QUALITY DRIVEN® SERVICE

SUBARU

CERTIFIED SUBARU TECHNICIAN

Technician Reference Booklet

5 Speed Automatic Transmission

Module 305

AUTOMOTIVE Youth Educational Systems®

July 2010

MSA5P0474C

Technical Training

This Technical Reference Booklet (TRB) is designed to be used in a classroom environment or as a guide for self study.
The TRB is not intended to be used as a supplement or substitute for the Subaru Service Manual. Always consult the appropriate Subaru Service Manual when performing any diagnostics, maintenance or repair to any Subaru vehicle.

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SRS Disclaimer:

The airbag Supplemental Restraint System (SRS) affords the driver and the front passenger additional protection in moderate to severe frontal and side-impact collisions and outboard 2nd row passengers additional protection in moderate to severe side impact collisions. This system provides supplemental protection only, and seatbelts must be worn in order to avoid injuries to out-of-position occupants upon bag deployment and to provide the best combined protection in a serious accident. Children should always be properly restrained in one of the rear seats. See Owner's Manual for recommended seating position.

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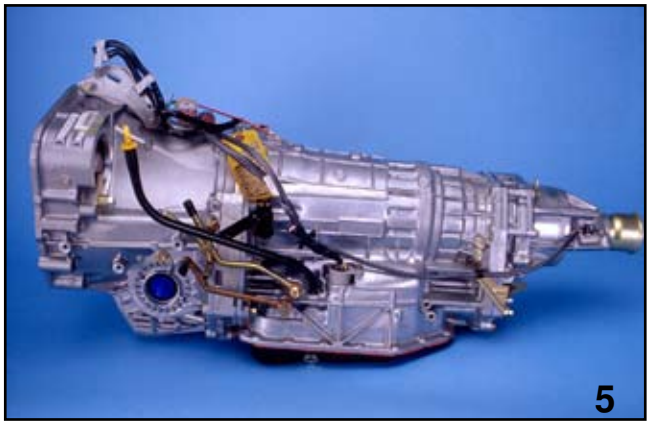
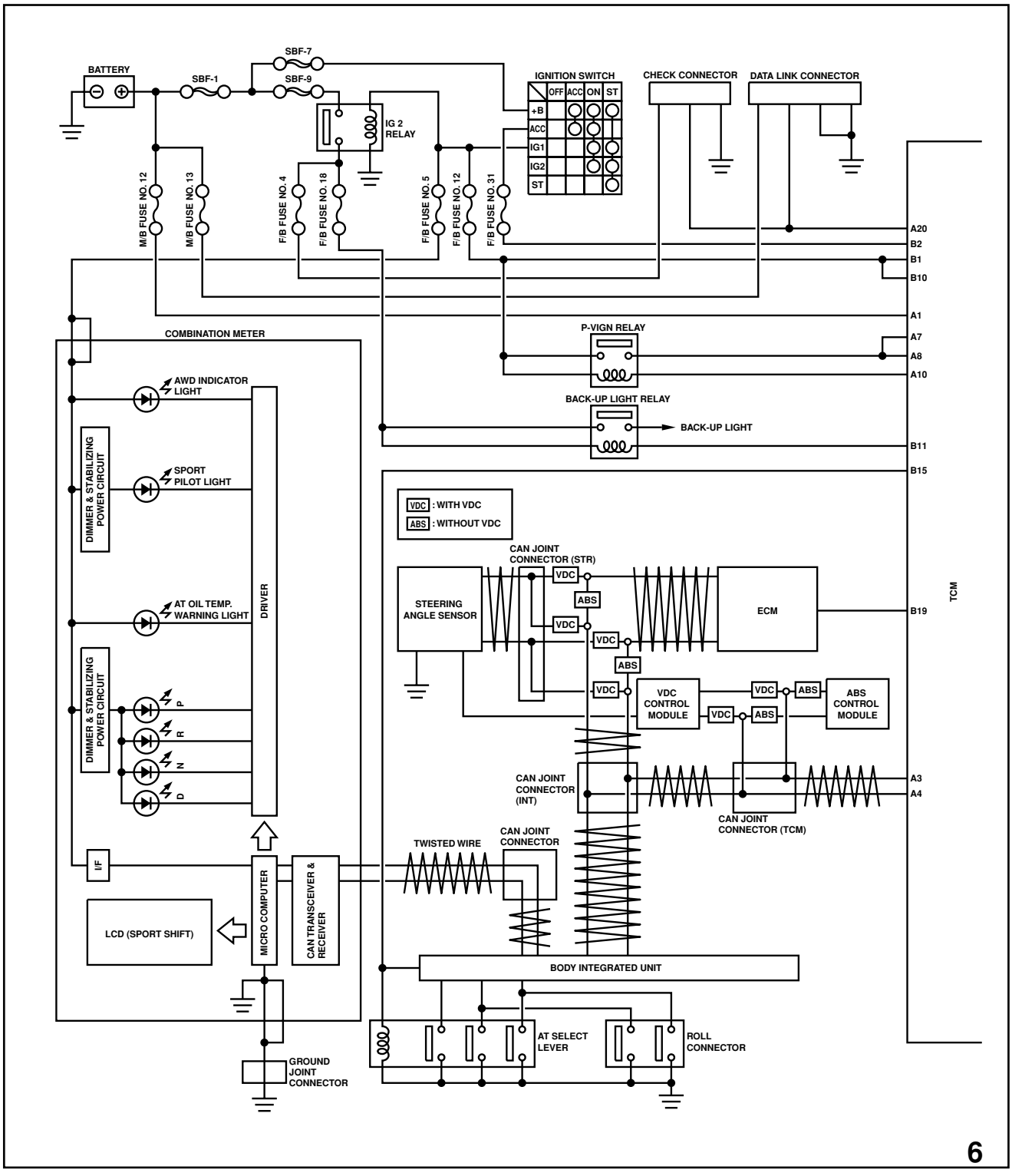
5 Speed Automatic Transmission (305)

INTRODUCTION AND OPERATION

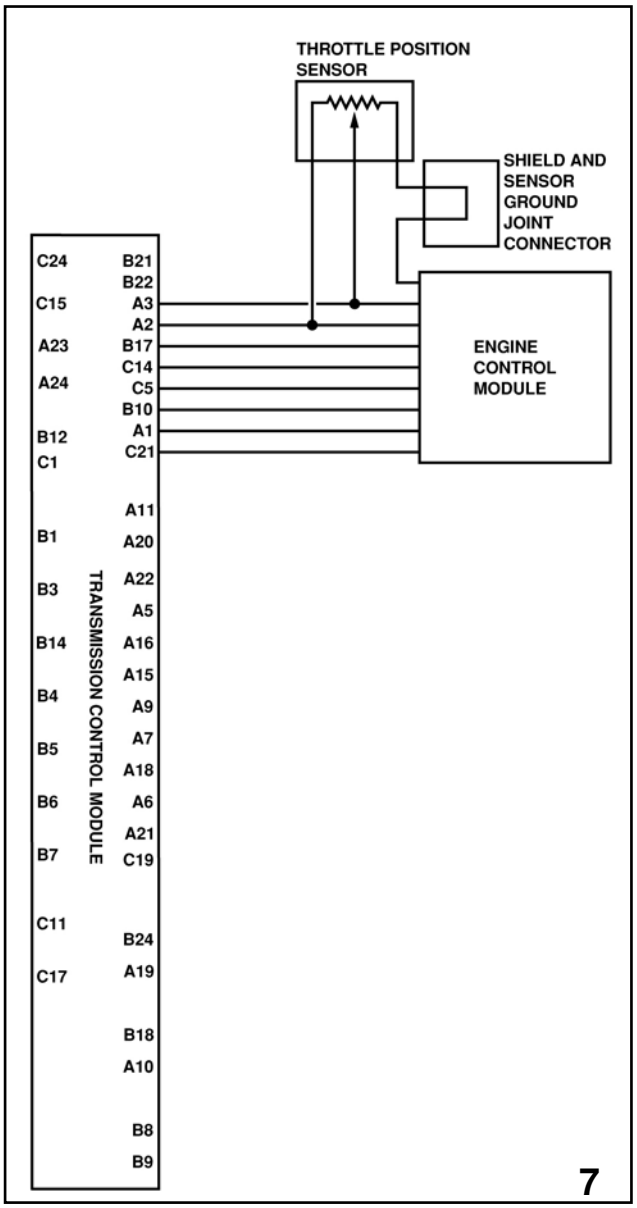


5 Speed Transmission

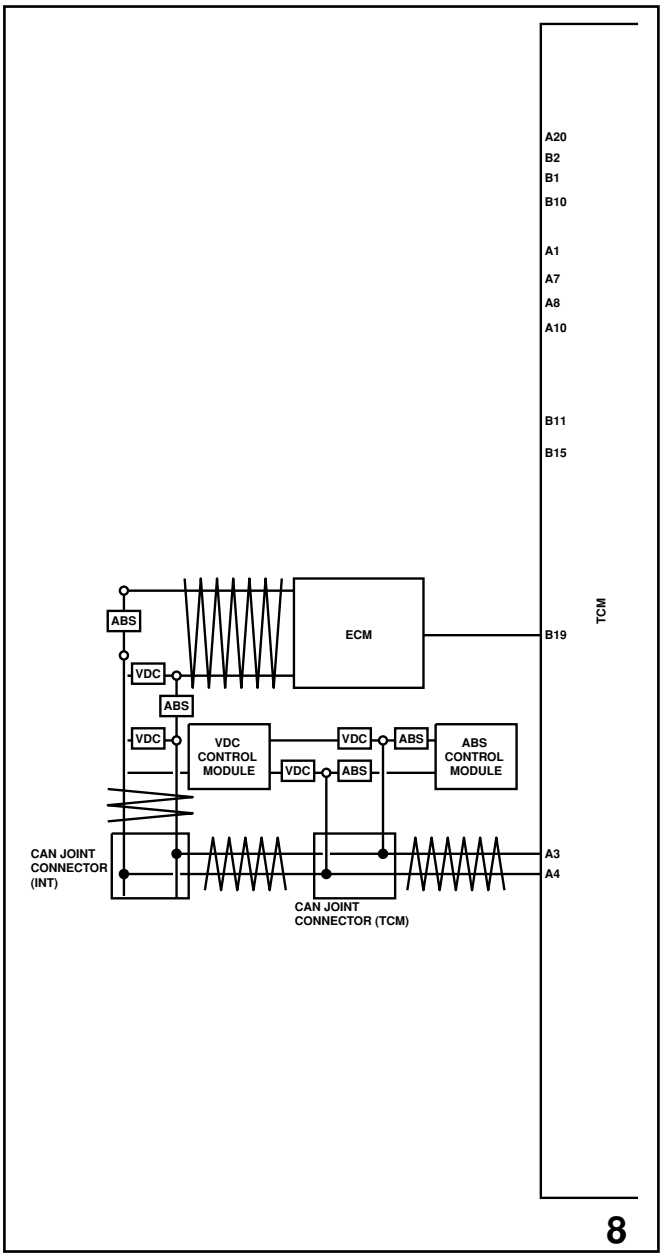
The 5 speed automatic transmission equipped on select 2005 Legacy vehicles is designed to electrically function with the Local Area Network (LAN). The LAN is a network of computers and components that share information over a single pair or wires. The name for this shared information is Controller Area Network (CAN) data. CAN data is transmitted, received and translated by creating or reading a series of binary codes from one computer to the others. All of the computers on the LAN have this ability; however, components on the drive train side operate at a faster rate than those on the body side. When drive train components and body components need to share information a translator must be used. This translator is called the Body Integrated Unit (BIU). The faster signals from the drive train and the slower signals of the body components are adjusted so that they can be read and understood by each other. This is also referred to as a gateway function. The BIU performs many other functions but the gateway functions are all we are concerned with in regards to the 5 AT.



2005 Wiring Schematic



2004 4AT



2005 5AT

The LAN also reduces the number of wires connecting to the TCM. For example the throttle position sensor normally hard wired to the TCM is now delivered to the TCM through the LAN. This improves performance and reliability by reducing the number of physical connections and conductors that can short or open. Additionally the diagnostics become more simplified as the number of DTCs and circuits to trouble shoot are reduced.

The chart below lists all the signals that the TCM receives through the LAN.

T = Transmits the signal

R = Receives the signal

G = Gateway function

Signal	ECM	TCM	ABS	SAS	BIU	Com. Meter	AC
Current engine torque	T	R	R				
Accelerator pedal open angle	T	R	R				
Engine speed	T	R	R		R		
Torque down prohibit	T	R					
Idle switch	T	R					
Power steering switch	T	R					
AC compressor output	T	R					
Cruise control main switch	T	R	R				
Throttle position switch	T	R					
Torque control signal	R	T					
Idle up request	R	T					
Gear position	R	T			GR	R	
Lock up information	R	T					
AT turbine speed	R	T					
Road surface gradient est.	R	T			G	R	
ATF temperature	R	T			G	R	
Sport lamp output		T			G	R	
AWD lamp output		T			G	R	

5 Speed Automatic Transmission (305)

			VDC				
Major Signal Name	**ECM**	**TCM**	**ABS**	**SAS**	**BIU**	**Com. Meter**	**AC**
ECO lamp output		T			G	R	
Sports shift buzzer output		T			G	R	
Shift range information	R	T			G	R	
AT trouble info 1,2	R	T			G	R	
Yaw rate	R	T					
Brake pressure	R	T					
Lateral acceleration	R	T					
ABS operation	R	R	T		R		
TCS operation	R	R	T		G	R	
VDC/ABS sensor failure	R	R	T		R		
Vehicle speed	R	R	T		GR	R	R
ABS/VDC judgment flag	R	R	T		R		
Brake lamp switch	R	R			T		
Sport Shift mode switch		R			T		
Sport Shift, shift up		R			T		
Sports shift, shift down		R			T		
ECO mode switch	R	R			T		
BIU failure info	R	R			T	R	
Ambient temperature Cel.	R	R			T	R	R
Engine coolant temp	T	R			G	R	R

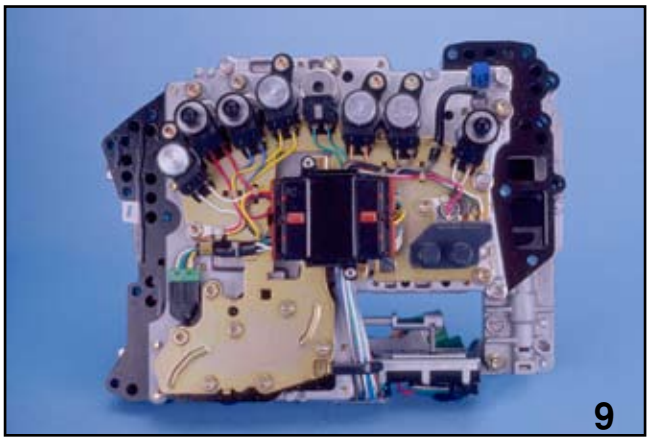
It is important to remember that analog signals remain an integral part of the operation of the transmission.

- Power
- Ground
- ATF temperature sensor 1
- ATF temperature sensor 2
- High & Low Reverse Clutch oil pressure switch
- Front Vehicle speed sensor
- Lateral G sensor
- Inhibitor switch
- Rear vehicle speed sensor
- Front brake oil pressure switch
- Turbine speed sensor 1
- Direct Clutch oil pressure switch
- Low Coast brake oil pressure switch
- Input clutch oil pressure switch

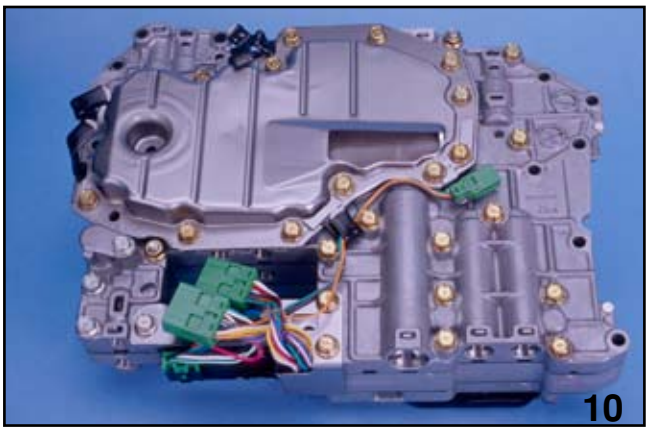
These input signals are all located inside the transmission except for:

- Power
- Ground
- Speed sensor 1
- Turbine speed sensor 1 and the lateral G sensor

These signals control the activation and timing of the solenoids located on the valve body.

