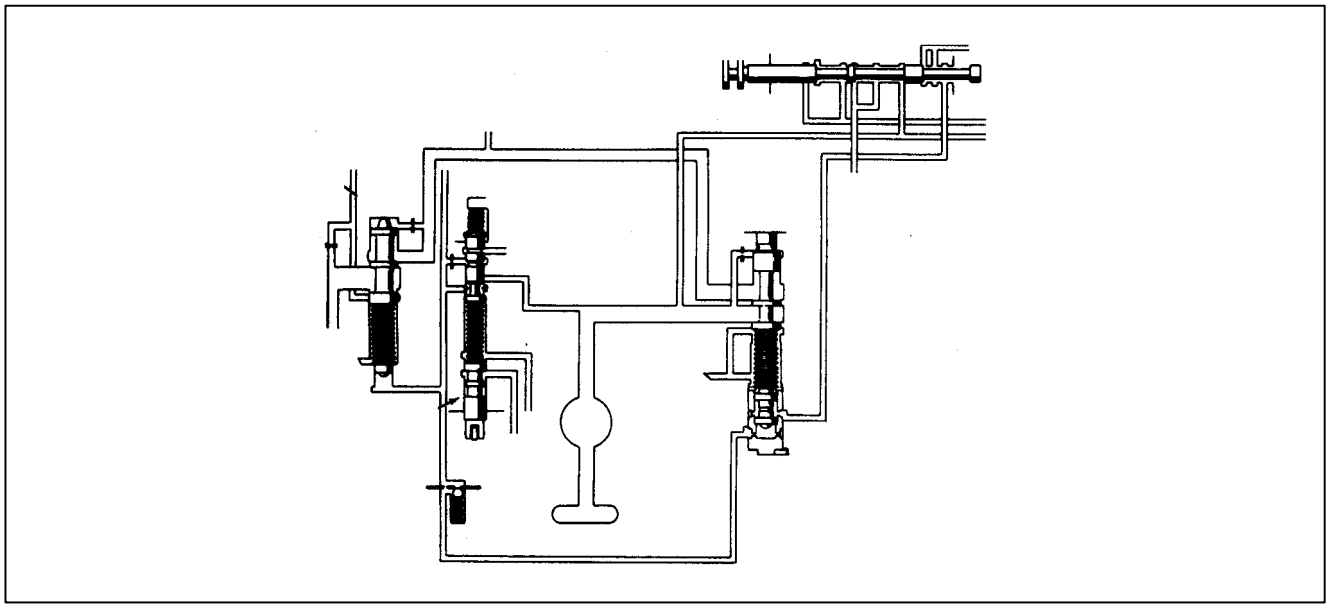
Section 8

VALVE BODY CIRCUITS



Lesson Objectives:

1. Describe the function of pressure control valves in the valve body as they apply to:
   - Slippage
   - Upshifting
   - Downshifting
   - Lubrication
2. Describe the function of shift control valves in the valve body as they apply to:
   - Line pressure distribution
   - Downshifting
   - Upshifting
3. Describe the function of timing (sequencing) valves in the valve body as they apply to:
   - Manual second gear downshift quality
   - Manual low gear shift quality
   - Reverse gear engagement quality
   - Automatic upshift and downshift engagement
4. Describe the function of pressure modulating valves in the valve body as they apply to:
   - Manual second gear downshift quality
   - Manual low gear shift quality
   - Control of line at cruise speed
5. Explain the effect that throttle pressure and governor pressure have on the shift valves and clutch application.
6. Describe the effect of the shift solenoids on the position of the shift valves in each of the following gear ranges:
   - First gear
   - Second gear
   - Third gear
   - Fourth gear

The valve body consists of an upper valve body, a lower valve body and a manual valve body. The two body halves are separated by a separator plate which contains openings that control the flow of fluid between valve circuits. The valves contained therein control fluid pressure and switch fluid from one passage to another. Hydraulic circuits extend to the transmission housing and are connected either by direct mounting or through oil tube passages.

The valves are a precision fit to the bore in the body, and their position is determined by a balance between spring tension and hydraulic pressure. Hydraulic pressure within the valve body will vary based on throttle position or pressure modulating valves. In the case of a non-ECT transmission, pressure also varies based on vehicle speed through the governor valve.

In order to understand what the many valves do in the valve body, they have been separated by function as listed below:

- Pressure control valves
- Hydraulic control valves
- Timing (Sequencing) valves
- Pressure modulating valves

Pressure Control Valves

Pressure control valves regulate pressure within the transmission. Hydraulic pressure is necessary to apply the clutches, brakes, and bands that hold planetary gear components of the transmission. There are times when high pressure is necessary and other times when it is less important. The primary concern with high pressure is that engine power is lost and excessive heat is generated. Heat breaks down the transmission fluid and robs it of its properties. On the other hand, fuel economy is important to achieve, so by regulating pressure, less load is placed on the engine.

Primary Regulator Valve

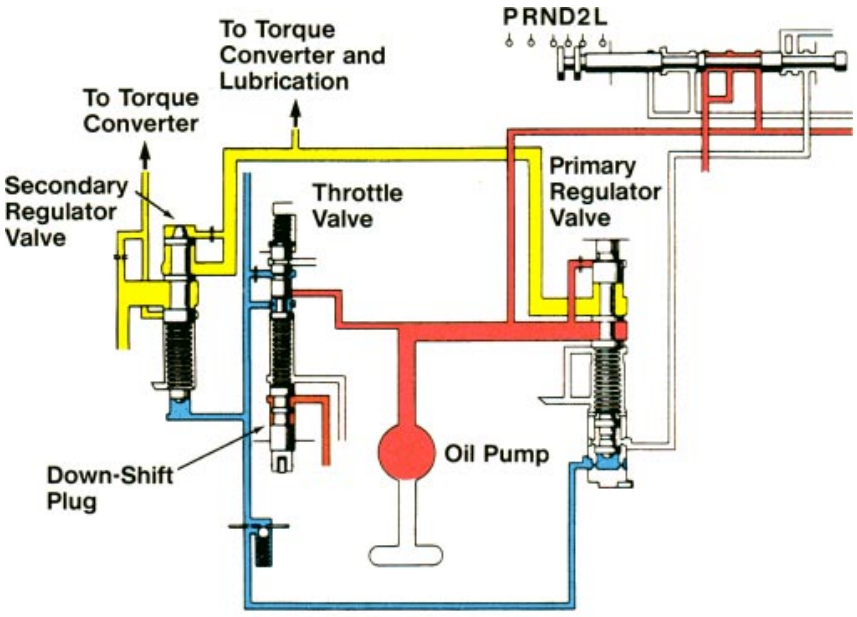
This valve adjusts the pressure from the oil pump to all the hydraulic circuits in the transmission. The purpose of the valve is to reduce engine load and power loss. If pressure remained high, it would cause hard shifting and would create more heat which would be a problem for fluid life, and additional engine power is lost just turning the pump. By reducing pressure, less power is required to rotate the pump and less heat is generated.

The amount of pressure has a direct effect on the holding force of clutches and brakes. It should be high when accelerating the vehicle in first or reverse gear. As the vehicle picks up speed, less holding force is needed, and therefore, pressure is decreased.

The output of the valve is called the ”line pressure,” the highest oil pressure anywhere in the transmission. Line pressure is shown in the color red at all times in Toyota publications.

The position of the primary regulator valve is determined by throttle pressure, line pressure and spring tension. Spring tension pushes the valve up for higher line pressure. Line pressure is routed to the top of the valve and counters spring tension to reduce line pressure. The overall effect is a balance between line pressure and spring tension.

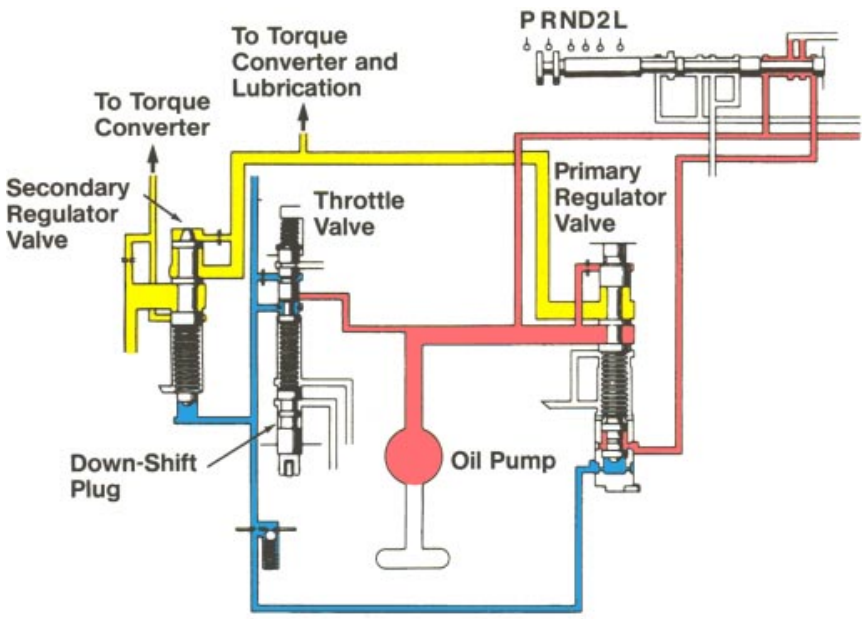
Primary Regulator Valve



At the base of the valve, throttle pressure is applied to push the valve upward, increasing line pressure. The greater the throttle opening, the greater line pressure becomes as the pressure regulator valve bleeds off less pressure.

Line pressure is also increased when reverse gear is selected. Line pressure from the manual valve is directed to the bottom of the valve pushing it upward, increasing line pressure by as much as 50%.

Primary Regulator Valve in R-Range

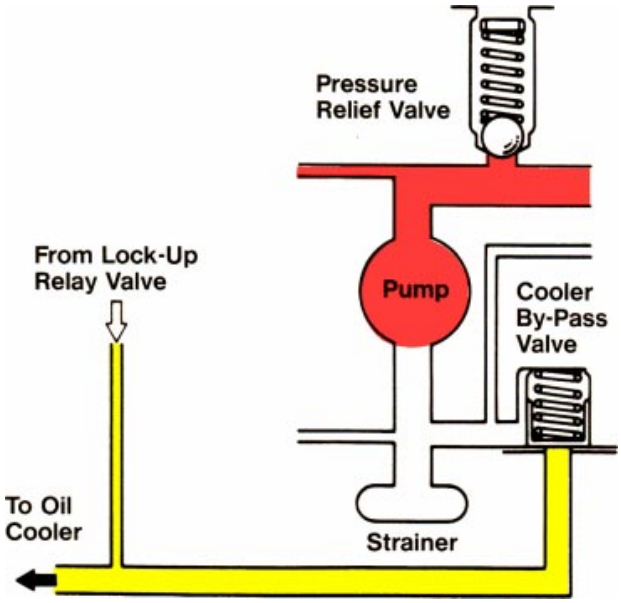


This valve regulates the converter pressure and lubrication pressure. Spring tension pushes the valve upward to increase converter pressure. Converter pressure acts on the top of the vvalve to create a alance between it and spring tension. In addition, in some applicatio

Oil Cooler By-Pass Valve

This valve prevents excessive pressure in the circuit to the oil cooler. The circuit is a low pressure system which routes oil through the oil cooler in the tank of the radiator and back to the sump of the transmission. The valve is spring loaded in the closed position. When pressure exceeds the spring rate, excess pressure is relieved.

Oil Cooler By-Pass Valve and Pressure Relief Valve



Pressure Relief Valve

This valve regulates the oil pump pressure so that it does not rise above a predetermined maximum value. A calibrated spring-is used to control the pressure by holding the valve against its seat.

