket located under the brake and clutch fluid tank.

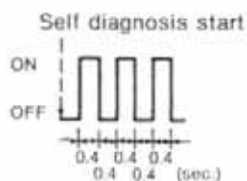
A DTC can be retrieved by jumping a wire from terminal 1 (Black/White) and terminal 3 (Black) located at both ends of the Data Link Connector.



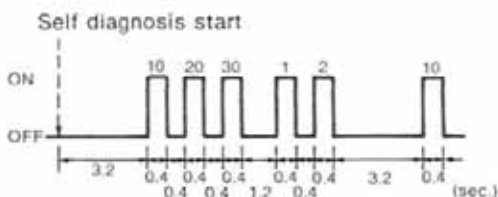
Green Three Pin Connector

When no problem exists, the display flashes “1” repeatedly. When a malfunction exists, the DTC is displayed three times repeatedly. When two or more DTCs are generated, they are all displayed three times repeatedly, one at a time, starting with the lowest code number first.

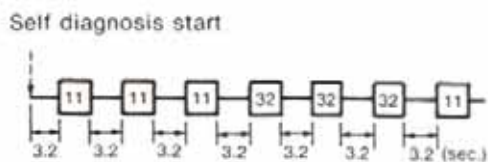
A. NORMAL



B. DIAGNOSTIC TROUBLE CODE "32"










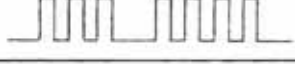


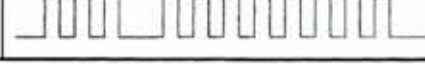


C. DIAGNOSTIC TROUBLE CODE "11" AND "32"



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Codes

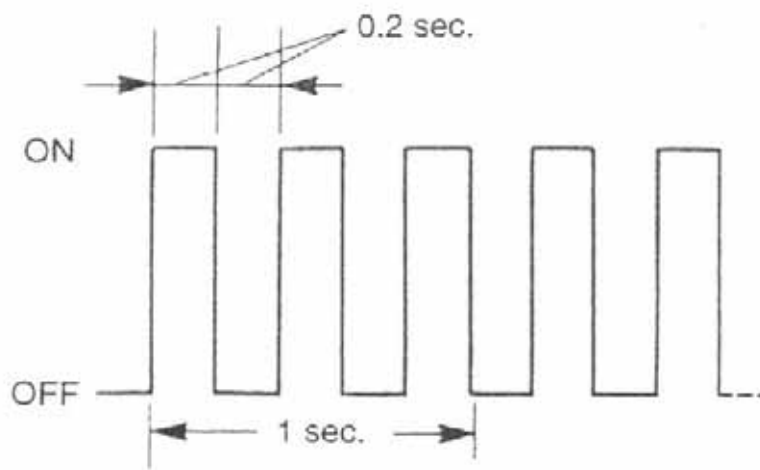
DTC No.	DISPLAY PATTERN	DIAGNOSED CONTENT
11	ON OFF 	Vehicle speed sensor 1 circuit open or shorted (Fitted to transmission)
13		Engine speed sensor circuit open or shorted
15		Automatic transmission fluid thermosensor circuit open
17		Inhibitor switch circuit open or shorted
21		Throttle position sensor circuit open or shorted
24		Vehicle speed sensor 2 circuit open or shorted (Built into speedometer)
31		No.1 shift solenoid (S1) circuit open or shorted
32		No.2 shift solenoid (S2) circuit open or shorted
33		Timing solenoid (ST) circuit open or shorted
34		Lock-up solenoid circuit open or shorted
35		Line pressure solenoid circuit open or shorted
37		Exhaust brake cut system circuit open or shorted
38		Engine warming up cut system circuit open or shorted

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Clearing Codes

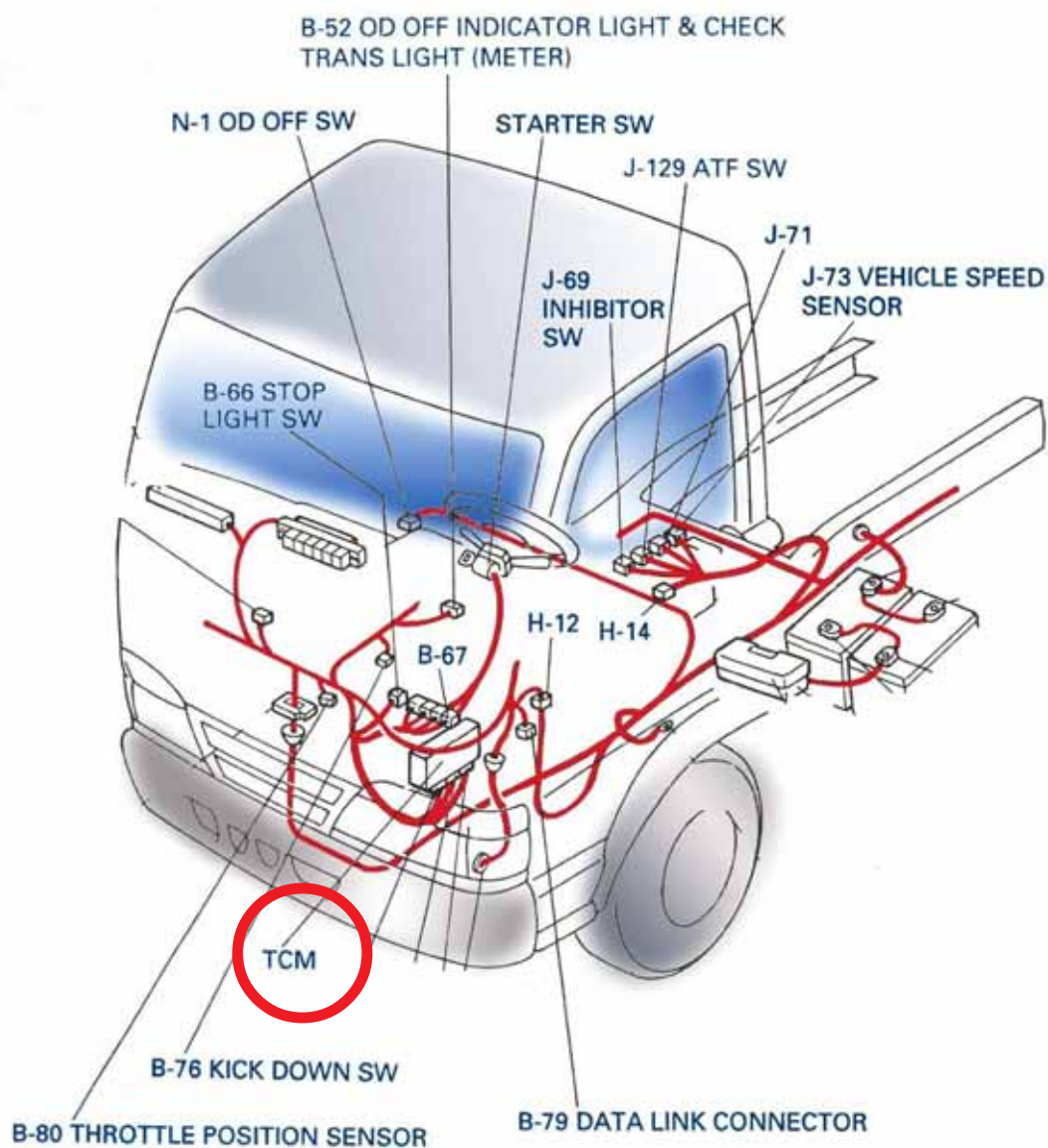
You can use the factory scan tool (Tech 2 or Mastertech), to clear the codes. However, if a Factory scan tool is unavailable, perform the following operation.

1. Turn the key switch to the ON position, but DO NOT start the engine.
(=No Engine RPM/No vehicle speed)
2. Connect a jumper terminal to pins 1 and 3 of the DLC.
(=Self-diagnostic is started)
3. Select "N" (Neutral) Range
(="N" range signal is sent)
4. Depress brake pedal fully
(=Brake switch is ON)
5. Depress accelerator pedal fully.
(=Kick-down switch is ON)
6. The Check Trans light will flash rapidly ("ON"-0.2 sec, "OFF"-0.2 sec) for ten seconds if the clear memory operation is successful.



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Component Locations



450-43LE

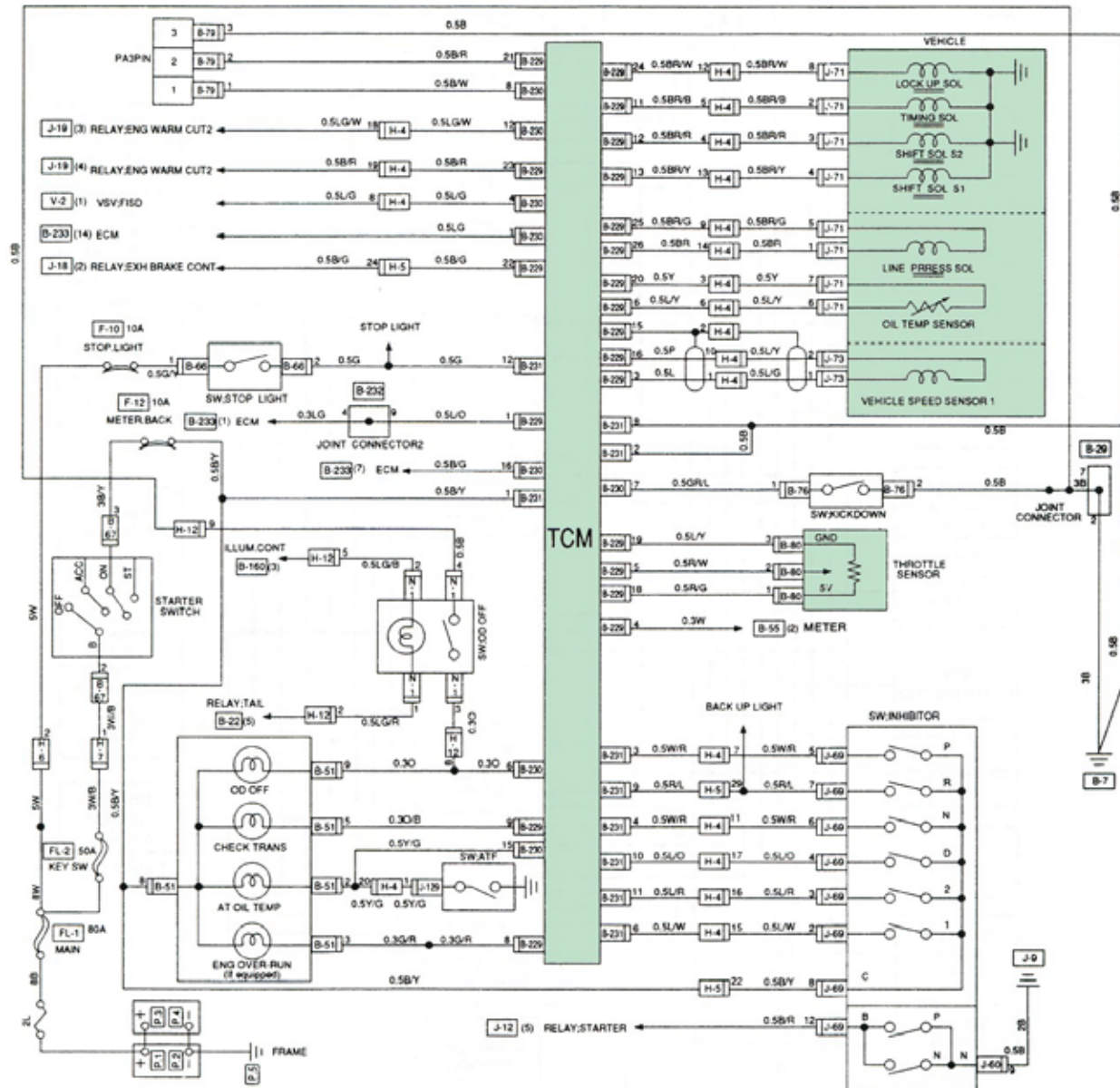
Wiring Diagram

Color Abbreviations:

L-Blue
W-White
R-Red

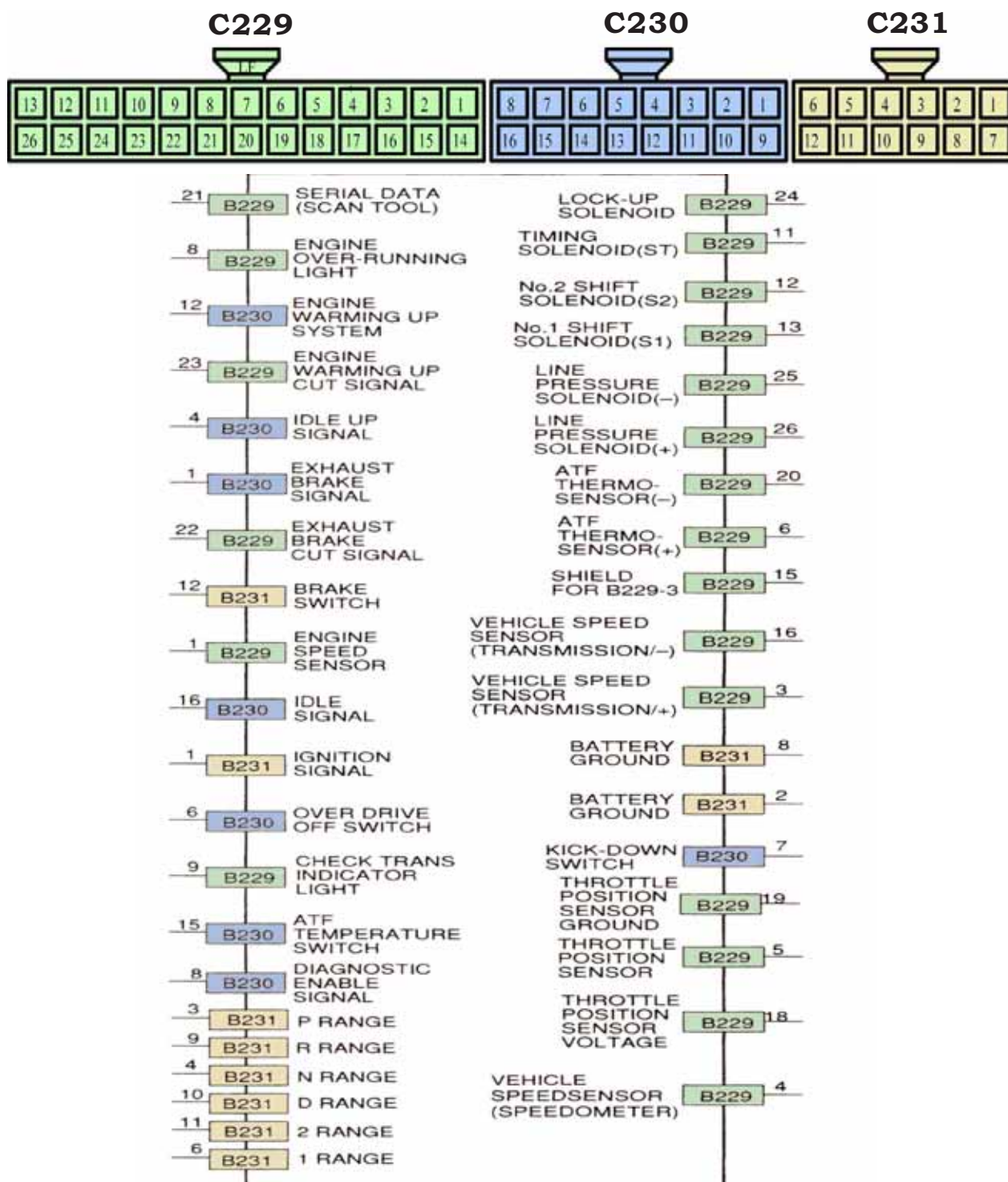
G-Green
P-Purple
O-Orange

B-Black
Y-Yellow



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TCM Pin Location



450-43LE

TCM Specifications



TCM Terminal No. (Wire Color)		Standard Voltage	Inspection Condition	Signal Type	Circuit
Tester (-)	Tester (+)				
B231-2 (B) or B231-8 (B)	B229-1 (L/O)	More than 1.0 (Intermittent AC)	At an engine speed of approx. 1,000 RPM	Input	Engine speed sensor
	B229-2	Not used	—	—	—
B229-16 (P)	B229-3 (L)	More than 0.35 (AC)	Vehicle speed 24 km/h (15 mph) (Voltage increases in proportion to the speed)	Input	Vehicle speed sensor (Transmission)
		0	Vehicle stopped		
B231-2 (B) or B231-8 (B)	B229-4 (L/G)	0-5	Vehicle moved at slowest possible speed at least 1 meter	Input	Vehicle speed sensor (SPEEDOMETER)
B229-19 (L/Y)	B229-5 (R/W)	3.8-4.5	Accelerator pedal fully closed	Input	Throttle position sensor
		0.5-1.8	Accelerator pedal fully opened		
B229-20 (Y)	B229-6 (L/Y)	0.9	ATF temp. approx. 10 °C (50 °F)	Input	ATF thermosensor
		0.3	ATF temp. approx. 40 °C (104 °F)		
B231-2 (B) or B231-8 (B)	B229-7	Not used	—	—	—
	B229-8 (B/W)	10-16	Engine speed more than 3,800 RPM	Output	Engine overrunning light (if equipped)
		Less than 1.0	Engine speed less than 3,700 RPM		
	B229-9 (O/B)	10-16	Normally state	Output	Check trans light
		Less than 3.0	In order to 2 seconds when after the key switch "ON"		
	B229-10	Not used	—	—	—
	B229-11 (R/B)	10-16	Shift up to 2nd or 3rd kick down to 1st	Output	Timing solenoid (ST)
		Less than 1.0	Normally state		
	B229-12 (BR/R)	10-16	Driving at "D2" and "D3" (No.2 shift solenoid (S2) "ON")	Output	No.2 shift solenoid (S2)
		Less than 1.0	Driving at "D1" and "D4" (No.2 shift solenoid (S2) "OFF")		

