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ZF8HP Introduction



Presented by:
Mike Souza
ATRA Senior
Research Technician



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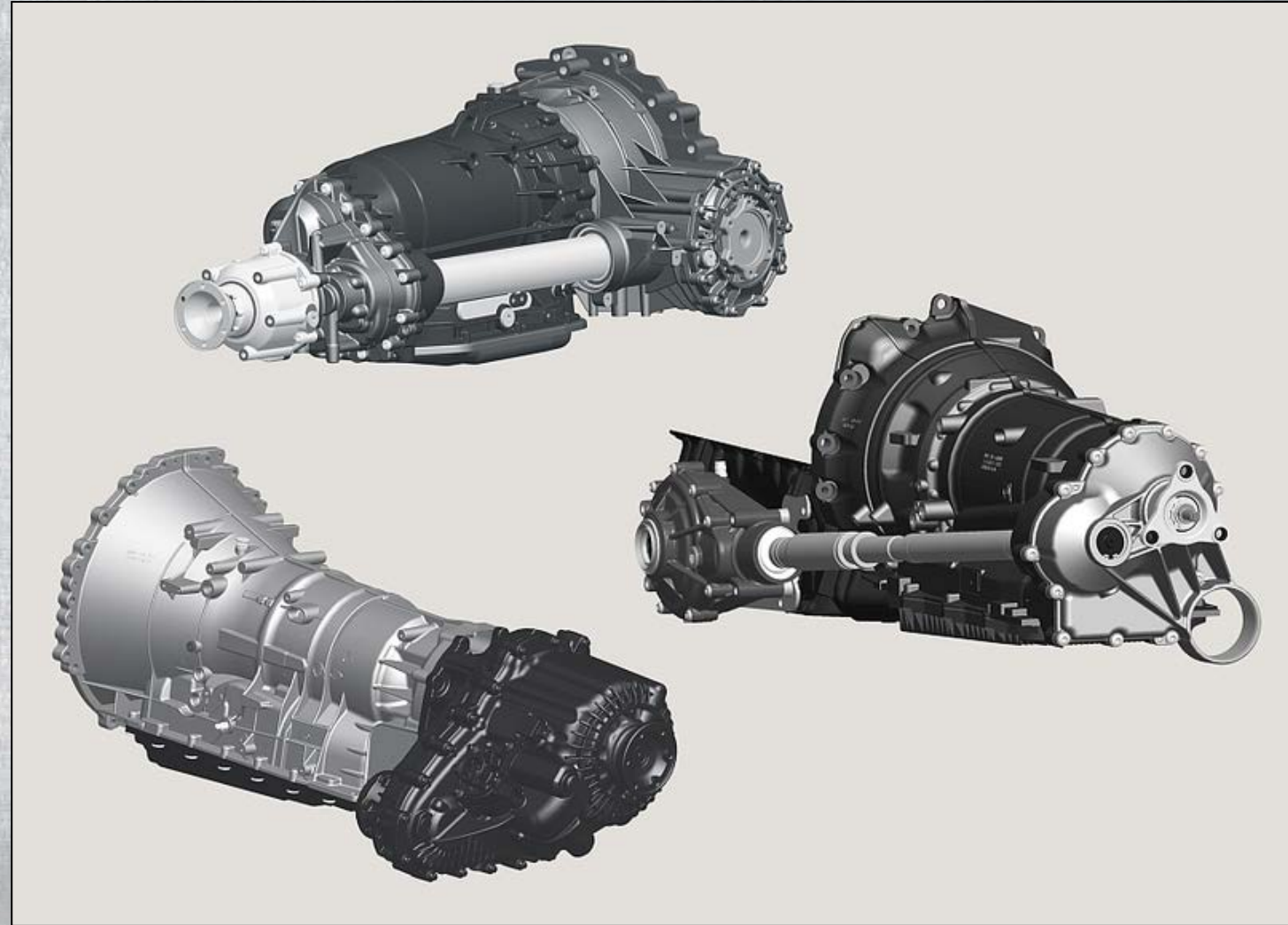




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All Wheel & Front Wheel Drives



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ZF8HP Introduction

ZF refers to this transmission as the 8HP45. Other versions and torque ratings of this transmission are also available. The 8HP30, 8HP70 and the 8HP90. A version of this transmission has been used in flagship Audi, Rolls Royce, BMW, and Bentley models since 2010 and in the 2012 Chrysler 300 and Dodge Charger referred to as the 845RE. 845RE

This 8-speed transmission has fewer moving parts than the 6HP26 6-speed. There are only two multi-disc brakes A, B and three multi-disc clutch packs labeled C, D and E, in the transmission gear train. Only two of the five clutch elements are open (released) in each gear to reduce drag.

The fewer open shift elements there are, the fewer internal transmission components that'll be rotating relative to one another. This provides a significant reduction in friction loss and reduces the transmission's rotating mass. Both qualities will contribute to improving the overall fuel economy and acceleration. By comparison, the Lexus AA80E 8-speed uses four gear sets and seven multi-disc clutch packs.



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ZF8HP Introduction

Technical Features

- *Enhanced planetary gear meshing to reduce noise*
- *Four planetary gear sets and five clutch elements*
- *Offset chain driven variable displacement pump*
- *Optional engine stop/start feature. Not used in Chryslers for 2012*
- *Hybrid technology capable*
- *Two and all wheel drive versions*
- *Non-sequential shifting*
- *Torque capacity from 300-1000nM, 8HP30-8HP90*
- *200 millisecond shift times fully electronic shift by wire, no shift cable or linkage*
- *NIC Neutral idle control allows clutch "B" slippage to reduce load vehicle creep*
- *Similar weight and physical dimensions to the ZF6HP26*
- *Adaptive strategies: high temperature, warm up, cruise control, winter mode, drag recognition and neutral idle control*
- *Air cooled (Oil To Air Cooler)*



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Optional Engine Start/Stop Function

This feature is enabled by the development of the hydraulic impulse oil storage system(HIS).



At idle, the engine automatically shuts off. The HIS system supplies the oil pressure needed to keep the transmission's clutch elements engaged while the engine is off.



350 milliseconds after starting, the vehicle is ready to drive.



With the start/stop function, it's possible to reduce fuel consumption by another 5% and further reduce CO² output.



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Manual Shift Mode

Sporty models like the Chrysler 300S and the Charger Rally as well as some European models will receive a manual shift mode with shift paddles mounted on the steering wheel.

With a 200 millisecond shift time, the shifts are so fast and smooth; if it didn't have a tachometer you might not know it shifted.

Other lower-priced models won't have the manual mode feature.

Those cars will only have drive and low select options.



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Vehicle Application

Audi Zf8HP45/55/90AF
A4/5/7 Cabriolet 2010-14
A6 Quattro 2012-14
A7 2010-14
A8 2009-14
Q5 Hybrid 2011-14
Q7 2010-14

Bentley ZF8HP90
Azure 2013-14
E-Suv 2014
Flying Spur 2010-14
GT/GTC 2010-14
Mulsanne 2010-14

BMW ZF8HP45/70
I thru 7 Series 2009-14
X1 thru X6 2010-14
Z4 Roadster 2012-14

Chrysler 845RE
300 2011-14

Dodge 845RE
Barracuda 2014
Charger 2012-14
Durango 2012-14
Ram 1500 2014

Jaguar ZF8HP70
F Type 2013-14
XF 2011-14
XJ 2011-14
XK 2012-13

Lancia ZF8HP45/70
Thesis 2011

Land Rover ZF8HP45/70
Discovery LR3 2010-14
Range Rover Sport 2011-14

Maserati ZF8HP70
Quattroporte 2012-14

Porsche
Macan 2013-14

Rolls Royce ZF8HP70
Ghost 2009-14
Wraith 2013-14

Volkswagen ZF8HP45
Amarok 2012-14



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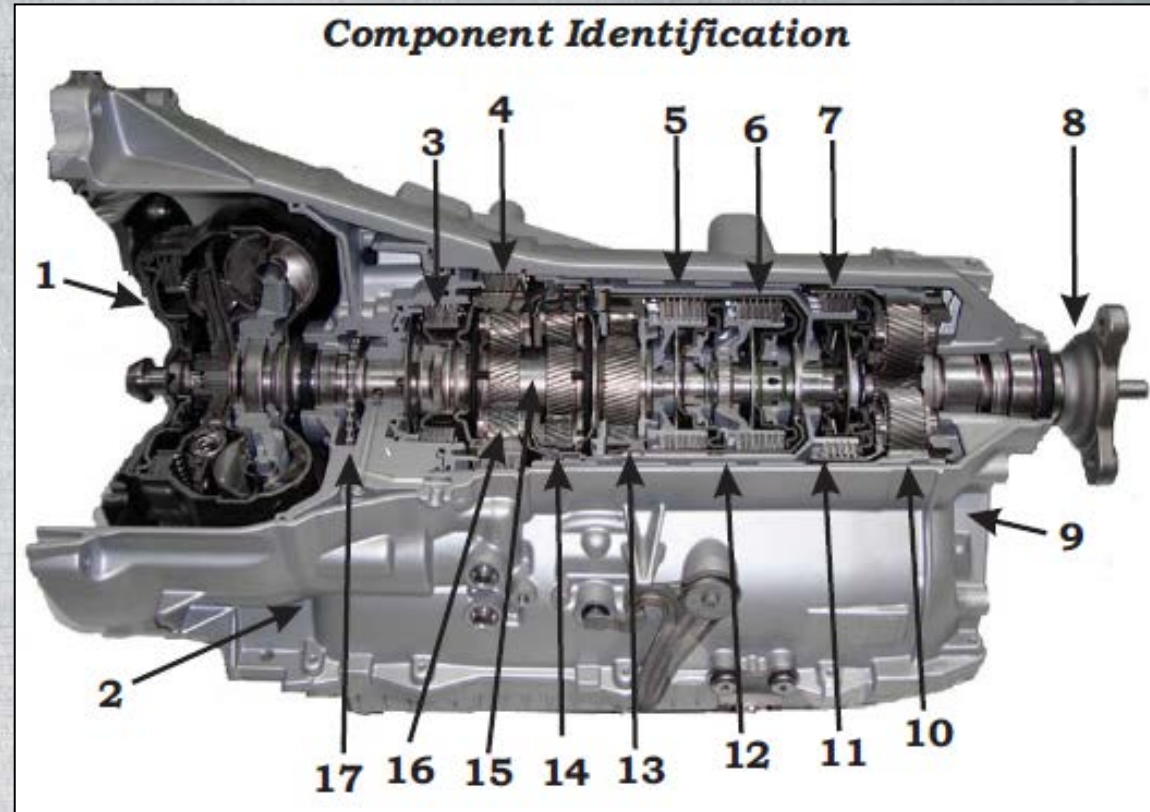




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Component Identification



- | | | |
|----------------------------|------------------------------|---------------------------------|
| 1: Torque Converter | 7: D Clutch | 13: P3 Planet |
| 2: Oil Pump | 8: Output Shaft | 14: P2 Planet |
| 3: A Brake Clutch | 9: Case | 15: P1 & P2 Sun Gear |
| 4: B Brake Clutch | 10: P4 Planet | 16: P1 Planet |
| 5: E Clutch | 11: P4 Sun Gear Shell | 17: Pump Drive Chain |
| 6: C Clutch | 12: D Clutch Drum | |



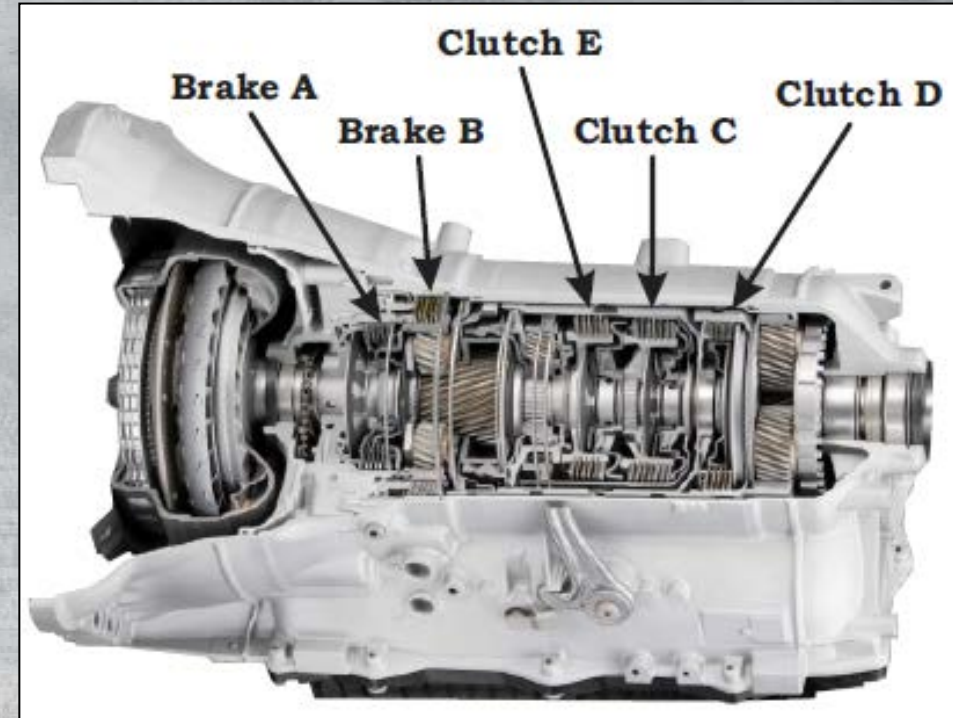
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Clutch Application Chart

Gear	Holding		Driving		
	A	B	C	D	E
Reverse	X	X	O	X	O
1st	X	X	X	O	O
2nd	X	X	O	O	X
3rd	O	X	X	O	X
4th	O	X	O	X	X
5th	O	X	X	X	O
6th	O	O	X	X	X
7th	X	O	X	X	O
8th	X	O	O	X	X



O Released
X Applied

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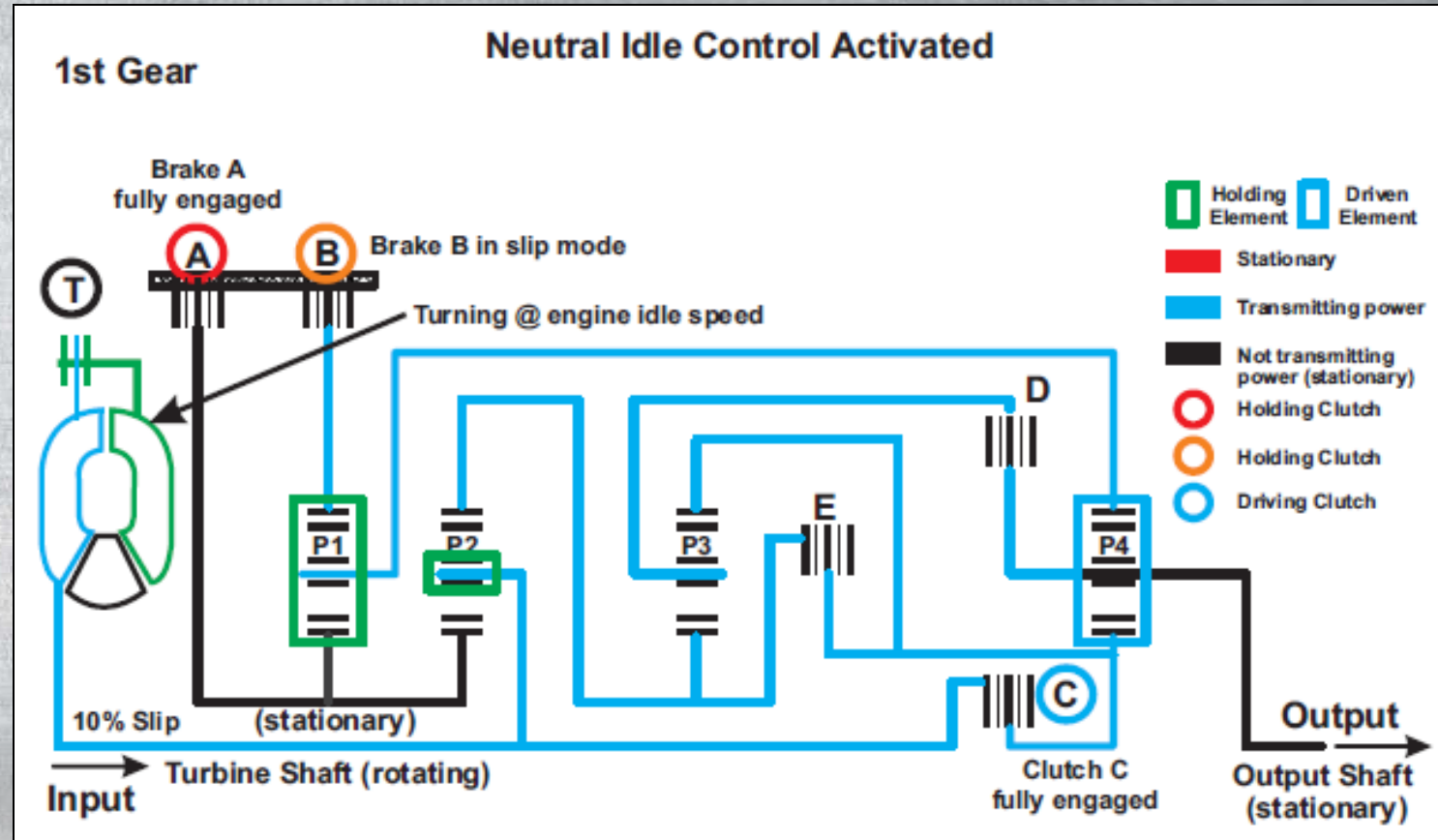


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Power Flow 1st Gear Neutral Idle Control Activated

Neutral Idle Control system (NIC) improves fuel economy in city driving. The neutral idle control is activated in the transmission by slipping the Brake B, which lowers torque through the transmission to ring gear 1



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Power Flow 1st Gear Neutral Idle Control Activated

A Brake B Brake and C Clutch fully applied

B Brake is in slip mode (torque converter 10% slip)