Notes

Governor Valve

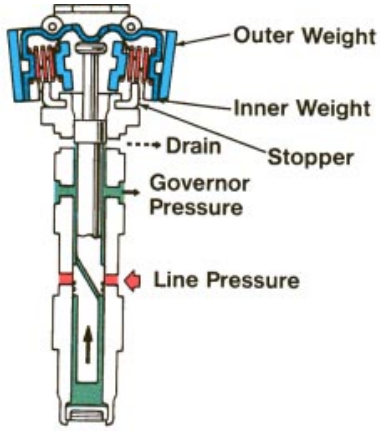
This valve is found on all non-ECT transmissions. It is mounted on the output shaft of rear-wheel drive transmissions or is driven from the drive gear on the differential drive pinion/output shaft on front-wheel drive transmissions. It balances the line pressure routed from the manual valve and the centrifugal force of the governor weights to produce hydraulic pressure in proportion to vehicle speed. The greater the speed of the output shaft, the greater the governor pressure.

The parts which make up the governor include an inner weight and an outer weight mounted to the governor body. Both weights are hinged at their axis point. The calibrated springs push the outer weights in toward the center of the governor. The lever ends of the inner weights push down on the governor valve. The governor valve is located in the center of the governor body and is pushed upward by governor pressure through a drilled passage in the valve.

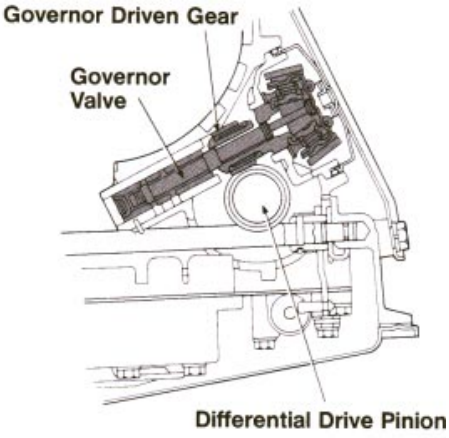
Below 10 mph, centrifugal force is low and line pressure entering through the drilled passage in the valve to the base of the valve pushes the valve upward, blocking the line pressure passage and opening the drain at the top land.

Governor Valve

Line pressure to the base of the valve moves it upward, opening the drain pport. Centrifugal force does not begin to push the valve down until approximately 10 mph.



Engine Running Vehicle Stopped



As the governor turns, the centrifugal force of the inner and outer weights along with the spring cause the weights to open outward. As the weights move outward, the governor valve is pushed downward by the lever of the inner weights. The governor valve position is balanced between centrifugal force acting on the lever at the top of the valve and governor pressure at the base of the valve. The balance of these two forces becomes the governor pressure at that vehicle speed.

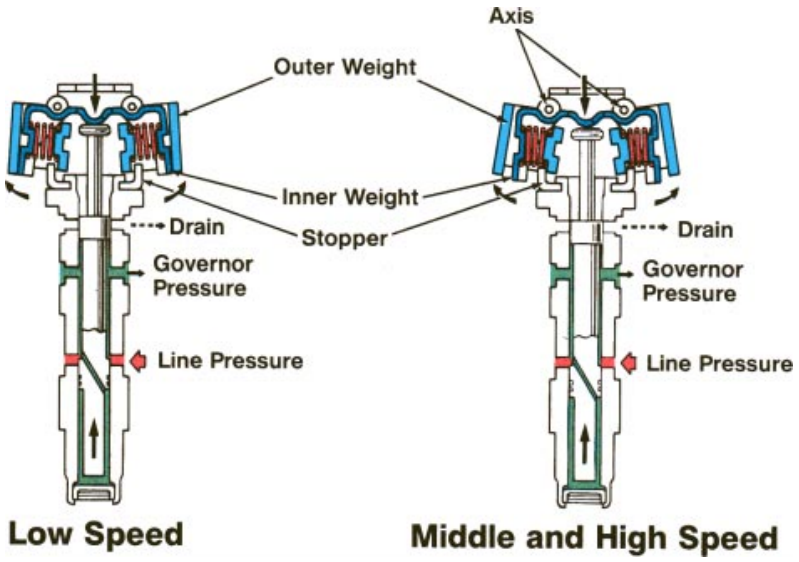
As the rpm increases (middle and high speed) the outer weight movement is limited by the stopper of the governor body. Increased governor pressure acting on the base of the valve works against spring tension. With increased rpms the centrifugal force of the inner weight and spring tension places additional force to push the valve down.

Governor pressure will remain at 0 psi until approximately 10 mph. For specific governor pressures, be sure to check the appropriate repair manual which will give a pressure and vehicle speed relationship.

Governor pressure shown in Toyota publications is always green.

Governor Valve

Governor pressure increases as weights move outward by centrifugal force



Throttle Valves

The throttle valve produces throttle pressure in response to throttle opening angle. When the accelerator pedal is depressed, the downshift plug is pushed upward via the throttle cable and throttle cam. The throttle valve therefore moves upward by means of the spring, opening the pressure passage and modifying line pressure to throttle pressure.

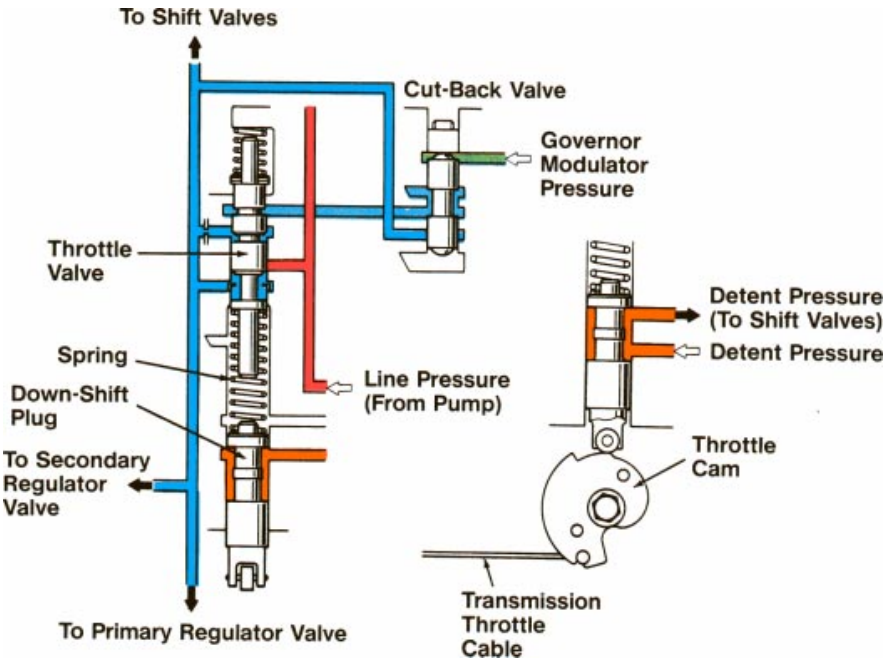
Throttle pressure shown in Toyota publications is always blue.

This throttle pressure also acts on the throttle valve, pushing it down against the spring tension. The throttle valve supplies throttle pressure to each shift valve and acts in opposition to governor pressure.

Throttle pressure also affects line pressure either directly or through throttle modulator pressure. Hydraulic pressure affected by throttle opening is directed to the base of the pressure regulator valve to increase line pressure when engine torque is increased. Additional line pressure serves to provide additional holding force at the holding devices to prevent slippage.

Throttle Valve

Throttle pressure is provided to each shift valve to counter governor pressure.



Shift Control Valves

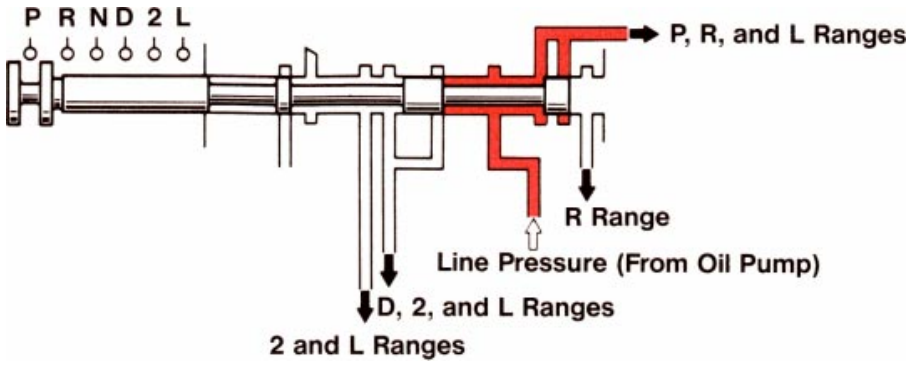
Shift control valves are responsible for directing fluid to different passages in the transmission. They can be manually controlled, solenoid controlled, or hydraulically controlled. They block hydraulic passages while other lands of the valve open passages.

Manual Valve

This valve directs line pressure to various passages in the valve body. It is linked to the driver's selector lever and shifts the transmission into and out of the P, R, N, D, 2 and L ranges as directed by the driver. As the valve moves to the right, it exposes passages to line pressure which will determine the gear selected. The various positions of the valve are maintained by a detent mechanism which also provides feedback to the driver.

Manual Valve

Directs line pressure to various passages in the valve body.



1-2 Shift Valve

This valve controls shifting between first and second gears based on governor and throttle pressures. The valve is held in position by a calibrated spring located between the low coast shift valve and the 1-2 shift valve. When governor pressure is low but throttle pressure is high, this valve is pushed down by throttle pressure and spring tension. In first gear the forward clutch (Cl) is applied through the manual valve, and the one-way clutch No. 2 (F2) is holding. Line pressure is blocked by the valve from the second brake (B2) and the transmission is held in first gear.

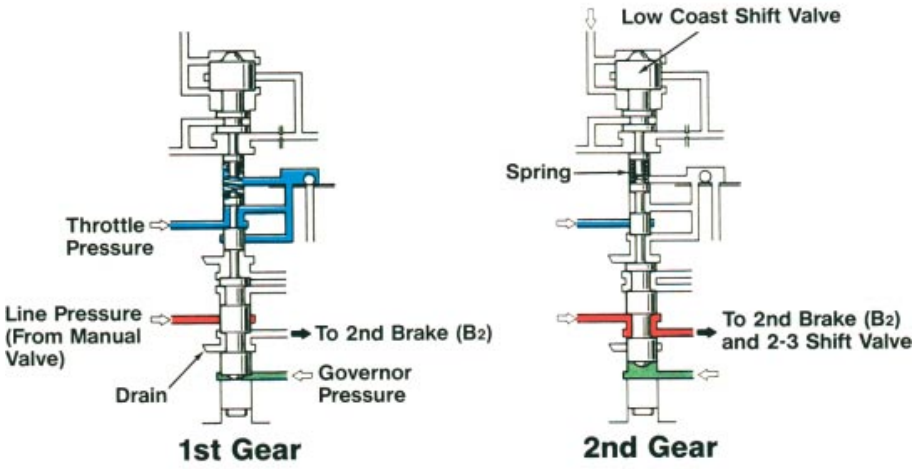
As vehicle speed becomes greater, governor pressure increases and overcomes throttle pressure and spring tension at the 1-2 shift valve. The valve is pushed up by governor pressure, and the circuit to the second brake piston opens, causing the transmission to shift to second gear. When the shift valve moves up, it covers the throttle pressure passage; thus the downshift to first gear depends on spring tension and governor pressure only. This occurs when coasting to a stop. The downshift occurs when spring tension overcomes governor pressure. This happens at such a low speed that it is hardly noticeable.