AC: Alternating Current ATF: Automatic Transmission Fluid TCM: Transmission Control Module

450-43LE

TCM Specifications (continued)

TCM Terminal No. (Wire Color)		Standard Voltage	Inspection Condition	Signal Type	Circuit
Tester (-)	Tester (+)				
B231-2 (B) or B231-8 (B)	B230-4 (L/G)	10-16	Air conditioner compressor "ON"	Input	Engine idle up
		Less than 1.0	Air conditioner compressor "OFF"		
	B230-5	Not used	—	—	—
	B230-6 (O)	10-16	O/D OFF switch "OFF"	Input	O/D OFF switch
		Less than 1.0	O/D OFF switch "ON"		
	B230-7 (GR/L)	10-16	Accelerator pedal "released"	Input	Kick down switch
		Less than 1.0	Accelerator pedal "depressed"		
	B230-8 (B/W)	10-16	Self diagnosis "OFF"	Input	Data link connector
		Less than 1.0	Self diagnosis "ON"		
	B230-9	Not used	—	—	—
	B230-10	Not used	—	—	—
	B230-11	Not used	—	—	—
	B230-12 (LG/W)	10-16	QWS switch "ON"	Input	Engine warming up
		Less than 1.0	QWS switch "OFF"		
	B230-13	Not used	—	—	—
	B230-14	Not used	—	—	—
	B230-15 (Y/G)	10-16	Normally state	Input	ATF thermo switch
		Less than 1.0	ATF temperature more than 147 °C		
	B230-16 (B/G)	10-16	Engine speed more than 880 RPM	Input	Idle signal
		Less than 1.0	Accelerator pedal full closed. Engine speed 400-880 RPM		

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TCM Specifications (continued)

TCM Terminal No. (Wire Color)		Standard Voltage	Inspection Condition	Signal Type	Circuit
Tester (-)	Tester (+)				
B231-2 (B) or B231-8 (B)	B231-1 (BY)	10-16	Key switch "ON"	Source	Battery voltage
	B231-3 (W/R)	10-16	Selector "P" range	Input	"P" range switch
		Less than 1.0	Selector other than except "P" range		
	B231-4 (W/R)	10-16	Selector "N" range	Input	"N" range switch
		Less than 1.0	Selector other than except "N" range		
	B231-5	Not used	—	—	—
	B231-6 (L/W)	10-16	Selector "1" range	Input	"1" range switch
		Less than 1.0	Selector other than except "1" range		
	B231-7	Not used	—	—	—
	B231-9 (R/L)	10-16	Selector "R" range	Input	"R" range switch
		Less than 1.0	Selector other than except "R" range		
	B231-10 (L/O)	10-16	Selector "D" range	Input	"D" range switch
		Less than 1.0	Selector other than except "D" range		
	B231-11 (L/R)	10-16	Selector "2" range	Input	"2" range switch
		Less than 1.0	Selector other than except "2" range		
	B231-12 (G)	10-16	Stop light "ON"	Input	Stop light
		Less than 1.0	Stop light "OFF"		

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Sprag Rotation

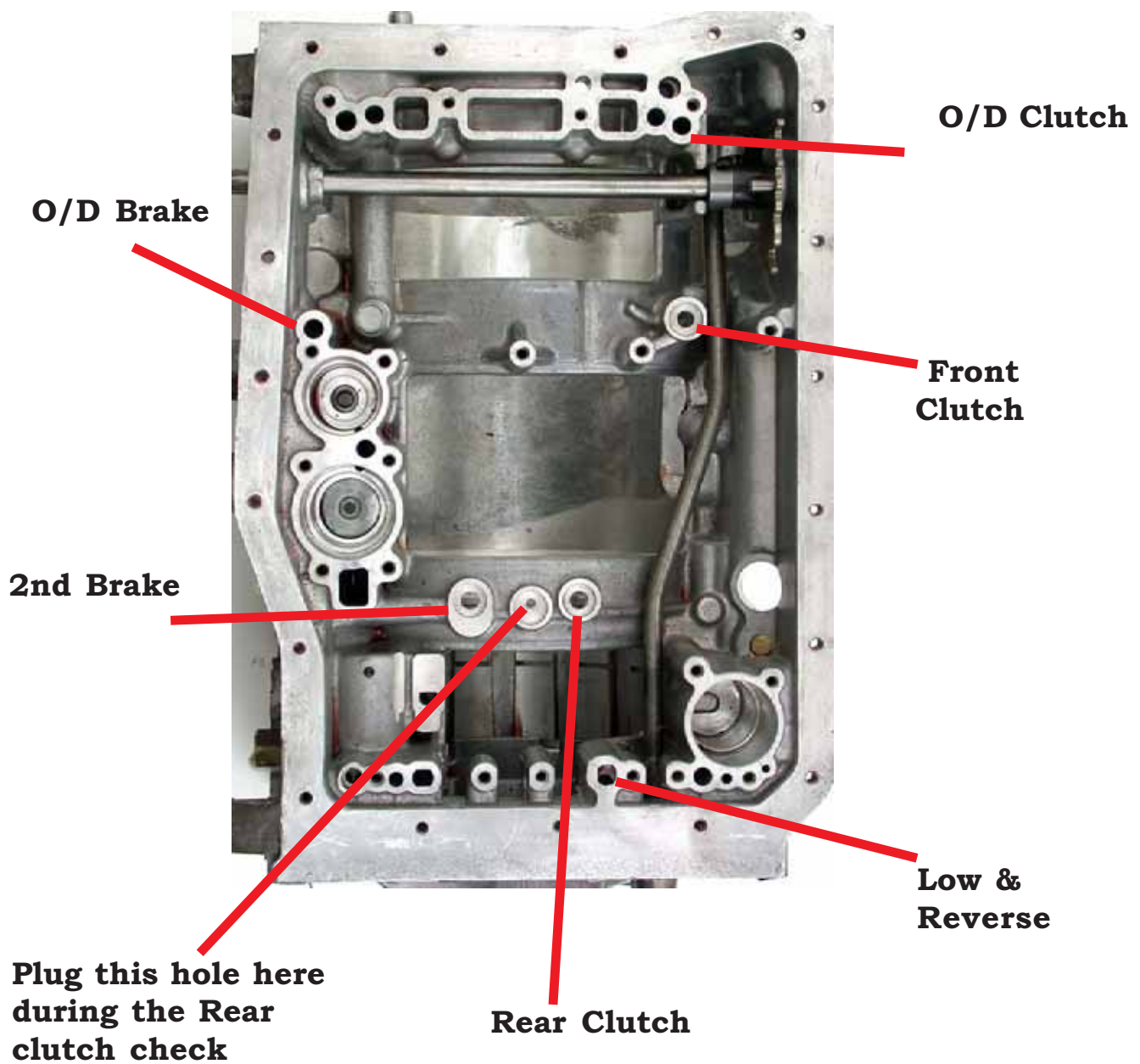
Low One-way Clutch

The Low one-way clutch is connected to the case and the Planetary rotates clockwise.



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Air Checking

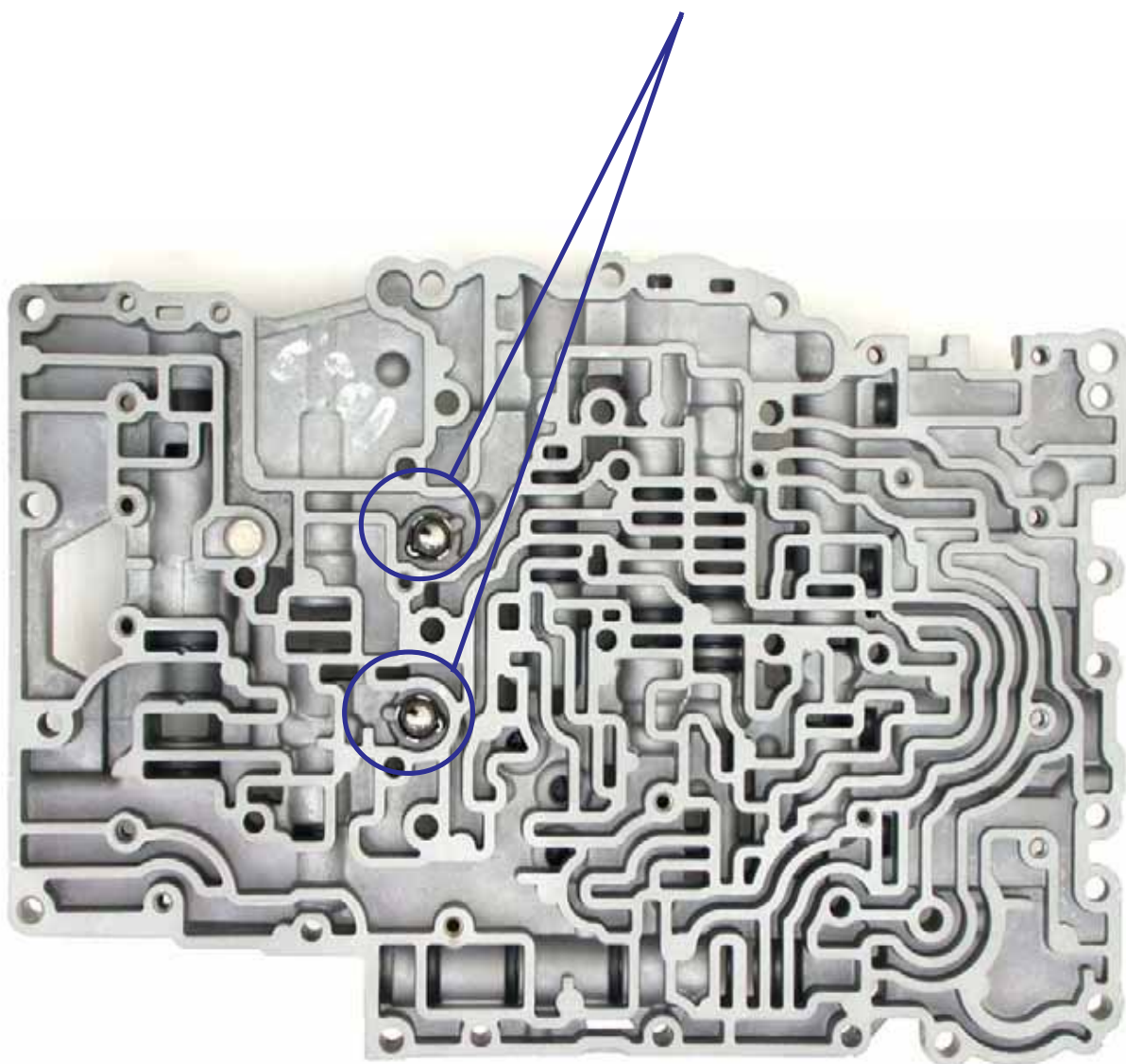


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Checkball Location

Lower Valve body

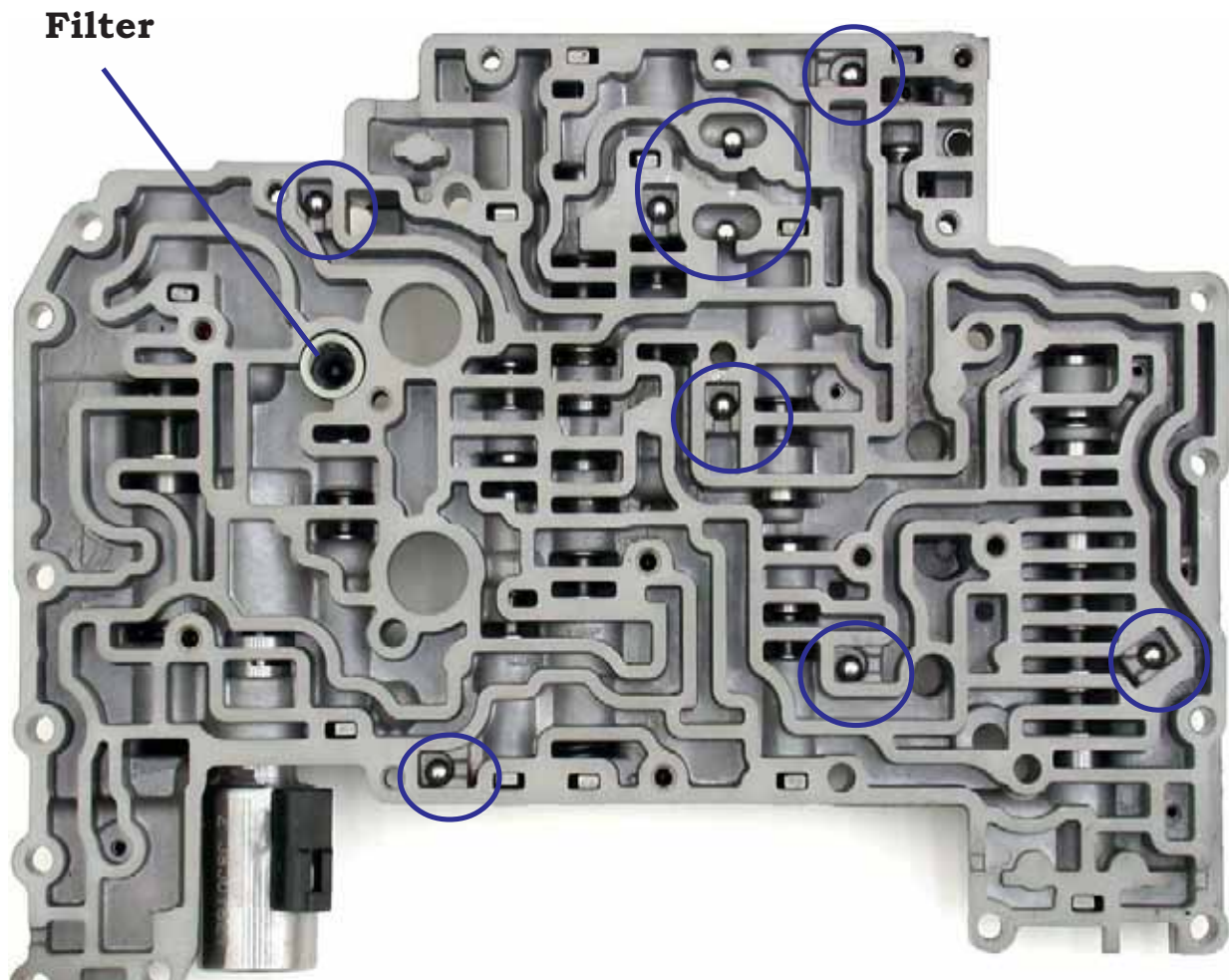
Relief Valve and Check ball



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Checkball Location (continued)