Holding Elements: A, B Brake Clutch and P1/P2 Sun, and P1 Planet assembly

Driving Element: C Clutch

Driven Element: P4 Planet assembly



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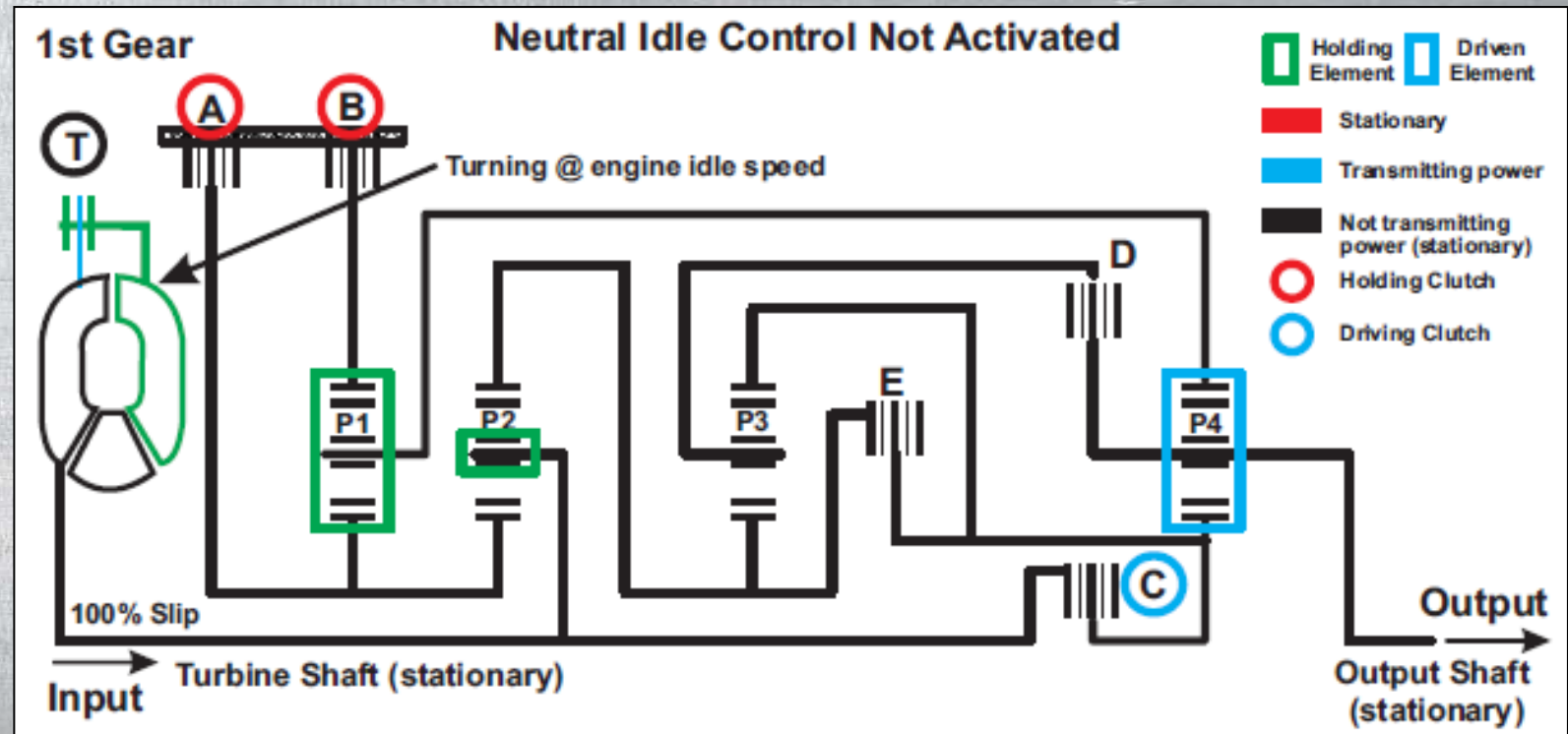
Power Flow 1st Gear Neutral Idle Control "Not" Activated

Clutches Fully Applied: A, B Brake and C Clutch (torque converter 100% slip)

Holding Elements: A, B Brake Clutch and P1/P2 Sun, and P1 Planet assembly

Driving Element: C Clutch

Driven Element: P4 Planet assembly



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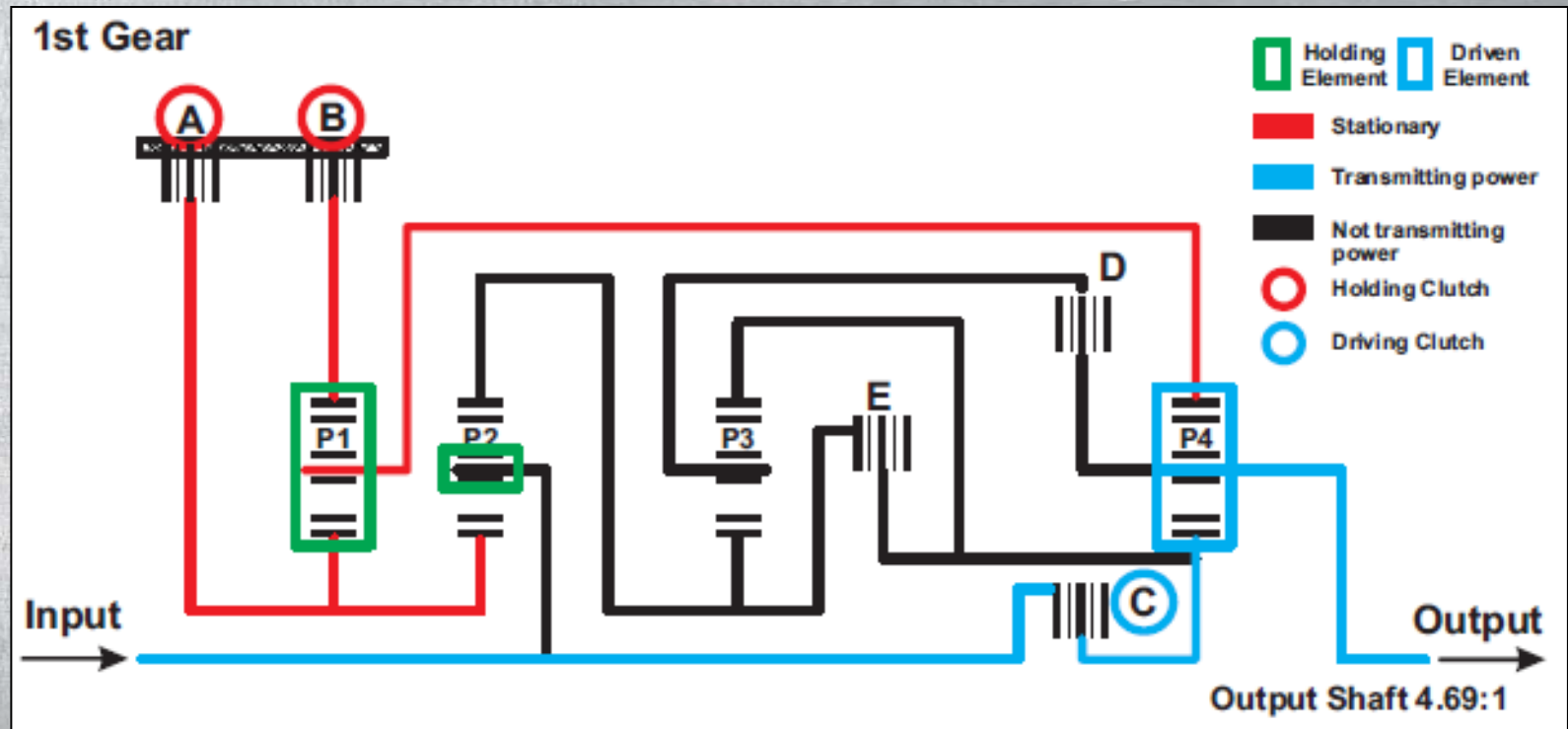
Power Flow 1st Gear

Clutches Applied: A, B Brake and C Clutch

Holding Elements: A, B Brake Clutch and P1/P2 Sun, and P1 Planet assembly

Driving Element: C Clutch

Driven Element: P4 Planet assembly



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GEARS FOR THE TRANSMISSION REBUILDING INDUSTRY

WIT WHATEVER IT TAKES TRANSMISSION PARTS, INC

TK TOLEDO TRANS-KIT

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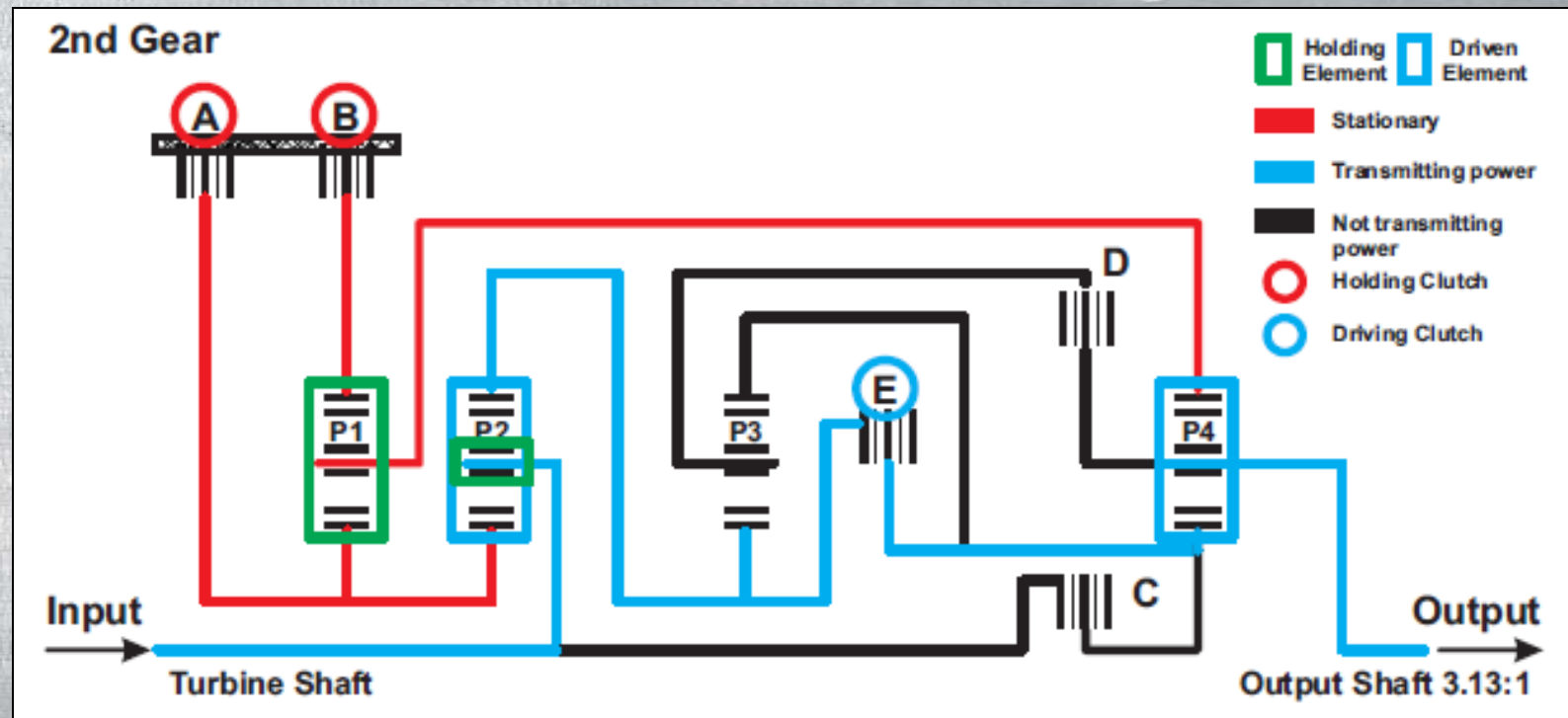
Power Flow 2nd Gear

Clutches Applied: A, B Brake and E Clutch

Holding Elements: A, B Brake Clutch and P1/P2 Sun Gear and P1 Planet assembly

Driving Element: E Clutch

Driven Element: P2 and P4 Planet assembly



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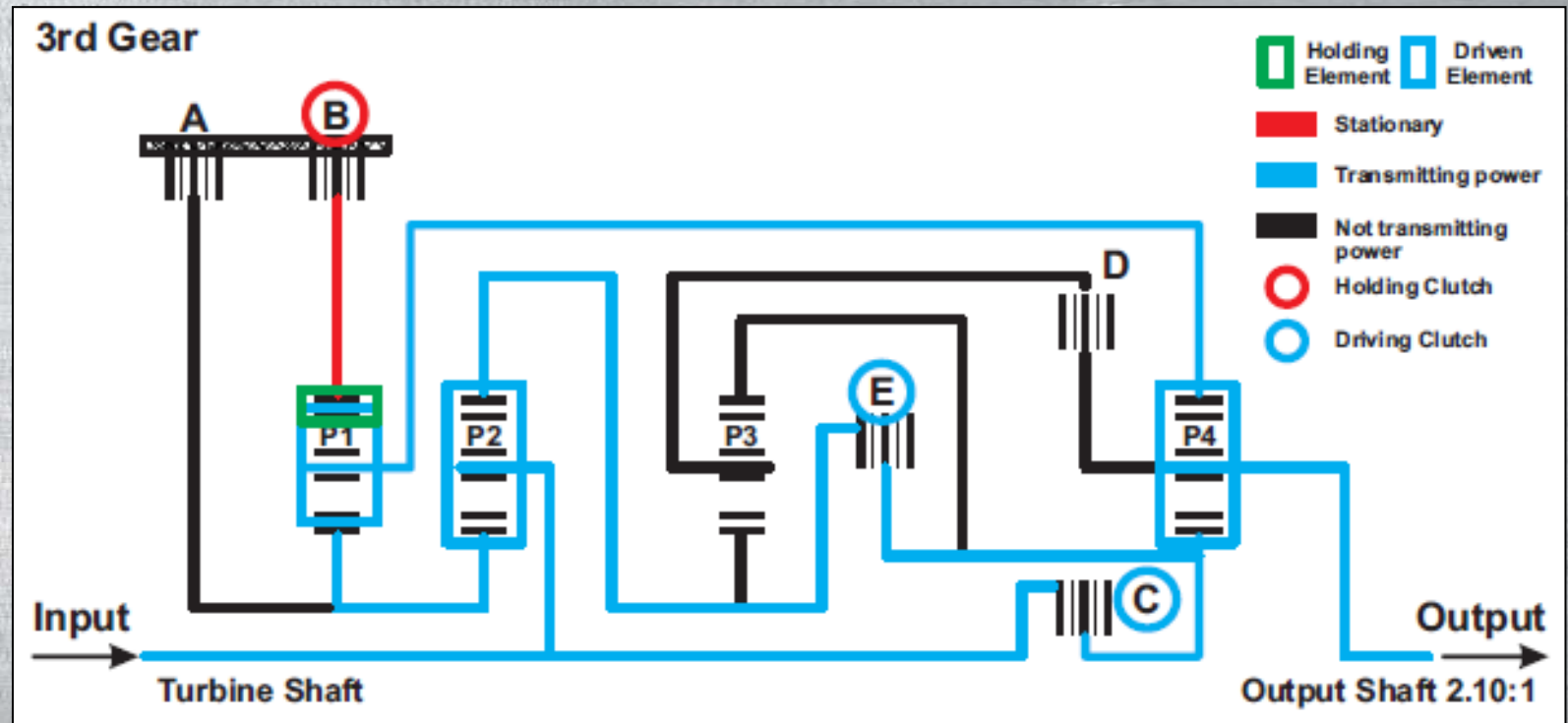
Power Flow 3rd Gear

Clutches Applied: B Brake, E and C Clutch

Holding Elements: B Brake Clutch and P1 Ring Gear

Driving Element: E and C Clutch

Driven Element: P1, P2 and P4 Planet assembly



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Power Flow 4th Gear

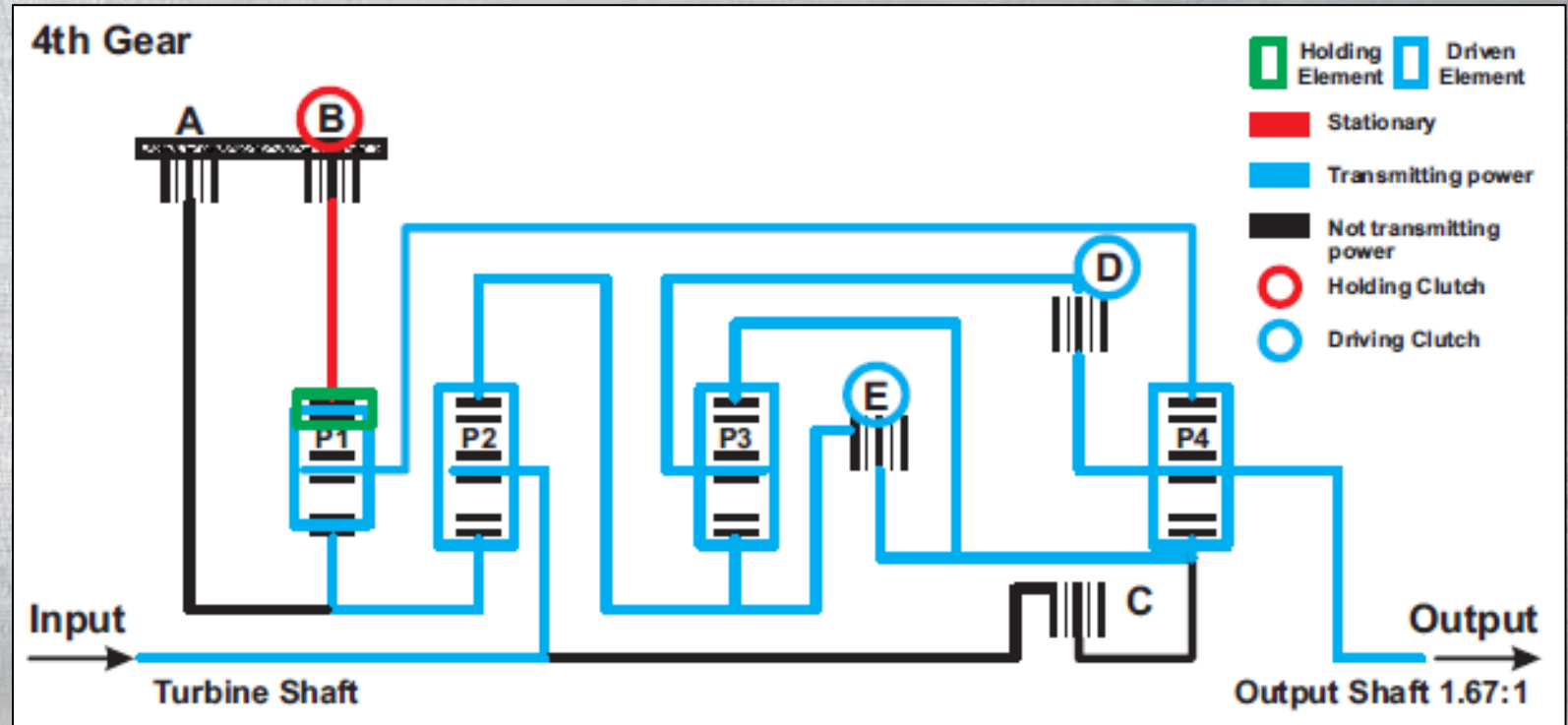
Clutches Applied: B Brake, E and D Clutch

Holding Elements: B Brake Clutch and P1 Ring Gear

Driving Element: E and D Clutch

Driven Element: P1, P2, P3 and P4 Planet assembly

Note: P3 and P4 Planet assemblies are turning at a 1:1 ratio.



