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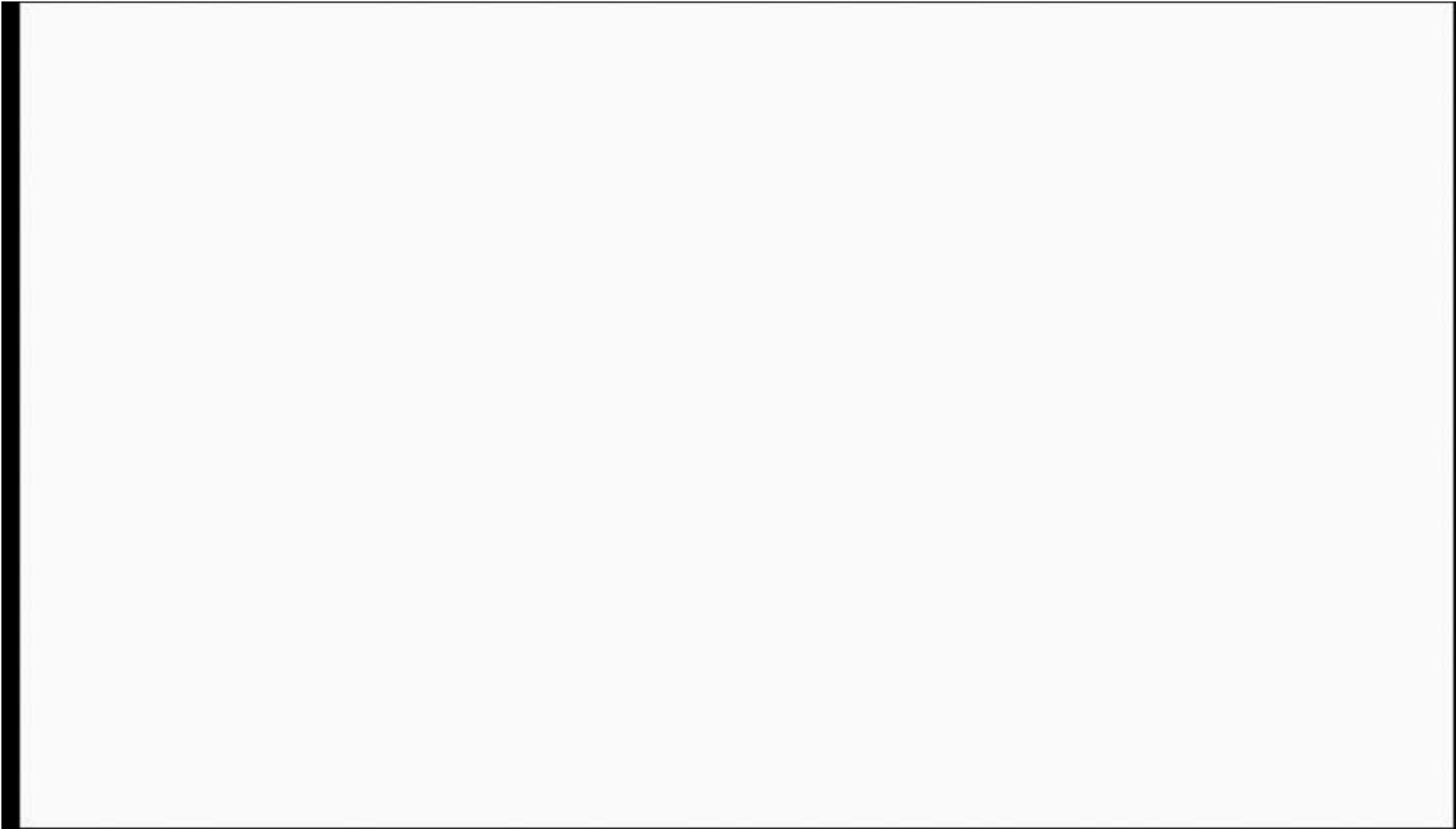
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Webinar Schedule

July 7/8	DPS6	Internal Operation
July 21/22	U660	Introduction
Aug 4/5	8L90	Internal
Aug 18/19	U660E	Rebuild
Sept 1/2	948TE	Internal
Sept 15/16	5R110W	Problems & Fixes
Sept 29/30	6R60 - ZF6HP	Comparison
Oct 13/14	6R140	Problems & Fixes





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October 29 - November 1 2015



Powertrain expo 2015

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18	19	20	21	22	23	24
25	26	27	28	29	30	31

NOVEMBER

S	M	T	W	T	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

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2015 TECHNICAL SEMINAR

SCHEDULE

Registration 7am- 8am
Seminar 8am
Lunch..... 12pm-1pm

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**Expo Package includes 1 Complete Conference Registration & up to 4 nights hotel stay at the Rio Hotel & Casino. Must be present to win.*

LOCATIONS

AUGUST

[8/8/15 -- Albuquerque, NM](#)

[8/15/15 -- Portland, OR](#)

[8/22/15 -- Atlanta, GA](#)

[8/29/15--Anaheim, CA](#)

SEPTEMBER

[9/12/15 -- Billings, MT](#)

[9/19/15 -- Chicago, IL](#)

[9/26/15-- Clark-Newark, NJ](#)

OCTOBER

ATRA's Powertrain Expo
October 29 - November 1

NOVEMBER

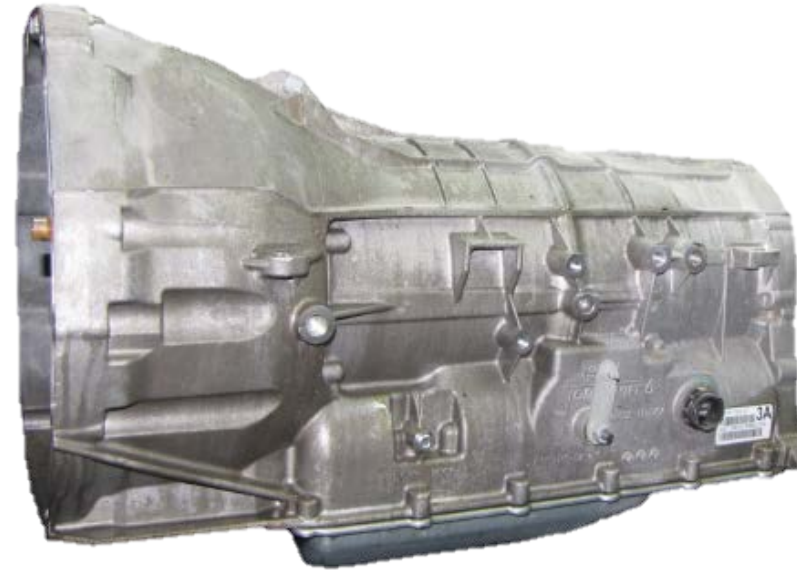
[11/7/15 -- Baltimore, MD](#)



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Ford 6R140W Introduction “TorqShift 6”



Presented by:
Mike Souza
ATRA Senior
Research Technician

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Introduction

This is a 6-speed electronically controlled transmission .

This transmission includes:

- Torque converter with an integral converter clutch
- Electronic shift and pressure controls
- Single planetary gear-set
- Double (Ravigneaux) planetary gear-set
- Two holding multi-disc clutch sets
- Three driving multi-plate clutch sets
- One one-way holding clutch
- Valve body unit

The (6) forward gears and one reverse gear are obtained from (2) planetary gear sets.

The valve body assembly with solenoids inside the transmission and is controlled by a PCM for gas engine applications and a Transmission Control Module (TCM) for diesel engine applications located outside the transmission.

In the event of a system fault, the PCM or TCM also provides for Failure Mode Effect Management to maintain maximum functional operation of the transmission with a minimum power reduction.

In the event of a total loss of control or electrical power, the basic transmission functions P, R, N and D are retained.

Also 5th gear is retained by the hydraulic system.



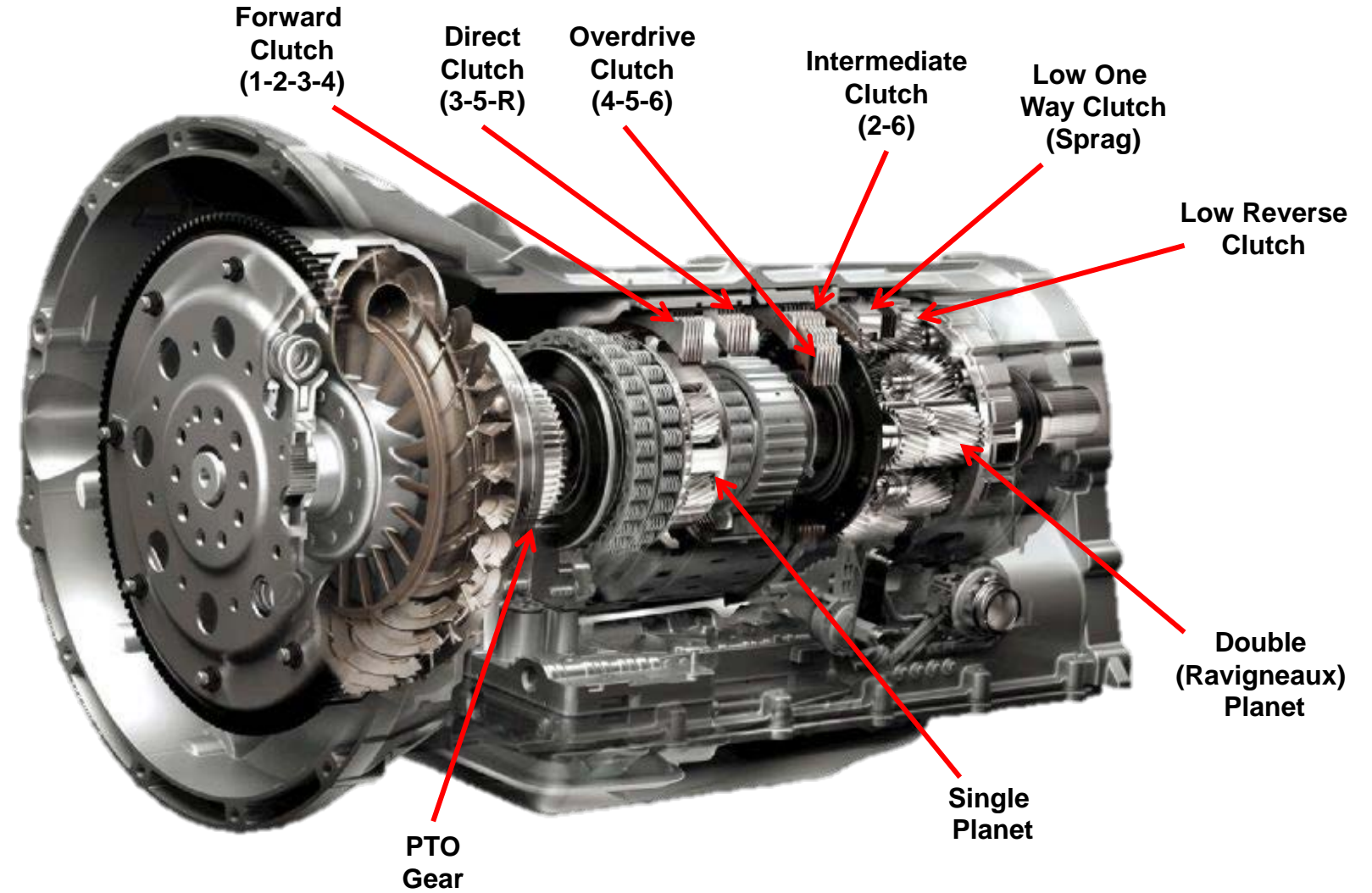
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Component Locations



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Component Application Chart



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CLUTCH APPLICATION CHART						
Gear	Forward (1, 2, 3, 4)	Direct (3, 5, R)	Intermediate (2, 6)	Low/ Reverse (1, R)	Overdrive (4, 5, 6)	Low-OWC
Park				H		
Reverse		D		H		
Neutral				H		
1st Gear D	D			H (1)		H
2nd Gear D	D		H			O/R
3rd Gear D	D	D				O/R
4th Gear D	D				D	O/R
5th Gear D		D			D	O/R
6th Gear D			H		D	O/R
1st Gear Manual	D			H		H
Planetary Components	Front planetary carrier-to- No. 3 sun gear	Front carrier- to-No. 2 sun gear	No. 2 sun gear	Rear planetary carrier	Input shaft- to-rear planetary carrier	Rear planetary carrier

(1) = Low/Reverse clutch is holding until vehicle reaches 5 mph.
 D = Drive Clutch
 H = Hold Clutch
 O/R = Overrunning

Gear Ratio	
1st	3.974 to 1
2nd	2.318 to 1
3rd	1.516 to 1
4th	1.149 to 1
5th	0.858 to 1
6th	0.674 to 1
Reverse	3.128 to 1

STALL SPEED		
Engine	Drive	Reverse
Diesel	1,600-1,750 rpm	1,800-2,000 rpm
Gas	2,100-2,300 rpm	1,900-2,200 rpm

The two overdrive gears create a shorter ratio. This, combined with different available rear axle ratios, gives the Torqshift the pulling power it needs



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Shift Speed Chart Gas Engines



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SHIFT SPEEDS - GAS ENGINES					
Throttle Position	(D) Position Shift	Speed Tow/Haul OFF Km/H	Speed Tow/Haul OFF mph	Speed Tow/Haul ON Km/H	Speed Tow/Haul ON mph
Closed	6-5	40-58	30-36	57-69	35-43
	5-4	33-40	20-25	47-57	29-35
	4-3	25-30	16-19	37-45	23-28
	3-2	15-18	9-11	25-30	16-19
	2-1	9-11	6-7	11-13	7-8
Minimum	1-2	11-13	7-8	14-17	9-11
Throttle	2-3	20-24	13-15	29-35	18-21
Accelerator Pedal	3rd TCC Lock(1) (2)	-	-	35-43	22-27
Position (APP)	3-4	29-36	18-22	42-51	26-32
13%	4-5	36-44	22-27	54-65	33-40
	5th TCC Lock (3)	41-50	26-31	-	-
	5-6	52-63	32-39	65-79	41-49
Wide Open	1-2	49-60	31-37	52-63	32-39
	2-3	85-103	53-64	87-106	54-66
	3rd TCC Lock (1) (2)	94-114	58-71	92-112	57-69
	3-4	132-160	82-99	134-163	83-101
	4-5	178-215	110-134	178-215	110-134
	5-6	238-289	148-179	238-289	148-179
(1) = The Torque Converter Clutch (TCC) will lock: in 3rd gear between the 2-3 and 3-4 shift when the accelerator pedal is above 30%.					
(2) = The Torque Converter Clutch (TCC) will lock: in 3rd gear between the 2-3 and 3-4 shift with Tow/Haul ON.					
(3) = The Torque Converter Clutch (TCC) will lock: in 5th gear between the 4-5 and 5-6 shift when the accelerator pedal is below 30%.					



