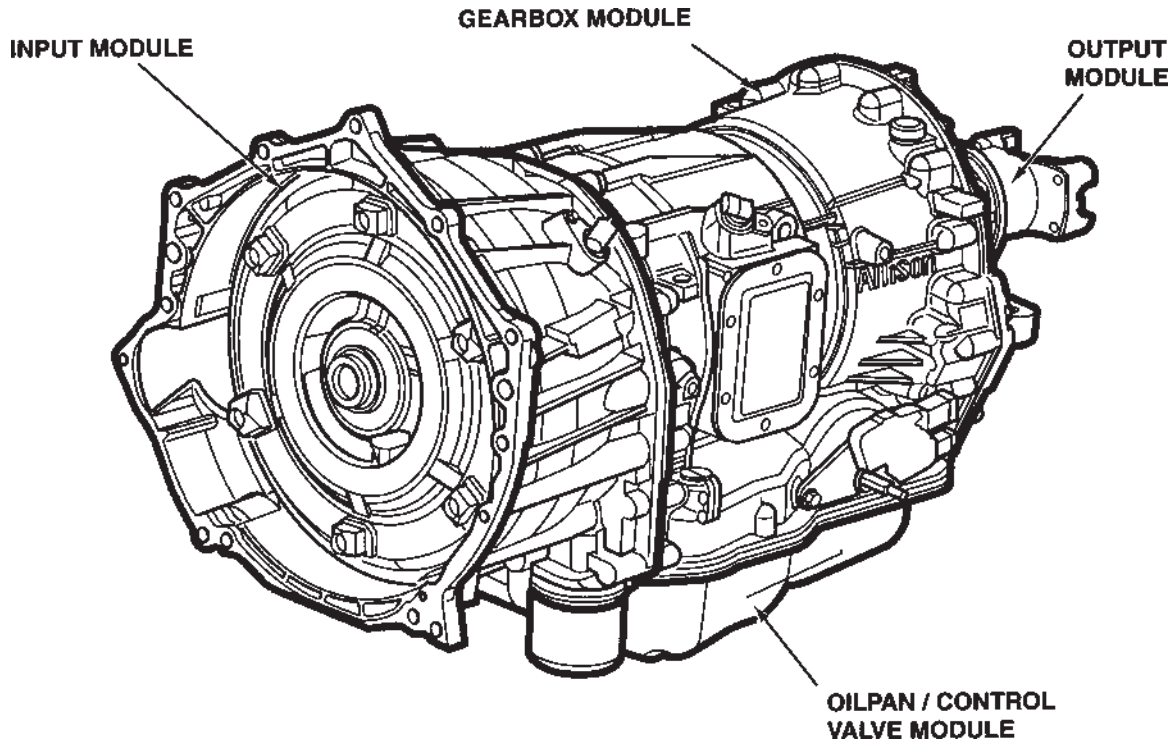




# Benchnotes

## Volume 19



# Allison 1000



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## Introduction

The Allison LCT 1000 is electronically controlled with five forward gears. Fourth gear provides direct drive and fifth an overdrive ratio. The transmission is equipped with a torque converter clutch to provide a direct connection between the engine and transmission. The torque converter clutch can be applied in second through fifth gears.

### Gear Ratios:

1st = 3.10:1

2nd= 1.81:1

3rd= 1.41:1

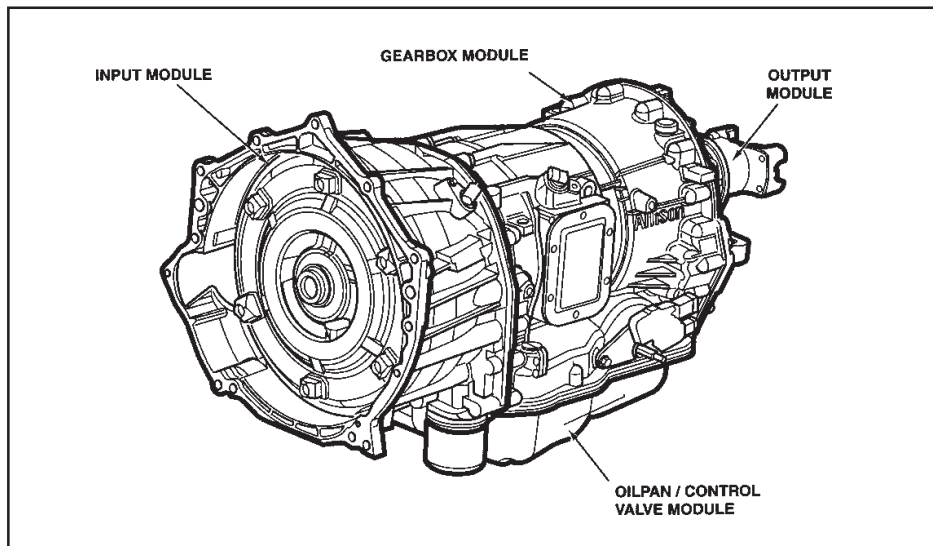
4th = 1.00:1

5th = 0.71:1

Reverse = 4.49:1

### Vehicle Applications:

2001- 2004 Chevrolet and GMC 2500HD and 3500 C/K trucks with the 6.6L Duramax diesel and 8.1L gasoline engines.



### Allison LCT 1000 Modules:

Input Module (Converter Housing)

Gear Box Module

Oil Pan and Control Valve Module

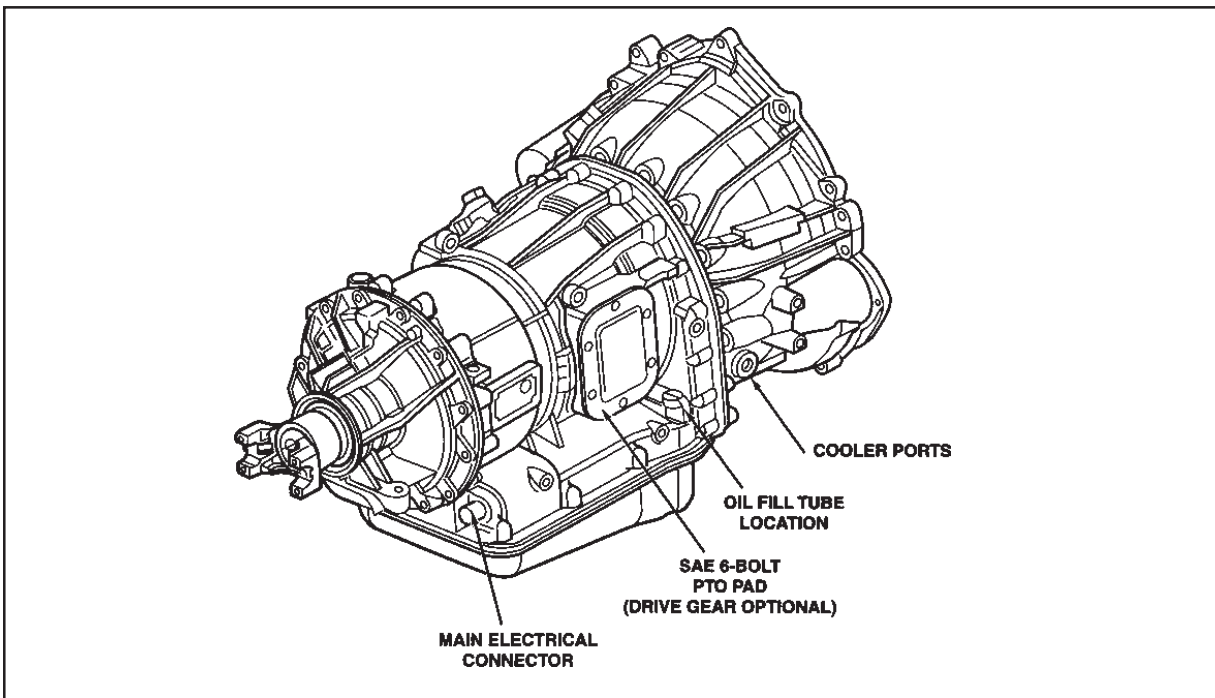
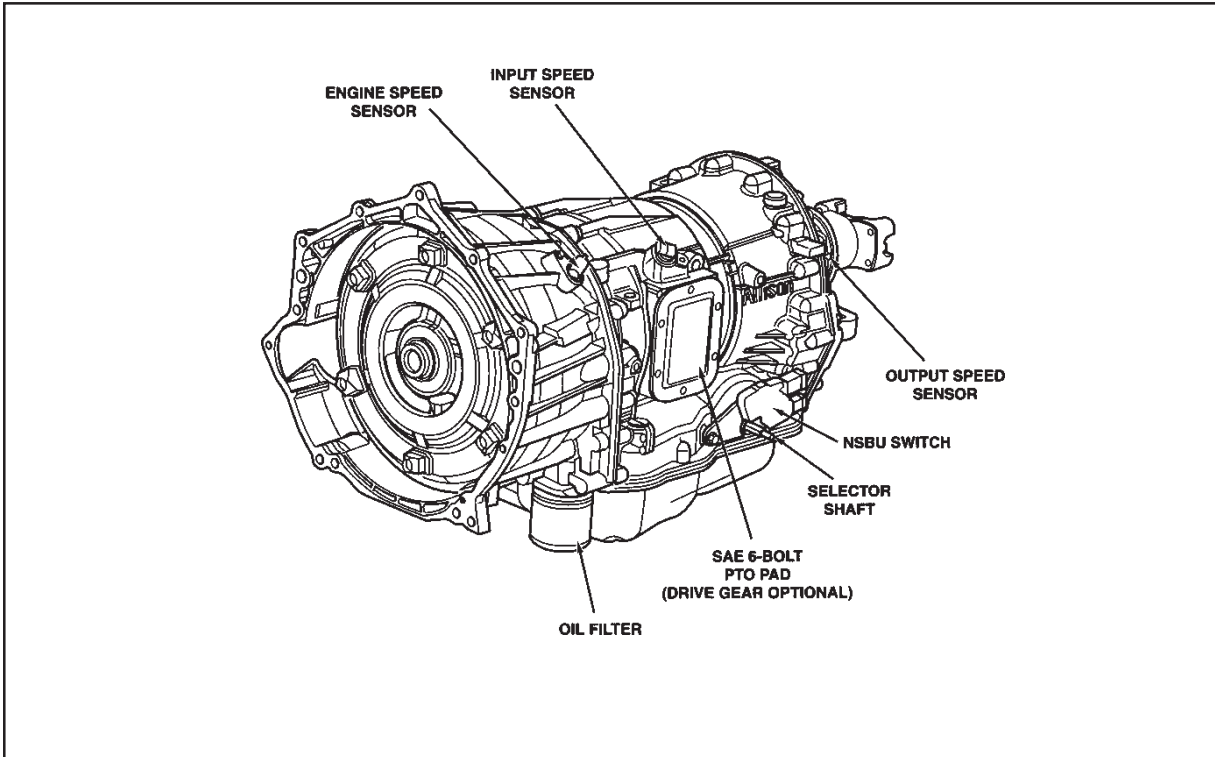
Output Module (Output Housing)

The input module is engine specific.

The output module is matched to either a two wheel or four wheel drive application.



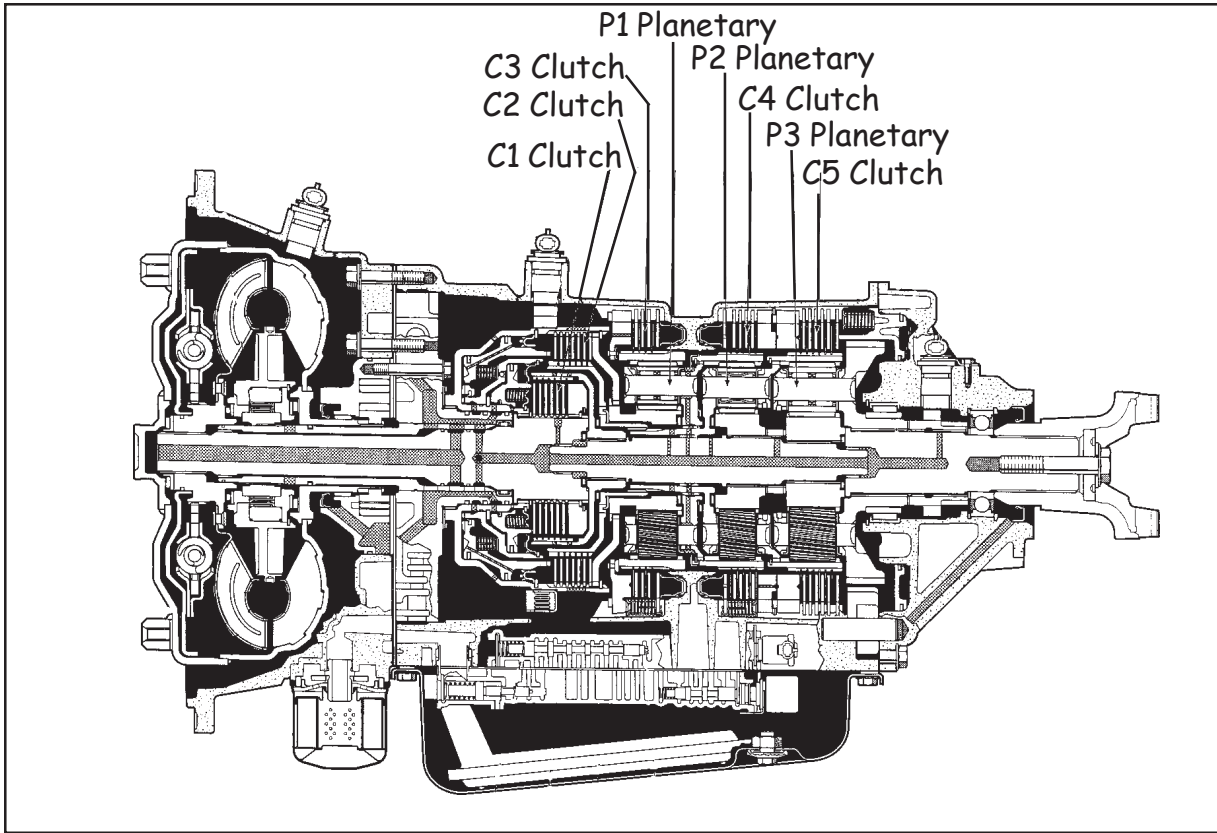
## External Features



There are two provisions for power take-off, one on each side of the case (GM recommends using the passenger side only).  
Spin-on external oil filter (Only filter that must be replaced during a fluid change).



# Mechanical Operation



There are five multiple plate clutch packs. They are numbered C1 through C5. C stands for clutch and the number indicates their position starting at the front of the transmission. The front inner clutch is C1 and the front outer clutch is C2. These clutches are used to drive the planetary gear train. The other three clutches are C3, C4 and C5. They are used to connect a gear set component to the case.

The transmission uses three planetary gear sets to create the different gear ratios. They are identified as P1, P2 and P3 starting with P1 at the front of the transmission.

Clutch Application Chart					
	C1	C2	C3	C4	C5
Reverse			x		x
Neutral					x
First	x				x
Second	x			x	
Third	x		x		
Fourth	x	x			
Fifth		x	x		



## Hydraulic Control System

The pump supplies pressurized fluid to the main hydraulic circuit. All of the other transmission hydraulic circuits derive their pressure from this circuit. The main regulator valve regulates the main line pressure. On 2001 to 2003 models a pressure control solenoid is not used. Pressure regulation is the result of balance pressure and spring force resulting in fixed main line pressure. During high-pressure situations the main regulator valve moves to allow excess flow to return to the pump intake. Fluid pressure is reduced during TCC operation. This is accomplished by TCC signal oil acting on the pressure regulator valve in addition to the balance oil. The pressure is reduced to compensate for the low fluid flow through the torque converter. On 2004 models a pressure control solenoid was added. This was done to give additional cooler flow and reduce pump load during certain low speed operating conditions.

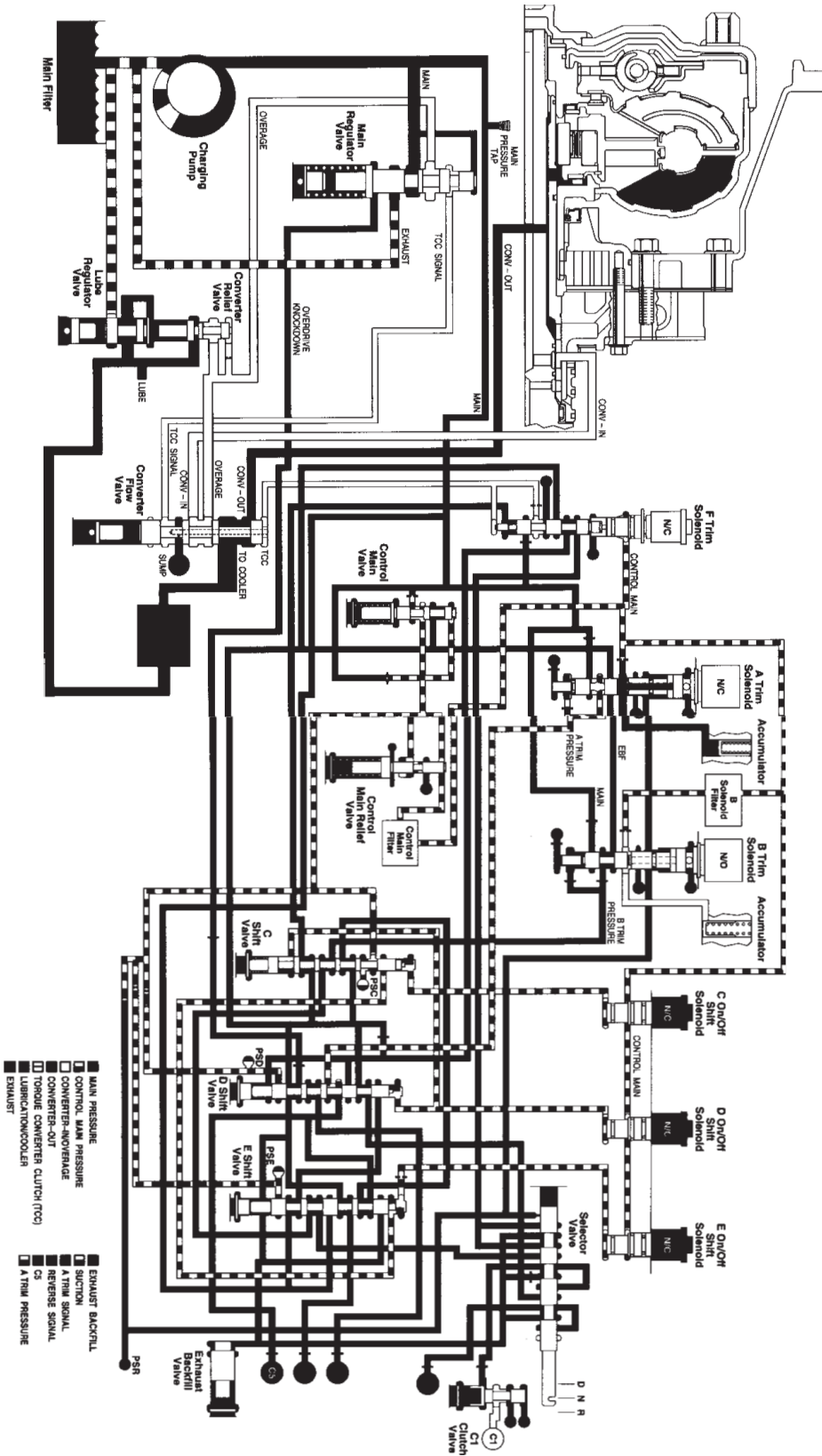
Pressure supplied to the clutches is regulated in order to control shift feel. This pressure is controlled by two trim solenoids.

Three shift solenoids are used to control the position of the shift valves. Each solenoid controls a shift valve.

The position of the shift valves routes the trim pressure to the clutch circuits.

There are two accumulators. They are used to dampen pressure variations in the trim hydraulic circuits. This reduces the amount of pulsing in the trim circuits and allows for smoother clutch apply and release.

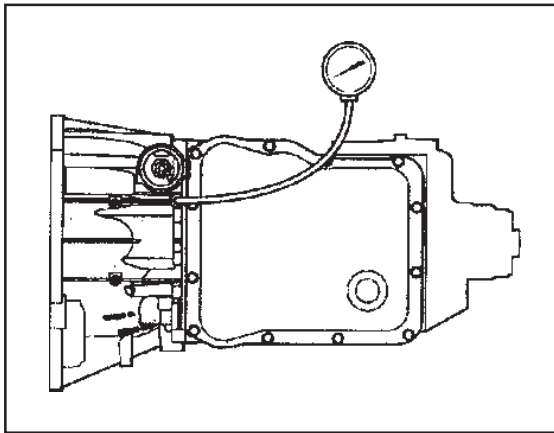
The TCM applies the torque converter clutch by energizing the TCC solenoid. Current flow through the solenoid controls the TCC valve position. This regulates the flow of main line pressure into the TCC apply circuit. The fluid pressure created by the TCC solenoid is regulated by TCC apply pressure and spring force. This prevents high pressure in the torque converter regardless of solenoid operation.



Hydraulic Schematic-Neutral/Park  
1000 Series™ (2001-2003)



## Line Pressure Check Procedure



**NOTE** All Transmission fluid level and pressure checks must be made at normal operating temperature (160-200° F)

1. Check the transmission fluid level.
2. Connect 0-300 PSI oil pressure gauge. Use a Scan Tool to check the engine RPM.
3. With the brakes applied, check the line pressure in Neutral/Reverse and Drive with the engine running at 600 RPM.
4. With the brakes applied, check the line pressure in neutral at 2100 RPM.

## Line Pressure Specifications 2001-2003

Range	Line Pressure @ 600 RPM	Line Pressure @ 2100 RPM
Forward Converter (Torque Converter Clutch not applied)	(101-200 PSI)	(220-260 PSI)
Forward Lockup (Torque Converter Clutch applied)	_____	(145-170 PSI)
Reverse	(101-200 PSI)	(220-260 PSI)
Neutral/Park	(130-240 PSI)	(220-260 PSI)

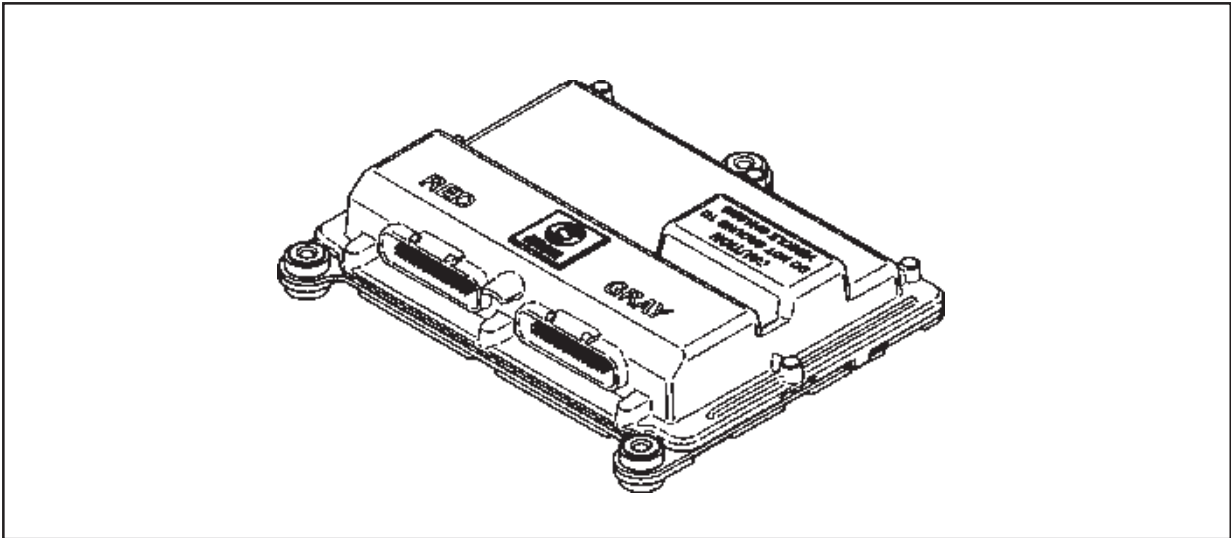
## Line Pressure Specifications 2004-UP

Range	Line Pressure @ 600 RPM	Line Pressure @ 2100 RPM
Forward/Rev Converter w/G solenoid active	(85-105 psi)	(92-110 psi)
Forward Converter w/ G inactive	(101-200 psi)	(220-260 psi)
* Forward Lock-up w/ G active	N/A	(74-91 psi)
Forward Lock-up w/G inactive	N/A	(145-170 psi)
Neutral/Park w/G solenoid active	(85-105 psi)	N/A
Neutral/Park	(130-240 psi)	(220-260 psi)

\*Medium duty gasoline engines only



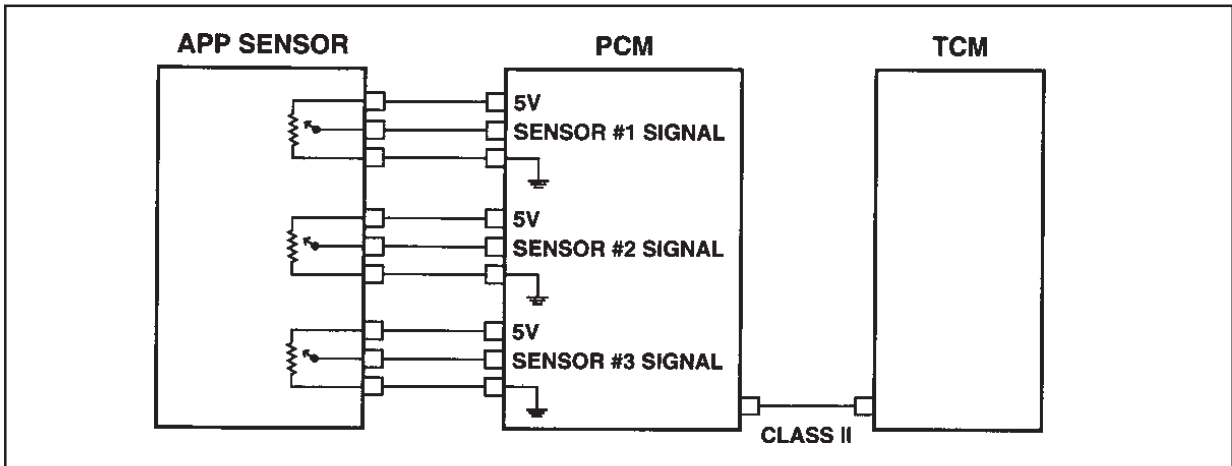
# Electrical



## Transmission Control Module

The system uses a separate Transmission Control Module (TCM) to control operation of the transmission. Most of the primary inputs for transmission control are directly connected to the TCM. However there are several engine inputs provided from the Powertrain Control Module (PCM) on serial data lines between the two modules. The six (2001-2003) or seven (2004) solenoids located on the valve body are the outputs from the TCM used to control the operation of the transmission.

## Inputs

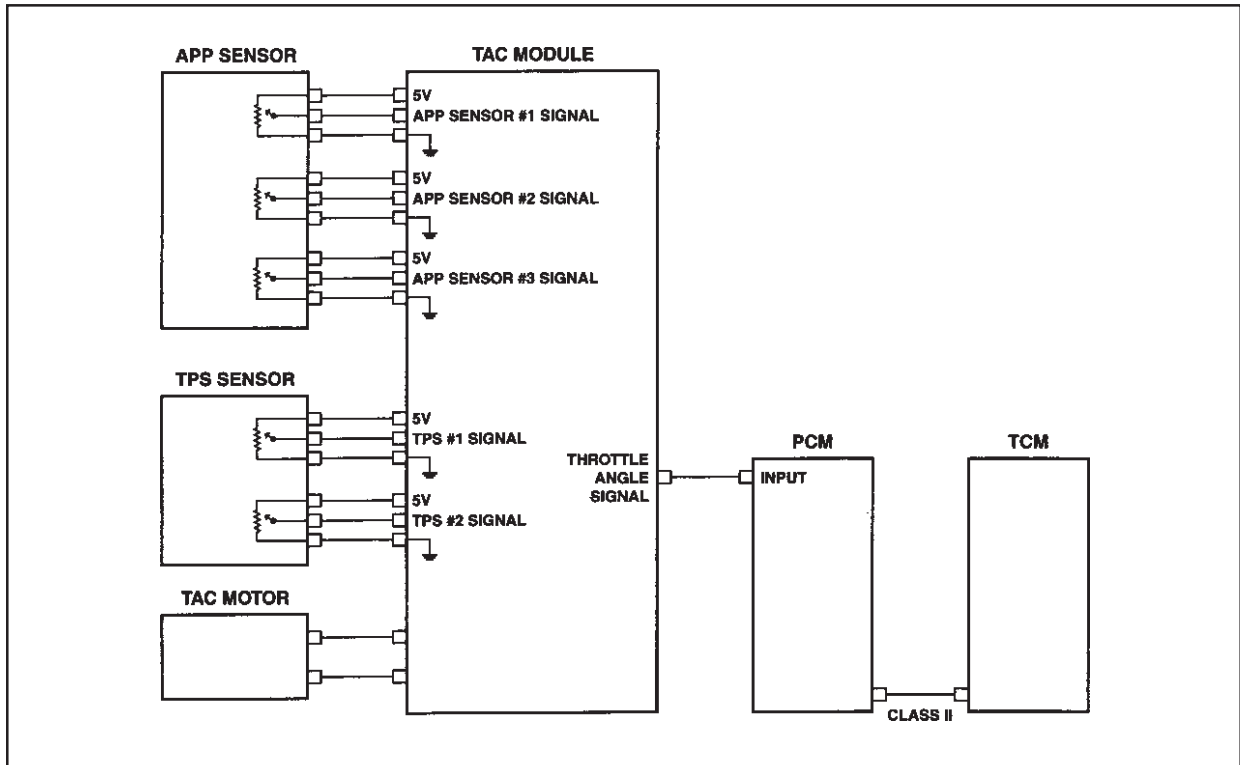


### Accelerator Pedal Position Sensor (Diesel)

The Accelerator Pedal Position (APP) sensor provides the desired acceleration input. Desired acceleration is also an indication of engine load. The APP sensor is part of the accelerator pedal assembly. Inside the APP sensor are three potentiometers. Each is connected to the PCM by three circuits: power (5V), ground and signal. The signal from each potentiometer is different. This allows the PCM to perform diagnostic testing of the sensor. Since the APP sensor is a PCM input the TCM must receive the signal on the serial data lines between the two modules.



# Electrical

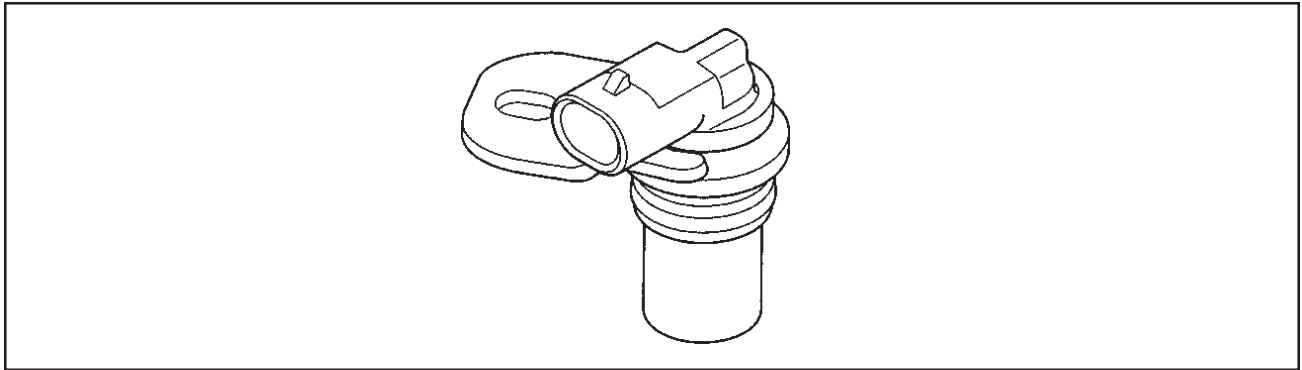


## Accelerator Pedal Position Sensor (Gas)

On gasoline engine applications the Accelerator Pedal Position (APP) sensor is connected to the Throttle Actuator Control (TAC) module. The TAC module uses the APP sensor input to control the throttle actuator motor, which controls the position of the throttle blade. There is no mechanical connection between the accelerator pedal and throttle body. A Throttle Position (TP) sensor is connected to the throttle shaft and provides the TAC module with the actual position of the throttle blade. The TP sensor has two potentiometers that produce two different signals for diagnostic purposes. The TAC module provides a throttle angle input to the PCM based on the TP sensor signals. Since the TAC module signal is a PCM input the TCM must receive the signal on the serial data lines between the two modules.