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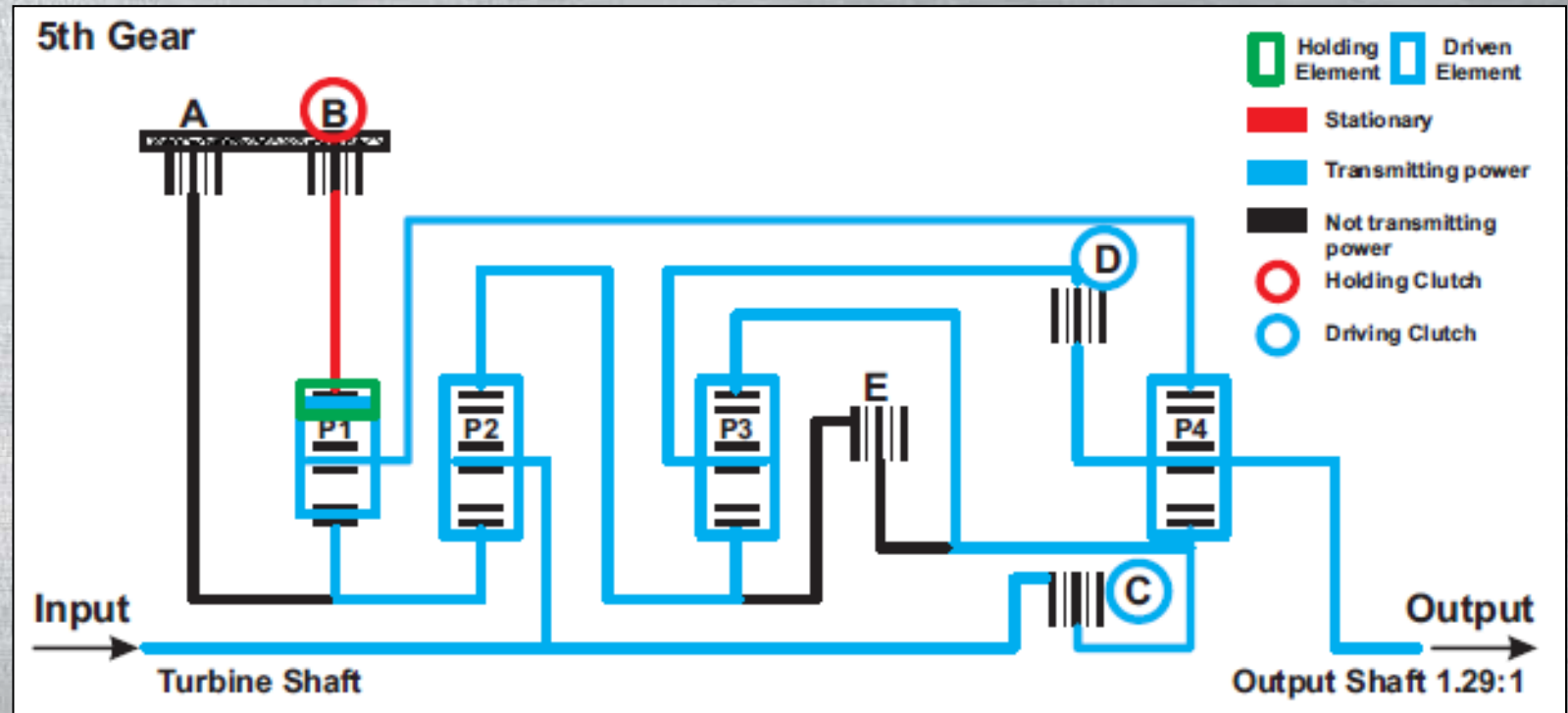
Power Flow 5th Gear

Clutches Applied: B Brake, D and C Clutch

Holding Elements: B Brake Clutch and P1 Ring Gear

Driving Element: D and C Clutch

Driven Element: P1, P2, P3 and P4 Planet assembly



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Power Flow 6th Gear

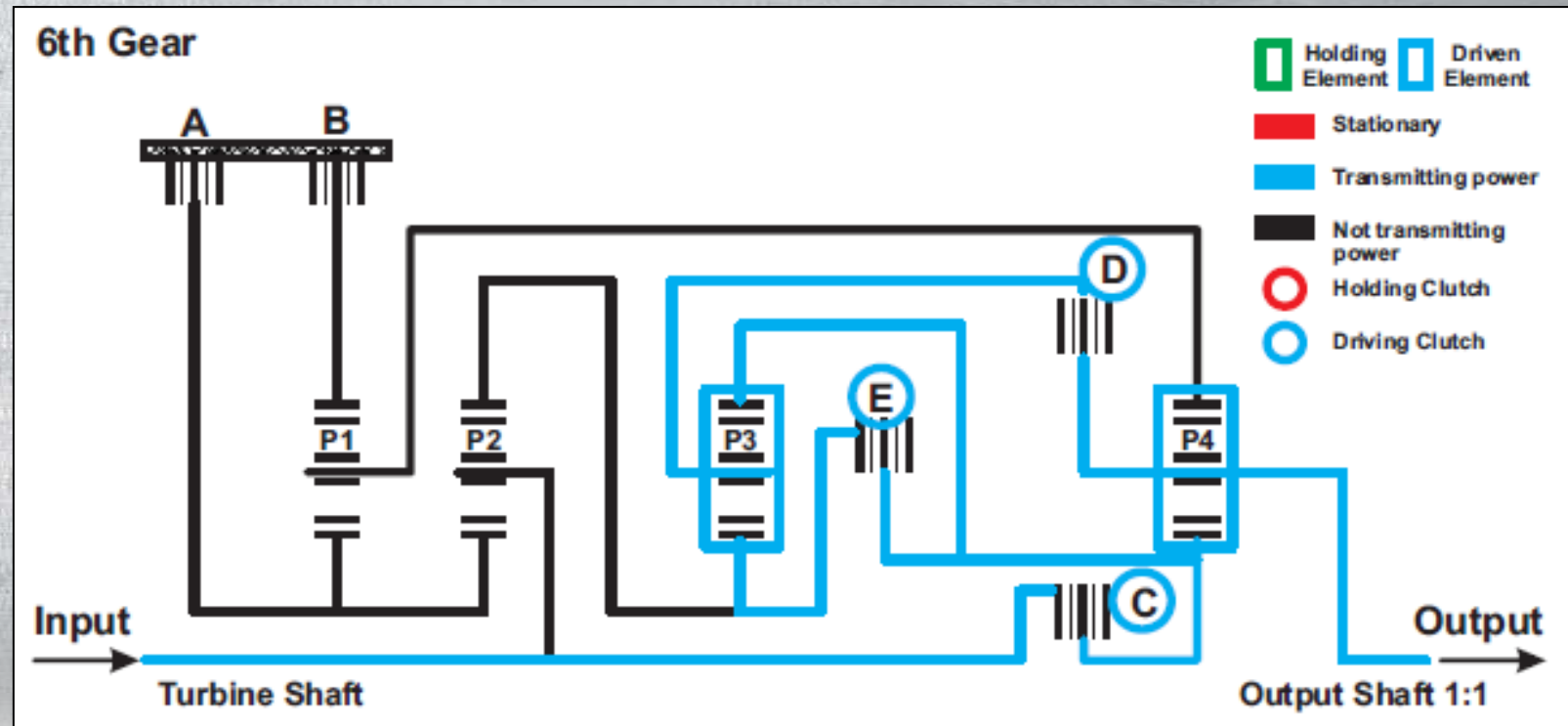
Clutches Applied: E, D and C Clutch

Holding Elements:

Driving Element: E, D and C Clutch

Driven Element: P3 and P4 Planet assembly

Note: Complete planetary gearbox rotates at Turbine speed 1:1.



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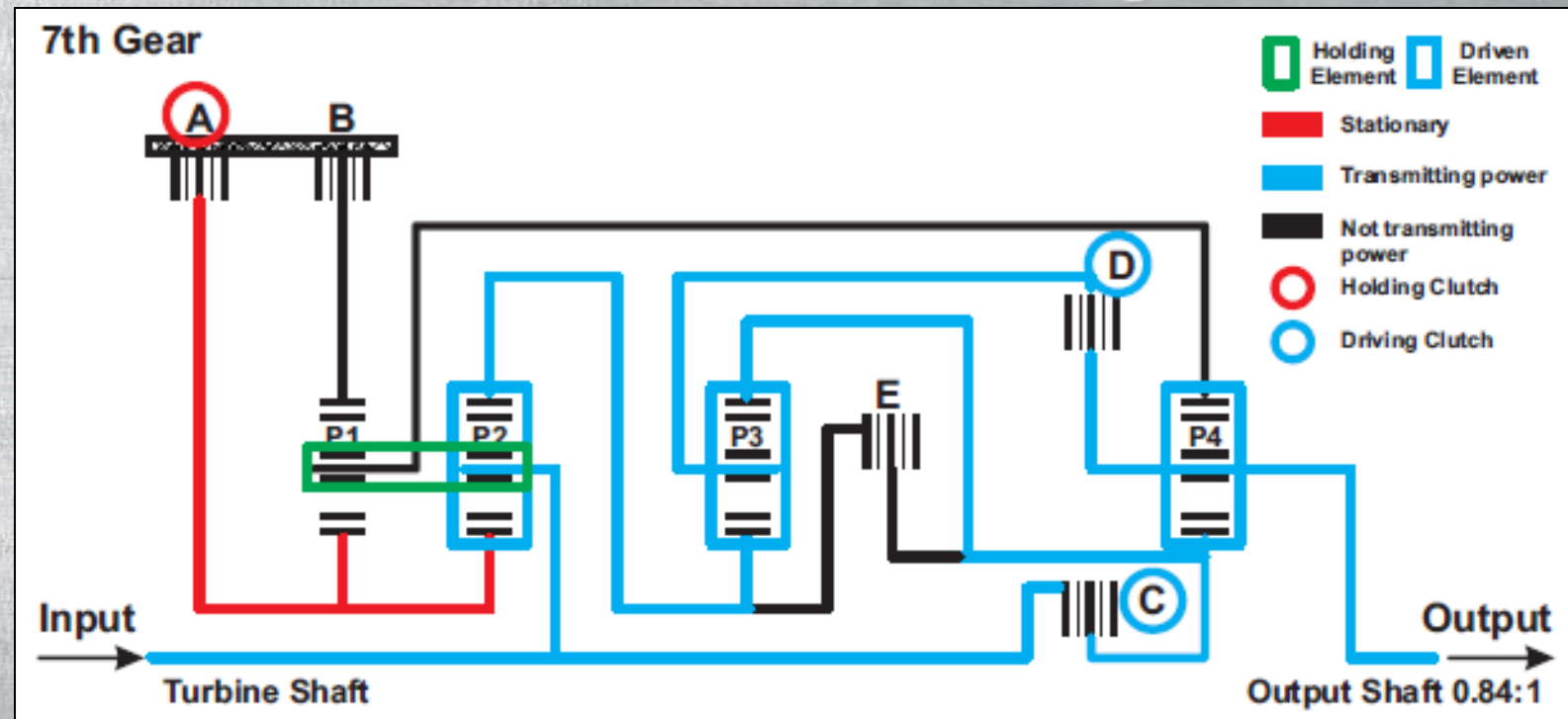
Power Flow 7th Gear

Clutches Applied: A Brake Clutch, D and C Clutch

Holding Elements: A Brake Clutch, P1/P2 Sun Gear

Driving Element: D and C Clutch

Driven Element: P2, P3 and P4 Planet assembly



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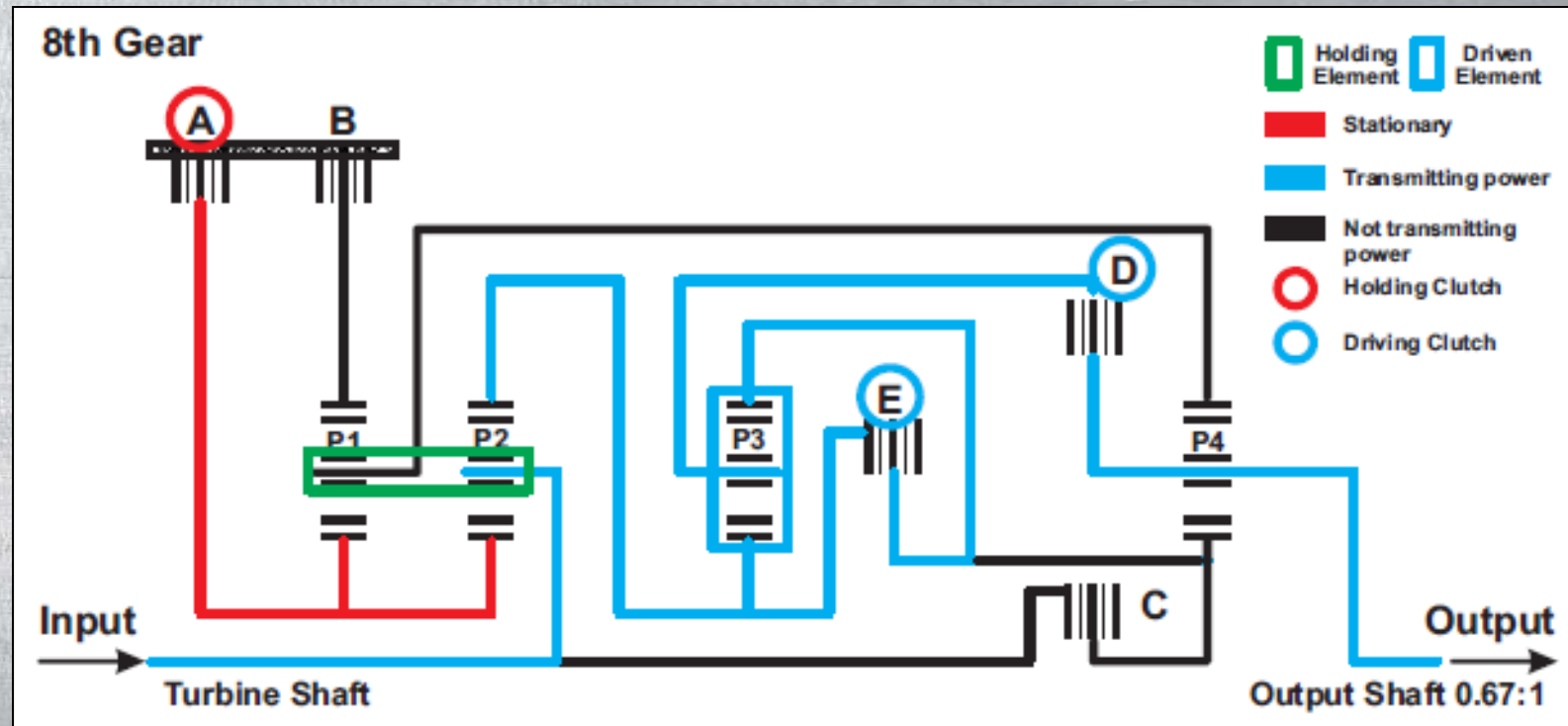
Power Flow 8th Gear

Clutches Applied: A Brake, D and C Clutch

Holding Elements: A Brake and P1/P2 Sun Gear

Driving Element: E, D and C Clutch

Driven Element: P2, P3 and P4 Planet assembly



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Power Flow Reverse Gear

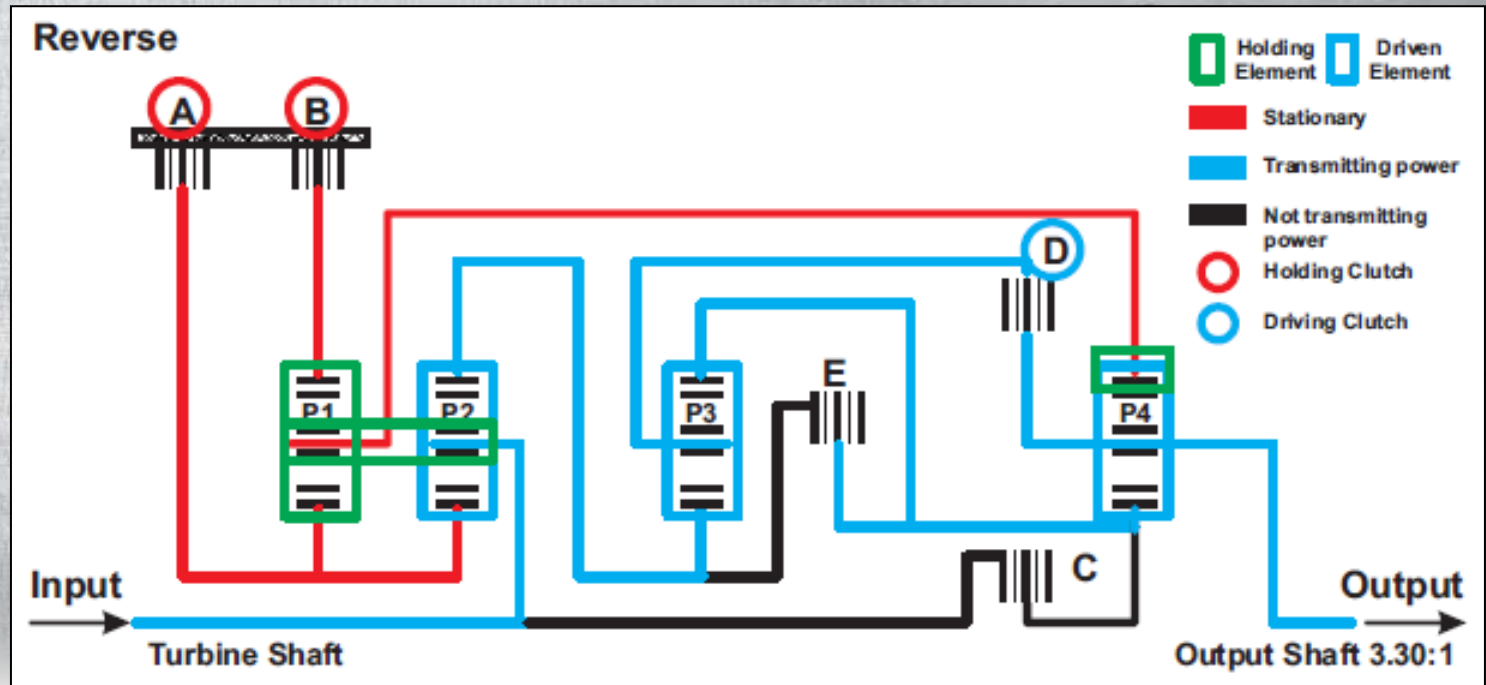
Clutches Applied: A, B Brake, and D Clutch

Holding Elements: A, B Brake P1/P2 Sun Gear P1 Planet assembly & P4 Ring Gear

Driving Element: D and C Clutch

Driven Element: P2, P3 and P4 Planet assembly

Note: P3 Ring Gear is connected to the P4 Sun Gear. The P4 Sun Gear drives P4 Planet assembly in the opposite direction of the engine rotation. The P4 Planet assembly rolls along the held P4 Ring Gear.



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Solenoid Identification

All solenoids are mounted to the TCM.