Upper Valve Body



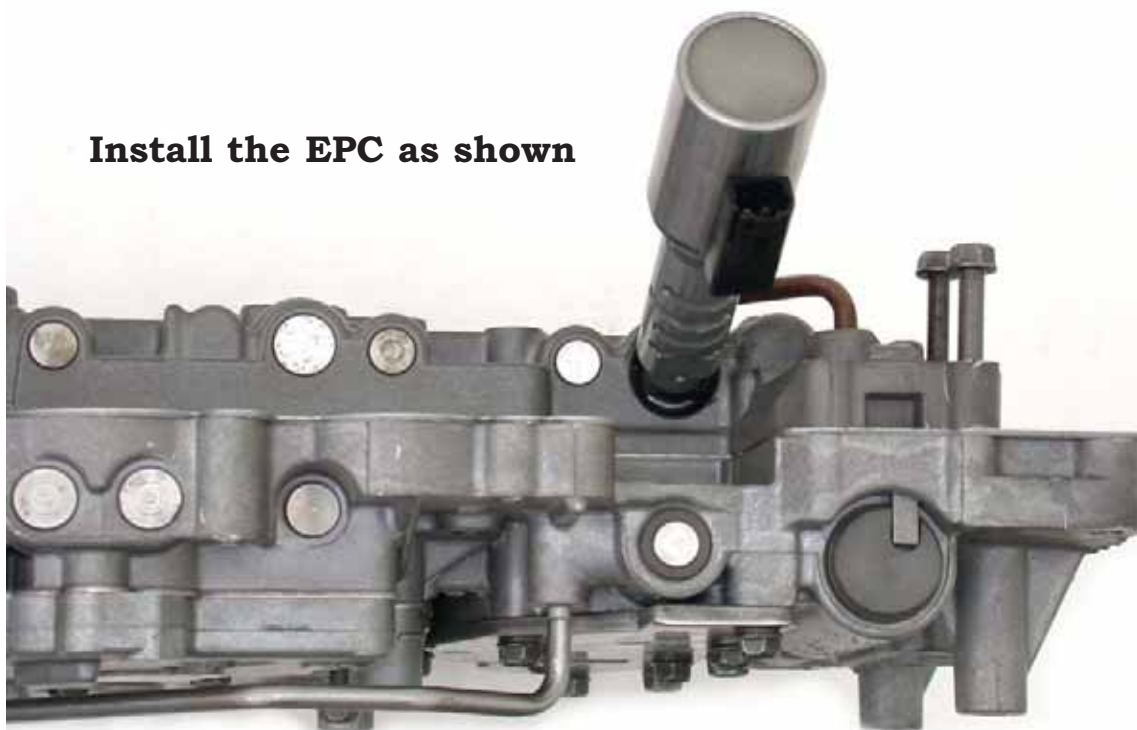
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EPC Location

The EPC solenoid can be installed upside down. Be sure when reinstalling the EPC solenoid that the slots are pointing toward the worm tracks on the upper valvebody.

Description	Resistance
EPC	3.5-5.5 ohms

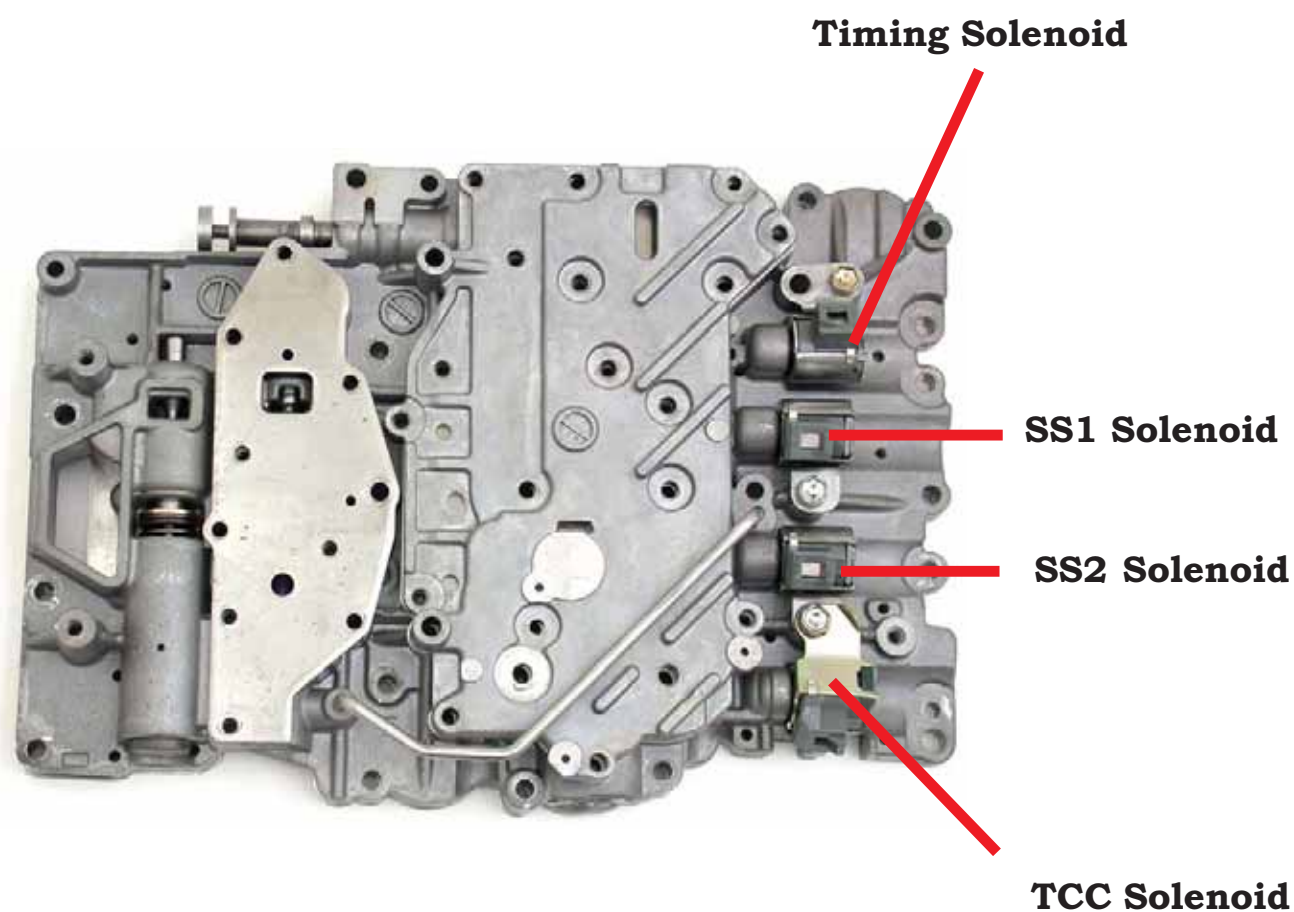
Install the EPC as shown



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Solenoid Location

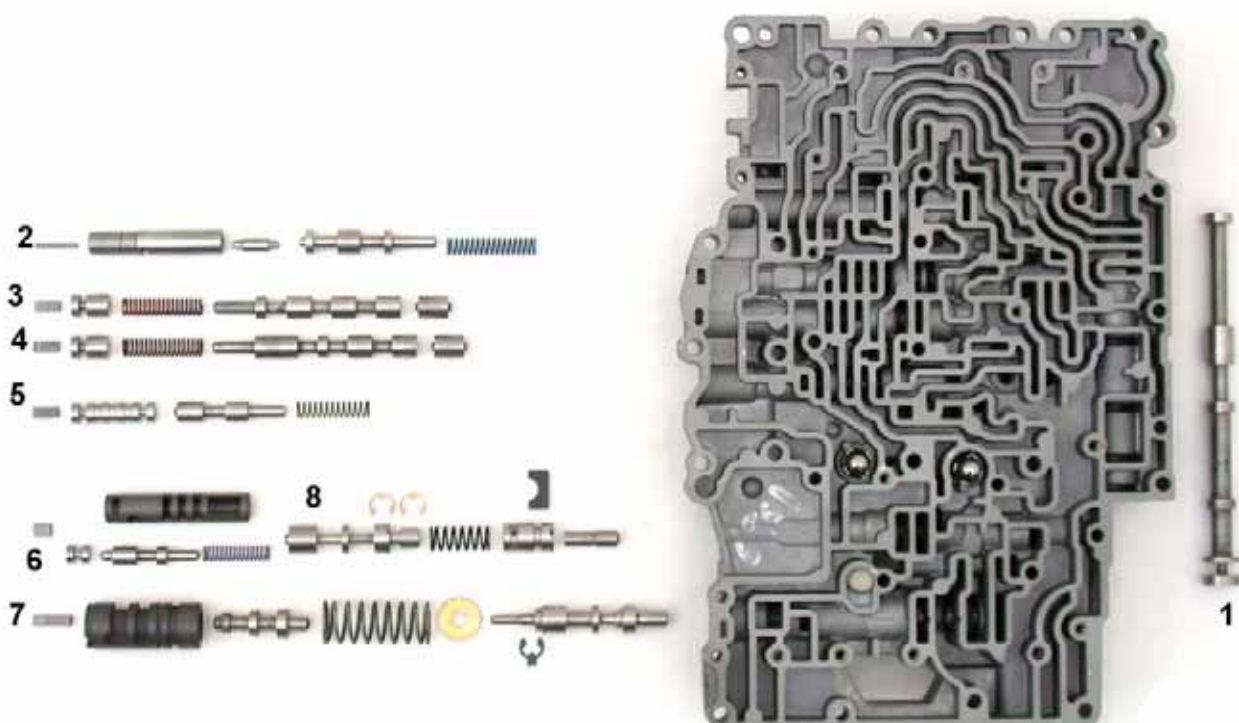
Description	Resistance
SS1	10-20 ohms
SS2	10-20 ohms
TCC	10-20 ohms
Timing	10-20 ohms



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Valve Body Exploded View

Lower Valve Body

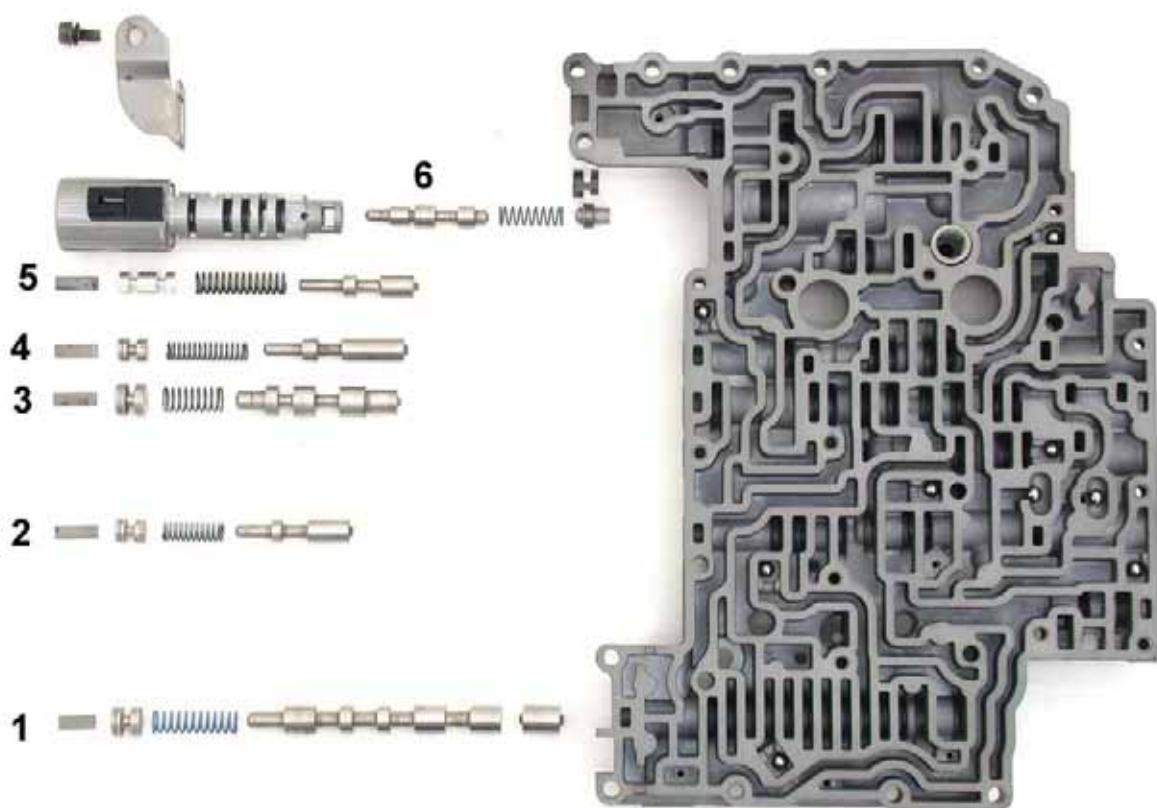


ID	Description
1	Manual Valve
2	2-3 Timing Valve
3	1-2 Shift Valve
4	3-4 Shift Valve
5	CO Exhaust Valve
6	Cut-Back Valve
7	Pressure Relief Valve
8	Lock-Up Control Valve

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Valve Body Exploded View (continued)

Upper Valve Body

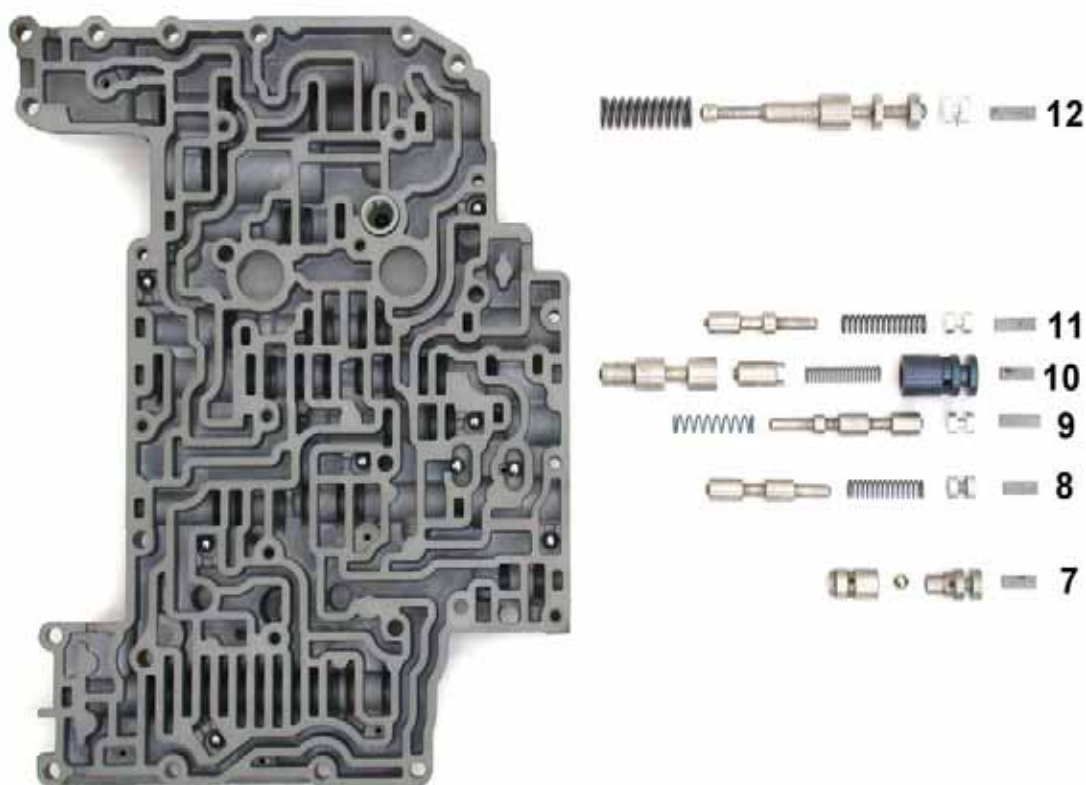


ID	Description
1	2-3 Shift Valve
2	Orifice control Valve
3	Accumulator Control Valve
4	Lock-Up Signal Valve
5	Reducing Valve
6	Throttle Valve