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Shift Speed Chart Diesel Engines



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SHIFT SPEEDS - DIESEL ENGINES					
Throttle Position	(D) Position Shift	Speed Tow/Haul OFF Km/H	Speed Tow/Haul OFF mph	Speed Tow/Haul ON Km/H	Speed Tow/Haul ON mph
Closed	6-5	41-62	25-39	47-72	29-45
	5-4	31-48	19-30	38-59	24-37
	4-3	23-35	14-22	29-45	18-28
	3-2	15-23	9-14	20-31	12-19
	2-1	8-12	5-7	9-14	6-9
Minimum	1-2	11-16	7-10	14-22	9-14
Throttle	2-3	18-27	11-17	24-37	15-23
Accelerator Pedal	3rd TCC Lock (1)	22-34	14-21	29-45	18-28
Position (APP)	3-4	26-40	16-25	35-53	22-33
13%	4-5	34-52	21-33	44-68	27-42
	5-6	44-68	27-42	53-81	33-50
Wide Open	1-2	21-32	13-20	23-35	14-22
	2-3	40-61	25-38	40-61	25-38
	3rd TCC Lock (1)	47-72	29-45	45-70	28-43
	3-4	65-99	40-62	61-94	38-58
	4-5	85-131	53-81	80-123	50-77
	5-6	111-170	69-106	107-165	67-102

(1) = The Torque Converter Clutch (TCC) locks in 3rd gear between the 2-3 and 3-4 shift.



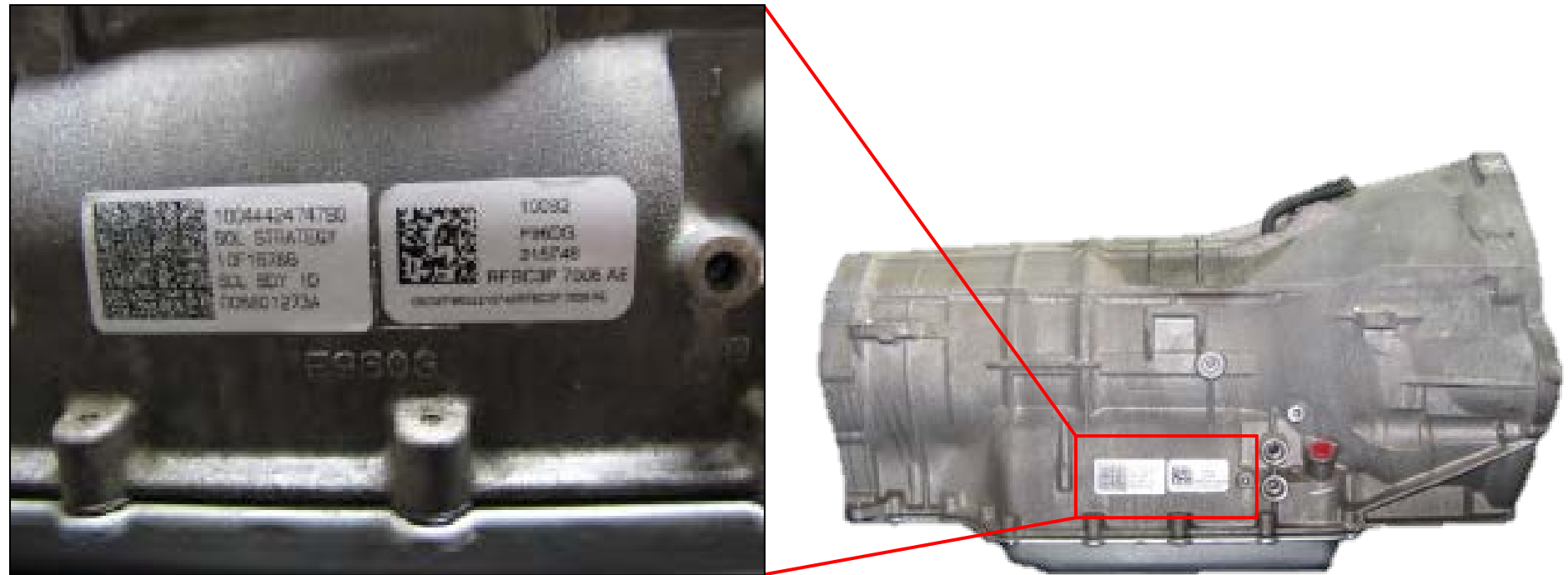
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Solenoid Body Strategy

The solenoid body strategy is a file programmed into the PCM or TCM.

The solenoid body tag on the transmission case contains the 13-digit solenoid body strategy and the 8-digit solenoid body identification.

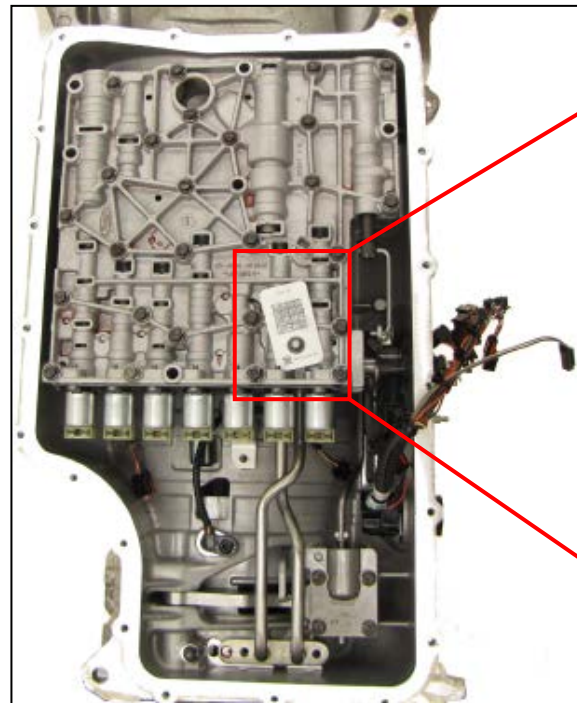




Valve Body / Solenoid Replacement

Anytime a new valve body is installed, a new solenoid body strategy file is downloaded into the PCM or TCM using a capable scan tool. A replacement solenoid body tag is supplied with the new solenoid body which contains the 13-digit solenoid body strategy and the 8-digit solenoid body identification. The new tag is placed over the original solenoid body tag.

If the solenoid body strategy printed on the tag on the solenoid body does not match the solenoid body tag on the side of the transmission case, a new valve body must be installed and the solenoid body strategy must be downloaded into the PCM or TCM or harsh shifts will result.





Valve Body / Solenoid Replacement

1. Using the scan tool, select Module Programming and Programmable Parameters then select transmission. Follow the instructions displayed on the scan tool.

There are fields to enter the solenoid body eight-digit identification and thirteen-digit strategy recorded from the tag on the main control.

2. **NOTICE:** If the solenoid body information is not correct, transmission damage or driveability concerns can occur. Enter the solenoid body identification and strategy.

The scan tool verifies numbers entered are valid and displays a message if the information is not valid. The scan tool checks to see if the file is present on the scan tool.

If the file is present, the technician may proceed with downloading the file to the PCM or Transmission Control Module (TCM). If the file is not present, connect the scan tool to the Professional Technician Society (PTS) server to download the file onto the scan tool or www.motorcraft.com.

3. Verify the file is present on the scan tool. If the file is present, go to Step 8. If the file is not present, continue with this procedure.

4. Connect the scan tool to the PTS server. The screen displays a progress bar when connecting to the network.

5. Follow the instructions on the network to download the strategy file to the scan tool.



Valve Body / Solenoid Replacement



6. If the scan tool cannot connect to the PTS server, download the file from www.motorcraft.com. If the scan tool cannot download a strategy from the web site, a partial strategy is downloaded automatically.

7. Reconnect the scan tool to the vehicle.

8. Follow the instructions displayed on the scan tool.

9. If a new main control was installed, clean the existing solenoid strategy tag on the transmission case and cover it with the replacement solenoid body tag provided with the main control service kit.

The scan tool automatically downloads the strategy file or partial strategy file to the PCM or TCM. The scan tool displays a message when its finished downloading the data stating the file was downloaded successfully.

10. **NOTICE:** If the adaptive drive cycle has not been performed, the customer may feel erratic shifts and driveability concerns. Perform the adaptive drive cycle.

Refer to Shift Point Road Test in this section.



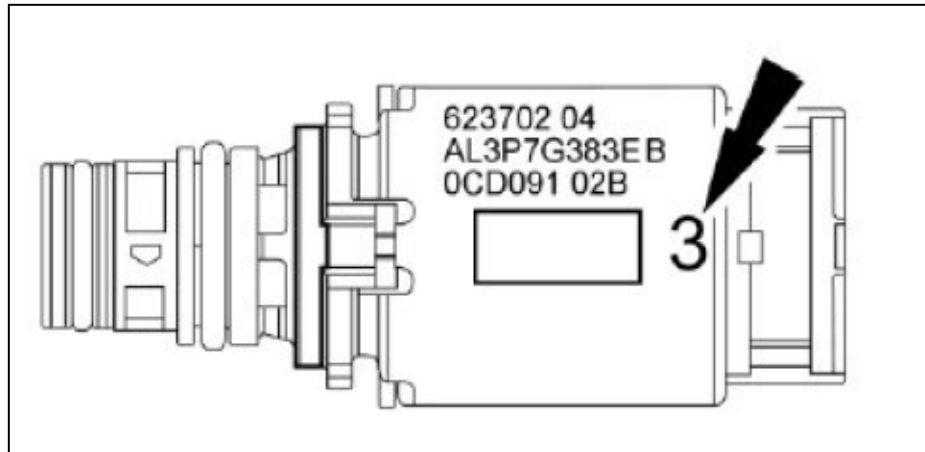


Solenoid Replacement

The solenoids are calibrated from the factory and are not all the same. There are (2) types of solenoids, normally high and normally low solenoids.

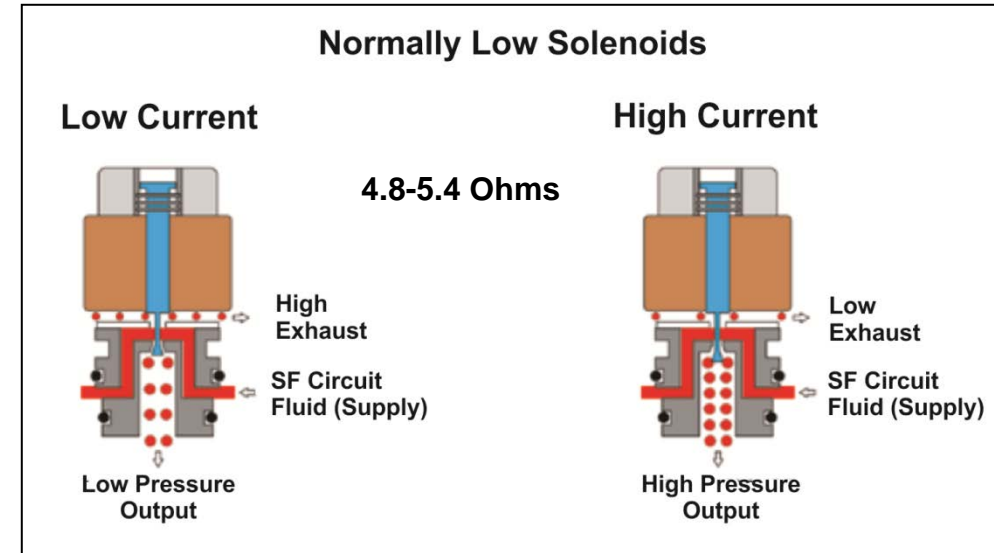
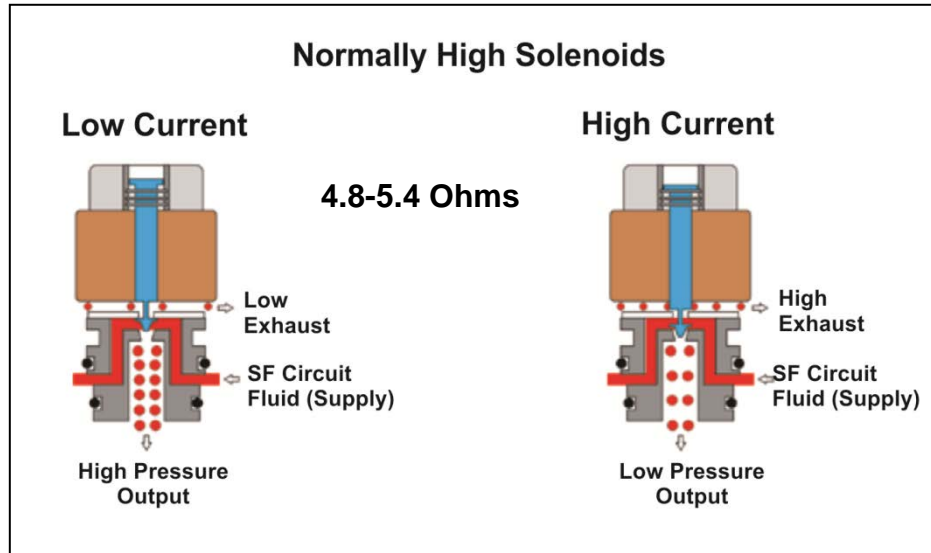
The solenoids can be replaced separately, but only with the same type of solenoid. The replacement solenoid band number must match the band number of the solenoid being replaced.