- ***Five shift solenoids are used to control clutches A through E.***
- ***The TCC solenoid is used to apply the torque converter.***
- ***A line pressure and park release solenoid are included.***
- ***The park release solenoid is an On/Off solenoid.***
- ***The Park Hold solenoid is mechanical. All other solenoids are variable force solenoids.***
- ***All VFS solenoids are approximately 5.5 ohms.***
- ***The On/Off park release and mechanical hold solenoids are approx. 25 ohms.***
- ***The Park Release solenoid is normally open.***
- ***Solenoids A, B and TCC are Normally Vented solenoids when powered off produce no pressure.***
- ***Solenoids C, E, D and Line Pressure are Normally Applied solenoids when powered off high pressure.***



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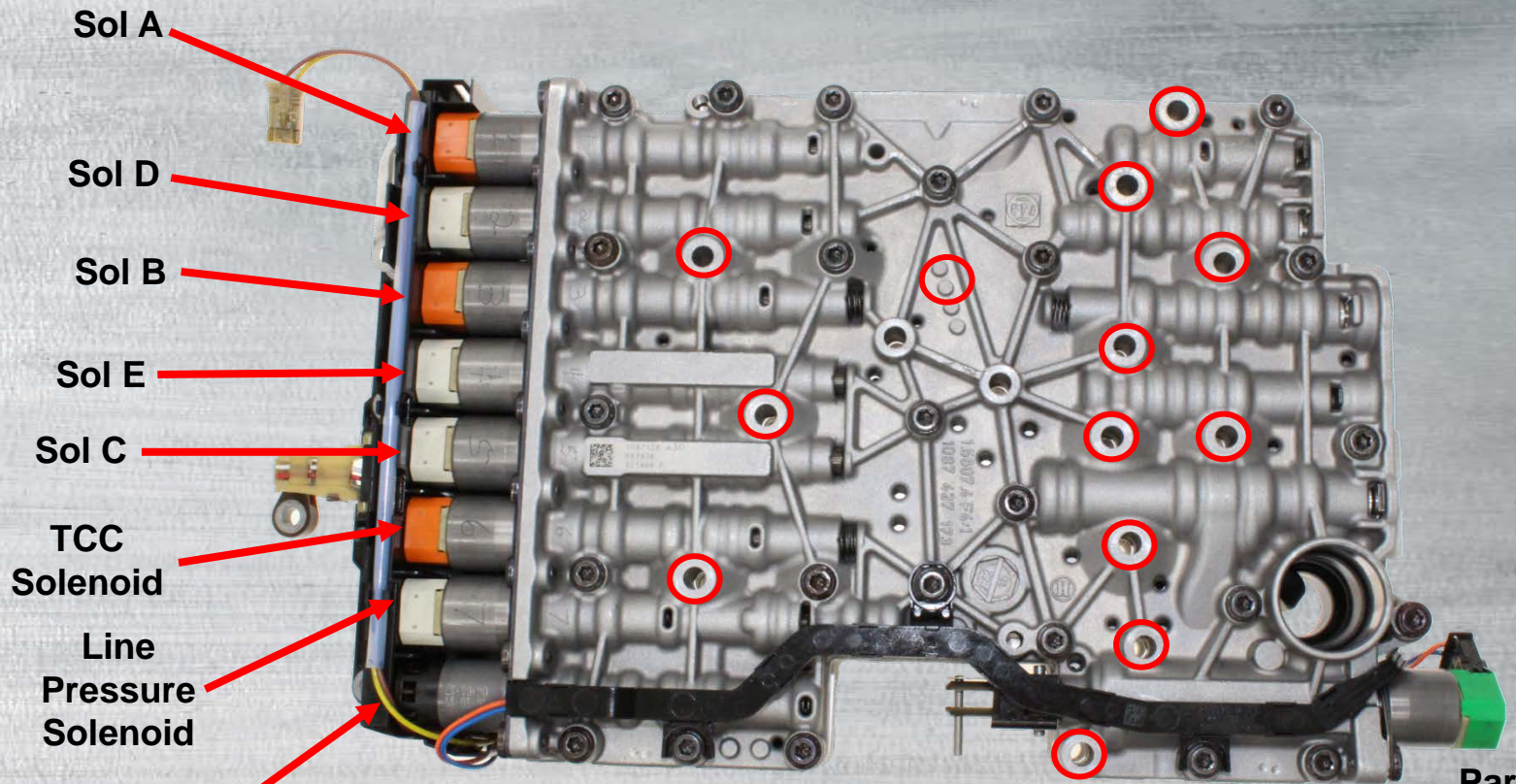




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Solenoid Identification



- Sol A
- Sol D
- Sol B
- Sol E
- Sol C
- TCC Solenoid
- Line Pressure Solenoid
- Park Release Solenoid

Remove these bolts only to remove valve body ○

Torque to 10 Nm

Park Hold Mechanical Solenoid
 "E" Shift Valve Body

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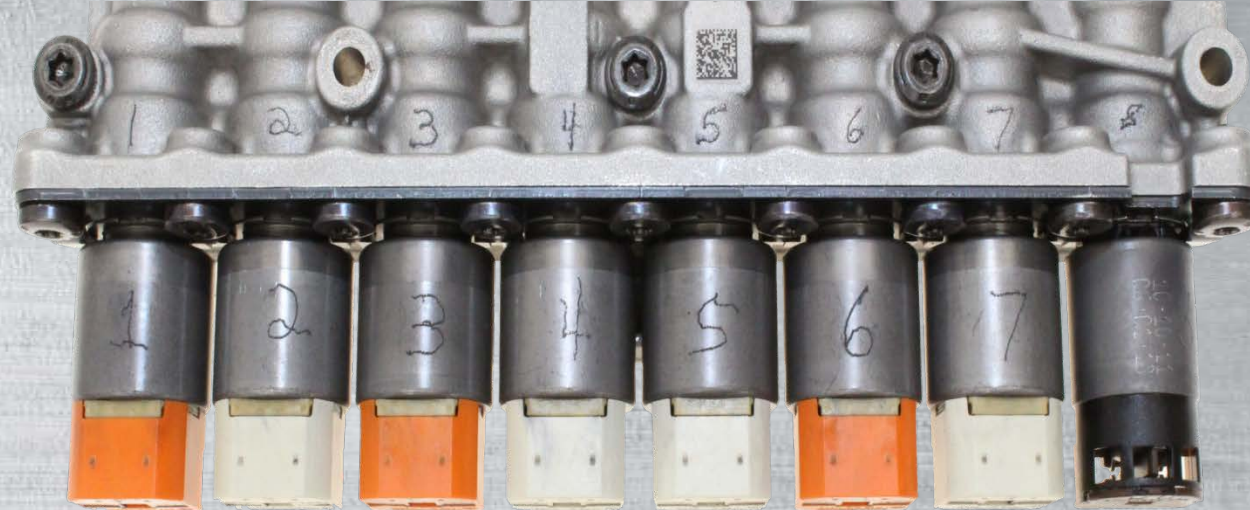


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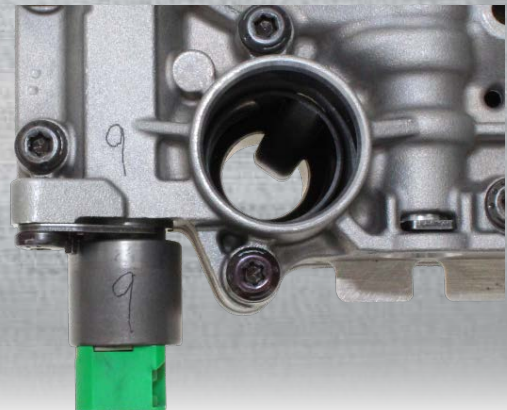


Solenoid Identification

Always mark/engrave the solenoids before disassembly to ensure the solenoids will get back into the right spot.



*Note: # 9 solenoid is a mechanical solenoid,
it does not flow hydraulic oil.*



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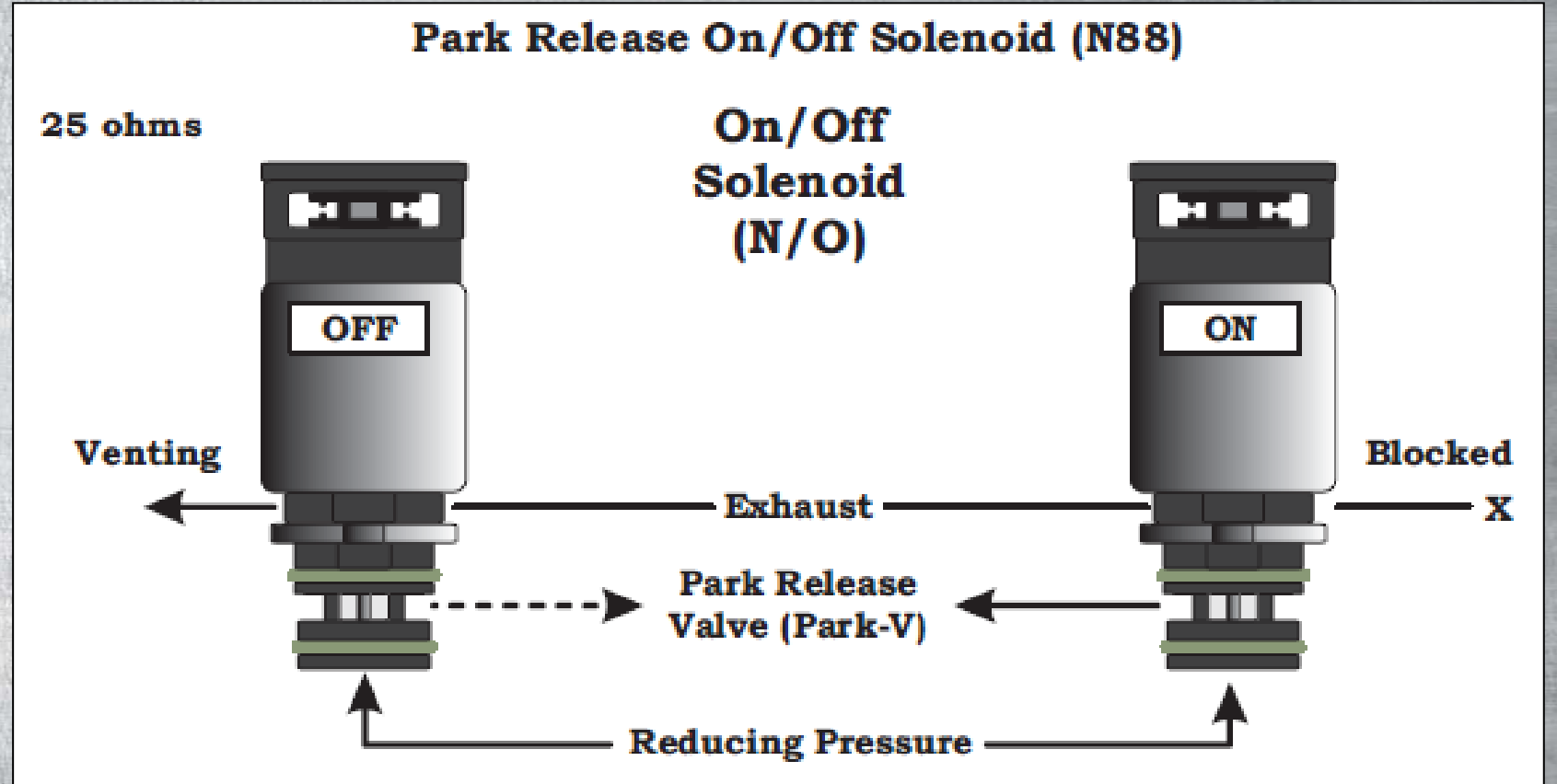




Park Release Solenoid Function



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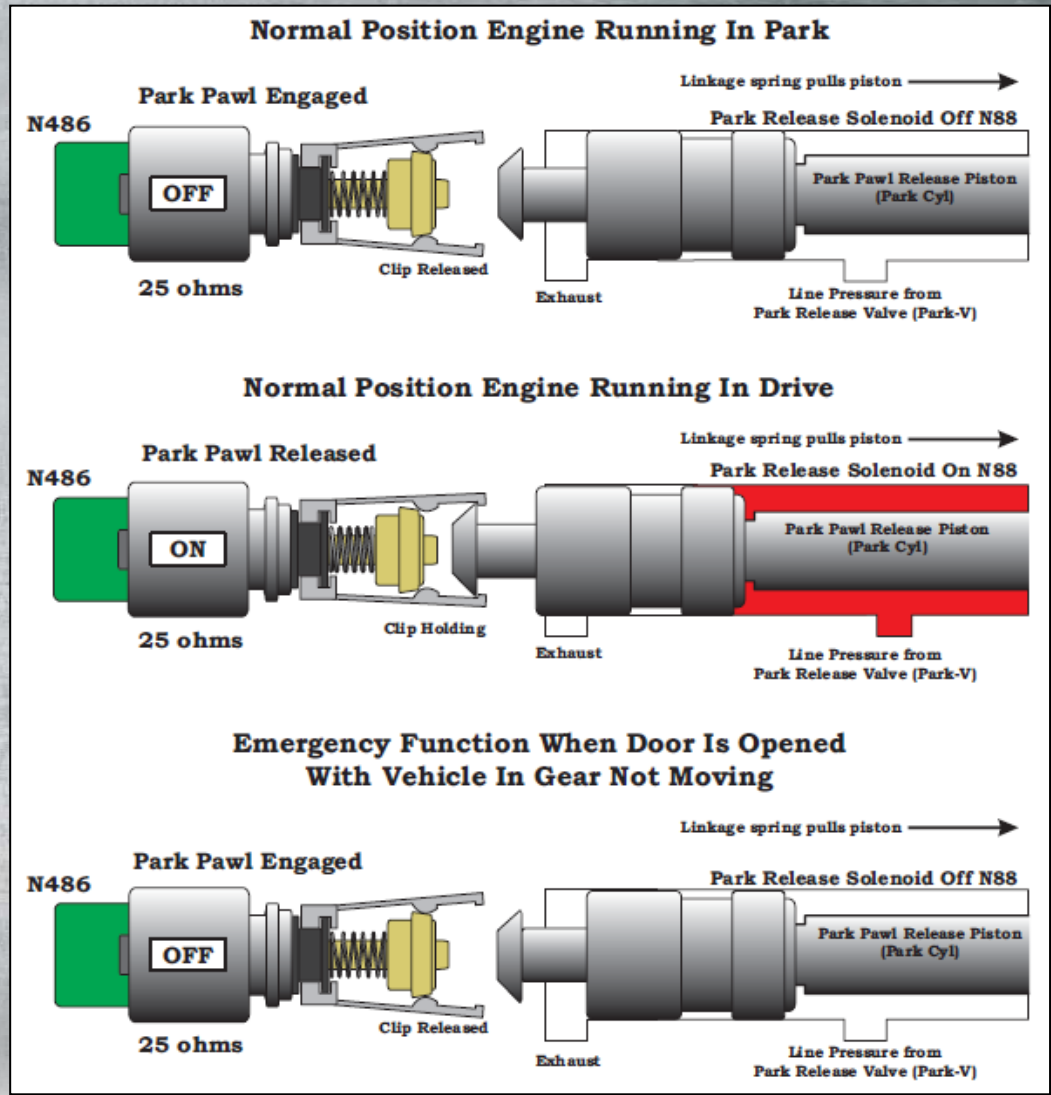


Park Hold Mechanical Solenoid (N486) Function

NOTE: Manual release is provided by way of a release mechanism located under a cover in the floor board at left front of driver's seat on Audi models. Vehicle must be running with the shifter in the neutral position.

When the park lock manual release has been actuated a warning light will appear in the instrument cluster.

Locations and procedures are different for each vehicle model (see owners manual).



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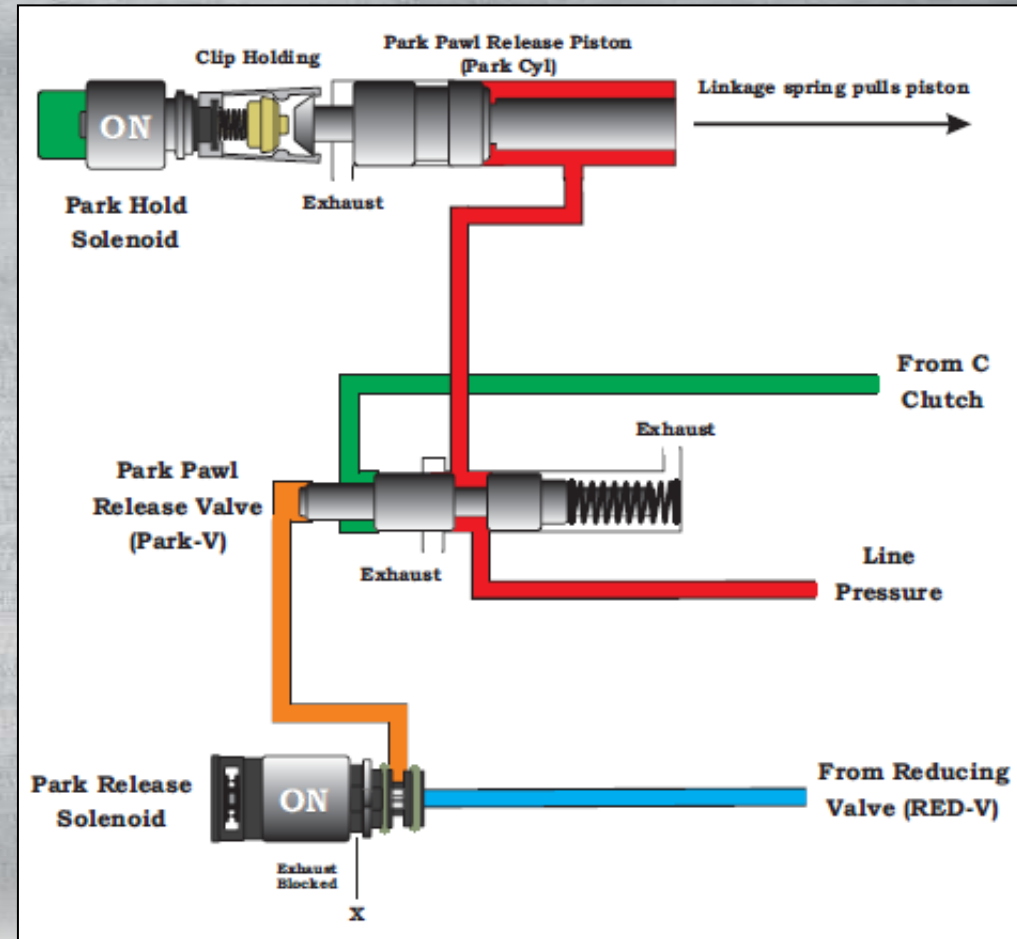


Park Lock Hydraulic Operation

When shifting out of park, the Park Release Solenoid (N88) is energized. The park release solenoid directs line pressure to the Park Release Valve. The park release valve direct main line pressure to the Park Release Piston, pulling the linkage rod releasing the parking pawl.

The Park Hold Mechanical Solenoid (N486) is also energized and holds the parking release piston. This is accomplished by clipping onto the tip of the piston and holding the linkage in the "Parking Lock Disengaged" position.

There is no hydraulic fluid going to this solenoid.



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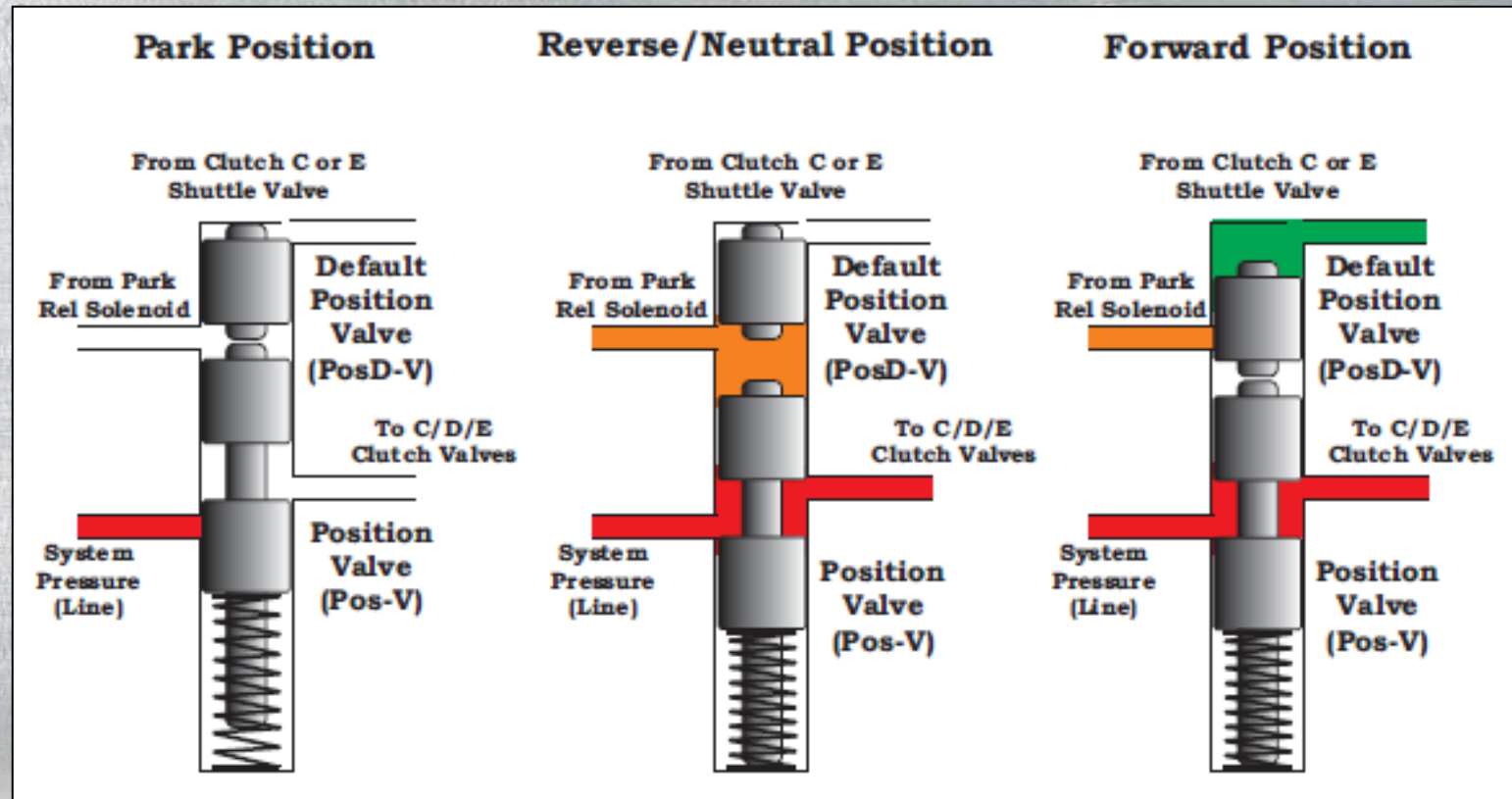


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Position Valve Operation

There are two position valves used in the valve body. These valve supply oil pressure to the C, D and E clutch valves. The position valves are designed to supply pressure to the driving clutches and to maintain supply pressure in the clutch circuits if an electrical failure should occur.