Forced downshifts from second to first gear occurs when the downshift plug at the base of the throttle valve opens to allow detent regulator pressure to act on the top of the 1-2 shift valve. This forces the shift valve down, which opens the second brake piston to a drain and the downshift occurs as the second brake releases.

When the selector is placed in the L range, low modulator pressure is applied to the top of the low coast shift valve, holding the 1-2 shift valve in the first gear position.

1-2 Shift Valve

Controls line pressure to the 2nd brake (B2) and the 2-3 shift valve



2-3 Shift Valve

This valve controls shifting between second and third gears based on throttle and governor pressures. The valve is positioned by a calibrated spring located between the intermediate shift valve and the 2-3 shift valve. When governor pressure is low but throttle pressure is high, such as under acceleration, this valve is pushed down by throttle pressure and spring tension, holding the transmission in second gear.

When governor pressure rises with increased vehicle speed, this valve is moved upward against throttle pressure and spring tension opening the passage to the direct clutch (C2) piston and causing a shift into third gear. As vehicle speed decreases with the same or increased throttle position, throttle pressure at the top of the 2-3 shift valve causes the valve to move downward, closing the passage to the direct clutch (C2). The pressure in the direct clutch drains and the transmission is downshifted into second gear.

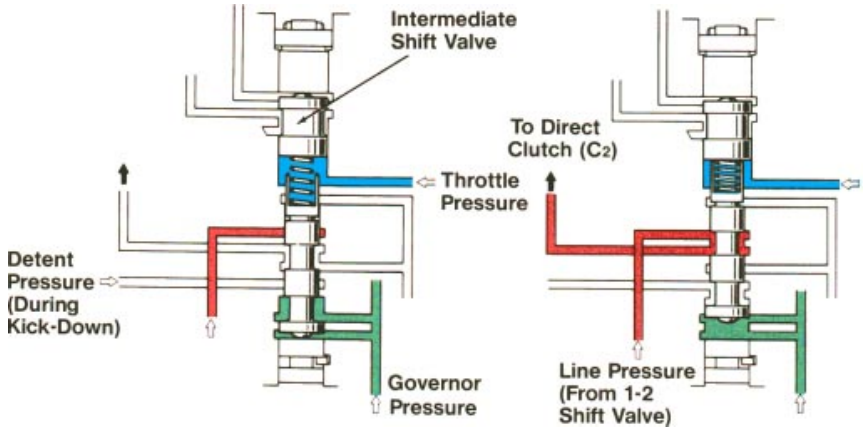
In the event that the accelerator is depressed at or near full throttle, the detent pressure acts on the 2-3 shift valve to permit quicker downshifting to second gear. As the throttle is opened wider, the cam at the base of the throttle valve pushes the detent valve upward. This allows detent pressure to assist throttle pressure at the top of the 2-3 shift valve pushing down on the valve, resulting in faster valve movement.

In addition, take note that the line pressure which applies the direct clutch (C2) comes through the 1-2 shift valve. So if this 1-2 shift valve is stuck, there can be no third gear because the direct clutch cannot be applied.

When the gear selector is placed in the 2-range, line pressure from the manual valve acts on the intermediate shift valve. The 2-3 shift valve descends, causing a downshift into second gear and preventing an upshift to third gear. Also, line pressure passages through the second modulator valve and 1-2 shift valve and acts on the second coast brake to effect engine braking.

2-3 Shift Valve

Controls line pressure to the direct clutch (C2). This line pressure comes through the 1-2 shift valve in the second gear position.



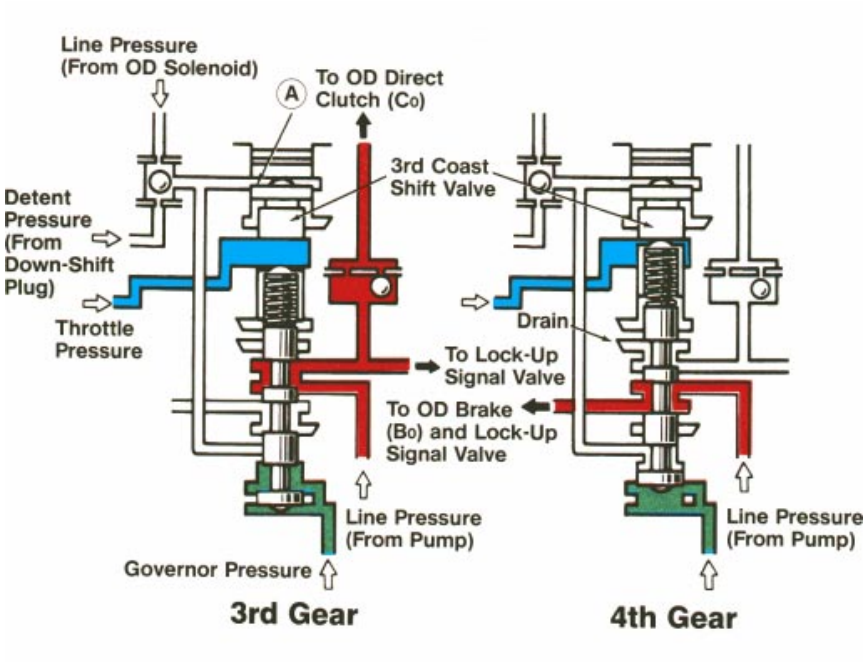
3-4 Shift Valve

This valve controls shifting between third and fourth gears based on governor and throttle pressures. The valve is held in position by a calibrated spring located at the top of the 3-4 coast shift valve which transfers the tension and holds the 3-4 shift valve down. Line pressure controlled by the 3-4 shift valve comes from the oil pump directly. Whenever the pump is turning, pressure is present through the 3-4 shift valve to either the overdrive direct clutch or the overdrive brake. When the overdrive direct clutch is applied, the overdrive unit is in direct drive. When the overdrive brake is applied, the overdrive unit is in overdrive.

When governor pressure is low but throttle pressure is high, this valve is pushed down by throttle pressure and spring tension. When vehicle speed increases, governor pressure rises. At some point, it overcomes throttle pressure and moves the valve upward, diverting line pressure from the overdrive direct clutch (CO) to the overdrive brake (BO) and resulting in an upshift to overdrive.

3-4 Shift Valve

Controls line pressure to the OD brake (B0) and OD direct clutch (C0).



NOTE!

The operation of overdrive can be overridden to prevent a shift into fourth gear or force a downshift into third gear by closing the OD main switch. Line pressure is directed to the top of the third coast shift valve from moving upward.

Downshift Plug

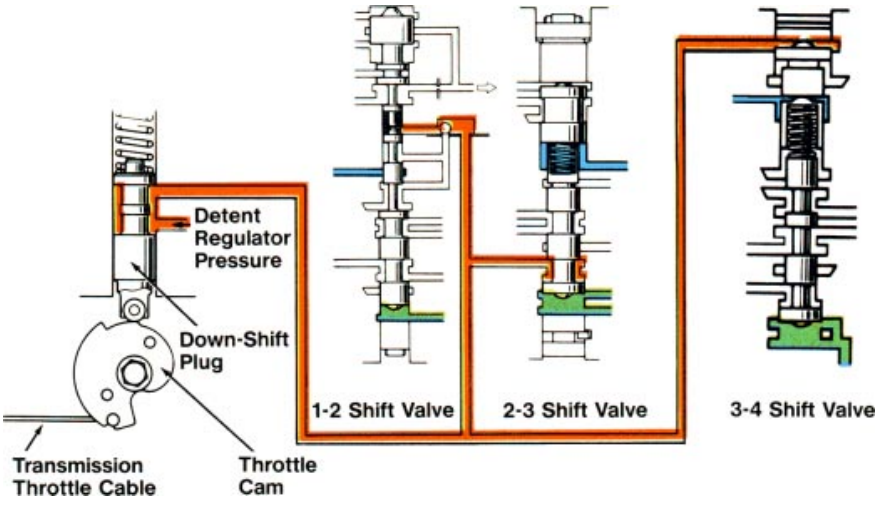
The downshift plug is located below the throttle valve. It is actuated by the throttle cam in response to engine throttle movement when the driver presses down on the accelerator, opening it more than 85%. It is used in a governor-controlled transmission to enhance downshifting rather than relying on throttle pressure alone to overcome governor pressure and move the shift valve down. The net result is that a downshift occurs at a higher vehicle speed than if relied on throttle pressure alone.

When the throttle is opened 85% or more, the downshift valve moves upward and detent regulator pressure is directed to each shift valve to counter governor pressure. Detent pressure provides added force in addition to throttle pressure and spring tension to move the valve downward against governor pressure. Depending on the vehicle speed, governor pressure may be great enough to allow the 1-2 shift valve and 2-3 shift valve to remain up, whereas the 3-4 shift valve may immediately move downward to cause a 4 to 3 downshift.

Electronic control transmissions will use the throttle sensor input to the ECT ECU to control kickdown through the No. 1 and No. 2 solenoids.

Downshift Plug

Enhance downshifting rather than relying on throttle pressure alone to overcome governor pressure in a forced downshift.



Timing Valves

These valves are responsible to finesse the quality of transmission shift characteristics. In some cases the apply clutch is a dual piston application and one is applied before the other. In other cases the pressure which applies a holding device or forces a shift valve to downshift is reduced to enhance the application.

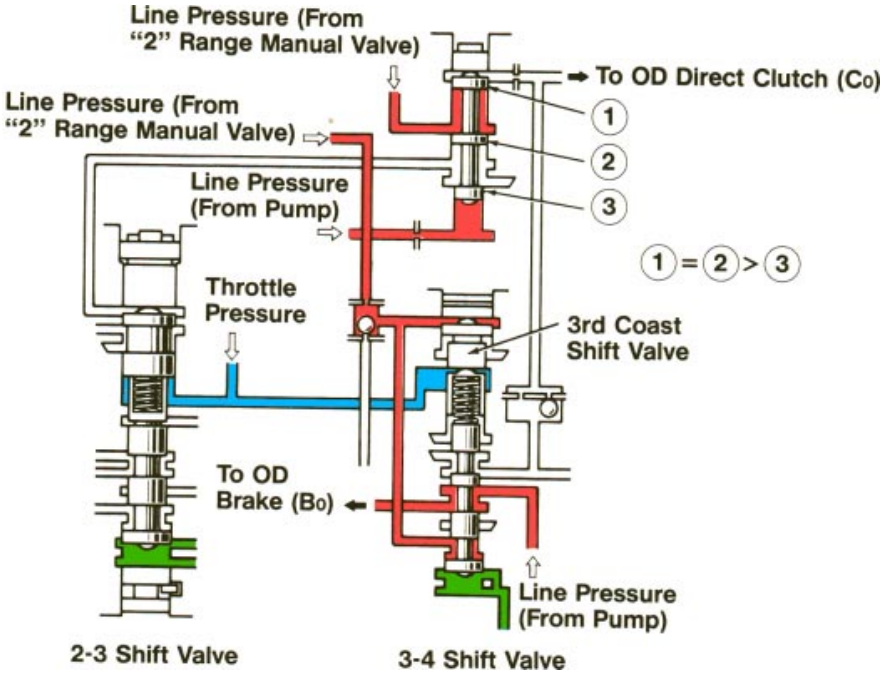
D-2 Downshift Timing Valve

This valve serves to prevent a direct downshift from overdrive to second gear in the A40 Series transmissions. If the shift selector lever is put into 2-range while the vehicle is running in overdrive, the transmission automatically shifts into third gear for a moment before shifting into second. This is to avoid shift shock that would occur if the transmission went directly from overdrive into second gear. After the line pressure acting on the intermediate shift valve is switched from the overdrive brake (BO) to overdrive direct clutch (CO), it acts on the 2-3 shift valve, causing it to shift from third gear to second gear.