The band number is printed on the side of the solenoid and will be a 2, 3, 4 or 5.





Solenoid Function



Solenoid

- Shift Solenoid A (SSA)
- Shift Solenoid B (SSB)
- Shift Solenoid C (SSC)
- Shift Solenoid D (SSD)
- Shift Solenoid E (SSE)
- Line Pressure Control (LPC) solenoid
- Torque Converter Clutch (TCC) solenoid

Clutch Type

- Forward (1,2,3,4)
- Direct (3,5,R)
- Intermediate (2,6)
- Low/reverse (1,R)
- Overdrive (4,5,6)

Solenoid Type

- Normally Low
- Normally High
- Normally Low
- Normally Low
- Normally High
- Normally High
- Normally Low

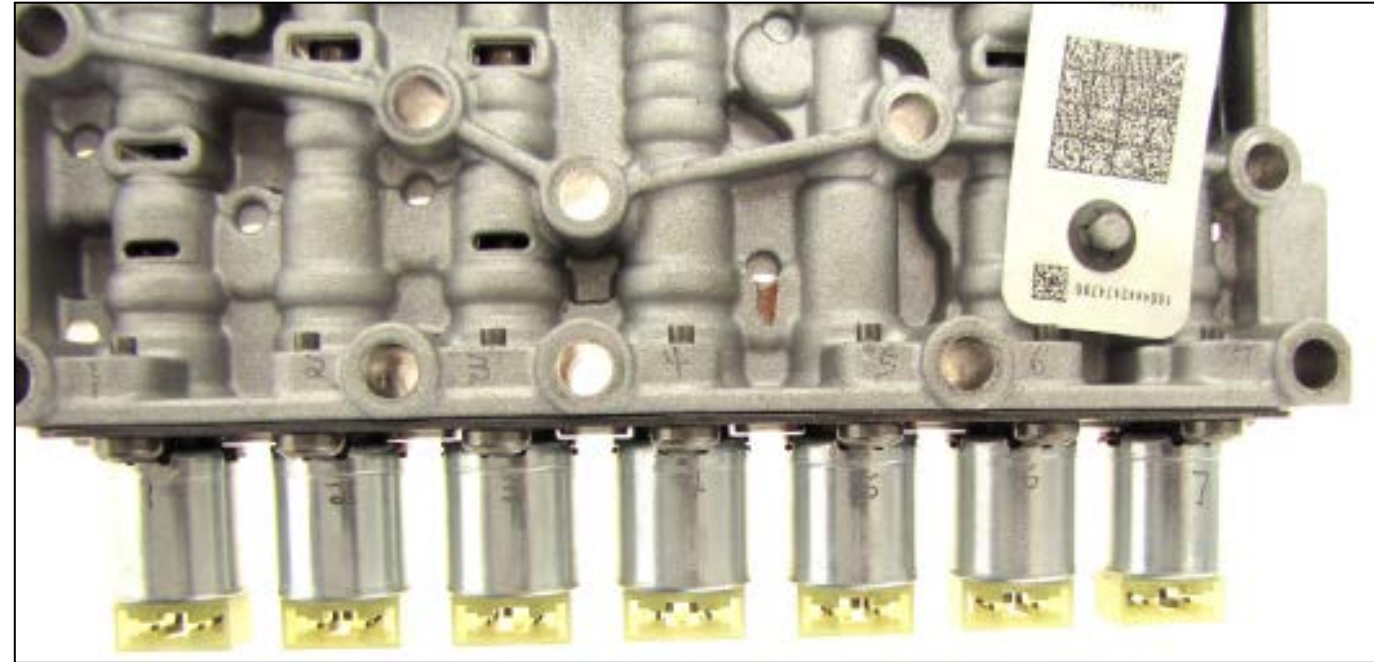




Solenoid Removal

It is recommended to use a scribe or electronic etching tool to mark the solenoids.

This will ensure the proper placement after removal.



Solenoid Description	
1	Shift Solenoid E (SSE) Overdrive Clutch (4,5,6) Clutch, Normally Open
2	Shift Solenoid C (SSC) Intermediate (2,6) Clutch, Normally Closed
3	Shift Solenoid A (SSA) Forward (1,2,3,4) Clutch, Normally Closed
4	Shift Solenoid B (SSB) Direct (3,5,R) Clutch, Normally Open
5	Torque Converter Clutch (TCC) Solenoid, Normally Closed
6	Line Pressure Control (LPC) Solenoid, Normally Open
7	Shift Solenoid D (SSD) Low/Reverse (L,R) Clutch, Normally Closed



Solenoid Part Numbers

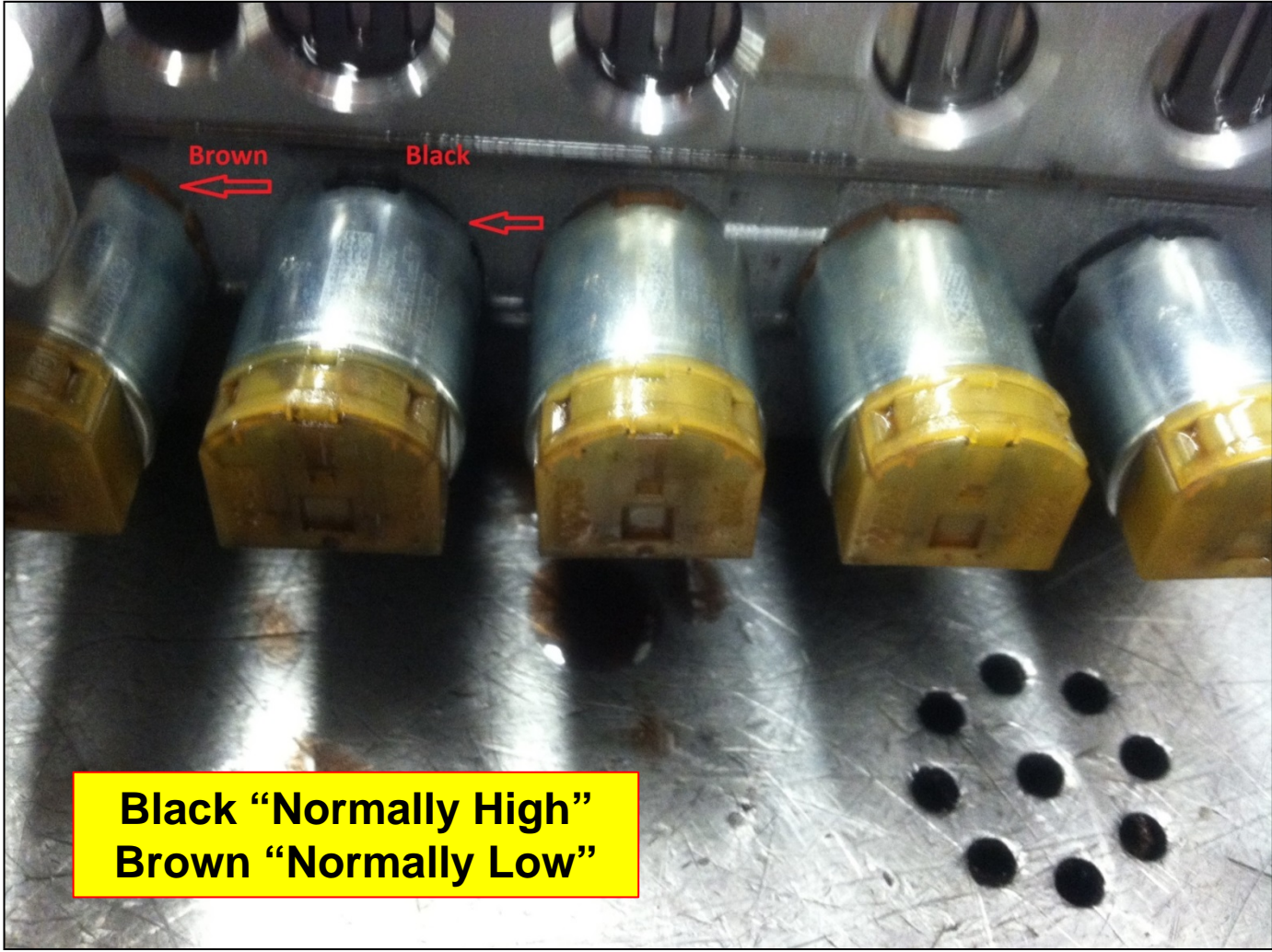


SOLENOID BAND #	Normally HIGH Solenoid Part Number
1	BC3Z-7G383-J
2	BC3Z-7G383-K
3	BC3Z-7G383-L
4	BC3Z-7G383-M
5	BC3Z-7G383-N

SOLENOID BAND #	Normally LOW Solenoid Part Number
1	BC3Z-7G383-R
2	BC3Z-7G383-S
3	BC3Z-7G383-T
4	BC3Z-7G383-U
5	BC3Z-7G383-V



Easiest Way To Determine NH & NL Solenoids



Solenoid Apply Chart



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SOLENOID OPERATION CHART							
Selector Lever Position	Commanded Gear	Shift Solenoid					TCC NL
		SSA NL (1, 2, 3, 4)	SSB NH (3, 5, R)	SSC NL (2, 6)	SSD NL (1, R)	SSE NH (4, 5, 6)	
P	P	Off	On	Off	On	On	Off
R	R	Off	Off	Off	On	On	Off
N	N	Off	On	Off	On	On	Off
D	1	On	On	Off	Off (1)	On	On/Off (2)
	2	On	On	On	Off	On	On/Off (2)
	3	On	Off	Off	Off	On	On/Off (2)
	4	On	On	Off	Off	Off	On/Off
	5	Off	Off	Off	Off	Off	On/Off
	6	Off	On	On	Off	Off	On/Off
L	L	On	On	Off	On	On	Off

(1) = Solenoid will change state when vehicle speed is greater than 5 mph.
 (2) = TCC may be commanded ON early in 1st, 2nd and 3rd gears depending on transmission fluid temperature.
 NH = Normally high NL = Normally low



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Case Connector Pin ID



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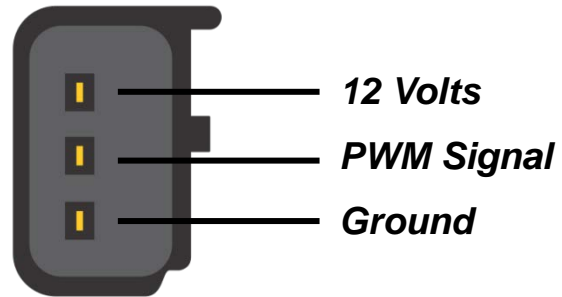
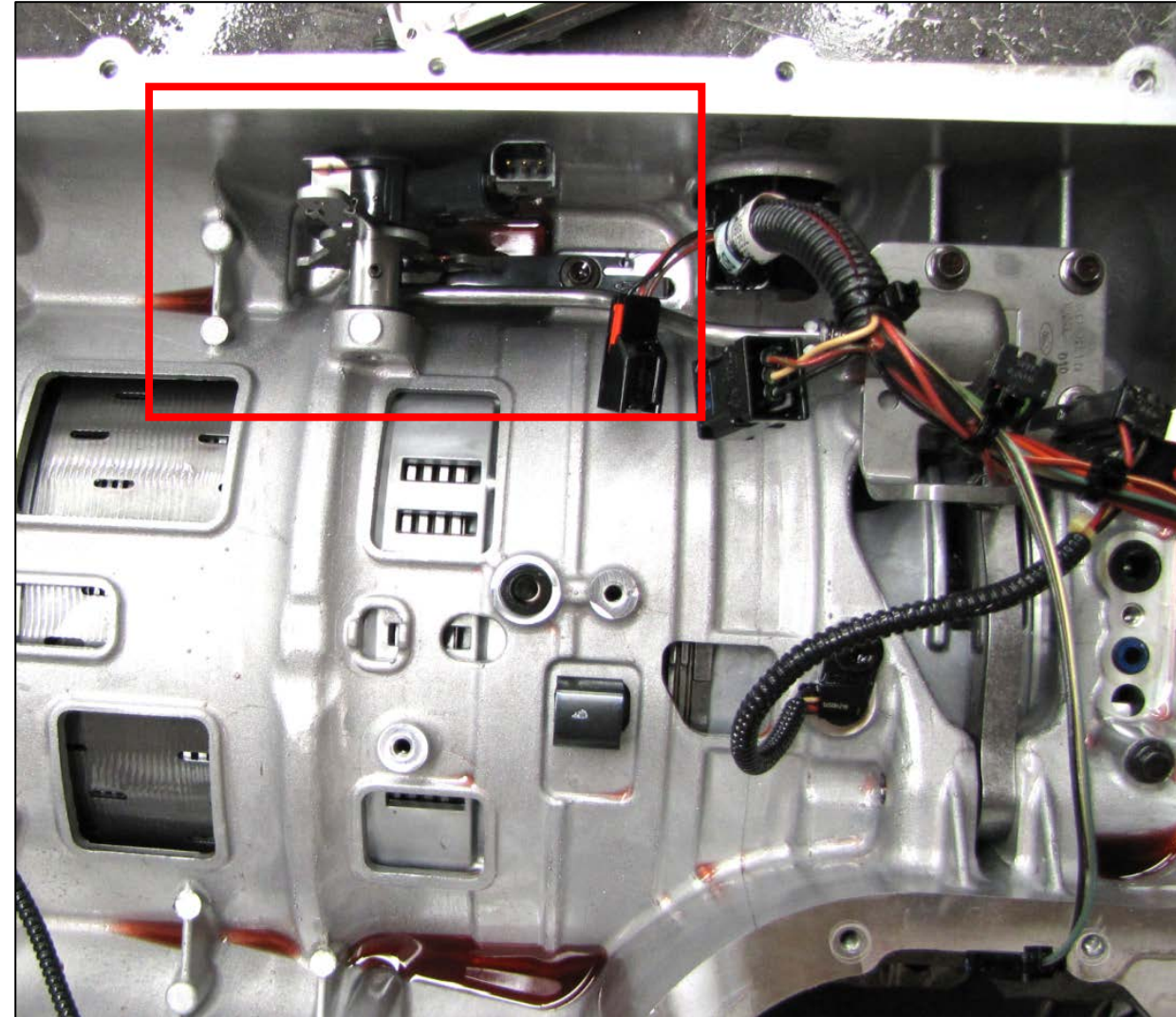