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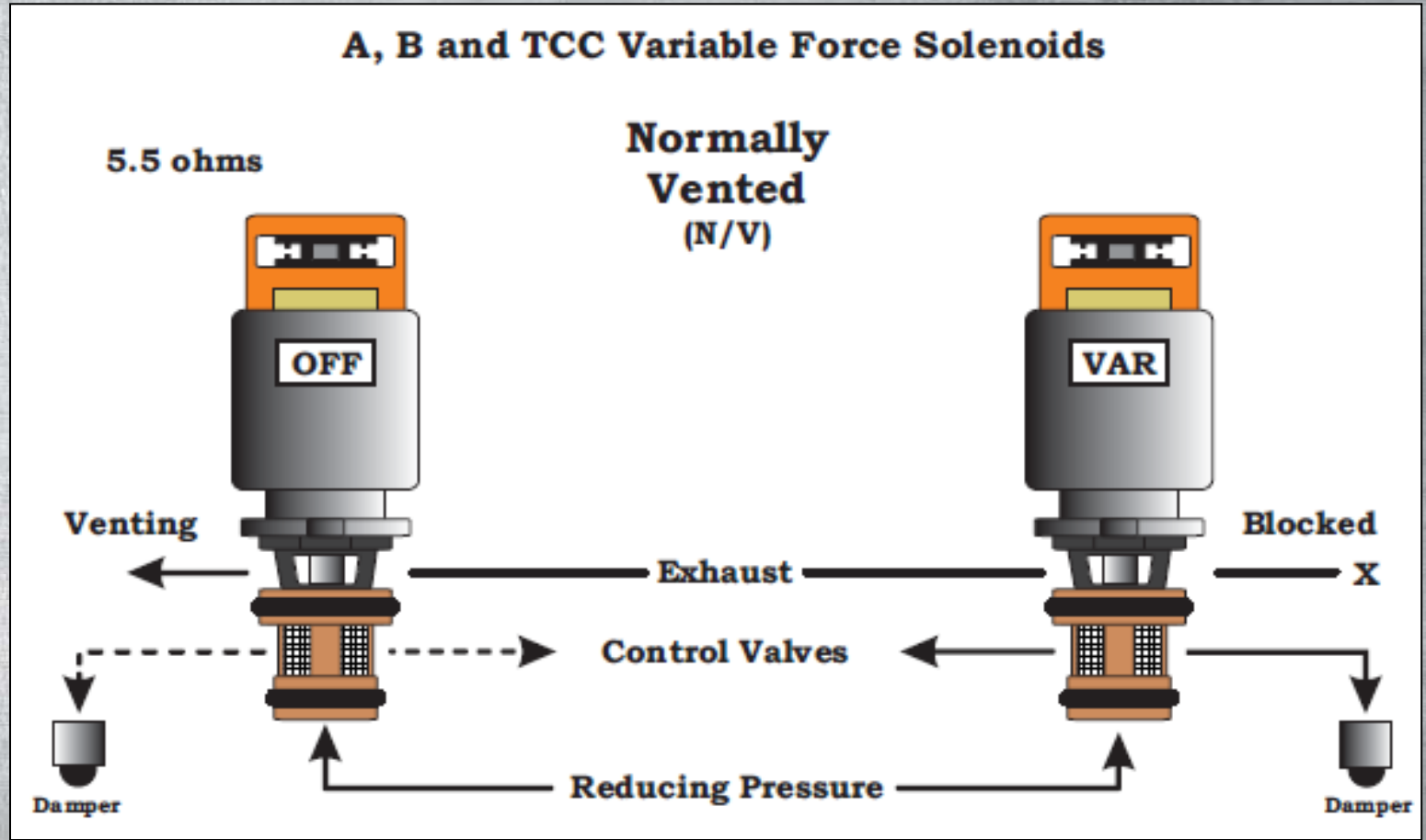


Variable Solenoid Function

A, B and TCC Variable Force Solenoids



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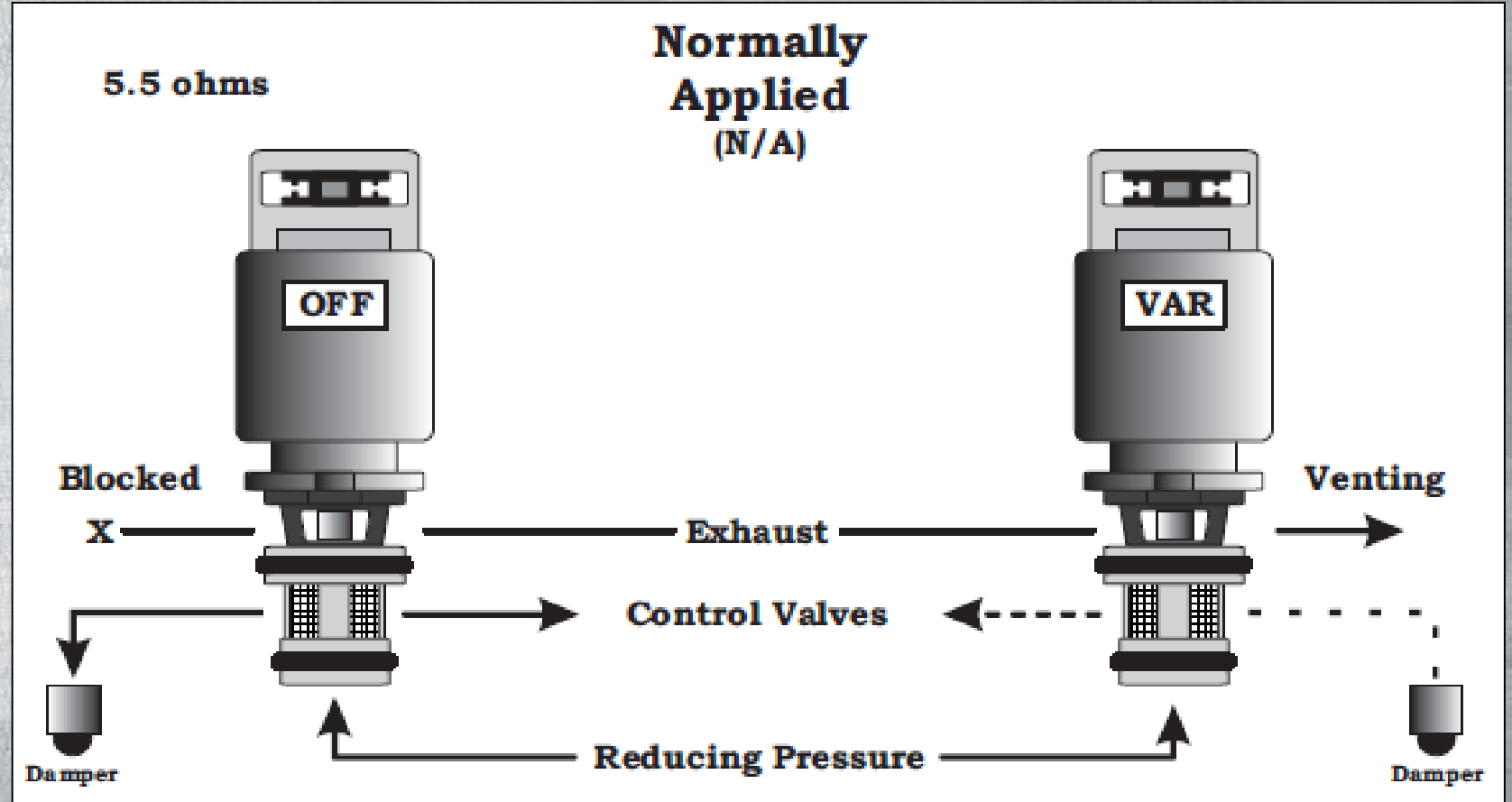


Variable Solenoid Function

Line, C, D and E Variable Force Solenoids



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Clutch & Solenoid Apply Chart



Clutch		Brake A	Brake B	Clutch C	Clutch D	Clutch E	Converter	
Gear	Sol.	Sol. A EDS A N215 (N/V)	Sol. B EDS B N216 (N/V)	Sol. C EDS C N217 (N/A)	Sol. D EDS D N218 (N/A)	Sol. E EDS E N233 (N/A)	TCC EDS-WK N371 (N/V)	Line EDS Sys N443 (N/A)
	Park Release N88 (N/O)							
Park	O	X	X*	O	O	O	O	O
Neutral	X	X	X*	O	O	O	O	O
Reverse	X	X A	X A	O	X A	O	O	+/-
1st	X	X A	X A	X A	O	O	+/-	+/-
2nd	X	X	X	O	O	X	+/-	+/-
3rd	X	O	X A	X A	O	X A	+/-	+/-
4th	X	O	X A	O	X A	X A	+/-	+/-
5th	X	O	X A	X A	X A	O	+/-	+/-
6th	X	O	O	X A	X A	X A	+/-	+/-
7th	X	X A	O	X A	X A	O	+/-	+/-
8th	X	X A	O	O	X A	X A	+/-	+/-

O = Un-pressurized X = Pressurized A = Clutch Applied



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Direct Shift Operation

Direct Shift examples: according to specific vehicle operating conditions.

Shift from 8th gear to 6th, 4th or 2nd gear.

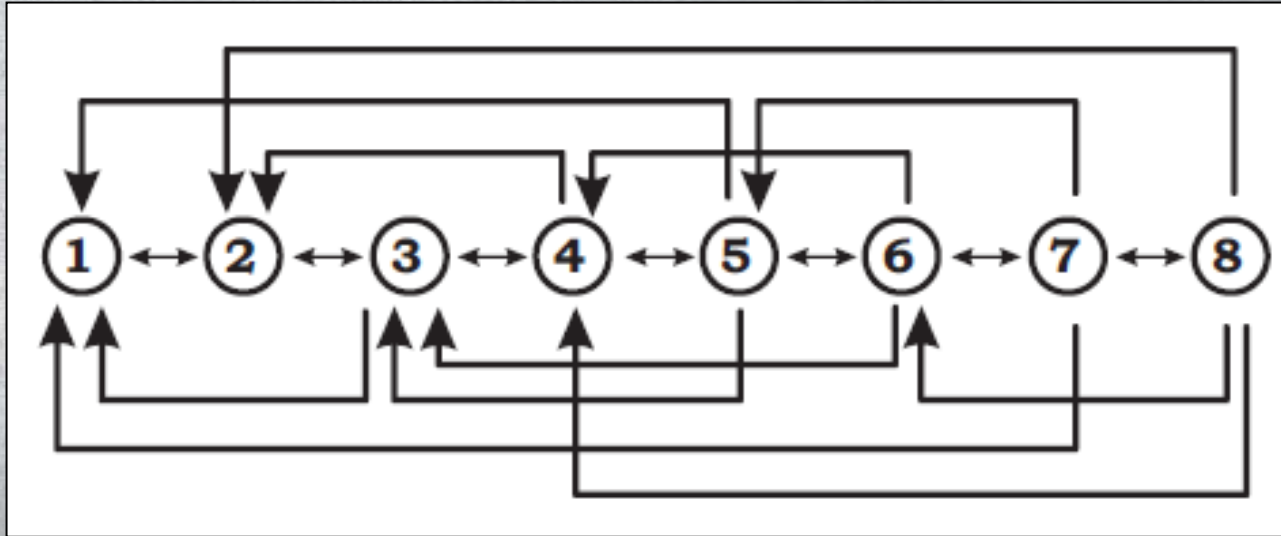
Shift from 7th gear to 5th or 1st gear

Shift from 6th gear to 4th or 3rd gear.

Shift from 5th gear to 3rd or 1st

Shift from 4th gear to 2nd

Shift from 3rd gear to 1st



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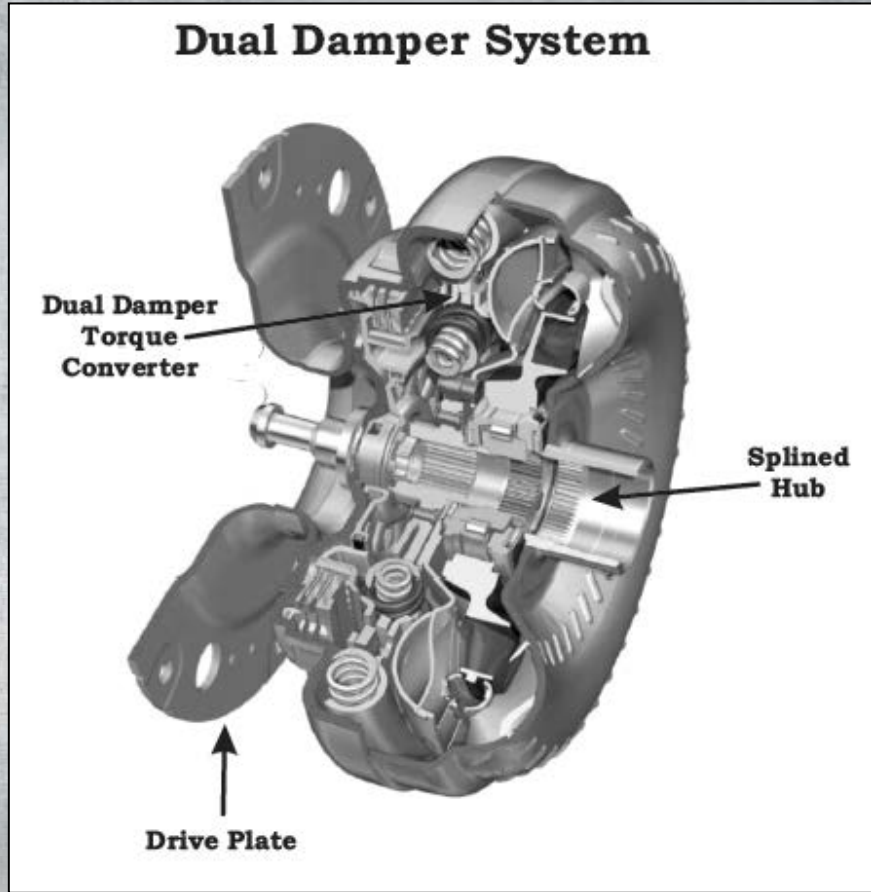


Torque Converter

Although the converter has a dual damper system similar to the ZF6HP transmission. The hub is splined to a gear driven chain to turn the pump.



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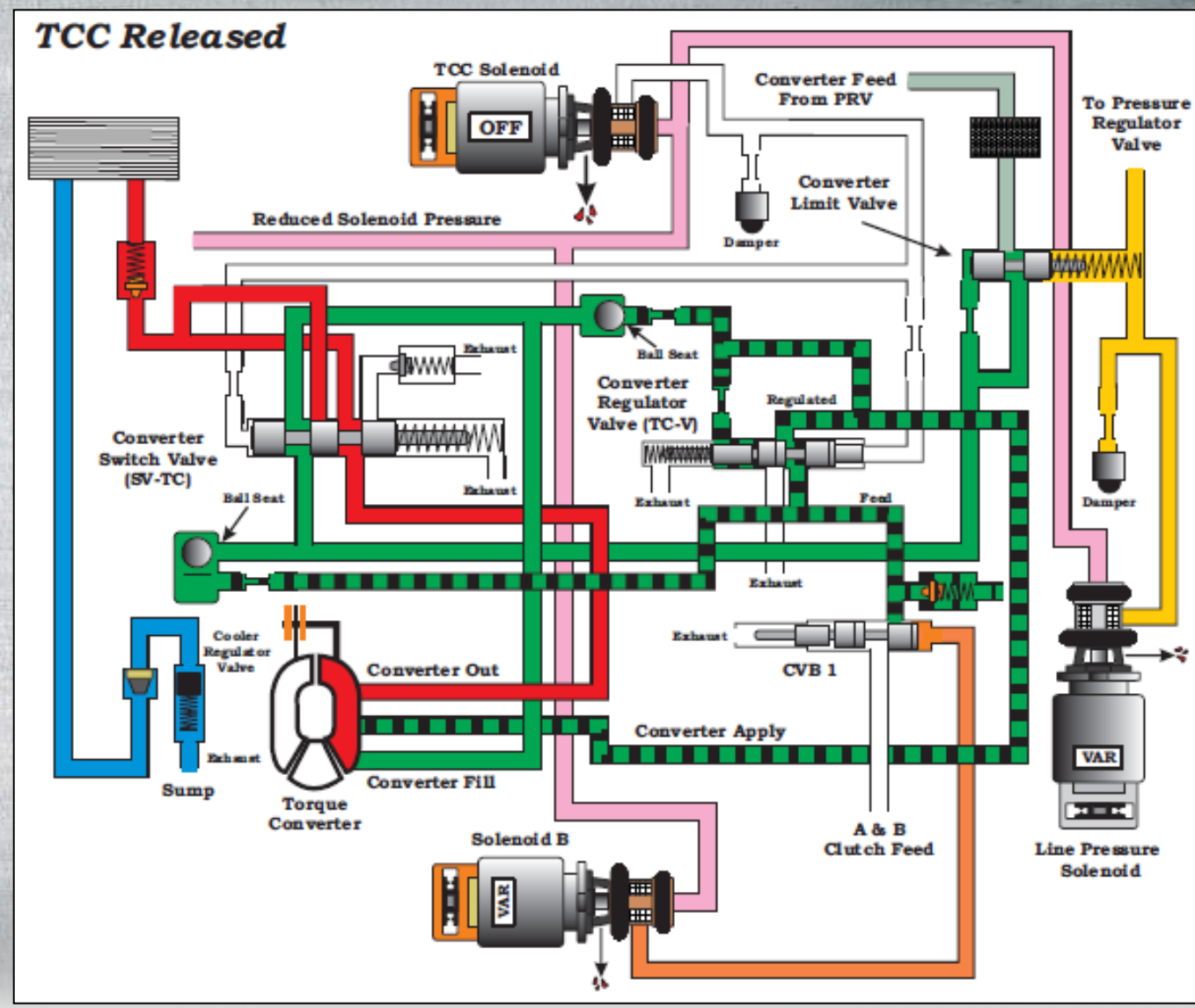