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Valve Body Exploded View (continued)

Upper Valve Body (continued)



ID	Description
7	Check Valve
8	Low Inhibitor Valve
9	Low coast Modulator Valve
10	Reverse Inhibitor Valve
11	Modulator Valve
12	Secondary Regulator Valve

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Erratic TCC Operation

Missing Lock-Up control valve clip

The Lock-Up control valve clip may fall out during the disassembly of the valve body. Take extra measures during the reassembly to ensure the clip is installed correctly

Correct location and installation



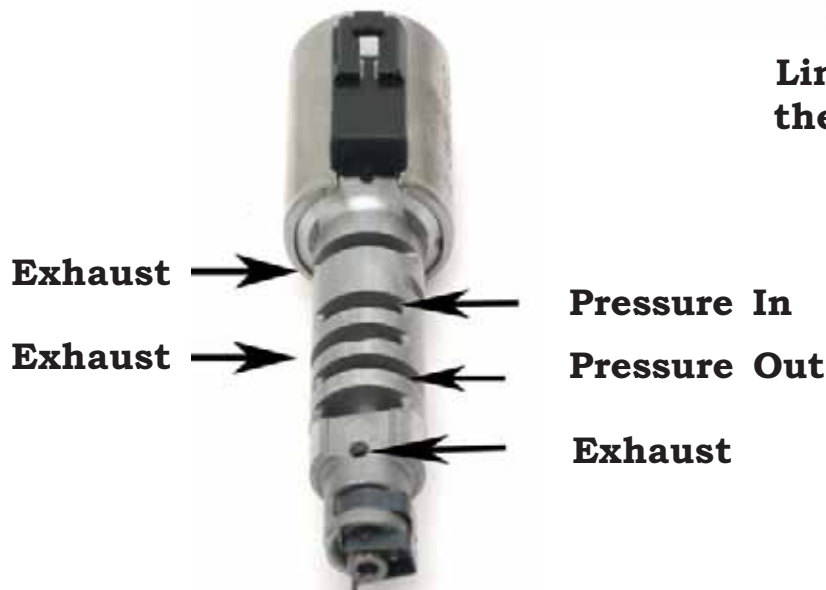
450-43LE

Low Line Pressure

The correct installation of the EPC solenoid is critical. The EPC should be facing the Lower valve body. If you're not sure about the location or installation, look inside the valve body bore. The lands will help you locate the correct position.



Line pressure from the regulator valve



NOTES:

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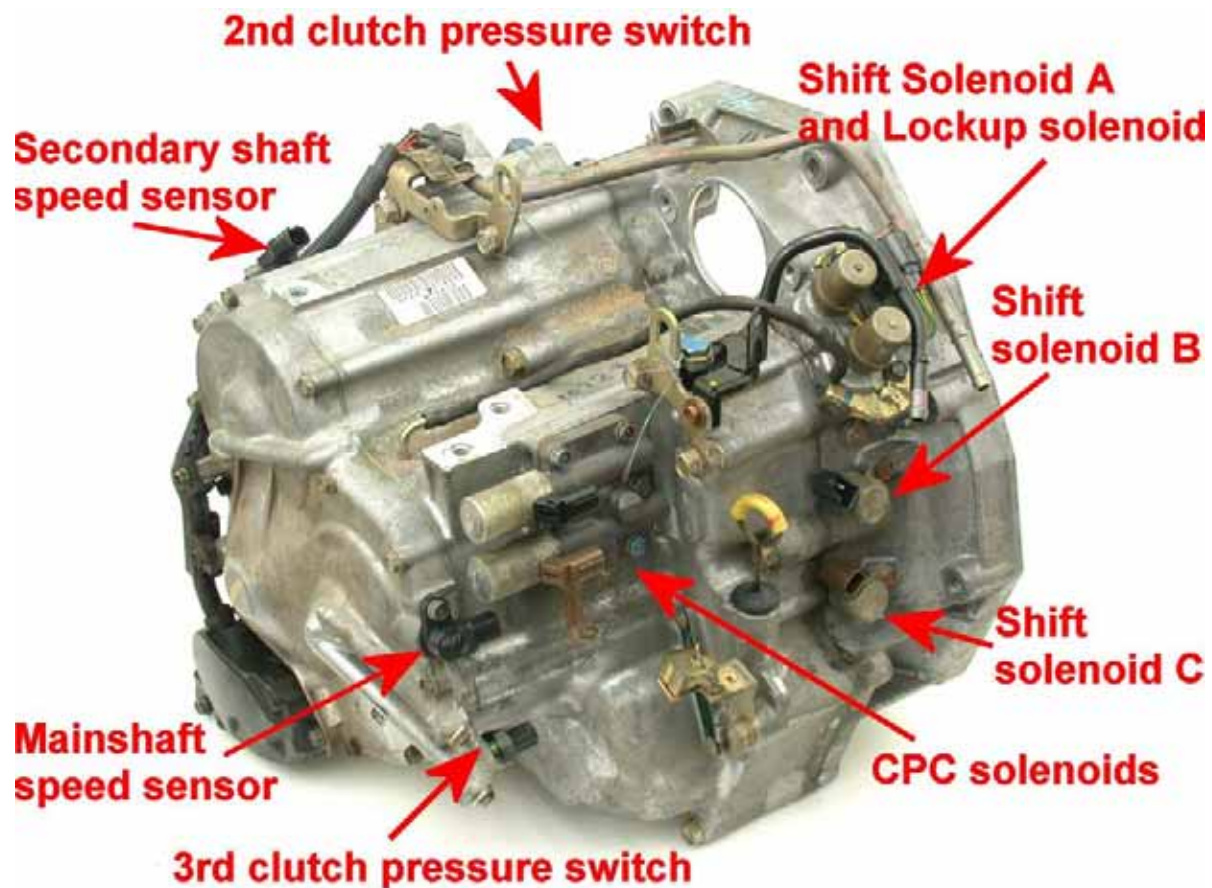
Valve Body and Solenoid ID..... 262

BAXA, MAXA, B7XA

4 Cylinder Unit

Component Identification

Below is an illustration showing various electrical components used in the BAXA, MAXA, and B7XA family transaxles used on 4 cylinder vehicles.

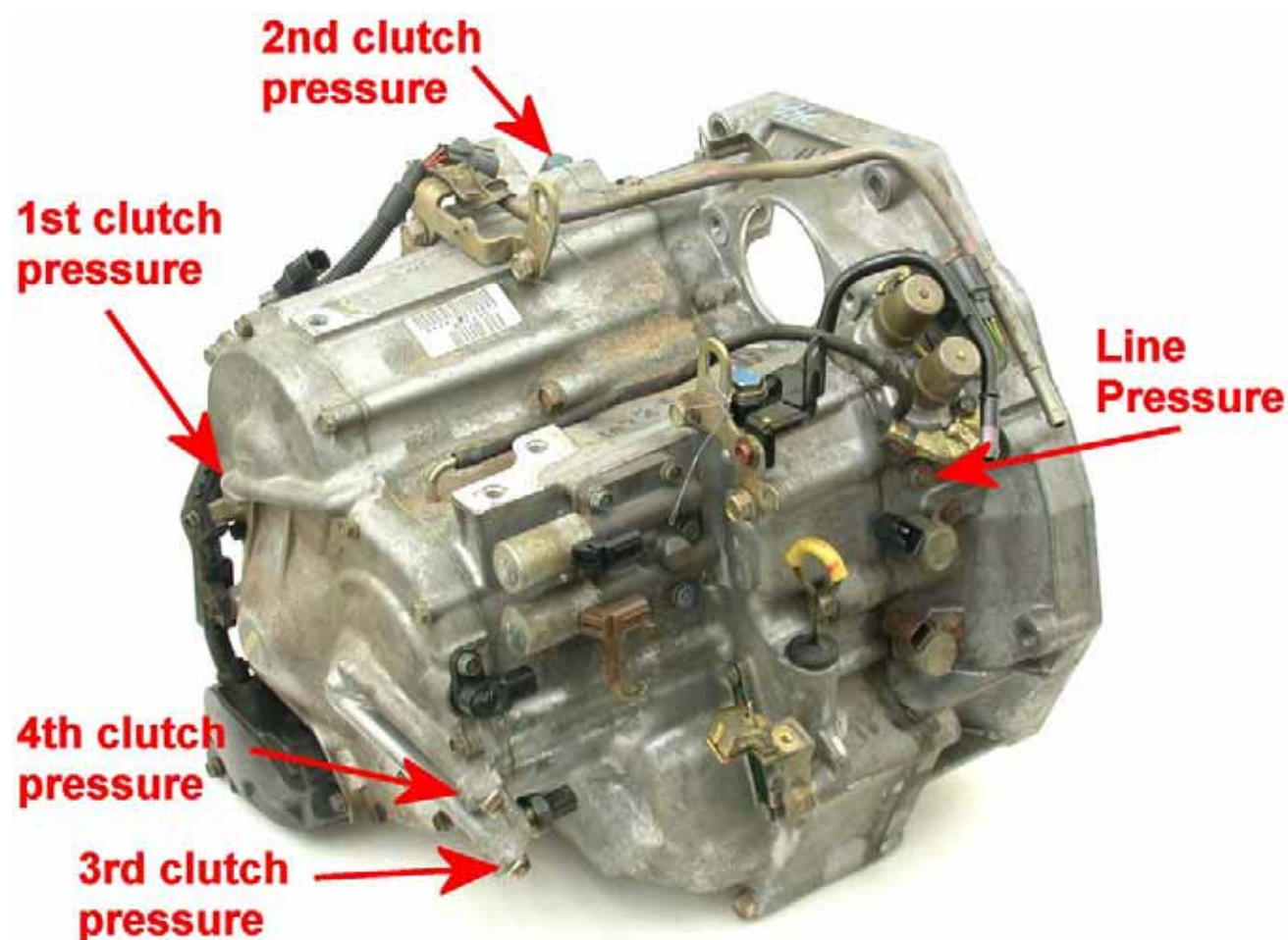


BAXA, MAXA, B7XA (continued)

4 Cylinder Unit

Pressure Taps

Pressure specifications are 120-130 psi. Line pressure will boost to approximately 300 psi at full throttle.

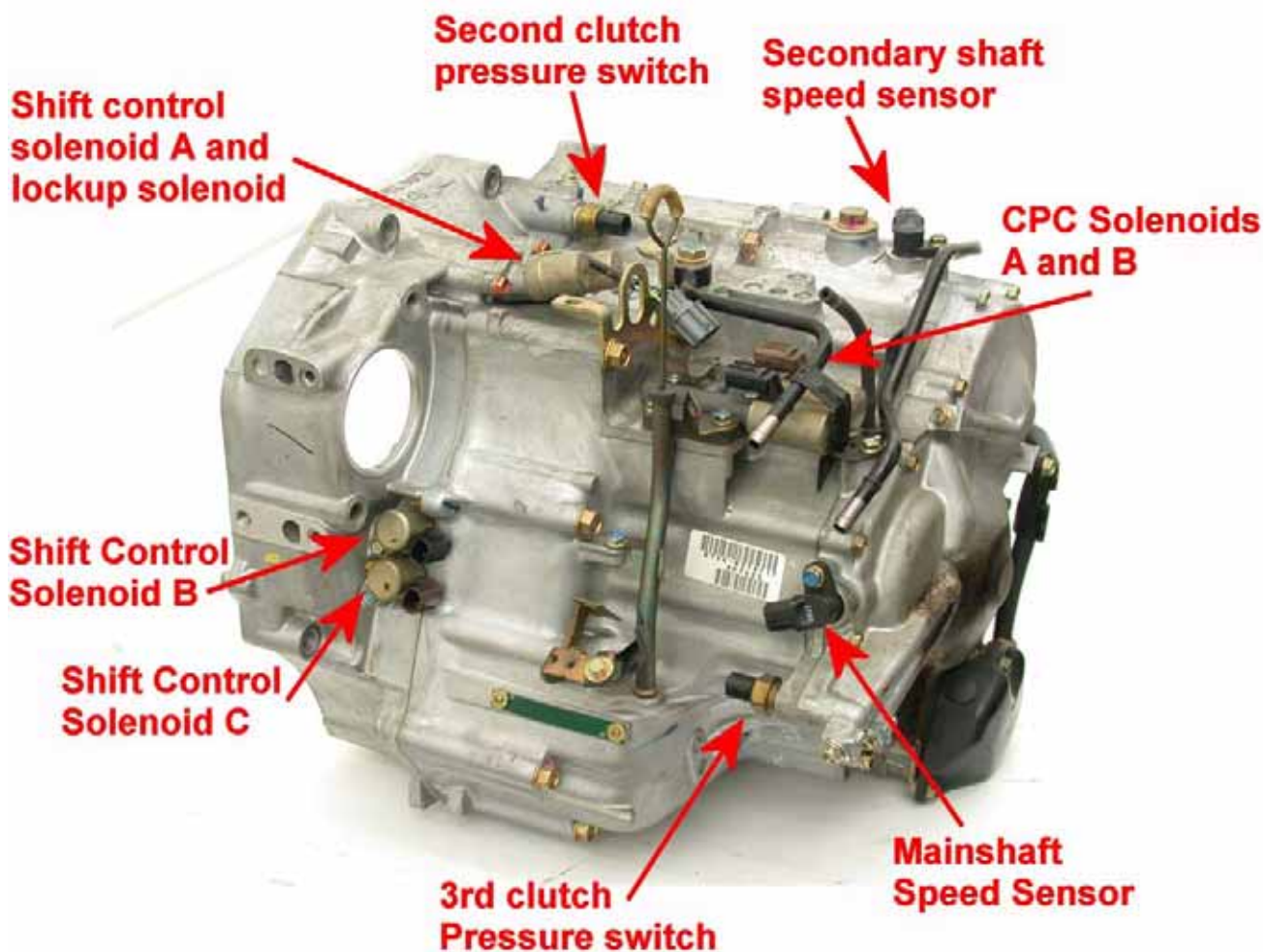


BAXA, MAXA, B7XA (continued)

V6 Unit

Component Identification

Below is an illustration showing various electrical components used in the BAXA, MAXA, and B7XA family transaxles used on V6 vehicles.