Pin	Circuit
1	Transmission Solenoid Power Control 1
2	Transmission Solenoid Power Control 2
3	Shift Control Solenoid "A" 4.8-5.4 Ohms
4	Shift Control Solenoid "B" 4.8-5.4 Ohms
5	Shift Control Solenoid "C" 4.8-5.4 Ohms
6	Shift Control Solenoid UD" 4.8-5.4 Ohms
7	Shift Control Solenoid "E" 4.8-5.4 Ohms
8	Line Pressure Solenoid Control 4.8-5.4 Ohms
9	TCC Solenoid Control 4.8-5.4 Ohms
10	Transmission Range Sensor Ground
11	Turbine Speed Sensor Signal
12	TSS, OSS, TRS VPWR
13	Transmission Range Sensor Signal
14	Not Used
15	Not Used
16	Not Used
17	Output Shaft Speed Sensor Signal
18	Transmission Temperature Sensor Signal
19	Transmission Temperature Sensor Signal Ground





Range Sensor



Position	% Duty Cycle
P	13.3 - 15.5
R	33.2 - 34.5
N	40.0 - 46.6
D	58 - 60.5
M	69.0 - 70.5
2	80.0 - 90.5
1	85.5 - 95.0

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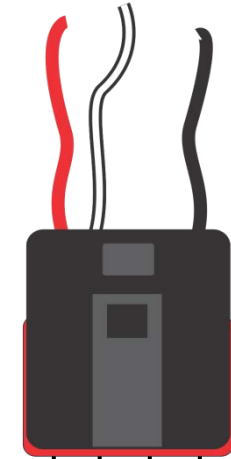
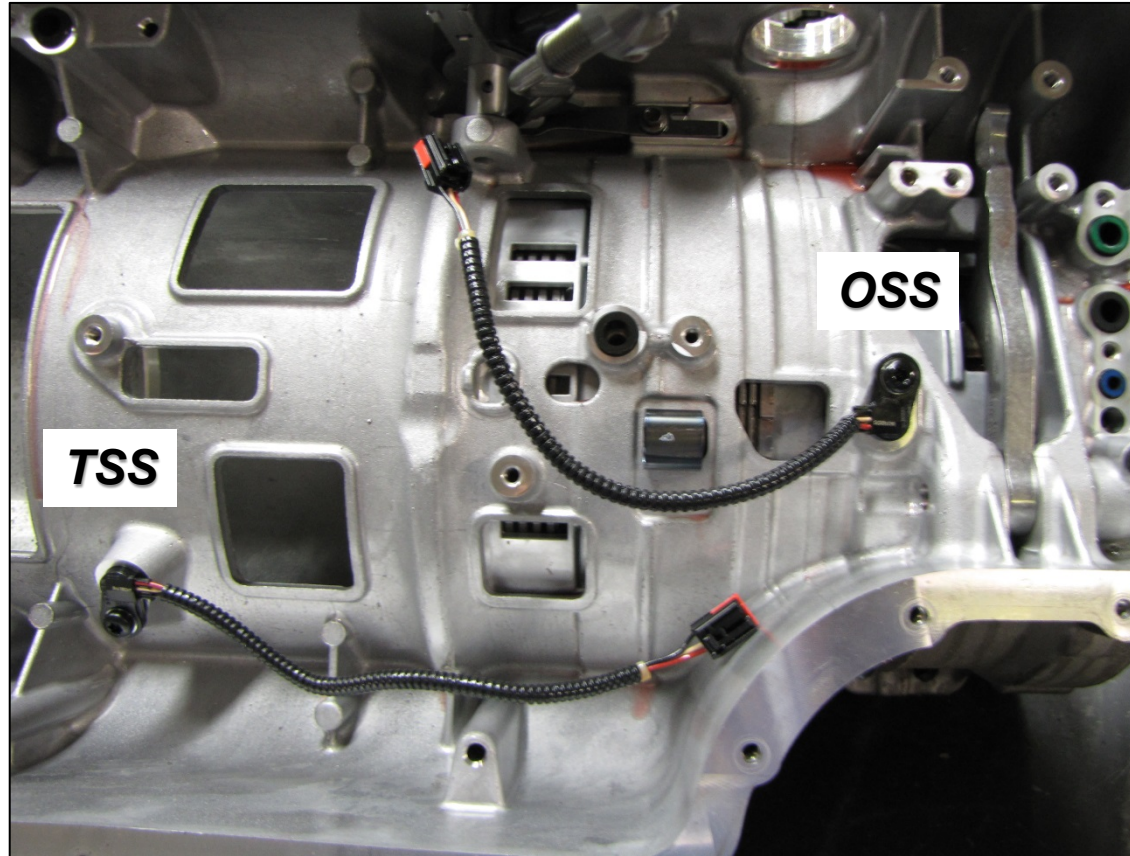
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Speed Sensors

There is one Turbine and one Output Speed Hall Effect Type Sensor. These sensors produce a five volt D/C signal to the PCM or TCM.



12 Volts Red

Signal White

Not Used

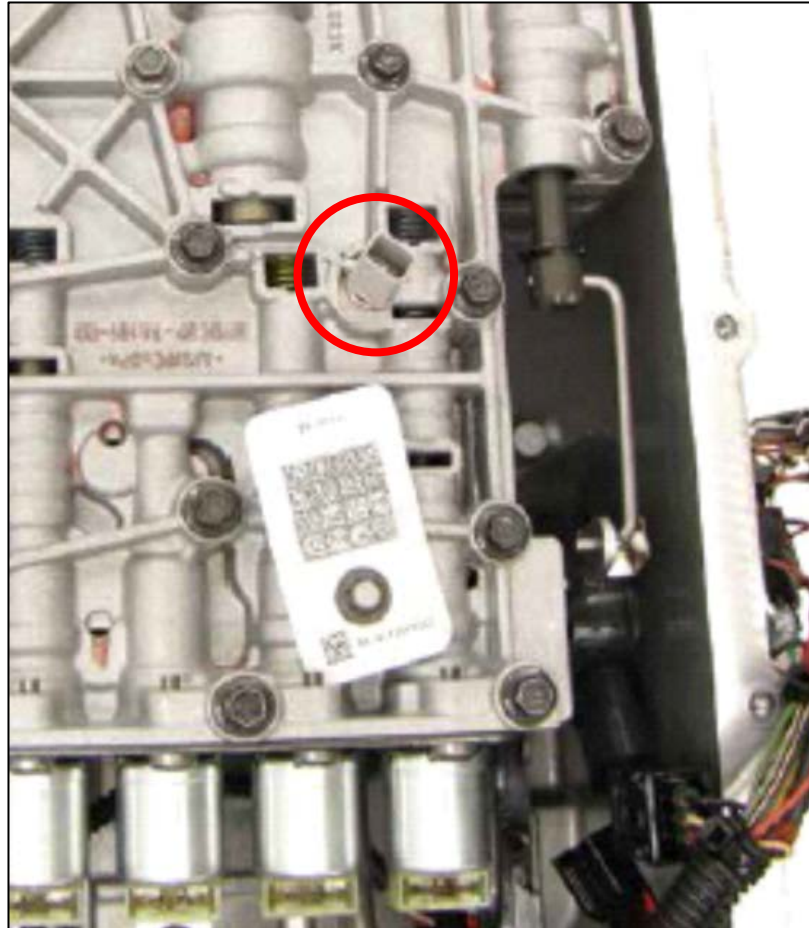
Ground Black



Transmission Fluid Temperature Sensor



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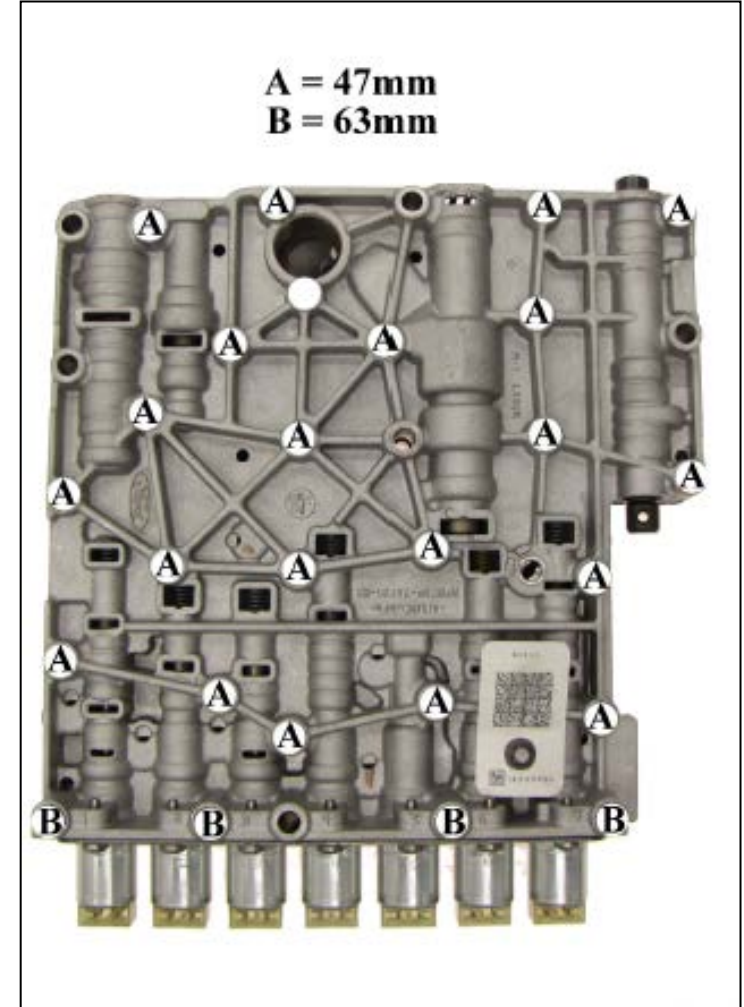
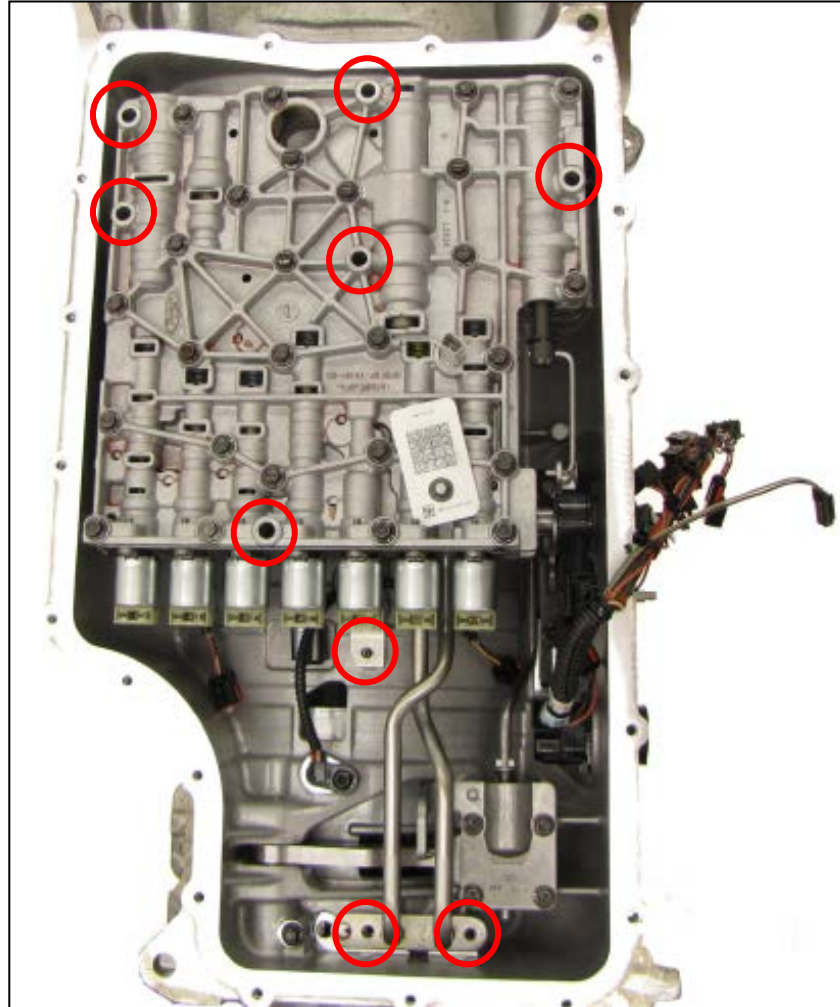
Degrees (F)	Degrees (C)	Resistance (K)
- 40 to - 4	- 40 to -20	967 - 284
- 3 to 31	- 19 to - 1	284 - 100
32 to 68	0 to 20	100 - 37
69 to 104	21 to 40	37 - 16
105 to 158	41 to 70	16 - 5
159 to 194	71 to 91	5 - 2.7
195 to 230	91 to 110	2.7 - 1.5
231 to 266	111 to 130	1.5 - 0.8
267 to 302	131 to 150	0.8 - 0.54



Valve Body Overhaul

To remove the valve body, remove the nine (9) bolts shown in the picture on the left.

To separate the valve body remove the two different size bolts shown in the picture on the right.