When the selector is shifted from D-range to the 2-range, line pressure from the manual valve is applied to the area between the upper and middle land of the timing valve and to the top of the third coast shift valve. This causes the 3-4 shift valve to move down, and the direct clutch (C2) is applied to give us third gear. The same pressure applying the direct clutch also acts on the top of the timing valve which directs pressure to the top of the intermediate shift valve, resulting in a downshift to second gear.

D-2 Downshift Timing Valve

Requires a downshift to 3rd gear before going into manual second in a manual downshift.

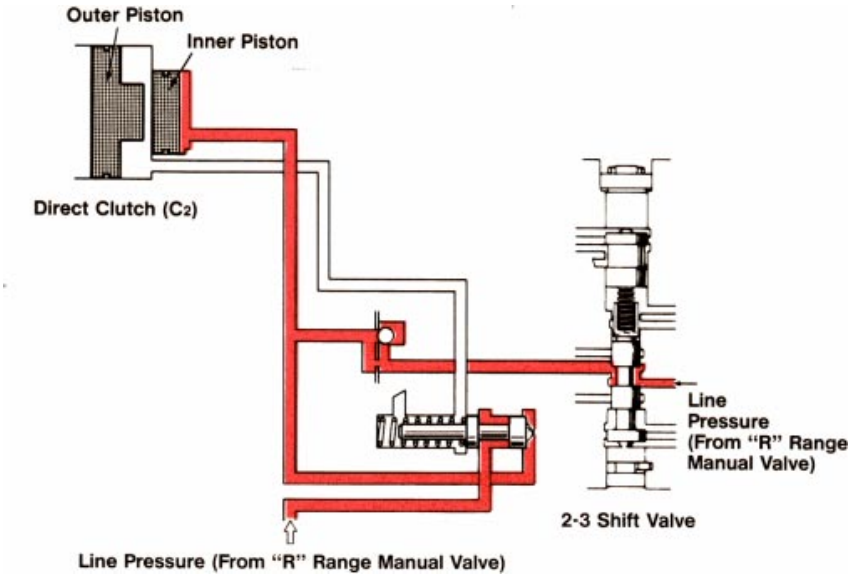


Reverse Clutch Sequencing Valve

This valve controls the timing of the application of the double piston direct and reverse clutch (C2) found in the A40 Series transmissions. It acts to reduce shift shock when the transmission is shifted into reverse. When the selector is shifted into the R-range, the passage to the outer piston of the direct and reverse clutch (C2) is blocked by the sequencing valve. As pressure builds and the inner piston begins to apply, the valve moves to the left. Line pressure from the manual valve is applied between the two lands. When the spring is compressed, line pressure is applied to the outer piston for full engagement of the direct and reverse clutch. This causes the outer piston to begin operating after the inner piston operates, which softens engagement.

Reverse Clutch Sequencing Valve

Reduces shift shock when the transmission is shifted into reverse.

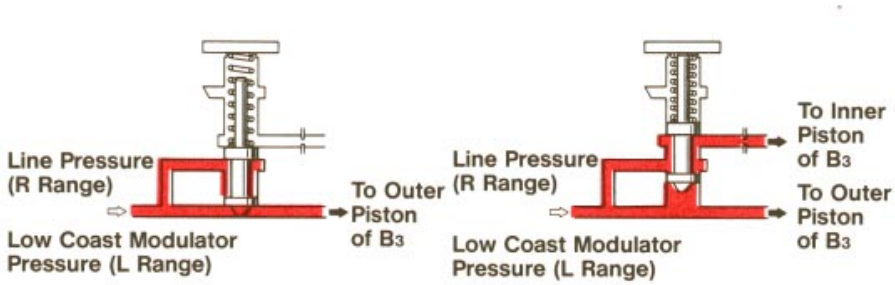


Reverse Brake Sequencing Valve

Similar to the reverse clutch sequencing valve discussed above, this valve controls the timing of the application of the double piston first and reverse brake (B3) found in the A40 Series transmissions. It acts to reduce shift shock when the transmission is shifted into low or reverse gear. When the selector is shifted into the low 1 or R-range, the passage to the outer piston of the direct and reverse clutch (C2) is blocked by the sequencing valve. As pressure builds and the outer piston begins to apply, the valve moves to the left. Line pressure from the manual valve is applied between the two lands. When the spring is compressed, line pressure is applied to the inner piston for full engagement of the first and reverse brake. This causes the inner piston to begin operating after the outer piston operates, which softens engagement. This operation is the opposite of the reverse clutch sequence valve, where the inner piston is applied before the outer piston.

Reverse Brake Sequencing Valve

Acts to reduce shsift shock when the transmission is shifted into low or reverse gear.



Accumulators

The accumulators act to cushion shifting shock. These valves are basically pistons located in a bore with a heavy calibrated spring to counter hydraulic pressure. They are located in the hydraulic circuit between The shift valve and the holding device. When the shift valve moves, fluid is directed to the circuit of the holding device. As the piston begins to compress the clutch return springs, pressure in the circuit begins to build. As pressure builds, it acts to load the spring in the accumulator. Pressure in the circuit cannot reach its potential until the spring is compressed and the piston is seated. The pressure builds more slowly, and the clutch engagement is softened.

Clutch application can be tailored even more closely by providing hydraulic pressure to the spring side of the accumulator. Line pressure applying the holding device has to overcome spring tension and additional fluid pressure, and therefore, higher pressure is exerted on the holding device before full pressure is applied. Hydraulic pressure to the accumulator is controlled by the accumulator control valve, which will be discussed next.

Application of accumulators are found on the following circuits:

Overdrive Direct Clutch (CO)
Forward Clutch (Cl)
Direct & Reverse Clutch (C2)
Underdrive Direct Clutch (C3)
Overdrive Brake (BO)
Second Brake (B2)

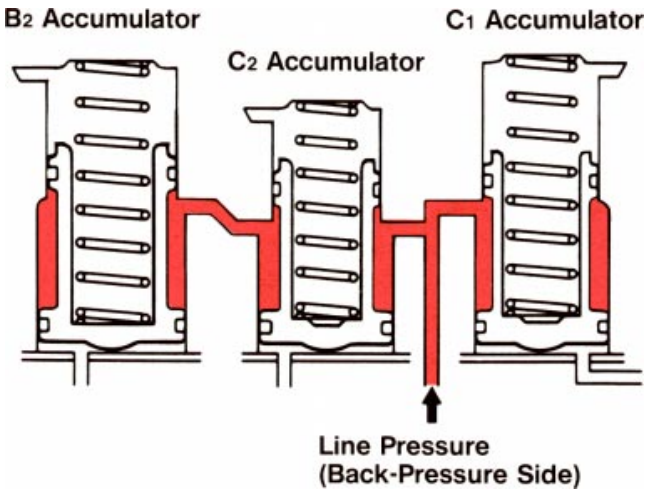
REFERENCE

AT TYPE	ACCUMULATOR	BACK PRESSURE (From Accumulator Control Valve)
A40 Series	C_1, C_2, B_2*	C_1, C_2, B_2*
A240 Series	C_1, C_2, C_3, B_2, B_4	C_2, C_3, B_3
A440 Series	C_1, C_2, B_0, B_2	C_1, C_2, B_2
A540 Series (ECT)	C_0, C_1, C_2, B_2	C_2, B_2
A340E, H (ECT)	C_0, B_0, C2, B_2	C_2, B_0, B_2
A341 E (ECT)	C_0, C_2, B_0, B_2	C_0, C_2, B_0, B_2

*** Except A40D automatic transmission**

Accumulators

Reduce shift shock



Pressure Modulating Valves

Pressure modulating valves change controlling pressures to tailor operational characteristics of the automatic transmission. Line pressure, throttle pressure and governor pressure all have an effect on how the automatic transmission operates.

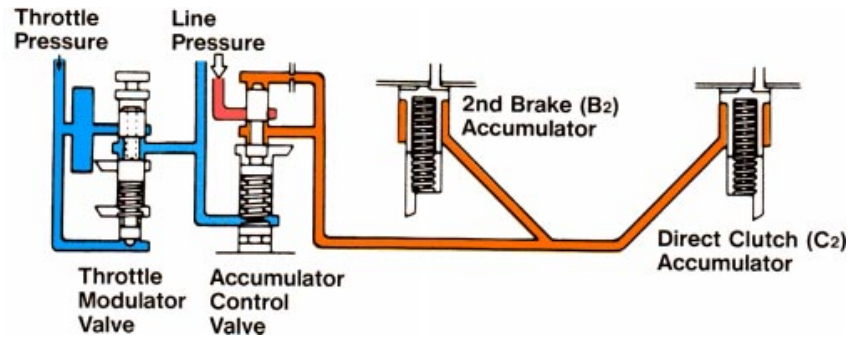
Accumulator Control valve

This valve modifies line pressure from the pump to the accumulators based on engine load. It reduces shift shock by lowering the back pressure of the direct clutch (C2) accumulator and second brake (B2) accumulator when the throttle opening is small. Since the torque produced by the engine is low when the throttle opening is small, accumulator back pressure is reduced. This prevents shift shock when the brakes and clutches are applied.

Conversely, engine torque is high when the throttle angle is large, during moderate to heavy acceleration. Not only is line pressure increased, but throttle pressure acting at the base of the accumulator control valve increases back pressure to the accumulators. Accumulator pressure is increased to prevent slippage when the clutches and brakes are applied.

Accumulator Control Valve

Modifies line pressure to the accumulators based on engine load.



Reference:

- On all transmissions, hydraulically controlled or ECT with the exception of the A40 Series, throttle pressure acts directly on the bottom of the accumulator control valve to increase accumulator control pressure.

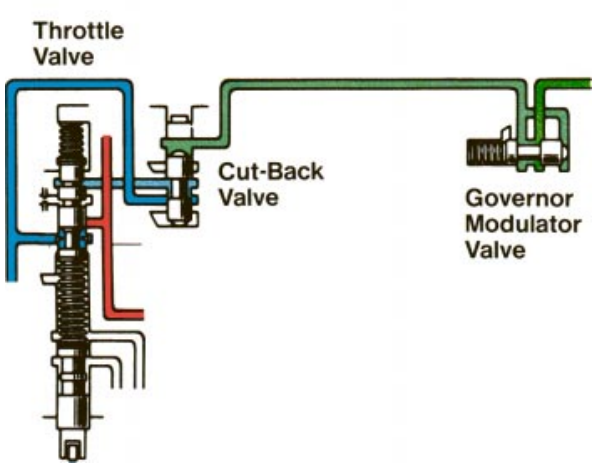
- There is no accumulator control valve in the A40 Series automatic transmissions; line pressure acts directly on the rear of each accumulator.

Governor Modulator Valve

This valve is located between the governor valve and the cut-back valve. It modifies the governor pressure generated by the governor valve. The governor modulator valve is pushed to the right by a spring, while governor modulator pressure acts on the right side of the valve, pushing it toward the left. The governor modulator valve maintains a pressure constant between governor pressure and spring tension.

Governor Modulator Valve and Cut-Back Valve

Governor modulator valve provides the aspect of vehicle speed to the cut-back valve which acts to reduce throttle pressure.



Cut-Back Valve

This valve modifies throttle pressure. It regulates the cut-back pressure acting on the throttle valve and is actuated by governor pressure and throttle pressure. Applying cut-back pressure to the throttle valve in this manner lowers the throttle pressure and ultimately lowers line pressure to prevent unnecessary power loss due to the transmission oil pump at higher speeds.