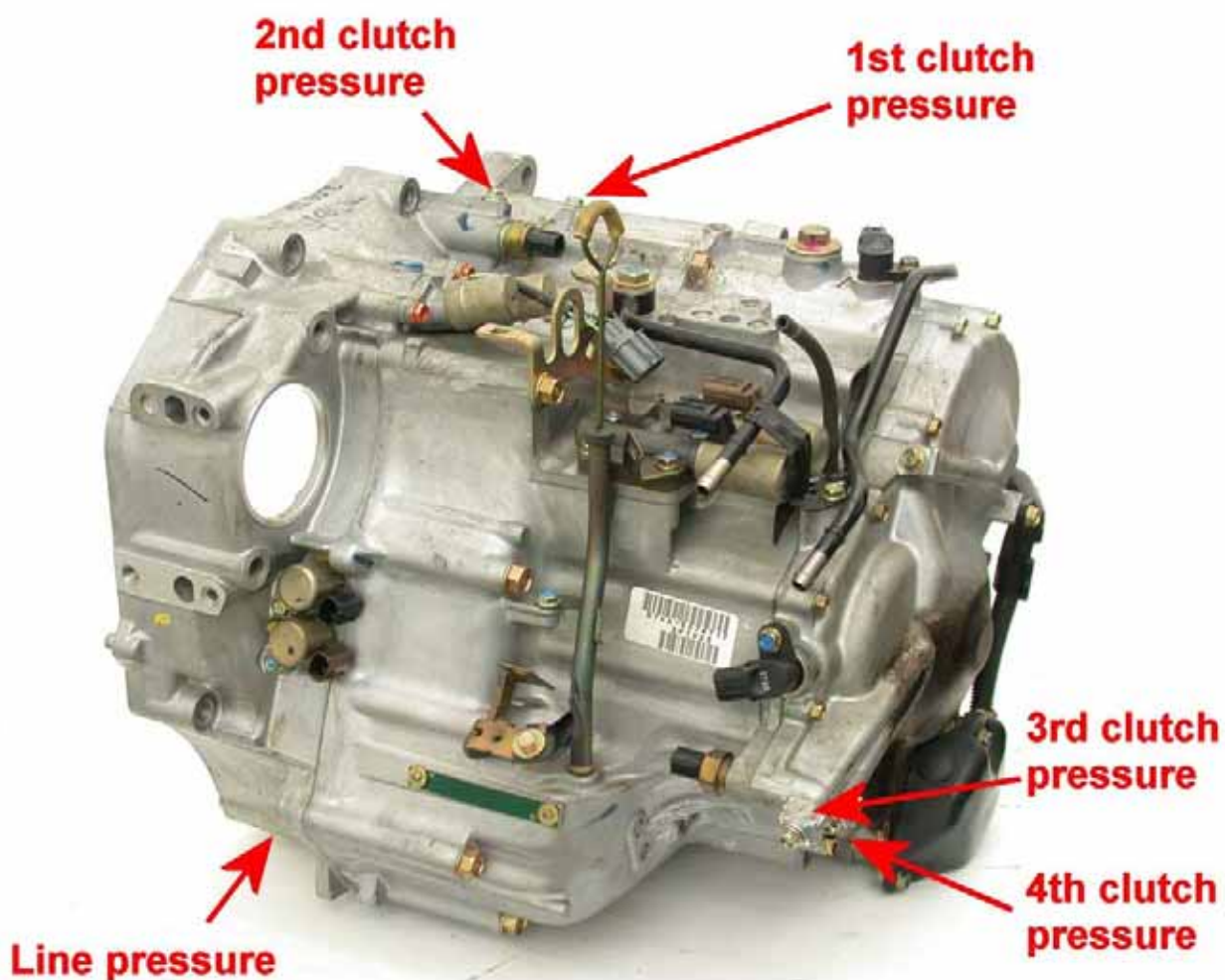


BAXA, MAXA, B7XA (continued)

V6 Unit

Pressure Taps

Pressure specifications are 120-130 psi. Line pressure will boost to approximately 300psi at full throttle.



BAXA, MAXA, B7XA *(continued)*

Erratic Shifts/Quality

Contamination CPC/Linear Solenoids

Many shift quality complaints including flares, harsh shifts, soft shifts, and engagement feel problems can be caused by contaminated CPC (Clutch Pressure Control) or Linear solenoids. Symptoms may be present only when cold. Normal flushing and cleaning of contaminated solenoids is usually not successful.



BAXA, MAXA, B7XA *(continued)*

Poor Shift Quality After Overhaul

The following can have a major effect on shift quality:

Fluid type, steel plate finish, and clutch material

Engine performance Adaptive learn: Make sure there are no DTC's , including engine codes.

Relearn Procedure

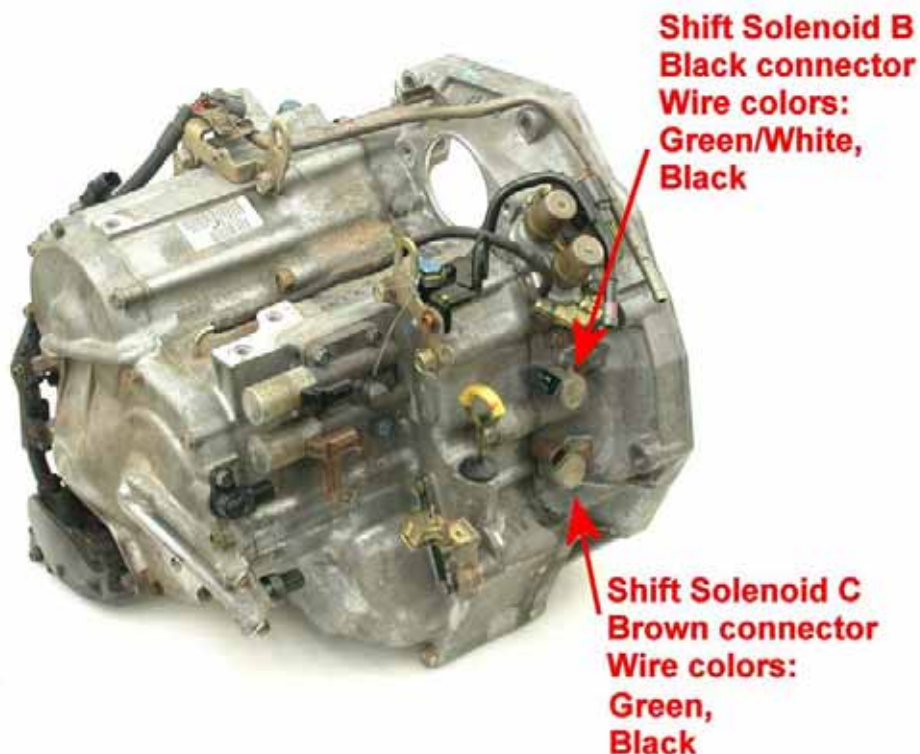
1. Start the engine and bring the transmission fluid temperature up to normal operating temperature of at least 104F°.
2. Turn the engine off and clear the codes.
3. Disconnect the battery. With both battery cables disconnected, touch them together, then turn on the headlights and press the brake pedal. Turn off lights, release the brake pedal, and reconnect battery.
4. Start the vehicle and let it idle until the cooling fan comes on.
5. As soon as the fan turns off let it idle in Park for one minute with the brake applied and all electrical accessories off.
6. Move the gear selector to the Drive position and let it idle for one minute with the brake applied and all electrical accessories off.
7. Road test the vehicle (do not drive with the wheels off of the ground). Accelerate lightly to 37 mph without exceeding 2400 rpm, then let it coast for five seconds (lift throttle).
8. Drive the vehicle at light throttle, automatically upshifting 1-2, 2-3, 3-4 and let it coast to a stop. Repeat this procedure four times.
9. Drive above 37 mph for five minutes.
10. Check for codes.

BAXA, MAXA, B7XA

Bindups, erratic shifting, lugs engine

A Bindup, Erratic shift and/or engine lugging may be caused by SSB and SSC harness connectors switched with CPC solenoid A and B harness connectors. Use wire colors to identify the correct harness connectors.

These wires may not be so easy to cross on a V6 unit, however you can cross the SSB and SSC solenoid wires; these connectors are the same.



4 cyl. model shown here

BAXA, MAXA, B7XA

Long or Delayed 1-2 Upshift

A Long/Delayed 1-2 upshift may be caused by a 2nd clutch pressure switch failure. This Switch is sensitive to moisture contamination, especially when it is unplugged. During disassembly of the transmission, do not expose this switches to water or moisture. Meaning, don't put it in the parts washer!

When testing the pressure switches, connect a digital volt/ohm meter to the switch leads. The readings will be either 0 ohms or open (infinite ohms). 0 ohms equals pressure below 36 psi, when the pressure rises above 36-40 psi the switch will open. It is very important that the switch opens and closes every time at the same pressure, if it does not, replace the switch.

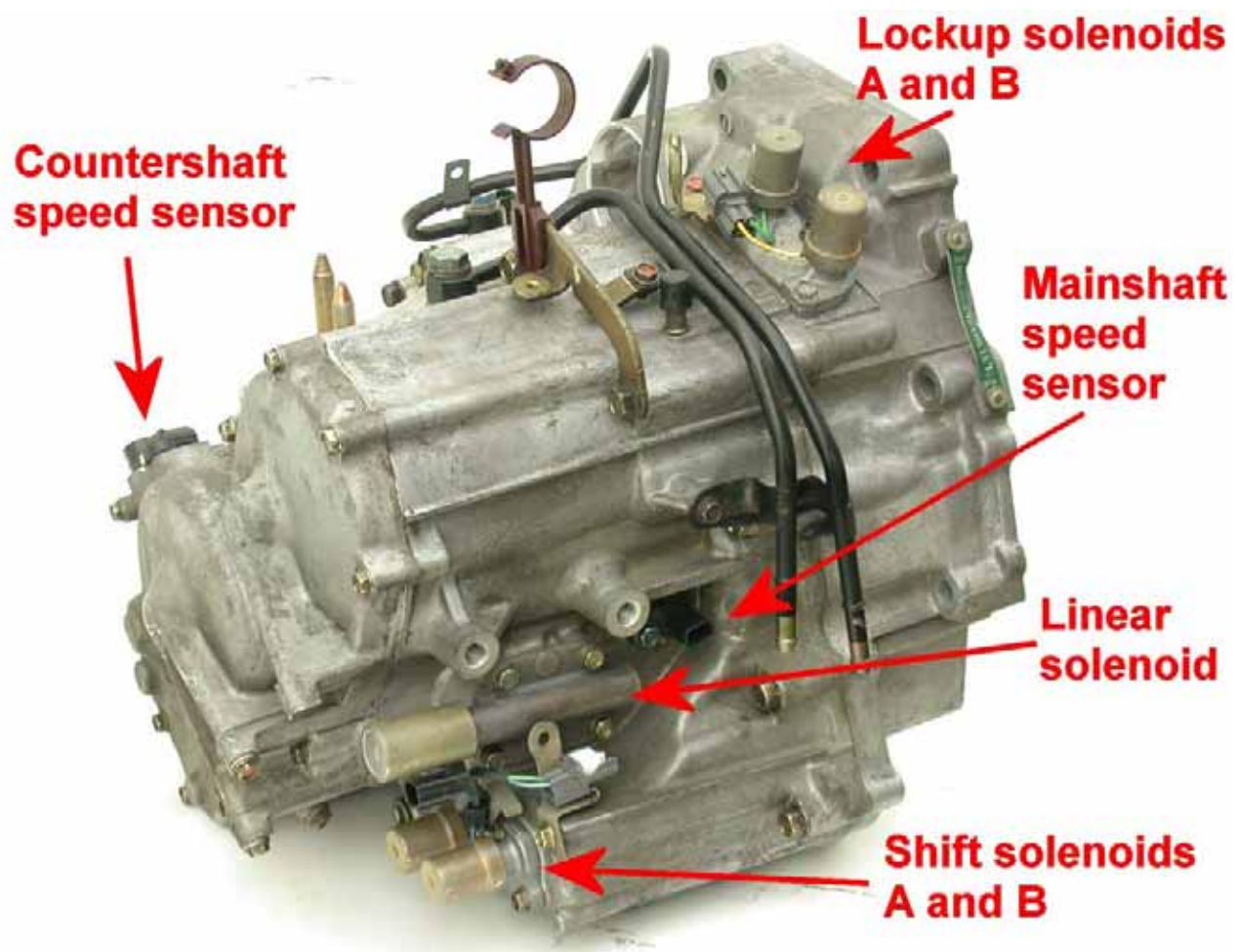
0 ohms = closed
Infinite ohms = open



A4RA, B4RA, M4RA

Identification

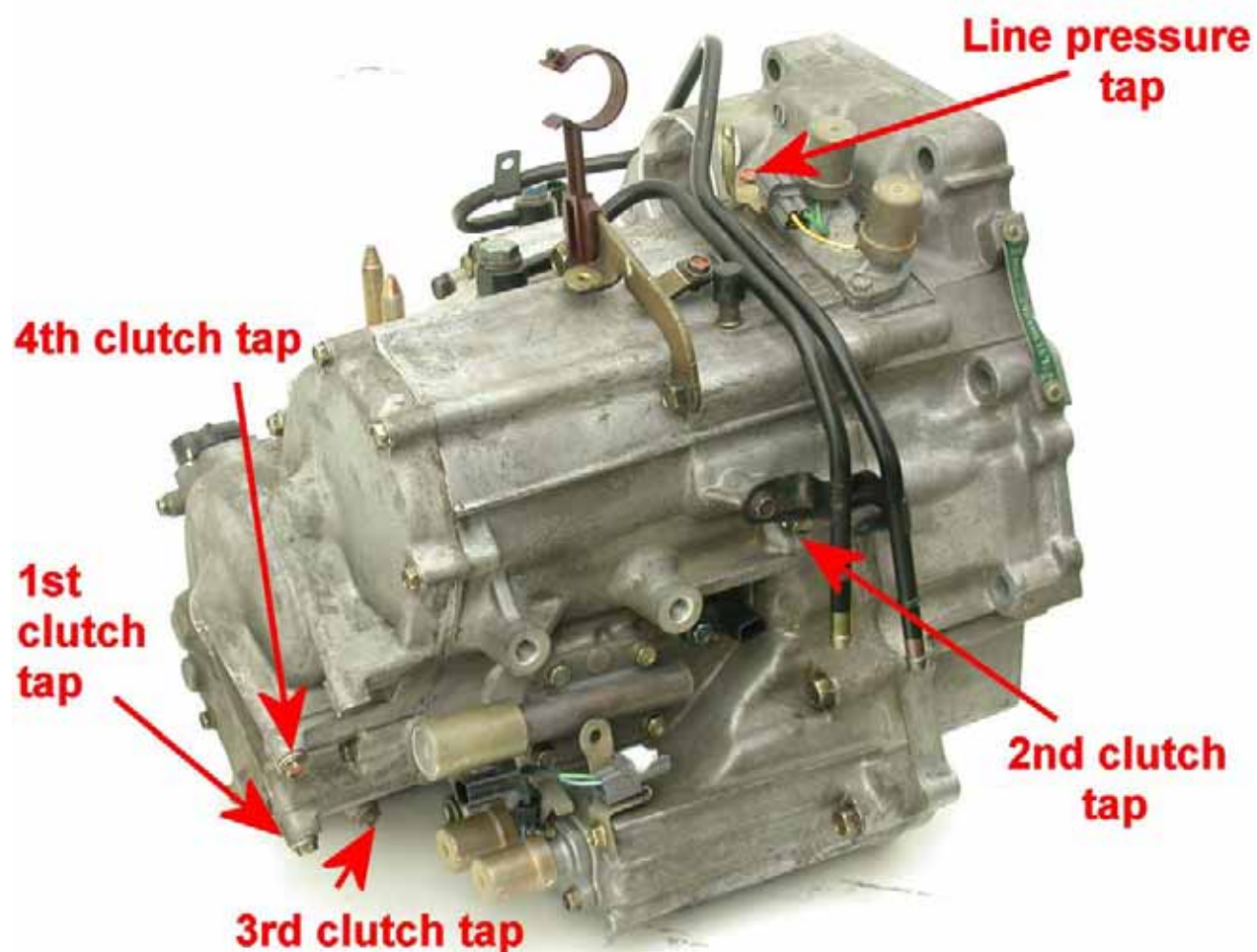
Identifying Honda transmission solenoids and switches can be difficult. Use the following pages to correctly identify them.