## Electrical



### Speed Sensors

The Allison LCT 1000 transmission uses three permanent magnet AC voltage generator speed sensors. All three of these sensors input directly to the TCM.

They are the:

Engine speed sensor

Input speed sensor

Output speed sensor

### Engine Speed Sensor

The engine speed sensor generates a signal based on the rotation of the torque converter. The ribs on the torque converter housing are what trigger the AC signal. Since the torque converter is bolted to the engine the signal produced provides the TCM with the speed of the engine. The TCM uses the engine speed and input speed to calculate the slip in the torque converter.

### Input Speed Sensor

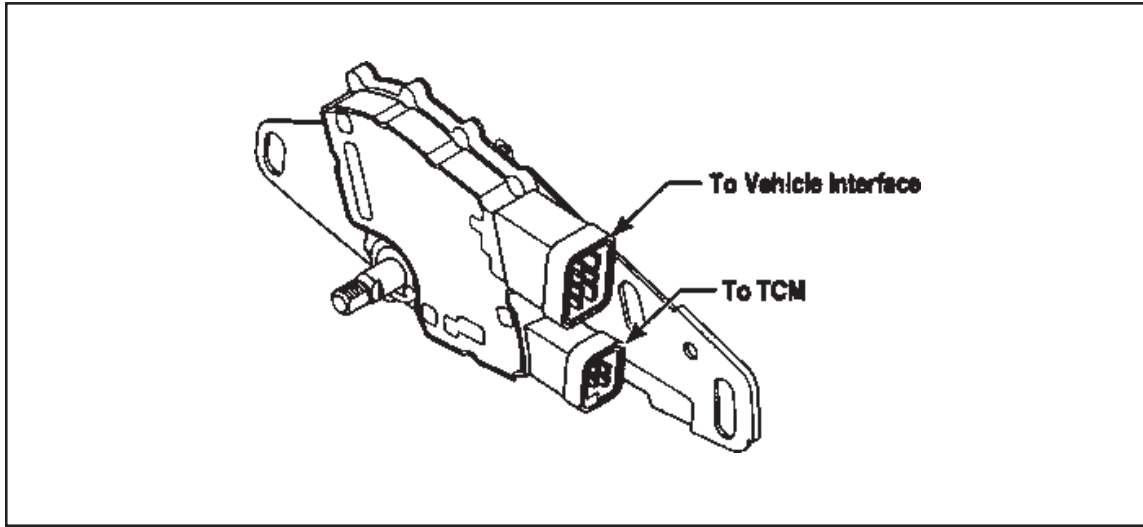
The input speed sensor is located on the gear box module and provides the TCM with the speed of the turbine shaft. The sensor uses either the PTO gear or a reluctor wheel connected to the rotating clutch housing to generate the signal. Turbine speed is used with engine speed to calculate torque converter slip. Turbine speed is also used with output shaft speed to calculate the gear ratio.

### Output Shaft Speed Sensor

The output sensor is located on either the output module (2WD) or transfer case (4WD). On two-wheel drive applications it uses a reluctor wheel on the output shaft to generate a signal. On four-wheel drive applications the signal is generated by an output member of the transfer case. Output speed along with input speed is used to calculate the actual gear ratio. It also is used to calculate vehicle speed.



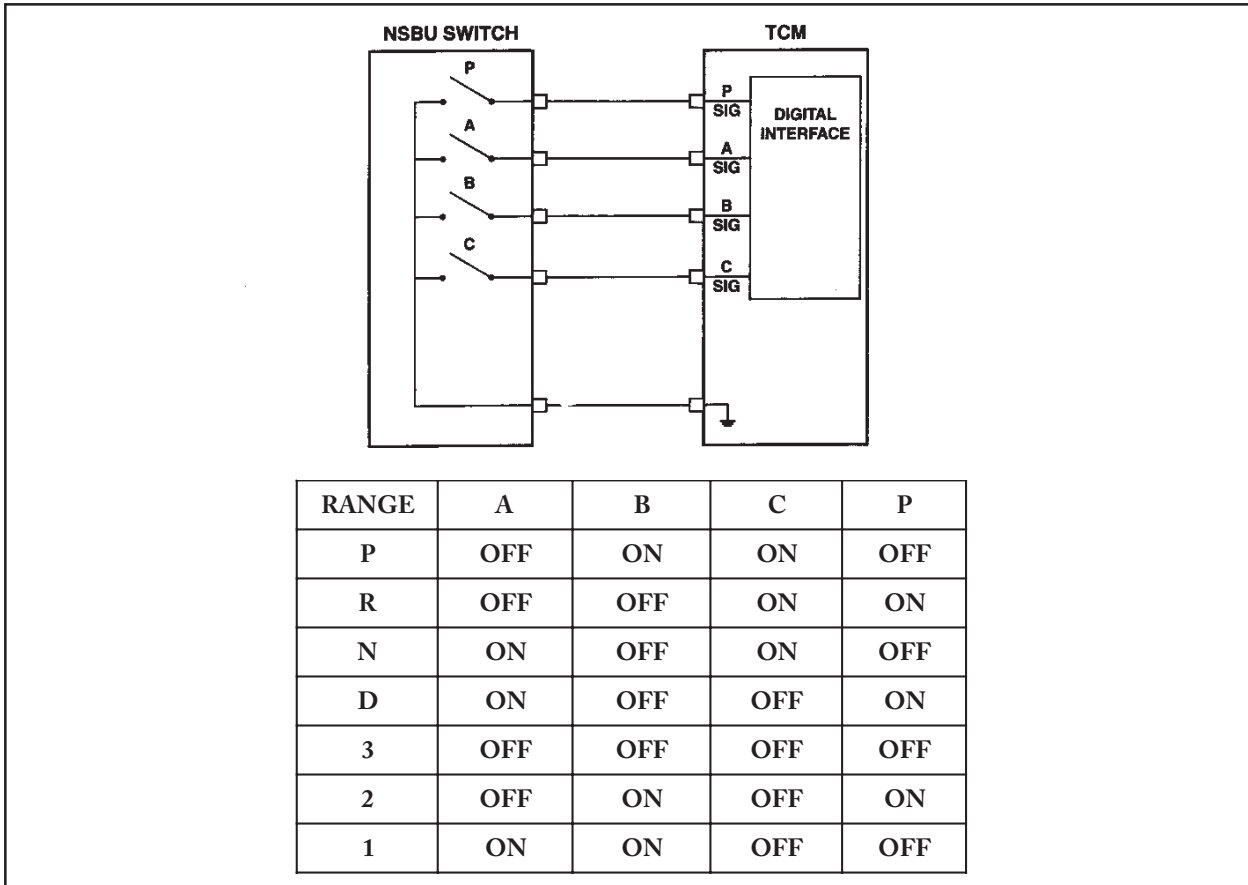
# Electrical



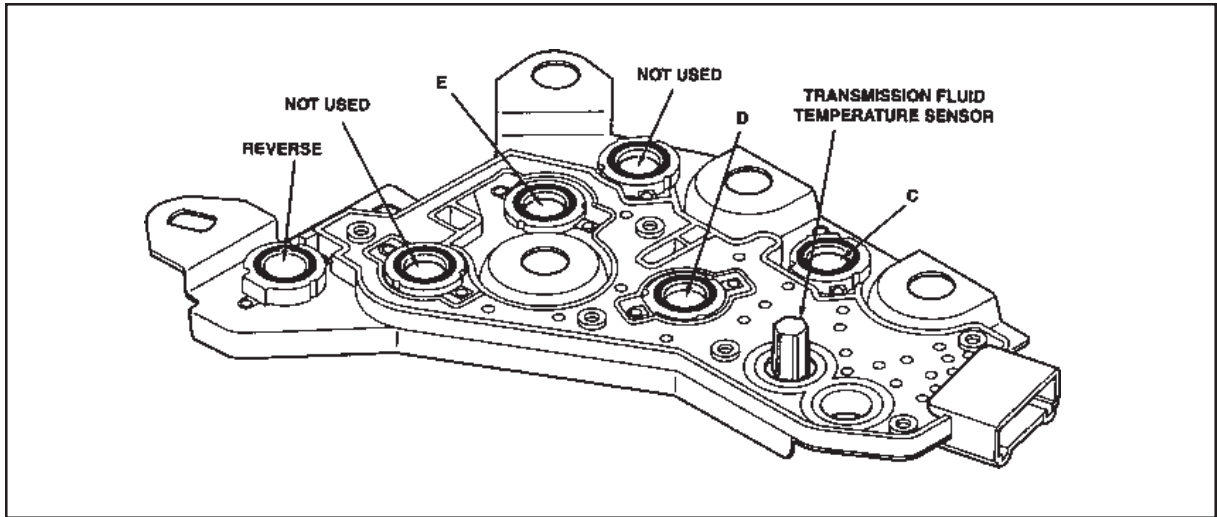
## Neutral Start/Back-Up (NSBU) Switch

The NSBU switch is mounted on the transmission selector shaft. It provides four signals to the TCM. Based on the signal combinations the TCM can determine which driving range the operator has selected.

The NSBU switch also contains separate switches for the back-up lamps and the neutral start function.

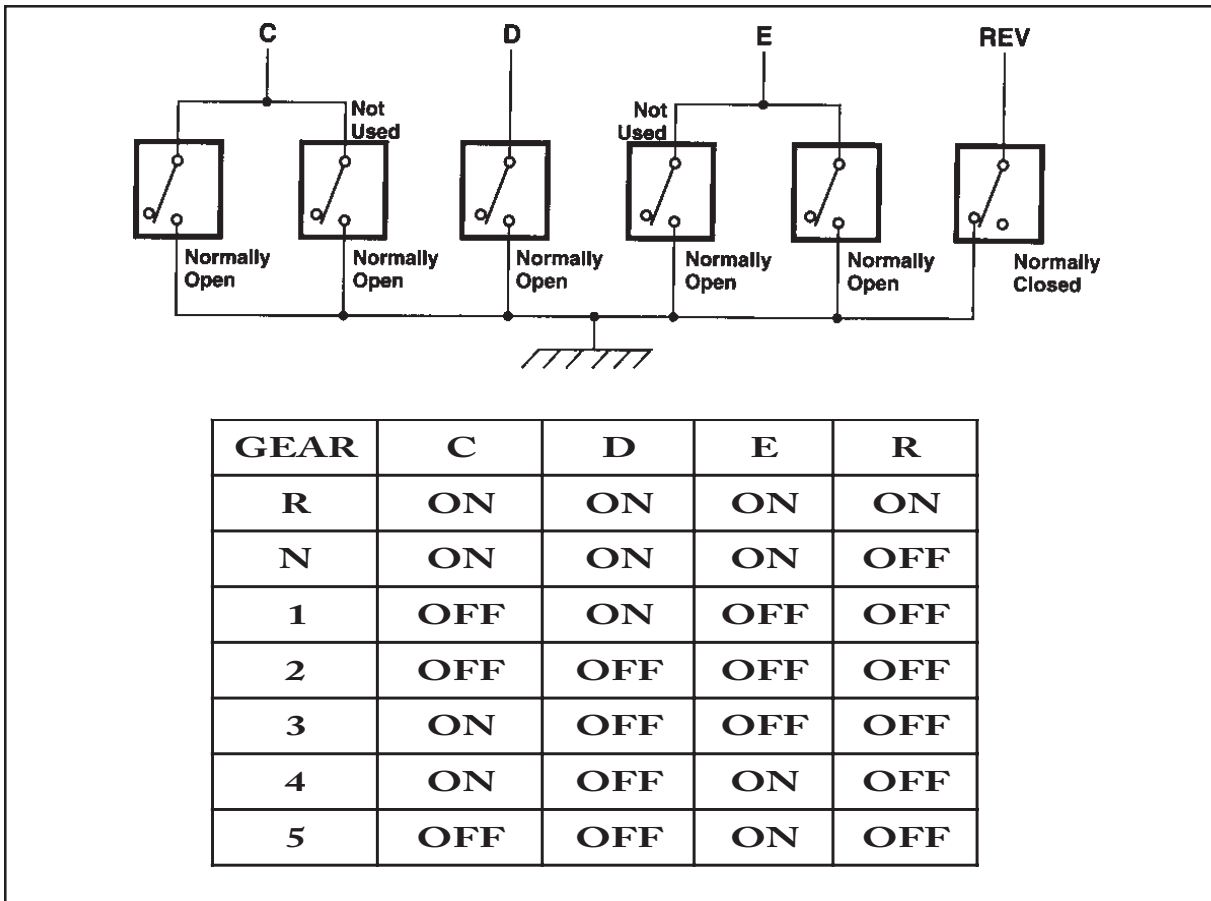


# Electrical



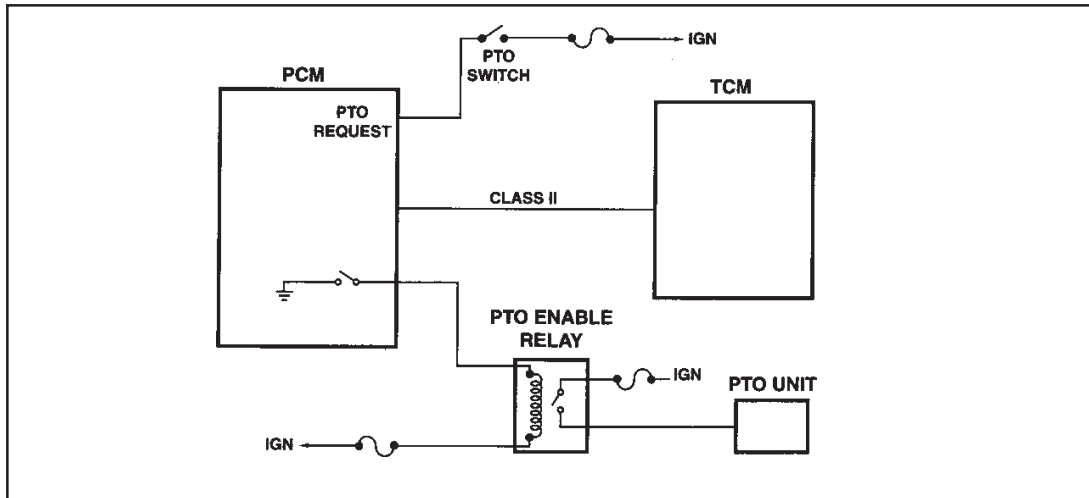
## Pressure Switch Assembly (PSA)

The PSA is a fluid pressure switch mounted on the transmission valve body. It provides four signals to the TCM. Based on the signal combinations the TCM can determine which gear is indicated by the hydraulic control system. The PSA also contains the transmission fluid temperature sensor.





## Electrical

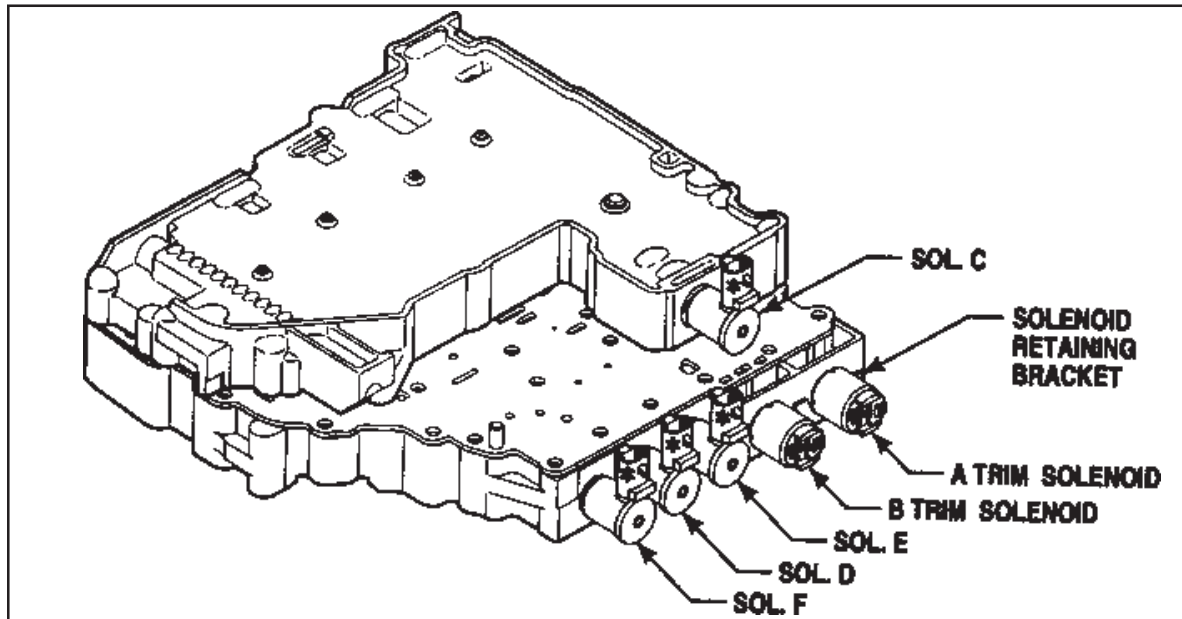


### Power Take-Off (PTO) Input

Vehicles equipped with a PTO have a PTO input to the PCM. When the PTO switch is turned on the PCM notifies the TCM of the request and verifies that the transmission and engine operating conditions are correct for PTO operation. Once the PCM verifies they are within specifications it turns on the PTO relay and the TCM will engage the torque converter clutch.



## Electrical



## Outputs

The six solenoids located on the valve body are the TCM outputs used to control the operation of the Allison LCT 1000 transmission. In 2004 a seventh solenoid was added which is used to modulate main line pressure.

### Trim Solenoids

Solenoids A and B are called trim solenoids. They control the apply, release and holding pressure supplied to the five clutch packs. These solenoids are referred to as Pressure Proportional to Current (PPC). The output pressure of the solenoids varies and is proportional to the current which is controlled by the TCM,

Trim solenoid A is a normally closed (NC) solenoid that blocks the flow of fluid through the solenoid. Trim Solenoid B is a normally open (NO) solenoid which allows fluid to flow through the solenoid to exhaust.

### Shift Solenoids

Solenoids C D and E are shift solenoids. Each solenoid controls the position of a shift valve. All three solenoids are normally closed (NC) and are controlled by an on/off command from the TCM.

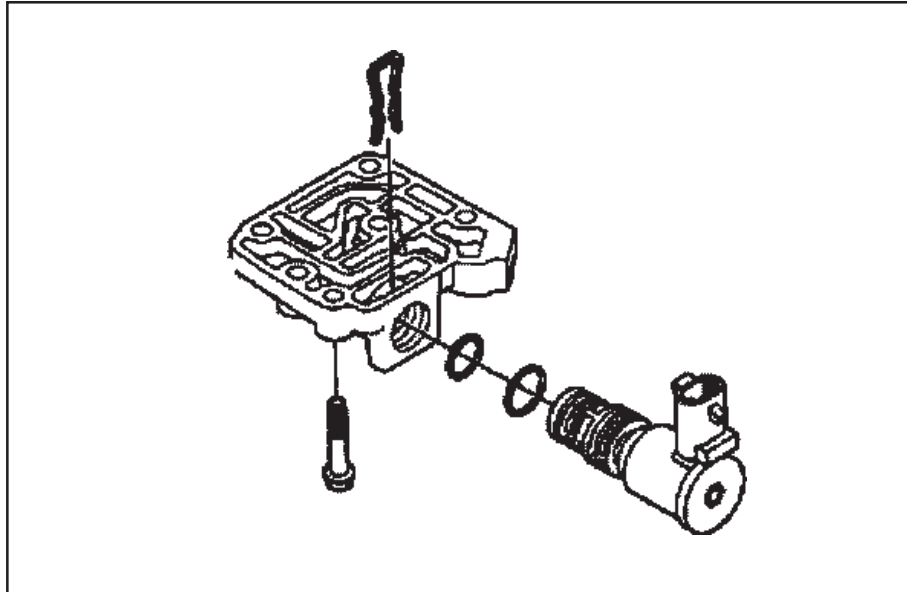
### Torque Converter Clutch Solenoid

Solenoid F controls the fluid pressure acting on the TCC valve. The amount of pressure is controlled by the TCM using Pulse-Width Modulation (PWM). Longer solenoid on time causes the pressure acting on the TCC valve to increase. The TCC valve then moves down in its bore to allow more main pressure into the TCC circuit.





## Electrical



### **Main Pressure Modulation Solenoid**

Solenoid G was added in 2004 to allow the TCM to modulate the main fluid pressure. At throttle openings below eight percent solenoid G fluid pressure acting on the main regulator valve lowers main fluid pressure to approximately 100 psi. This was done to provide additional cooler flow and reduce pump load during certain low speed operating conditions.



# Electrical

## Adaptive Control

Adaptive control allows the TCM to tailor the shift quality to compensate for transmission wear and tolerances. The TCM calculates how long a shift takes by measuring the time between when the shift is commanded to when the desired gear ratio is attained. If the shift time does not fall within the parameters stored in memory for the specific driving condition the TCM determines the necessary corrections and stores the information in the adaptive memory. During any further shifts under the same driving condition the TCM will use the information stored in the adaptive memory.

Whenever a transmission repair is made that could affect shift timing the TCM shift adapts should be cleared or reset using a scan tool. When the shift adapts have been cleared the TCM adjusts the adaptive control to quickly compensate for any major change in system tolerances. For 2002-2004 models a "Fast-Learn" procedure is also available. With this procedure much of the clutch fill data is learned before the vehicle is road tested. If your scan tool has the capability this is the preferred method.

## Failsafe

The TCM will go into Failsafe during specific electrical conditions relating to the shift solenoids and TCM inputs. During Failsafe operation all solenoids are turned off to prevent transmission damage.

Generally speaking in Failsafe operation the transmission will have reverse and third gears only. However there are some exceptions to this. One of them is that the Allison LCT 1000 is one of the few transmissions that could have a no move condition in Failsafe. If the problem occurs while the transmission is in neutral both forward and reverse will be inhibited. The only way the vehicle will move is to turn the key off and restart the engine. In most cases you will have a transmission that has been restarted with the current condition therefore reverse and third gear will be available. See the chart below for all of the failsafe possibilities.

Range when Fault Occurred	Default Range	Range on Shift from N-R	Shift on Shift from N-D
R	N	N*	5**
N	N	N*	N**
1	1	R	1***
2	3	R	3
3	3	R	3
4	5	N*	5**
5	5	N*	5**

\* Reverse can be attained by stopping and restarting the engine  
 \*\* Third Gear can be attained by stopping and restarting the engine  
 \*\*\* Third Gear can be attained after Reverse is selected



## Electrical

### Grade Brake Feature

The grade brake features primary purpose is to use engine braking to slow a heavy vehicle on steep grades to reduce wear on the braking system. The TCM accomplishes this by overriding the PRNDL position and selecting the next lower gear range automatically. The TCM takes several factors into consideration before commanding a downshift for engine braking. The primary inputs are:

- Throttle position
- Brake state (The brakes must be applied to activate grade braking)
- Vehicle acceleration/deceleration
- Grade/load
- Vehicle speed

Normally the grade-braking feature will not command downshifts below fourth gear. In the Tow/Haul mode the grade-brake feature can select a 5-4, 4-3, or 3-2 downshift. The grade-braking feature is part of the TCM logic and cannot be disabled.

### Tow/Haul mode

The Tow/Haul mode is designed to give better drivability when the vehicle is loaded to at least 75% of the gross vehicle combined weight. To accomplish this the TCM will:

- Reduce shift cycling at a given engine and vehicle load
- Eliminate closed throttle upshifts to reduce shift cycling on/off throttle
- Increase shift points to allow the engine to operate within its power band
- Command TCC on during lower gear operation

The Tow/Haul mode is controlled by a switch either on the dash board or the end of the shift lever.



## Electrical

### Diagnostic Trouble Code List

Code	Description
PO218	Transmission Fluid Over Temperature
PO500	Vehicle Speed Sensor Circuit
PO561	Unrealistic Variations in Vehicle System Voltage
PO562	System Voltage Low
PO563	System Voltage High
PO606	Controller Internal Performance
PO700	MIL Illumination Requested
PO701	Transmission Control System Performance
PO703	Brake Switch Circuit
PO706	Transmission Range Sensor Circuit Performance
PO708	Transmission Range Sensor Circuit High Input
PO711	Transmission Fluid Temperature Sensor Circuit Performance
PO712	Transmission Fluid Temperature Sensor Circuit Low Input (High Temperature)
PO713	Transmission Fluid Temperature Sensor Circuit High Input (Low Temperature)
PO716	Turbine Speed Sensor Circuit Performance
PO717	Turbine Speed Sensor Circuit No Signal
PO721	Output Speed Sensor Circuit Performance
PO722	Output Speed Sensor Circuit No Signal
PO726	Engine Speed Sensor Circuit Performance
PO727	Engine Speed Sensor Circuit No Signal
PO731	Incorrect 1st Gear Ratio
PO732	Incorrect 2nd Gear Ratio
PO733	Incorrect 3rd Gear Ratio
PO734	Incorrect 4th Gear Ratio
PO725	Incorrect 5th Gear Ratio
PO736	Incorrect Reverse Ratio
PO741	Torque Converter Clutch System Stuck Off
PO742	Torque Converter Clutch System Stuck On
PO743	Torque Converter Clutch-Electrical
PO746	Solenoid "A" Controlled Clutch Stuck OFF
PO747	Solenoid "A" Controlled Clutch Stuck ON
PO748	Pressure control Solenoid "A" Electrical
PO763	Shift Solenoid "C"-Electrical
PO768	Shift Solenoid "D"-Electrical
PO773	Shift Solenoid "E"-Electrical
PO776	Solenoid "B" Controlled Clutch Stuck OFF
PO777	Solenoid "B" Controlled Clutch Stuck ON



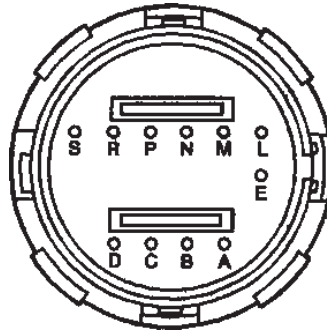
## Electrical

### Diagnostic Trouble Code List

Code	Description
PO778	Pressure control Solenoid "B" Electrical
PO836	4-Wheel Drive Low Switch Circuit Malfunction
PO840	Pressure Switch Solenoid "C" Circuit Malfunction
PO841	Pressure Switch Solenoid "C" Circuit Stuck Open
PO842	Pressure Switch Solenoid "C" Circuit Stuck Closed
PO843	Pressure Switch Solenoid "C" Circuit High
PO845	Pressure Switch Solenoid "D" Circuit Malfunction
PO846	Pressure Switch Solenoid "D" Circuit Stuck Open
PO847	Pressure Switch Solenoid "D" Circuit Stuck Closed
PO848	Pressure Switch Solenoid "D" Circuit High
PO870	Pressure Switch Solenoid "E" Circuit Malfunction
PO871	Pressure Switch Solenoid "E" Circuit Stuck Open
PO872	Pressure Switch Solenoid "E" Circuit Stuck Closed
PO873	Pressure Switch Solenoid "E" Circuit High
PO875	Reverse Pressure Switch Circuit Malfunction
PO876	Reverse Pressure Switch Stuck Open
PO880	TCM Power Input Signal
P1571	TCM Torque Request Signal (8.1L)
P1688	Unmanaged Engine Torque Delivered to TCM
P1709	Pressure Switch "E" Circuit Malfunction
P1710	Pressure Switch Solenoid "E" Circuit Stuck Open
P1711	Pressure Switch Solenoid "E" Circuit Stuck Closed
P1712	Pressure Switch Solenoid "E" Circuit High
P1713	Reverse Pressure Switch Circuit Malfunction
P1714	Reverse Pressure Switch Stuck Open
P1718	Incorrect Neutral Gear Ratio
P1720	Solenoid "A" Controlled Clutch Stuck Off
P1721	Solenoid "B" Controlled Clutch Stuck Off
P1723	Solenoid "A" Controlled Clutch Stuck On
P1724	Solenoid "B" Controlled Clutch Stuck On
P1726	Solenoid "D" Controlled Clutch Engaged
P1727	Solenoid "E" Controlled Clutch Engaged
P1760	TCM Supply Voltage
P1779	Engine Torque Delivered to TCM
P1860	Torque Converter Clutch Electrical
P1875	4-Wheel Drive Low Switch Circuit
P2810	Pressure Control Solenoid "G" Electrical
U2105	CAN Bus PCM Error



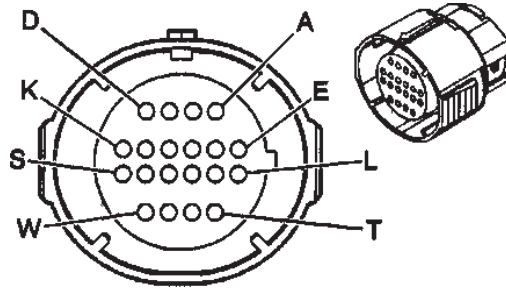
## Automatic Transmission Inline Harness (Transmission Side)



Pin	Wire Color	Function
A	DK GRN	Shift Solenoid C Control
B	YEL/BLK	Shift Solenoid D Control
C	PNK	Solenoid Supply Voltage
D	LT GRN	Transmission Fluid Pressure Switch Signal A
E	RED	Transmission Fluid Pressure Switch Signal C
F	DK BLU	Transmission Fluid Pressure Switch Signal B
G	YEL	TFT Sensor Signal
H	BLK	Sensor Ground
J	BRN	TCC PWM Solenoid F Control
K	TAN	Transmission Fluid Pressure Switch Signal R
L	RED/BLK	Trim Solenoid A Low Control
M	LT BLU	Trim Solenoid A High Control
N	GRY	Trim Solenoid B High Control
P	PPL	Trim Solenoid B Low Control
R	ORG	Pressure Control Solenoid G Control (2004)
S	BLK	TCC PWM Solenoid F Supply Voltage Pressure Control Solenoid G Supply Voltage (2004)
T	BLK	Transmission ID
W	BLK/WHT	Shift Solenoid E Control



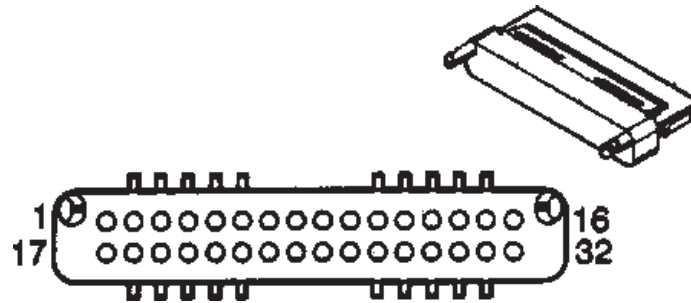
## Automatic Transmission Inline Harness (Engine Harness Side)



Pin	Wire Color	Function
A	LT GRN	Shift Solenoid C Control
B	YEL/BLK	Shift Solenoid D Control
C	BRN	Solenoid Supply Voltage
D	PNK	Transmission Fluid Pressure Switch Signal A
E	RED	Transmission Fluid Pressure Switch Signal C
F	DK BLU	Transmission Fluid Pressure Switch Signal B
G	YEL/BLK	TFT Sensor Signal
H	BLK	Sensor Ground
J	BRN	TCC PWM Solenoid F Control
K	LT GRN/BLK	Transmission Fluid Pressure Switch Signal R
L	LT BLU/WHT	Trim Solenoid A Low Control
M	RED/BLK	Trim Solenoid A High Control
N	PNK/BLK	Trim Solenoid B High Control
P	BRN/WHT	Trim Solenoid B Low Control
R	DK BLU	Pressure Control Solenoid G Control (2004)
S	DK GRN/WHT	TCC PWM Solenoid F Supply Voltage Pressure Control Solenoid G Supply Voltage (2004)
T	PPL	Transmission ID
W	ORN/WHT	Shift Solenoid E Control