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TCC Function Released

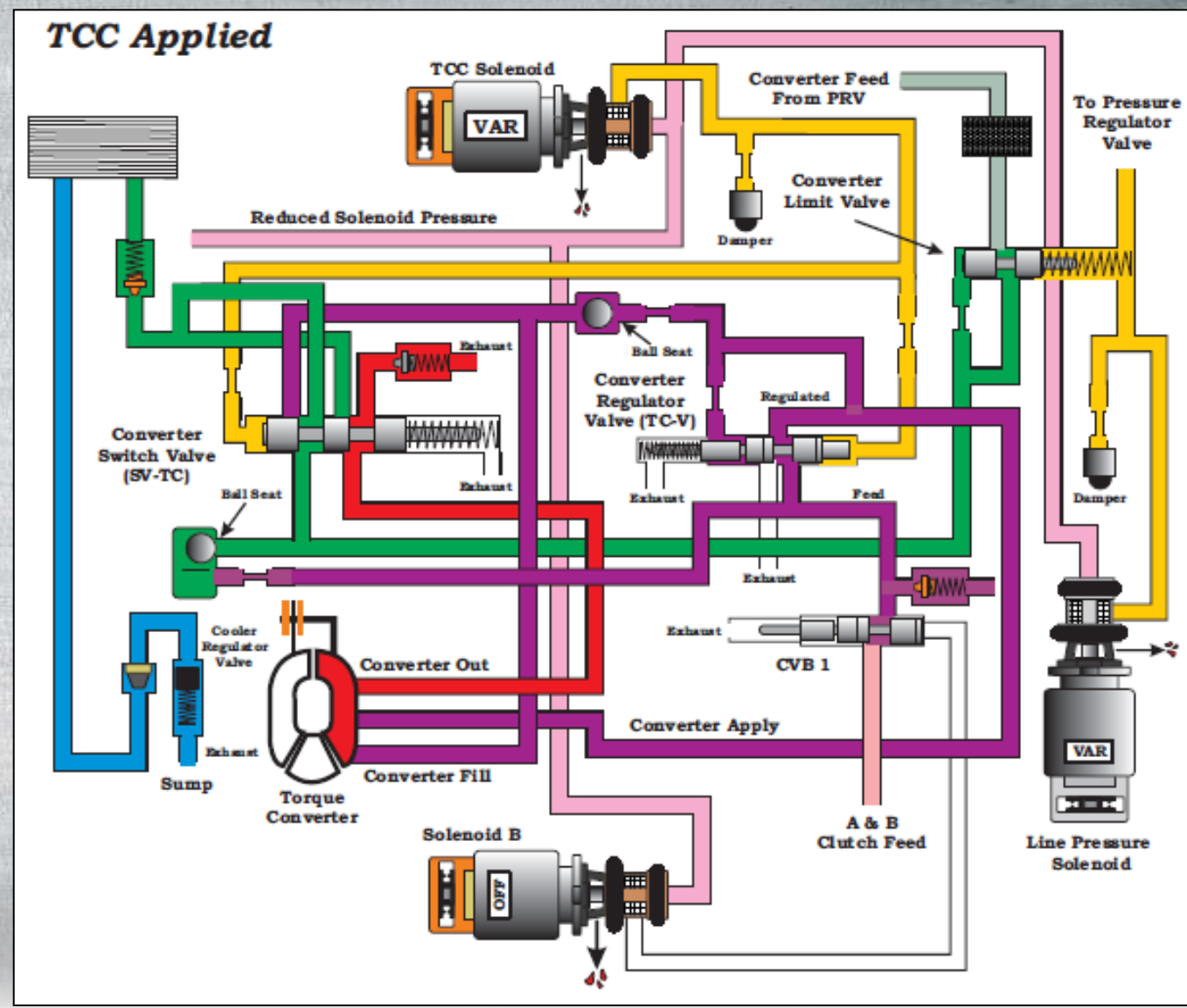


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TCC Function Applied



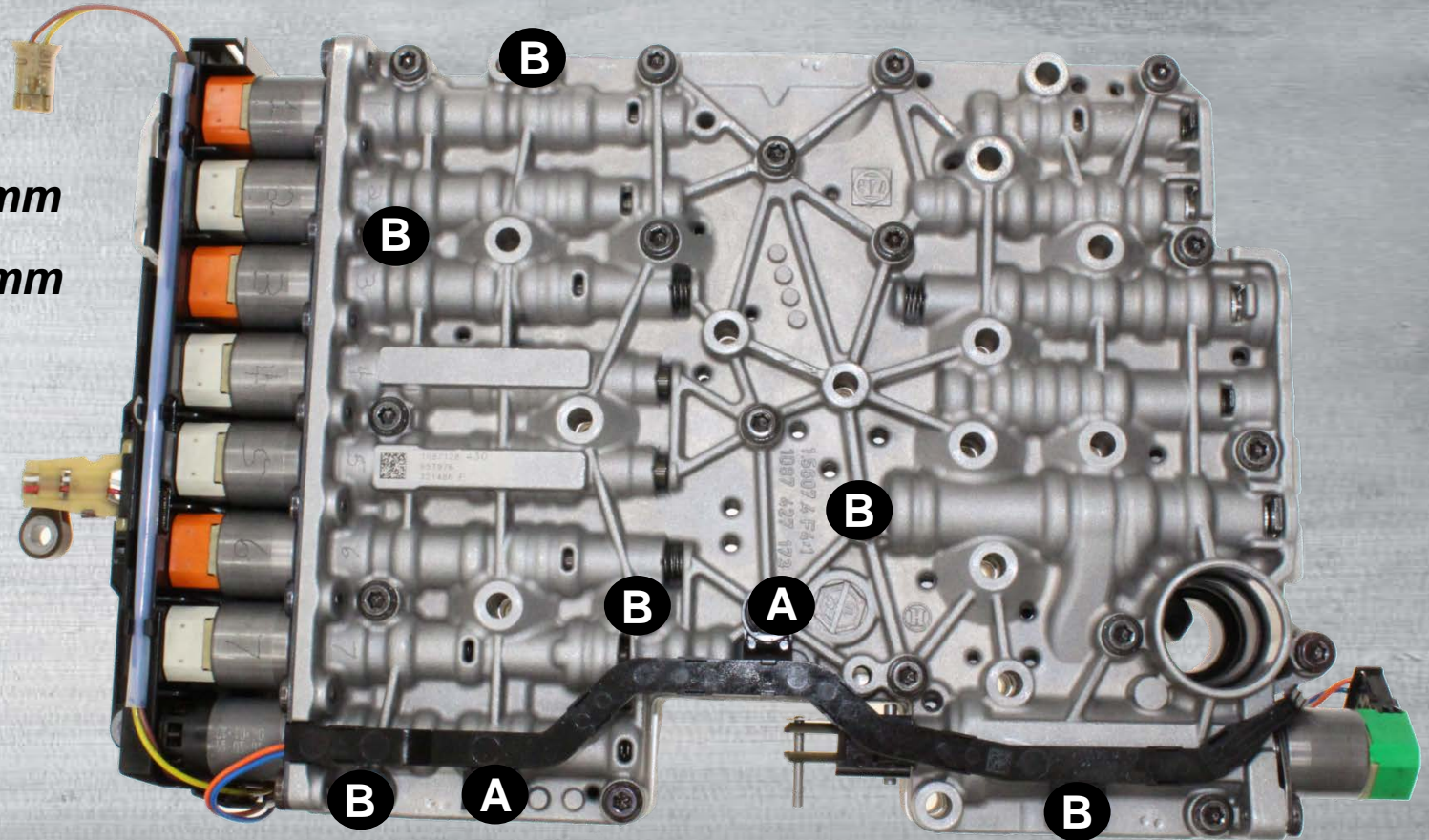
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TCM Removal

Remove these bolts to remove the TCM



A = 40mm

B = 60mm

Torque Specifications 8Nm



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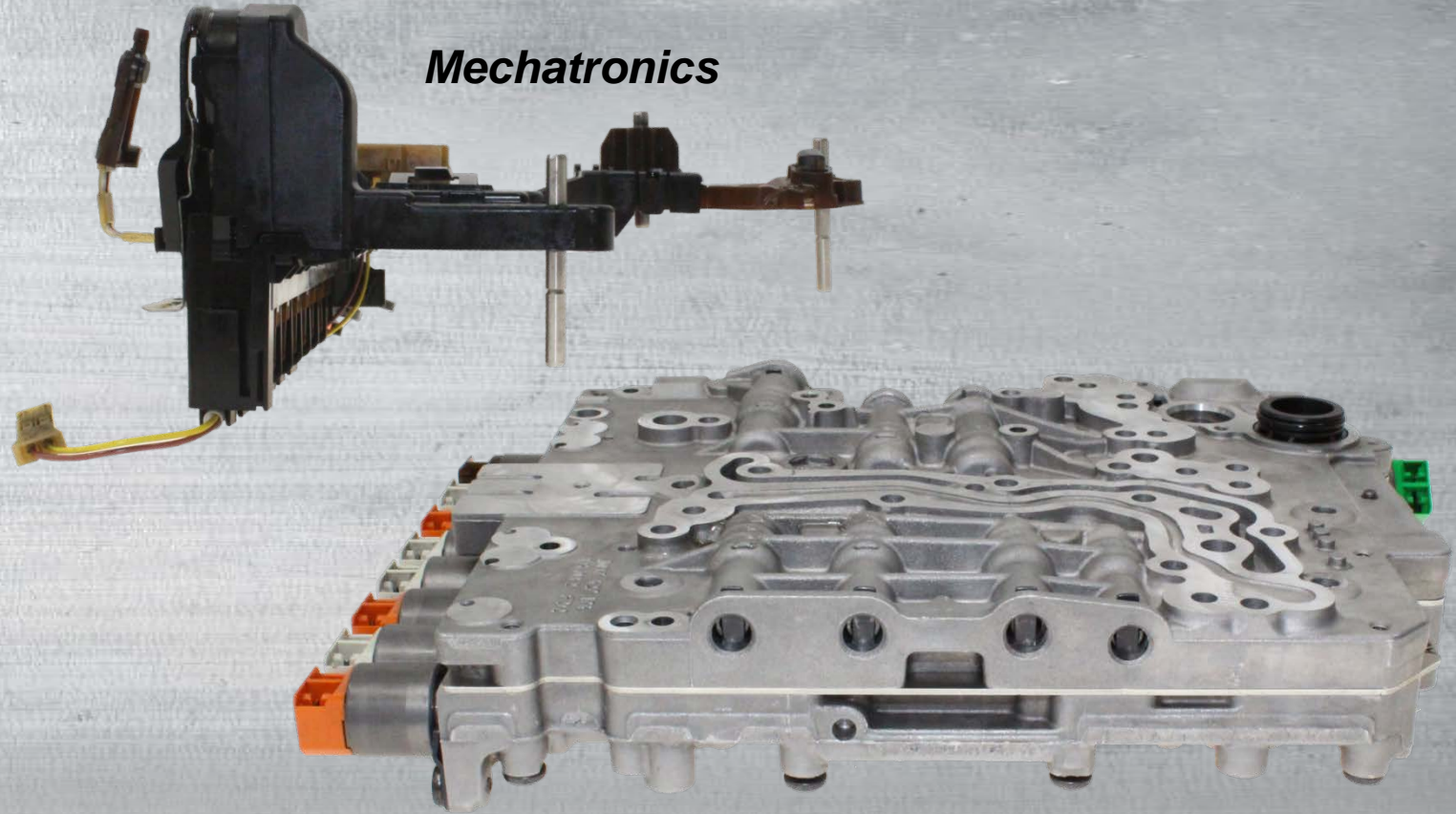


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TCM Removal

If the TCM does not lift off of the valve body use a screwdriver to gently pry the TCM assembly off the valve body. The alignment pins will stay with the TCM.



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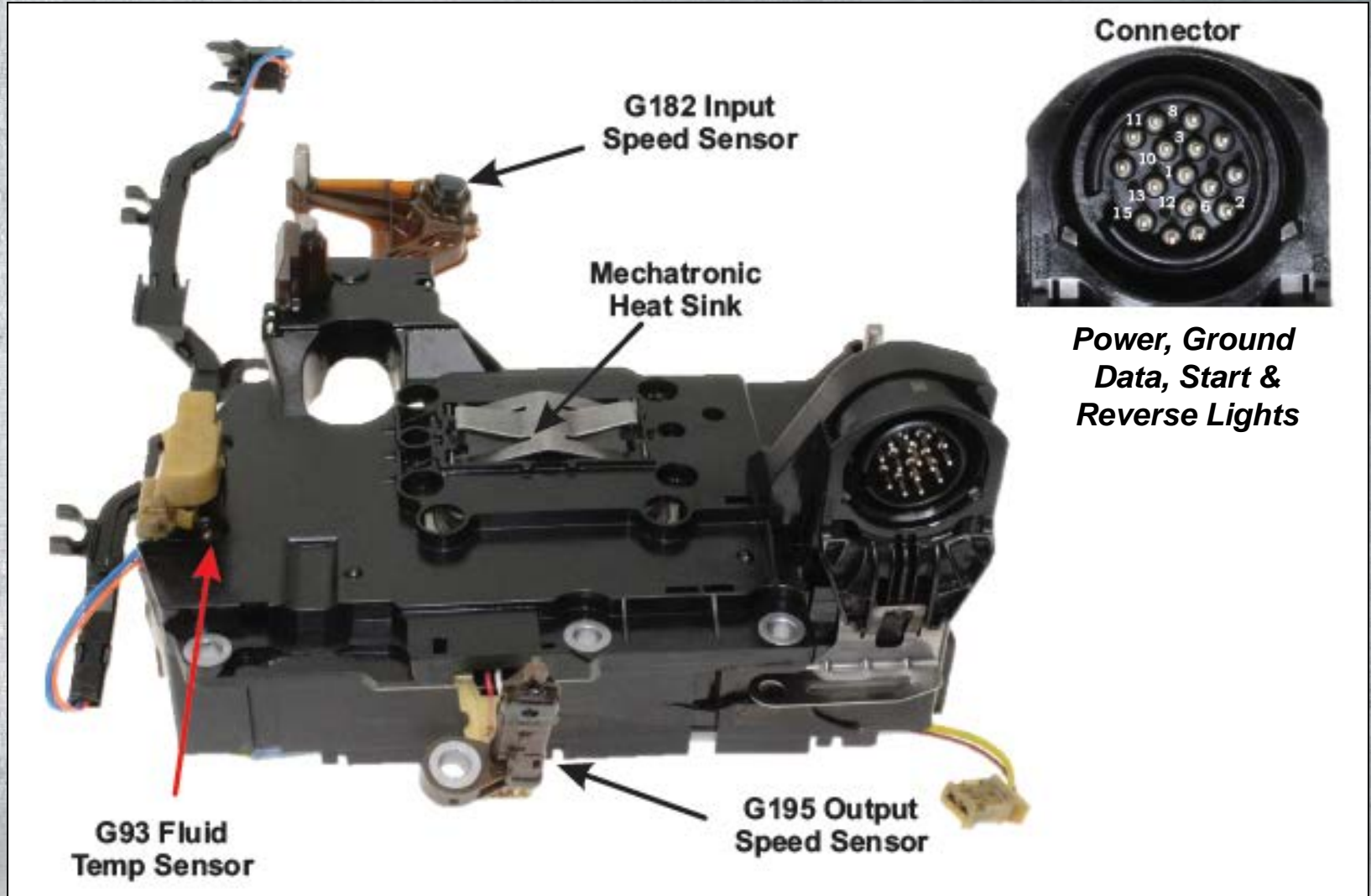




Mechatronic Unit



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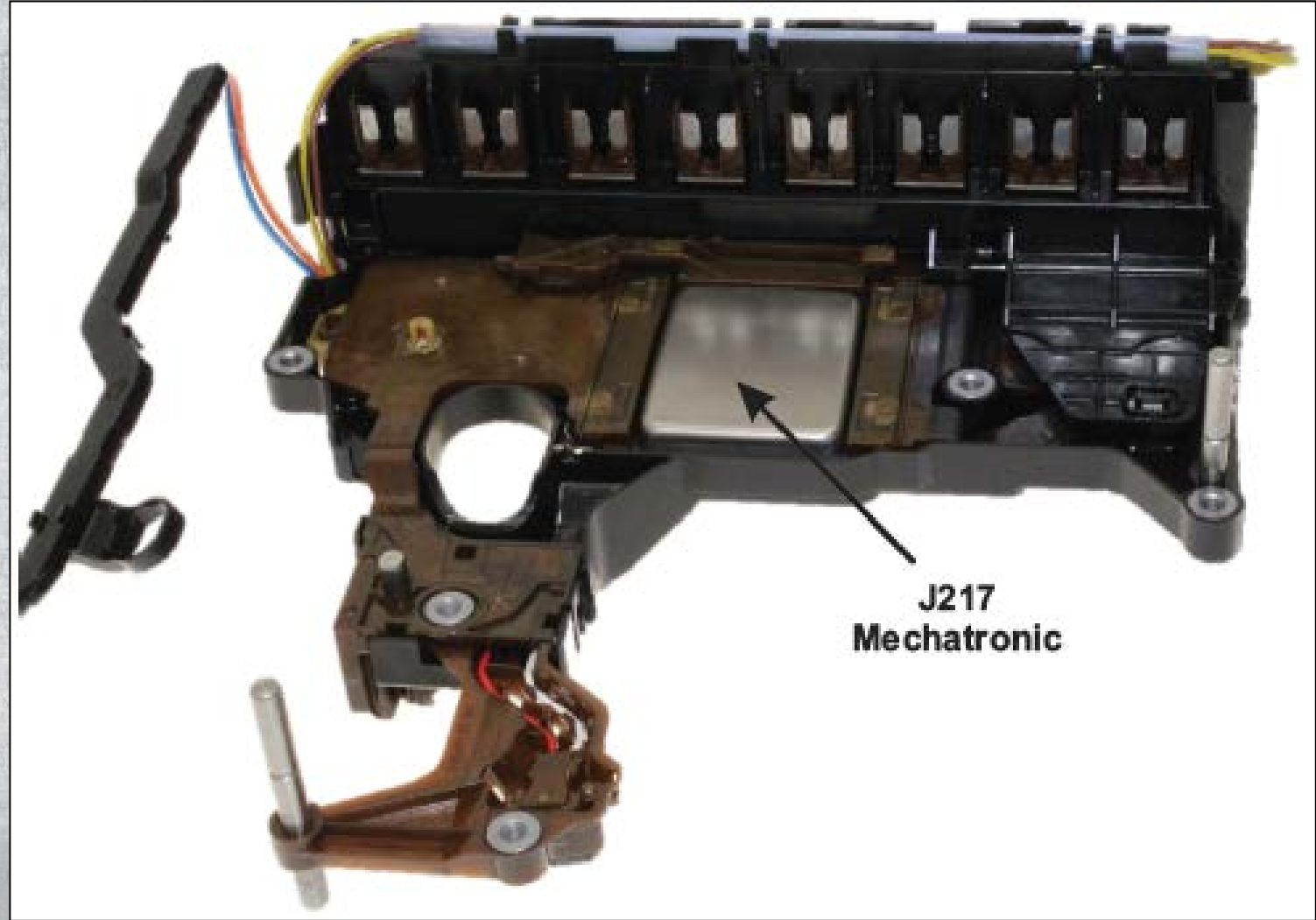




Mechatronic Unit



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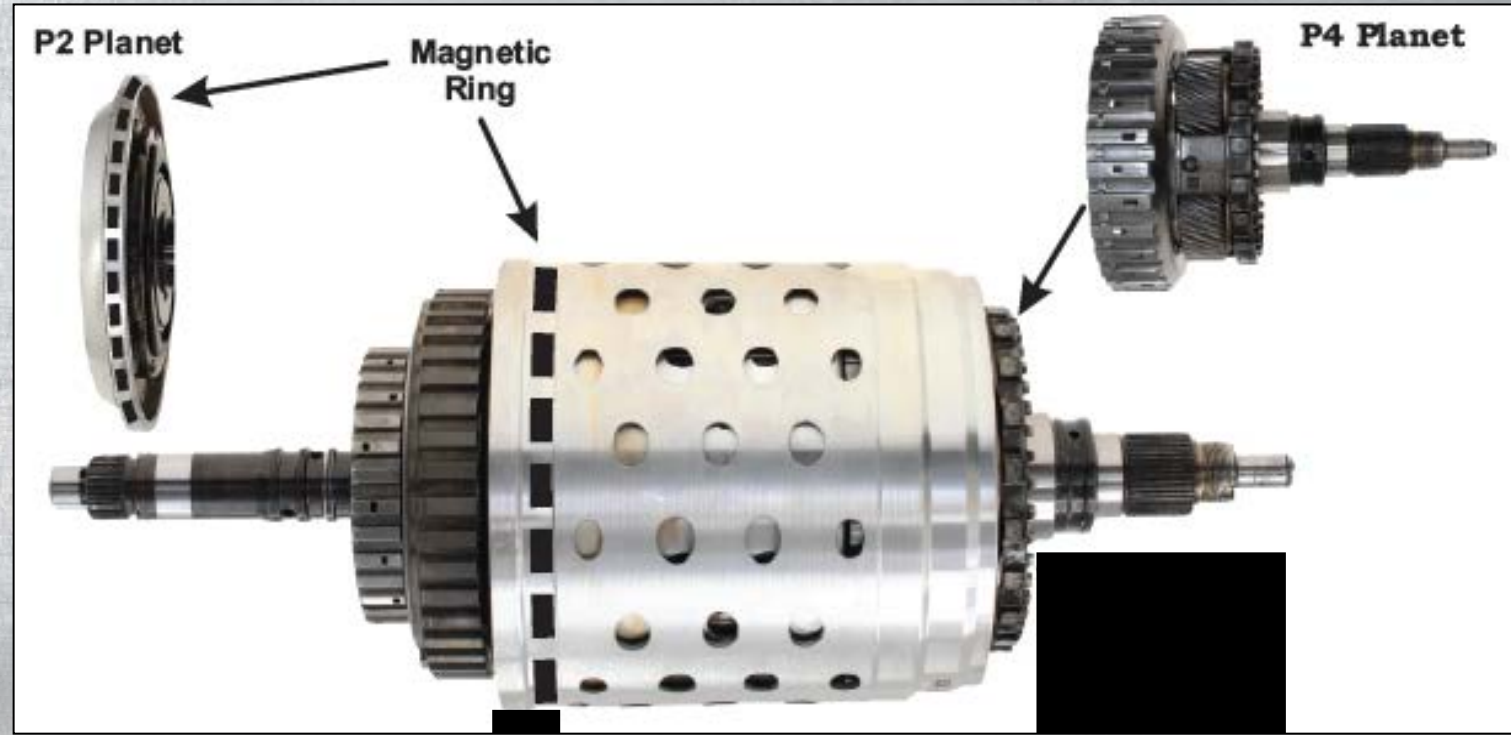


Speed Sensors

Input Speed Hall Effect Sensor G182 monitors an encoder wheel with a magnetic ring.