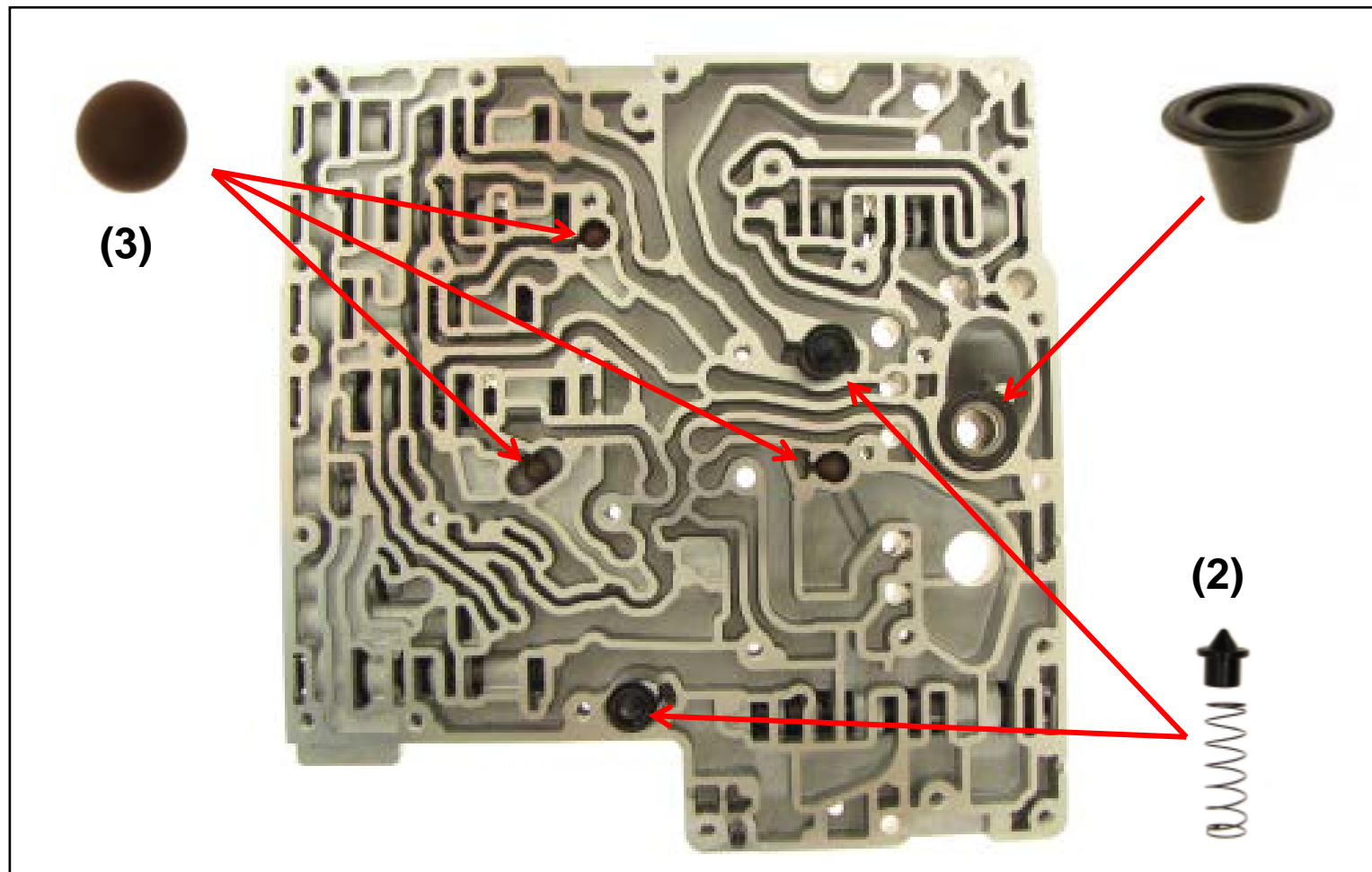




Valve Body Overhaul

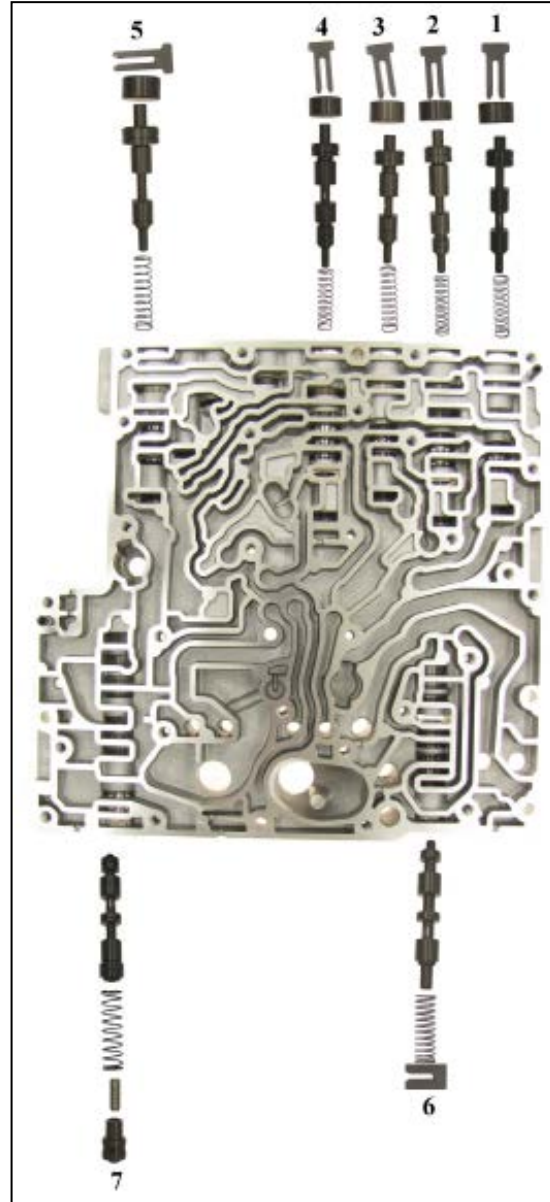
Note the location of the (3) check balls, the relief valves and the control valve inlet nozzle for assembly.

Remove the (3) check balls, the (2) relief valves and the pump inlet nozzle.





Valve Body Overhaul



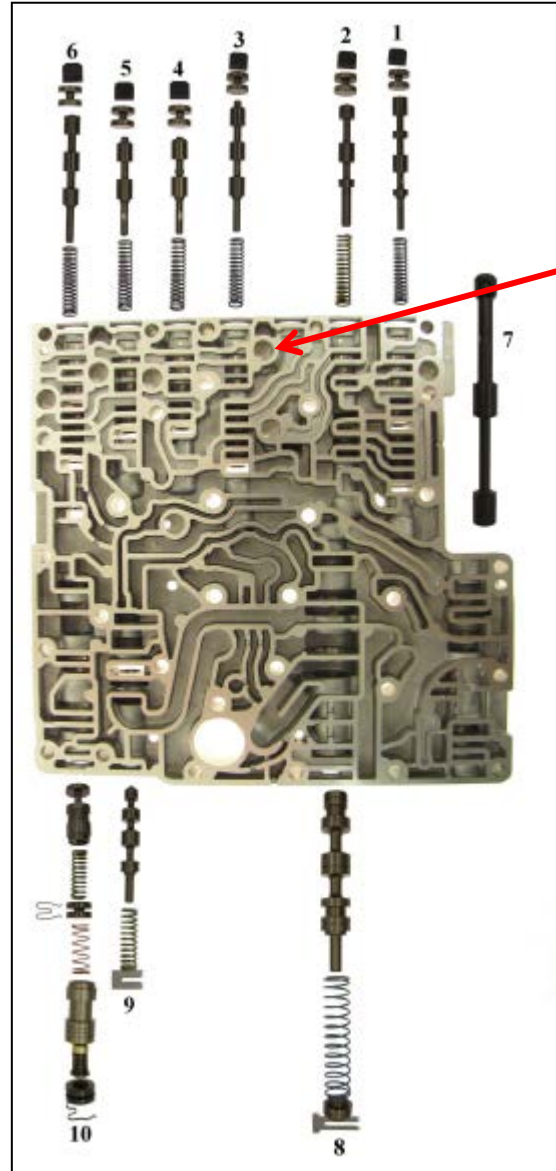
Upper Valve Body Valve Identification (Spring Dimension)	
1	Overdrive (4,5,6) Clutch Regulator Valve (1.352" X .355" X .028")
2	Intermediate (2,6) Clutch Regulator Valve (1.352" X .355" X .028")
3	Forward (1,2,3,4) Clutch Regulator Valve (1.352" X .355" X .028")
4	Direct (3,5,R) Clutch Regulator Valve (1.352" X .355" X .028")
5	Low/Reverse Clutch Regulator Valve (1.352" X .355" X .028")
6	Torque Converter Clutch (TCC) Regulator Valve (1.356" X .442" X .034")
7	TCC Apply Regulator Valve (1.707" X .485" X .033")



Valve Body Overhaul



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Lower Valve Body Identification (Spring Dimensions)	
1	Low/Reverse Latch Valve (1.626" X .363" X .043")
2	Solenoid Feed Pressure Regulator Valve (1.608" X .365" X .048")
3	Direct (3,5,R) Clutch Latch Valve (1.626" X .363" X .043")
4	Forward (1,2,3,4) Clutch Latch Valve (1.626" X .363" X .043")
5	Intermediate (2,6) Clutch Latch Valve (1.626" X .363" X .043")
6	Overdrive (4,5,6) Clutch Latch Valve (1.626" X .363" X .043")
7	Manual Valve
8	Line Pressure Regulator Valve (3.114" X .719" X .057")
9	TCC Charge Limit Valve (1.163" X .481" X .056")
10	Cooler Bypass Valve Orange Spring (1.267" X .492" X .038") Yellow Spring (1.263" X .433" X .038")



Input Shaft Sealing Ring Replacement

Using a suitable tool, remove the 4 solid input shaft and 1 Torque Converter Clutch (TCC) Teflon® sealing ring.



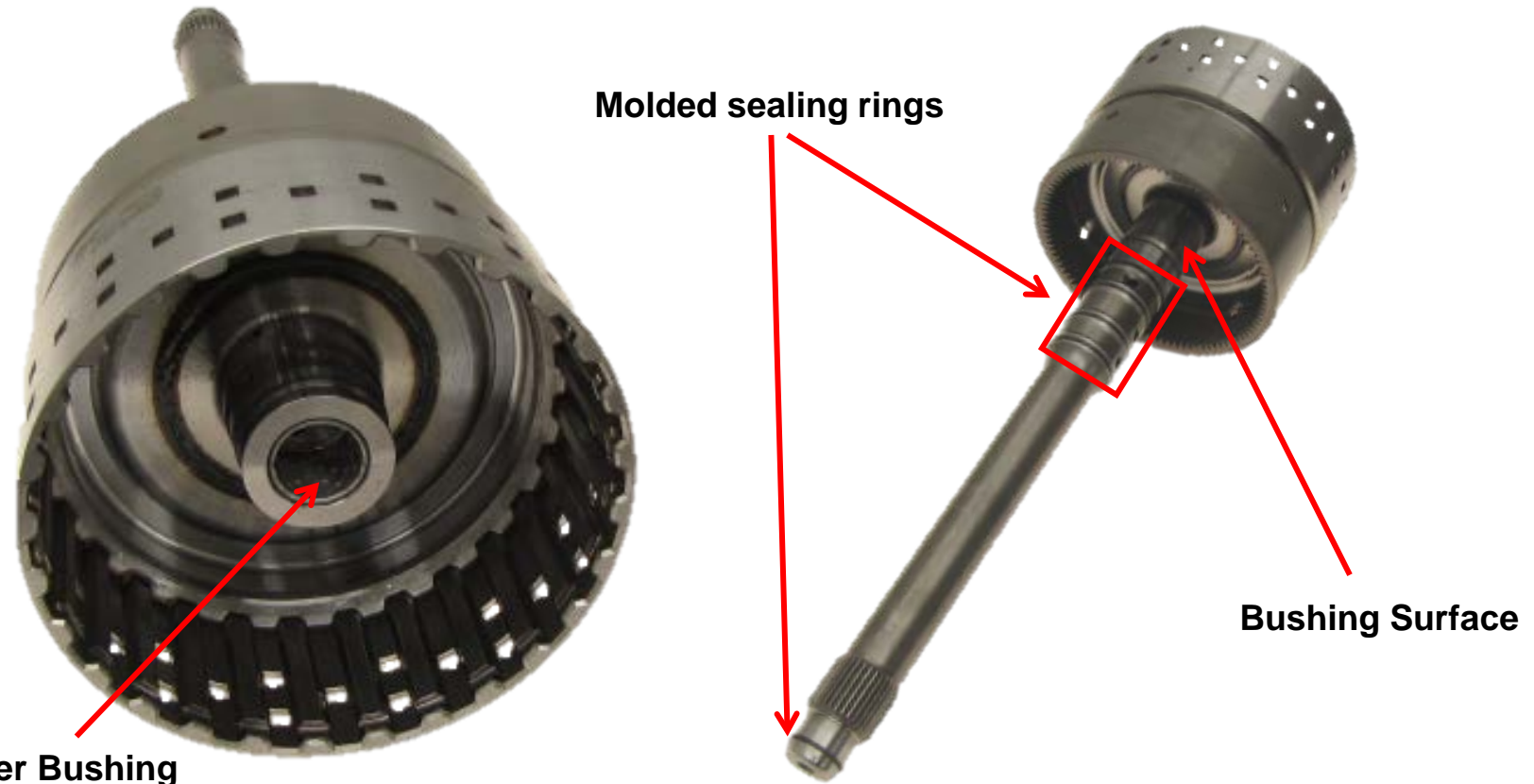


Input Shaft Sealing Ring Replacement

Inspect the overdrive (4,5,6) clutch cylinder and input shaft assembly for damage.

Inspect the bushing surfaces, Teflon® seal surfaces, ring gear and bushing surfaces for excessive wear or damage.

If damage or excessive wear is found, install new components as necessary.



Cylinder Bushing

Molded sealing rings

Bushing Surface





Input Shaft Sealing Ring Replacement

Install the Input Shaft Teflon® Seal Sizer on the input shaft and adjust it so the bottom edge is lined up just above the top edge of the bottom Teflon® seal groove.

Lubricate the Input Shaft Teflon® Seal Sizer with clean transmission fluid and install a new Teflon® seal by sliding it down the Input Shaft Teflon® Seal Sizer into the groove.