## Transmission Control Module (TCM) -C1 (Gray)

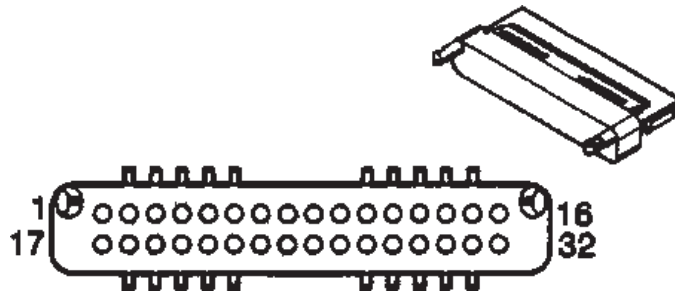


Pin	Wire Color	Function
1	BLK/WHT	Ground
2	PNK	Off/Run/Crank Voltage
3	ORN	Battery Positive Voltage
4	PNK	Off/Run/Crank Voltage
5	BLK/WHT	Ground
6	YEL	Power Take Off (PTO) Reference Voltage
7	PPL	TCC Brake Switch Signal
8	-----	Not Used
9	WHT	Unmanaged Torque Signal
10	GRY/BLK	4WD Low Signal
11-15	-----	Not Used
16	TAN/BLK	Delivered Torque Signal
17-21	-----	Not Used
22	ORN/BLK	Requested Torque Signal
23-24	-----	Not Used
25	DK BLU	Transmission MIL Request Signal
26	-----	Not Used
27	YEL	Signal High - Front
28	-----	Not Used
29	YEL	CAN Data Link Signal HI
30	YEL	Class 2 Serial Data
31	-----	Not Used
32	DK GRN	CAN Data Link Signal LO





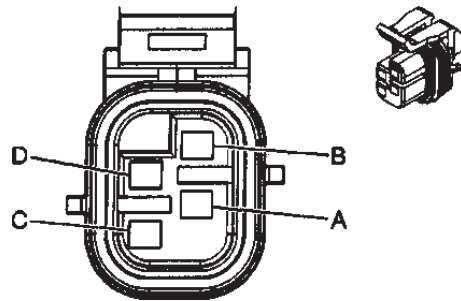
## Transmission Control Module (TCM) - C2 (RED)



Pin	Wire Color	Function
1	PNK	Transmission Fluid Pressure Switch Signal A
2	DK BLU	Transmission Fluid Pressure Switch Signal B
3	RED	Transmission Fluid Pressure Switch Signal C
4	LT GRN/BLK	Transmission Fluid Pressure Switch Signal R
5	BLK/WHT	Transmission Range Switch Signal A
6	YEL	Transmission Range Switch Signal B
7	GRY	Transmission Range Switch Signal C
8	WHT	Transmission Range Switch Signal P
9	-----	Not Used
10	YEL/BLK	TFT Sensor Signal
11-12	-----	Not Used
13	ORN	Turbine Speed Signal HI
14	LT BLU	Turbine Speed Signal LO
15	PPL/WHT	Vehicle Speed Signal HI
16	LT GRN/BLK	Vehicle Speed Signal LO
17	RED/BLK	Input Shaft Speed Signal HI
18	DK BLU/WHT	Input Shaft Speed Signal LO
19	-----	Not Used
20	BLK	Sensor Ground
21	PPL	Transmission ID
22	LT BLU/WHT	Trim Solenoid A Low Control
23	RED/BLK	Trim Solenoid A High Control
24	PNK/BLK	Trim Solenoid B High Control
25	BRN/WHT	Trim Solenoid B Low Control
26	LT GRN	Shift Solenoid C Control
27	YEL/BLK	Shift Solenoid D Control
28	ORN/WHT	Shift Solenoid E Control
29	BRN	TCC PWM Solenoid F Control
30	DK BLU	Pressure Control Solenoid G Control (2004)
31	BRN	Solenoid Supply Voltage
32	DK GRN/WHT	TCC PWM Solenoid F Supply Voltage Pressure Control Solenoid G Supply Voltage (2004)

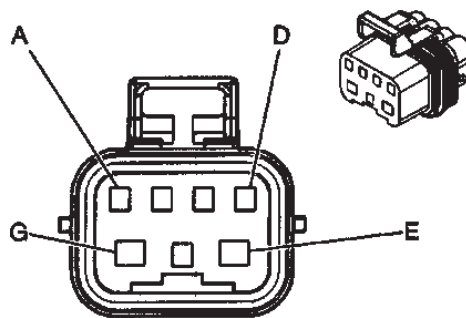


### Park/Neutral Position Switch - C1



Pin	Wire Color	Function
A	BLK/WHT	Transmission Range Switch Signal A
B	GRY	Transmission Range Switch Signal C
C	WHT	Transmission Range Switch Signal P
D	YEL	Transmission Range Switch Signal B

### Park/Neutral Position Switch - C2



Pin	Wire Color	Function
A	ORN/BLK	Park/Neutral Signal
B	LT GRN	Park Neutral Position Switch Park Signal
C	PNK	Ignition Voltage
D	BLK/WHT	Ground
E	PPL/WHT	Starter Relay Coil Supply Voltage
F	LT GRN	Backup Lamp Supply Voltage
G	YEL	Neutral Safety Switch Park/Neutral Signal



# Electrical

## Solenoid Application Chart

Range Status	Logic State	Trim Solenoids		Shift Solenoids			TCC Sol.
		A	B	C	D	E	F
Steady State	R	De-energized; C3 Applied	Energized; C5 Applied	ON	ON	ON	OFF
Down Shift	R-N	De-energizing; C3 Trimming Off	Energizing; C5 Applied	ON	ON	ON	OFF
Up Shift	N-R	Energizing; C3 Trimming On	Energizing; C5 Applied	ON	ON	ON	OFF
Steady State	N	De-energized; C5 Applied	De-energized; Exhausted	ON	ON	ON	OFF
Up Shift	N-1	De-energizing; C5 Applied	Energizing; C1 Trimming On	ON	ON	ON	OFF
Down Shift	1-N	De-energizing; C5 Applied	Energizing; C1 Trimming Off	ON	ON	ON	OFF
Steady State	1	De-energized; C5 Applied	De-energized; C4 Exhausted	OFF	ON	OFF	OFF
Up Shift	1-2	Energizing; C5 Trimming Off	Energizing C4 Trimming On	OFF	ON	OFF	OFF
Down Shift	2-1	Energizing; C5 Trimming On	Energizing; C4 Trimming Off	OFF	ON	OFF	OFF
Steady State	2	Energized; C3 Exhausted	Energized; C4 Applied	OFF	OFF	OFF	ON or OFF*
Up Shift	2-3	De-energizing; C3 Trimming On	De-energizing; C4 Trimming Off	OFF	OFF	OFF	ON
Down Shift	3-2	De-energizing; C3 Trimming Off	De-energizing; C4 Trimming On	OFF	OFF	OFF	ON
Steady State	3	De-energized; C3 Applied	De-energized; C2 Exhausted	ON	OFF	OFF	ON
Up Shift	3-4	Energizing; C3 Trimming Off	Energizing; C2 Trimming On	ON	OFF	OFF	ON
Down Shift	4-3	Energizing; C3 Trimming On	Energizing; C2 Trimming Off	ON	OFF	OFF	ON
Steady State	4	Energized; C3 Exhausted	Energized; C1 Applied	ON	OFF	ON	ON
Up Shift	4-5	De-energizing; C3 Trimming On	De-energizing; C1 Trimming Off	ON	OFF	ON	ON
Down Shift	5-4	De-energizing; C3 Trimming Off	De-energizing; C1 Trimming On	ON	OFF	ON	ON
Steady State	5	De-energized; C3 Applied	Energized; No Clutch Applied	OFF	OFF	ON	ON



# Electrical

## Transmission Fluid Temperature Sensor Temperature vs Resistance

Temperature	Temperature	Minimum Resistance	Nominal Resistance	Maximum Resistance
°C	°F	ohms	ohms	ohms
-45	-49	128565	141951	155338
-40	-40	95826	100735	105644
-35	-31	68952	72315	75679
-30	-22	50153	52480	54807
-25	-13	36854	38478	40103
-20	-4	27345	28488	29631
-15	5	20476	21286	22097
-10	14	15467	16045	16624
-5	23	11781	12197	12612
0	32	9045	9345	9646
5	41	6998	7219	7441
10	50	5458	5623	5787
15	59	4291	4413	4536
20	68	3398	3490	3582
25	77	2710	2779	2849
30	86	2173	2228	2282
35	95	1754	1797	1840
40	104	1424	1459	1493
45	113	1163	1191	1218
50	122	955.0	977.1	999.2
55	131	788.6	806.5	824.5
60	140	654.7	669.3	683.9
65	149	546.3	558.3	570.2
70	158	458.1	467.9	477.8
75	167	385.9	394.1	402.2
80	176	326.6	333.3	340.1
85	185	277.5	283.2	288.9
90	194	236.5	241.6	246.7
95	203	202.4	206.9	211.5



# Electrical

## Transmission Fluid Temperature Sensor Temperature vs Resistance Cont'd

Temperature	Temperature	Minimum Resistance	Nominal Resistance	Maximum Resistance
°C	°F	Ohms	Ohms	Ohms
100	212	173.8	177.9	182.0
105	221	149.8	153.6	157.3
110	230	129.7	133.0	136.4
115	239	112.6	115.6	118.7
120	248	98.17	100.9	103.6
125	257	85.87	88.29	90.71
130	266	75.35	77.52	79.69
135	275	66.34	68.27	70.21
140	284	58.58	60.31	62.04
145	293	51.88	53.42	54.97
150	302	46.08	47.46	48.84
155	311	41.04	42.27	43.5
160	320	36.65	37.74	38.84

## Temperature vs Resistance (Solenoid)

Sump Temperature	Sump Temperature	Solenoid A, B Resistance	Solenoid C, D, E, G Resistance	Solenoid F Resistance
°C	°F	Ohms	Ohms	Ohms
0	32	4.5	20.0	9.5
20	68	5.5	22.0	10.5
40	104	6.5	24.5	11.5
80	176	7.5	27.0	12.5
120	248	8.5	29.5	13.5



# Electrical

## Temperature vs Resistance (Speed Sensor)

Temperature	Temperature	Minimum Resistance	Nominal Resistance	Maximum Resistance
°C	°F	K Ohms	K Ohms	K Ohms
-25	-13	1.93	2.14	2.36
0	32	2.16	2.40	2.64
25	77	2.34	2.60	2.86
50	122	2.61	2.90	3.20
75	167	2.84	3.16	3.47
100	212	3.07	3.41	3.75
125	257	3.30	3.67	4.03
150	302	3.48	3.87	4.26

## Pressure Switch Manifold (PSM) Logic

Range	Pressure Switch C (N/O)		Pressure Switch D (N/O)		Pressure Switch E (N/O)		Pressure Switch R (N/C)	
	Switch Status	Pressure Status	Switch Status	Pressure Status	Switch Status	Pressure Status	Switch Status	Pressure Status
R	Closed	Pressure	Closed	Pressure	Closed	Pressure	Closed	Exhaust
N	Closed	Pressure	Closed	Pressure	Closed	Pressure	Open	Pressure
1	Open	Exhaust	Closed	Pressure	Open	Exhaust	Open	Pressure
2	Open	Exhaust	Open	Exhaust	Open	Exhaust	Open	Pressure
3	Closed	Pressure	Open	Exhaust	Open	Exhaust	Open	Pressure
4	Closed	Pressure	Open	Exhaust	Closed	Pressure	Open	Pressure
5	Open	Exhaust	Open	Exhaust	Closed	Pressure	Open	Pressure

N/C = Normally Closed

N/O = Normally Open



# Electrical

## Park/Neutral Position (PNP) Switch Logic

Range	A	B	C	P
P	OFF	ON	ON	OFF
R	OFF	OFF	ON	ON
N	ON	OFF	ON	OFF
1	ON	ON	OFF	OFF
2	OFF	ON	OFF	ON
3	OFF	OFF	OFF	OFF
4	-----	-----	-----	-----
5	ON	OFF	OFF	ON

ON = Open Circuit      OFF = Grounded Circuit



# LCT 1000 Updates and Modifications

## Factory Updates and Fixes

### Neutral Start Back-up (NSBU) Switch

*Problem:*

- PRNDL display flashing
- Engine will not start
- The "Service Engine Soon" light is on (various codes present).
- Transmission does not shift properly.
- The vehicle will not move (transmission does not engage)

These conditions can be caused by moisture intrusion into the NSBU switch. This occurs during inclement weather by the left front tire spraying water directly onto the switch during left turns. An updated switch kit is available under GM P/N 29540479. This kit contains a new switch and water shields. Updated switches are tan in color. The original switch is black. This fix only applies to vehicles with a two-plug NSBU switch. In 2004 the switch was changed to a one-plug design.

### Transmission Fluid level Indicator (Dipstick)

*Problem:*

- Fluid leaking out the vent at cold startup during low ambient temperatures (0 Degrees F or less).

This condition can be caused by the transmission not being vented properly. The new dipstick is a vented type while the original is not. The original non-vented dipstick is the lever lock type used on several GM vehicles. The new vented type has a plain loop end. The dipstick is available under GM P/N 15115171.

### Torque Converter Relief and Lube Regulator Valve Spring Kit

*Problem:*

- Transmission slips, has a delayed engagement or cold hesitation on first start-up after sitting for a long period of time.

These complaints can be caused by converter drain back. This kit is for repairing converter drain back that occurs after sitting for a long period of time, usually a week or more. Models years affected are 2001-2003. Both of these valves and springs are located in the front support and require the transmission be removed and the converter housing disassembled to replace them. The springs are available in a torque converter drain-back modification kit GM P/N 88996718.





## LCT 1000 Updates and Modifications

### Factory Updates and Fixes Cont'd

#### **Copper Washers Added to Two Lower Converter Housing Bolts**

*Problem:*

- Leak in converter housing area.

A leak in the converter housing area can be caused by case porosity in the area of the two lower converter housing bolts. This concern usually occurs at very low mileage. To check for this condition remove the bottom two converter housing bolts and inspect the threads for being wet with transmission fluid. If there is fluid present install copper washers under the bolt heads. The washers are available under GM P/N 10139097. The washers starting being installed in production in September of 2003. Anytime you see these washers installed be sure to replace them.

#### **Pressure Control Solenoid Added in 2004**

*Problem:*

- Low cooler flow and high pump load during low speed operating conditions

Starting in 2004 on the 8.1L gas and certain diesel engine applications a pressure control solenoid was added to the valve body. This was done to reduce pump load and provide additional cooler flow during certain low speed operating conditions. This valve body assembly will be used by GM to service all previous model LCT 1000 applications. The pressure solenoid will not operate on 2001-2003 models. If the valve body is used to service an earlier application the internal transmission wiring harness will have to be changed also. Do not try to mix match sections or components of the two style valve bodies. They are not interchangeable. The dowel pin used to line up the sections of the valve body has been relocated to prevent mixing components.

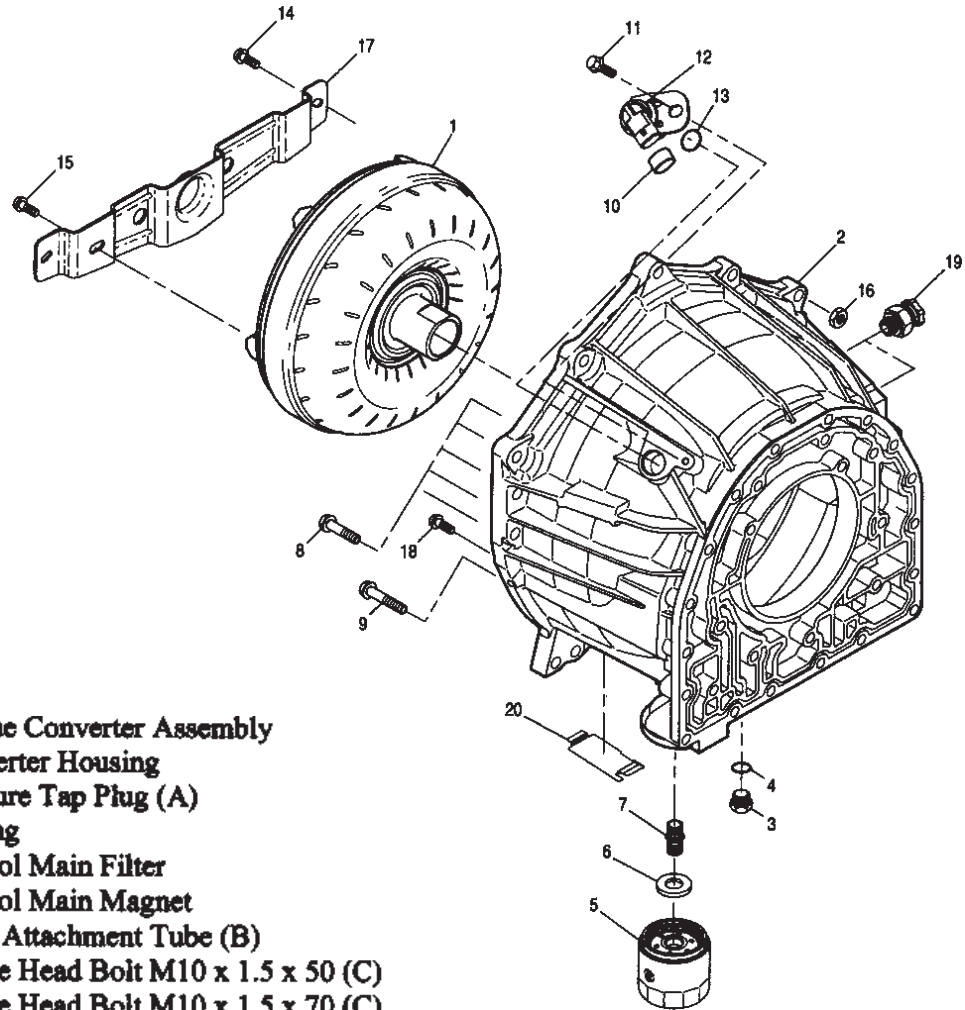
#### After Market Updates and Fixes

Transgo Shift Kit Transtar # K15908

C-1 Clutch High Capacity Kit Alto # 152755



# Torque Converter Housing and Front Support Module

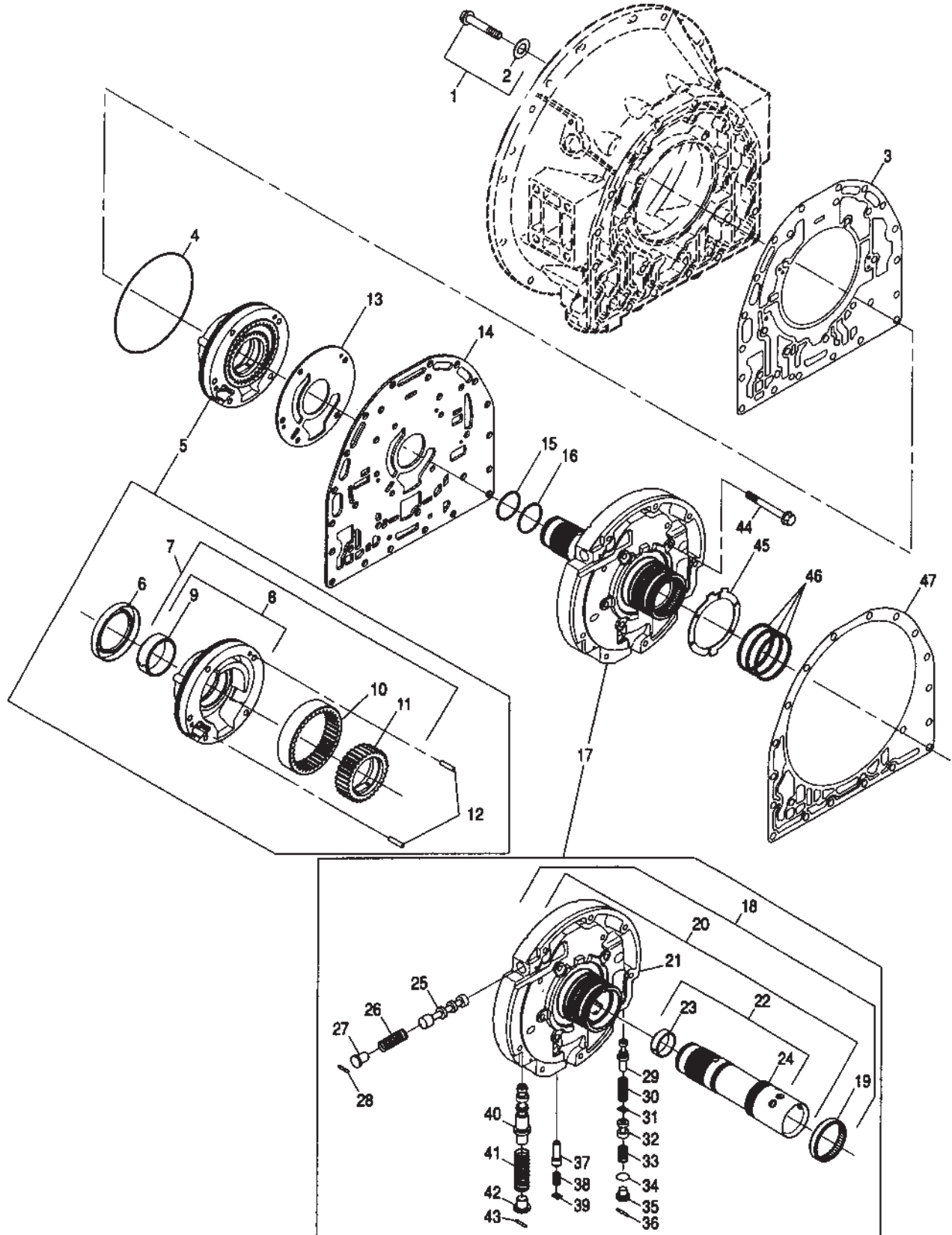


- 1. Torque Converter Assembly
- 2. Converter Housing
- 3. Pressure Tap Plug (A)
- 4. O-Ring
- 5. Control Main Filter
- 6. Control Main Magnet
- 7. Filter Attachment Tube (B)
- 8. Flange Head Bolt M10 x 1.5 x 50 (C)
- 9. Flange Head Bolt M10 x 1.5 x 70 (C)
- 10. Sensor Shipping Cover
- 11. Flange Head Bolt M6 x 1.0 x 13 (B)
- 12. Input Speed Sensor
- 13. Speed Sensor O-Ring
- 14. Flange Head Bolt M10 x 1.5 x 35 (D)
- 15. Flange Head Bolt M10 x 1.5 x 25 (D)
- 16. Nut M10 x 1.5 (D)
- 17. Shipping Bracket
- 18. Flange Head Bolt M10 x 1.5 x 110 (C)
- 19. Cooler Line Connector (E)
- 20. Bolt Access Cover

Torque	lb-ft
(A)	7-10
(B)	18-26
(C)	38-45
(D)	15-25
(E)	15-20



# Torque Converter Housing and Front Support Module





## Torque Converter Housing and Front Support Module

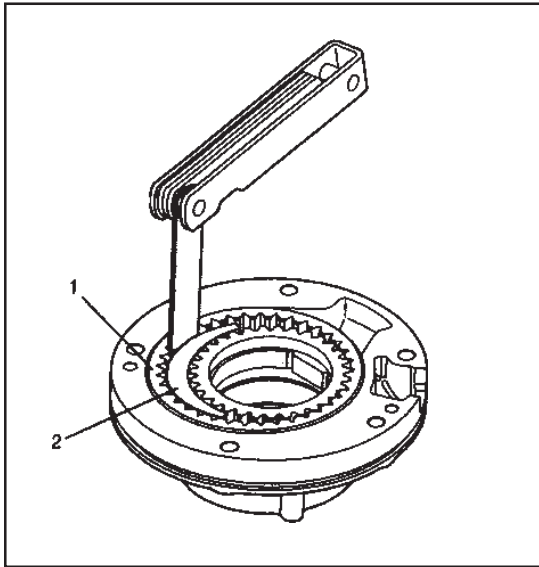
1. Flange Head Bolt
2. Seal
3. Converter Housing Separator Plate Gasket.
4. O-Ring
5. Pump Assembly
6. Seal
7. Pump Body and Gears
8. Pump Body with Bushing
9. Pump Bushing
10. Pump Driven Gear (Selective)
11. Pump Drive Gear (Selective)
12. Dowel Pins
13. Pump Wear Plate
14. Converter Housing to Main Case Separator Plate.
15. Sealing Ring
16. Sealing Ring
17. Front Support Assembly
18. Ground Sleeve and Front Support Assembly
19. Needle Bearing
20. Ground Sleeve and Front Support Assembly
21. Front Support
22. Ground Sleeve and Bushing Assembly
23. Bushing
24. Ground Sleeve
25. Converter Flow Valve
26. Converter Flow Valve Spring
27. Converter Flow Valve Stop
28. Converter Flow Valve Retainer Pin
29. Converter Relief Valve \*
30. Converter Relief Valve Spring
31. Converter Relief and Spring Retaining Clip
32. Lube Regulator Valve \*
33. Lube Regulator Valve Spring
34. O-Ring
35. Lube Regulator Valve Stop
36. Lube Regulator Valve Retainer Pin
37. Clutch Back Fill Valve
38. Clutch Back Fill Valve Spring
39. Clutch Back Fill Valve and Spring Retaining Clip
40. Main Regulator Valve
41. Main regulator Valve Spring
42. Main Regulator Valve Stop
43. Main regulator Valve Retainer Pin
44. Flange Head Bolt M 8 x 1.25 x 55 (A)
45. Thrust Washer
46. Sealing Rings
47. Main Housing Separator Plate Gasket

\* Converter Relief and Lube Regulator update to avoid drain back use kit GM # 88996718.  
GM TSB # 03-07-30-011A

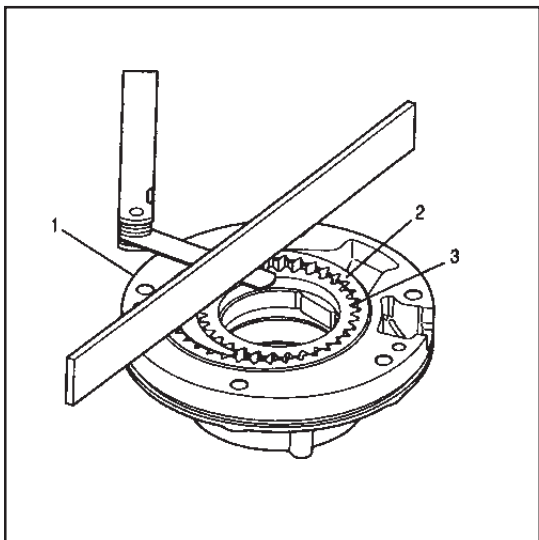
(A) Torque 18-21 lb-ft



# Pump Inspection



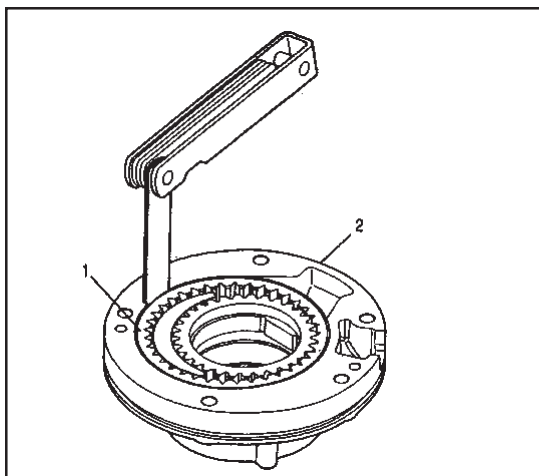
Driven gear to crescent clearance:  
0.017 inch.



Pump gear to face clearance:  
Drive 0.002 inch.  
Driven 0.002 inch.

Drive Gear Selective:  
0.9792 inch (24.872 mm).  
0.9799 inch (24.892 mm).  
0.9804 inch (24.904 mm).

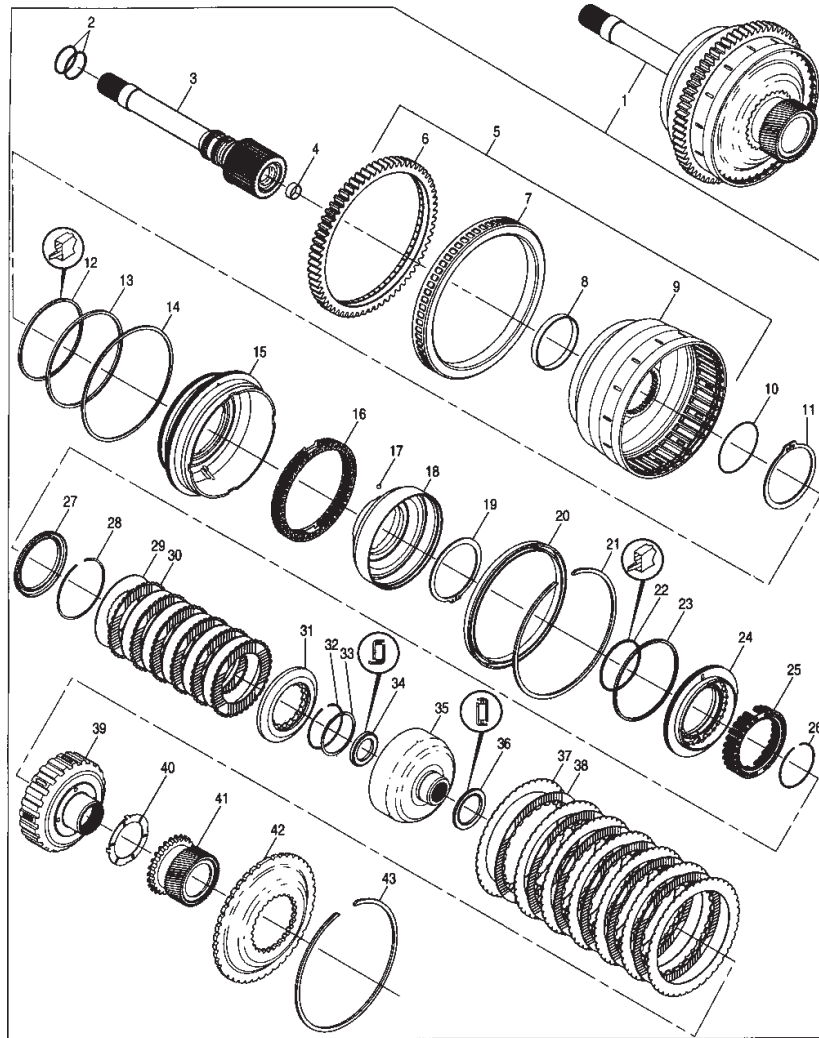
Driven Gear Selective:  
0.9799 inch (24.892 mm).  
0.9803 inch (24.902 mm).  
0.9807 inch (24.912 mm).



Driven gear to pump body clearance:  
0.008 inch.