The Output Speed Hall Effect Sensor G195 monitors output speed by the extended teeth on the parking gear.

Both of these Hall Effect sensors are referred to as “Intelligent Sensors”.

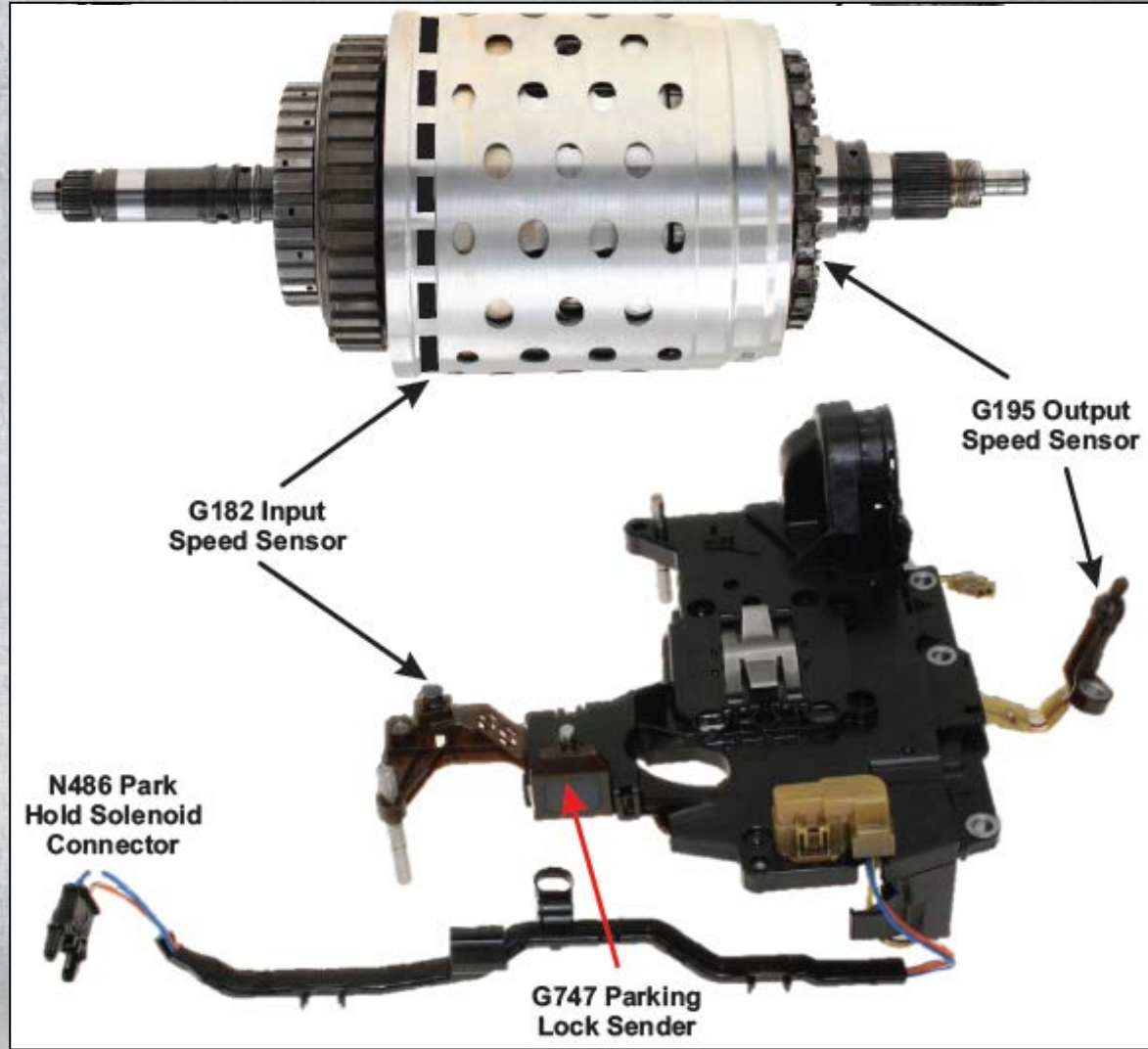


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Speed Sensors



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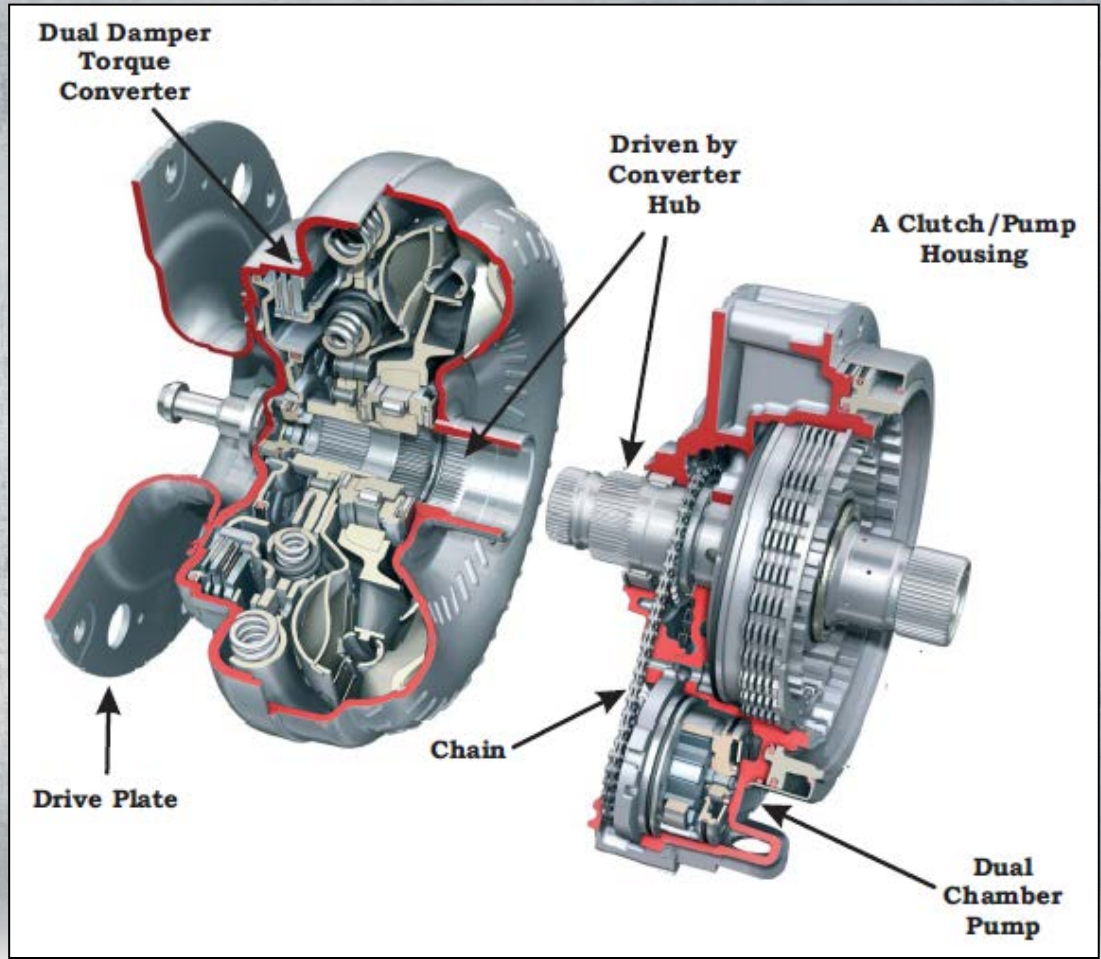




Pump Assembly

This ZF unit is designed with a chain driven, double stroke vane pump.

The torque converter hub is splined to a drive sprocket that turns a chain to rotate the pump



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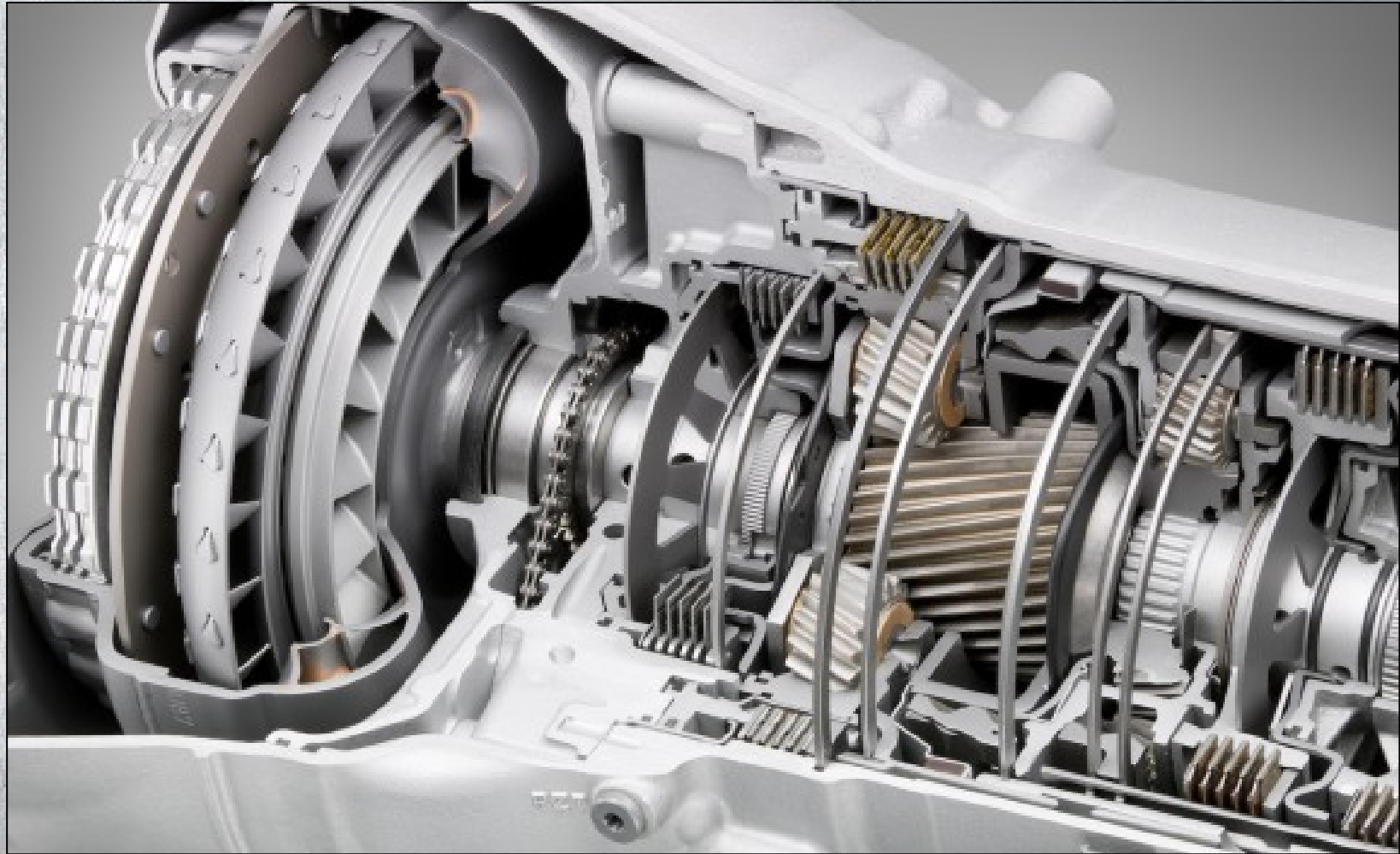




Pump Assembly



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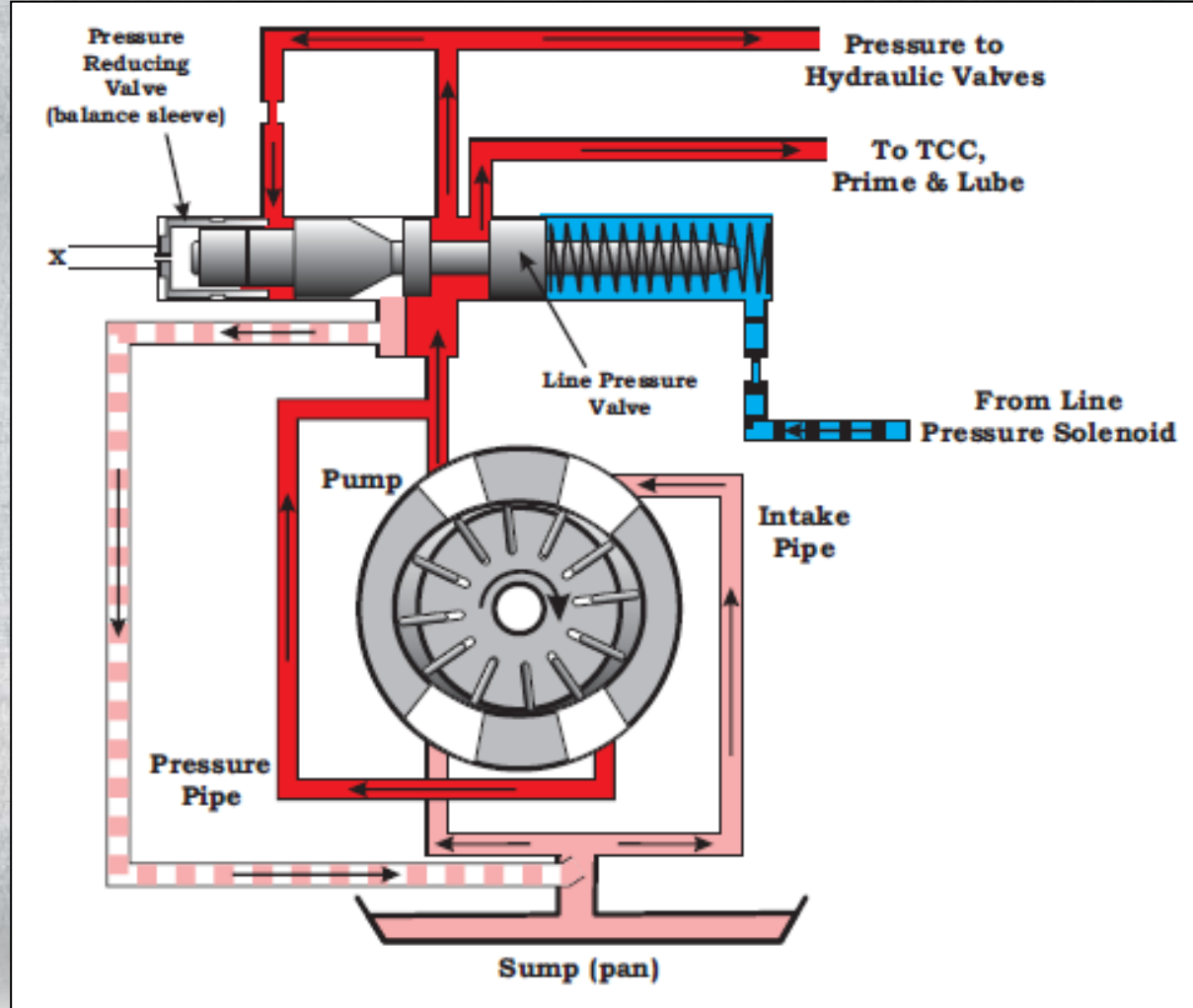
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Pump Function

Reduces Cavitation & Noise



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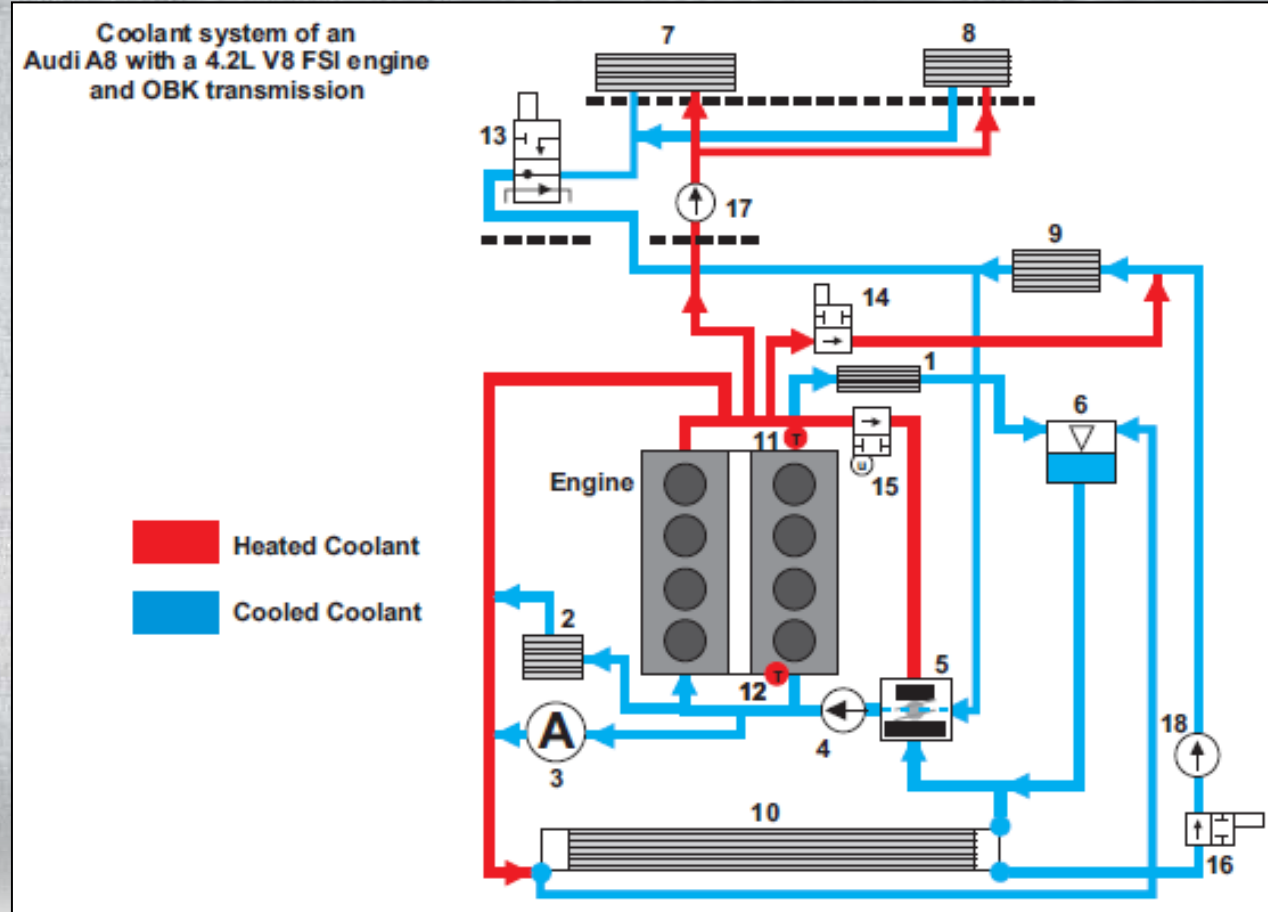


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Audi Innovative Thermal Management (ITM)

The gearbox cooling system is part of the Innovative Thermal Management System (ITM). This system improves fuel economy by shortening the warm-up phase of the engine and transmission.