Adjust the Input Shaft Teflon® Seal Sizer and install the remaining (3) input shaft Teflon® seals into the grooves.

Lubricate the Input Shaft Teflon® Seal Sizer with clean transmission fluid and install it over the Teflon® seals to size the seals. Do the same procedure on the other side of the drum.



307-653/4

307-653/1





Output Shaft Nut Removal

The output shaft nut is coated with Loctite® from the factory, then tightened to 150 lb. ft. (about 200 Nm). Failure to loosen the Loctite® by applying heat to the output shaft nut can cause damage to the output shaft nut socket.

NOTICE: Make sure to clean any debris from the Loctite® that may have fallen into the transmission case when removing the output shaft nut. Failure to clean the debris can result in transmission fluid or filter contamination or damage to the transmission.

Fixed flange/Four-Wheel Drive (4WD) shown, slip yoke similar. Apply heat to the output shaft nut to soften the Loctite®. Using the output shaft nut socket, remove the output shaft nut.





Output Shaft Nut Removal

You need to remove this nut to service the low/reverse piston assembly and the rear case seal. The output nut tool is identical to the Torqshift (5R110W) nut just bigger. This nut requires the special tool and lots of heat.

The output shaft nut socket is available from Ford, part number #307-649, for about \$250 to \$300. Although, you can find them through the aftermarket for much less.



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Other Tools Required

This unit weighs in at a hefty 350 lbs. (almost 160 kilos) with the torque converter installed. This is slightly heavier than the LCT 1000 which weights in at 330 lbs. (150 kilos).

Now we can muscle this unit around and risk injuries, or we can take a few minutes and put some tools together that are going to make working on this unit easy and, more importantly safe.



Use an engine hoist to get this unit on the bench for a teardown



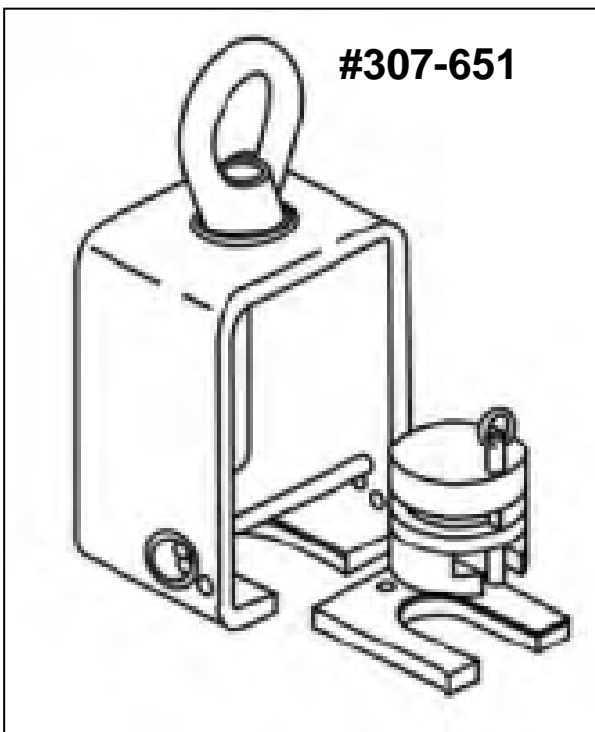


Other Tools Required

The input drum assembly must be installed into the transmission as a unit. Using the engine hoist to install this assembly will also be much easier and safe.

The easier way to assemble this unit is to stand it on end. You can use an old Allison case as a stand.

Ford has a special lifting fixture, tool #307-651, for this operation.



#307-651





Other Tools Required

A duplicate tool can be made fairly quickly with a piece of square tubing, an eye bolt, and two pieces of flat steel.



Duplicated
Tool





Parts Comparison

A comparison in some parts sizes to the Ford 5R110W "TorqShift".





One Way Clutch (Diode)

A Ford-patented, rocker one-way clutch (diode) is integrated in the carrier to improve 1-2 shift quality through the gear-set





Torque Converter

Note the spline on the converter hub much like a Honda transmission. There is also an internal spline to drive a PTO gear.

The PTO is splined to the engine in this arrangement and spins constantly whenever the engine runs. This eliminates the need to apply another clutch or the torque converter clutch to engage the PTO gear.

As you can see here the converter is no lightweight either.

Splined Hub



Internal Spline For PTO Gear

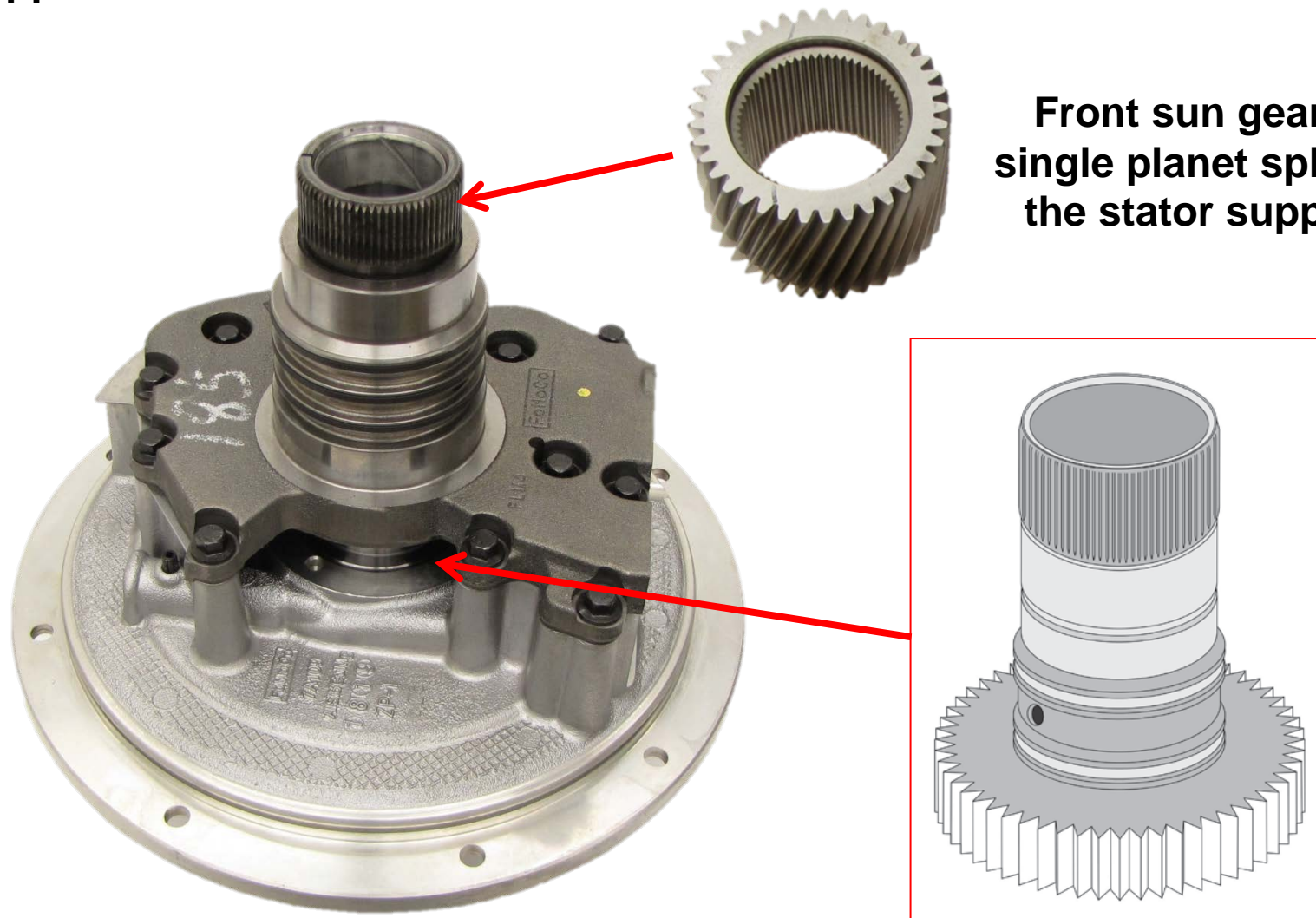




Pump & PTO Gear

Some vehicles with a Power Take Off unit will have a PTO gear located here on the stator support.

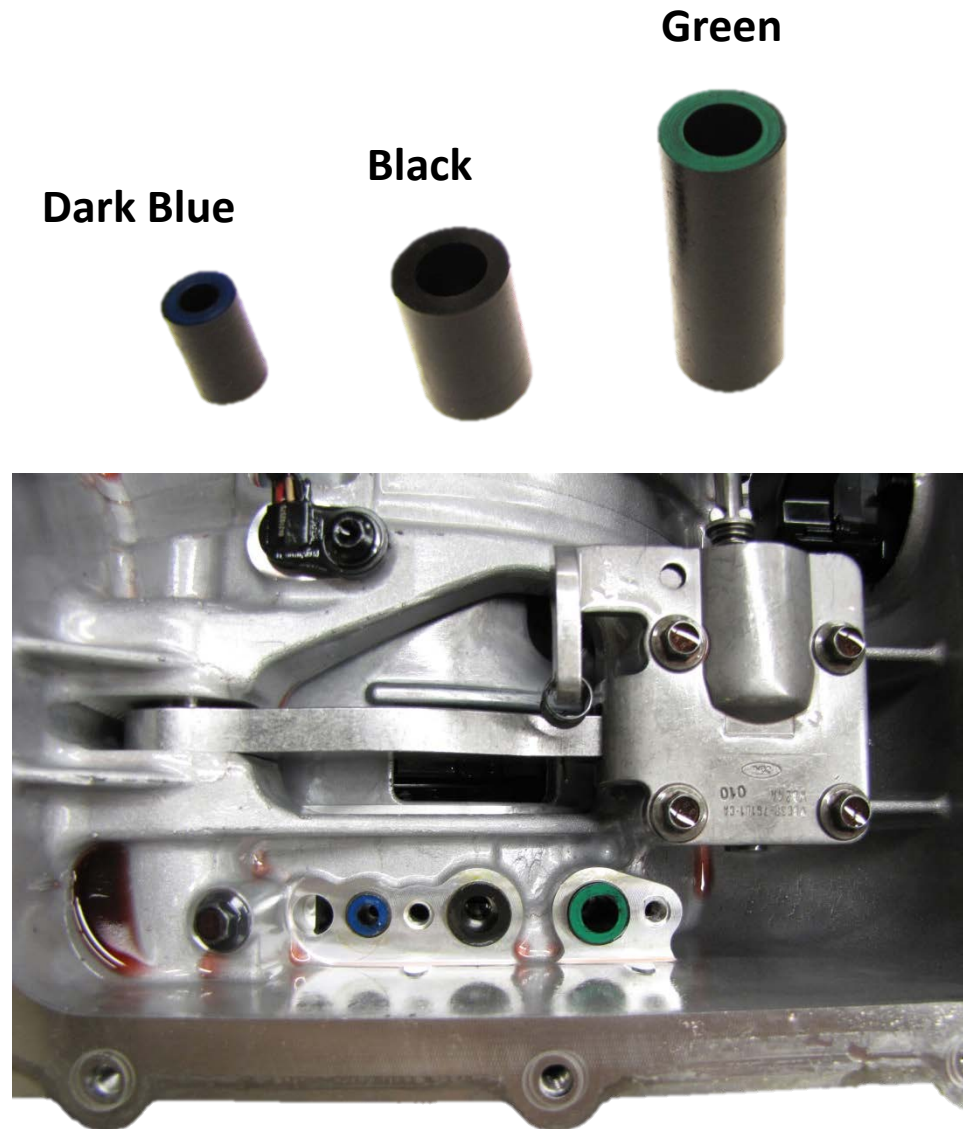
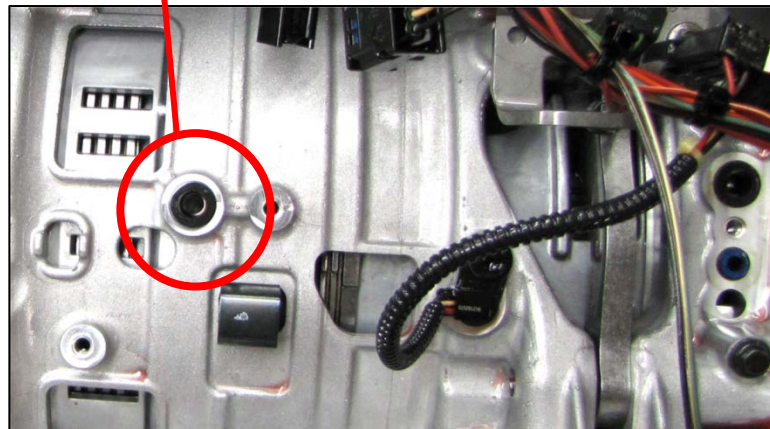
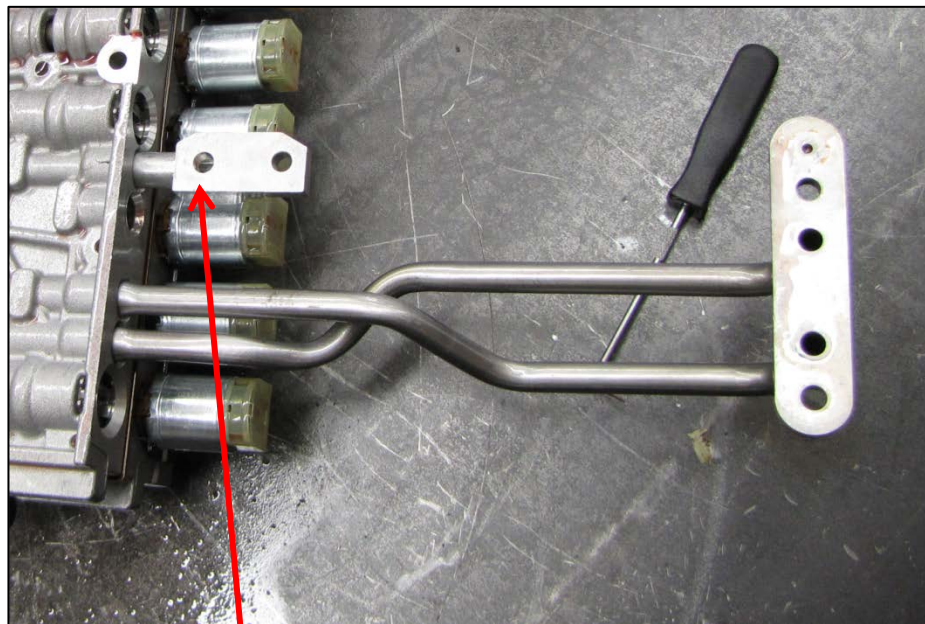
Front sun gear for the single planet splines onto the stator support also





Case Seals

Case seals at back and center of case.