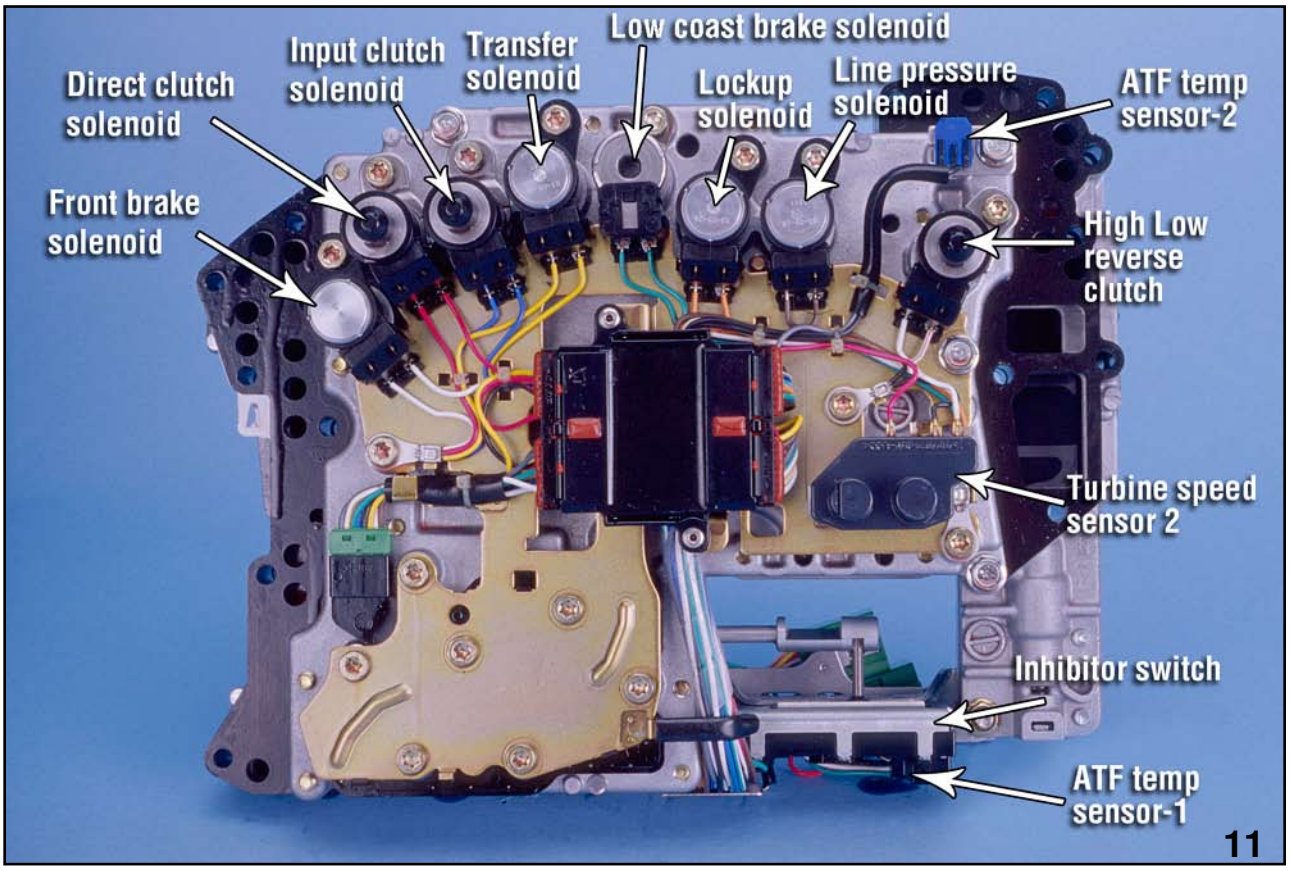


Transmission Side View of Control Valve Body

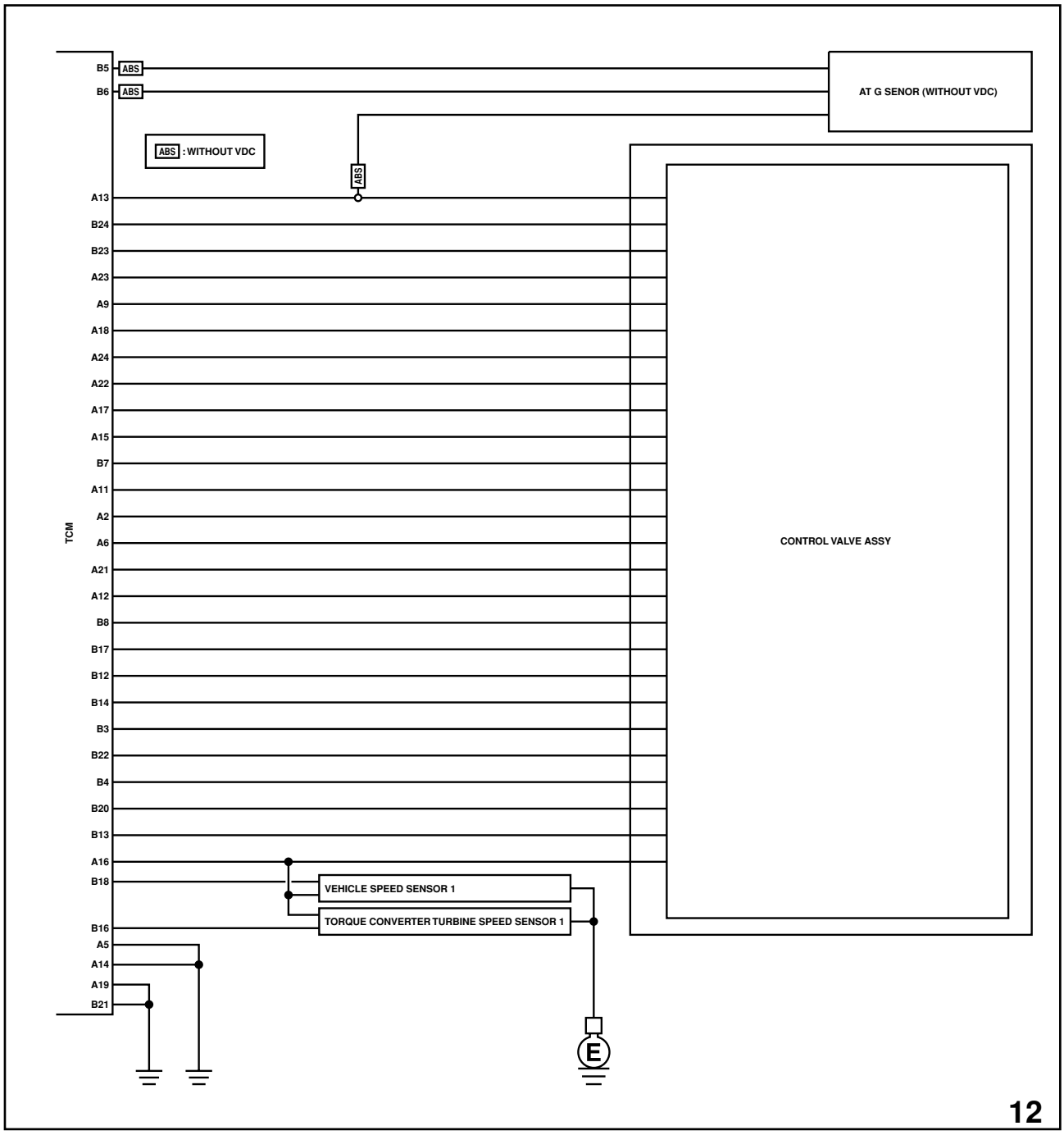


Oil Pan View of Control Valve Body

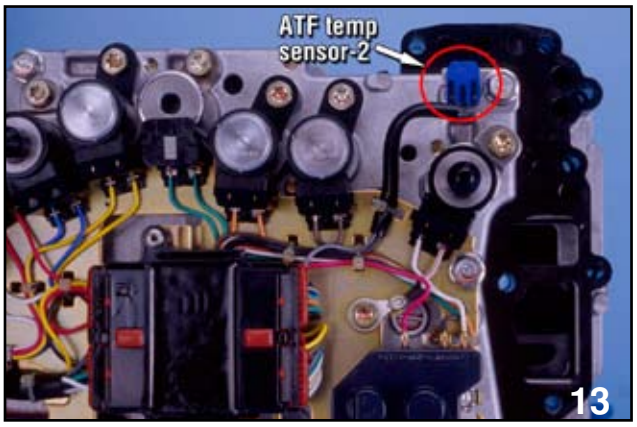
The valve body cannot be serviced. The factory calibrates and adjusts each solenoid and monitors the reaction and timing of the valves and stores the information on the built in memory box which is located on the valve body itself.



Valve Body Component Location



Analog Signals



Memory Box

The TCM uses the data on the memory box for initial control of the valves until adjustments are made to fine tune their control.

Contents of shift learning control

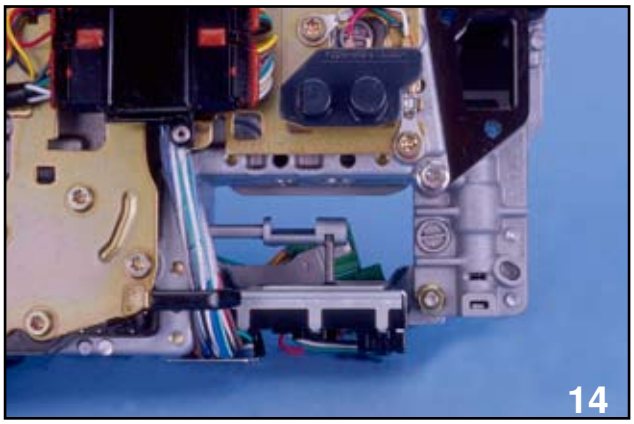
1. The current and oil pressure characteristics of the linear solenoid are measured by the control valve unit, and calibration values are stored in the memory box at the factory.
2. The transmission is test-driven with the hydraulic control valve, and the input and output torque variation characteristics that the transmission undergoes during shifting are stored in the memory box as initial learning values.
3. The calibration values and initial learning values stored in the memory box at the factory are read by the TCM. Based on this data, the TCM executes learning control, which ensures smooth shifting right from day one.

ATF Temperature sensors

ATF temperature sensor 1, which is mounted on the inhibitor switch, measures the temperature of the ATF in the oil pan.

ATF temperature sensor 2, which is mounted in the hydraulic control valve oil passage, measures the temperature of the ATF returning from the torque converter. The value measured by ATF temperature sensor 2 is used for lock-up clutch control.

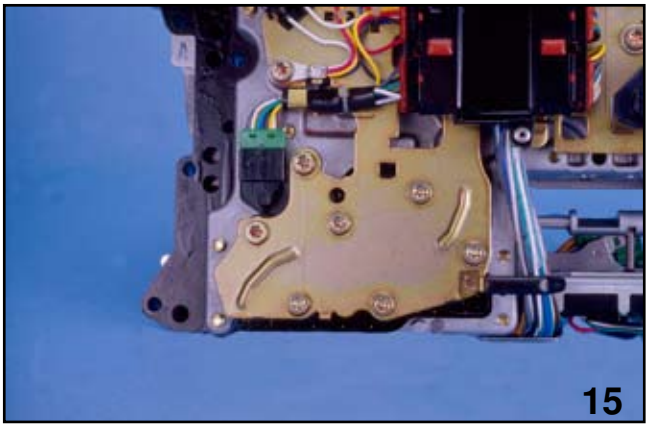
Turbine Sensor



Turbine Speed Sensor 2

Turbine sensor 1 detects the rotation of the front sun gear, while turbine sensor 2 detects the rotation of the front carrier. Using the values detected by these sensors, the TCM calculates the turbine speed and uses it for shift control.

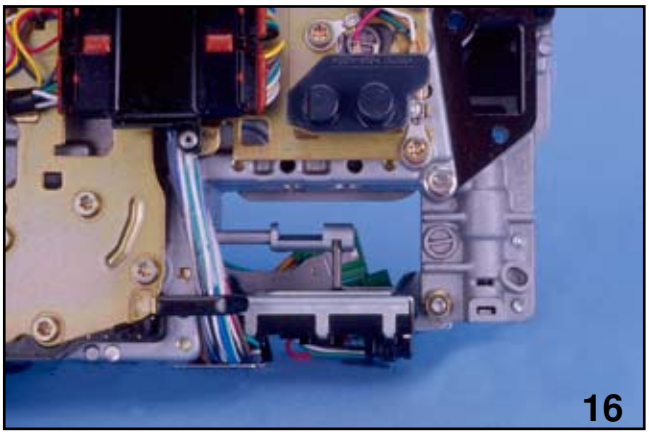
Oil Pressure Switches



Oil Pressure Switches

Five oil pressure switches detect the shift circuit oil pressure, and this data is used to diagnose solenoid valve trouble.

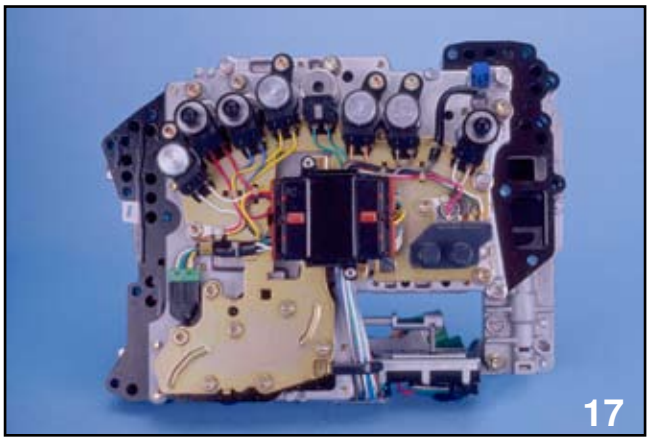
Inhibitor Switch



Inhibitor Switch

A slide-switch type inhibitor switch is provided inside the transmission to detect the manual valve position (P, R, N, D).

Based on the values detected by this switch, the TCM outputs a P signal or N signal to the ECM, allowing the starter motor to operate only in P position or N position. In R position, it turns on the back-up lamp relay and illuminates the back-up lamp.



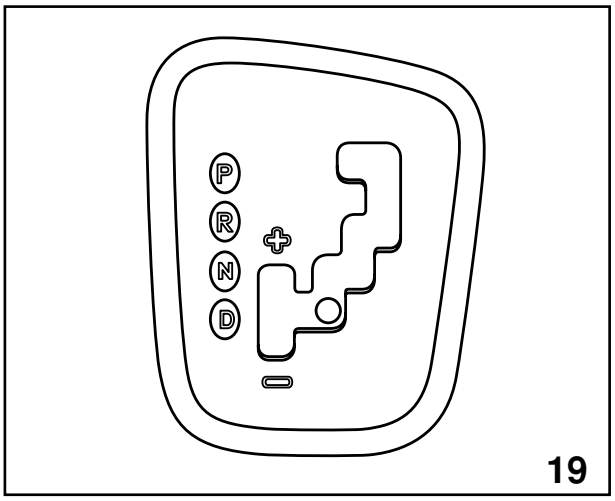
Solenoids

Hydraulic Control Valve has 8 solenoid valves, which are used for line pressure control, shift control, and various other controls.

SELECTOR LEVER FUNCTION

There are three modes on the selector lever. Normal mode, Sport mode and Manual shift mode. These operation modes are changed over with the position of the selector lever.