A4RA, B4RA, M4RA

Pressure Taps

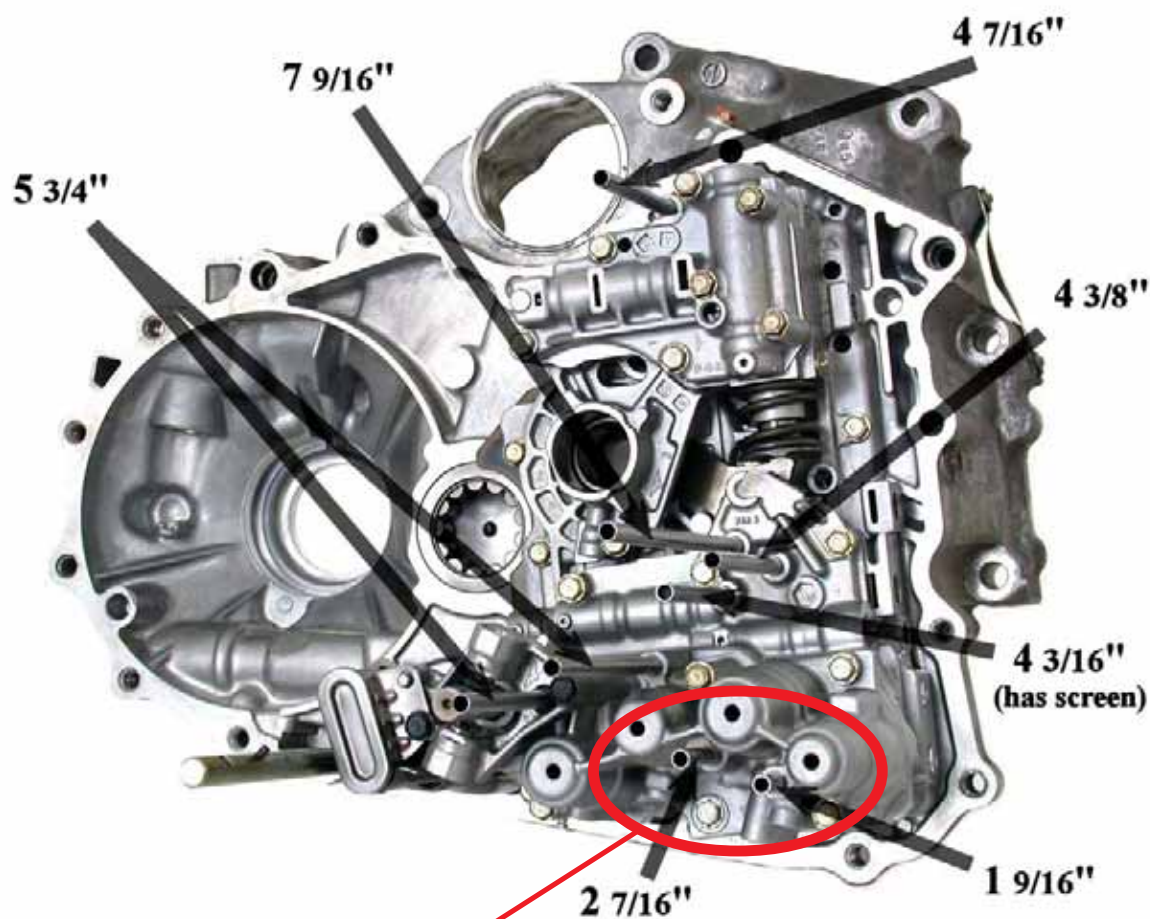
Pressure specifications are 120-130 psi. Line pressure will boost to approximately 300 psi at full throttle.



A4RA, B4RA, M4RA

***Wrong gear starts with 2nd and 3rd gear only,
mainshaft speed sensor code (P0715)***

Shift solenoid feed pipes incorrectly installed may cause a number of shift concerns including; wrong gear starts or no first no fourth. Use the diagram below for correct length and location of the feed pipes.



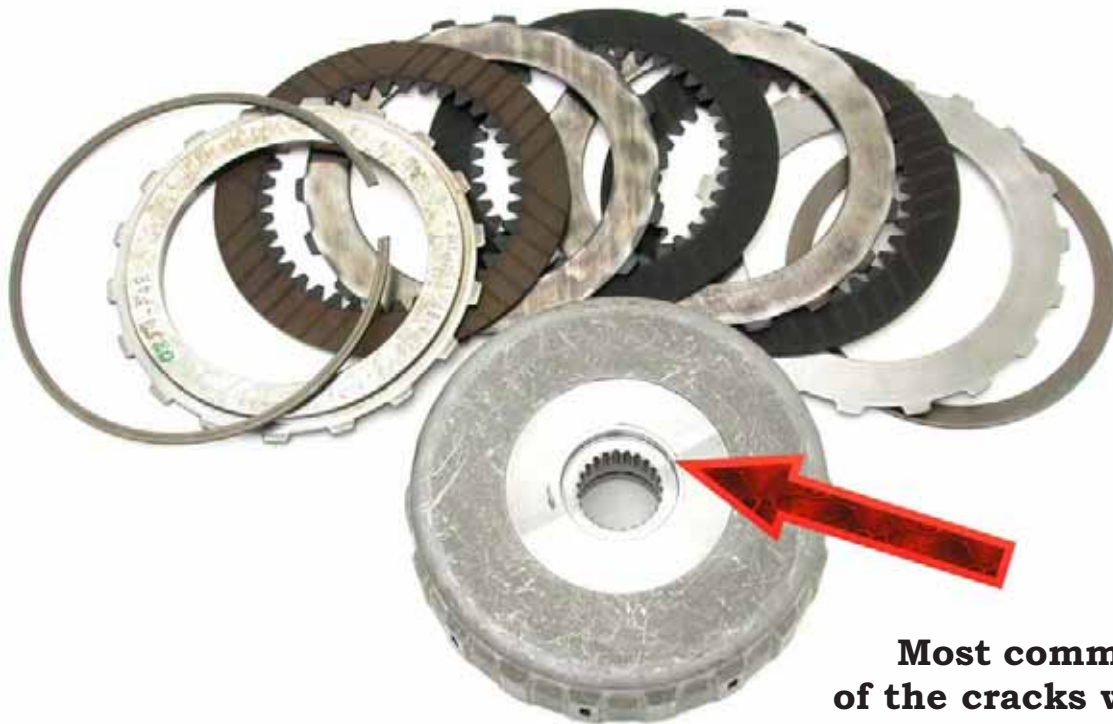
Shift solenoid feed pipes

A4RA, B4RA, M4RA

Cracked 1st clutch drum

A cracked 1st clutch drum can cause a number of different concerns. These concerns may be: Slipping in D on takeoff, OK after 1-2 shift, falls out of gear at a stop, no forward engagement, 1st clutch failure. These symptoms usually get worse as the transmission warms up.

Carefully inspect the drum on every one of these units. Many times a crack can be difficult to see.



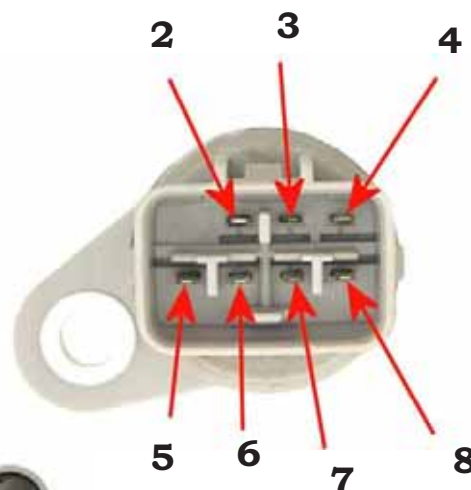
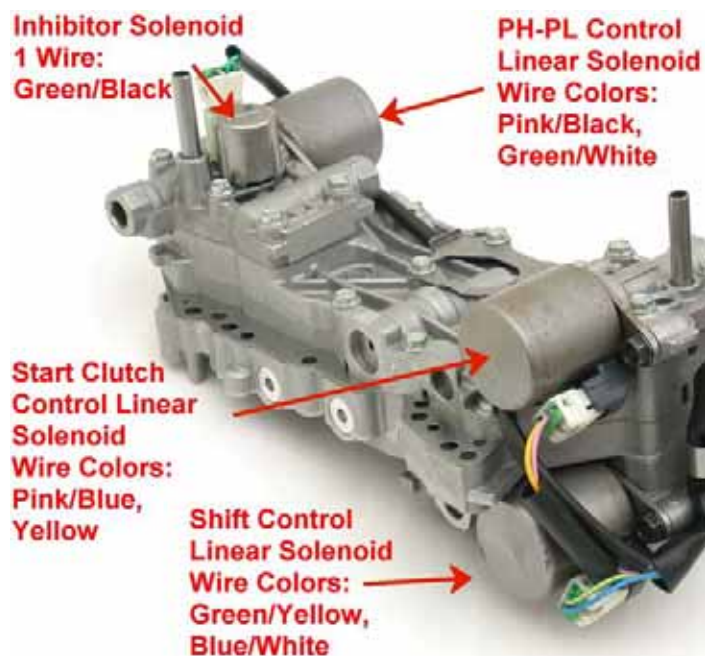
**Most common area
of the cracks will be
seen here.**

Civic CVT

Valve Body and Solenoids

Solenoid identification and wire colors.

Solenoid:	Measure between:	Resistance spec:
Shift Control Linear Solenoid	Terminals 3 and 7	3.8 to 6.8 ohms
PH-PL Linear Solenoid	Terminals 2 and 6	3.8 to 6.8 ohms
Start Clutch Control Linear Solenoid	Terminals 4 and 8	3.8 to 6.8 ohms
Inhibitor Solenoid	Terminal 5 and the valve body	11.7 to 21.0 ohms



NOTES:



Some people take their rebuilds...

...to the edge.

When a rebuild leaves your shop, your reputation is on the line. You have no control over what happens next – heat, cold, dust, stop, go – the only thing you can control is what parts you use. That's why you'll want to go with a name you can depend on – Raybestos Powertrain.

- **OEM Parts**
- **Quality Guaranteed**
- **Fewer Comebacks**
- **American Made**



Raybestos
POWERTRAIN

The best choice, the first time and every time.

ZF5HP19FL

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ZF5HP19FL

Transmission Identification

Identifying the ZF transmission tag is easy. The tag refers directly to the model of the transmission. It will also give you a part number to references.



This transmission is from an Audi

ZF5HP19FL

Application and General Information

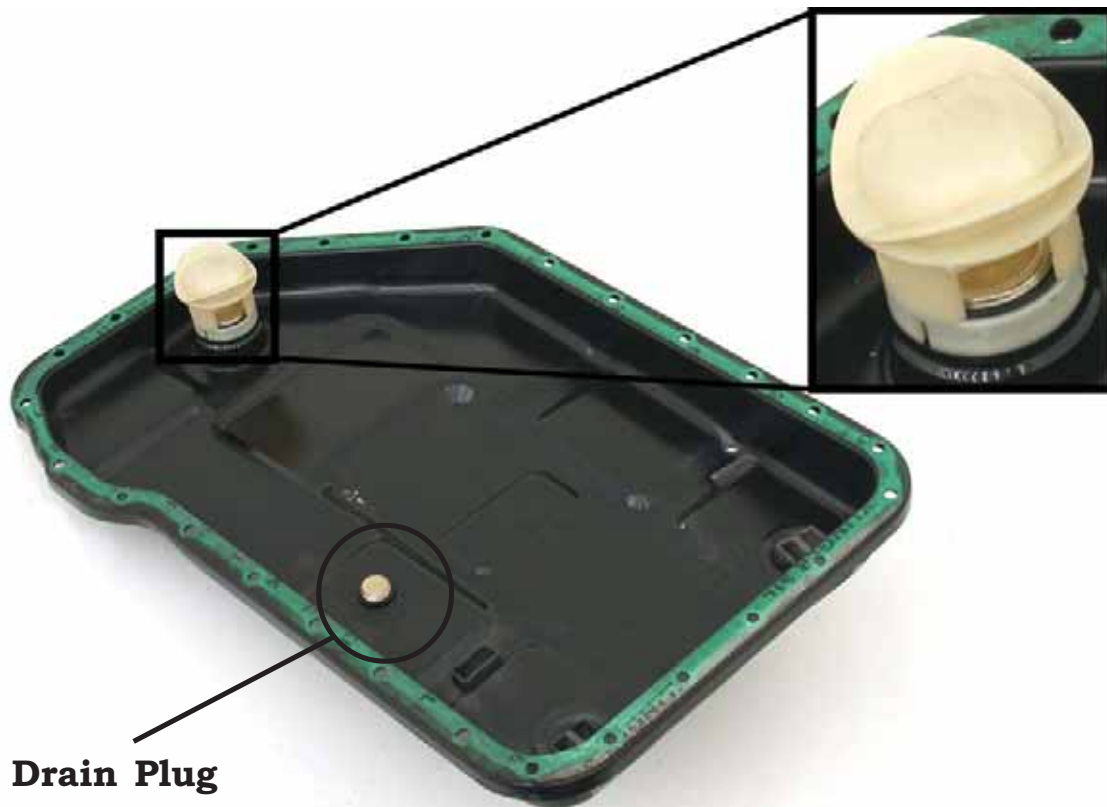
01V Transmissions				
Trans Code Letters		DRD	DSS	EBD
Date Manufactured		Apr-97	May-97	01/99-08/00
Vehicle		98-up Passat		
Engine		2.8L	2.8L	1.8L
Converter codes		F31	F31	M28
Transmission Ratios	1 st	3.665:1		
	2 nd	1.999:1		
	3 rd	1.407:1		
	4 th	1.000:1		
	5 th	0.742:1		
	Reverse	4.096:1		
Intermediate Drive Teeth & Ratios	Input	29	29	29
	Output	35	29	35
	Ratio	1.207:1	1.000:1	1.207:1
Final Drive Teeth & Ratios	Pinion	11	11	11
	Ring	30	34	30
	Ratio	2.727:1	3.091:1	2.727:1
Bus Data		Yes	Yes	No
Hydraulic Control		E17	E17	E18/2

*** VW models only**

ZF5HP19FL

Oil Pan and Fill Hole

The ZF5HP19FL unit is a Fill for Life fluid. The pan holds 2.7-3.2 quarts of oil and a complete refill will hold 9.5 quarts of oil. Fill the transmission with the engine idling and the transmission in park. The oil temperature must be between 95 °F and 115 °F.



ZF5HP19FL

Clutch and Band Application Chart

E17 Models

Position/Gear	Solenoid Valves							Clutches				Brakes			Freewheel
	N88	N89	N90	N91	N92	N93	N94	A	B	E	F	C	D	G	1 ST Gear
Reverse	X			X		X			X				X	X	
Neutral	X	X		X		X					X			X	
D/1 st	X	X		X		X		X						X	X
D/2 nd	X	X		X	X	X		X				X		X	
D/3 rd		X	X	X	X			X			X	X			
D/4 th			X	X				X		X	X				
D/5 th	X		X	X	X					X	X	X			
2/1 st	X			X		X		X					X	X	X
D/5 th -4 th	X		X	X	X		X	(X)		X	X	(X)			