Green

Black

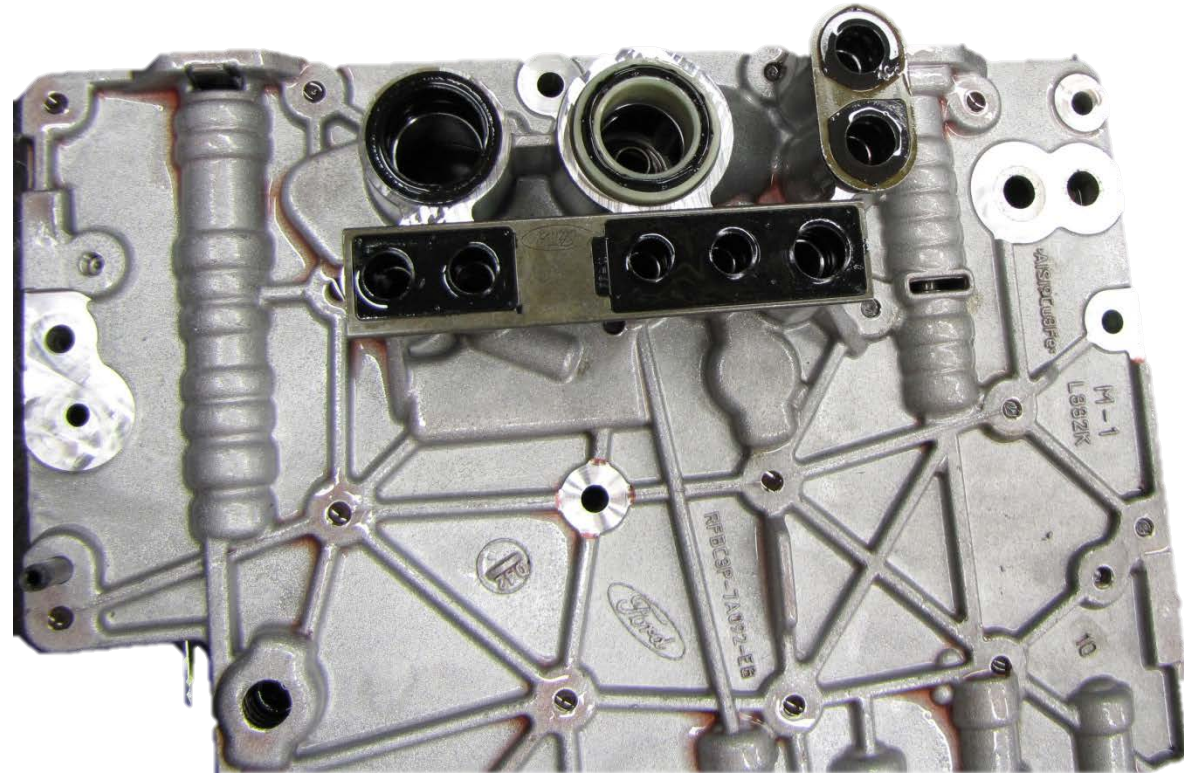
Dark Blue





Case Seals

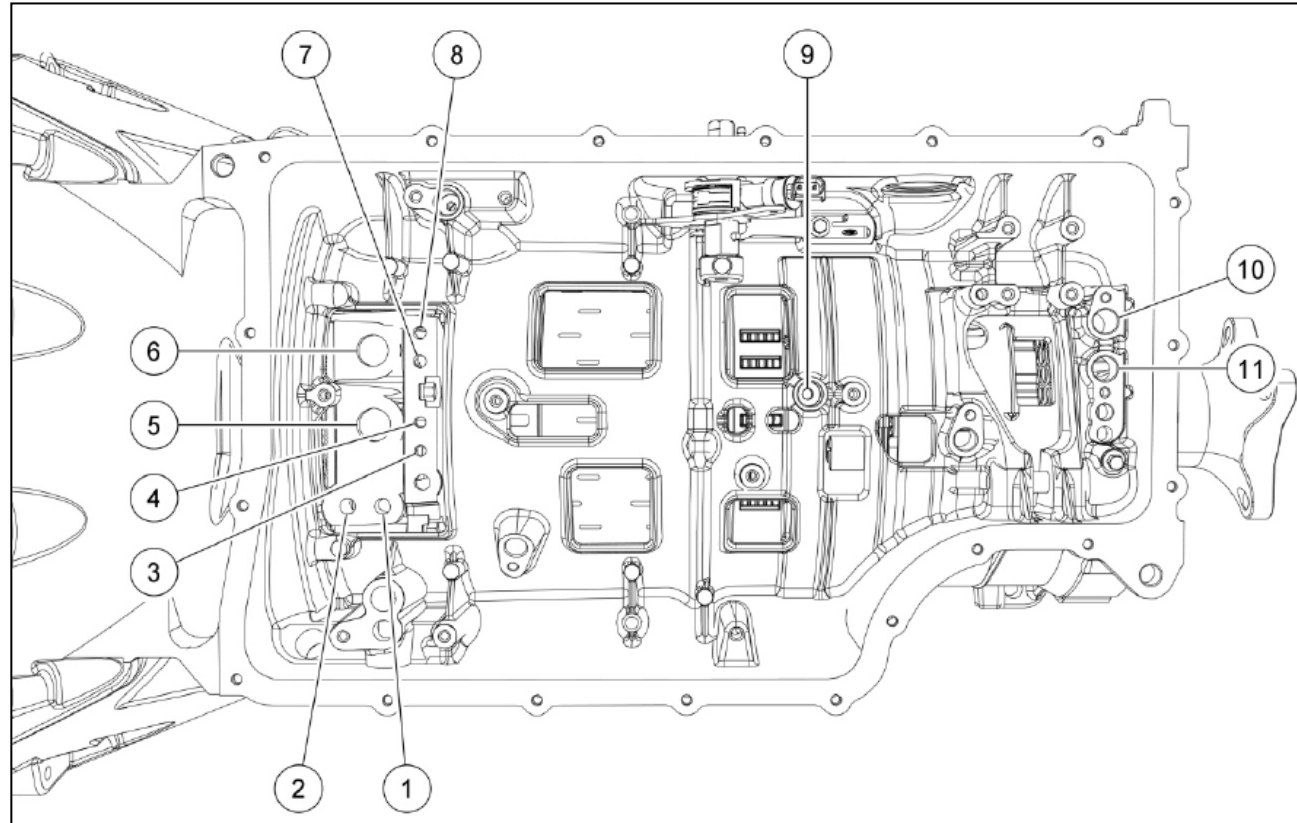
Valve Body Seals to front of Case



Case Air Checks & Hydraulic Ports



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Item	Description
1	Converter Inlet
2	Converter Outlet
3	Overdrive Clutch
4	Forward Clutch
5	Pump Inlet
6	Pump Outlet
7	Direct Clutch
8	Torque Converter Clutch
9	Intermediate Clutch
10	Low/Reverse Dynamic
11	Low/Reverse Static





Line Pressure Tap Location

Line pressure Allan type tap threads are 10mm x 1.00mm located on the left side of the case between the bellhousing and the linkage.



Line Pressure Specifications



PRESSURE CHART - DIESEL ENGINES				
Gear	Line Pressure - kPa (psi)		Commanded - LPC pressure kPa (psi) (1)	
	Idle	WOT Stall	Idle	WOT Stall
P, N	619 (90)	-	94 (14)	-
R	619 (90)	1,790 (260)	94 (14)	480 (70)
(D)	619 (90)	1,550 (225)	94 (14)	375 (55)
3	619 (90)	1,100 (160)	94 (14)	240 (35)
2	619 (90)	1,650 (235)	94 (14)	410 (60)
1	619 (90)	1,550 (225)	94 (14)	375 (55)

(1) = Commanded pressure as viewed on diagnostic equipment.

PRESSURE CHART - GAS ENGINES				
Gear	Line Pressure - kPa (psi)		Commanded - LPC pressure kPa (psi) (1)	
	Idle	WOT Stall	Idle	WOT Stall
P, N	619 (90)	-	94 (14)	-
R	619 (90)	1,675 (240)	94 (14)	410 (60)
(D)	619 (90)	1,600 (230)	94 (14)	375 (55)
3	619 (90)	1,230 (180)	94 (14)	275 (40)
2	619 (90)	1,675 (240)	94 (14)	410 (60)
1	619 (90)	1,600 (230)	94 (14)	375 (55)

(1) = Commanded pressure as viewed on diagnostic equipment.



Fluid Specifications

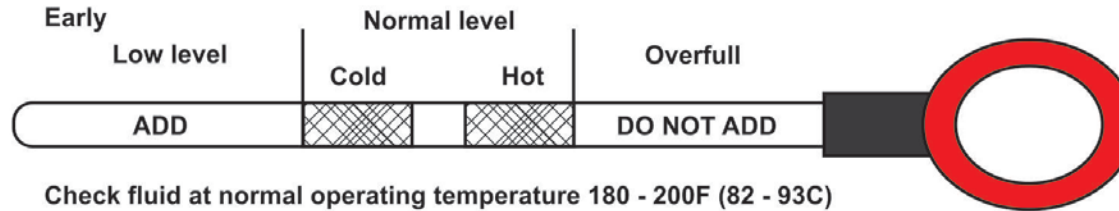


FLUID SPECIFICATIONS		
Item	Specification	Fill Capacity
Motorcraft® MERCON® LV Automatic Transmission FluidXT-10-QLVC	MERCON® LV	15.3L (16.2 qt) Diesel Engines 16.3L (17.2 qt) Gas Engines



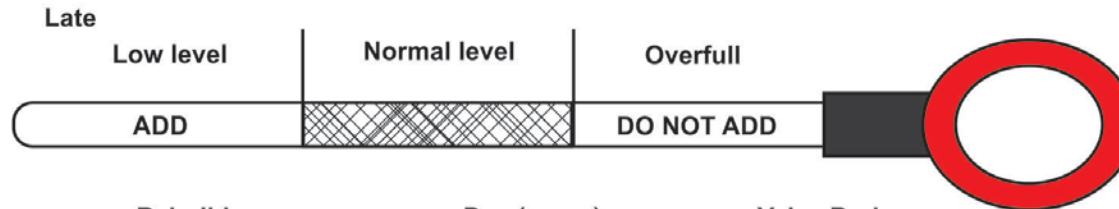
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PRODUCTS

Fluid Level Check (check @ normal operating temp)



Check fluid at normal operating temperature 180 - 200F (82 - 93C)
Recommended fluid Mercon LV

Rebuild	Pan (sump)	Valve Body
Diesel 18 Qts. (17 Liters)	10.0 Qts. (9.5 Liters)	12.0 Qts. (11.4 Liters)
Gas 19 Qts. (18 Liters)	11.0 Qts. (10.4 Liters)	13.0 Qts. (12.3 Liters)



Rebuild	Pan (sump)	Valve Body
Diesel 16.2 Qts. (15.3 Liters)	8.2 Qts. (7.8 Liters)	10.2 Qts. (9.7 Liters)
Gas 17.2 Qts. (16.3 Liters)	9.2 Qts. (8.7 Liters)	11.2 Qts. (10.5 Liters)





Clutch Quantity

CLUTCH PLATE QUANTITY - DIESEL ENGINES		
Component	Number of Frictions	Number of Separator Plates
Forward Clutch (1, 2, 3, 4)	5	5
Direct Clutch (3, 5, R)	5	5
Intermediate Clutch (2, 6)	5	5
Low/Reverse (1, R)	5	4
Overdrive Clutch (4, 5, 6)	7	7

CLUTCH PLATE QUANTITY - GAS ENGINES		
Clutch	Number of Frictions	Number of Separator Plates
Forward Clutch (1, 2, 3, 4)	3	3
Direct Clutch (3, 5, R)	4	4
Intermediate Clutch (2, 6)	5	5
Low/Reverse (1, R)	5	4
Overdrive Clutch (4, 5, 6)	7	7



Clutch Clearances



CLUTCH CLEARANCE - DIESEL ENGINES	
Item	Specifications
Forward Clutch (1, 2, 3, 4)	0.26-0.55 mm (0.010-0.021 in)
Direct Clutch (3, 5, R)	0.21-0.50 mm (0.008-0.020 in)
Intermediate Clutch (2, 6)	0.24-0.53 mm (0.009-0.021 in)
Overdrive Clutch (4, 5, 6)	0.98-1.37 mm (0.039-0.054 in)

CLUTCH CLEARANCE - GAS ENGINES	
Item	Specifications
Forward Clutch (1, 2, 3, 4)	0.15-0.44 mm (0.006-0.017 in)
Direct Clutch (3, 5, R)	0.27-0.56 mm (0.011-0.022 in)
Intermediate Clutch (2, 6)	0.24-0.53 mm (0.009-0.021 in)
Overdrive Clutch (4, 5, 6)	0.98-1.37 mm (0.039-0.054 in)

LOW/REVERSE CLUTCH MEASUREMENT - GAS/DIESEL ENGINES	
Item	Specifications
Low/Reverse Clutch (1, R) (1)	42.65-43.65 mm (1.68-1.72 in)

(1) = The low/reverse specification is a measurement of the height of the low/reverse clutch not the clearance.