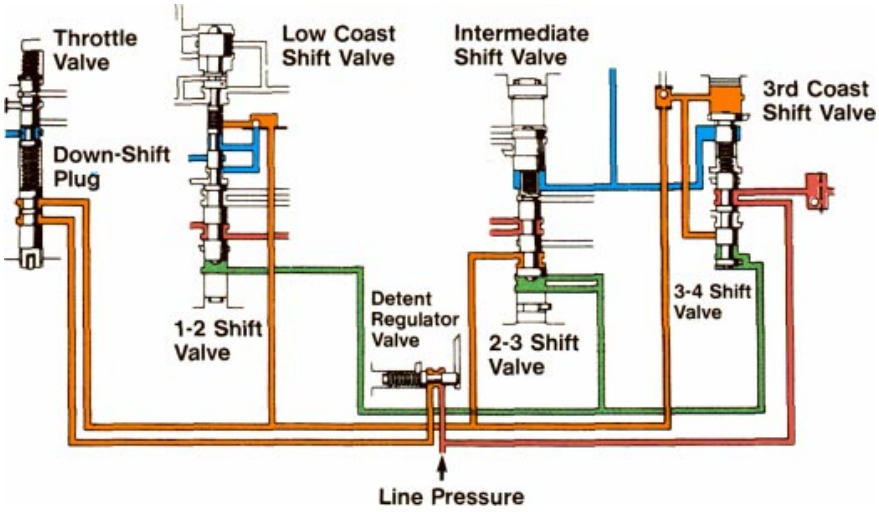
Governor pressure acts on the upper portion of this valve. As the valve is pushed downward, a passage from the throttle valve is opened and throttle pressure is applied. The cut-back valve is pushed upward as a result of the difference in the diameters of the valve pistons. The balance between the downward force due to governor pressure and the throttle pressure becomes the cut-back pressure.

Detent Regulator Valve

This valve modifies line pressure during kick-down to stabilize the hydraulic pressure acting on the 1-2, 2-3 and 3-4 shift valves. It is located between the oil pump and the downshift plug. A calibrated spring pushes the valve to the right. Line pressure acts on the left land of the valve to move it to the left, which lowers line pressure to the top of the shift valves.

Detent Regulator Valve

Modifies line pressure controlled by the downshift plug during forced downshifts.

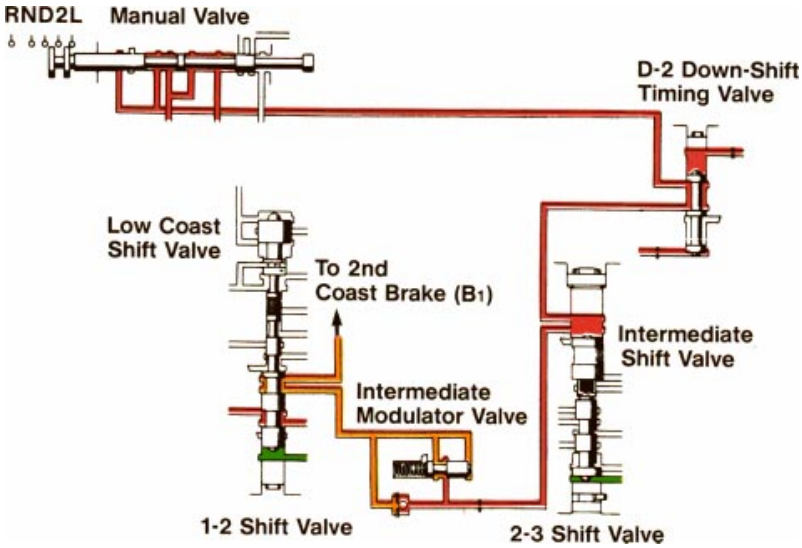


Intermediate Modulator Valve

In 2-range, this valve reduces line pressure from the intermediate shift valve (second modulator pressure). The second modulator pressure acts on the second coast brake (B1) through the 1-2 shift valve to reduce shifting shock.

Intermediate Modulator Valve

Reduces line pressure to the second coast brake (B1) to reduce shift shock during manual downshift.

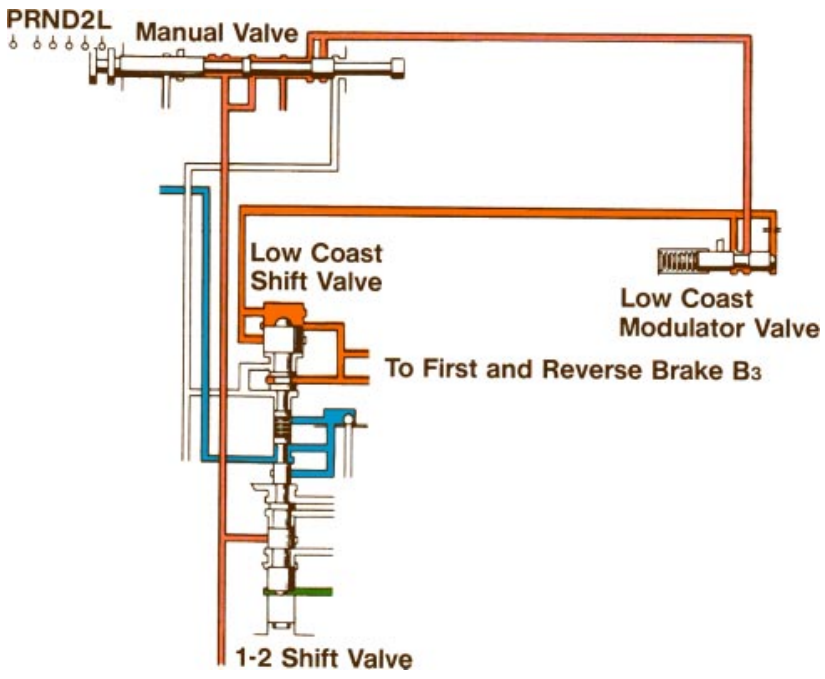


Low Coast Modulator Valve

The low modulator valve reduces the line pressure from the manual valve to reduce shock when the transmission is shifted into the L range. The low modulator pressure pushes the low coast shift valve down and also acts on the first and reverse brake (B3) to buffer the shock. It also causes low modulator pressure to act on the primary regulator valve to raise line pressure, thus increasing pressure and preventing the clutches and brakes from slipping.

Low Coast Modulator Valve

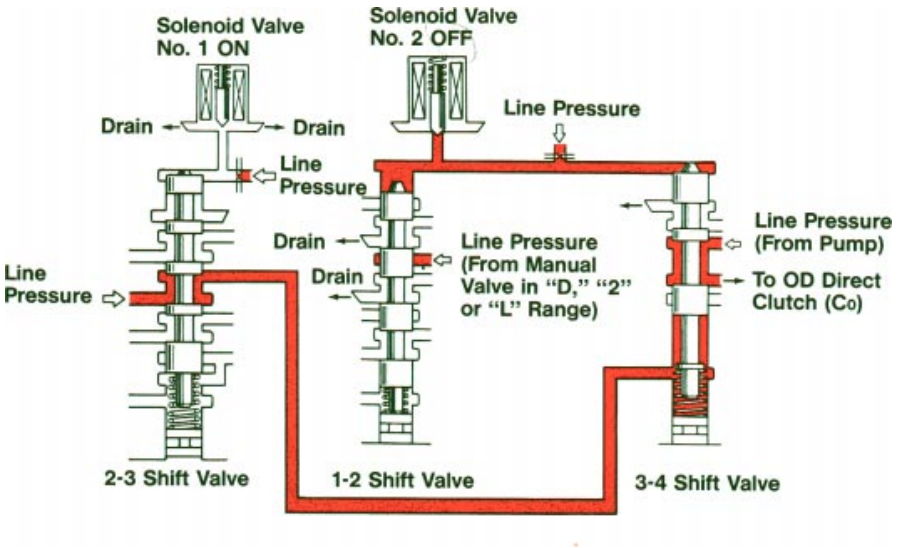
Reduces line pressure from the manual valve in the "L" position to reduce shock when shifting into manual low.



ECT Shift Valve Operation

Two electrically operated solenoids control the shifting of all forward gears in the Toyota electronic control four speed automatic transmission. These solenoids are controlled by an ECU which uses throttle position and speed sensor input to determine when the solenoids are turned on. The solenoids normal position is closed, but when it is turned on, it opens to drain fluid from the hydraulic circuit. Solenoid No. 1 controls the 2-3 shift valve. It is located between the manual valve and the top of the 2-3 shift valve. Solenoid No. 2 controls the 1-2 shift valve and the 3-4 shift valve.

Shift Solenoid Operation ECT - First Gear



First Gear

During first gear operation, solenoid No. 1 is on and solenoid No. 2 is off. With line pressure drained from the top of the 2-3 shift valve by solenoid No. 1, spring tension at the base of the valve pushes it upward. With the shift valve up, line pressure flows from the manual valve through the 2-3 shift valve and on to the base of the 3-4 shift valve.

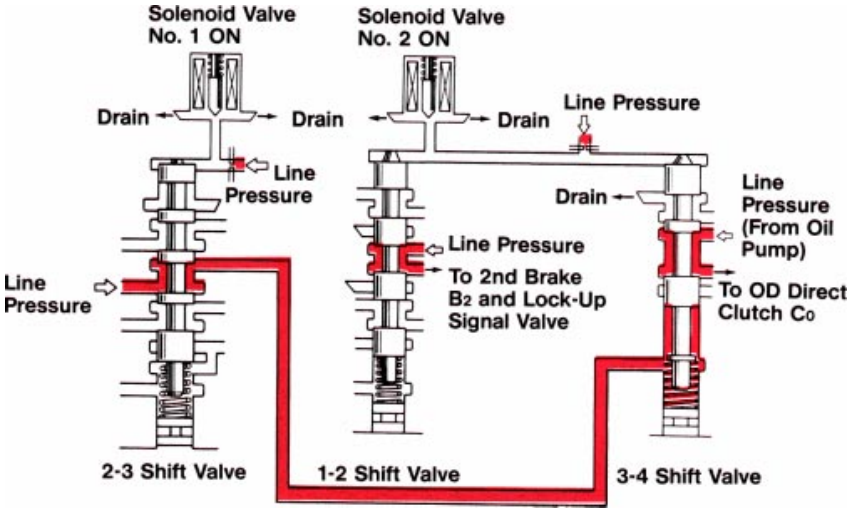
With solenoid No. 2 off, line pressure pushes the 1-2 shift valve down. In this position, the 1-2 shift valve blocks line pressure from the manual valve. Line pressure and spring tension at the base of the 3-4 shift valve push it upward.

Second Gear

During second gear operation, solenoid No. 1 and No. 2 are on. Solenoid No. 1 has the same effect that it had in first gear with the 2-3 shift valve being held up by the spring at its base. Pressure from the manual valve flows through the 2-3 shift valve and holds the 3-4 shift valve up.

With solenoid No. 2 on, line pressure from the top of the 1-2 shift valve bleeds through the solenoid. Spring tension at the base of the 1-2 shift valve pushes it upward. Line pressure which was blocked, now is directed to the second brake (B2), causing second gear. The 3-4 shift valve maintains its position with line pressure from the 2-3 shift valve holding it up.