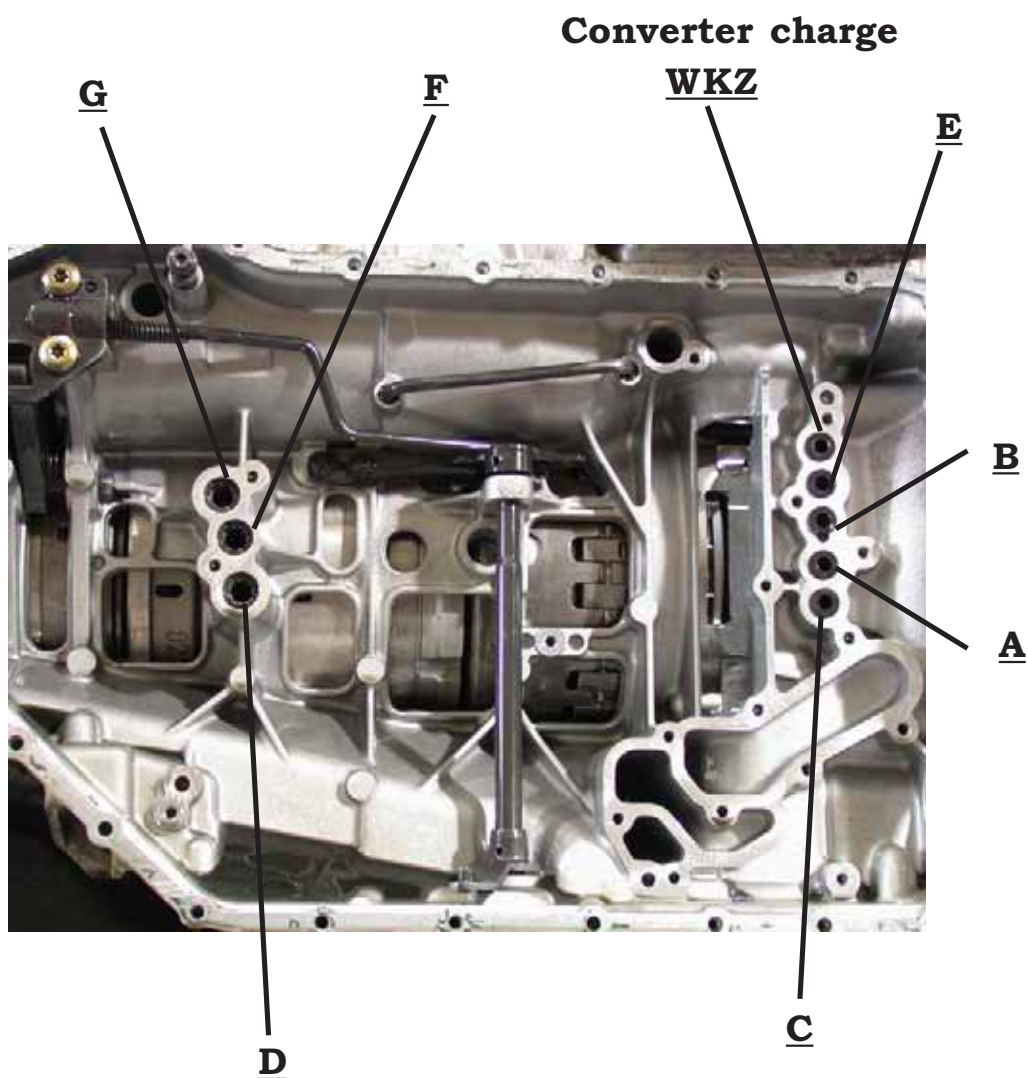
E18 Models

Position/Gear	Solenoids							Clutches							
	Solenoid Valves				Pressure Regulating			Clutches				Brakes			Freewheel
	N88	N89	N90	N215	N216	N217	N218	A	B	E	F	C	D	G	1 ST Gear
Reverse	X			X		X			X				X	X	
	X	X		X		X					X			X	
D/1 st	X	X		X		X		X						X	X
D/2 nd	X	X		X	X	X		X				X		X	
D/3 rd		X	X	X	X			X			X	X			
D/4 th			X	X				X		X	X				
D/5 th	X		X	X	X					X	X	X			
2/1 st	X			X		X		X					X	X	X
D/5 th -4 th	X		X	X	X		X	(X)		X	X	(X)			

ZF5HP19FL

Air Checking the Case

When air checking a case to clutch application, use regulated air pressure at approximately 30 psi.



ZF5HP19FL

Front Seal and Oil Deflector

When dissassembling the pump assembly, you can choose to remove the oil deflector or simply stake it in to place. In some cases the oil deflector becomes loose and can cause the pump bushing to jar loose and spin in the housing. This can cause severe damage to the hub and seal.

**Remove oil deflector or
stake it in place**

Front Bushing Wear



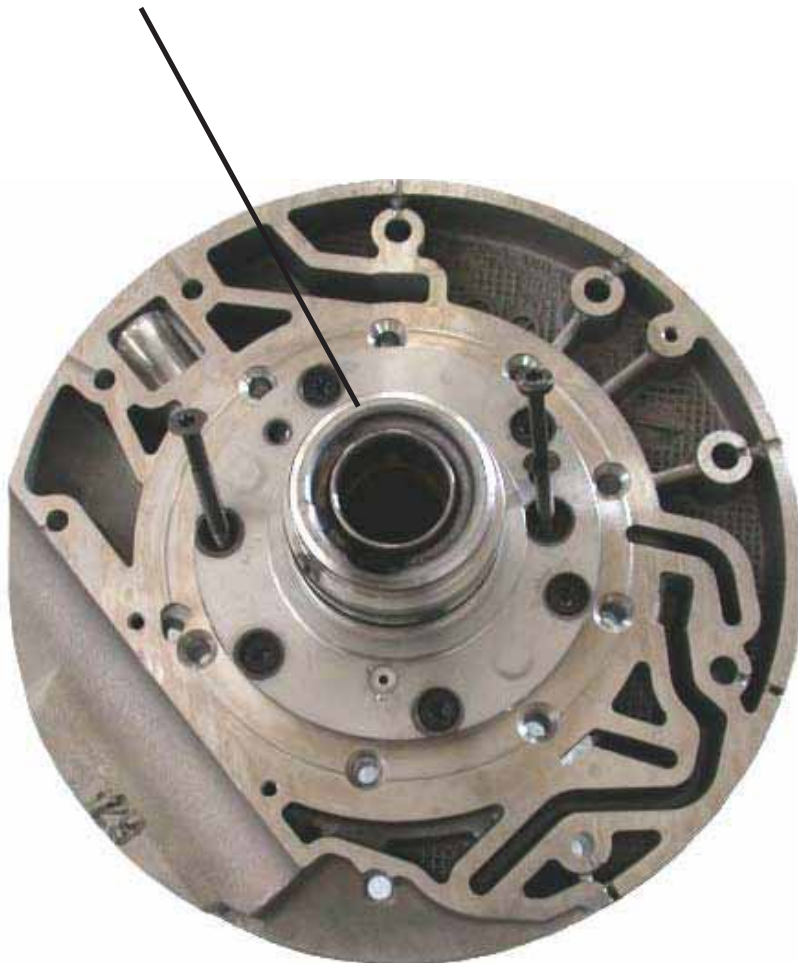
**Possible front seal leak due
to the oil deflector becoming
loose and damaging the seal**



ZF5HP19FL

Pump Disassembly

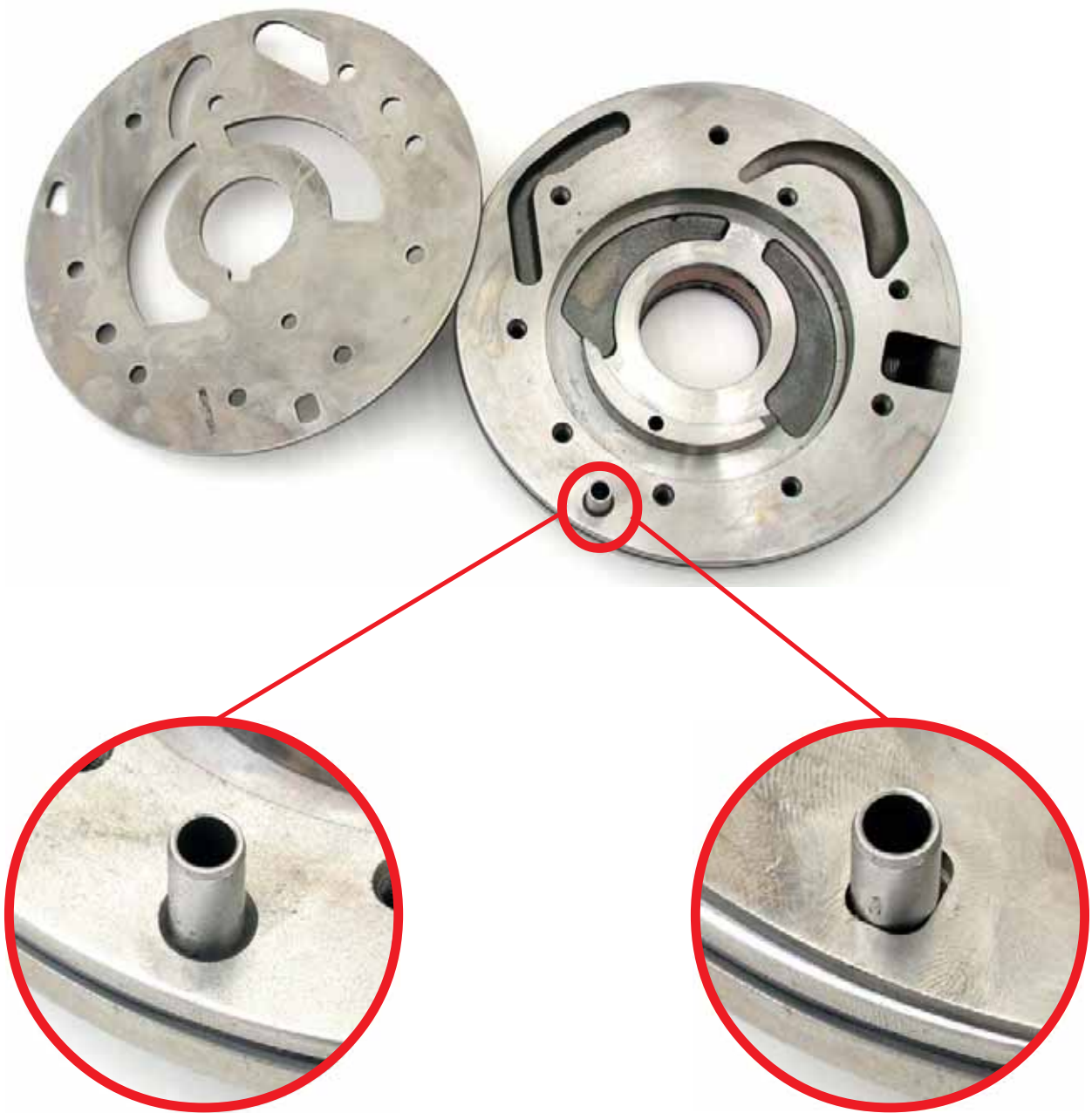
Look here for bushing wear.



This alignment dowel is used to align the pump halves. VERY IMPORTANT not to lose it.

ZF5HP19FL

Pump Disassembly (continued)

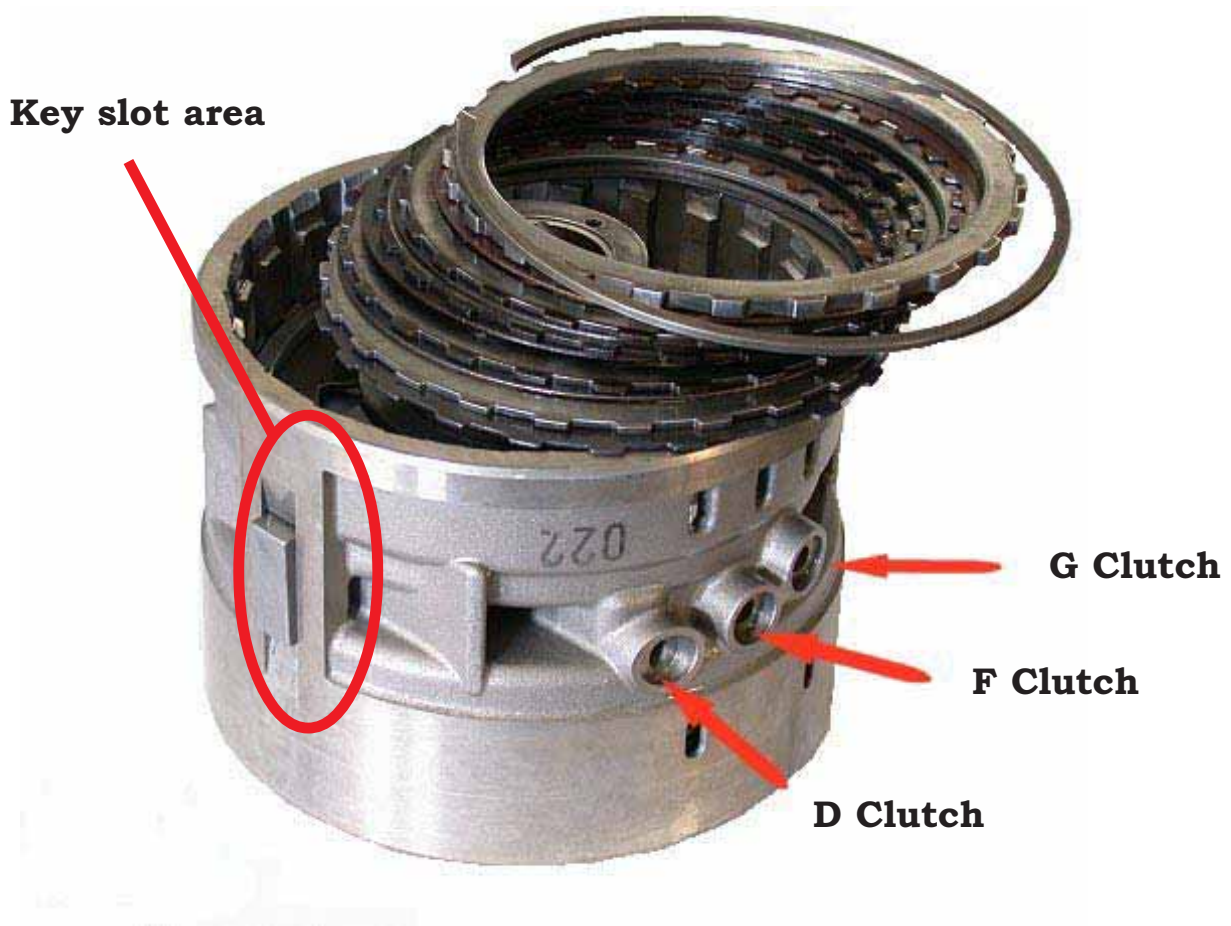


ZF5HP19FL

D Clutch Failure, No Reverse

The rear clutch support housing can become damaged at the key slot area. During disassembly pay close attention to the key slot area. It may be necessary to replace the drum assembly.

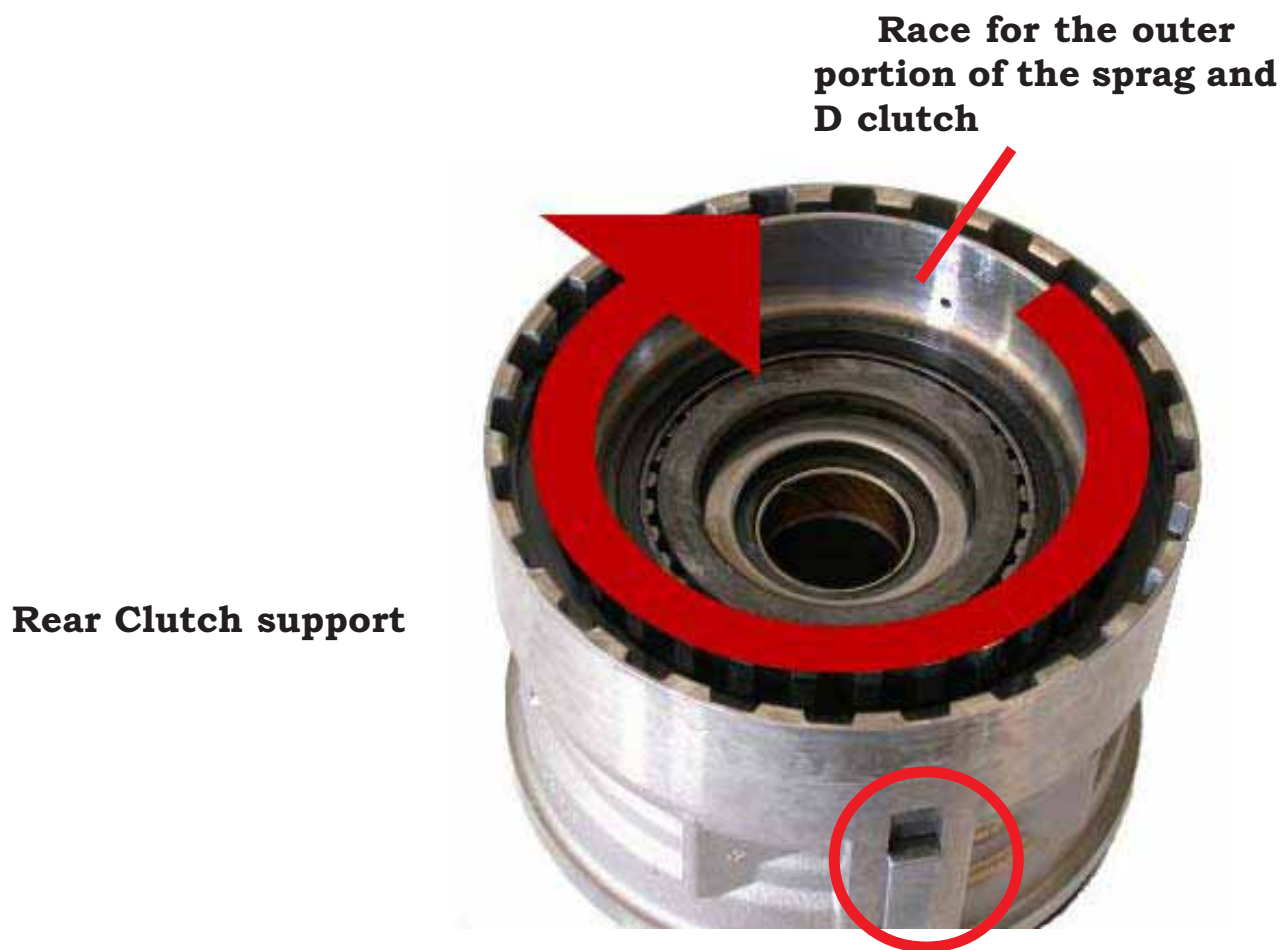
Note: Also check the case for slot wear.