Normal Mode

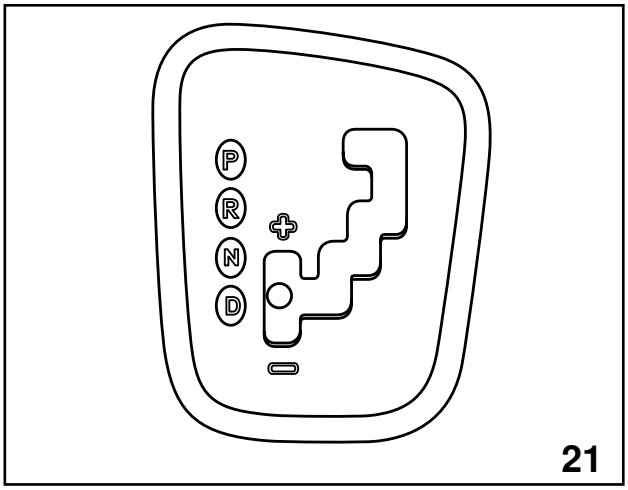


Selector Normal

Drive Light

The TCM performs gear shifting control according to driving conditions by using the normal shifting map stored in the memory of the TCM.

Sport Mode



Selector Sport

Sport Light

When the selector lever is moved to the sport mode position the TCM changes over shifting control map data from the normal map to the sport mode map. The shifting up and the shifting down point are varied more high ranges. (sports mode only).

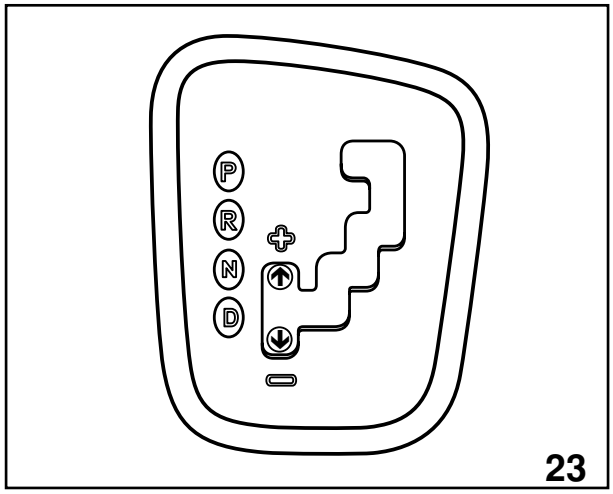
Control during cornering

When the system interprets that the vehicle is turning a corner by the lateral acceleration and the change rate in vehicle speed, it prevents unwanted upshifts to maintain a stable drive force and cornering performance (operates in sports shift mode only).

Sports Mode Control

When the shift lever is moved toward the manual gate side in D range, the SPORT light in the combination meter illuminates and the system enters the Sports mode. Gearshift timings are set at higher vehicle and engine speeds to make more use of low speed gears. The full lockup vehicle speed in 5th is also set higher than in the normal mode.

Manual Shift Mode Control



Selector Manual

Manual Lights +-

Manual shift mode is activated by moving the select lever to the manual gate and activating the up shift or downshift switch. .In this mode, operating the “+” switch causes up shifting while operating the “–” switch causes downshifting; manual shifting is enabled and the selected gear position is held while driving.

However, at certain vehicle speeds or ATF temperatures, the following inhibiting control is performed.

Up shift inhibiting and auto down shift control

The gear up shifts from 1st to 5th each time the "+" switch is operated, however, when the vehicle speed is too low for the selected gear speed, the TCM inhibits further up shifting. If the vehicle speed becomes too slow for the current gear speed, a downshift will be made automatically to prevent engine stall. When the vehicle comes to a stop, the transmission will always be controlled to shift to 1st speed unless the vehicle was in sports shift 2nd hold control.

Downshift inhibiting control

The gear downshifts from 5th to 1st each time the "–" switch is operated, however, when the vehicle speed is too high for the selected gear speed, the TCM inhibits further shifting. A sports shifting inhibiting buzzer will sound to warn the driver.

Engine over speed prevention control

If the engine speed exceeds the preset value during accelerating, the fuel supply is cut to prevent over-revving of the engine.

Semi sports mode

The up and downshift buttons on the steering wheel can be used in normal drive mode to temporarily shift the vehicle into manual mode. The vehicle must be moving greater than 6 m.p.h. and under low engine load conditions for activation. Pushing the up or downshift button will activate the semi sports mode and will stay engaged until the engine load is reduced or the up or downshift buttons are left untouched for a time while the vehicle is operating.

The buttons can also be used when the shifter is placed into manual mode and the buttons are used for up or downshift control instead of the shifter lever.

2nd Hold Control

When the "+" switch is operated when the vehicle is in manual shift mode and not moving, the transmission shifts to 2nd speed enabling start in 2nd. This status is held unless the manual shift mode is canceled, the vehicle speed exceeds a certain value, or 1st speed is selected with the "–" switch.

Downshifting is limited to 2nd even when the stopping the vehicle.

2nd Light

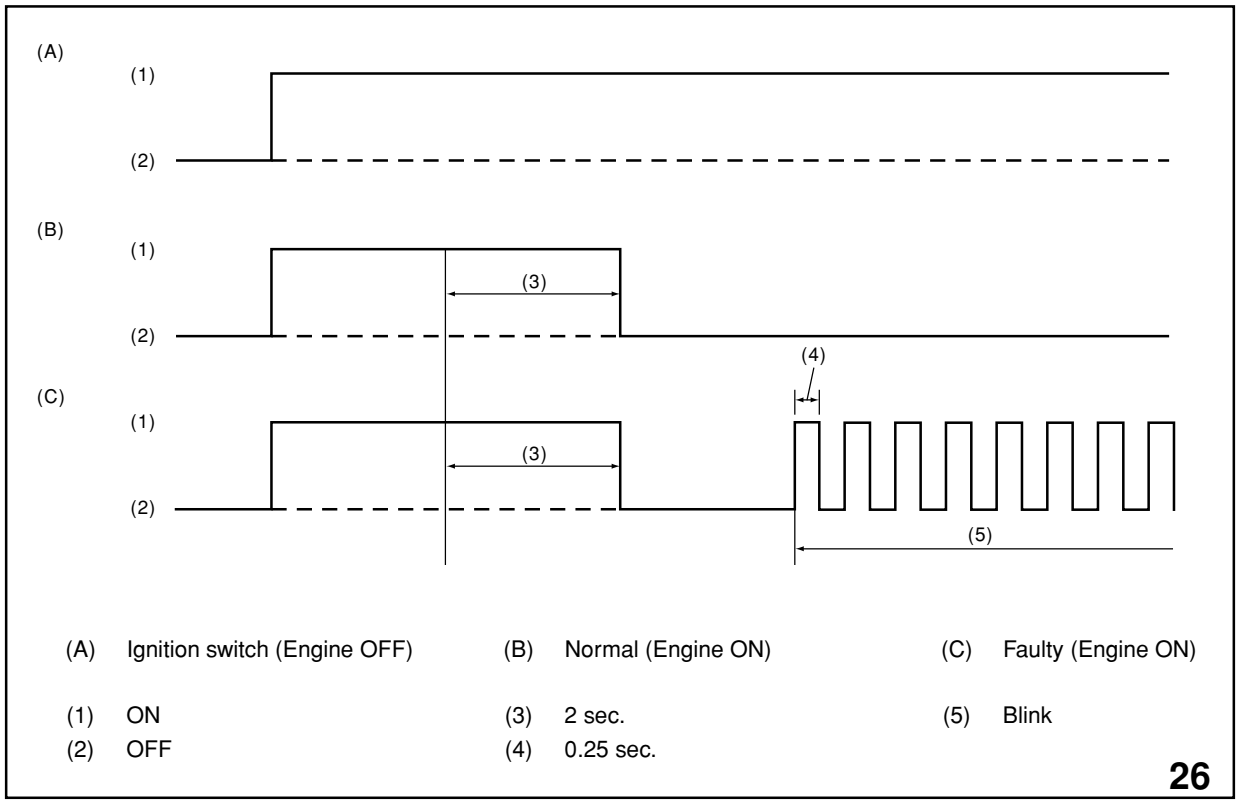
Diagnostics

Sport Indicator Light Display

Diagnostics for the 5AT are necessary when the function of the sports light illuminates as described below or the vehicle operator physically detects unwanted operation. As previously described the proper operation of the 5AT is dependent on the complete operation of the LAN. The transmission itself is checked by the TCM for electrical and mechanical performance. The TCM no longer outputs specific trouble codes for the transmission itself rather it communicates Diagnostic Trouble Codes generated by the TCM or the LAN. Hydraulic ports for checking pressures of individual clutches has been deleted and replaced by a single port for checking line pressure and transfer clutch pressure. The use of the select monitor when checking hydraulic pressure becomes necessary as the target pressure for gear ranges is provided.

When any on-board diagnostics item is malfunctioning, the SPORT indicator light blinks from the time the malfunction is detected after starting the engine until the ignition switch is turned OFF. The malfunctioning part or unit can be determined by a DTC during the on-board diagnostics operation.

Problems which occurred previously can also be identified through the memory function. If the SPORT indicator light does not show a problem (although a problem is occurring), the problem can be determined by checking the performance characteristics of each sensor using the Subaru Select Monitor.



Sports Light Operation

	In/C	H & LR	Di/C	Rev/B	Fr/B	LC/B	FW D/B	OWC 1st	OWC fwd	OWC 3rd
P		0			0					
R		0		0	0			0		0
N		0			0					
1st					0	Sp	0	0	0	0
2nd			0		0	Sp	0		0	0
3rd		0	0		0		0			0
4th	0	0	0				0			
5th	0	0			0		0			
Sp: Sport mode										

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Application Chart

Fail Safe Function

Front or rear speed sensor

The vehicle speed information received from the ABS unit VIA CAN communication is substituted for control. This enables normal quality shifting.

Inhibitor switch

If an input other than the specified pattern is entered into the TCM, the select position indicator lights in the combination meter are turned off, the starter is disabled, the reverse light is disabled, the transmission is fixed in D range and sports shift mode is inhibited.

PN signal abnormal

The output is inhibited (starter inhibited) if an abnormality is detected in the PN signal output. However if the ECM is receiving range signals through the backup of CAN communications, the starter can be used in P and N ranges.

AT interlock

If an AT interlock is detected, the vehicles minimum mobility is maintained by fixing the transmission in 2nd, 4th or 5th speeds in accordance with the engaging pattern detected by the hydraulic switch. The relationship between the hydraulic switch detection pattern and fixed gear speeds are shown in the following table.

- **ENGINE BRAKING IN 1ST ABNORMAL**
  If engine braking in 1st is judged as abnormal the low coast brake solenoid is deactivated to cancel the engine braking effect.
- **LINE PRESSURE SOLENOID ABNORMAL**
  The solenoid is deactivated and the line pressure is set to maximum, 5th speed is inhibited. Except for this, the system is controlled normally.
- **LOCKUP SOLENOID ABNORMAL**
  The solenoid is deactivated and lockup is inhibited.
- **LOW COAST BRAKE SOLENOID ABNORMAL**
  If the solenoid is failed and is stuck on (electrically or mechanically) the transmission is fixed to the 2nd speed, and when the solenoid is failed and is stuck off the solenoid is turned off. (Engine braking is made available in 1st and 2nd speeds.
- **INPUT CLUTCH SOLENOID ABNORMAL**
  The transmission is fixed to 4th gear.
- **DIRECT CLUTCH SOLENOID ABNORMAL**
  The transmission is fixed to 4th gear.
- **FRONT BRAKE SOLENOID ABNORMAL**
  If the solenoid is stuck on the transmission is fixed to 5th gear. If the solenoid is stuck off the transmission is fixed to 4th gear.
- **HIGH AND LOW REVERSE CLUTCH SOLENOID ABNORMAL**
  The transmission is fixed to the 4th gear.

- **TRANSFER CLUTCH SOLENOID**

  The transfer clutch solenoid is turned off.

- **TURBINE SENSOR 1, 2 ABNORMAL**

  Shifting control is performed without using turbine sensor values to maintain minimum mobility. 5th speed and sports shift mode are inhibited.

- **TCM DATA COMMUNICATION IS ABNORMAL**

  If communication with the memory box on the control valve assembly fails, back up values stored in the TCM are used for controlling the solenoids.

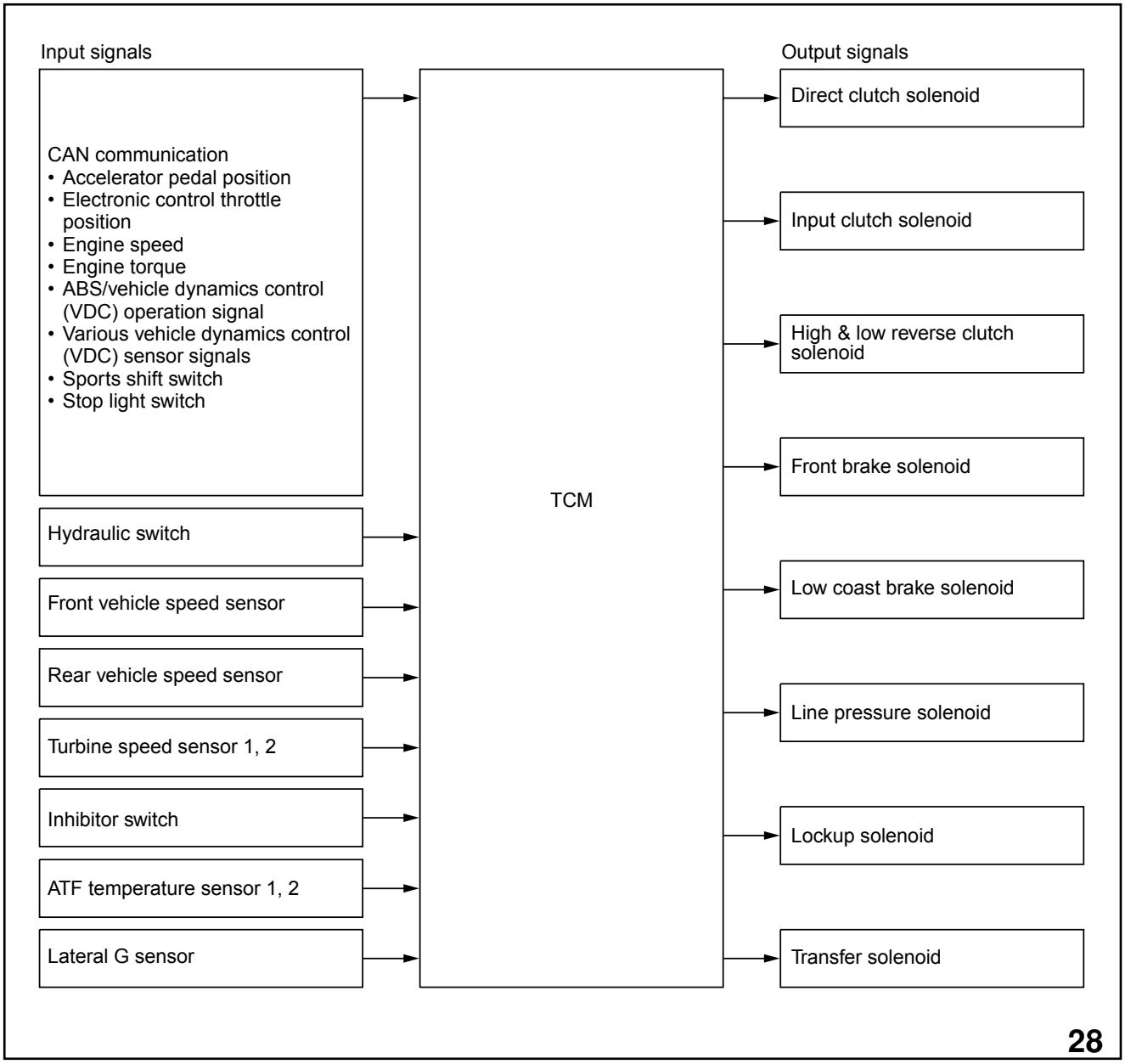
- CAN communications abnormal

  If an abnormality occurs in CAN communications, data received via CAN communications are fixed to preset values to perform shift control and maintain minimum mobility. Lockup and sports shift mode are inhibited.