## Rotating Clutch Module

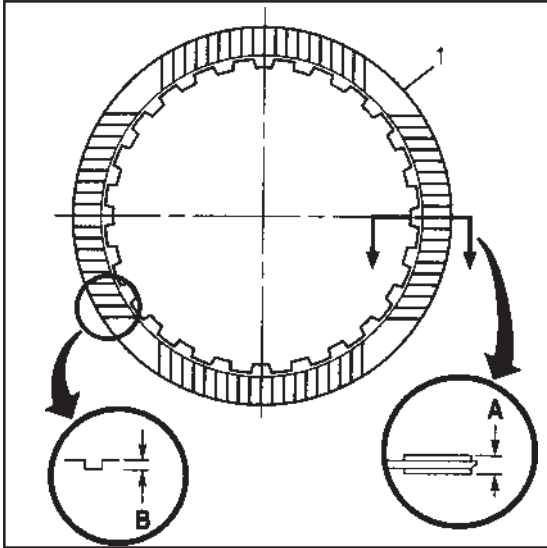


- |   |   |
|---|---|
| 1. Rotating Clutch Assembly                 | 22. C1 Clutch Piston Inner Seal             |
| 2. Butt Joint Sealing Rings                 | 23. C1 Clutch Piston Outer Seal             |
| 3. Turbine Shaft                            | 24. C1 Clutch Piston                        |
| 4. Bushing                                  | 25. C1 Clutch Piston return Spring Assembly |
| 5. Rotating Clutch Housing Assembly         | 26. External Snap Ring                      |
| 6. PTO Gear                                 | 27. C1 Clutch Balance Piston                |
| 7. Turbine Tone Wheel                       | 28. Internal Snap Ring                      |
| 8. Rotating Clutch Bushing                  | 29. C1 Clutch Steel Plate                   |
| 9. Rotating Clutch Housing                  | 30. C1 Clutch Friction Plate                |
| 10. O-Ring                                  | 31. C1 Clutch Backing Plate (Selective)     |
| 11. External Retaining Ring                 | 32. External Snap Ring                      |
| 12. C2 Clutch Piston Inner Seal             | 33. Internal Spiral Retaining Ring          |
| 13. C2 Clutch Piston Outer Seal             | 34. Thrust Bearing Assembly T1              |
| 14. C2 Clutch Balance Piston Outer Seal     | 35. C1 Clutch Drive Hub                     |
| 15. C2 Clutch Piston                        | 36. Thrust Bearing Assembly T2              |
| 16. C2 Clutch Piston Return Spring Assembly | 37. C2 Clutch Steel Plate                   |
| 17. Check Ball                              | 38. C2 Clutch Friction Plate                |
| 18. C1 Piston Housing                       | 39. C2 Clutch Drive Hub                     |
| 19. External Retaining Ring                 | 40. Thrust Washer W2                        |
| 20. C2 Balance Piston                       | 41. P1 Sun Gear                             |
| 21. Snap Ring                               | 42. P1 Drive Flange                         |
|   | 43. Internal Snap Ring                      |



# Clutch Component Inspection

## C1 Clutch Component Inspection



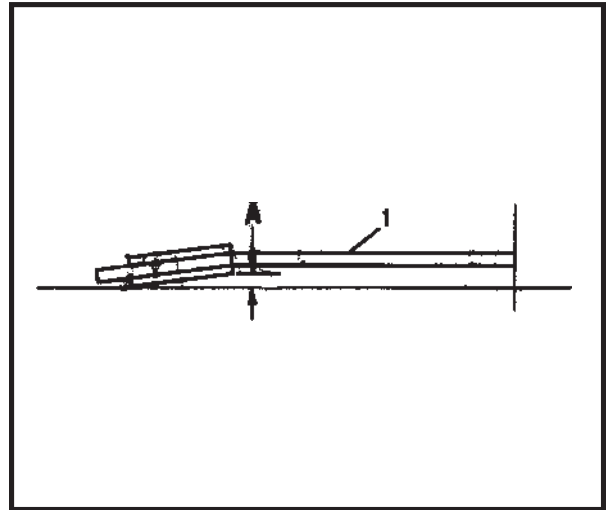
### C1 Clutch Friction Plates

1. Measure the thickness of each C1 clutch friction plate (1) (Dimension A). Minimum thickness is (0.093 inch).
2. Measure the oil groove depth of each C1 clutch friction plate (Dimension B). Minimum groove depth is (0.007 inch).



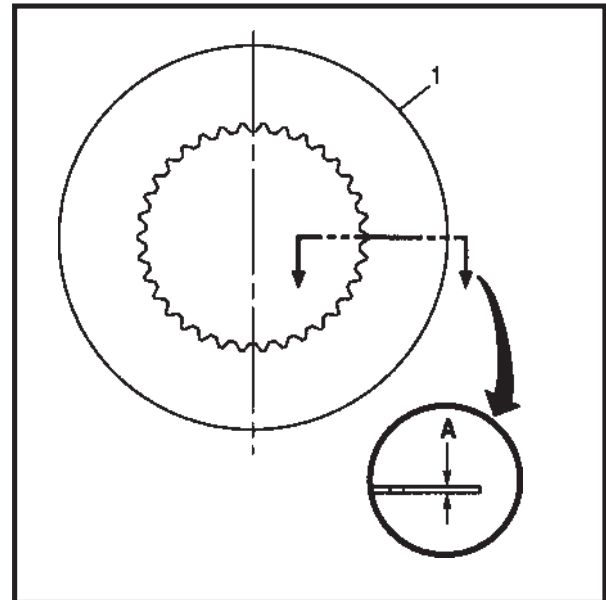
## Clutch Component Inspection

3. Measure the cone of each C1 clutch friction plate (1) (Dimension A). Maximum cone is (0.010 inch).

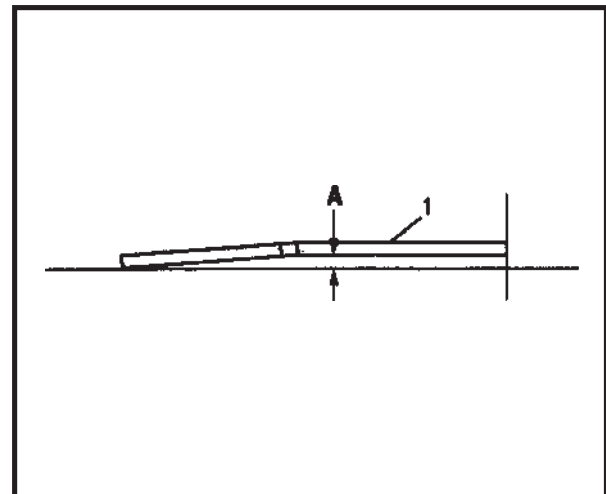


### C1 Clutch Steel Plates

1. Measure the thickness of each C1 clutch steel plate (1) (Dimension A). Minimum thickness is (0.084 inch).



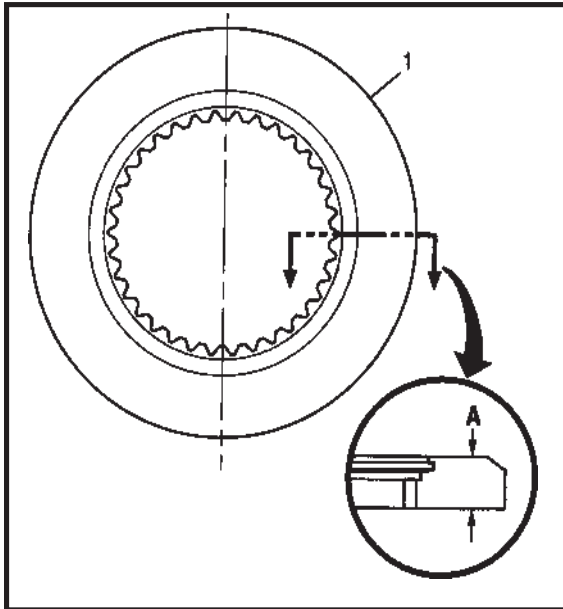
2. Measure the cone of each C1 clutch steel plate (1) (Dimension A). Maximum cone is (0.007 inch).





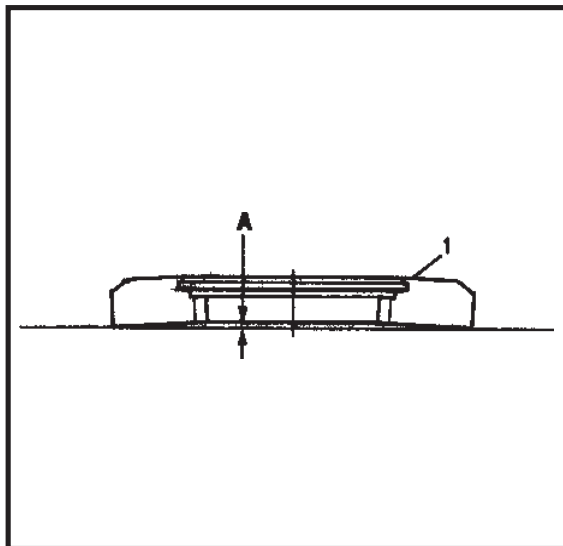


# Clutch Component Inspection



3. Measure the wear surface thickness of the C1 clutch backplate (1) (Dimension A). Minimum thickness is shown in the table.

ID	Minimum Thickness
6221	0.4661 inch (11.840 mm)
6222	0.4835 inch (12.280 mm)
6223	0.5012 inch (12.730 mm)
6224	0.5189 inch (13.180 mm)
6225	0.5366 inch (13.630 mm)



4. Measure the cone of the C1 clutch backplate (1) (Dimension A). Maximum cone is 0.000 inch (Plate must be flat).

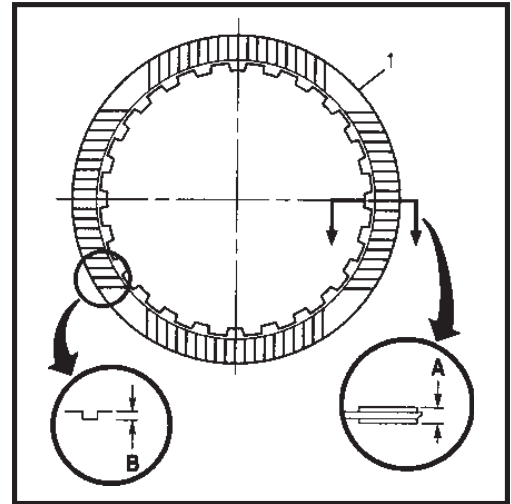


# Clutch Component Inspection

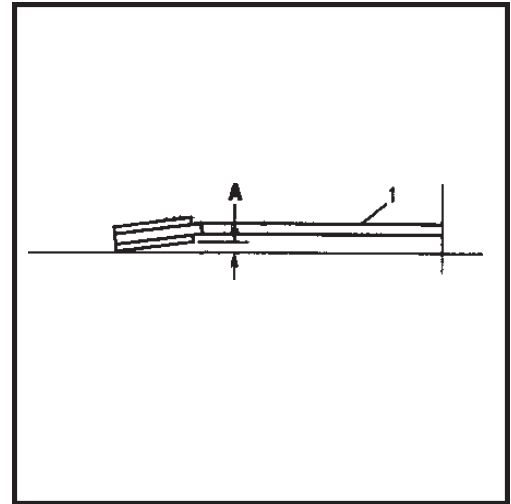
## C2 Clutch Component Inspection

### C2 Clutch Friction Plates

1. Measure the thickness of each C2 clutch friction plate (1) (Dimension A). Minimum thickness is (0.093 inch).
2. Measure the oil groove depth of each C2 clutch friction plate (Dimension B). Minimum groove depth is (0.007 inch).

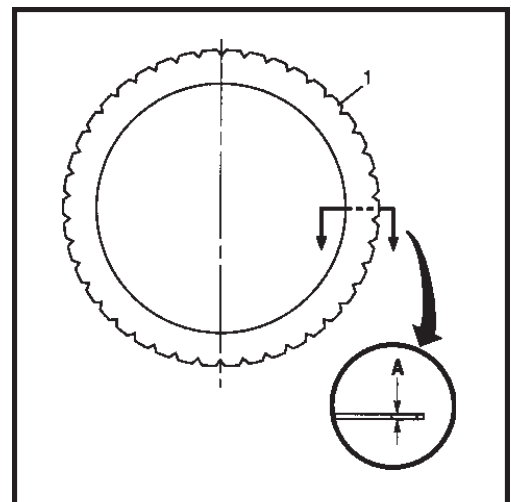


3. Measure the cone of each C2 clutch friction plate (1) (Dimension A). Maximum cone is (0.008 inch).



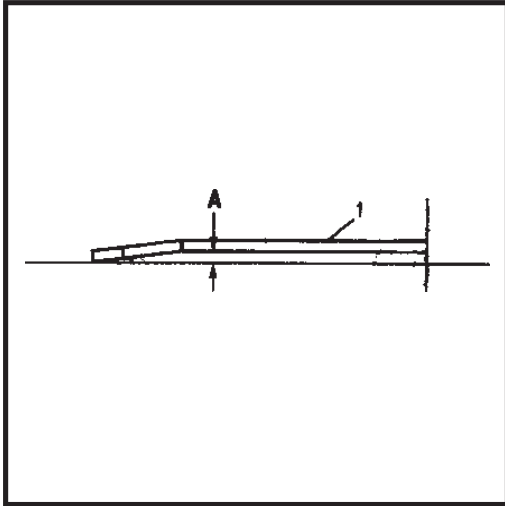
### C2 Clutch Steel Plates

1. Measure the thickness of each C2 clutch steel plate (1) (Dimension A). Minimum thickness is 2.135 mm (0.0841 inch).





## Clutch Component Inspection

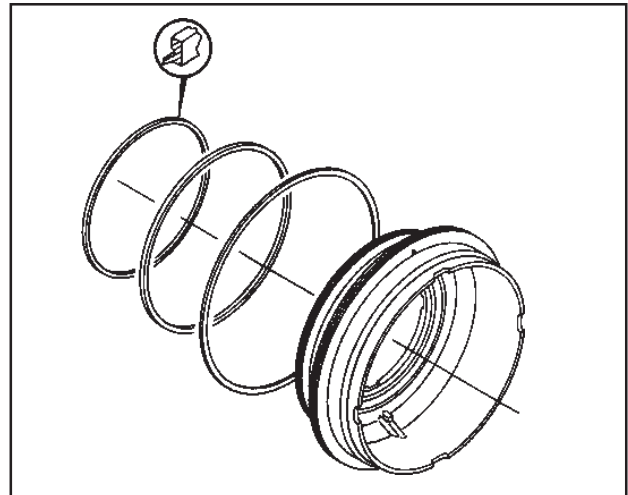


2. Measure the cone of each C2 clutch steel plate (1) (Dimension A).  
Maximum cone is (0.009 inch).

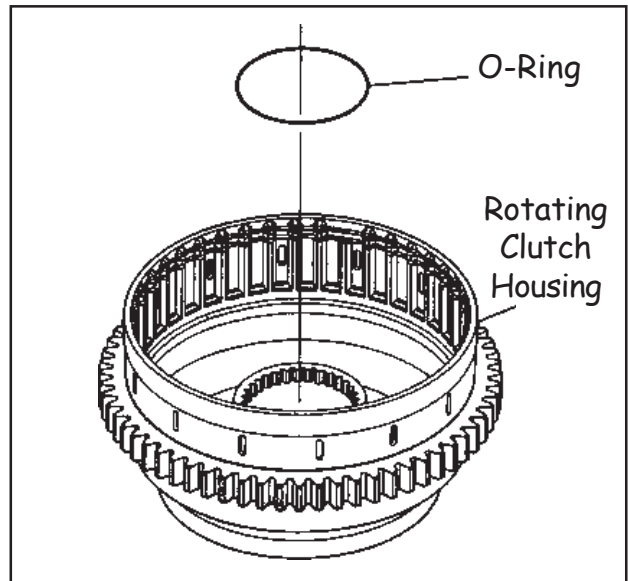


## Rotating Clutch Module Assembly

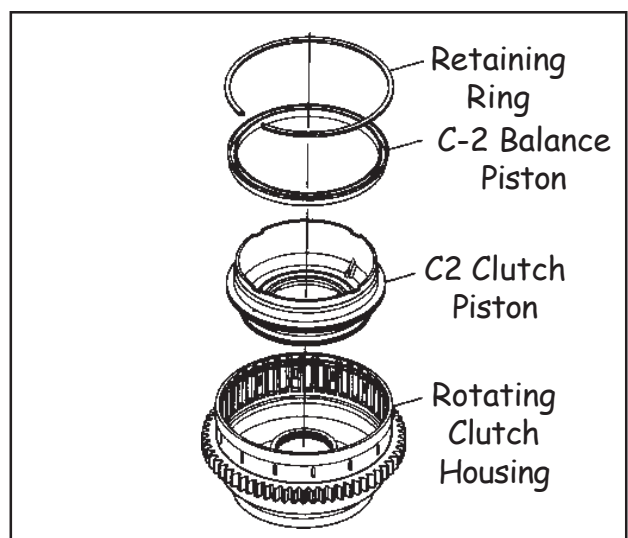
1. Install the piston seals onto the C2 clutch piston.



2. Position the rotating clutch housing on the work table so that the rear of the housing is facing upward.
3. Install the O-ring into the bottom groove on the inner hub of the rotating clutch housing.

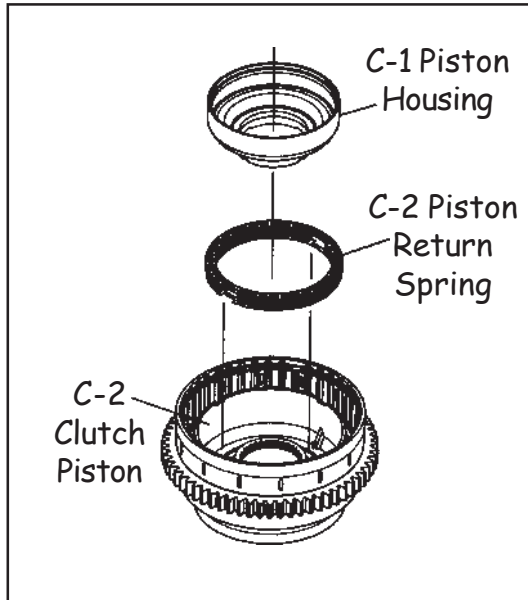


4. Install the C2 clutch piston with the C2 balance piston attached into the rotating clutch housing. Ensure that the C2 clutch piston is seated on the rotating clutch housing.
5. Push the C2 balance piston below the retaining ring groove on the rotating clutch housing.
6. Install the retaining ring into the rotating clutch housing. Ensure that the retaining ring is seated completely around the rotating clutch housing.



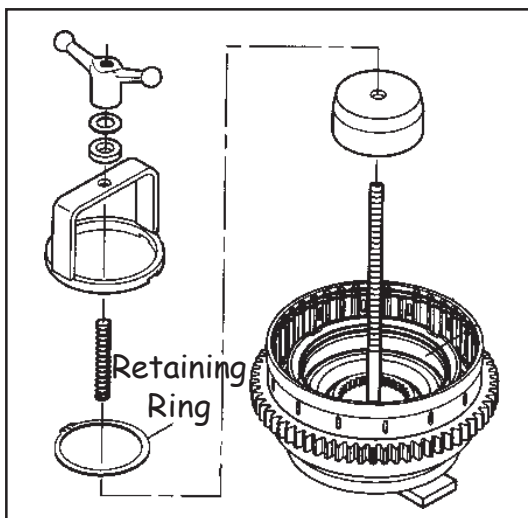


## Rotating Clutch Module Assembly



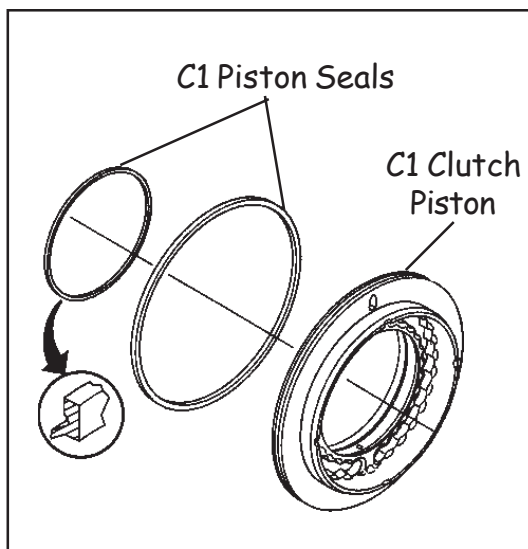
7. Install the C-2 piston return spring assembly into the C2 clutch piston.

8. Install the C1 piston housing into the C2 clutch piston.



9. Compress the C2 piston return spring assembly until the retaining ring groove on the inner hub of the rotating clutch housing is visible.

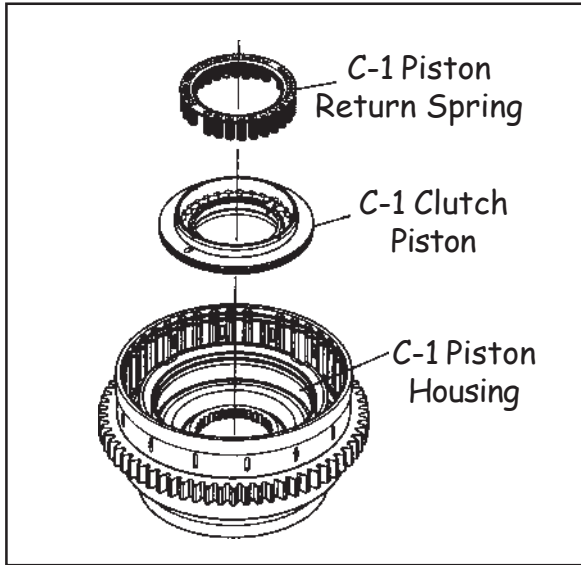
10. Install the retaining ring onto the rotating clutch housing inner hub. Ensure that the retaining ring is seated all around the clutch housing.



11. Install the C1 piston seals onto the C1 clutch piston.

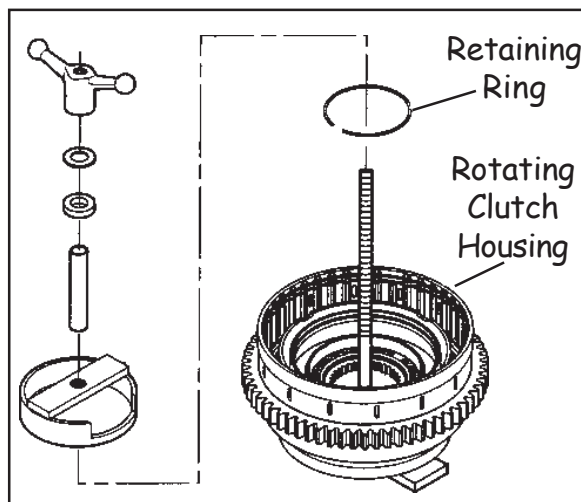


## Rotating Clutch Module Assembly



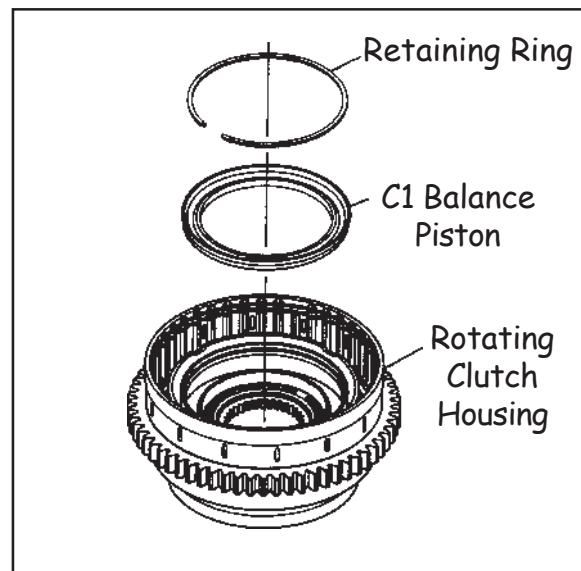
12. Install the C1 clutch piston into the C1 piston housing. Ensure that the C1 clutch piston is seated in the C1 piston housing.

13. Install the C1 piston return spring assembly into the C1 clutch piston.



14. Compress the C1 piston return spring assembly until the retaining ring groove on the rotating clutch housing inner hub is visible.

15. Install the retaining ring onto the rotating clutch housing inner hub.



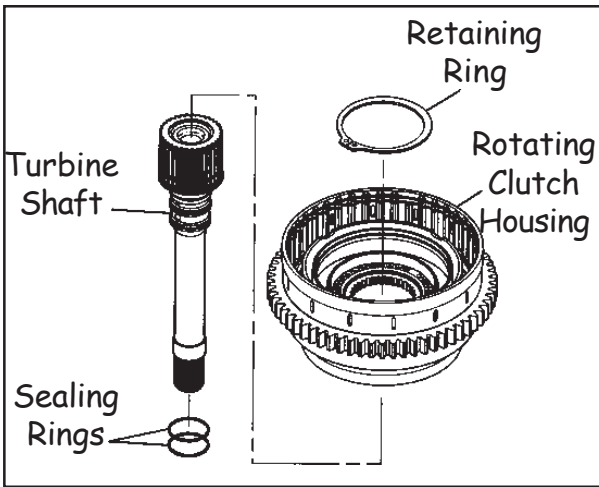
16. Install the C1 balance piston between the C1 clutch piston and the C1 piston housing.

17. Press the C1 balance piston into the C1 piston housing until the C1 balance piston is below the retaining ring groove on the C1 piston housing.

18. Install the retaining ring. Ensure that the retaining ring is seated in its groove.



## Rotating Clutch Module Assembly

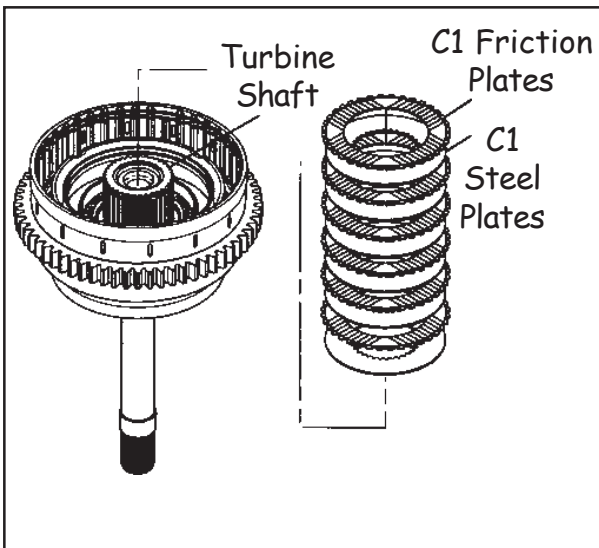


19. Install two butt-joint seal rings onto the turbine shaft

20. Position the turbine shaft on the work table so that the rear of the shaft is facing upward.

21. Install the rotating clutch housing onto the rear of the turbine shaft.

22. Install the retaining ring onto the turbine shaft. Ensure that the retaining ring is seated completely around the turbine shaft.

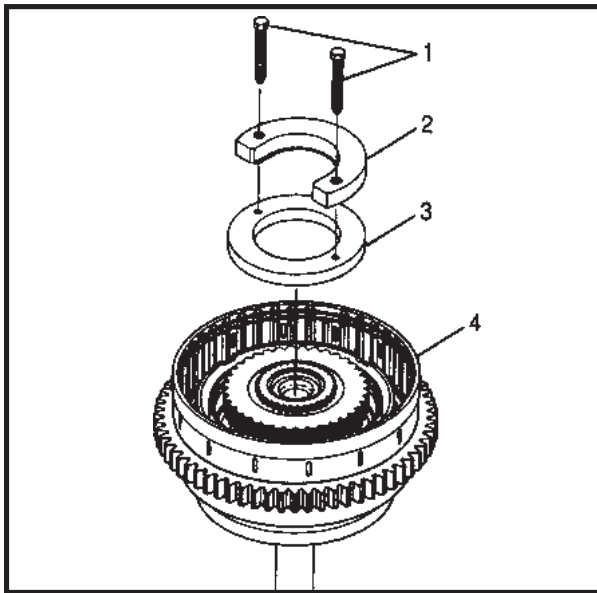


23. Starting with a C1 clutch steel plate, alternately install six C1 clutch steel plates and six C1 clutch friction plates (1) onto the turbine shaft.



# Rotating Clutch Module Assembly

## Setting C1 Clutch Clearance



**NOTE** The shift quality of the transmission depends heavily on selecting the correct C1 clutch backplate.

24. Align the J 44525-2 (3) with the turbine shaft so that the counter sunk holes of the J 44525-2 are facing upward.

25. Install the J 44525-2 (3) onto the turbine shaft.

26. Align the J 44525-1 (2) with the turbine shaft so that the inner ridge of the J 44525-1 is facing downward.

27. Slide the inner ridge of the J 44525-1 (2) into the turbine shaft retaining ring groove.

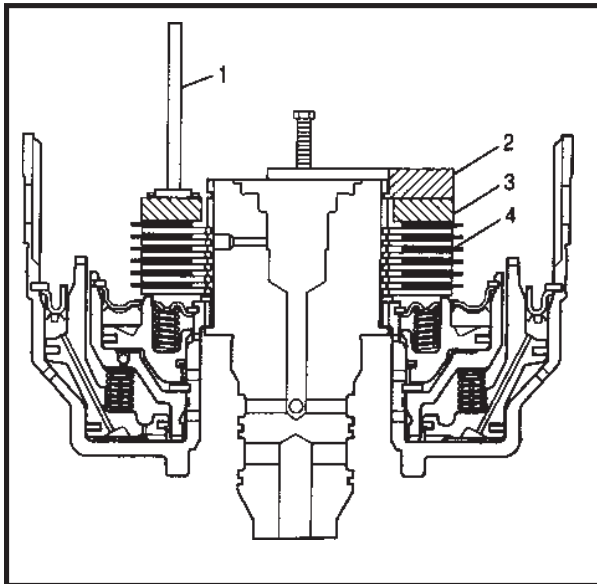
28. Align the holes in the J 44525-1 (2) with the countersunk holes of the J44525-2 (3).

29. Hand install two bolts (1) of the J44525 into the holes of the J 44525-1 (2).

30. Torque the bolts (1) of the J 44525-1 to 5.4 N.m (48 lb in.).

31. For each tab of the J 44525-3 (1), do the following.

- Place the flat surface (tabbed end) of the J 44525-3 (1) onto the top surface of the J 44525-2 (3).
- Try to slide the tabbed end of the J 44525-3 (1) into the retaining ring groove on the turbine shaft.







# Rotating Clutch Module Assembly

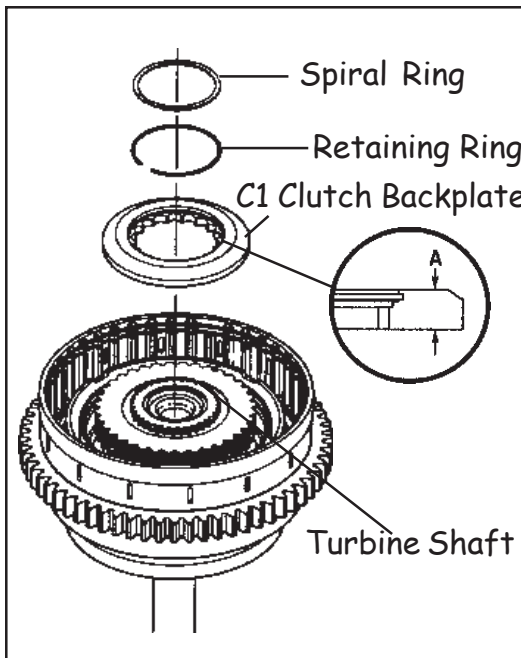
C1 Clutch Backplate	
ID No.	Part Number
6221	29536221
6222	29536222
6223	29536223
6224	29536224
6225	29536225

**NOTE** At most, two of the tabs will fit into the retaining ring groove.

- If the tab fits into the retaining ring groove, record the four digit ID number on the stem of the J 44525- 3 associated with the tab.

32. Select the C1 clutch backplate as follows.

- If no tab of the J 44525-3 fits into the retaining ring groove, select the C1 clutch backplate with ID No. 6221.
- If one or more tabs of the J 45525-3 fit into the retaining ring groove, select the C1 clutch backplate with ID No. corresponding with the highest number recorded in the previous step.



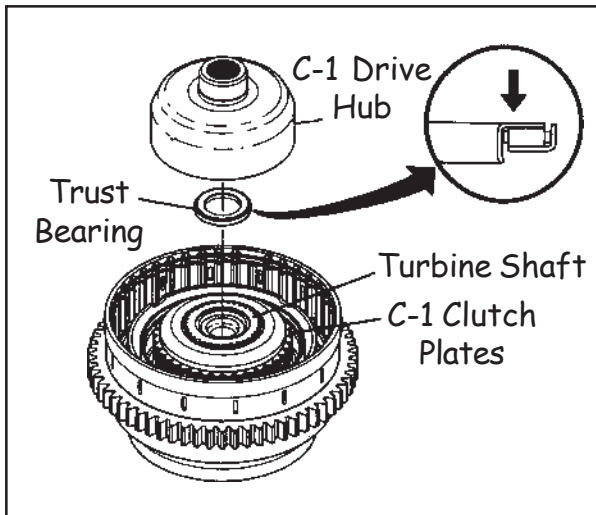
33. Install the C1 clutch backplate onto the turbine shaft with the beveled edge facing upward.

34. Install the retaining ring onto the turbine shaft.

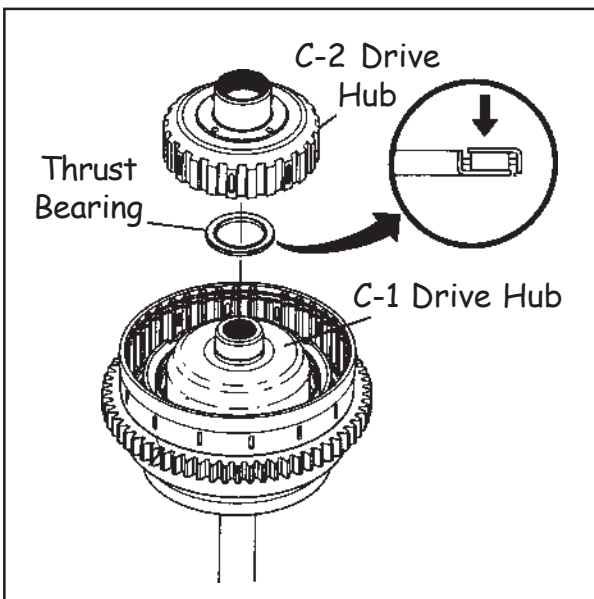
35. Lift the C1 clutch backplate and install the spiral retaining ring into the C1 clutch backplate.