Second Gear

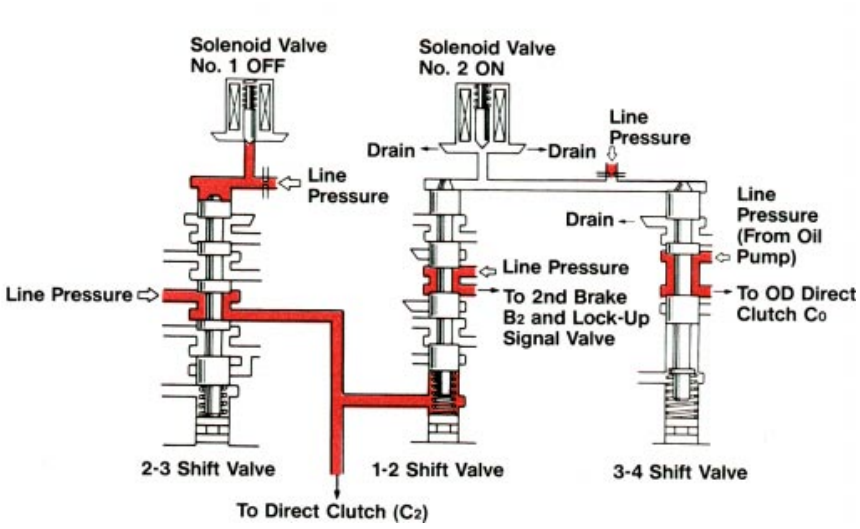


Third Gear

During third gear operation, solenoid No. 1 is off and Solenoid No. 2 is on. When solenoid No. 1 is off, it closes its drain and line pressure from the manual valve pushes the 2-3 shift valve down. Line pressure from the manual valve is directed to the direct clutch (C2) and to the base of the 1-2 shift valve.

With solenoid No. 2 on, it has the same effect that it had in second gear; pressure is bled at the top of the 1-2 shift valve and spring tension pushes it up. Line pressure is directed to the second brake (B2). However in third gear, the second brake (B2) has no effect since it holds the one-way clutch No. 1 (F1) and freewheels in the clockwise direction. The second coast brake is ready in the event of a downshift when the OD direct clutch (C2) is released.

Third Gear

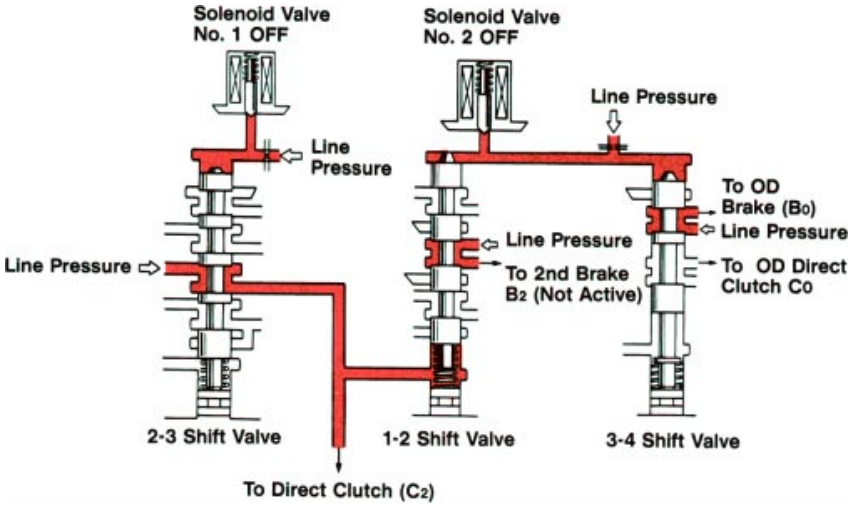


Fourth Gear

During fourth gear operation, both solenoids are off. When solenoid No. 1 is off, its operation is the same as in second and third gears.

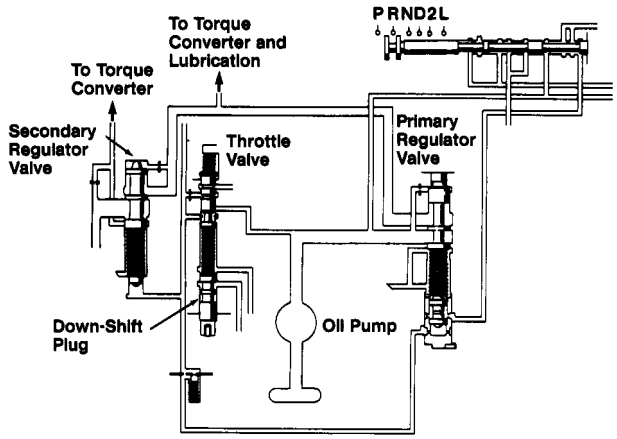
A third solenoid controls lock-up operation.

Fourth Gear



WORKSHEET 4
Pressure Control Valves

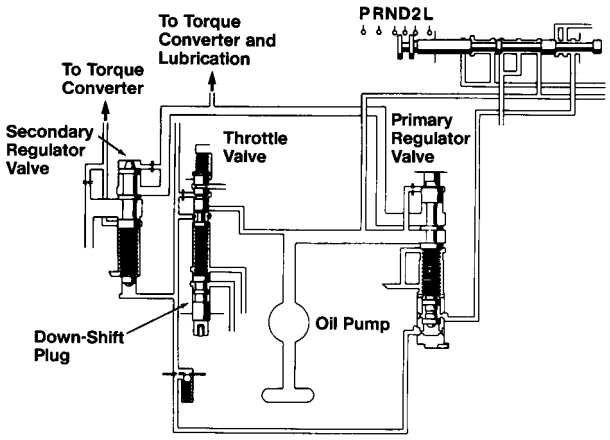
Primary Regulator Valve in R Range



1. Primary Regulator Valve

- Modifies pressure directly from the oil pump based on _____.
- Throttle pressure is at the bottom of the valve. As it increases, the valve is _____, increasing the _____.
- In Reverse range, line pressure increases because the _____ valve applies pressure to the bottom side of the _____ valve.

Pressure Regulator Valves

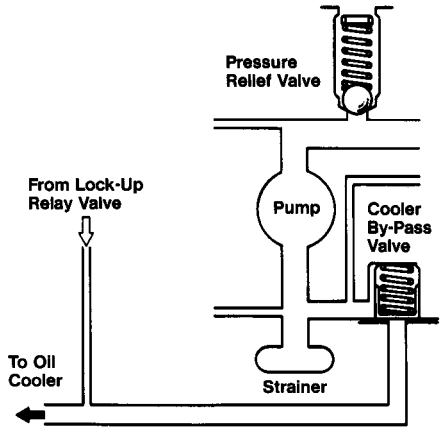


2. Secondary Regulator Valve

- Regulates _____ pressure and _____ pressure based on _____.
- Throttle pressure and spring tension push the valve _____ to increase pressure.
- Converter pressure at the top of the valve opens the valve, to reduce _____.

WORKSHEET 4
Pressure Control Valves (Continued)

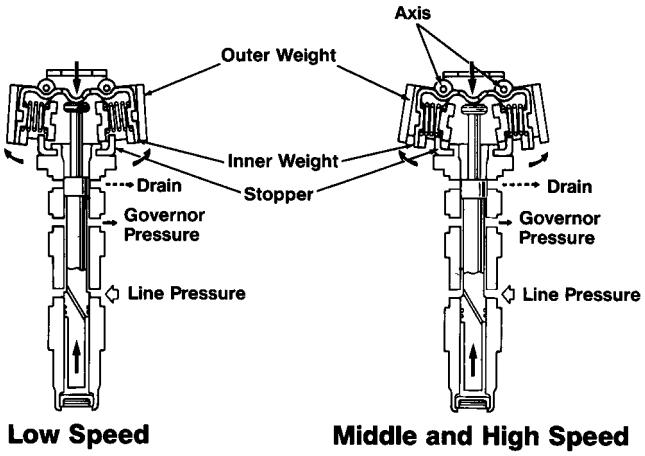
Oil Cooler By-Pass Valve/Pressure Relief Valve



3. Oil Cooler By-Pass and Pressure Relief Valves

- The cooler by-pass valve regulates pressure applied to the transmission cooler to prevent _____ converter pressure.
- The pressure relief valve _____ oil pump pressure. This is done with a calibrated _____ valve.

Governor Valve

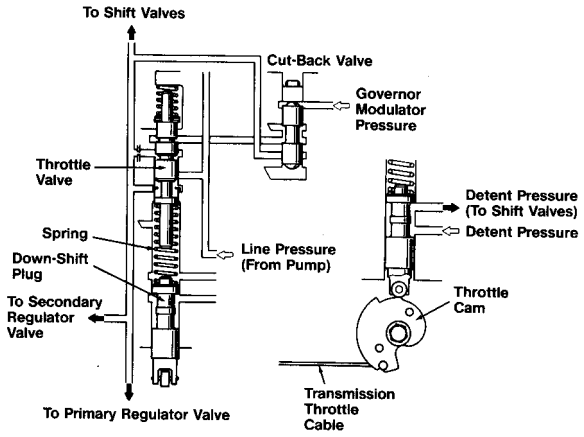


4. Governor Valve

- Located on the transmission _____ shaft, it produces pressure based on _____. Increase in vehicle speed = _____ governor pressure.
- Decrease in vehicle speed = _____ governor pressure.
- The primary function of governor pressure is to create transmission _____.

WORKSHEET 4
Pressure Control Valves (Continued)

Throttle Valve



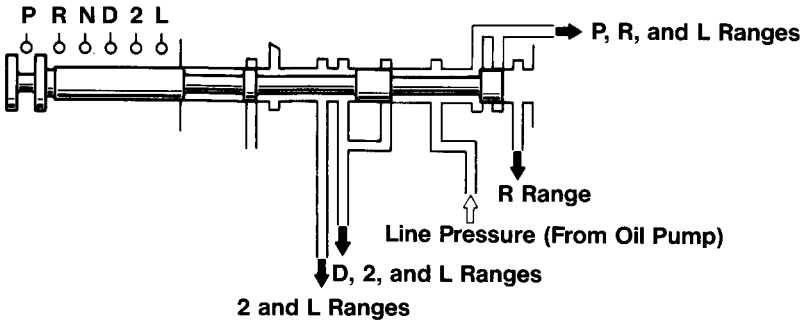
5. Throttle Pressure

- Modulates line pressure by the movement of the transmission _____ which moves the throttle _____. It pushes the _____ valve up, via the _____.
- As the throttle valve opens, it increases _____ pressure.
- In a hydraulic transmission, throttle pressure is used to increase _____ and affect _____.
- In an electronic control transmission, throttle pressure is used only to modify _____.

Notes

WORKSHEET 5
Shift Valves

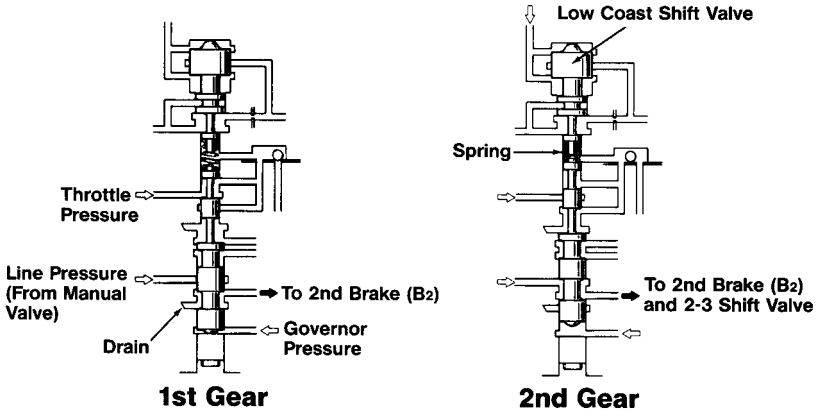
Manual Valve



1. Manual Valve

- This valve is connected to the _____. It directs fluid to _____ based on the shift lever position.