Electronic-Hydraulic Control System

Description

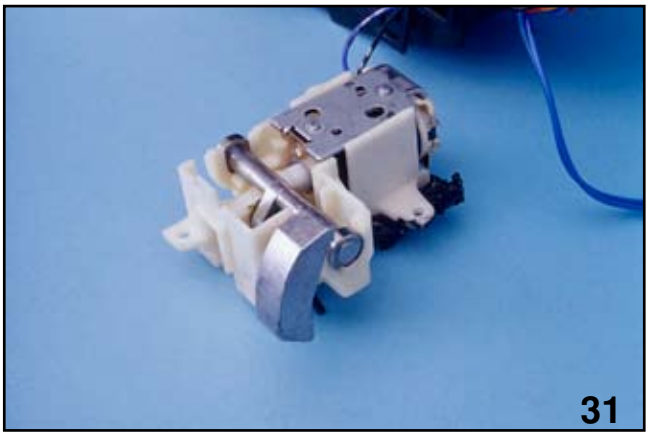
The electronic-hydraulic control system for the transmission and transfer consists of various sensors and switches, TCM, and the control valves including solenoid valves. The system controls the automatic transmission operation, including gear shifting, lockup clutch operation, line pressure, pilot pressure, and gear-shift timing. It also controls the operation of the transfer clutch. The TCM determines vehicle operating conditions from various input signals and controls a total of eight solenoids (front brake solenoid, low coast brake solenoid, input clutch solenoid, high and low reverse clutch solenoid, direct clutch solenoid, lockup solenoid, line pressure solenoid, and transfer solenoid) by sending appropriate signals to them.



Electronic-Hydraulic Control

SHIFT LOCK

Shifter



Shift Lock Solenoid

The shift lock solenoid located in the shifter assembly performs two functions.

When in “Park” position the shift lock solenoid is off, allowing the shifter lever to be blocked from moving until the brake pedal is depressed with the ignition on.

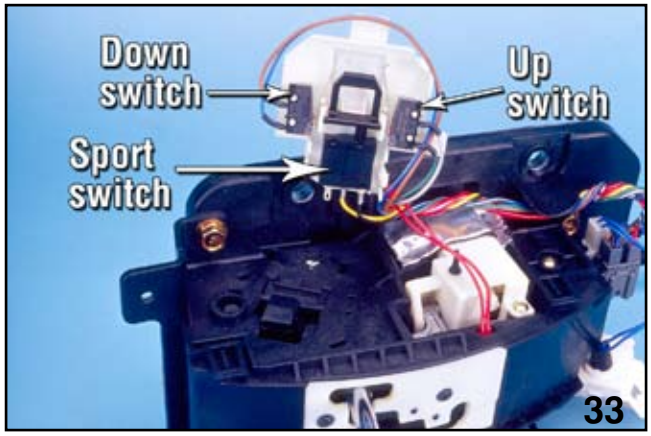
When in a gear range other than “Park” at a speed greater than 6 MPH, the shift lock solenoid will be off, preventing the shifter lever from accidentally being placed into “Park” or “Reverse”.

When the shift lock solenoid is on the BIU activates the solenoid, allowing the shift lever to be placed into any gear range.

With the ignition off, and the shifter in a gear range other than “Park”, the shift lock solenoid will be turned off after 30 seconds. This will prevent the shifter from being placed into “Park”.

CAUTION: SET THE PARKING BRAKE TO ON WHEN PERFORMING SERVICE TO THE VEHICLE WITH THE TRANSMISSION PLACED IN A GEAR OTHER THAN “PARK”.

Shift Lock Solenoid Bench

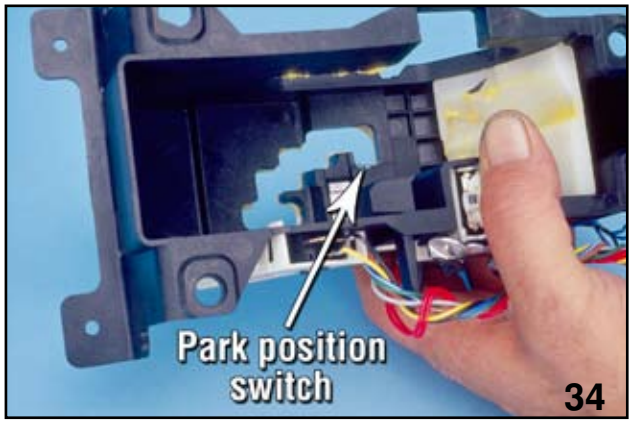


Sports Switch

The “Sport” mode or “Tiptronic” switch assembly is attached to the shifter near the sport gate.

When the shifter is placed in to the sport gate the shift lever pushes on the “Sport” or “Tiptronic” switch and the switch sends a signal to the BIU. The BIU will then illuminate the “Sport” mode light in the combination meter.

The “Up” and “Down” switches are located next to the “Sport” or “Tiptronic” switch. These switches send signals to the BIU that control the up and down shifting of the transmission in manual mode. The BIU will also use these signals for controlling the illumination of the manual gear lights in the combination meter.



Park Position Switch

The “Park” position switch is located in the shifter assembly top plate and signals the BIU when the shifter is in or out of park. The BIU will use this signal to control the shift lock solenoid and “Park” light in the combination meter.

Signals from the inhibitor switch to the TCM are used for controlling the starter motor.

DISASSEMBLE

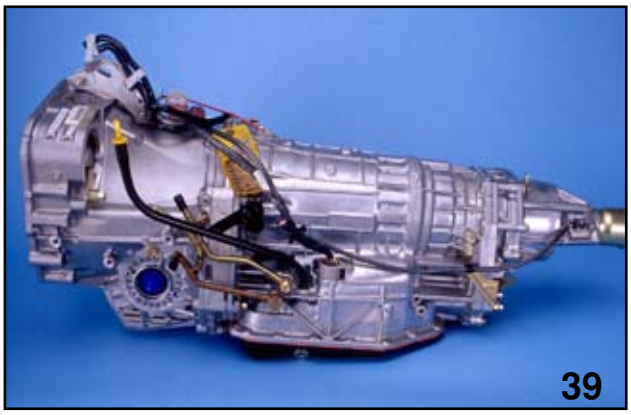
Converter Housing

Torque Converter

Begin disassembly by removing the torque converter and the oil pump drive shaft.

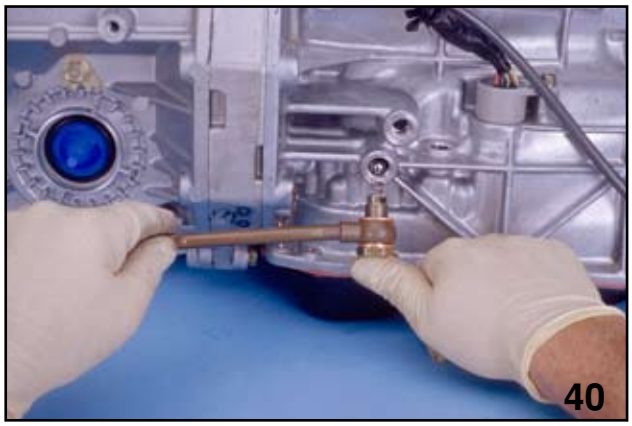
Separating Pump Drive

The oil pump drive shaft is connected to the torque converter with a circlip. The oil pump drive shaft can be separated from the torque converter by squeezing the two ends of the circlip together , allowing the circlip to clear the grooves in the torque converter.



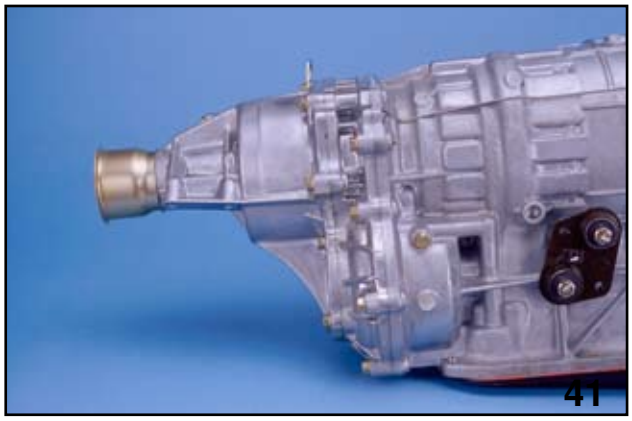
Transmission

Remove the transmission oil dip stick, atf inlet and outlet pipes.



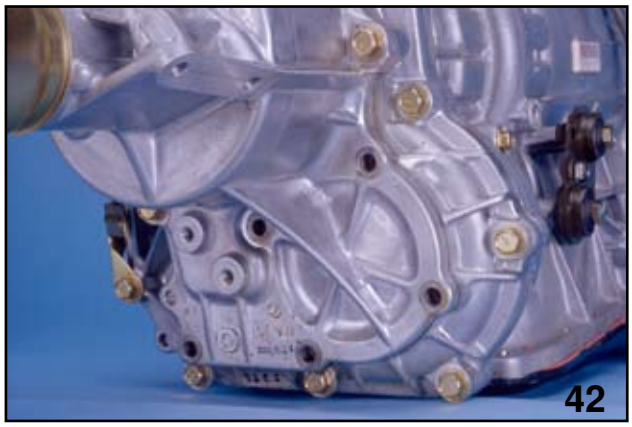
Check Valve

The ATF outlet pipe houses a spring and check ball that assist with preventing the drain down of atf from the torque converter when the engine is off.



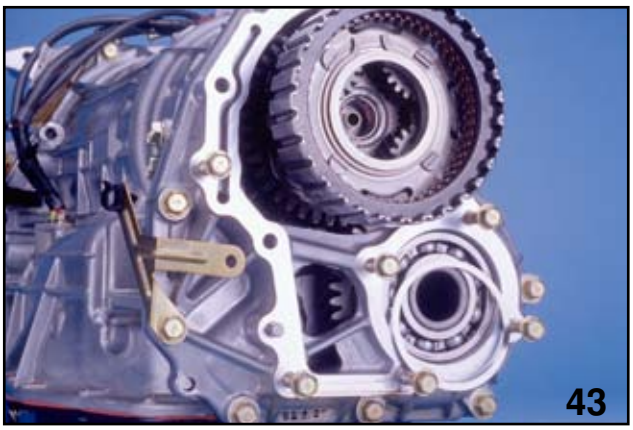
Extension Housing

Remove the bolt from the transmission harness main support and from speed sensor 1 and 2. Pull the sensors from the transmission case but be aware of their location to prevent damage to them during the remainder of the disassembly procedure.



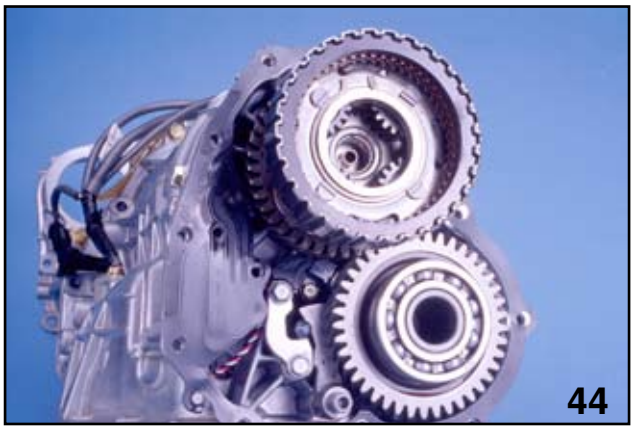
Extension Case 6 Bolts

Remove the extension case. Six (6) of these bolts are coated with thread sealing compound. Clean and recoat before installation.



Shim and 6 Bolts

A shim will be found on the back side of the extension case or left on reduction driven gear bearing. Remove the shim for possible reuse during assemble. The shim controls the end play of the reduction driven gear.

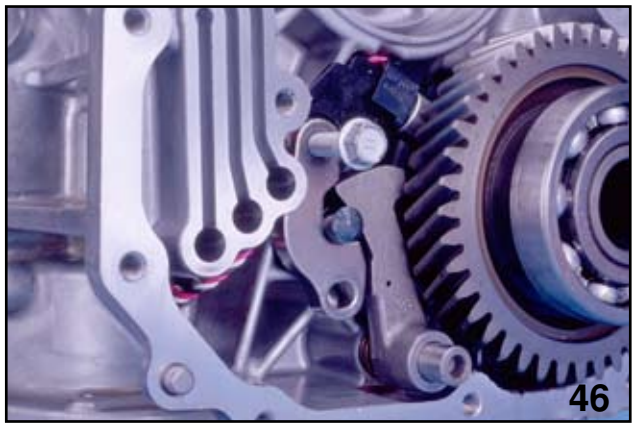


Transfer (VTD)

Remove the bolts from the intermediate case and gasket.

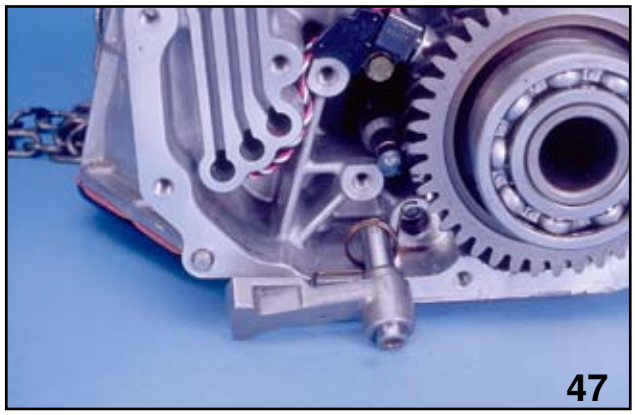
Transfer Drive Gear

Remove the VTD/reduction drive gear and intermediate shaft.



Parking Pawl

Remove the bolts that secure the parking support actuator and remove the parking support actuator.



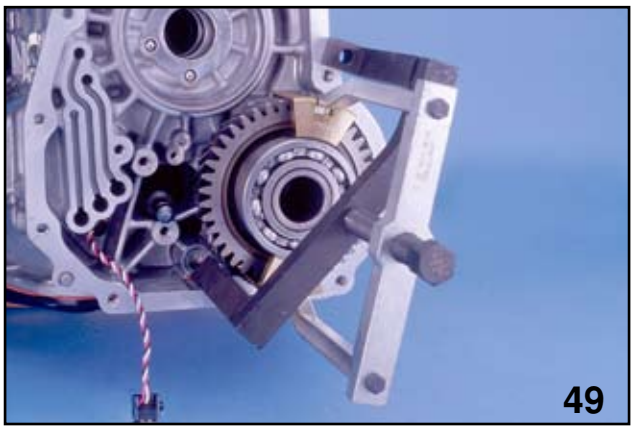
Spring Location

Remove the parking pawl shaft, spring and parking pawl.

NOTE: OBSERVE THE LOCATION OF THE SPRING BEFORE REMOVAL.

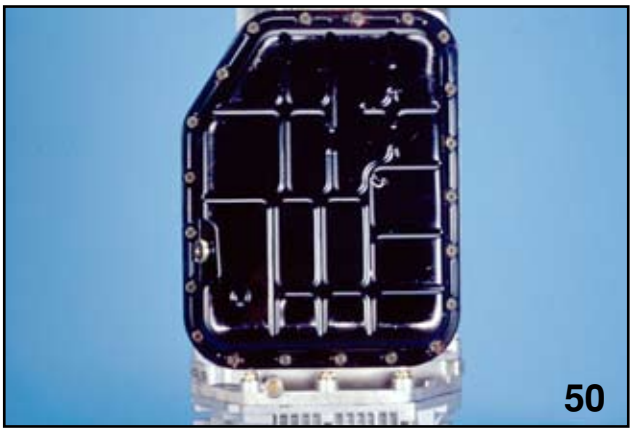
Front Speed Sensor

Remove the front vehicle speed sensor bolt, front vehicle speed sensor and sensor cover. The connector of the front vehicle speed sensor is not accessible until the oil pan is removed.



Removing VTD Driven Gear

Using special tool 499737100 puller set and new special tool 18680AA000 remove the reduction driven gear.