## Rotating Clutch Module Assembly



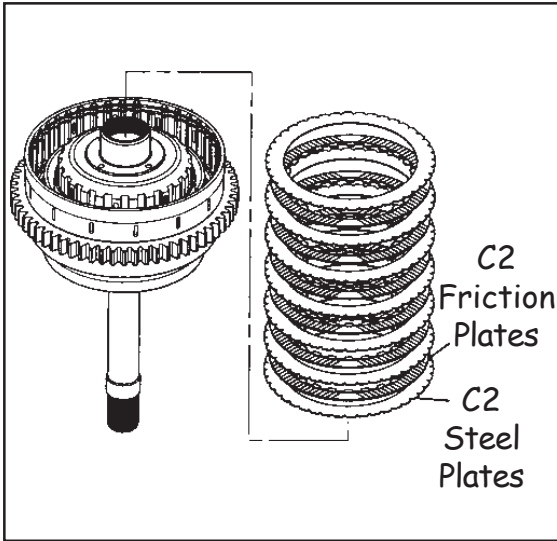
36. Align the thrust bearing assembly so that the blue stripe on the thrust bearing assembly is facing away from the turbine shaft.
37. Install the thrust bearing assembly into the turbine shaft. Ensure that the blue stripe on the thrust bearing assembly is visible.
38. Install the C1 drive hub over the C1 clutch plates. Ensure that the C1 drive hub has seated on the thrust bearing assembly.



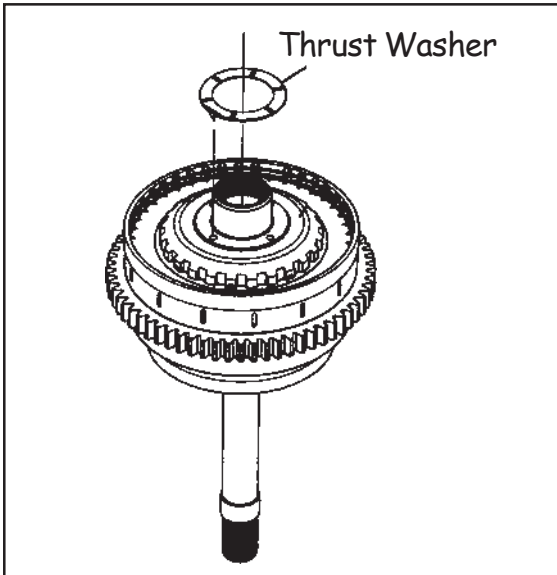
39. Align the thrust bearing assembly so that the blue stripe on the thrust bearing assembly is facing away from the C1 drive hub.
40. Install the thrust bearing assembly onto rear of C1 drive hub. Ensure that the blue stripe on the thrust bearing assembly is visible.
41. Install the C2 drive hub.



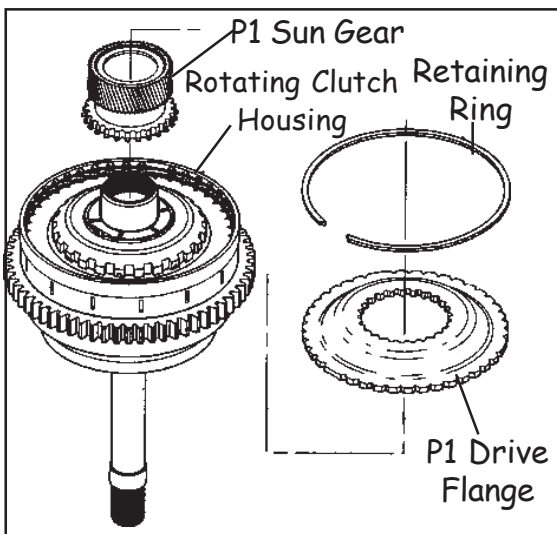
# Rotating Clutch Module Assembly



- 42. Starting with a C2 clutch steel plate, alternately install seven C2 clutch steel plates and six C2 clutch friction plates into the rotating clutch housing.



- 43. Install the bronze thrust washer onto the C2 drive hub.

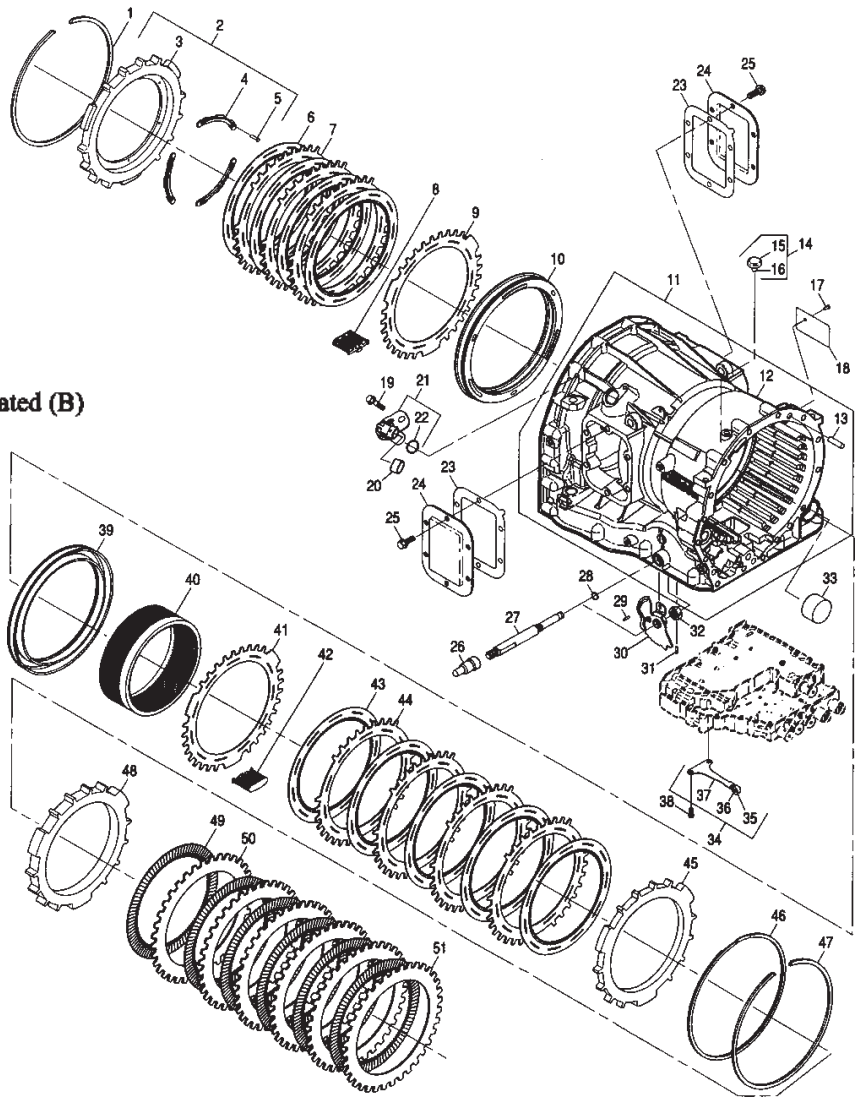


- 44. Install the P1 sun gear into the P1 drive flange. Ensure that the splines are engaged.
- 45. Install the P1 sun gear with the P1 drive flange into the rotating clutch housing.
- 46. Install the retaining ring into the rotating clutch housing. Ensure that the retaining ring is seated all the way around the rotating clutch housing.



# Main Housing Module

1. Internal Snap Ring
2. Back Plate Assembly C3 Clutch
3. Back Plate C3 Clutch
4. Gear Thrust Plate
5. Rivet
6. C3 Clutch Friction Plate
7. C3 Clutch Steel Plate
8. C3 Clutch Return Spring
9. C3 Clutch Spring Plate
10. C3 Clutch Bonded Piston
11. Main Housing Assembly
12. Main Housing
13. Dowel Pin
14. Vent Assembly
15. Vent Cap
16. Vent
17. Rivet
18. Identification Plate
19. Flange Head Bolt M6 x 1.0 x 13 (A)
20. Sensor Shipping Cover
21. Turbine Speed Sensor
22. Speed Sensor O-Ring
23. PTO Cover Gasket
24. PTO Cover
25. Flange Head Bolt M10 x 1.5 x 20 Coated (B)
26. Selector Shaft Cover
27. Selector Shaft
28. Selector Shaft Seal
29. Selector Valve Pin
30. Detent Lever
31. Roll pin
32. Flange Nut M10 x 1.50 (C)
33. Connector Shipping Cover
34. Detent Spring Assembly
35. Detent Roller
36. Pin
37. Detent Spring
38. Flange Head Bolt M6 x 1.0 x 12 (A)
39. C4 Clutch Bonded Piston
40. P1 Ring Gear
41. C4 Clutch Spring Plate
42. C4 Clutch Return Spring
43. C4 Clutch Friction Plate
44. C4 Clutch Steel Plate
45. C4 Clutch Backing Plate
46. Internal Retaining Ring
47. Internal Snap Ring
48. C5 Clutch Backing Plate
49. C5 Clutch Friction Plate
50. C5 Clutch Steel Plate
51. C5 Clutch Steel Plate Selective

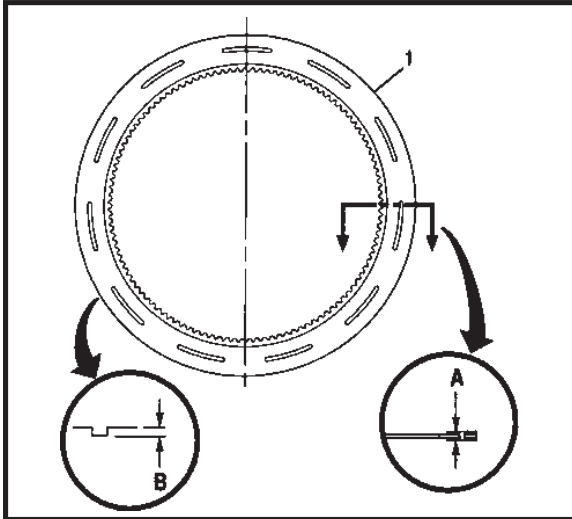


Torque	lb-ft
(A)	7-10
(B)	30-33
(C)	18-25



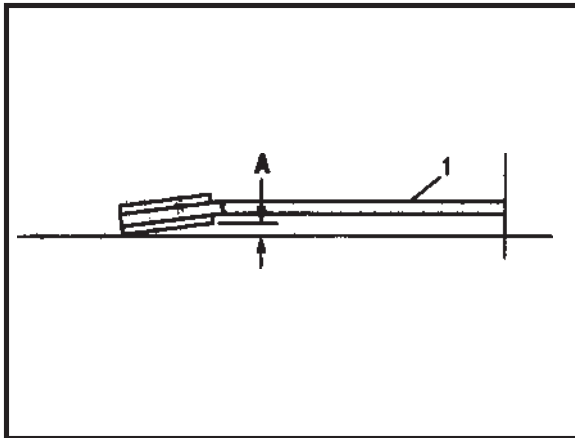
## Clutch Component Inspections

### C3 Clutch Component Inspection

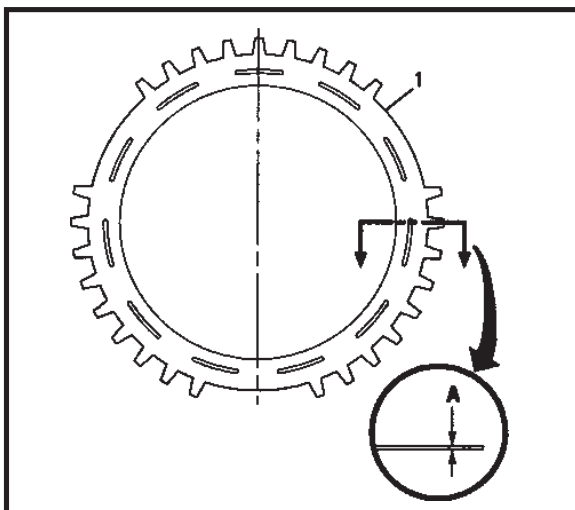


#### C3 Clutch Friction Plates

1. Measure the thickness of each C3 clutch friction plate (Dimension A). Minimum thickness is (0.093 inch).
2. Measure the oil groove depth of each C3 clutch friction plate (Dimension B). Minimum groove depth is (0.007 inch).



3. Measure the cone of each C3 clutch friction plate (1). Maximum cone is (0.008 inch).



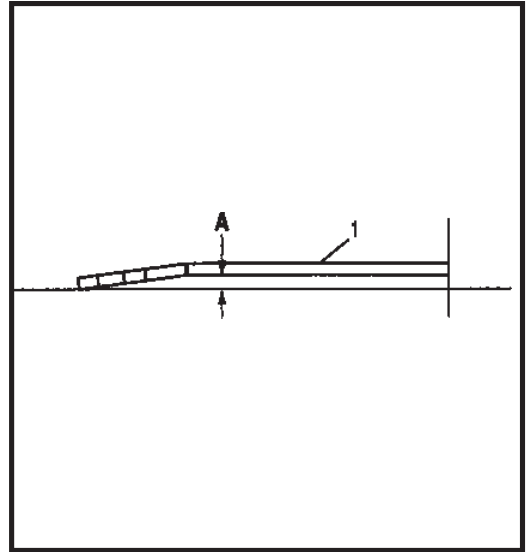
#### C3 Clutch Steel Plates

1. Measure the thickness of each C3 clutch steel plate (1) (Dimension A). Minimum thickness is (0.096 inch).



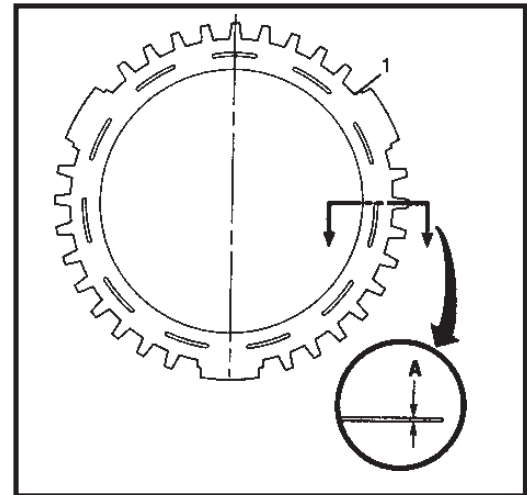
## Clutch Component Inspections

2. Measure the cone of each C3 clutch steel plate (1) (Dimension A). Maximum cone is (0.015 inch).

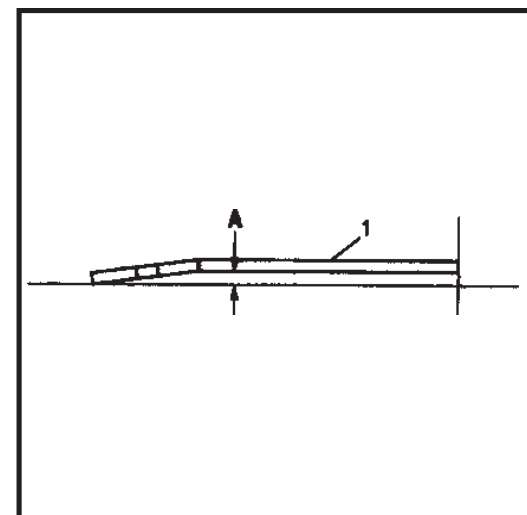


### C3 Clutch Spring Plate

1. Measure the thickness of the C3 clutch spring plate (1) (Dimension A). Minimum thickness (0.122 inch).

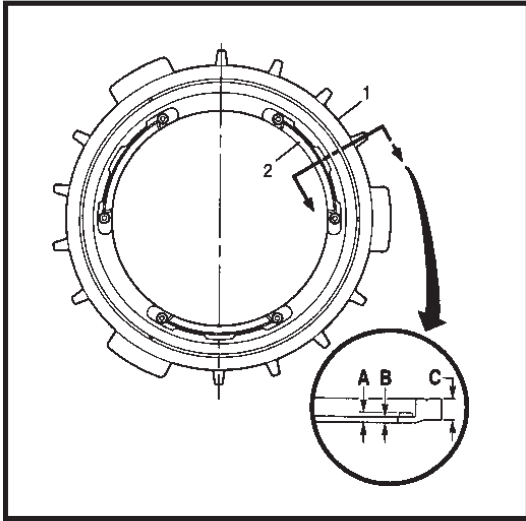


2. Measure the cone of the C3 clutch spring plate (1) (Dimension A). Maximum cone is (0.015 inch).





## Clutch Component Inspections



### C3 Clutch Back Plate

1. Measure the thickness of the C3 clutch backplate (1) (Dimension C). Minimum thickness is (0.603 inch).
2. Measure the distance from the top of the thrust washer (2) to the bottom of the C3 clutch plate inner rim (Dimension A). Measure the thickness of the C3 clutch plate inner rim (Dimension B). Calculate the thickness of the thrust washer (Dimension D) by subtracting Dimension B from Dimension A (Dimension D = Dimension A - Dimension B). Minimum thrust washer thickness is (0.115 inch).
3. Measure the cone of the C3 clutch backplate (1). Maximum cone is 0.000 inch (Plate must be flat).

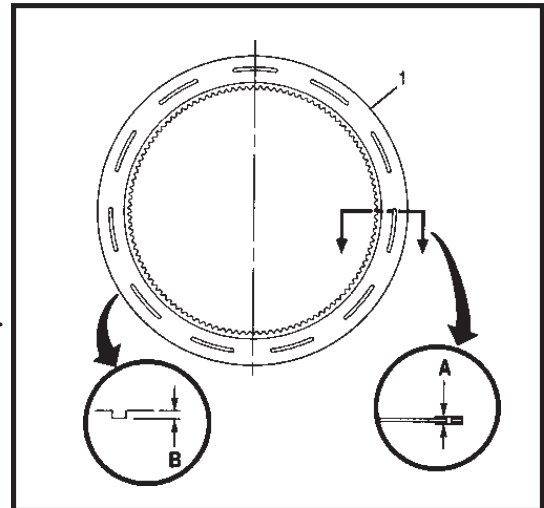


## Clutch Component Inspections

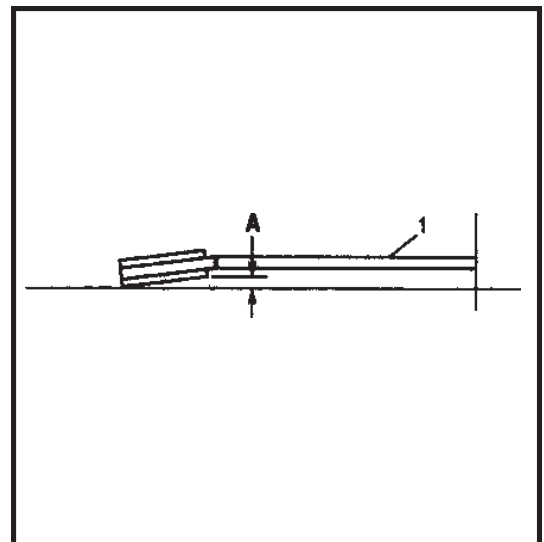
### C4 Clutch Component Inspection

#### C4 Clutch Friction Plates

1. Measure the thickness of each C4 clutch friction plate (1) (Dimension A). Minimum thickness is (0.093 inch).
2. Measure the oil groove depth of each C4 clutch friction plate (1) (Dimension B). Minimum groove depth is (0.007 inch).

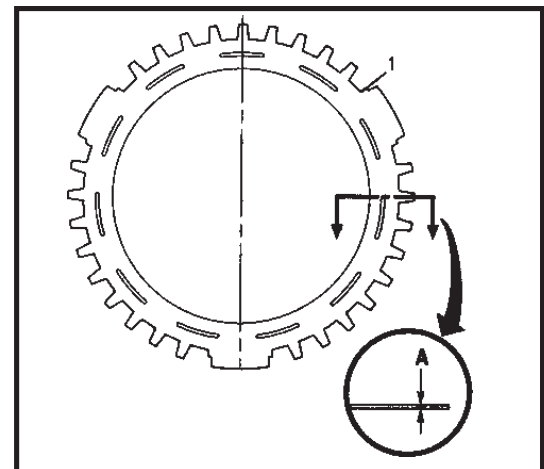


3. Measure the cone of each C4 clutch friction plate (1) (Dimension A). Maximum cone is (0.008 inch).



#### C4 Clutch Steel Plates

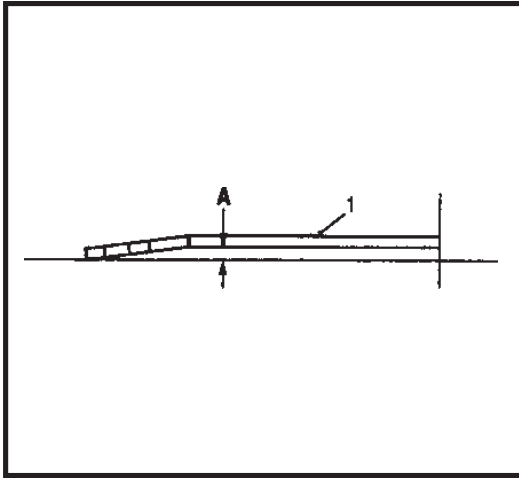
1. Measure the thickness of each C4 clutch steel plate (1) (Dimensions A). Minimum thickness is (0.096 inch).



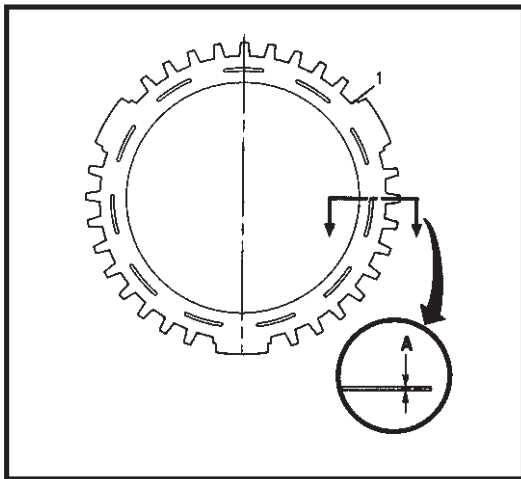




## Clutch Component Inspections

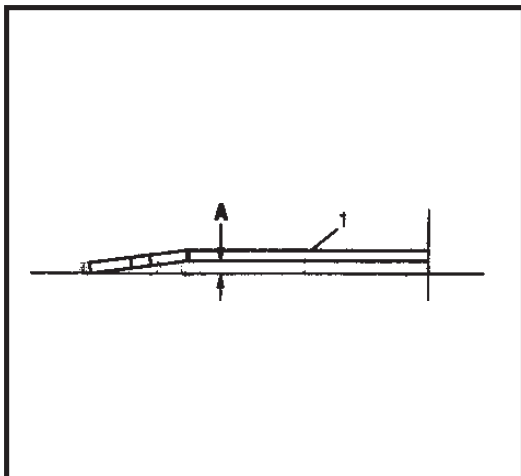


2. Measure the cone of each C4 clutch steel plate (1) (Dimension A). Maximum cone is (0.015 inch).



### C4 Clutch Spring Plate

1. Measure the thickness of the C4 clutch spring plate (1) (Dimension A). Minimum thickness (0.122 inch).



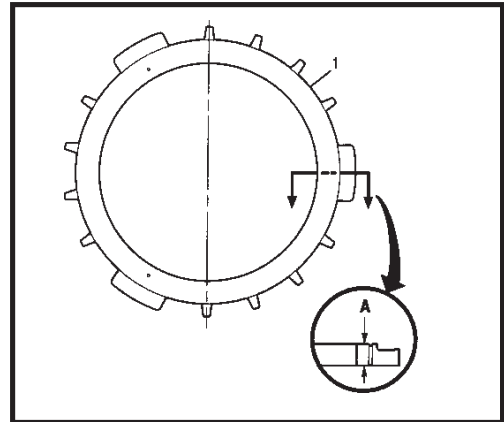
2. Measure the cone of the C4 clutch spring plate (1) (Dimension A). Maximum cone is (0.015 inch).



## Clutch Component Inspections

### C4 Clutch Back Plate

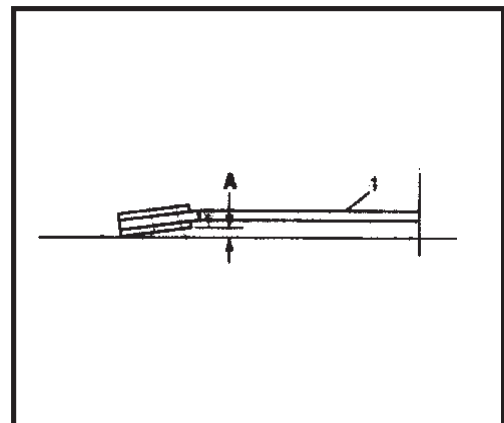
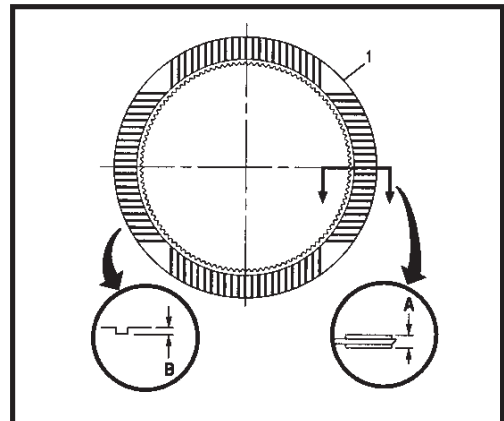
1. Measure the thickness of the C4 clutch backplate (Dimensions A). Minimum thickness is (0.606 inch).
2. Measure the cone of the C4 clutch backplate. Maximum cone is 0.000 inch (Plate must be flat).



### C5 Clutch Component Inspection

#### C5 Clutch Friction Plates

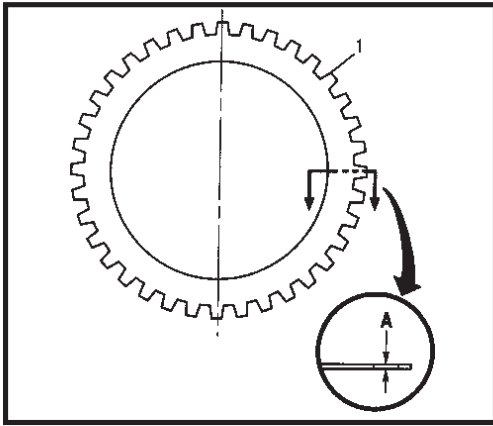
1. Measure the thickness of each C5 clutch friction plate (1). Minimum thickness is (0.093 inch).
2. Measure the oil groove depth of each C5 clutch friction plate (1). Minimum groove depth is (0.007 inch).
3. Measure the cone of each C5 clutch friction plate (1). Maximum cone is (0.008 inch).





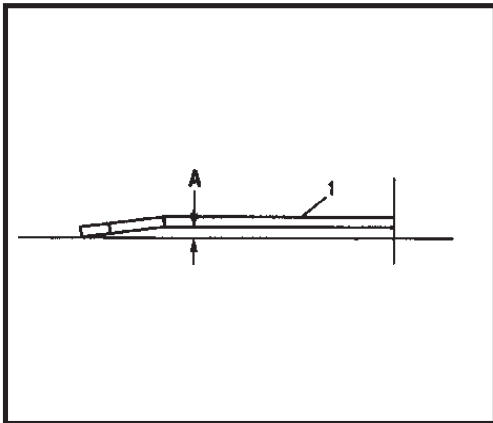
# Clutch Component Inspections

## C5 Clutch Steel Plates



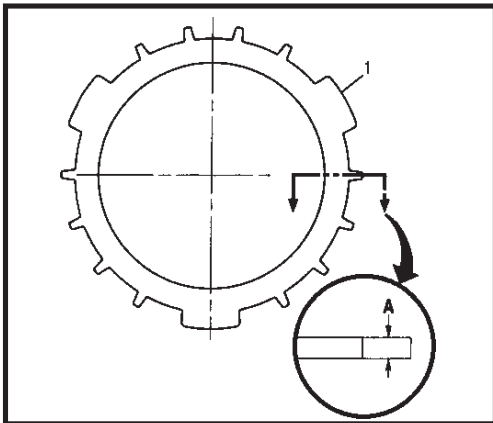
1. Measure the thickness of each C5 clutch steel plate (1). Minimum thickness is given in the following table.

Part Number	Minimum Thickness	ID Number
29536481	0.0762 (in.) 1.935 mm	1
29536482	0.0959 (in.) 2.435 mm	2
29536483	0.1156 (in.) 2.935 mm	3



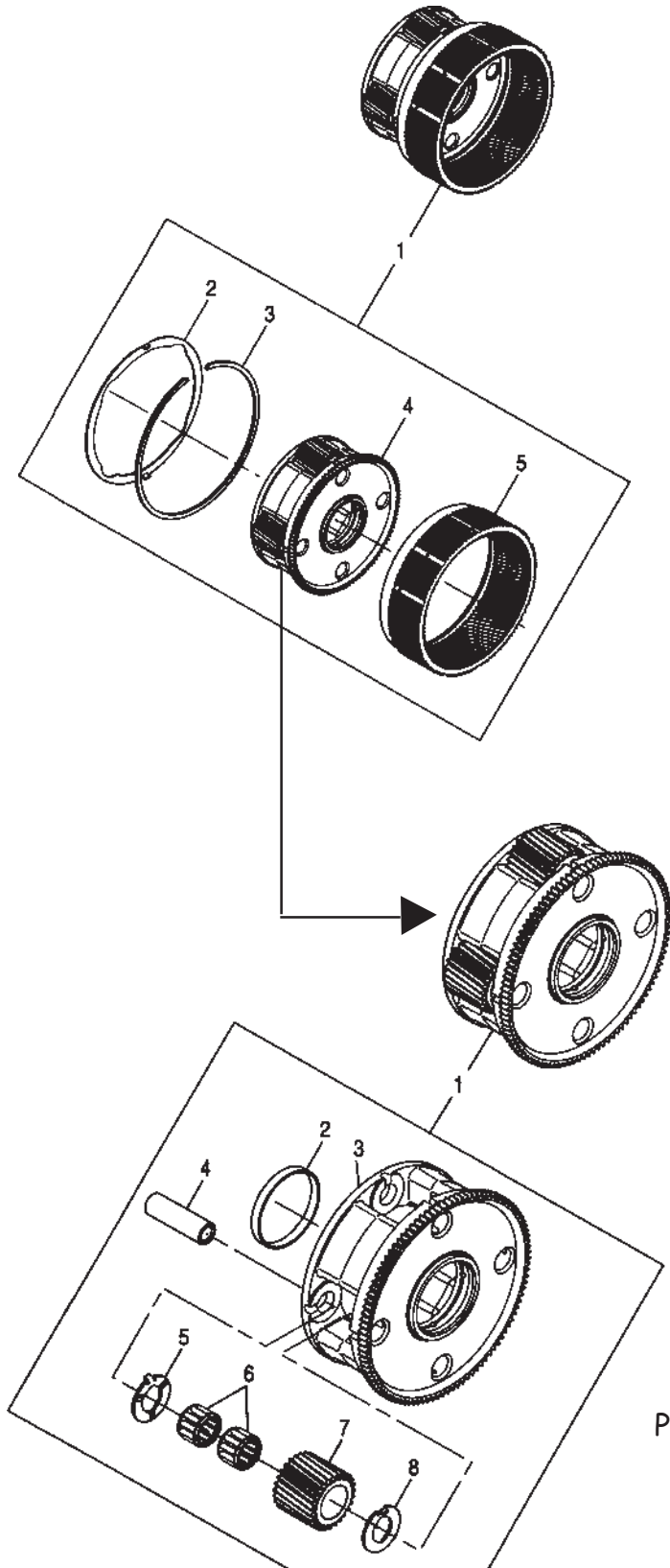
2. Measure the cone of each C5 clutch steel plate (1) (Dimension A). Maximum cone is (0.011 inch).

## C5 Clutch Back Plate



1. Measure the thickness of the C5 clutch backplate (1) (Dimension A). Minimum thickness is (0.704 inch).
2. Measure the cone of the C5 clutch backplate (1) (Dimension A). Maximum cone is 0.000 inch (Plate must be flat).