1-2 Shift Valve



2. 1-2 Shift Valve

a. First Gear Position

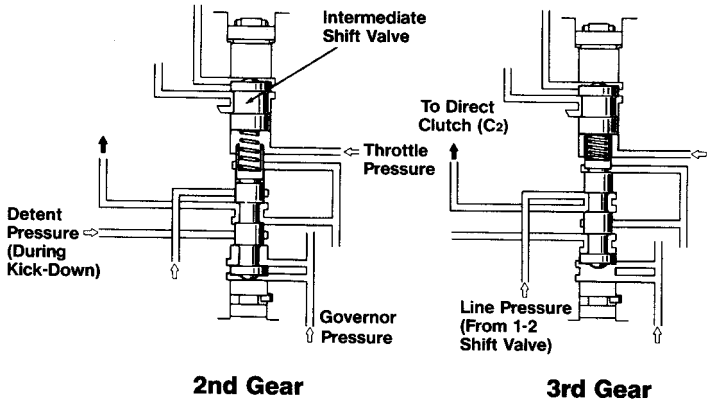
- Controls shifting between first and second gears based on _____ pressure and _____ pressure.
- Line pressure from the manual valve is _____ at the shift valve.
- The hydraulic circuit to the _____ is open to a drain.

WORKSHEET 5
Shift Valves (Continued)

b. Second Gear Position

- The shift valve moves up when _____ pressure overcomes _____ pressure.
- Line pressure from the manual valve is applied to the passage of the ____.

2-3 Shift Valve



3. 2-3 Shift Valve

a. Second Gear Position

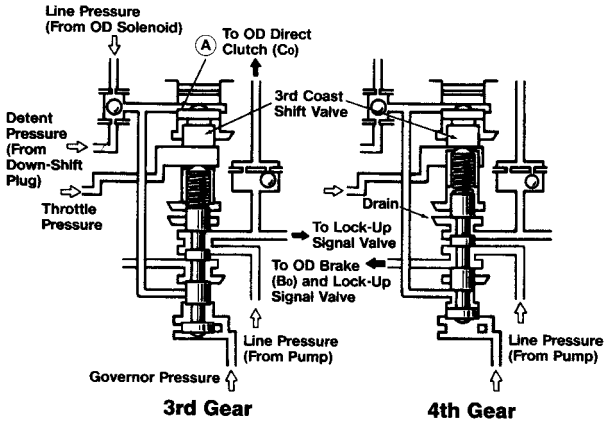
- Line pressure from the _____ is blocked, so no pressure is available to the _____.

b. Third Gear Position

- The shift valve moves up when governor pressure overcomes _____ pressure and the valve moves _____.
- Line pressure from the 1 -2 shift valve is now applied to the _____.

WORKSHEET 5
Shift Valves (Continued)

3-4 Shift Valve



4. 3-4 Shift Valve

a. Third Gear Position

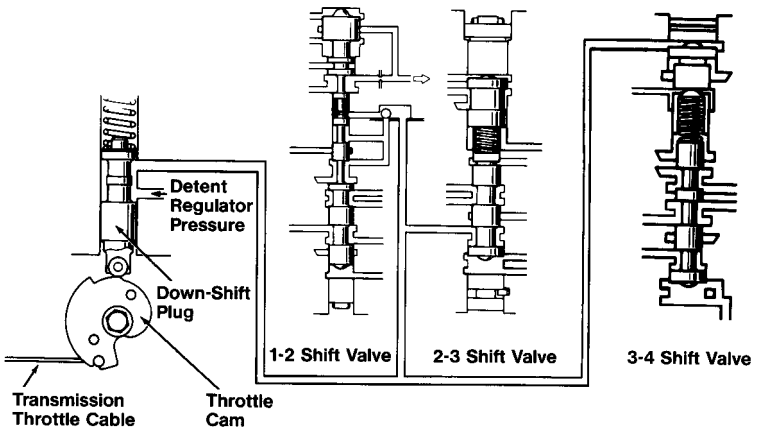
- Line pressure from the pump is applied to __ while line pressure to the ___ is blocked.

b. Fourth Gear Position

- The shift valve moves up when _____ pressure overcomes _____ pressure.
- The OD direct clutch (CO) is exposed to a _____ through the 3-4 shift valve.
- Line pressure from the _____ is applied to the passage of the _____.

WORKSHEET 5
Shift Valves (Continued)

Downshift Plug

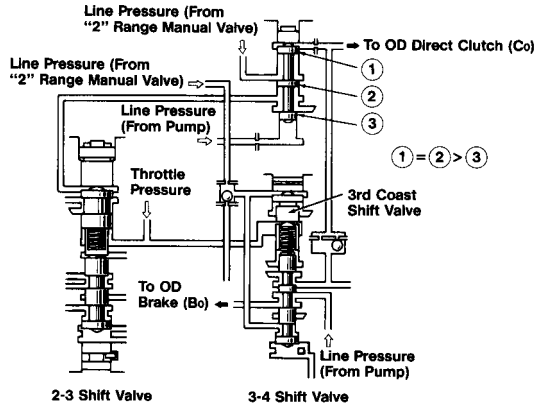


5. Downshift Plug

- Operated by the action of the _____.
- Controls _____ pressure.
- The downshift plug opens when the throttle is open to or greater.
- Detent regulator pressure is applied to the _____, _____, and _____ shift valves, countering _____, creating a downshift.
- Detent regulator pressure, in addition to _____, is applied to the upper land of the shift valve to provide an earlier downshift.

WORKSHEET 6
Timing Valves

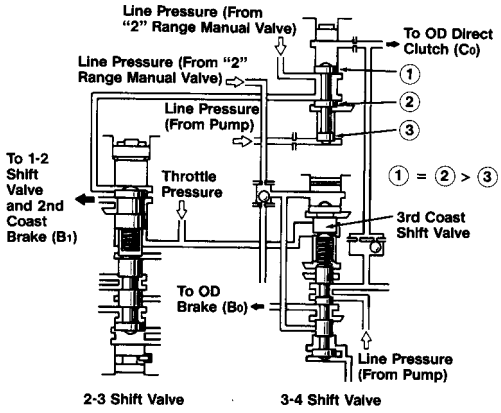
D-2 Downshift Timing Valve



1. D-2 Downshift Timing Valve

- Controls downshift when manually selecting _____ from overdrive.
- Line pressure from the _____ applied to the area between the _____ and _____ land of the timing valve.

D-2 Downshift Timing Valve - 4-3 Downshift

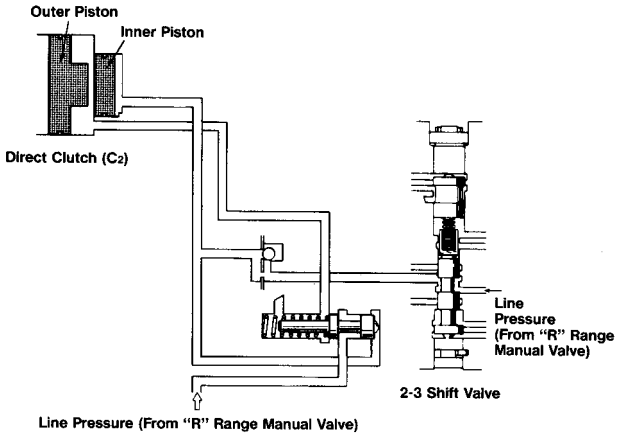


2. D-2 Downshift Timing Valve 4-3 Downshift

- Line pressure from the _____ is also applied to the top of the _____ valve. This creates a _____ to _____ gear.
- Line pressure from the oil pump moves through the _____ valve to the top of the _____ valve which moves the valve _____. This allows line pressure to push _____ on the _____ valve, producing a _____ to second gear.

WORKSHEET 6
Timing Valves (Continued)

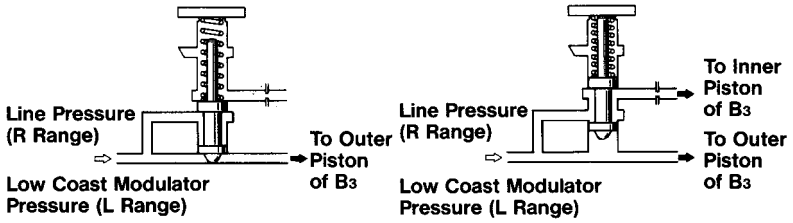
Reverse Clutch Sequencing Valve



3. Reverse Clutch Sequencing Valve

- Designed to _____ shift shock when shifting to _____ gear.
- Valve blocks line pressure to the _____ piston of the _____.
- As pressure to the _____ piston increases, it pushes the sequencing valve to the right against _____ tension, _____ the passage to the _____ piston.

Reverse Brake Sequencing Valve

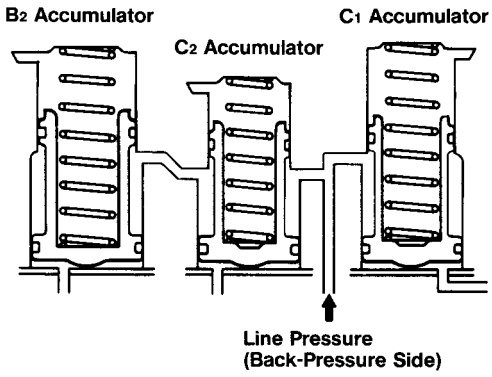


4. Reverse Brake Sequencing Valve

- Designed to reduce shift shock when shifting into _____ or _____ gear range.
- The valve is positioned to be a _____ which blocks pressure to the _____ piston of the _____.
- As pressure builds in the outer piston circuit, the valve _____ the passage to the _____ piston.

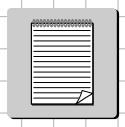
WORKSHEET 6
Timing Valves (Continued)

Accumulators



5. Accumulators

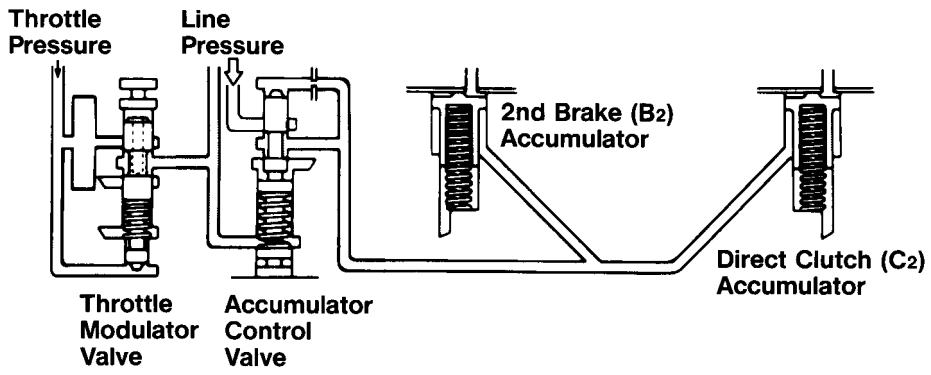
- Located in the hydraulic circuit between the _____ and the _____.
- Designed to reduce _____.
- Apply pressure must overcome _____ and _____ pressure to fully apply the brake or clutch.



Notes

WORKSHEET 7
Pressure Modulating Valves

Accumulator Control Valve

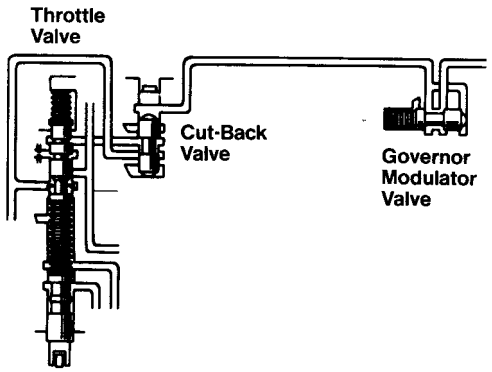


1. Accumulator Control Valve

- Adjusts line pressure in accordance to _____.
- Modulated pressure is applied to the back side (small area) of the _____ valves to counter the _____ pressure applying the clutch or brake at the top of the valve.
- _____ tension and _____ pressure push the accumulator valve upward.
- Increased engine load results in _____ accumulator control pressure to ensure a _____ application to reduce slippage at the clutch or brake.