Oil Pan On

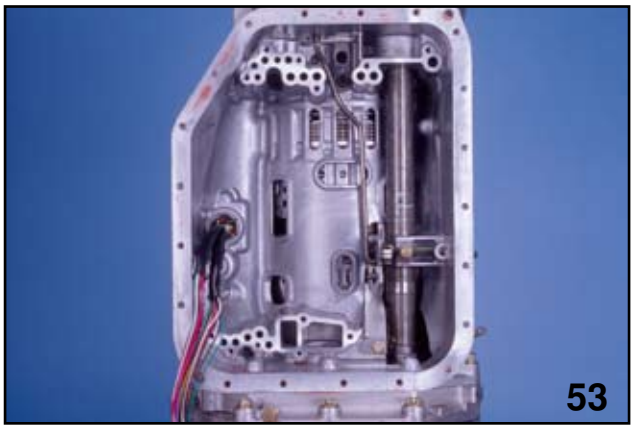
Vertically position transmission on the torque converter housing and remove the oil pan bolts.

Oil Pan Off

Disconnect the control valve body from the transmission harness.

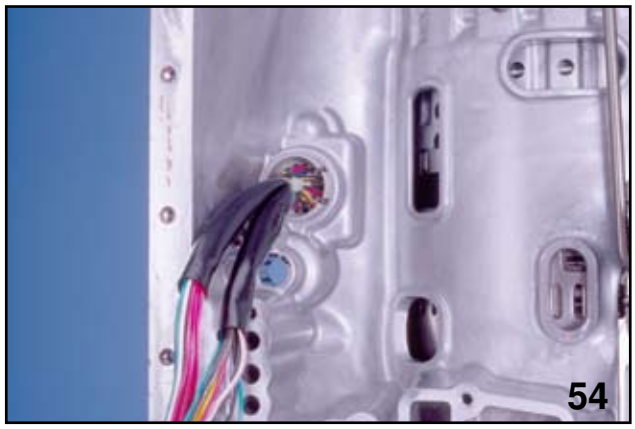
Torx® Bolts

Note the location of the three torque converter case alignment bolts. Special tool 18676AA020 Torx® Wrench is used to remove these bolts. The bolts cannot be removed or installed with the control valve body in place.



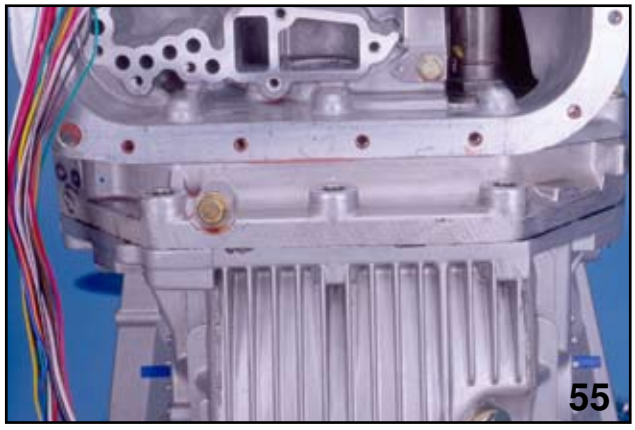
Valve Body Out

Remove the control valve body bolts and control valve body.



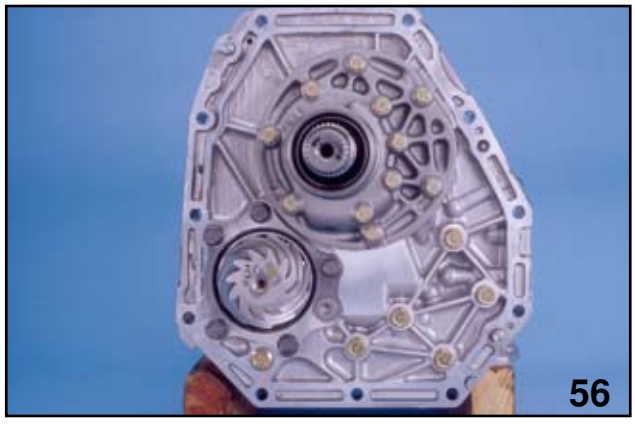
Harness Tabs

Lightly squeeze the release tabs of the transmission harness support and remove the harness from the transmission case.

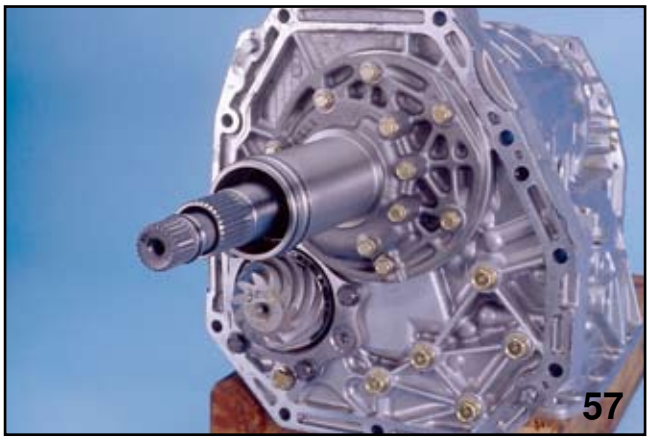


Torque Connector Case

Remove the Three (3) torque converter case alignment bolts.

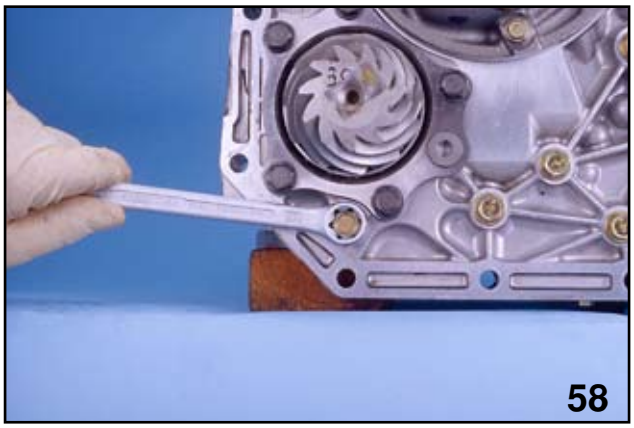


Transmission Pinion Gear View



Oil Pump Cover

Horizontally position the transmission while supporting the control valve body area with wooden blocks.



Removing Torx® Bolt

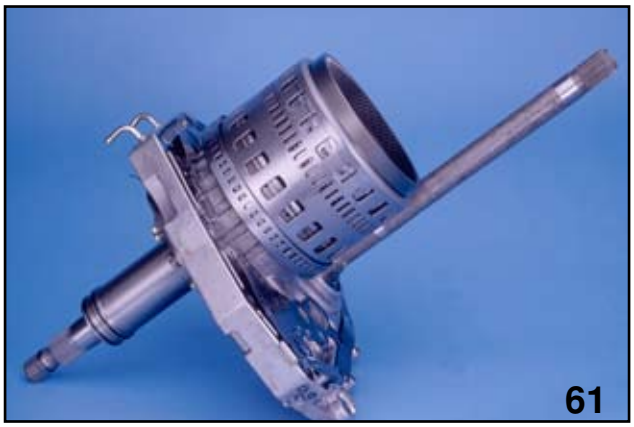
Remove the 6 bolts that secure the oil pump cover to the transmission main case. Note the Torx® Bolt below the pinion gear is removed with special tool 18676AA020 Torx® Wrench.

Torx® Bolt and Washer

The Torx® bolt uses a rubber inlay washer that prevents the mixing of transmission fluid with gear oil.

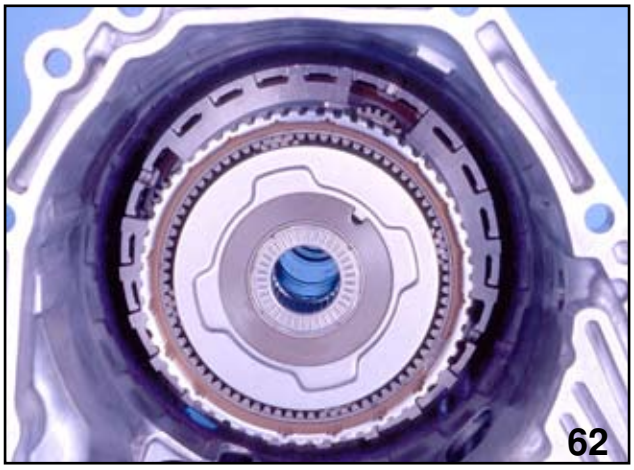
Separating Oil Pump Cover

Hold the oil pump cover and the oil pump housing while applying sufficient force to separate the oil pump cover from the transmission main case.



Oil Pump Cover Removed

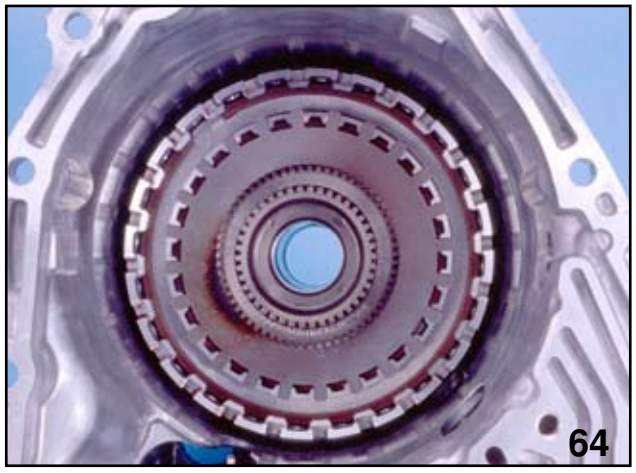
The weight of the resulting separation will be heavy. The oil pump cover, input clutch and front planetary assemble with rear internal gear usually is removed together.



Middle Carrier case view

Remove the middle carrier assembly from the transmission main case.

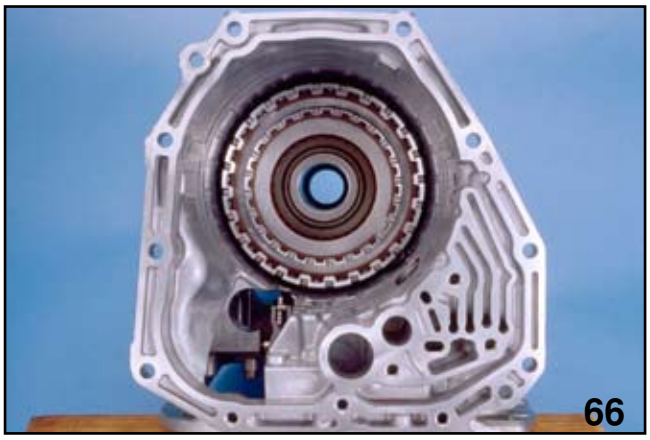
Middle Carrier



Top View of Middle Rear Sun Gear

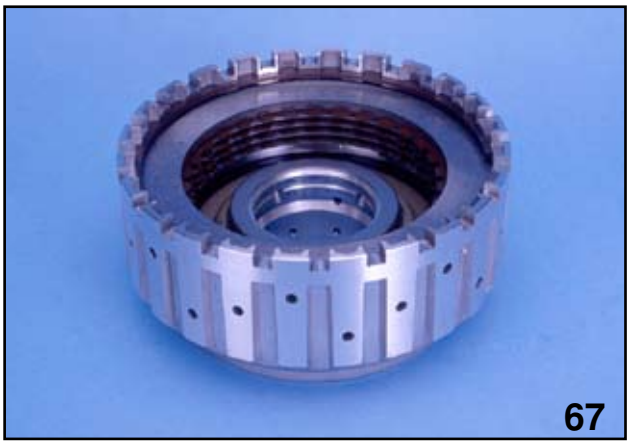
Remove the middle and rear sun gear assemble.

Middle and Rear Sun Gear

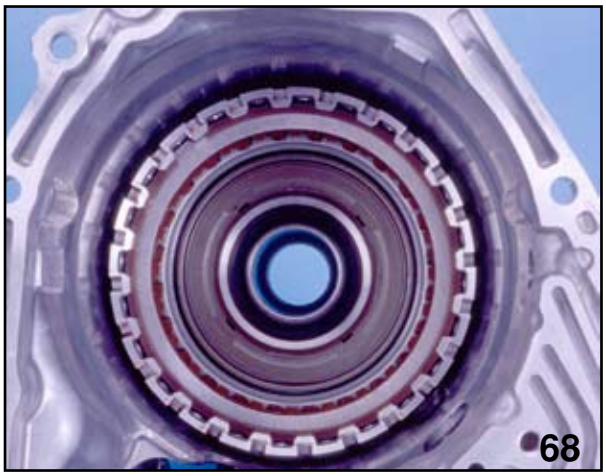


Top view of High and Low Reverse Clutch

Remove the high and low reverse clutch.

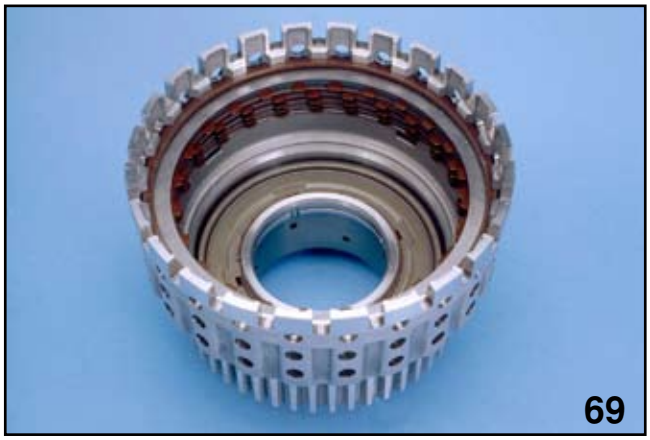


High and Low Reverse Clutch

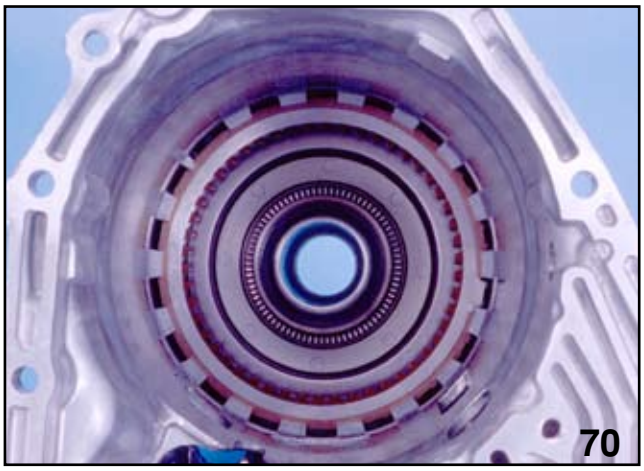


Top View of Direct Clutch

Remove the direct clutch.

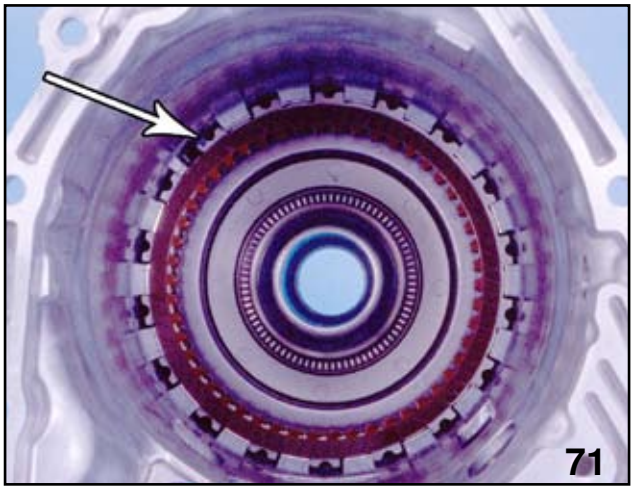


Direct Clutch



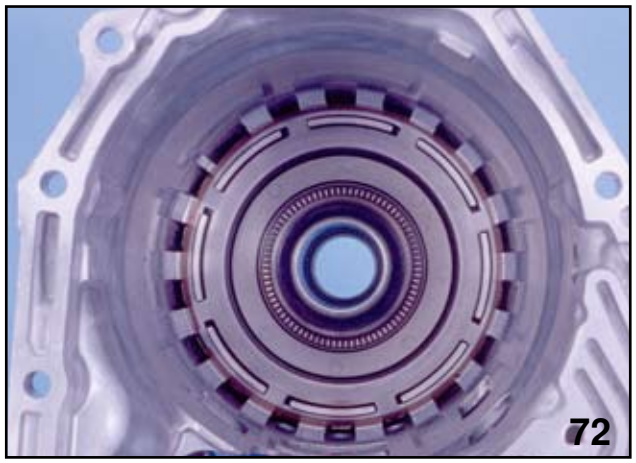
Reverse Brake Clutch Snap Ring

Remove the reverse brake clutch snap ring and the retainer plate.