# P1 Planetary Module



- 1. P1 Planetary Module
- 2. Thrust Washer
- 3. Internal Retaining Ring
- 4. P1 Planetary Carrier Assembly
- 5. P2 Planetary Ring Gear

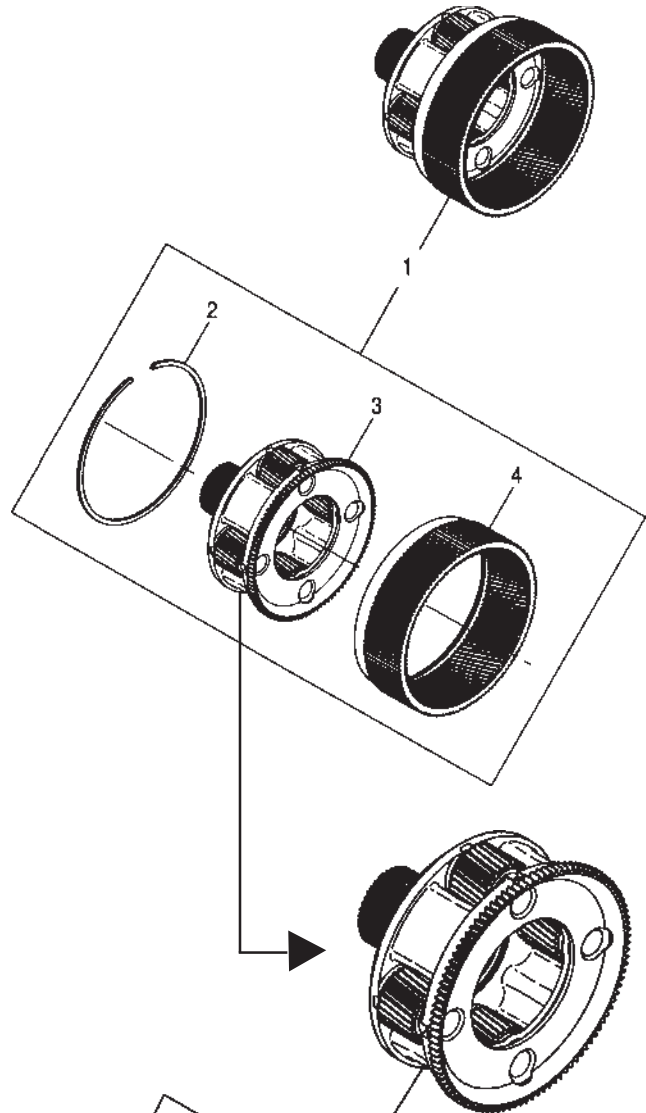
- P1 Planetary**
- 1. P1 Planetary Carrier Assembly
  - 2. Bushing
  - 3. P1 Planetary Carrier
  - 4. P1 Spindle
  - 5. P1 Thrust Washer
  - 6. P1 Roller Assembly
  - 7. P1 Pinion Gear
  - 8. P1 Thrust Washer

Planet Pinion Endplay .042 in. Max.



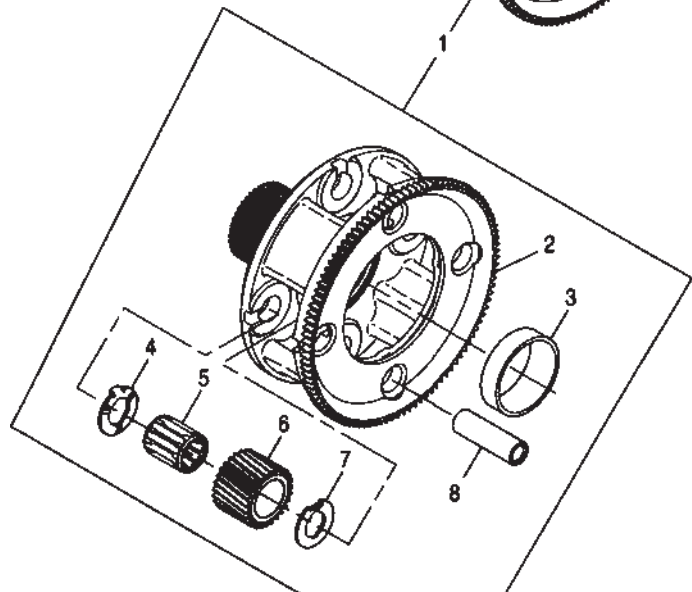
# P2 Planetary Module

- 1. P2 Planetary Module
- 2. Internal Retaining Ring
- 3. P2 Planetary Carrier Assembly
- 4. P3 Planetary Ring Gear



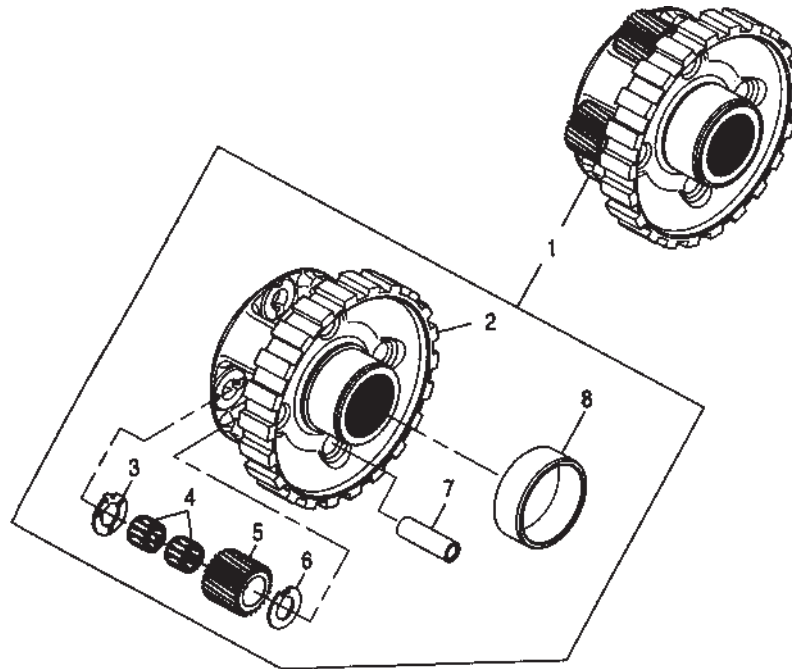
- P2 Planetary
- 1. P2 Planetary Carrier Assembly
  - 2. P2 Planetary Carrier
  - 3. Bushing
  - 4. P2 Thrust Washer
  - 5. P2 Roller Bearing Assembly
  - 6. P2 Pinion Gear
  - 7. P2 Thrust Washer
  - 8. P2 Spindle

Planet Pinion Endplay .042 in. Max.





## P3 Planetary Module



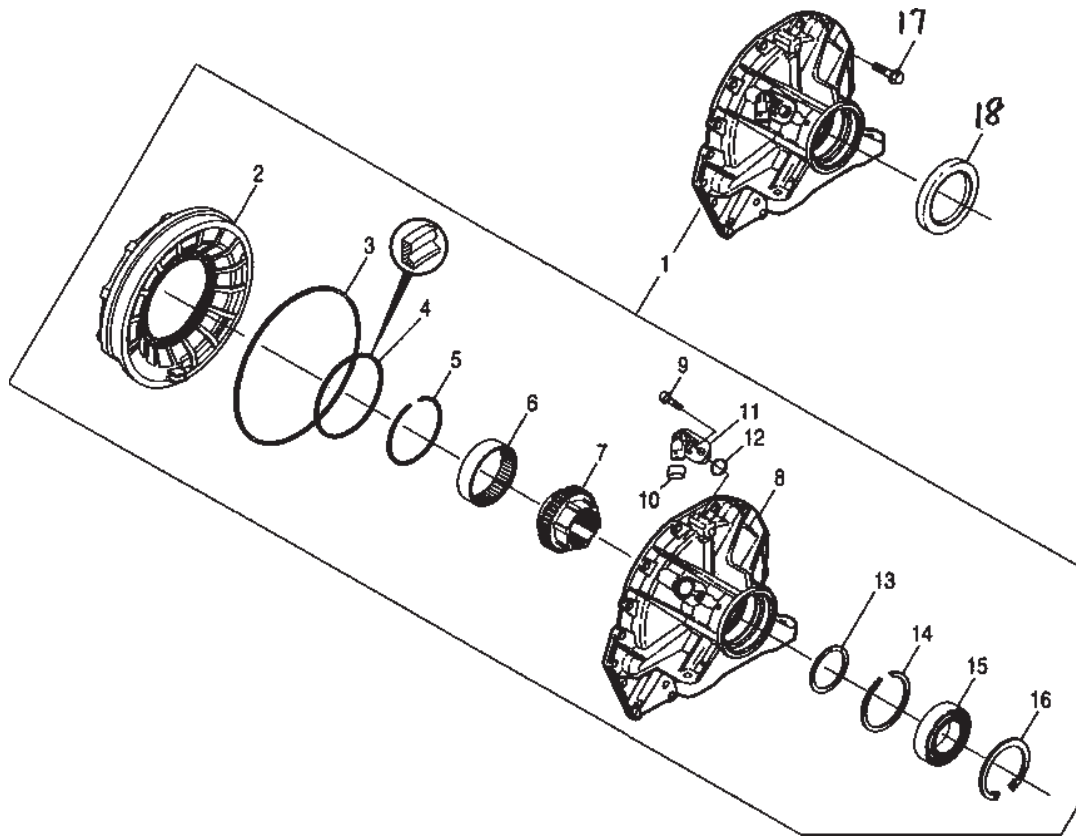
Planet Pinion Endplay .042 in. max.

### P3 Planetary

1. P3 Planetary Carrier Assembly
2. P3 Planetary Carrier
3. P3 Thrust Washer
4. P3 Roller Bearing Assembly
5. P3 Pinion Gear
6. P3 Thrust Washer
7. P3 Spindle
8. Bearing Race



# Rear Cover Module 2WD



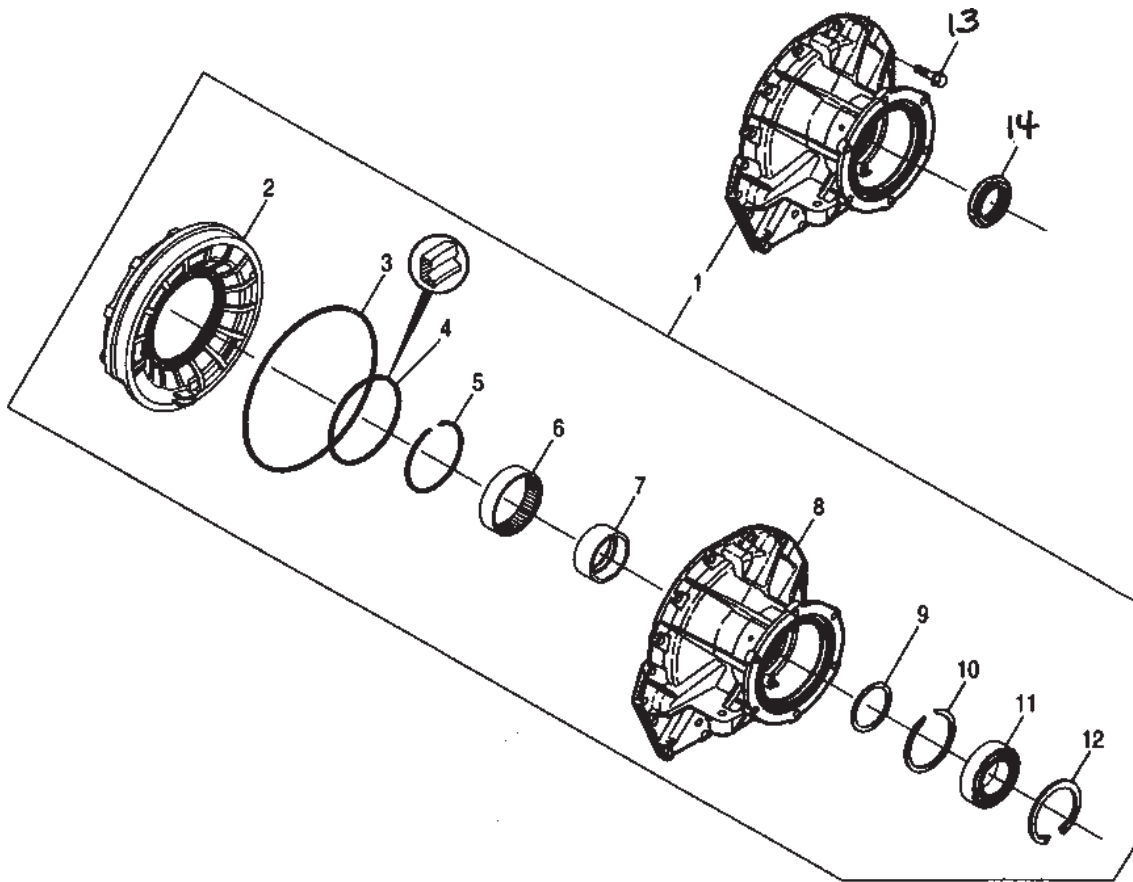
Rear Cover Assembly Components 2WD

- 1. Rear Cover Assembly
- 2. C5 Clutch Piston
- 3. C5 Clutch Piston Outer Seal
- 4. C5 Clutch Piston Inner Seal
- 5. Internal Retaining Ring
- 6. Needle Bearing Assembly
- 7. Output Tone Wheel
- 8. Rear Cover
- 9. Bolt M6 x 1.0 x 13 (A)
- 10. Sensor Shipping Cover
- 11. Output Speed Sensor
- 12. Speed Sensor O-Ring
- 13. Selective Spacer
- 14. External Retaining Ring
- 15. Ball Bearing Assembly
- 16. Internal Retaining Ring
- 17. Flange Head Bolt M10 x 1.5 x 40 (B)
- 18. Rear Oil Seal

Torque	lb-ft
(A)	7-10
(B)	38-45



## Rear Cover Module 4WD



Rear Cover Assembly Components 4WD

1. Transfer Case Adapter Housing Assembly
2. C5 Clutch Piston
3. C5 Clutch Piston Outer Seal
4. C5 Clutch Piston Inner Seal
5. Internal Retaining Ring
6. Needle Bearing Assembly
7. Bearing Spacer 4WD
8. Adapter Housing
9. Selective Spacer
10. External Retaining Ring
11. Ball Bearing Assembly
12. Internal Retaining Ring
13. Flange Head Bolt M10 x 1.5 x 40 (A)
14. Output Nut

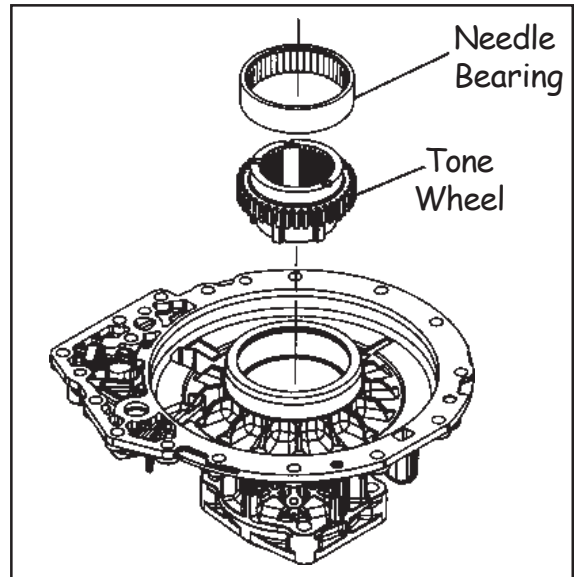
(A) Torque 38-45 lb-ft



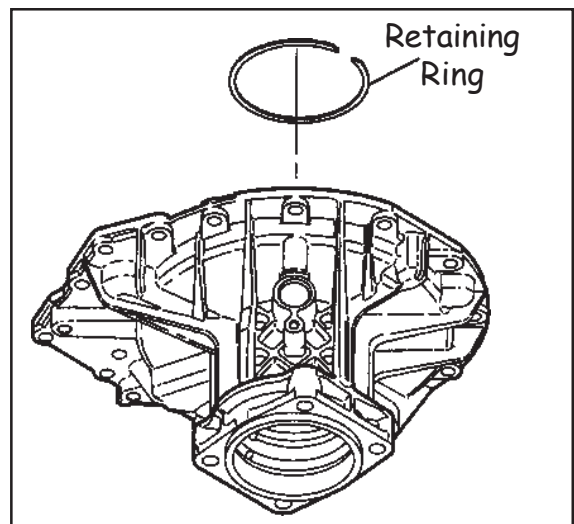


## Rear Cover Assembly

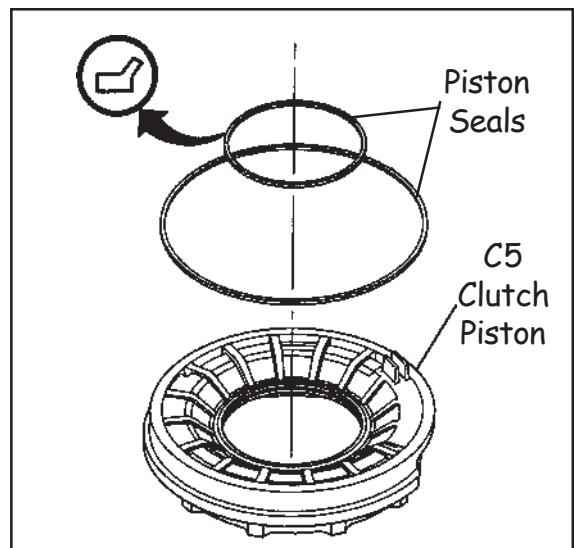
1. If present, install the output tone wheel.
2. Gently tap the needle bearing assembly into the rear cover.



3. Install the retaining ring.

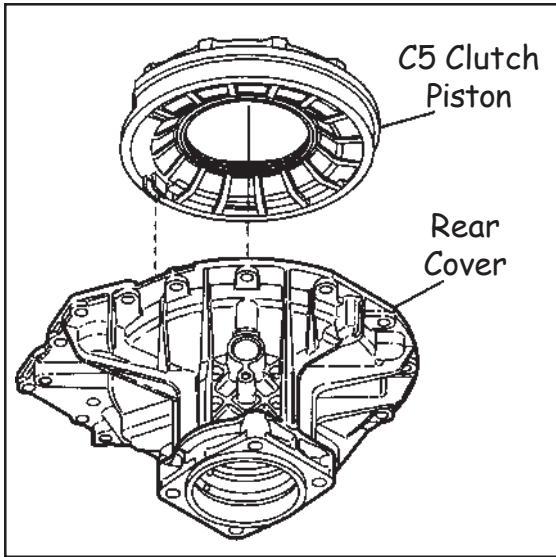


4. Install the seals onto the C5 clutch piston.





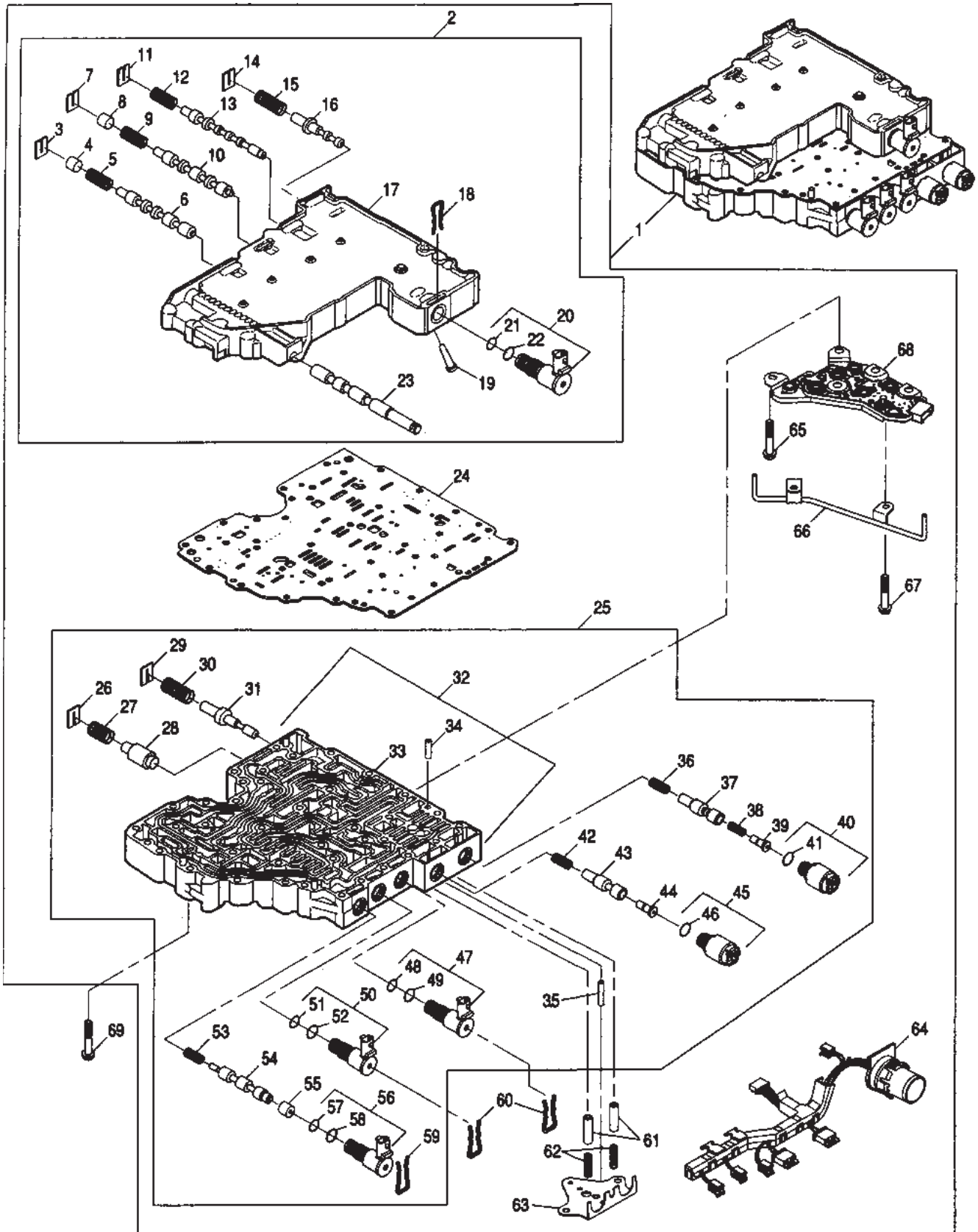
## Rear Cover Assembly



5. Align the tang on the C5 clutch piston with the tang hole in the rear cover.
6. Install the C5 clutch piston into the rear cover.



# Valve Body





# Valve Body

## Valve Body Components

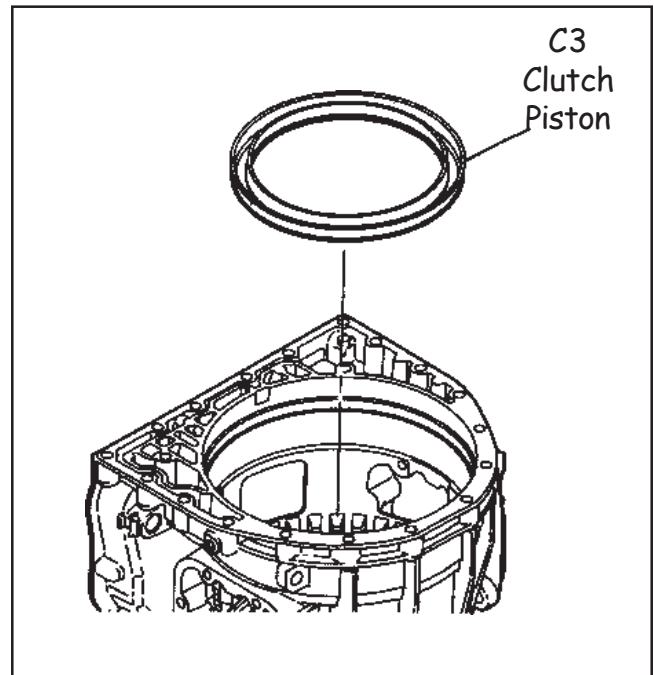
1. Valve Body Assembly
2. Shift Valve Body Assembly
3. Retaining Clip
4. D Shift Plug
5. Shift Spring
6. D Shift Valve
7. Retaining Clip
8. E Shift Plug
9. Shift Spring
10. E Shift Valve
11. Retaining Clip
12. Shift Spring
13. C Shift Valve
14. Retaining Clip
15. Control Main Spring
16. Control Main Valve
17. Shift Valve Body
18. ON/OFF Shift Solenoid Retainer
19. Solenoid Screen
20. CON/OFF Solenoid
21. Solenoid O-Ring
22. Solenoid O-Ring
23. Manual Selector Valve
24. Separator Plate
25. Main valve Body Assembly
26. Retaining Clip
27. Exhaust Backfill Spring
28. Exhaust Backfill Valve
29. Retaining Clip
30. Control Relief Spring
31. Control Relief Valve
32. Main Valve Body Pin and Valve Assembly
33. Main Valve Body
34. Dowel Pin
35. Dowel Pin
36. A Trim Spring
37. A trim Valve
38. A Trim Spring
39. Trim Gain Valve
40. A Trim Solenoid N/O
41. Solenoid O-Ring
42. B Trim Spring
43. B Trim Valve
44. Trim Gain Valve
45. B Trim Solenoid N/C
46. Solenoid O-Ring
47. E ON/OFF Shift Solenoid
48. Solenoid O-Ring
49. Solenoid O-Ring
50. D ON/OFF Shift Solenoid
51. Solenoid O-Ring
52. Solenoid O-Ring
53. F Trim spring
54. F Trim Valve
55. F Trim Sleeve
56. F Trim PWM Solenoid
57. Solenoid O-Ring
58. Solenoid O-Ring
59. Solenoid Retainer
60. Solenoid Retainer
61. Accumulator Plug
62. Accumulator Spring
63. A/B Solenoid Bracket
64. Wiring Harness Assembly
65. Flange Head Bolt M6 x 1.0 x 50 (A)
66. Reverse Signal Tube
67. Flange Head Bolt M6 x 1.0 x 65 (A)
68. Pressure Switch Assembly
69. Flange Head Bolt M6 x 1.0 x 50 (A)

(A) Torque 7-10 lb-ft

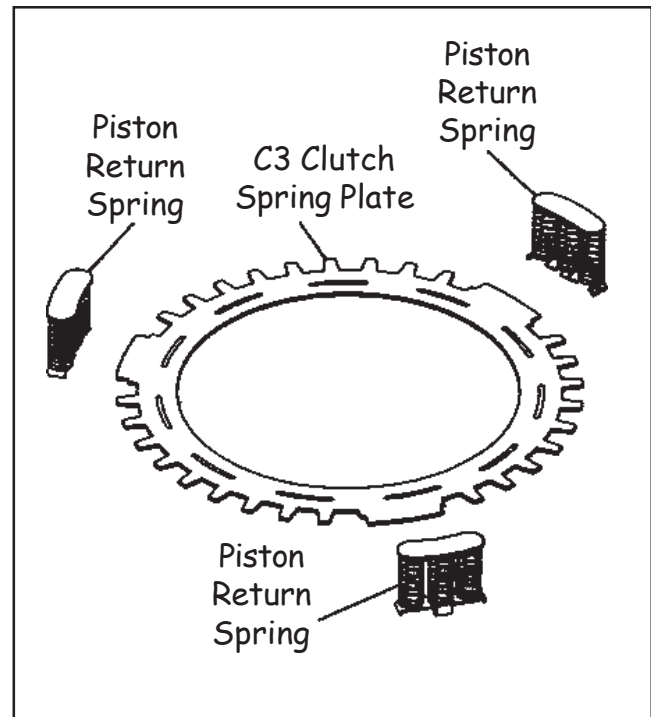


## Transmission Assembly

1. Position main housing so that the front of the case is facing up.
2. Lubricate and install the C3 clutch piston assembly.

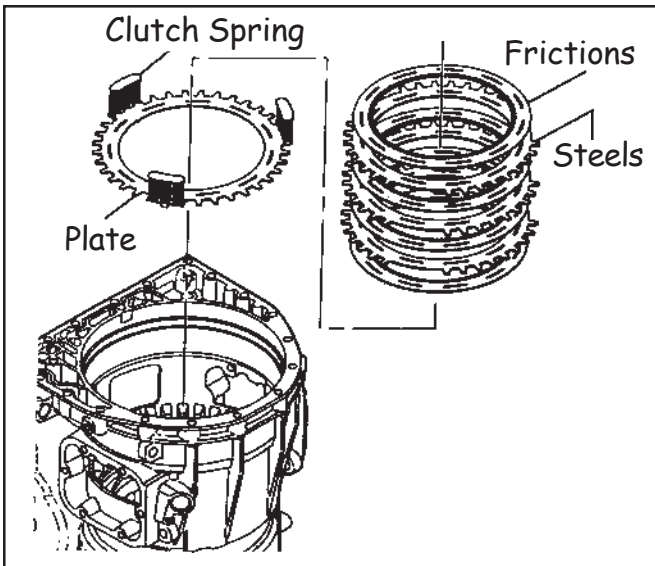


3. Install 3 piston return spring assemblies onto the C3 clutch spring plate.

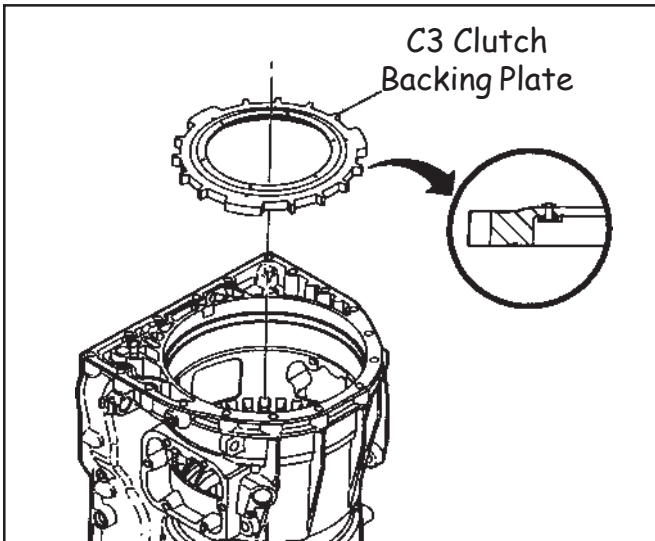




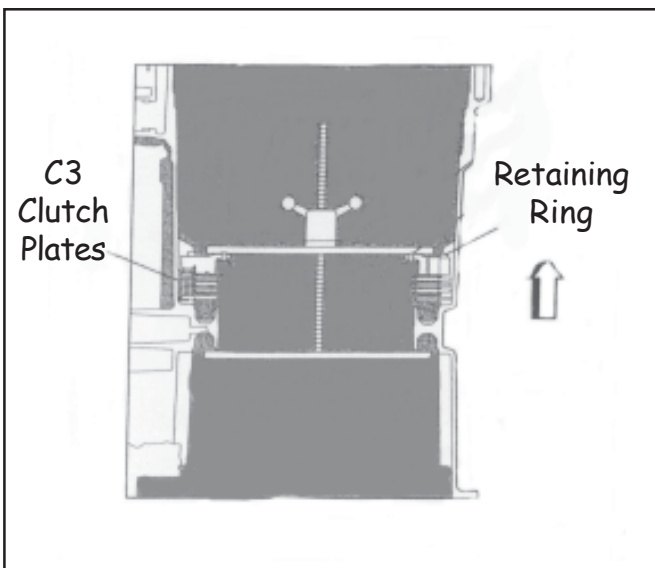
## Transmission Assembly



4. Install the C3 clutch spring and plate assembly into the main case with the springs facing up.
5. Starting with a friction clutch install 4 friction and 3 steel C3 clutch plates.



6. Install the C3 clutch backing plate with the thrust plates facing down.

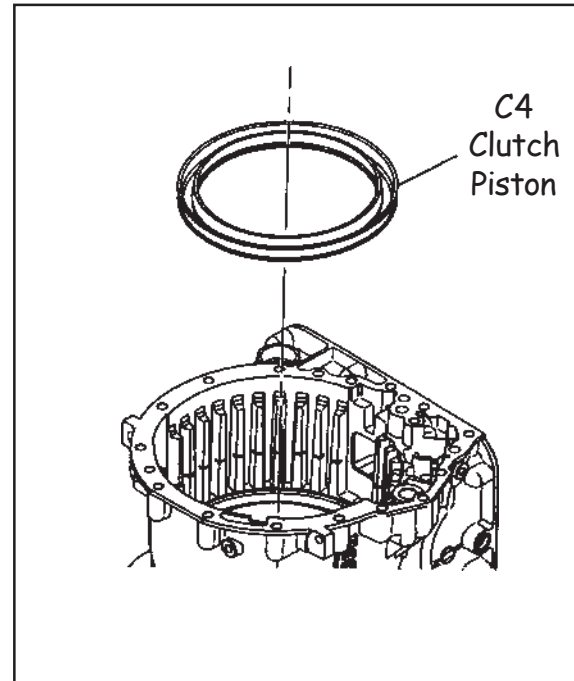


7. Using special tools J 24204-2 and J 44530 compress the C3 piston return spring assemblies and install the retaining ring.