Selective Snap Ring Charts

FORWARD (1, 2, 3, 4), DIRECT (3, 5, R), INTERMEDIATE (2, 6) CLUTCH SELECTIVE SNAP RING CHART

Part Number	Dimension
BC3Z-7D483-F	3.35-3.45 mm (0.132-0.136 in)
BC3Z-7D483-G	3.55-3.65 mm (0.140-0.144 in)
BC3Z-7D483-H	3.75-3.85 mm (0.148-0.152 in)
BC3Z-7D483-J	3.95-4.05 mm (0.156-0.159 in)
BC3Z-7D483-K	4.15-4.25 mm (0.163-0.167 in)
BC3Z-7D483-L	4.35-4.45 mm (0.171-0.175 in)
BC3Z-7D483-S	2.95-3.05 mm (0.116-0.120 in)
BC3Z-7D483-T	3.15-3.25 mm (0.124-0.128 in)

OVERDRIVE (4, 5, 6) CLUTCH SELECTIVE SNAP RING CHART

Part Number	Dimension
BC3Z-7D483-A	1.95-2.05 mm (0.077-0.081 in)
BC3Z-7D483-B	2.25-2.35 mm (0.089-0.093 in)
BC3Z-7D483-C	2.55-2.65 mm (0.100-0.104 in)
BC3Z-7D483-D	2.85-2.95 mm (0.112-0.116 in)
BC3Z-7D483-E	3.15-3.25 mm (0.124-0.128 in)



Front & Rear Unit Endplay



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FRONT SELECTIVE SHIM PART NUMBER CHART		
Clearance (1)	Selective Shim Part Number	Dimension/Color
5.35-5.55 mm (0.211-0.219 in)	BC3Z-7A527-A	5.1-5.2 mm (0.201-0.205 in)/Yellow
5.56-5.75 mm (0.219-0.226 in)	BC3Z-7A527-B	5.3-5.4 mm (0.209-0.213 in)/White
5.76-5.95 mm (0.227-0.234 in)	BC3Z-7A527-C	5.5-5.6 mm (0.217-0.220 in)/Red
5.96-6.15 mm (0.235-0.242 in)	BC3Z-7A527-D	5.7-5.8 mm (0.224-0.228 in)/Blue
(1) = The target clearance with the correct front selective shim installed is between 0.15-0.45 mm (0.006-0.018 in).		

REAR SELECTIVE SHIM PART NUMBER CHART		
Clearance (1)	Selective Shim Part Number	Dimension/Color
3.75-3.95 mm (0.148-0.156 in)	BC3Z-7F405-E	2.85-2.95 mm (0.112-0.116 in)/Black
3.95-4.15 mm (0.156-0.163 in)	BC3Z-7F405-A	3.05-3.15 mm (0.120-0.124 in)/Yellow
4.16-4.35 mm (0.164-0.171 in)	BC3Z-7F405-B	3.25-3.35 mm (0.128-0.132 in)/White
4.36-4.55 mm (0.172-0.179 in)	BC3Z-7F405-C	3.45-3.55 mm (0.136-0.140 in)/Red
4.56-4.75 mm (0.180-0.187 in)	BC3Z-7F405-D	3.65-3.75 mm (0.143-0.148 in)/Blue
(1) = The target clearance with the correct rear selective shim installed is between 0.8-1.1 mm (0.031-0.043 in).		





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Specifications

TORQUE SPECIFICATIONS			
Description	Nm	lb-ft	lb-in
Driveshaft flange bolts	103	76	-
Extension housing bolts	40	30	-
Inspection cover bolts	35	26	-
Line pressure tap plug	11	-	97
Low/reverse piston assembly bolt	11	-	97
Main control-to-transmission case bolts	11	-	97
Manual control lever nut	24	18	-
Output shaft flange bolt	133	98	-
Output shaft nut	200	148	-
Output Shaft Speed (OSS) sensor bolt	11	-	97
Park pawl abutment plate	11	-	97
Park pawl pin plug	35	26	-
Power Take-Off (PTO) cover bolts	25	18	-
Pump-to-transmission case bolts	25	18	-
Selector lever cable bracket bolts	48	35	-
Separator plate bolts	11	-	97
Solenoid retainer bracket bolts	11	-	97
Stator support-to-pump housing bolts	25	18	-
Torque converter nuts	48	35	-
Transfer case linkage bolts	115	85	-
Transmission Control Module (TCM)	19	-	168
Transmission feed tube-to-transmission case bolts	11	-	97
Transmission filler tube bolt	25	18	-
Transmission fluid cooler tube bolt	25	18	-
Transmission fluid filter bolts	11	-	97
Transmission fluid pan bolts	9	-	80
Transmission fluid pan drain plug	18	-	159
Transmission Range (TR) sensor detent spring bolt	12	-	106
Transmission support insulator studs	75	55	-
Transmission-to-engine bolts	48	35	-
Turbine Shaft Speed (TSS) sensor bolt	11	-	97
Upper valve body-to-lower valve body bolts	11	-	97



Data PID Identification



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PRODUCTS



DA1:C46IAGNOSTIC PID CHART		
PID Name	PID Description	Units
4X4L	4X4 Low	On/Off
APP	Accelerator Pedal Position (APP)	Percent
APP1	APP Sensor 1	Voltage
APP2	APP Sensor 2	Voltage
BOO1	Brake Pedal Position	Off/On
BOO2	Brake Pressure Applied	Off/On
CHT	Cylinder Head Temperature (CHT)	Temperature
DTCNT	DTC Count (includes those needing no action)	Number
ETC_ACT	Electronic Throttle Control Actual	Angle
ETC_DSD	Electronic Throttle Control Desired	Angle
GEAR	Gear Commanded by Module	1, 2, 3, 4, 5, 6
GEAR_OSC#	Gear Commanded by Output State Control	1, 2, 3, 4, 5, 6
GEAR_RAT	Gear Ratio	Ratio
HRSH_SHFT#	Firm Shift	Off/On
IN_GEAR	In Gear-Transmission is Applying a Load to Engine	In Gear
ISS_F	Intermediate Shaft Speed Reliable	No Fault/Yes Fault
ISS_SRC	Intermediate Shaft Speed	rpm
LINEDSD#	Line Pressure Control (LPC) Desired	Pressure
OSS_F	Output Shaft Speed (OSS) Reliable	No Fault/Yes Fault
OSS_SRC	Unfiltered OSS A	rpm
PCA	Pressure Control Solenoid A (PCA)	Pressure
PCA AMP#	PCA Amp	Current
PCA_F	PCA Status	No Fault/Yes Fault
RLC_F	Reverse Control Lamp Status	No Fault/Yes Fault
RPM#	Engine Revolutions Per Minute	rpm



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Data PID Identification

PID Name	PID Description	Units
SHFT_DROP	Shift RPM Drop in Input Shaft Speed Below Expected	rpm
SHFT_FLRE	Shift RPM Rise in Input Shaft Speed Above Expected	rpm
SHFT_ID	Shift Identification of Shift PIDs Lag, Time, Flare and Drop	Shift ID
SHFT_LAG	Shift Time Elapsed From 10% to 90% of Complete	Time
SHFT_TIME	Shift Time Elapsed From Commanded to 10% Complete	Time
SHIFT_TYPE	Shift Type	Type
SSA_AMP#	Shift Solenoid Pressure Control A (SSPCA)	Current
SSB_AMP#	Shift Solenoid Pressure Control B (SSPCB)	Current
SSC_AMP#	Shift Solenoid Pressure Control C (SSPCC)	Current
SSD_AMP#	Shift Solenoid Pressure Control D (SSPCD)	Current
SSE_AMP#	Shift Solenoid Pressure Control E (SSPCE)	Current
SSPCA	SSPCA	Pressure
SSPCA_F	SSPCA Status	No Fault/Yes Fault
SSPCB	SSPCB	Pressure
SSPCB_F	SSPCB Status	No Fault/Yes Fault
SSPCC	SSPCC	Pressure
SSPCC_F	SSPCC Status	No Fault/Yes Fault
SSPCD	SSPCD	Pressure
SSPCD_F	SSPCD Status	No Fault/Yes Fault
SSPCE	SSPCE	Pressure
SSPCE_F	SSPCE Status	No Fault/Yes Fault
SST_D	Select Shift Transmission - Down Switch Input	High/Low
SST_U	Select Shift Transmission - Up Switch Input	High/Low



Data PID Identification



PID Name	PID Description	Units
TCC	Torque Converter Clutch (TCC) Solenoid	Pressure
TCC AMP#	Converter Pressure Control	Current
TCC_F	TCC Fault	No Fault/Yes Fault
TCC_OSC#	Output State Control of Torque Converter	Locked/Unlocked
TCC_RAT	Transmission Slip Ratio	Ratio
TCIL	Transmission Control Indicator Lamp (TCIL)	On/Off
TCS_DEPRES	Transmission Control Switch (TCS) Pressed	Yes/No
TCS_STATE	TCS Requested State	On/Off
TC_SLIPACT	Torque converter slip actual	rpm
TC_SLIPDSD	Torque converter slip desired	rpm
TFT	Transmission Fluid Temperature (TFT)	Temperature
TFTTV	TFT	Voltage
TFT_F	TFT Status	No Fault/Yes Fault
TP1	Throttle Position (TP) Sensor 1	Voltage
TP2	TP Sensor 2	Voltage
TPMODE	TP	Closed Throttle, Part Throttle, Wide Open Throttle (WOT)
TR	Transmission Range (TR)	Mode
TRANS_VOLT_A	Transmission Supply Voltage Control State	On/Off
TRAN_RAT	Gear Ratio Measured	Ratio
TRO_N_F	Neutral Output Status	On/Off
TRO_P_F	Park Output Status	On/Off
TR_CRANK	TR Input Allowing Engine Start	Yes/No
TR_DC	TR	Percentage
TR_F	TR status	No Fault/Yes Fault
TR_FREQ	TR	Frequency
TSS_F	Turbine Shaft Speed (TSS) Reliable	No Fault/Yes Fault



Data PID Identification



PID Name	PID Description	Units
TSS_SRC	Unfiltered TSS	rpm
VPWR	Module Supply Voltage	Voltage
VREF	Reference Voltage	Voltage
VSOUT_F	Vehicle Speed Output Status	No Fault/Yes Fault
VSS	Vehicle Speed	Speed





Today's Presentation Sponsored By:



Any Questions? Thank You For Attending



PISTON KITS (Individual pistons are also available)

SAP #	Description	Pcs.	Brand
222	40E Acorn Cover low and narrow 24 dish 2004hp	3	OE
221	41E Acorn Cover low and narrow 24 dish 2004hp	3	OE
4851	45RE 1999hp	2	OE
4859	545RE 2004hp	5	OE/AM
4856	62E 2007hp	6	Hi-Per/OE
4840	68RE 2007hp	5	OE/AM
32380	67E 2009hp	7	OE/AM
780	5010W 2005hp	8	OE
45188	505N 1999hp	3	Hi-Per/OE
4843	67S 2007hp	5	OE
4847	67H 67S 67H 2007hp (Reman 1)	5	OE
46389	60N 1999hp	5	OE
4850	60N 65N 1999hp	5	OE
4850	60S 65S 1999hp	5	Hi-Per/OE
745A	67E 1999hp	3	OE
745B	67E 2009hp	3	OE
32380E	67H 1999hp	7	OE/AM
32380F	67S 2005hp	9	AM/Hi-Per
4841	67S 67S 67D 67S 2007hp	5	OE
790	600/2000 60m 2004hp	4	OE
757	64E 1999hp	3	OE
9408	60 40E 1999hp	3	OE
310	47E 1999hp	7	OE
4844	54E 2003hp	9	Hi-Per
247	54E 2003hp	9	OE
4849	54E 54L 54L 54L 54L 1999hp	3	Hi-Per
4857	64E 64S 2003hp	5	OE
4858	60 40 2004hp	5	Hi-Per
744	54m 1999hp	4	OE
20580	67D 67S 2003hp	2	AM
790	600/2000 2009hp	4	OE
32380	67H 2005hp	9	AM/Hi-Per
4855	67H 67S 2003hp	2	Hi-Per
21110	60M/2 2009hp	3	OE
17388	67S/2 2003hp	3	Hi-Per
29080C	67 1999hp	5	AM
25208	67D 67 1999hp	7	Hi-Per
25208A	67D 67 1999hp w/o Seal Kit	5	Hi-Per
26288A	67E 67E 1999hp	6	Hi-Per/OE
26288C	67E 67E 2003hp	6	Hi-Per/OE
26288C-I	67E 67E 2003hp	6	Hi-Per/OE
26288D	67E 67E 2004hp	6	Hi-Per/OE
26288F	67E 67E 2005hp including User Link Ring	7	AM/Hi-Per
4845	67E 67E 67E 67E 1999hp	3	Hi-Per/OE
8404	67H 67H 1999hp	7	AM
8405	67H 67H 67H 67H 67H	5	AM
8404	67H 67H 67H 67H 67H	7	AM
4871	67D 67D 2003hp	6	Hi-Per
4842	67E 67E 2003hp	2	Hi-Per

Automatic Transmission Pistons and Piston Kits

Seal Aftermarket Products offers a complete line of foreign and domestic pistons and piston kits; including:

- Original equipment
- Reengineered **Hi-Per Blue** pistons
- Aftermarket alternatives

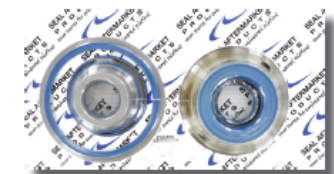
Reengineered **Hi-Per Blue** Pistons:

Hi-Per Blue™ pistons are reengineered original equipment design, manufactured with upgraded high performance blue AEM (ethylene acrylic elastomer) for superior thermal and chemical resistance, with better fit and performance. Other aftermarket pistons are made of a less-tolerant alkyl acrylate copolymer (ACM).

Hi-Per Blue™ pistons are available exclusively through Seal Aftermarket Products.

Hi-Per Blue™ Features and Benefits:

- Engineered utilizing best-in-class materials
- Meets or exceeds OEM specifications
- Better temperature range
- Higher tear strength
- Better bonding characteristics
- SAP-designed for better seal support
- Available separately, or in kits



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