Leaf Spring Location

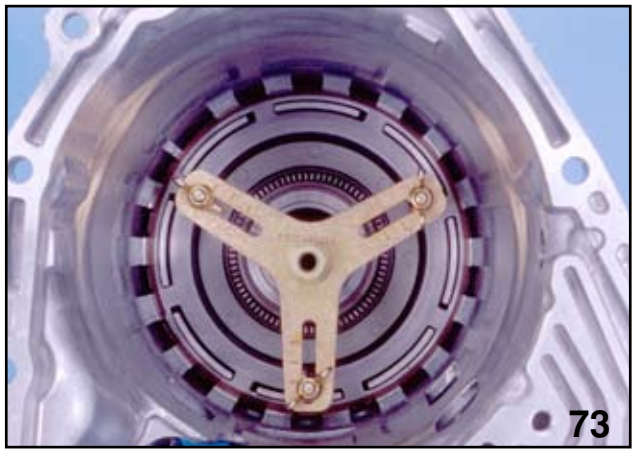
Not the location of the leaf spring and remove it.



Reverse Brake Piston Snap Ring In

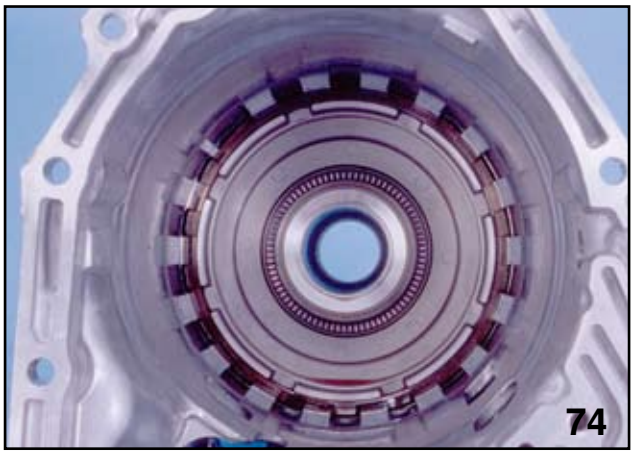
Remove the remainder of the drive and driven plates of the reverse brake.

NOTE THE ORIENTATION OF THE LOWER DISH PLATE WHICH IS DIRECTIONAL.



Special Tool 18762AA000

Install special tool 18762AA000 compressor, support and 18763AA000 compressor shaft over the reverse brake piston. Apply sufficient force to compress the return spring and remove the snap ring, spring retainer and return spring. Remove the special tools.

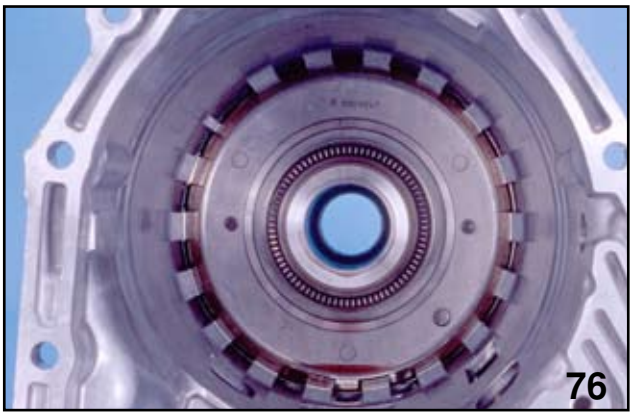


Reverse Brake Piston Snap Ring Out

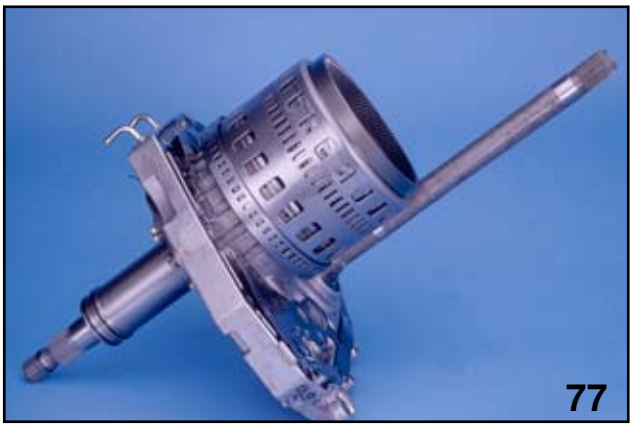
The remaining components under the reverse piston are not serviceable.

Center Support Bolts

NOTE: DO NOT REMOVE ANY COMPONENTS UNDER THE REVERSE PISTON OR THE BOLTS HOLDING THE CENTER SUPPORT TO THE TRANSMISSION CASE.

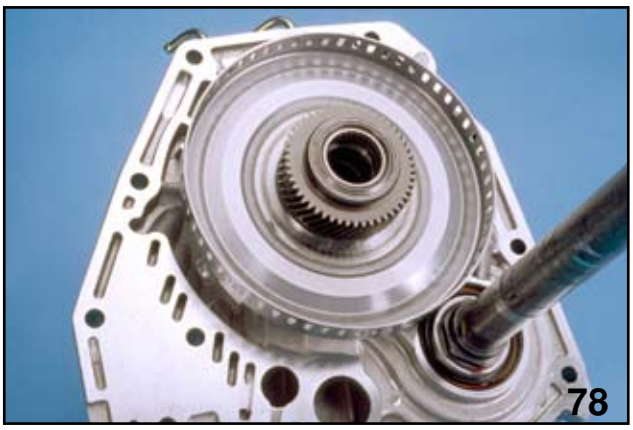


Center Support

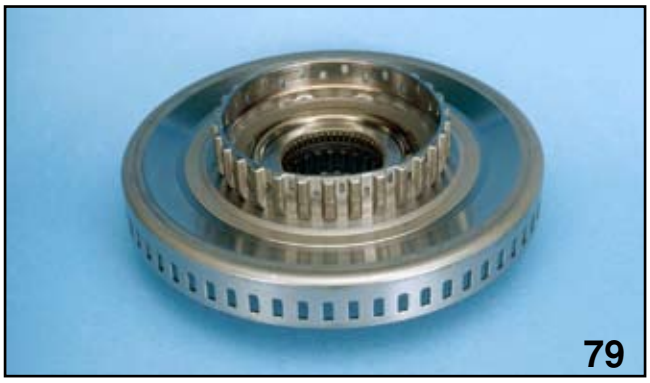


Input Clutch Drum and Oil Pump Cover

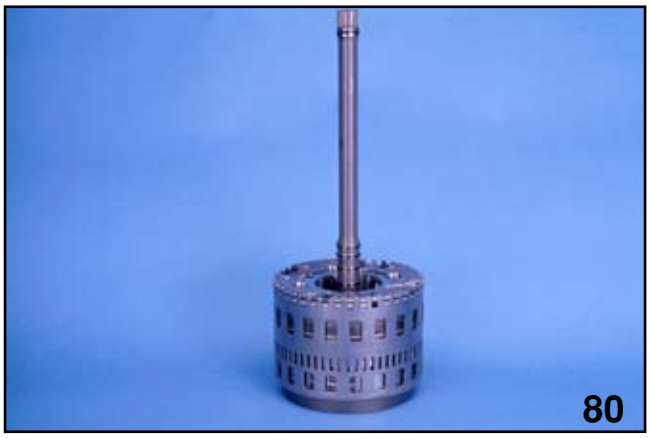
Separate the drive train components from the oil pump cover.



Back View of Front Sun Gear

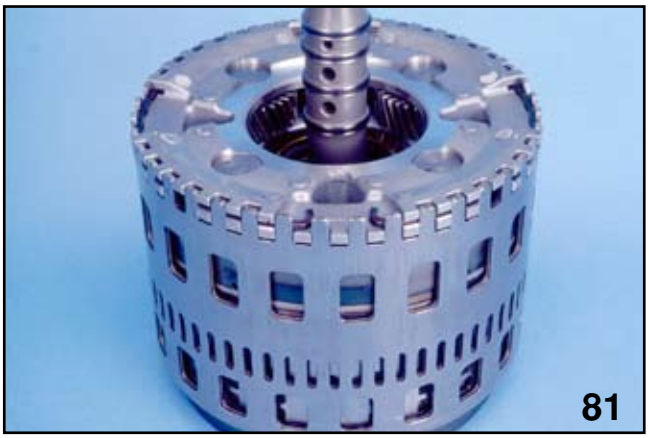


Front View of Front Sun Gear



Input Clutch Drum and Front Planetary Assembly

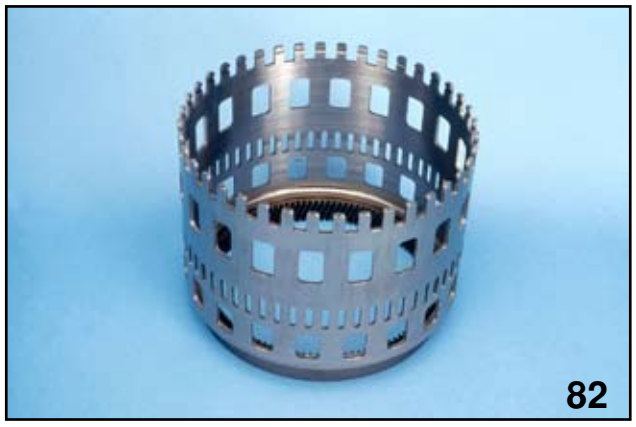
Remove the front sun gear from the back of the oil pump cover or front planetary carrier if it moved away with the reminder of the drive train components.



Snap Ring Release

The top side of the input clutch drum contains the front internal gear and houses the bearing, needle bearing side up, that supports the bottom of the front planetary carrier. The turbine or input shaft is also a part of the top side of the input clutch drum.

Squeeze the two ends of the snap ring that secure the front planetary carrier to the rear internal gear. Lift the front planetary carrier away from the rear internal gear.

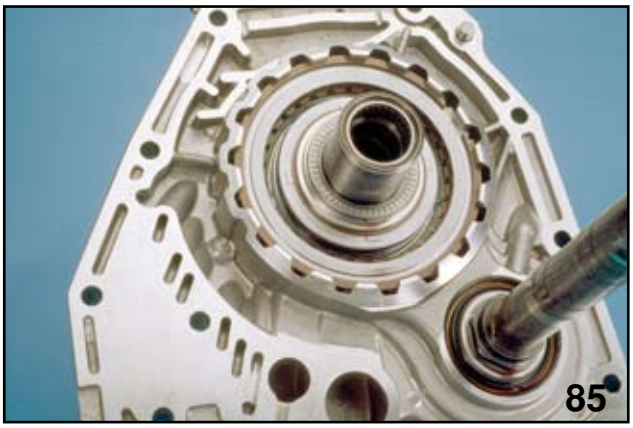


Rear Internal Gear

Remove the rear internal gear away from the input clutch drum.

Front Planetary Carrier and Input Clutch Drum

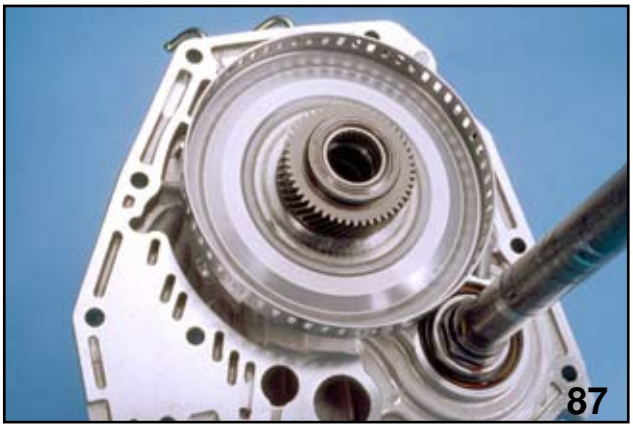
Front Internal Gear and Input Clutch Drum



Front Brake Clutch

Top View Front Sun Gear

The top side of the front sun gear provides a bearing running surface that seats the bearing on the on the lower step of the front sun gear support.



Bottom Side of the Front Sun Gear

The bottom side of the front sun gear is supported by the captured bearing at the top of the front planetary carrier.

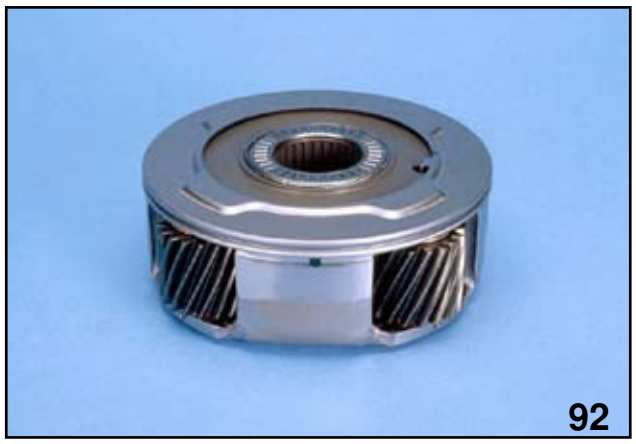
Front Planetary Carrier

Bottom of the Front Planetary Carrier

The bottom of the front planetary carrier seats a tanged washer that serves as a bearing running surface for the bearing located at the top of the input clutch drum.

Top View of Input Clutch Drum

Bottom View of Input Clutch Drum



Top of the Middle Planetary Carrier

The top of the middle planetary carrier provides a seat for the bearing (Needles up) that supports the bottom of the input clutch drum.

Bottom of the Middle Planetary Carrier

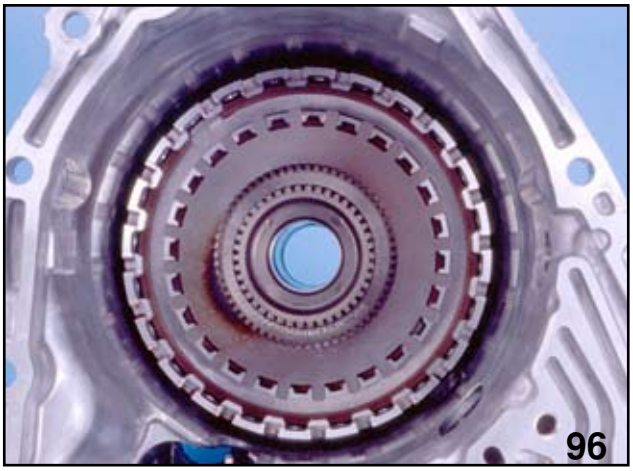
The bottom of the middle planetary carrier provides a bearing (Needles down) that seats against the tanged washer on the top of the rear planetary carrier.

Top of the Rear Planetary Carrier

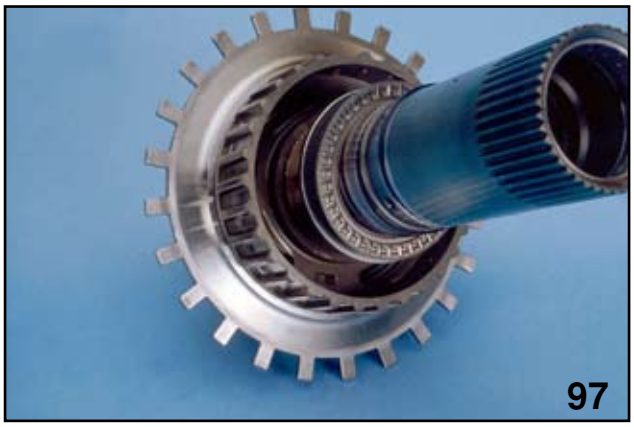
The top of the rear planetary carrier houses the middle internal gear and a tanged washer that provides a bearing running surface for the bearing on the bottom (Needles down) of the middle planetary carrier.