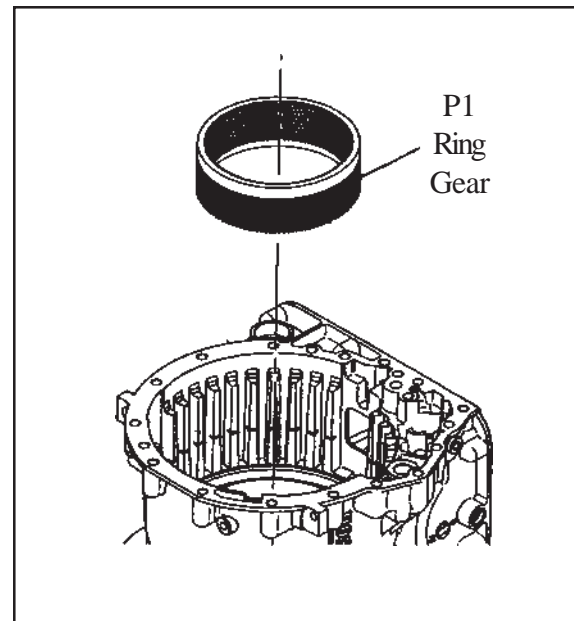


## Transmission Assembly

8. Position the main housing so that the rear of the case is facing up.
9. Lubricate and install the C4 clutch piston assembly.

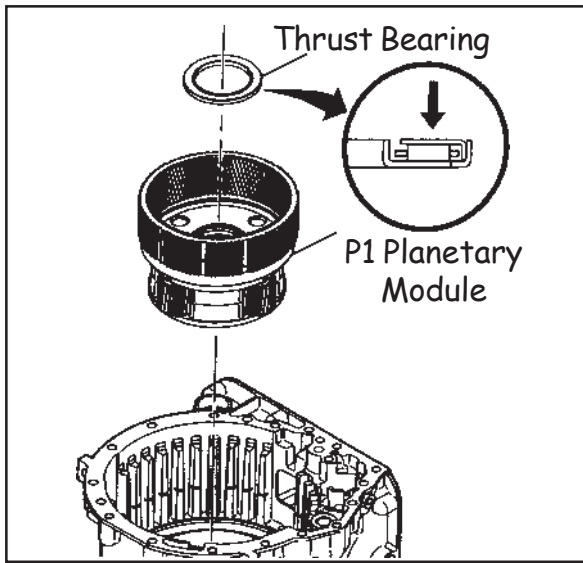


10. Install the P1 ring gear with the splines facing downward. Make sure the P1 ring gear engages all of the C3 friction clutches and is seated against the thrust plates on the C3 clutch backing plate.

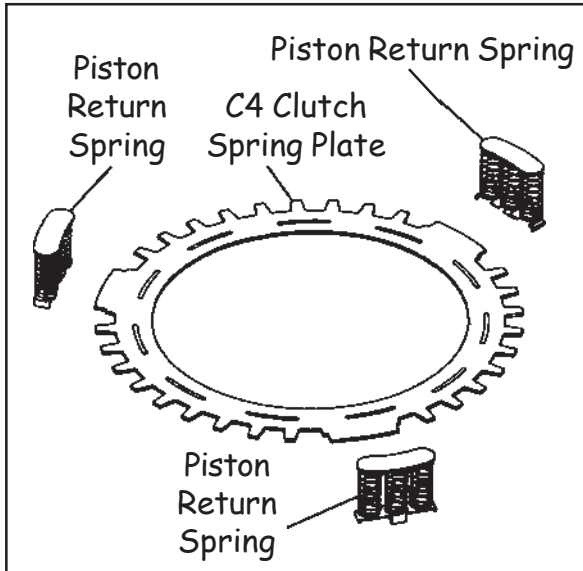




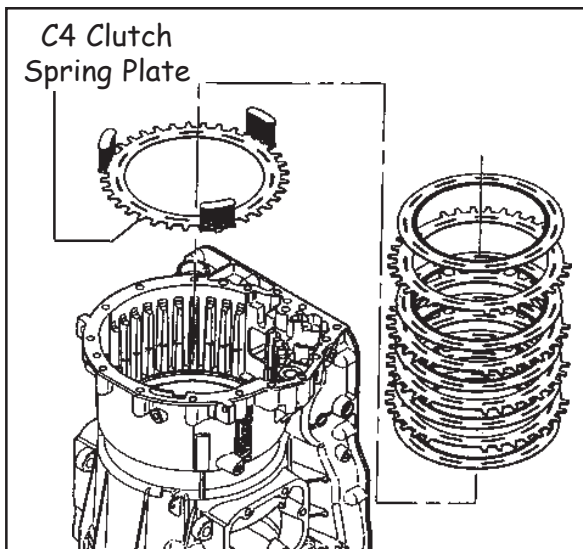
# Transmission Assembly



11. Install the P1 planetary module.
12. Install the thrust bearing onto the P1 planetary module with the blue stripe facing **Up**.



13. Install 3 piston return spring assemblies onto the C4 clutch spring plate.



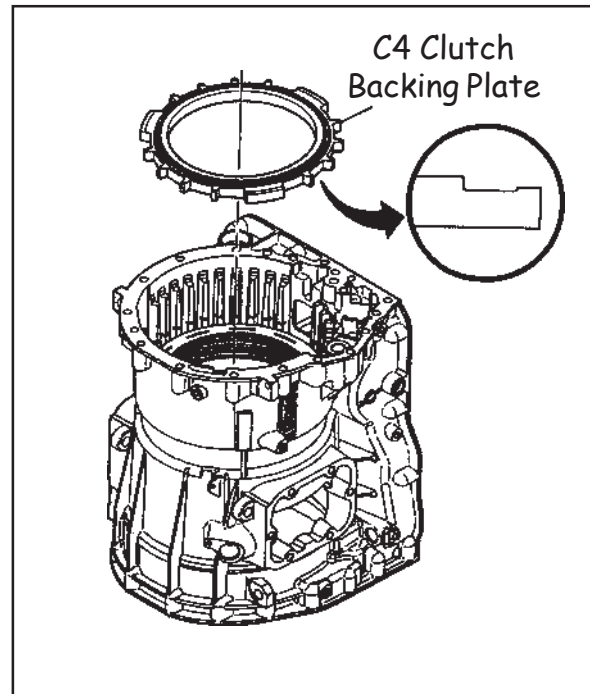
14. Install the C4 clutch spring and plate assembly into the main case with the springs facing up.
15. Starting with a friction clutch install 5 friction and 4 steel C4 clutch plates.



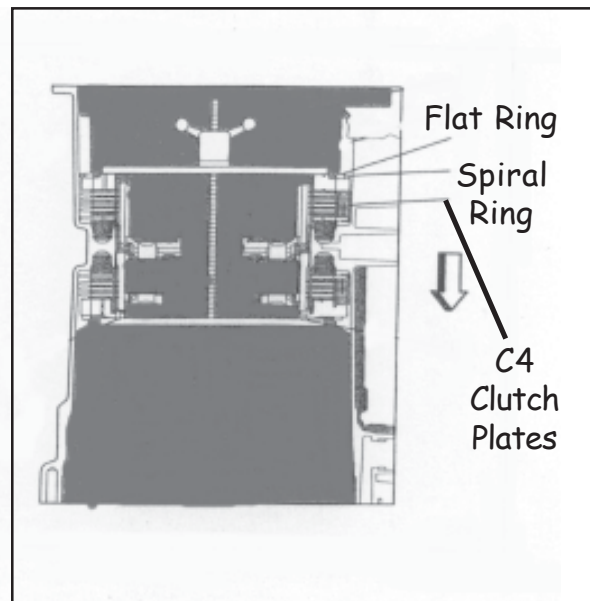


## Transmission Assembly

16. Install the C4 clutch backing plate with the step facing up.

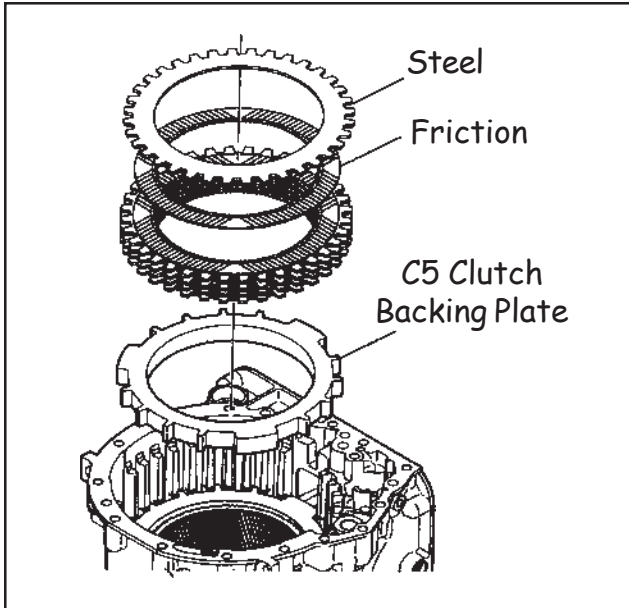


17. Using special tools J 24204-2 and J 44530 compress the C4 piston return spring assemblies. Install the spiral retaining ring first, then the flat retaining ring second.

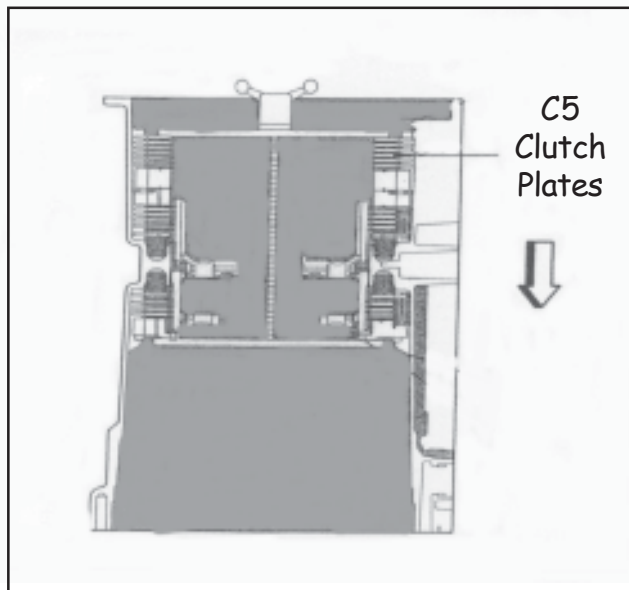




## Transmission Assembly



18. Install the C5 clutch backing plate.
19. Starting with a friction clutch install 6 friction and 5 steel C5 clutch plates.

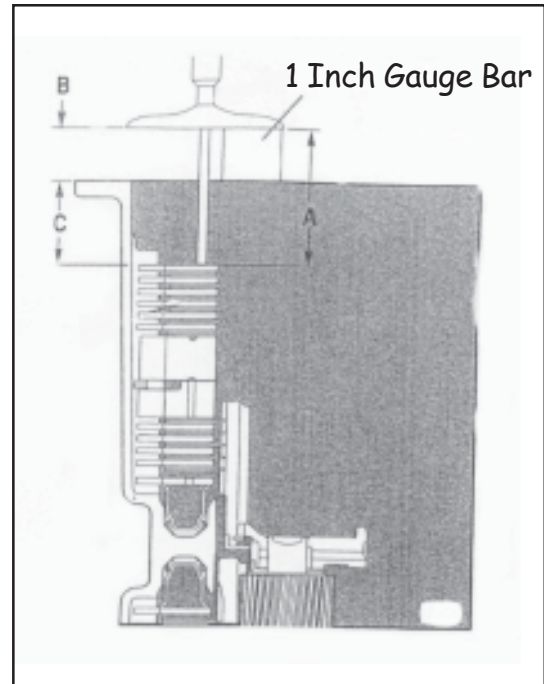


20. Set the C5 clutch clearance. Using special tools J 24204-2 and J 44530 compress the C5 clutch plates to remove any coning. Tighten the wing nut of J 24204-2 until hand tight.



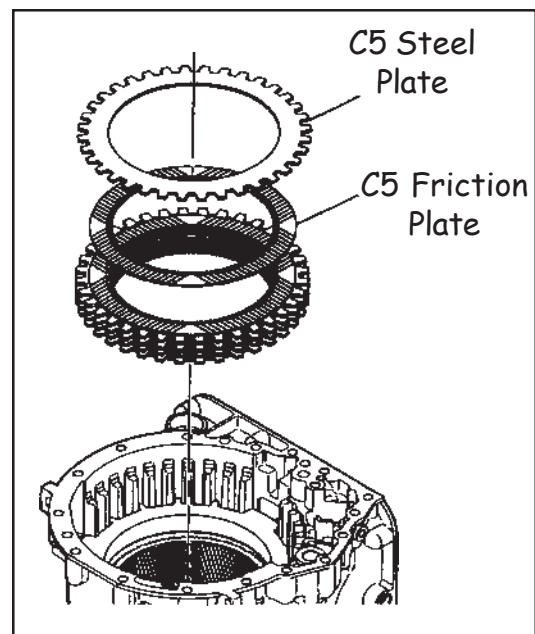
# Transmission Assembly

- 21. Place a 1 inch gauge bar on the rear surface of the main housing.
- 22. Measure from the top of the gauge bar to the top of the C5 clutch stack. This will be dimension A.
- 23. Subtract the width of the gauge bar (dimension B) from dimension A. This will be dimension C. Select the proper C5 selective steel clutch plate from the chart below.



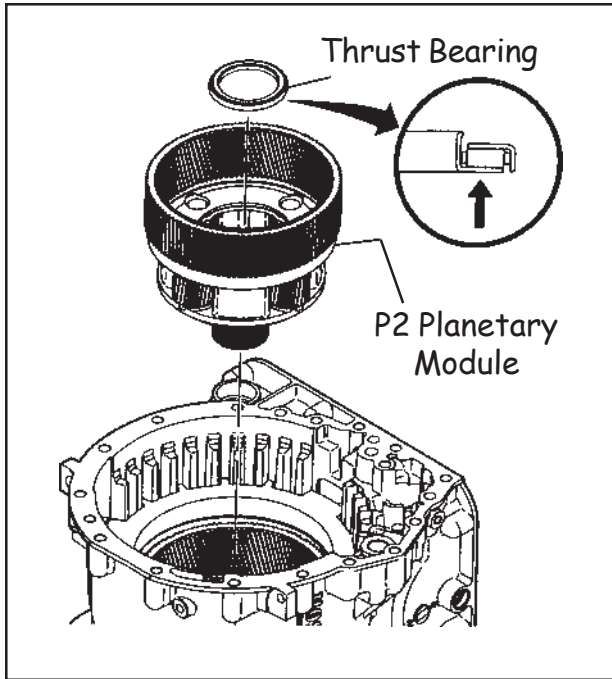
Dimension C	ID Number
1.393-1.412 in.	1
1.412-1.431 in.	2
1.432-1.467 in.	3

- 24. Once the proper selective C5 steel clutch plate has been determined. Remove all of the C5 friction and steel clutch plates from the main case.



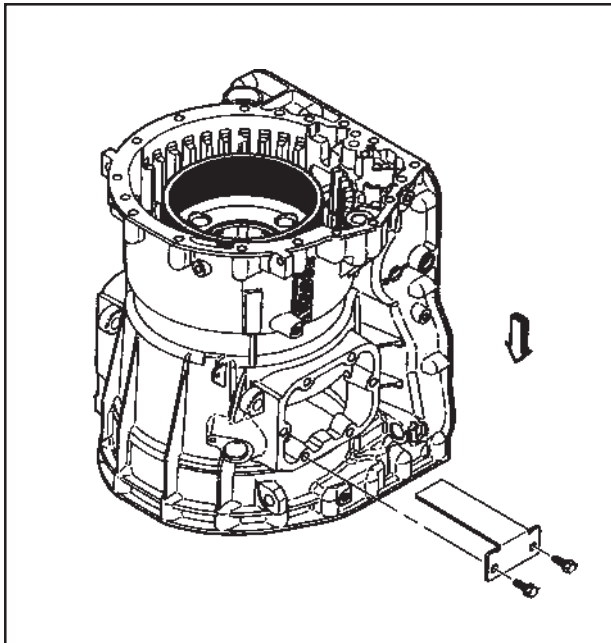


## Transmission Assembly



25. Install the P2 planetary module.

26. Install the thrust bearing on to the P2 planetary module with the blue stripe facing down.

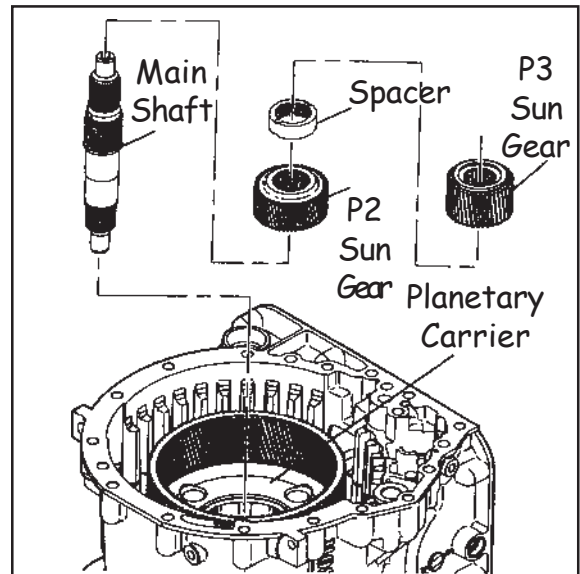


27. Install special tool J 44587 on to the PTO access hole to support the main shaft.

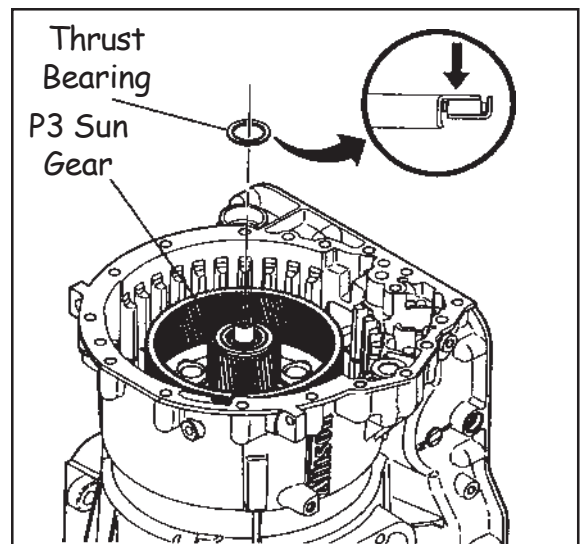


## Transmission Assembly

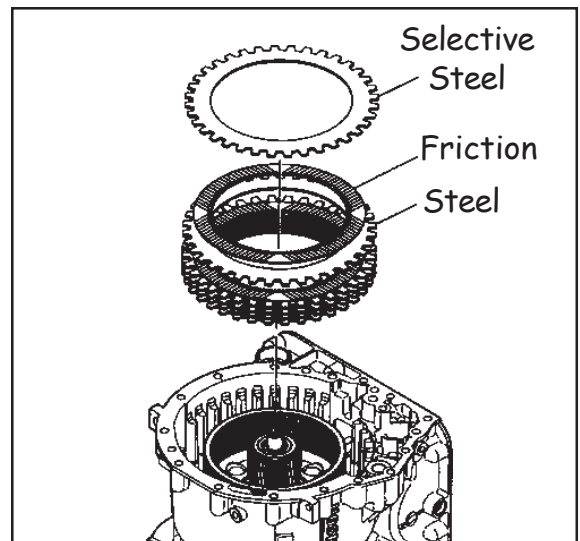
- 28. Install the P2 sun gear and sun gear spacer onto the main shaft.
- 29. As a unit, install the main shaft, P2 sun gear, and the sun gear spacer into the P2 planetary carrier.



- 30. Install the P3 sun gear with the flat side facing the sun gear spacer.
- 31. Install the thrust bearing with the blue stripe facing up.

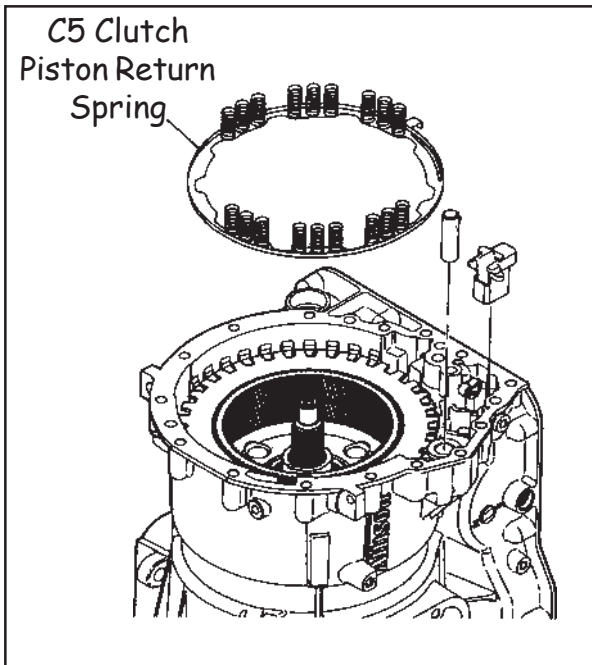


- 32. Reinstall the C5 clutch plates with the selective steel clutch plate on top.

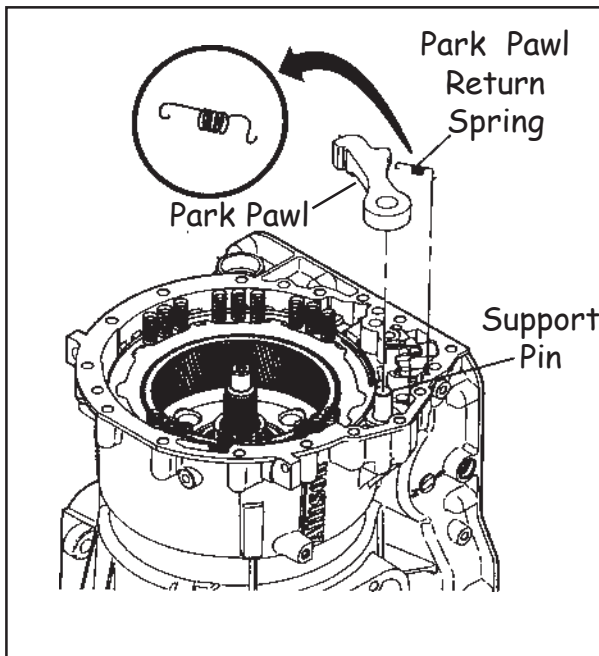




## Transmission Assembly



33. If the transmission has a park pawl, install the park pawl assembly guide.
34. Install the C5 clutch piston return spring assembly.



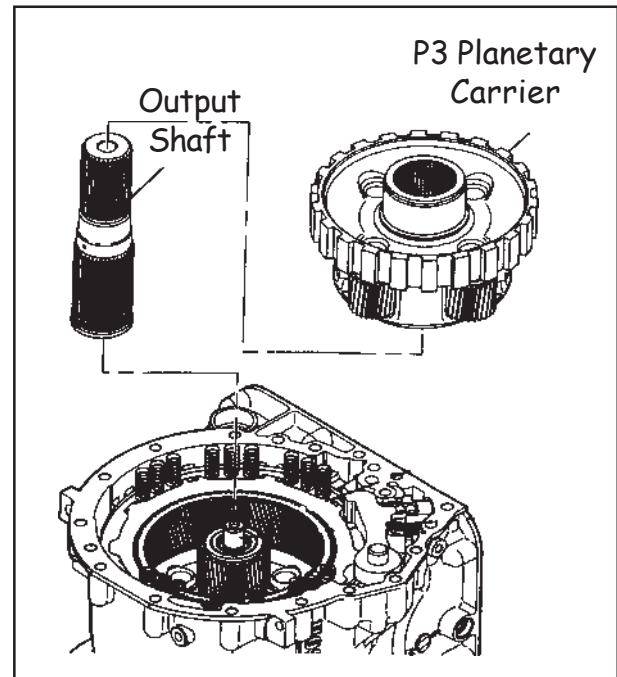
35. If the transmission has a park pawl, install the park pawl support pin, park pawl and return spring.



## Transmission Assembly

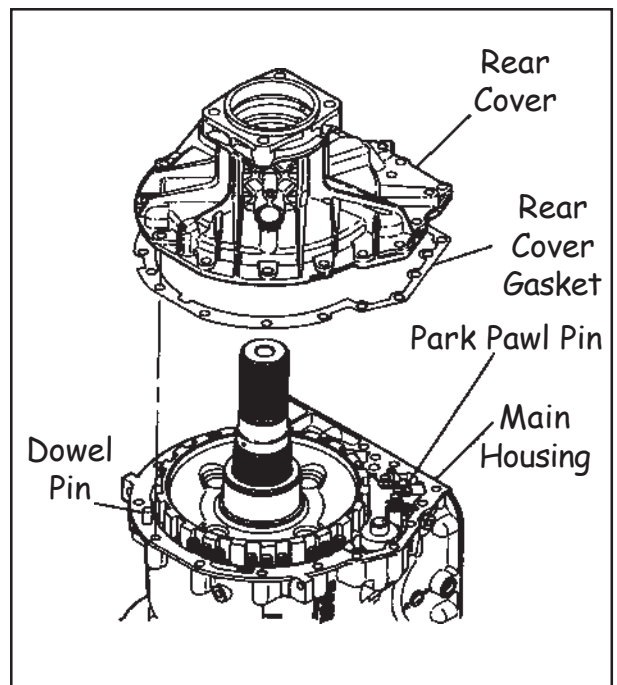
36. Install the output shaft into the P3 planetary carrier assembly.

37. While holding the output shaft install the P3 planetary carrier assembly into the P3 ring gear. Rotate the carrier assembly until it seats.



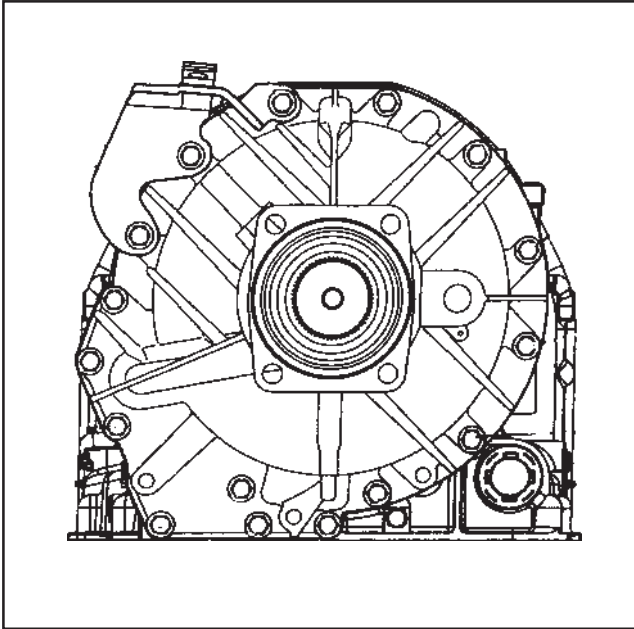
38. Install a new rear cover gasket onto the main housing.

39. Install the rear cover module. Align the rear cover with the main case dowel pin and the park pawl pin.





## Transmission Assembly



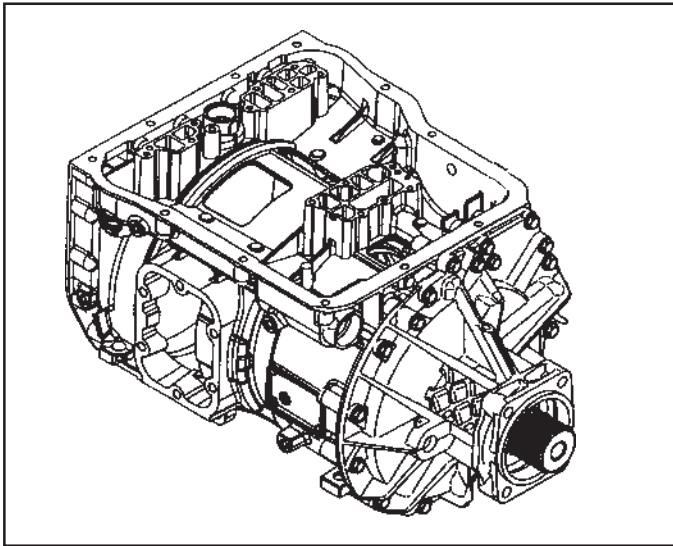
40. Hand install four rear cover bolts. Evenly draw down the bolts until the rear cover seats on the main housing.

41. Install the remaining twelve rear cover bolts and torque to 38-45 lb-ft.

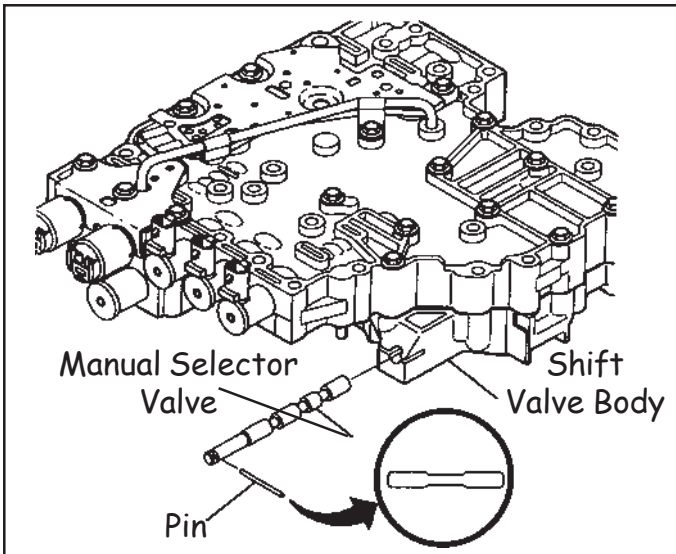




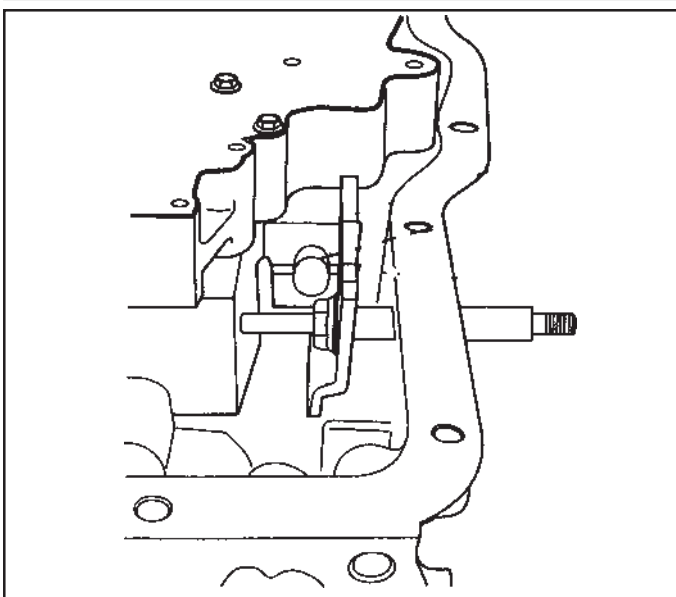
## Transmission Assembly



42. Position the main housing with the valve body face up.



43. Assemble the manual selector valve and pin into the valve body.

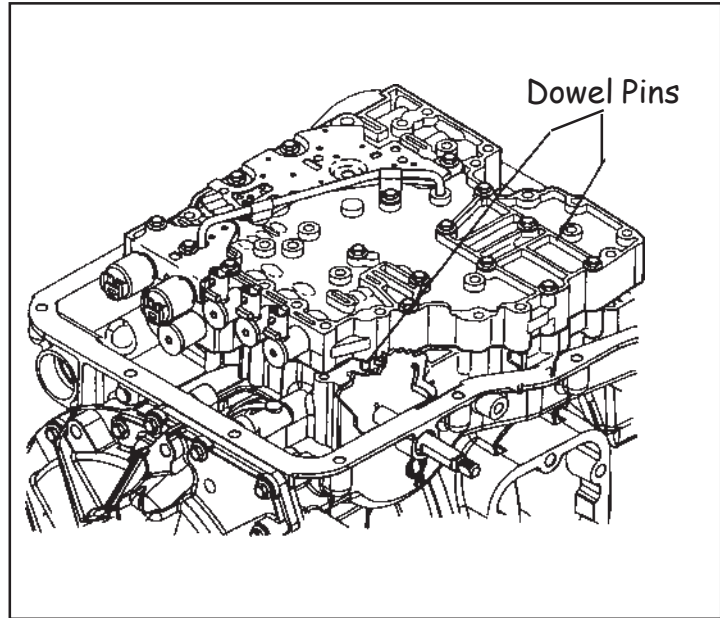


44. Align the valve body assembly with the main housing while installing the manual selector valve pin into the detent lever.