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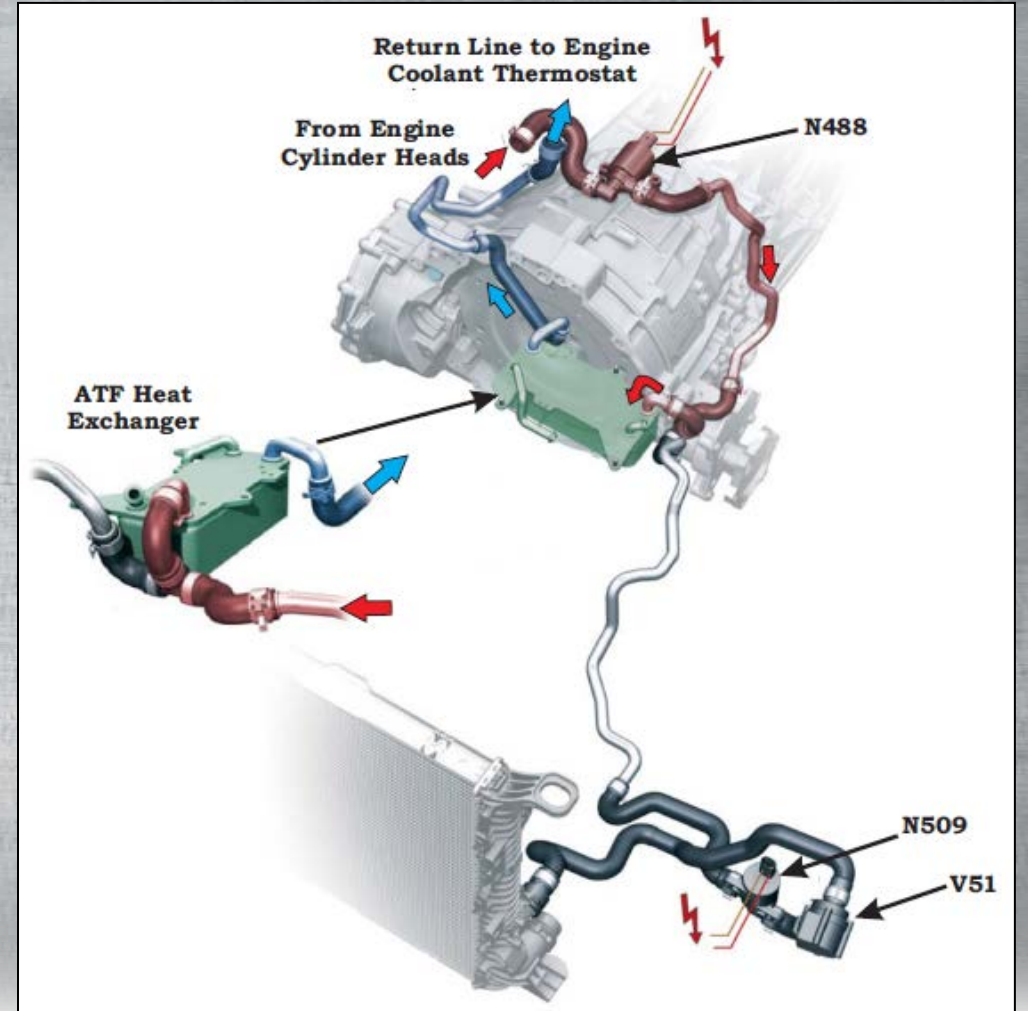
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Audi Innovative Thermal Management (ITM)

The air conditioning system (interior heating) have the highest priority. Engine and transmission heating are secondary.

The illustration shows the engine and transmission in a **cold** state.



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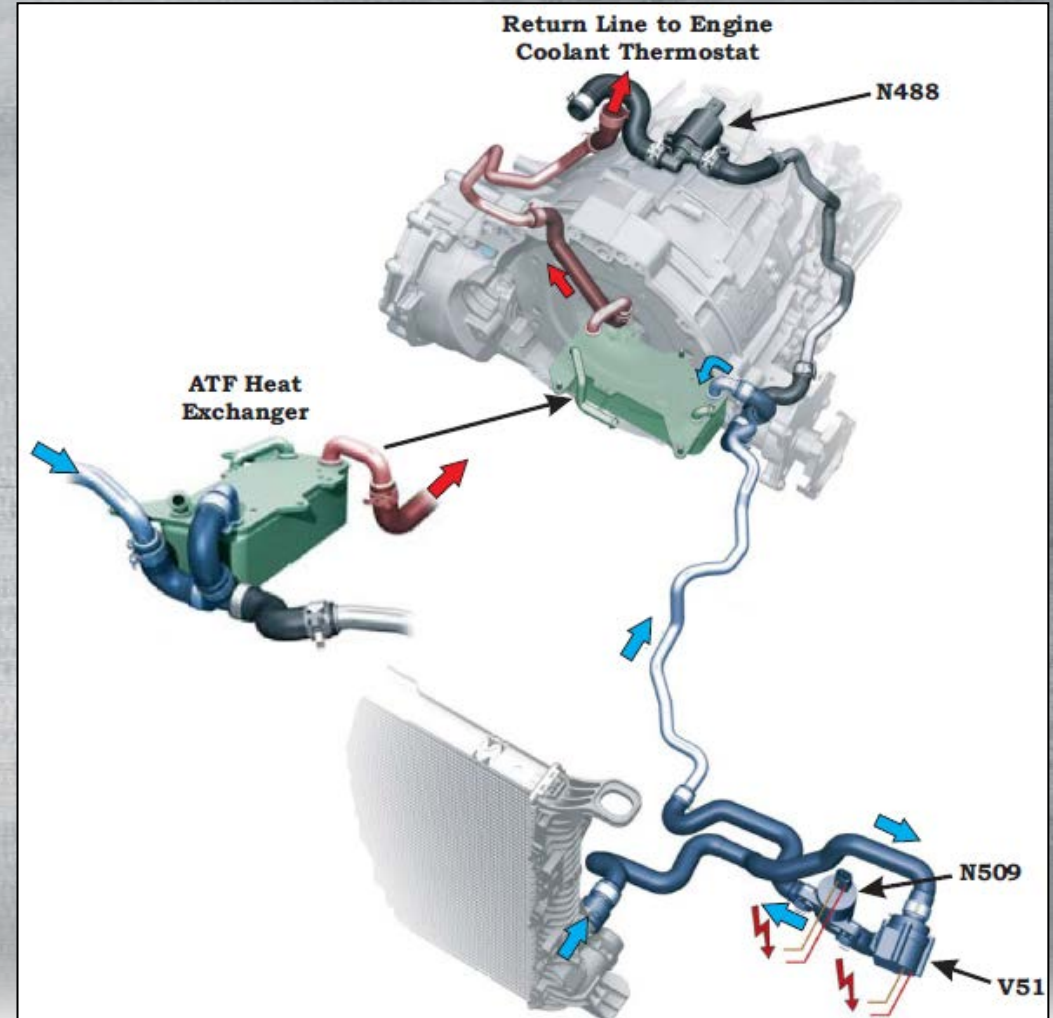




Audi Innovative Thermal Management (ITM)

This illustration shows the engine and transmission at operating temperature.

The transmission heating phase ends when a defined ATF temperature is exceeded and N488 is closed (switched OFF).



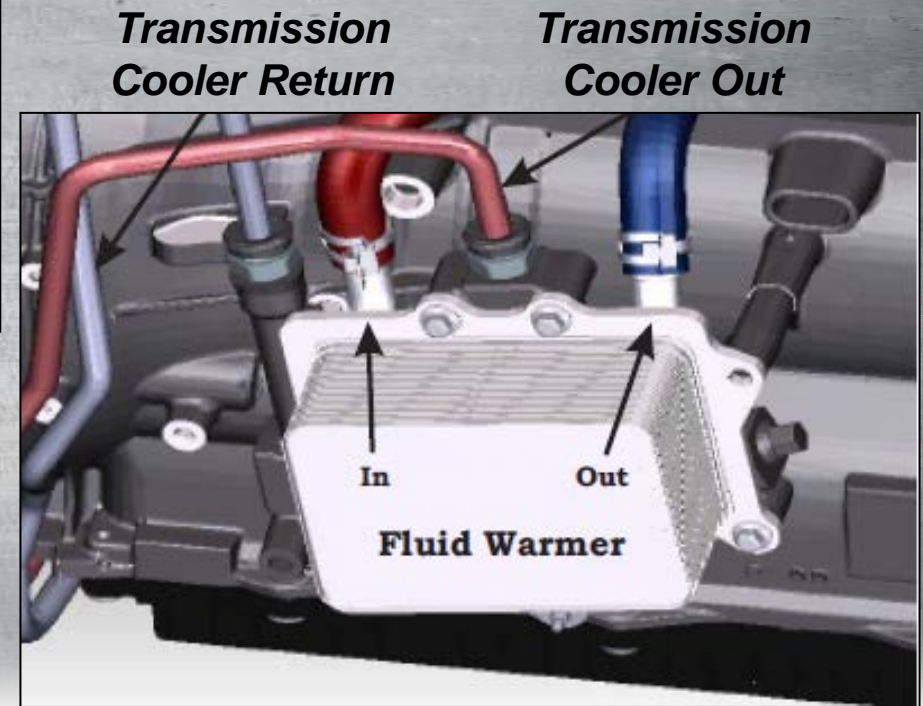
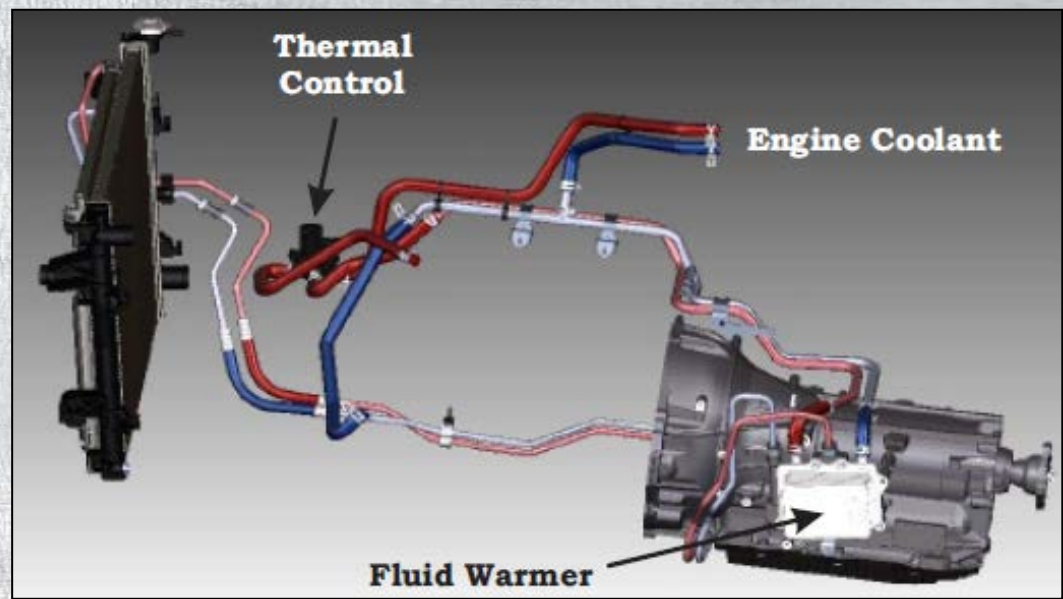
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Dodge 8HP45 Transmission Thermal Management Unit (TMU)

The ZF8HP is so efficient it requires an auxiliary heater to keep the fluid at a proper temperature of approximately 80C (176F)



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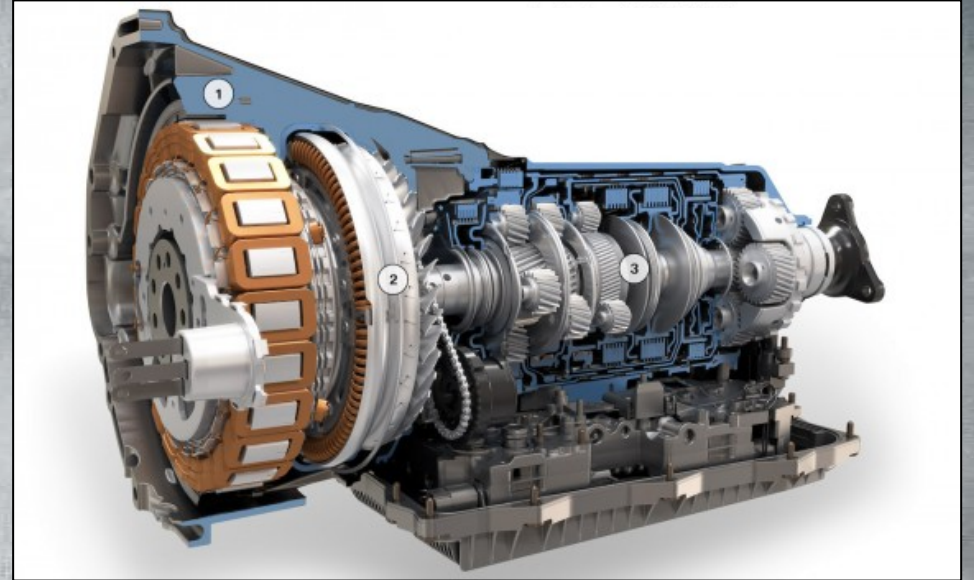
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Hybrid Models

**Dodge 15kW Electric Motor
210Nm Torque
Hydraulic Lockup Converter**

**DynaStart System
(similar to Mercedes)**



**BMW V8 Twin Turbo Gas
330kW / 650Nm Torque**



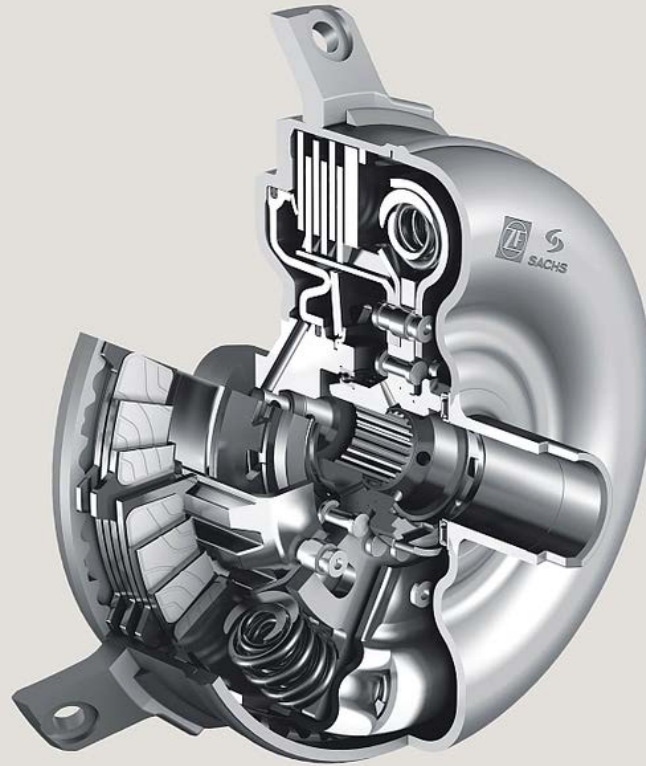
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Start/Stop Function

Wet Starting Clutch



Start Stop Feature

The engine can be re-started in only 350 milliseconds using an Integrated Hydraulic Impulse Oil Storage (HIS) system.

This system offers the option of eliminating the external starting element.



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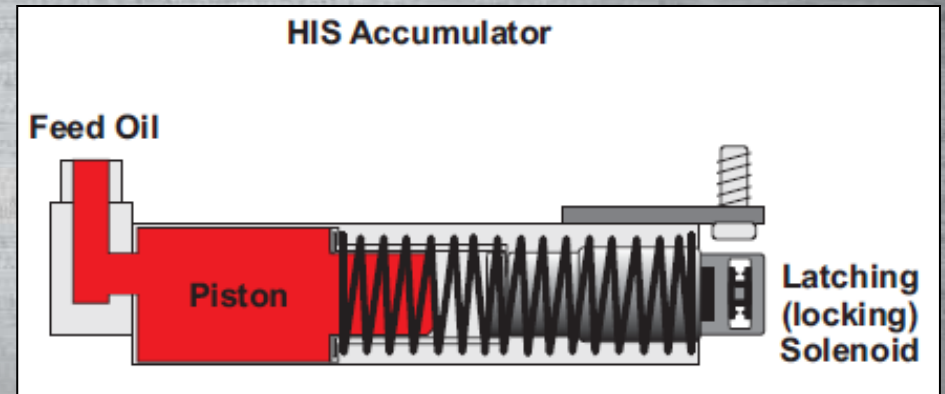
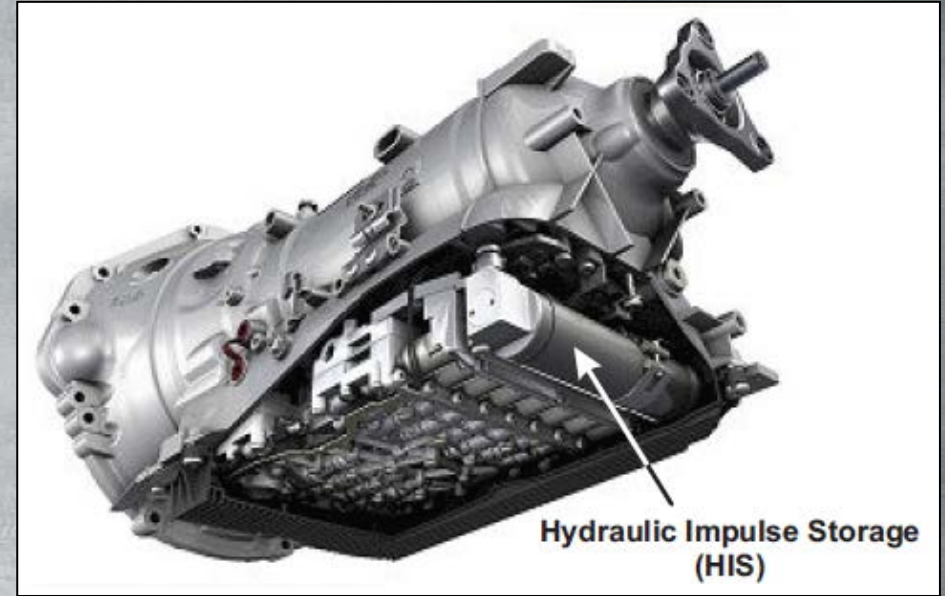
Hydraulic Impulse Storage (HIS)

With engine running, transmission fluid is pumped into the HIS accumulator and stored.

A latching solenoid maintains the piston under tension until the piston is released.

Spring pressure pushes the piston sending fluid out of the HIS into the transmission.

When the engine is restarted the HIS is refilled and ready for the next cycle.



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Any Questions? Thank You For Attending

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62TE Clutch Volume Index

This information can be found on the ATRA website to members in the repair center by typing in 62TE CVI in the search box. If you're a non member take a moment and write these specifications down.

62TE Clutch Volumes	(Preliminary)
UD	26-74
2/4	16-54
OD	42-143
L/R	16-63
LC	16-25
DC	26-34



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