Bottom of the Rear Planetary Carrier

The bottom of the rear planetary carrier seats a bearing (Needles down) that sears against the bearing running surface of the rear sun gear.



Top View of the Middle and Rear Sun Gear



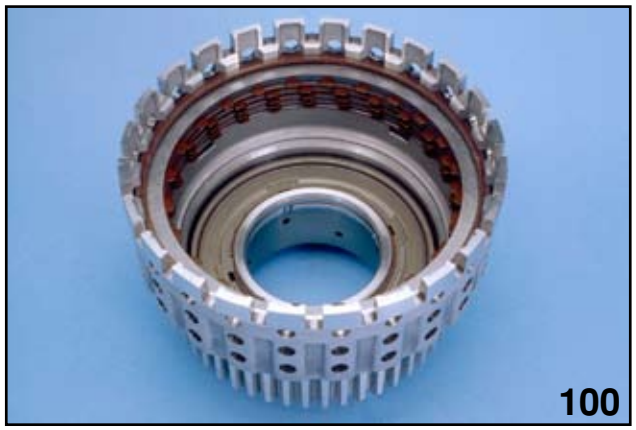
Bottom Side of the Middle and Rear Sun Gear

The bottom side of the middle and rear sun gear assemble seats a washer and a bearing (open) that seats against the washer seated on the center of the high and low reverse clutch.

Top View of the High and Low Reverse Clutch

Bottom of the High and Low Reverse Clutch Drum

The bottom of the high and low reverse clutch drum provides a bearing running surface that seats the bearing on the top of the center support.



Top View of the Direct Clutch

Bottom of the Direct Clutch Drum

The bottom of the direct clutch drum provide a bearing running surface that seats the bearing on the top of the lower step of the center support.

Center Support

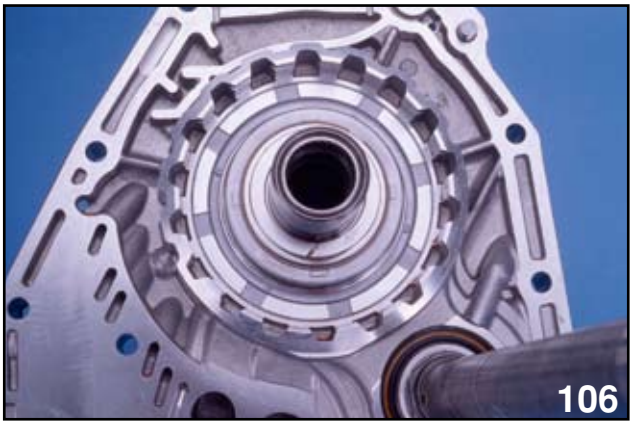
SERVICING THE FRONT BRAKE

Snap Ring and Retaining Plate from the Front Brake

Remove the snap ring and retaining plate from the front brake.

Retaining Plate

Remove the drive and driven plates.

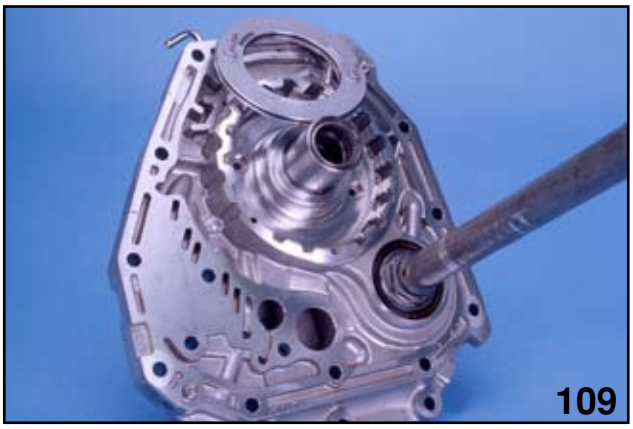


Front Brake Housing

Removing Front Brake Snap Ring

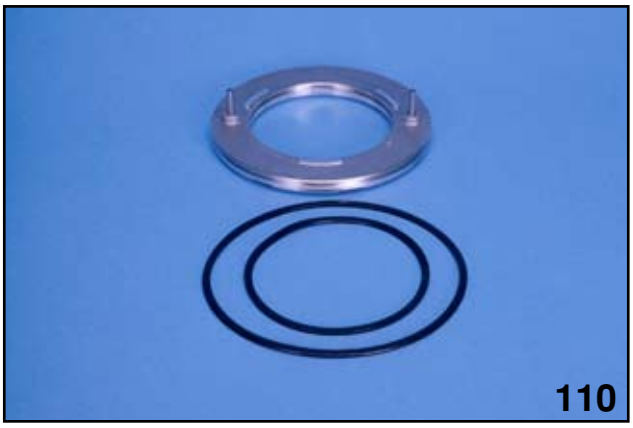
Install special tools 18762AA000 compressor, support and 18763AA00 compressor on the front brake piston. Apply sufficient force to compress the front brake piston return spring. Remove the snap ring, retainer and return spring. Remove the special tools and apply air pressure at the indicated port.

Spring Retainer and Snap Ring



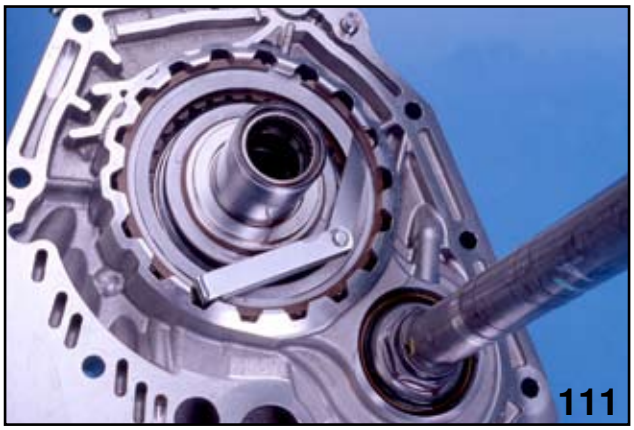
Front Brake Piston

Note the location of the arrows on top of the piston. The arrows will assist with properly positioning the piston during reassemble. Remove the piston and inner and outer o-rings.



Piston and O-rings

The square side of the O-rings face the piston while the rounded edge serve as the pressure sealing surfaces.



Measure the Clearance between the Snap Ring and the Retaining Plate

Install new o-rings and lubricate the piston with atf. Align the guide pins using the arrows on the top of the piston. Press down by hand until the piston bottoms in the bore. Reinstall the return spring and retainers. Install the special tools 18762AA000 compressor, 18765AA000 compressor support and 18763AA000 compressor. Compress the return spring with sufficient force for the retainer to clear the snap ring groove. Install the snap-ring and remove the special tools. Install the driver and driven plates. Install the retaining plate and the snap ring. Measure the clearance between the snap ring and the retaining plate.

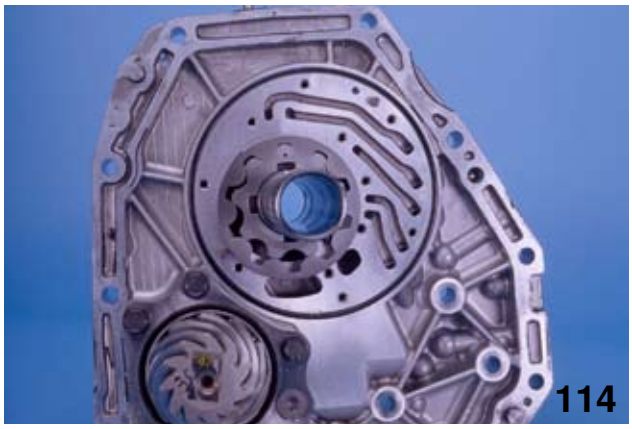
Servicing the Oil Pump

Oil Pump Outer Cover

Remove the Six (6) bolts from the pinion shaft bearing retainer. Vertically position the pinion shaft and remove the shaft from the oil pump housing.

Oil Pump Cover Bolt

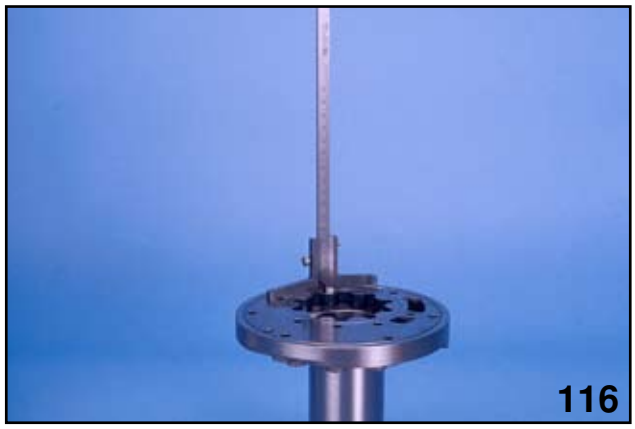
Remove the oil pump cover bolts. The bolts use washer with a rubber inlay to prevent the mixing of atf and gear oil.



Oil Pump Inner and Outer Rotors

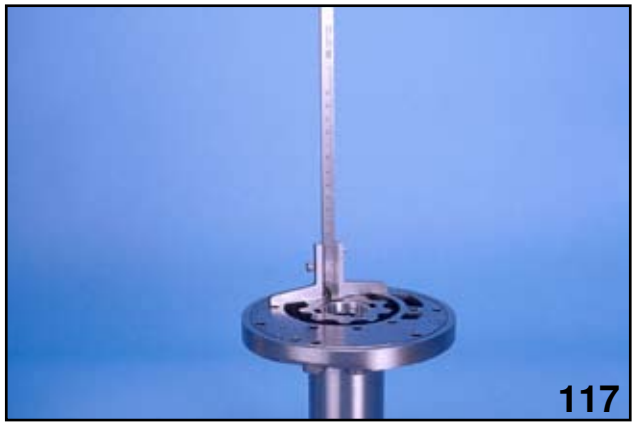
Rotor to Rotor Clearance

Place the inner and outer rotors of the oil pump into the oil pump cover. Measure the clearance between the inner and outer rotor tips.



Clearance between the top of the Inner and Outer Rotor

Measure the clearance between the top of the inner and outer rotor and the oil pump cover surface.

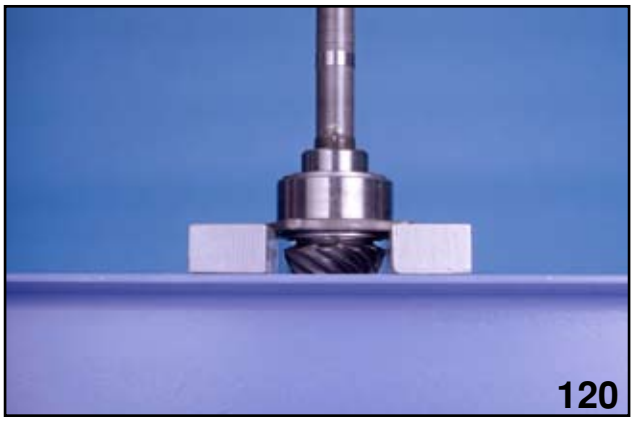


Checking Inner Rotor to Oil Pump Cover surface

SERVICING THE PINION SHAFT

Pinion Shaft In Vise

Remove the pinion depth shim form the pinion bearing retainer. Position the pinion shaft on a press and support the pinion shaft bearing retainer while applying force to the end of the pinion shaft. This will remove the pinion shaft bearing retainer and the upper bearing and spacer.

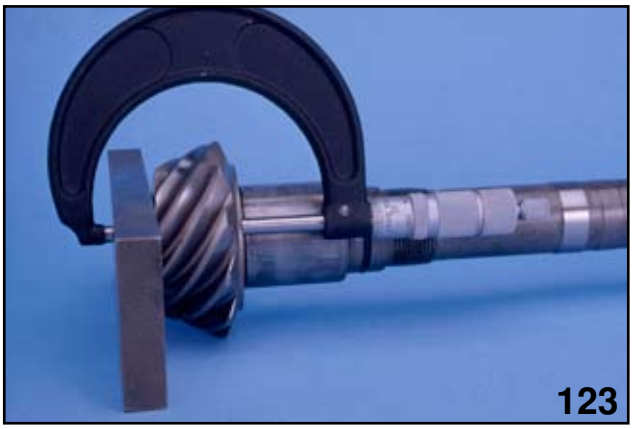


Removing Upper Bearing

Support the inner race of the lower bearing and apply pressure to the end of the pinion shaft. Replace the o-ring on the pinion shaft only after installation of the all bearings is complete.

Supporting Bearing

Pinion Shaft



Pinion Gear and Gauge Block "A"

Place "A" ST-398643600 gauge block at the end of the pinion gear. Measure the distance from the back of the pinion gear to the top of the gauge block. This is dimension A.

Pinion Shaft in Vise

Install the lower bearing, retainer, upper bearing, new o-ring, spacer and new lock nut. Torque the lock nut.

Tighten new lock nuts using ST1, ST2 and ST3. Calculate the lock nut specifications using following formula.

T2 = L2/(L1 + L2) × T1

T1: 116 N.m (11.8 kgf-m, 85.3 ft-lb) [Required torque setting]

T2: Tightening torque

L1: ST2 length 0.072 m (2.83 in)

L2: Torque wrench length

ST1 18667AA010 HOLDER

ST2 499787700 WRENCH

ST3 499787500 ADAPTER

NOTE: INSTALL THE ST2 TO TORQUE WRENCH AS STRAIGHT AS POSSIBLE.

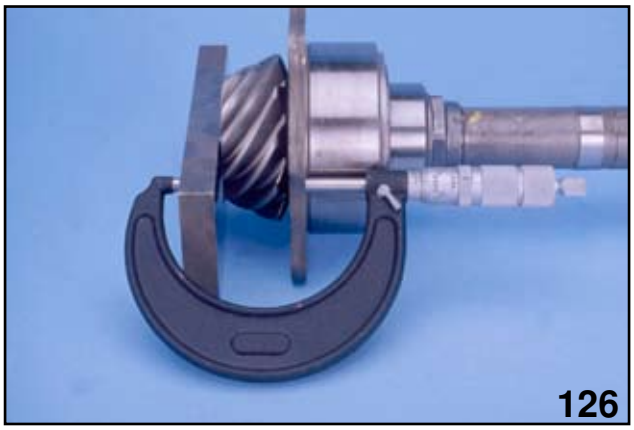
Measure the starting Torque of Bearing

Measure the starting torque of bearing. Make sure the starting torque is within the specified range. If the torque is not within specified range, replace the roller bearing.

Starting torque:

7.6 — 38.1 N (0.776 — 3.88 kgf, 1.7 — 3.88 kg)

Stake the caulking of lock nut at two points.



Pinion Bearing and Gauge Block “B”

Place the gauge block at the end of the pinion gear. Measure the distance from the back of the pinion bearing retainer to the top of the gauge block. This is dimension B.

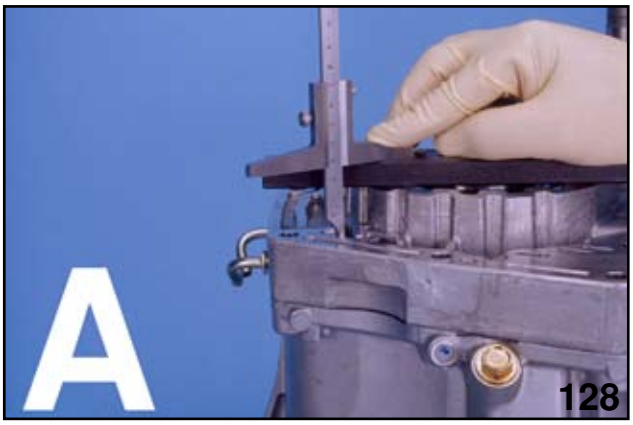
Calculate the thickness “t” (mm) of drive pinion shim.

$t = 6.5 \pm 0.0625 - (B - A)$

Drive pinion shim	
Part Number	Thickness mm (in)
31451AA180	0.150 (0.0059)
31451AA190	0.175 (0.0069)
31451AA200	0.200 (0.0079)
31451AA210	0.225 (0.0089)
31451AA220	0.250 (0.0099)
31451AA230	0.275 (0.0108)

Select three or less shims from the table.