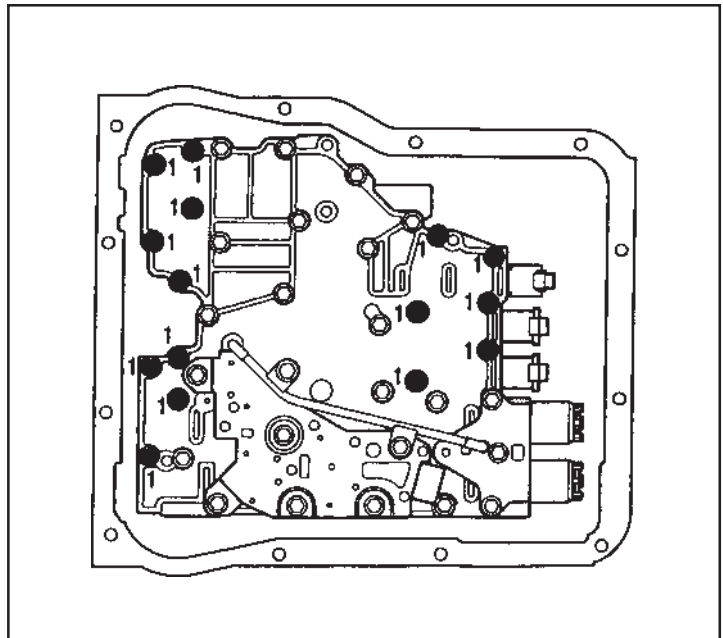


## Transmission Assembly

45. Align the two valve body dowel pins with the dowel pin holes in the main housing.

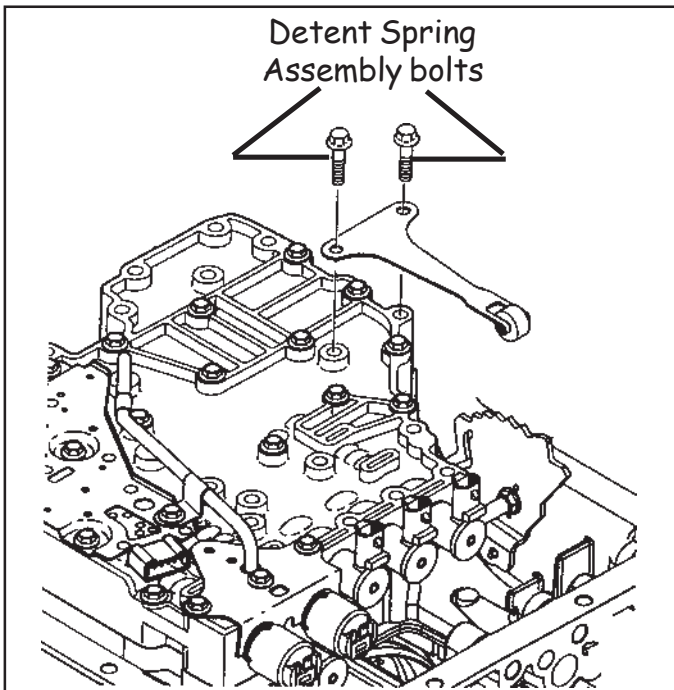


46. Install 15 valve body bolts and torque to 84-120 in-lb.

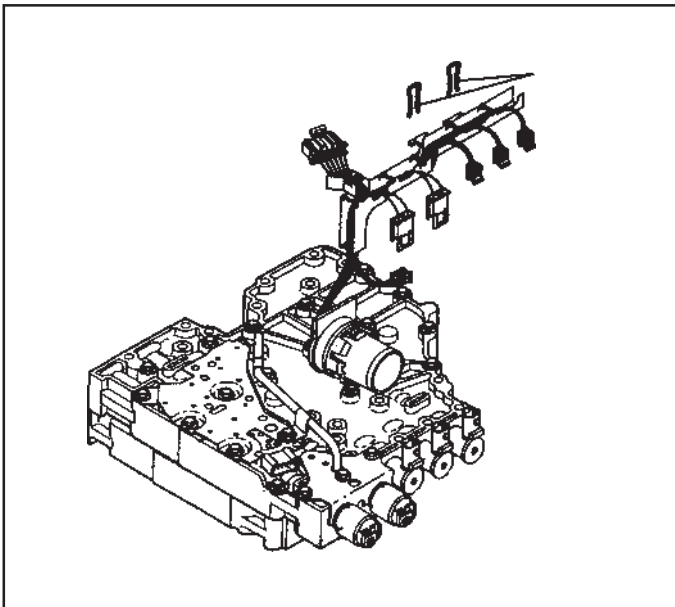




## Transmission Assembly



47. Install the detent spring assembly onto the main valve body. Make sure the detent roller rests on the detent lever. Install the 2 detent spring assembly bolts and torque to 84-120 in-lb.

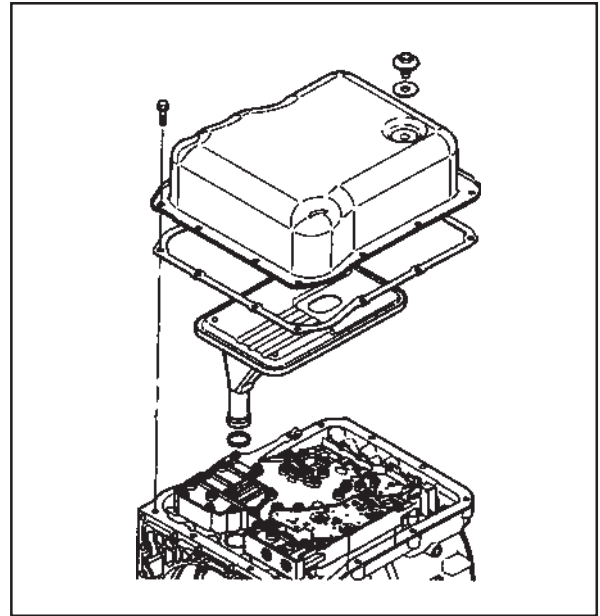


48. Install the main wiring harness connector into the main case.
49. Install the internal wiring harness onto the main valve body using the on/off shift solenoid retainers over wiring harness tabs to hold the harness in position.
50. Connect the harness to the internal electrical components.



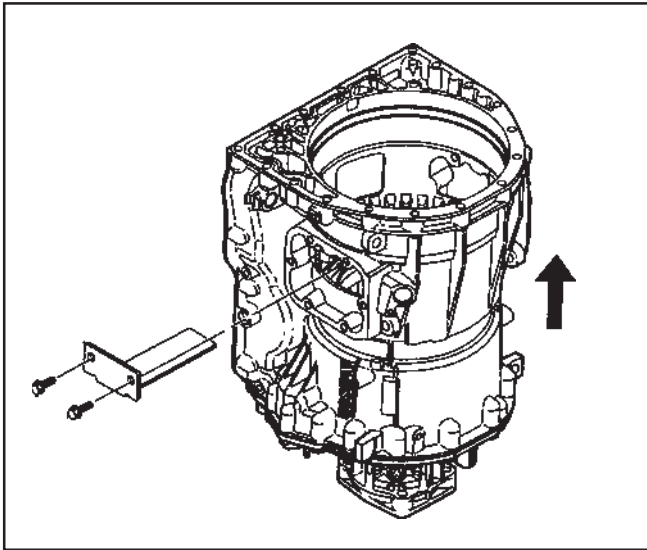
## Transmission Assembly

51. Install the suction filter.
52. Install a new oil pan gasket onto the main housing.
53. Install the oil pan and twelve oil pan bolts. Torque bolts to 18-21 lb ft.



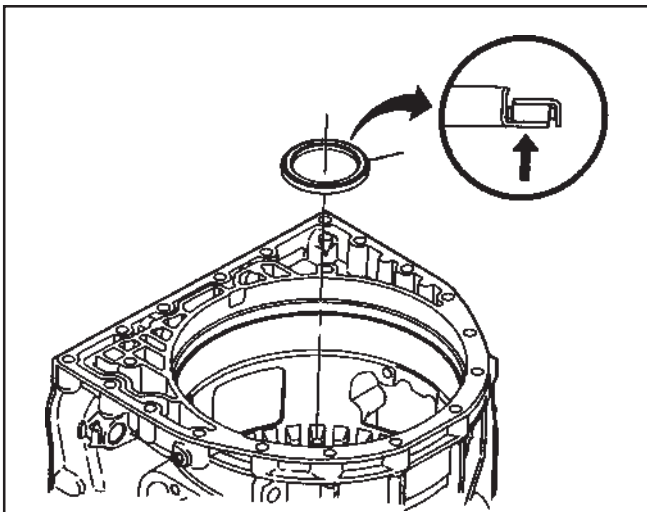


## Transmission Assembly

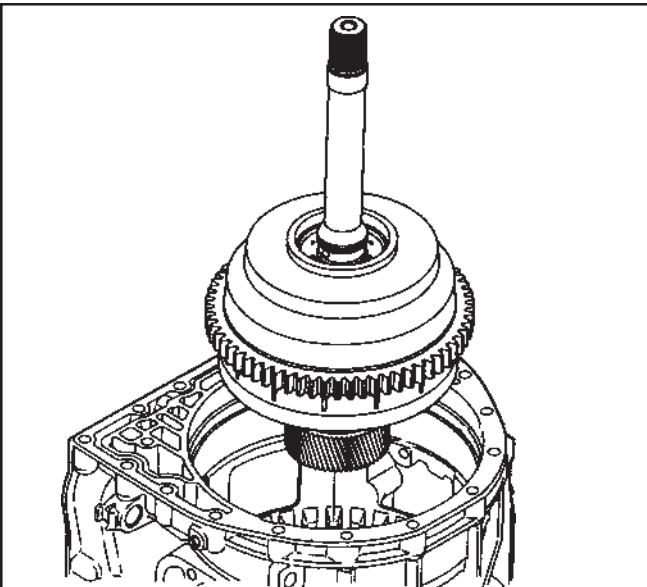


54. Position main housing so that the front of the case is facing up.

55. Remove special tool J 44587 from the PTO access hole.



56. Install the thrust bearing onto the P1 planetary carrier with the blue stripe facing down.

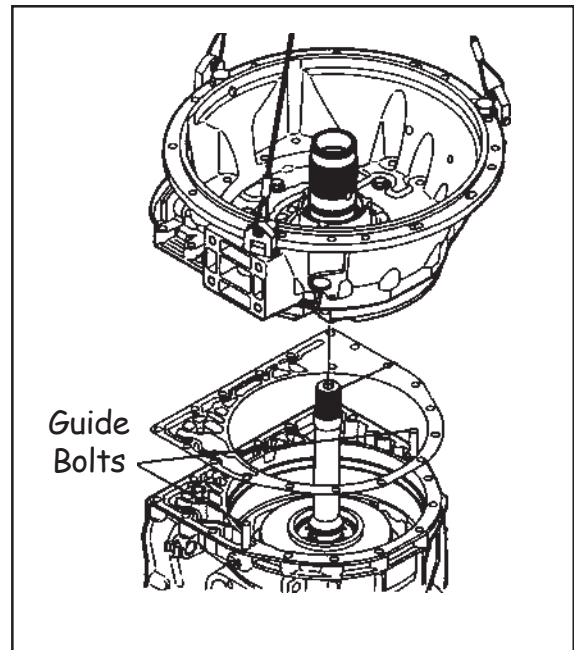


57. Install the rotating clutch assembly. Rotate the clutch assembly until the module seats.

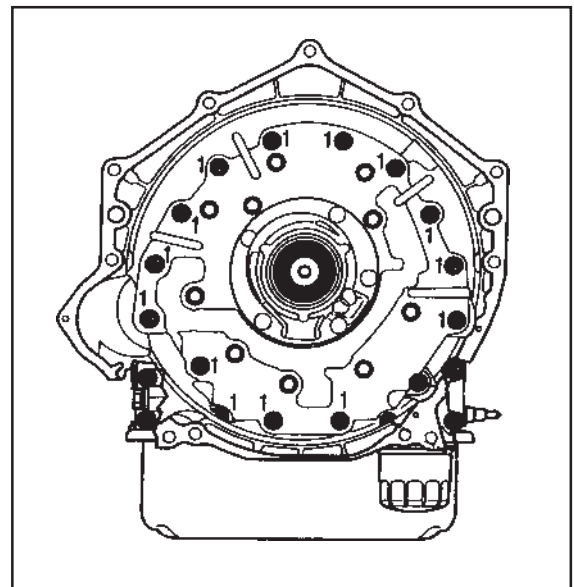


## Transmission Assembly

58. Install a new main housing/separator plate gasket onto the main housing.
59. Install two M10x 1.5 guide bolts into the main housing.
60. Lube the three sealing rings on the back of the front support.
61. Install the converter housing/front support module over the stator shaft and onto the main housing.

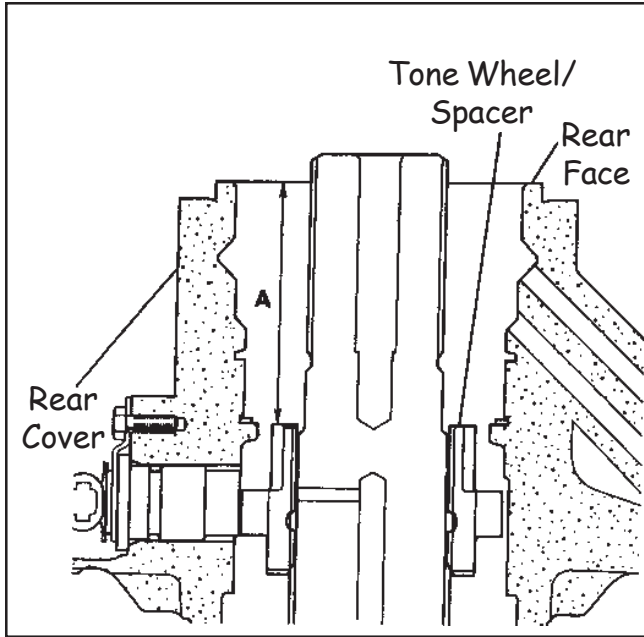


62. Remove the two guide bolts.
63. Install the 20 torque converter housing bolts and torque to 38-45 lb-ft.



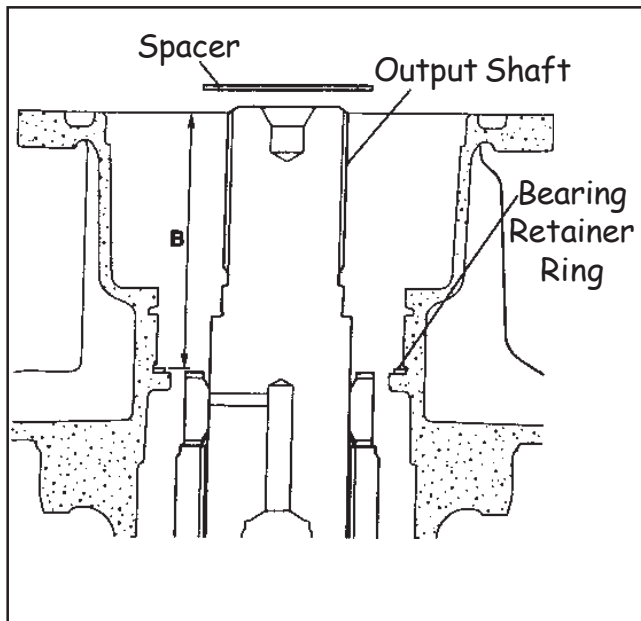


# Transmission Assembly



64. Determine the proper rear cover selective spacer. Start by positioning the main housing so that the rear of the main housing is facing upward.

65. Measure the distance from the rear face of the rear cover module to the rear face of the output tone wheel (2WD) or rear face of the bearing spacer (4WD). This will be dimension A.



66. Measure the distance from the rear face of the rear cover module to the rear face of the bearing retaining ring. This will be dimension B.

67. Calculate dimension C by subtracting dimension B from dimension A.

68. Select the appropriate spacer based on dimension C for the chart below.

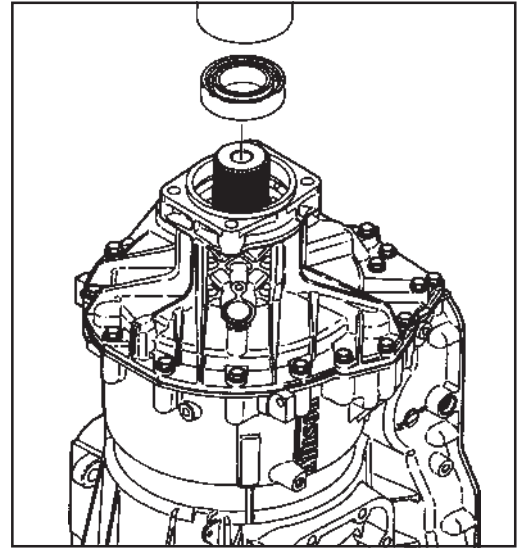
Dimension C	Thickness	# Holes
.0397-.0466 in.	.0096-.0116 in.	0
.0467-.0557 in.	.0187-.0207 in.	1
.0557-.0647 in.	.0278-.0297 in.	2
.0648-.0738 in.	.0368-.0388 in.	3
.0738-.0828 in.	.0459-.0478 in.	4
.0829-.0919 in.	.0549-.0569 in.	5
.0919-.0988 in.	.0640-.0659 in.	6

69. Install the selective spacer on the output shaft.

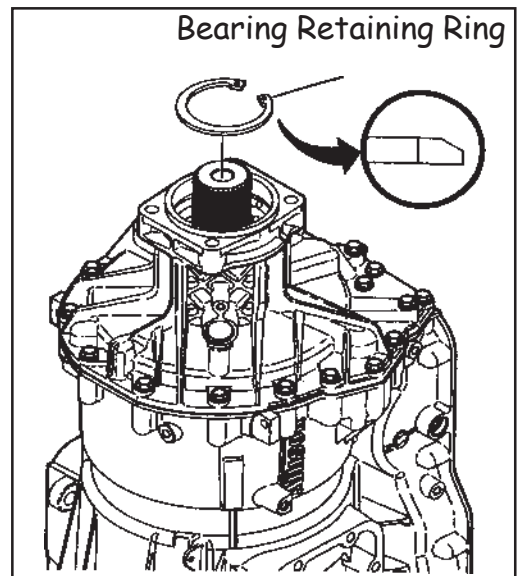


## Transmission Assembly

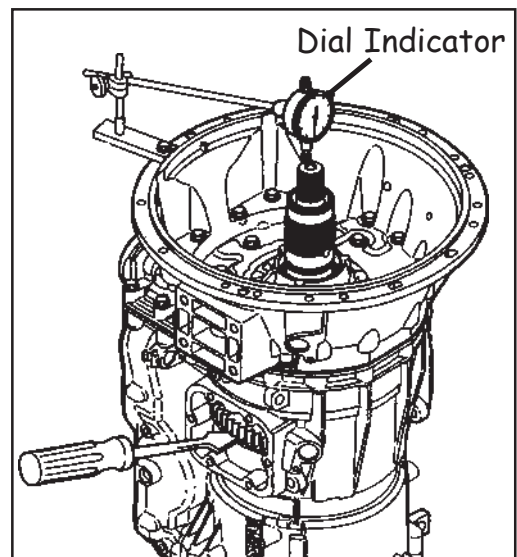
70. Using special tool J 24446 install the rear ball bearing assembly into the rear cover module.



71. Install the bearing retaining ring with the beveled edge facing up.



72. Position the main housing so that the converter housing is facing up.
73. Install a dial indicator on the converter housing to read the transmission end play.
74. Lift the rear of the rotating clutch housing with a screw driver through the PTO hole in the case. The endplay must be .011-.061 in. If the endplay is not within specifications, a different rear cover selective spacer must be installed.







## Fluid Capacity Specifications

Condition	Sump	Liters	Quarts	<b>Fluid Type Dexron III</b>
<b>(approximate)</b>				
Fill After Rebuild	Shallow Pan	12.0	12.7	
	Deep Pan	14.0	15.0	
Fill After Fluid and Filter Change	Shallow Pan	7.0	7.4	
	Deep Pan	10.0	10.5	

## Front Support & Main Pump Module Specifications

Application	In. (mm)
<b>Ground Sleeve</b>	
Bushing Inside Diameter (Maximum)	1.3315 (33.820)
Inside Diameter at Shaft Seal Ring Bore (Maximum)	1.7894 (45.451)
Spline Wear (Maximum)	0.000 (0.00)
<b>Main Pump</b>	
Bushing Inside Diameter (Maximum)	2.3015 (58.458)
Drive Gear Distance Between Flats - (Maximum)	2.0537 (52.164)
Drive Gear-To-Wear Plate Side Clearance (Maximum)	.0026 (.066)
<b>Driven Gear</b>	
Diameter Clearance W/Pump Body (Maximum)	.0080 (.203)
Outside Diameter (Minimum)	4.2908 (108.986)
Tooth Clearance w/Crescent (Maximum)	.0179 (.455)
To-Wear Plate Side Clearance (Maximum)	.0022 (.056)
<b>Gear Cavity</b>	
Depth (Maximum)	0.9819 (24.940)
Inside Diameter (Maximum)	4.2988 (109.190)
Wear Plate Thickness (Minimum)	.1161 (2.950)
Thrust Washer Thickness (Minimum)	.059 (1.50)



## Main Housing Module Specifications

Application	In. (mm)
Clutch Plate Spline Wear (Notching)	.0450 (1.143)
<b>C3 Backplate</b>	
Cone (Maximum)	.0000 (.000)
Thickness (Minimum)	.6033 (15.324)
Thrust Washer Inner Rim Thickness (Minimum)	.1150 (2.921)
<b>C3/C4 Friction Plate</b>	
Cone (Maximum)	.0089 (.226)
Oil Groove Depth (Minimum)	.0079 (.201)
Thickness (Minimum)	.0935 (2.375)
<b>C3/C4 Spring Plate</b>	
Cone (Maximum)	.0157 (.399)
Thickness (Minimum)	.1224 (3.109)
<b>C3/C4 Steel Reaction Plate</b>	
Cone (Maximum)	.0157 (.399)
Thickness (Minimum)	.0961 (2.441)
<b>C4 Backplate</b>	
Cone (Maximum)	.0000 (.000)
Thickness (Minimum)	.6063 (15.400)
<b>C5 Backplate</b>	
Cone (Maximum)	.0000 (0.000)
Thickness (Minimum)	.7047 (17.899)
<b>C5 Friction Plate</b>	
Cone (Maximum)	.0089 (.226)
Oil Groove Depth (Minimum)	.0079 (.201)
Thickness (Minimum)	.0935 (2.375)
<b>C5 Steel Reaction Plate</b>	
Cone (Maximum)	.0116 (.295)
<b>Thickness (Minimum) Selective</b>	
No. 29536481	.0762 (1.935)
No. 29536482	.0959 (2.436)
No. 29536483	.1156 (2.936)
P1 Planetary Ring Gear Spline Wear (Maximum) (Notching)	.0150 (.381)



## Planetary Gear Module Specifications

Application	In. (mm)
<b>Main Shaft</b>	
Journal Minimum Outside Diameter (P2 Carrier Bushing)	1.4333 (36.406)
Pilot Minimum Outside Diameter (Turbine & Output Shafts)	.7869 (19.987)
<b>P1 Carrier Assembly</b>	
Bushing Inside Diameter (Maximum)	1.9957 (50.690)
Pinion Gear End Play (Maximum)	.0400 (1.010)
P2 Ring Gear Spline Wear (Maximum) (Notching)	.0150 (.381)
Thrust Washer Thickness (Minimum)	.059 (1.50)
To-Thrust Washer End Play (Maximum)	.0400 (1.010)
<b>P2 Carrier Assembly</b>	
Bushing Inside Diameter (Maximum)	1.4404 (36.586)
Pinion Gear End Play (Maximum)	.0400 (1.010)
P3 Ring Gear Spline Wear (Maximum) (Notching)	.0150 (.381)
To-Thrust Washer End Play (Maximum)	.0400 (1.010)

## Rear Cover Module Specifications

Application	In. (mm)
<b>Output Shaft</b>	
Bearing Surface Outside Diameter (Minimum)	1.7708 (44.978)
Bushing Inside Diameter (Maximum)	.7925 (20.130)
Output Yoke Seal Surface Outside Diameter (Minimum)	2.5622 (65.080)
<b>P3 Carrier Assembly</b>	
Parking Pawl Gear Wear	.000 (.00)
Pinion Gear End Play (Maximum)	.0400 (1.010)
To-Thrust Washer End Play (Maximum)	.0400 (1.010)



## Rotating Clutch Module Specifications

Application	In. (mm)
<b>C1 Backplate</b>	
Cone (Maximum)	.000 (.00)
<b>Thickness (Minimum) Selective</b>	
No. 29536221	.4661 (11.839)
No. 29536222	.4835 (12.280)
No. 29536223	.5012 (12.730)
No. 29536224	.5189 (13.180)
No. 29536225	.5366 (13.630)
<b>C1 Friction Plate</b>	
Cone (Maximum)	.0100 (.254)
Oil Groove Depth (Minimum)	.0079 (.201)
Thickness (Minimum)	.0935 (2.375)
<b>C1 Steel Reaction Plate</b>	
Cone (Maximum)	.0079 (.201)
Thickness (Minimum)	.0841 (2.136)
<b>C2 Friction Plate</b>	
Cone (Maximum)	.0089 (.226)
Oil Groove Depth (Minimum)	.0079 (.201)
Thickness (Minimum)	.0935 (2.375)
<b>C2 Steel Reaction Plate</b>	
Cone (Maximum)	.0094 (.239)
Thickness (Minimum)	.0841 (2.136)
<b>Housing</b>	
Bushing Inside Diameter (Maximum)	3.0776 (78.171)
Rotating Seal Bore Inside Diameter (Maximum)	2.9154 (74.051)
Thrust Washer Thickness (Minimum)	.102 (2.59)
<b>Turbine Shaft</b>	
Bushing Inside Diameter (Maximum)	.7925 (20.130)
End Play	.0610 (1.549)

## Torque Converter Module Specifications

Application	In. (mm)
Cover Pilot Outside Diameter (Minimum)	1.699 (43.15)
Converter Pump Hub Distance Between Flats (Minimum)	2.0351 (51.692)
Converter Pump Hub Outside Diameter (Minimum)	2.2933 (58.250)
<b>Maximum Torque Converter End Play</b>	
New	.030 (.762)
Used	.040 (1.015)



## Torque Specifications

Application	Specification	
	English	Metric
Control Module Cover to Radiator Shroud Bolts	80 lb in	9 N. m
Control Valve Assembly to Main Housing Bolts	108 lb in	12 N. m
Converter Housing to Front Support Assembly Bolts	41 lb ft	56 N. m
Detent Lever Retaining Nut	21 lb ft	29 N. m
Detent Spring Assembly to Main Valve Body Bolts	108 lb in	12 N. m
Filler Tube Bracket to Transmission Nuts	13 lb ft	18 N. m
Fuel Line Bracket to Transmission Nut	13 lb ft	18 N. m
Fuel Line Retainer to Transmission Bolts	22 lb in	2.5 N. m
Heat Shield to Transmission Bolts	13 lb ft	17 N. m
Heat Shield to Transmission Nut	18 lb ft	25 N. m
Hydraulic Connector Assembly	18 lb ft	25 N. m
Input Speed Sensor to Torque Converter Housing Bolt	108 lb in	12 N. m
Main Pressure Tap Plug	108 lb in	12 N. m
Oil Cooler Line Clip to Oil Pan Nut	80 lb in	9 N. m
Oil Cooler to Radiator Brace Bolts	106 lb in	12 N. m
Oil Pan Drain Plug	26 lb ft	35 N. m
Oil Pan to Main Housing Bolts	20 lb ft	27 N. m
Output Speed Sensor to Rear Cover Bolt	108 lb in	12 N. m
PNP Switch to Main Housing Bolts	20 lb ft	27 N. m
Pressure Switch Assembly to Main Valve Body Bolts	108 lb in	12 N. m
PTO Cover(s) to Main Housing Bolts	32 lb ft	43 N. m
Shift Cable Bracket to Transmission Bolts	18 lb ft	25 N. m
Shift Cable Support to Steering Column Brace Bolt	89 lb in	10 N. m
Shift Lever to Shift Selector Shaft Nut	18 lb ft	24 N. m
Shipping Bracket to Torque Converter Housing Bolts	20 lb ft	27 N. m
Shipping Bracket to Torque Converter Lug Bolts	20 lb ft	27 N. m
Torque Converter to Flywheel Bolts	44 lb ft	60 N. m
Torque Converter Housing Inspection Cover to Transmission Bolts	89 lb in	10 N. m
Transmission Mount to Adapter Bolts (4WD)	35 lb ft	47 N. m
Transmission Mount to Transmission Bolts (2WD)	37 lb ft	50 N. m
Transmission Mount to Transmission Support Nuts	30 lb ft	40 N. m
Transmission Support to Frame Nuts and Bolts	52 lb ft	70 N. m
Transmission to Engine Studs and Bolts	37 lb ft	50 N. m
Turbine Speed Sensor to Main Housing Bolt	108 lb in	12 N. m
Wire Harness/Vent Tube Bracket to Transmission Nut	13 lb ft	18 N. m
Yoke Assembly to Output Shaft Bolt	91 lb ft	123 N. m

## Special Tool List

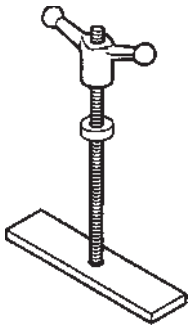
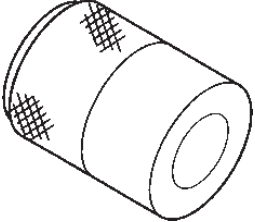


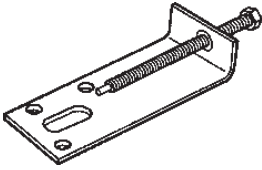
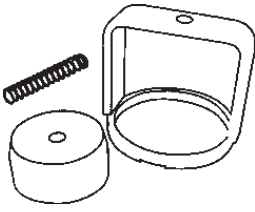
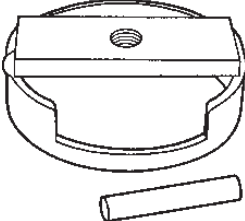
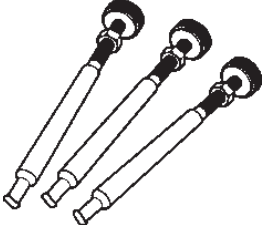
Illustration	Kent-Moore Tool No. **/Description
	J 24204-2 Bar and Stud Assembly
	J 24446 Rear Bearing Installer
	J 24459-5 Spring Compressor Adapter
	J 41364-A NSBU Switch Adjusting Tool

Illustration	Kent-Moore Tool No. **/Description
	J 43770 Main, Lube, Converter Relief Valve Spring Compressor
	J 43776 C2 Piston Return Spring Compressor
	J 43777 C1 Piston Return Compressor
	J 43910 Output Bearing Puller Leg Set



## Special Tool List

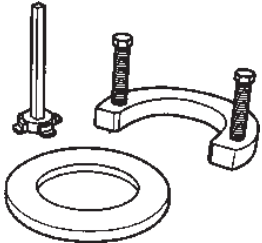
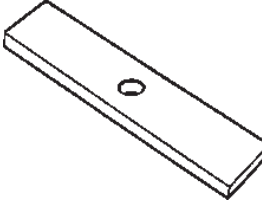
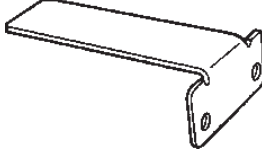
Illustration	Kent-Moore Tool No.**/Description
	J 44525 C1 Clutch Backplate Selector
	J 44530 C3/C4 Piston Spring Compressor

Illustration	Kent-Moore Tool No.**/Description
	J 44587 Main Shaft Holder

\*\* Kent-Moore Tool Division  
SPX Corporation  
1-800-345-2233



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