ZF5HP19FL

Sprag Rotation

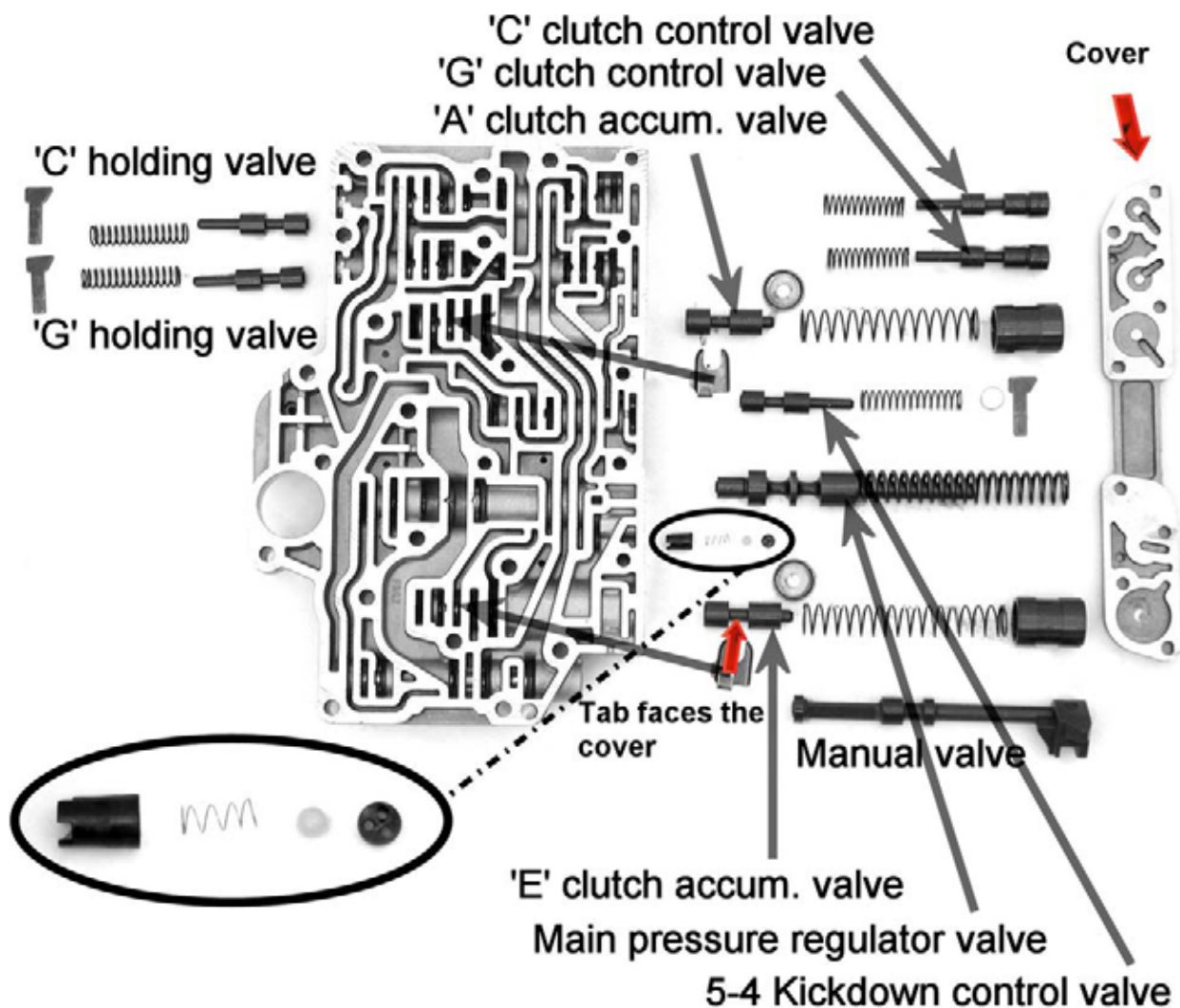
The sprag is viewed from the front of the case.



The support locks into the case using the outer key of the drum.

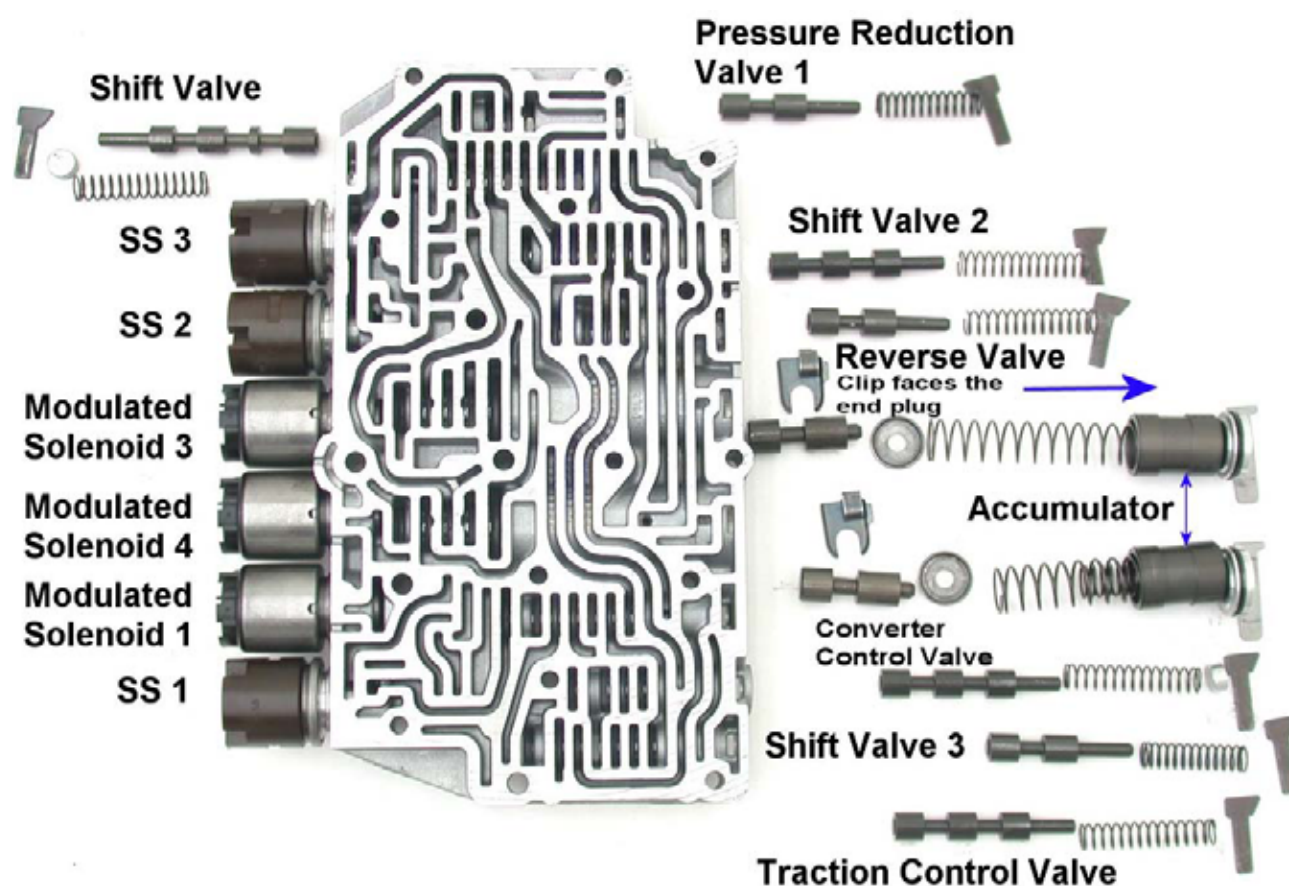
ZF5HP19FL

Main Valve Body Housing



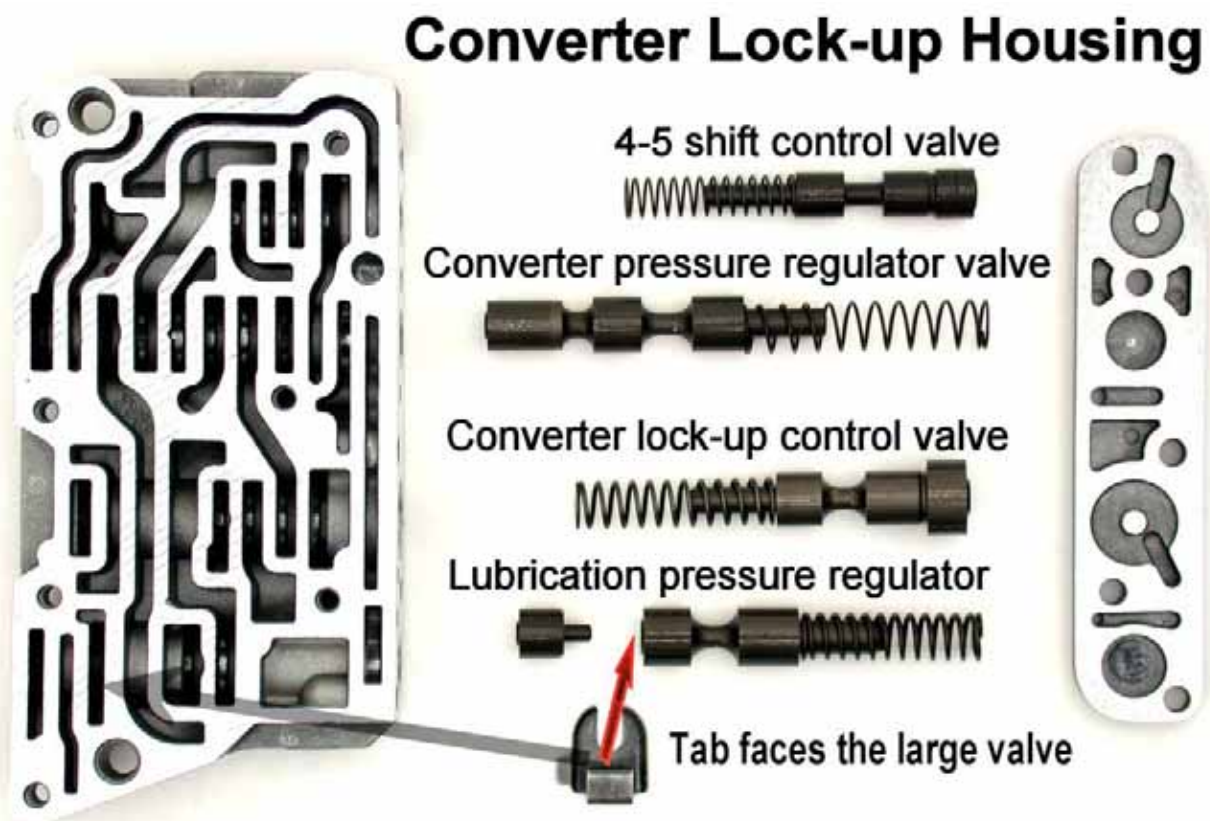
ZF5HP19FL

Main Valve Body Housing (continued)



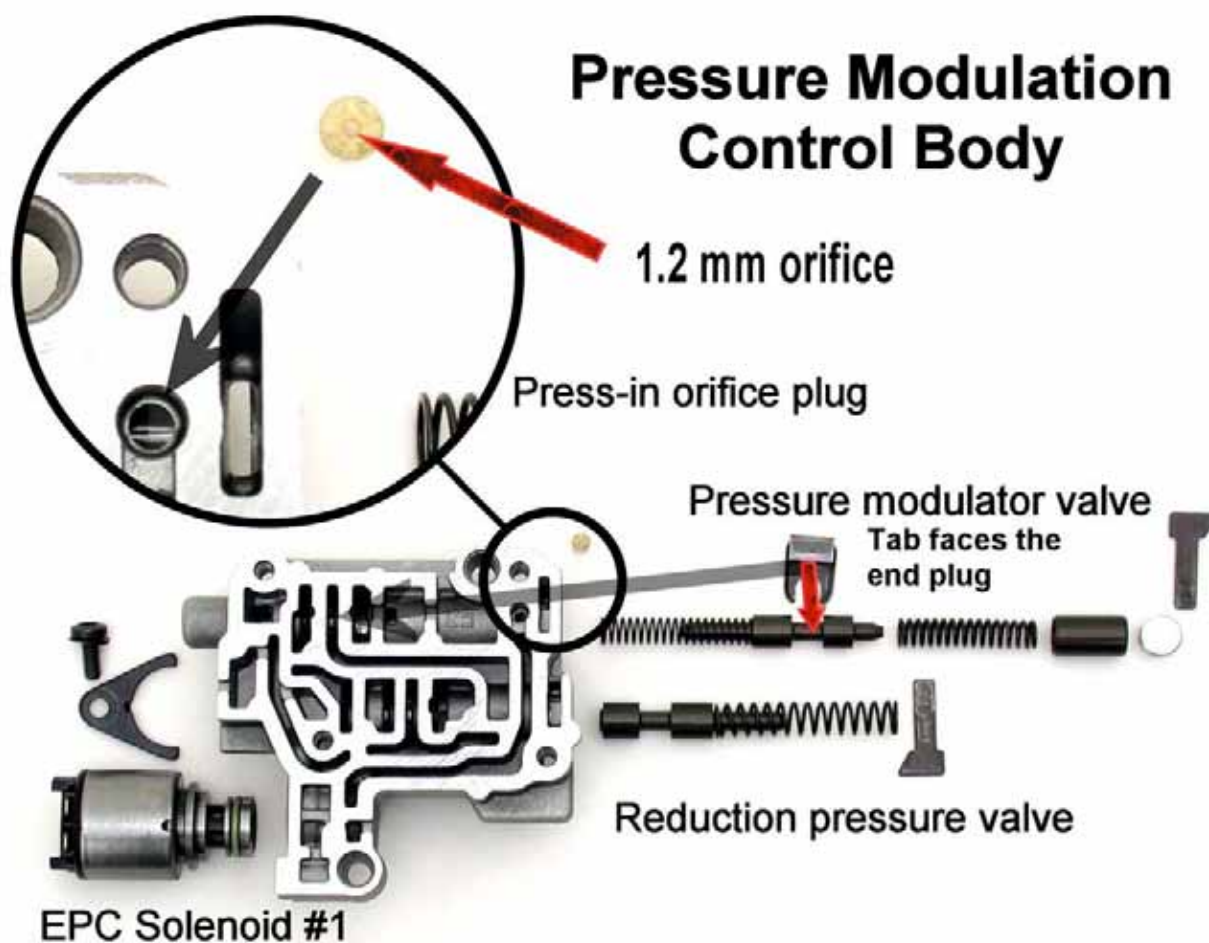
ZF5HP19FL

Converter Lock-up Housing



ZF5HP19FL

Pressure Modulation Control Body



ZF5HP19FL

Transfer Plate and Orifices

NOTE: Later units and service updates use a flat disc