END PLAY ADJUSTMENT



Top of Pump Cover to Mating Surface "A"

1) Using the ST, measure the height "A" from AT main case mating surface to convex surface of oil pump cover.

ST 499575400 GAUGE

Top of Pump Cover to Mating Surface "B"

2) Using the ST, measure the depth "B" from the convex surface of oil pump cover to thrust bearing transferring surface.

ST 499575400 GAUGE

3) Calculate the measured value on step 1) and 2), and then set the calculated value as "C"

Calculation formula: C = A - B

AT Main Case

Mating Surface to Bearing Surface of the Front Sun Gear "D"

4) Using the ST, measure the depth "D" from AT main case mating surface to thrust bearing transferring surface of front sun gear.

ST 499575400 GAUGE

5) Set the value as "E" which subtract the thickness of ST GAUGE from measured value on step 4).

Calculation formula:

E (mm) = D - 15 [E (in) = D . 0.59]

Select a thrust bearing from the table to adjust clearance within

0.25 — 0.55 mm (0.0098 — 0.022 in).

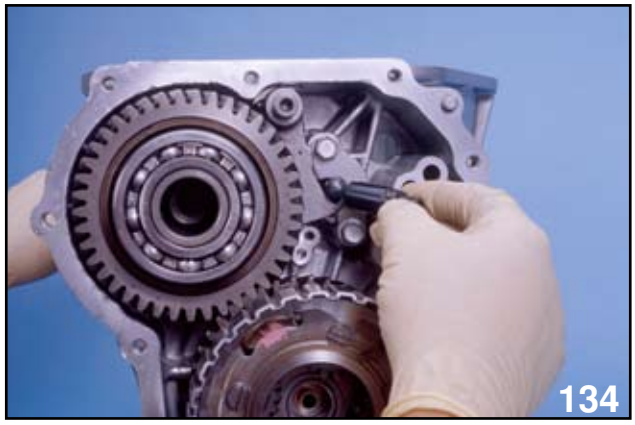
Thrust bearing

Part No.	Thickness mm (in)
806548020	3.2 (0.126)
606548030	3.4 (0.134)
806548040	3.6 (0.142)
806548050	3.8 (0.150)
806548060	4.0 (0.157)
806548070	4.2 (0.165)

PARKING PAWL INSTALLATION

Parking Pawl and Spring

Parking Pawl Spring location



Installing Special Tool

1) Set the transmission to “N” range.
2) Install the parking pawl, parking pawl shaft and return spring.
3) Temporarily secure the parking support actuator.
4) Set the ST between parking pawl and parking support actuator.

ST 18679AA000 ADJUSTER

5) Tighten the securing bolts while pressing parking support actuator with finger.

Tightening torque:

10 ±2 N .m (1.0 ±0.2 kgf-m, 7.4 ±1.5 ft-lb)

Angle Gauge

6) Using the ST, tighten the bolts which tightened in step 4) with specified angle.

TIGHTENING ANGLE: 18 °±2 °

ST 18679AA000 ADJUSTER

ST 18854AA000 ANGLE GAUGE

NOTE: DO NOT USE AN EXTENSION.

7) Install the center differential carrier.
8) Install the extension case and intermediate case.

During final reassemble, where the oil pump cover is placed onto the transmission case, a gasket must be installed. Use long bolts as a guide for holding the gasket in place while the oil pump cover is being installed (studs are on the oil pump cover) Remove the long bolts after the oil pump cover is making full contact with the gasket.

The top of the front sun gear must spline with the clutch plates of the front brake clutch. The center hub of the oil pump cover must engage with one way clutch in the top of the sun gear.

Rotate the front sun gear through the valve body area or install the output shaft and using a plastic tool, lock the pinions of the VTD assemble together and rotate the output shaft. This will turn the front sun gear, aligning the plates of the front clutch so the hub of the oil pump cover engages with the one way clutch. (DO NOT FORCE THE OIL PUMP COVER IN PLACE)

Gear position	Gear ratio
1st	3.540
2nd	2.264
3rd	1.471
4th	1.000
5th	0.834

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Gear Position

Final Gear Ratio

LEGACY					
2.5L	SOHC			2.5L	DOHC
5MT	4AT			5MT	5AT
3.9	4.111			4.111	3.272
OUTBACK					
2.5L	SOHC	2.5L	DOHC	3.0L	DOHC
5MT	4AT	5MT	5AT		5AT
4.111	4.444	4.444	3.583		3.272

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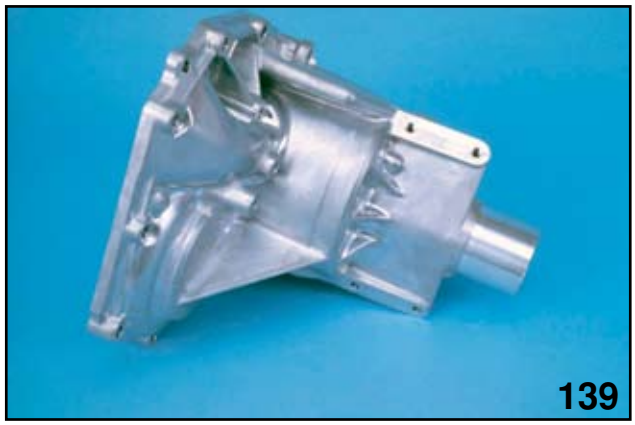
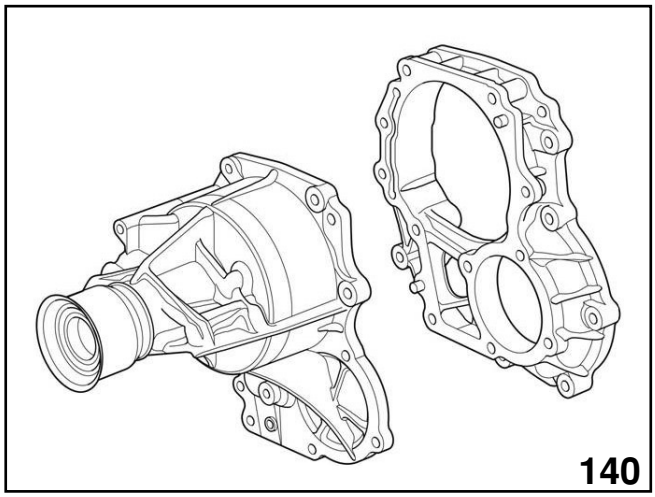
Final Gear Ratio

2006 NEW FEATURES



New Integrated Intermediate and Extension Housing



Current Extension Housing (Artwork)

Integrated intermediate and extension housing provides for easier servicing.

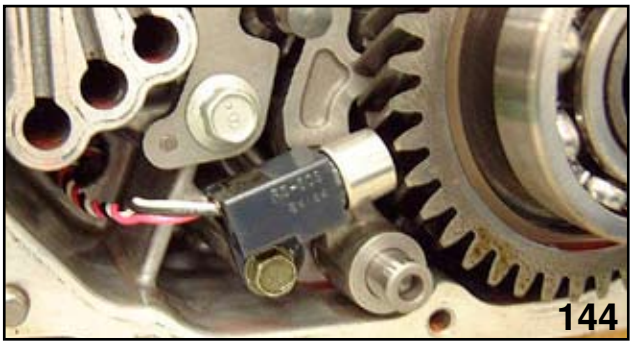
New Parking Pawl

New Parking Gear

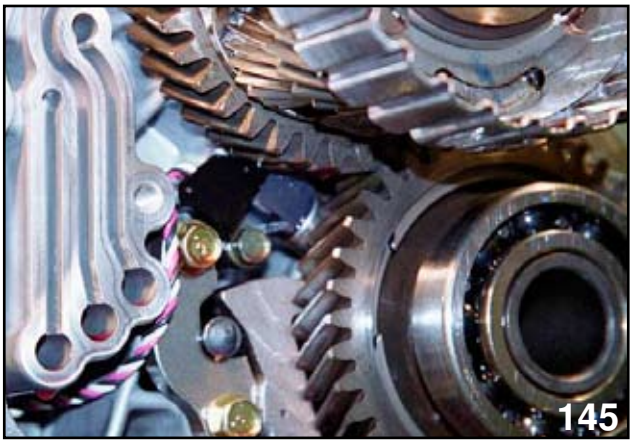
The parking mechanism construction has been made larger and stronger. The parking gear itself is serviceable separately from the reduction gear.

New Parking Actuator

The parking pawl actuator requires no adjustment and is positioned in the case with knock pins.

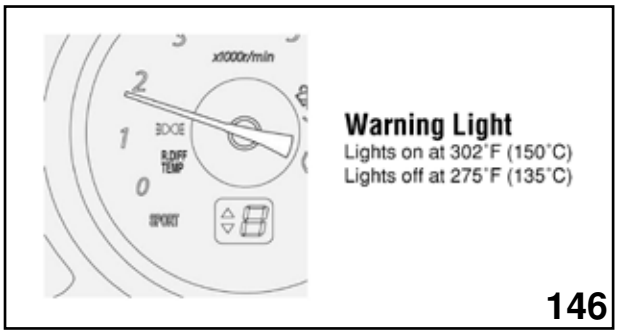


New Front Wheel Sensor



Current Front Wheel Sensor

The front wheel speed sensor has been relocated and now senses revolutions of the reduction gear. The speed sensor harness locator bracket has been deleted due to the new routing to the speed sensor harness.



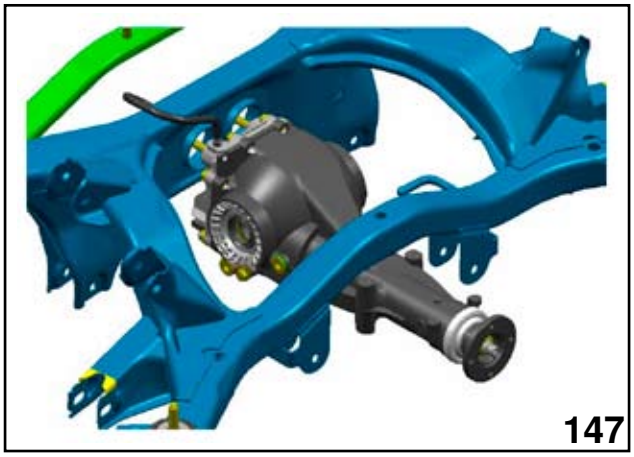
Warning Light

Rear differential

An open type differential is utilized to allow for more efficient operation of the VDC.

A temperature switch has been installed to advise the driver of high temperature in the rear differential.

Solid drive pinion shaft of front differential provides a stronger link in the drive train for operation of a heavier load.



Rear Differential Vent Hose

Breather changed to hose type (from cap type of ’05 Legacy)

Gear Ratios have changed for each gear which assists with increasing performance and fuel economy.

Engine			Subaru B9 Tribeca 3.0L NA	05 Legacy 3.0L NA
AT	Type		5AT	5AT
	Torque converter		C40	C40
	Gear ratio	1ST	3.842	3.540
		2ND	2.353	2.264
		3RD	1.529	1.471
		4TH	1.000	1.000
		5TH	0.839	0.834
		REV	2.765	2.370
	Final Gear. R		3.583	3.272
	A/T operation mode		Normal/Sport/Manual	Normal/Sport/Manual
Rear Differential	Type		New R160	New R160
	Rear LSD		None	Equipped
	R. Diff oil temp switch		Equipped	None
AWD Sys	Type		VTD	VTD
	Distribution rate		Fr:Rr = 45.7:54.3	Fr:Rr = 45.7:54.3

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Gear Ratio Chart

Sport Shift

Shifting in sport mode alters the shift point (delays upshift) to produce a sporty feel of driving. Manual mode allows driver controlled up shifts and downshifts. Starting in 2nd is allowed.

The TCU will upshift and downshift when manual mode is selected and neglected, however, the upshifts will occur near engine red line.

Sport mode is activated by placing the shift lever in the sport gate. Manual mode is activated by the shift lever in the sport gate and tapping up or down.

The indicator on the combination meter will display the current gear range.

5 Speed Automatic Transmission (3O5)

Tools and Equipment

Tool Number	Description
378744300	Piston Guide
398487700	Drift
398527700	Puller Assy.
398643600	Gauge
498057300	Installer
498077000	Driven Gear 5th Remover
498077300	Remover
498077600	Remover
498247001	Magnet Base
498247100	Dial Gauge
498255400	Plate
498277200	Stopper Set
498497100	Crankshaft Stopper
498517000	Replacer
498545400	Filter Wrench
498575400	Oil Pressure Gauge Assy.
498897200	Adapter
499575400	Gauge Brg. Height
499587100	Oil Seal Installer
499737100	Puller Set
499787500	Preload Adapter Wrench
499787700	Wrench
18630AA010	Wrench Compl Retainer
18667AA010	Drive Pin Holder
18675AA000	Differential Side Oil Seal Installer
18676AA020	Torx® Wrench
18679AA000	Adjuster
18680AA000	Gear Holder
18762AA000	Compressor
18763AA000	Compressor Shaft
18765AA000	Compressor Support
18767AA000	Bearing Remover
18854AA000	Angle Gauge
22771AA030	Subaru Select Monitor Kit (SMIII kit)
24082AA260	Cartridge
28399SA010	Oil Seal Protector
41099AC000	Engine Support Assembly

Service Bulletins

No.	Date	Title	Subject
01-160-05	05/06/05	2006MY B9 Tribeca Vehicles equipped with Automatic Transmission	Prevention for draw on batteries during initial vehicle transportation
16-72-07	12/17/07	Forester 04MY and later 4AT Turbo Forester 05MY and later 4AT NA (all Impreza 05MY and later 4AT NA (all) Impreza 06MY and later 4AT Turbo Legacy 05MY and later 4AT 2.5L NA Legacy 08MY and later 5AT 3.0L Legacy 08MY and later 5AT Turbo Tribeca 08MY and later 5AT 3.6L	Automatic Transmission Learning Control Procedure
16-63-99R	02/27/09	1990~2009MY All Models	Remanufactured Transaxles Program
16-73-09	03/05/09	2005~2009MY Legacy/Outback 5AT 2006~2009MY Tribeca 5AT	Transmission/Engine Mounting
16-74-09	03/18/09	2008~09MY Legacy/Outback 2.5L Turbo, 5AT and 3.0L, 5AT 2008~09MY Tribeca 3.6L, 5AT	5AT Torque Converter Shudder/ Vibration
01-167-08	09/09/08	All Subaru Vehicles	Recommended Materials
16-79-09	09/11/09	2010MY Legacy and Outback Equipped with 3.6L, 5AT	TCM Reprogramming Files
11-94-09R	01/05/10	2010MY Legacy and Outback 3.6L, 5AT	ECM Reprogramming Files

Service Program Bulletins

No.	Date	Title	Subject
WWV-06	03/2005	2005MY Subaru Outback H6 5EAT	Transmission Control Module Reprogramming

5 Speed Automatic Transmission (305)

Tech TIPS

Date	Subject
08/04	Transmission Information Worksheet
08/04	5AT Transmission Removal/Installation Precaution
10/04	2005MY Legacy/Outback AT Models Ring Indicator Removal – Revised
12/04	Inspection and Correction Methods of Connector T4/B11
01/05	T.S.B. # 16-67-04
03/05	Remanufactured Automatic Transmission Core Fluid Draining Process
04/05	WWV-06 Campaign
01/06	TCM Code 45 and the SSM III
05/06	Phase 2 4EAT Transmission Characteristics
09/06	2004-2005MY Baja (4AT) Noise On Turns
10/06	Package Changes To Remanufactured Transmissions
12/06	5A/T Remanufactured Transmission and “Learning Control”
08/07	Discontinuation Of Spin-On ATF Filter
08/07	Direct Control 4AT Transmission Information
09/07	More ATF HP Fluid Information
09/07	Performing 5 AT “Learning Control”
11/07	5 A/T Turbine Speed Sensor Precaution
12/07	DTC P0741
03/08	Learning Control Procedure Applicability
04/08	5AT Re-Manufactured Transmission Availability Announcement

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