WORKSHEET 7
Pressure Modulating Valves (Continued)

Governor Modulator Valve—Cut-Back Valve

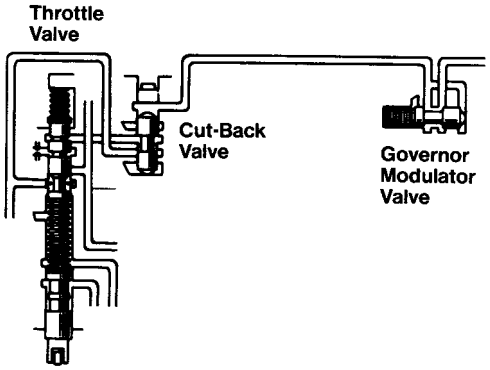


2. Governor Modulator Valve

- Regulates governor pressure to the _____ valve.
- Creates a pressure called _____ pressure.
- Spring tension acts to _____ the valve. As governor pressure increases, modulated pressure is applied to the _____ of the valve, causing it to _____.
- As governor pressure increases with vehicle speed, governor modulator pressure will _____.

WORKSHEET 7
Pressure Modulating Valves (Continued)

Governor Modulator Valve—Cut-Back Valve

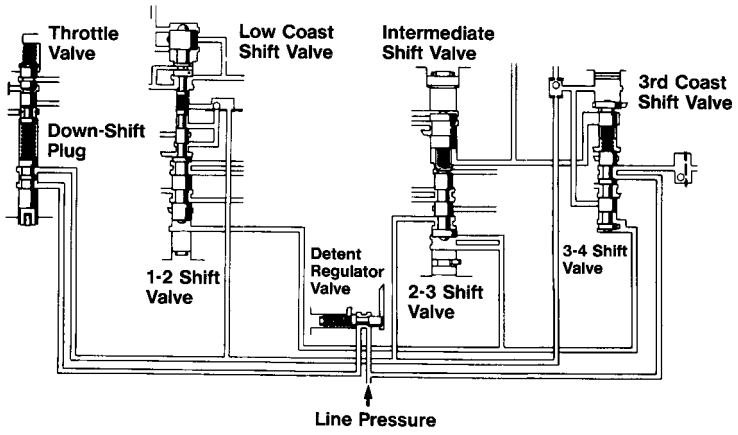


3. Cut-Back Valve

- Governor modulator pressure pushes on the top of the _____ valve and opens a passage from the _____.
- Throttle pressure acts to _____ the cut-back valve against governor modulator pressure resulting in _____ pressure.
- Cut-back pressure acts on the top land of the throttle valve and pushes it downward, _____ throttle pressure.
- With lower throttle pressure, line pressure is also _____.

WORKSHEET 7
Pressure Modulating Valves (Continued)

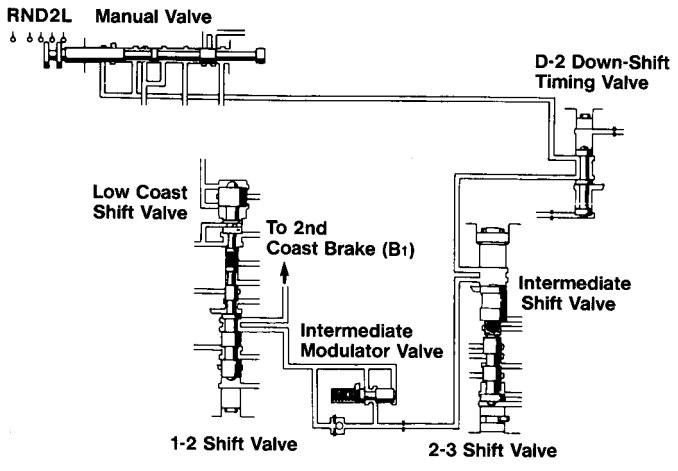
Detent Regulator Valve



4. Detent Regulator Valve

- This valve modifies _____ pressure to stabilize the pressure acting on the _____ used for forced _____.
- Spring tension pushes the valve to the _____ position. Line pressure overcomes spring tension and begins to _____ the valve and limiting pressure.
- The available detent pressure is controlled by the _____.

Intermediate Modulator Valve

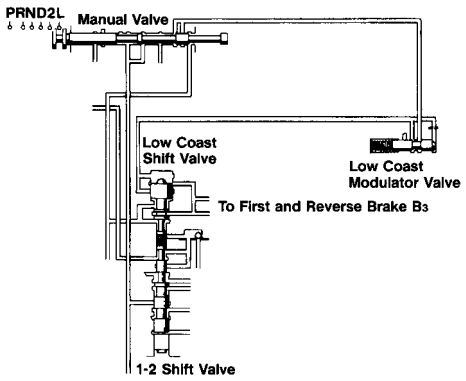


5. Intermediate Modulator Valve

- Pressure is applied to this valve in _____ range.
- Lowers line pressure, which is applied to the _____ .

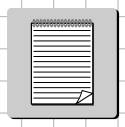
WORKSHEET 7
Pressure Modulating Valves (Continued)

Low Coast Modulator Valve



6. Low Coast Modulator Valve

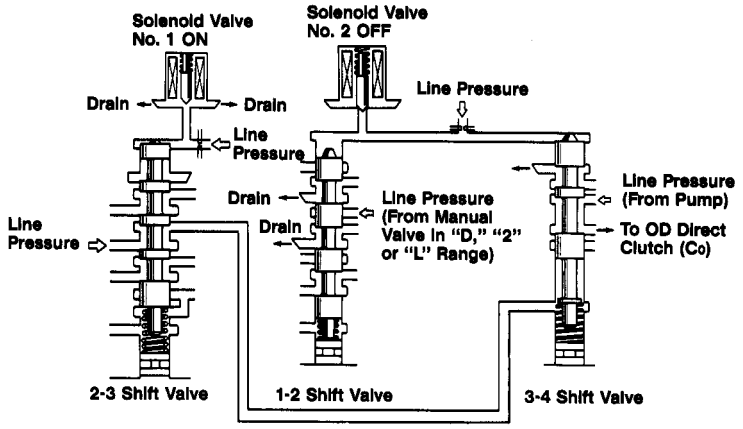
- Pressure is applied to this valve in _____ range.
- Lowers line pressure, which is applied to the _____.
- Low coast pressure is applied to the top of the _____ valve, above the 1-2 shift valve.



Notes

WORKSHEET 8
ECT Shift Valve Operation

Shift Solenoid Operation ECT—First Gear



1. First Gear

- Solenoid number one controls the _____ shift valve, while solenoid number two controls both the _____ and _____ shift valves.

Solenoid number one ON:

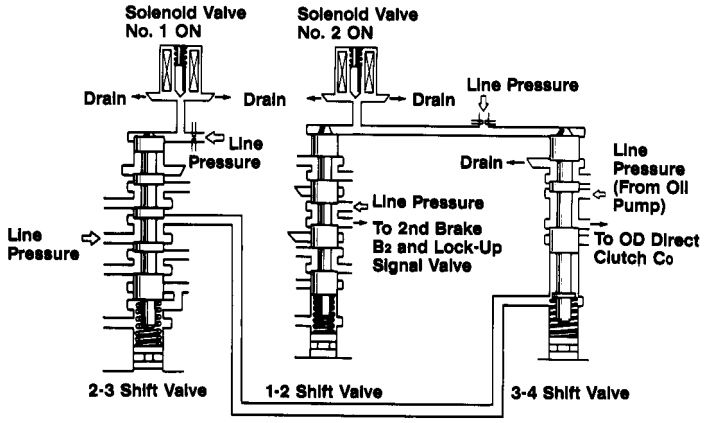
- Line pressure from the manual valve is _____ through the opening in the solenoid.
- _____ tension pushes the _____ shift valve _____.
- Line pressure flows through the _____ shift valve to the base of the _____ shift valve.

Solenoid number two OFF:

- Line pressure is applied to the top of the _____ and _____ shift valves.
- The 1 -2 shift valve is pushed _____, while the 3-4 shift valve is up because of _____ and line pressure from the _____ shift valve.

WORKSHEET 8
ECT Shift Valve Operation (Continued)

Shift Solenoid Operation—ECT Second Gear



2. Second Gear

Solenoid number one is ON:

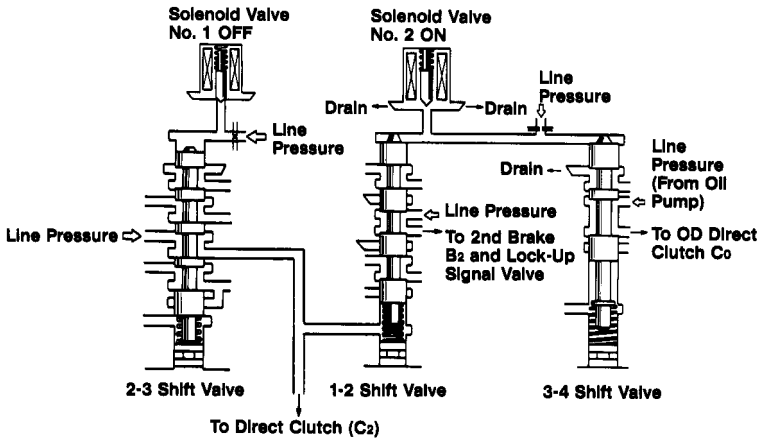
- The same condition as found in first gear.

Solenoid number two is ON:

- The solenoid opens a _____.
- _____ tension pushes _____ shift valve _____.
- Line pressure now flows through the valve applying the _____.

WORKSHEET 8
ECT Shift Valve Operation (Continued)

Shift Solenoid Operation—ECT Third Gear



3. Third Gear

Solenoid number one is OFF:

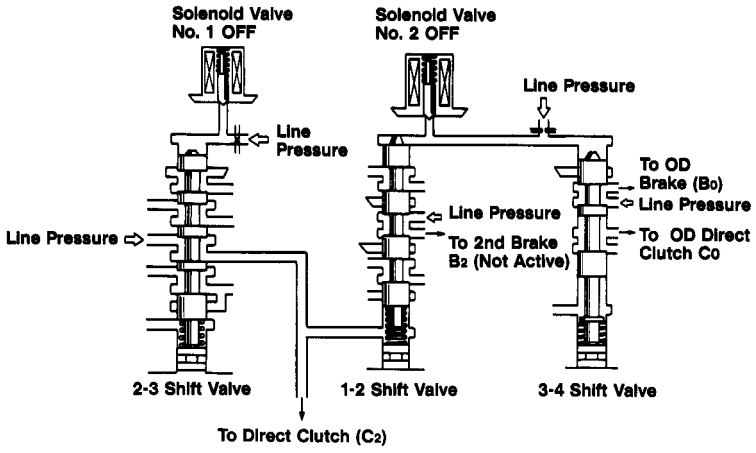
- The drain for the solenoid is now _____.
- Line pressure pushes the _____ shift valve _____.
- Line pressure flows through the valve to apply the _____ and apply pressure to the base of the _____ shift valve.

Solenoid number two is ON:

- Line pressure and _____ tension push up on the 1 -2 shift valve while spring tension alone holds up the _____ shift valve.

WORKSHEET 8
ECT Shift Valve Operation (Continued)

Shift Solenoid Operation—ECT OD Gear



4. OD Gear

Solenoid number one is OFF:

- The same condition as found in third gear.

Solenoid number two is OFF:

- The drain for solenoid number two is _____.
- Line pressure and spring tension at the base of the 1 -2 shift valve keep it pushed _____, while the line pressure will push the 3-4 shift valve _____. This cuts pressure to the _____ and directs pressure to the _____.