

Description

Lock-up System

Lock-up Clutch

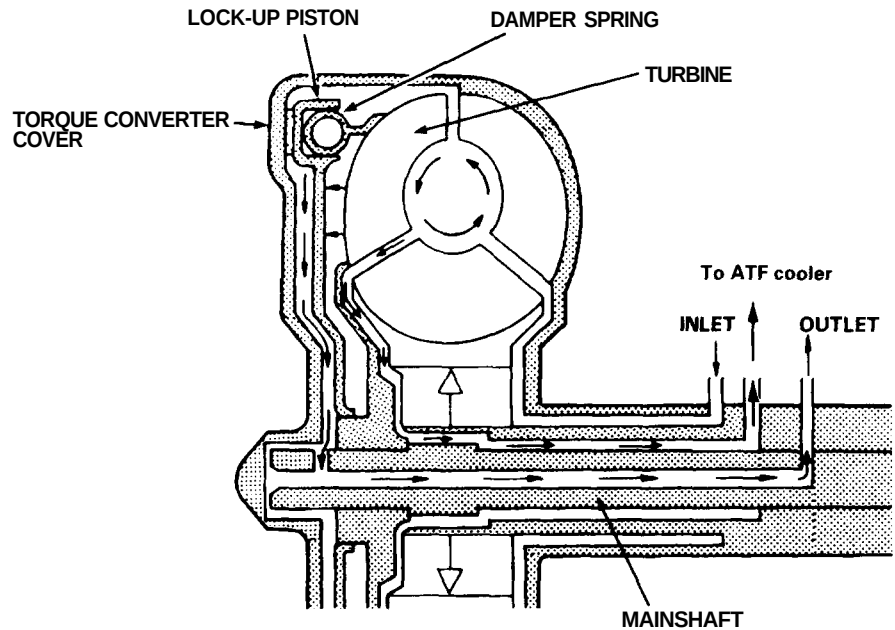
1. Operation (clutch on)

With the lock-up clutch on, the fluid in the chamber between the torque converter cover and the lock-up piston is drained off, and the converter fluid exerts pressure through the piston against the torque converter cover. As a result, the converter turbine is locked to the converter cover. The effect is to bypass the converter, thereby placing the vehicle in direct drive.

Power flow

The power flows by way of:

Engine
↓
Drive plate
↓
Torque converter cover
↓
Lock-up piston
↓
Damper spring
↓
Turbine
↓
Mainshaft

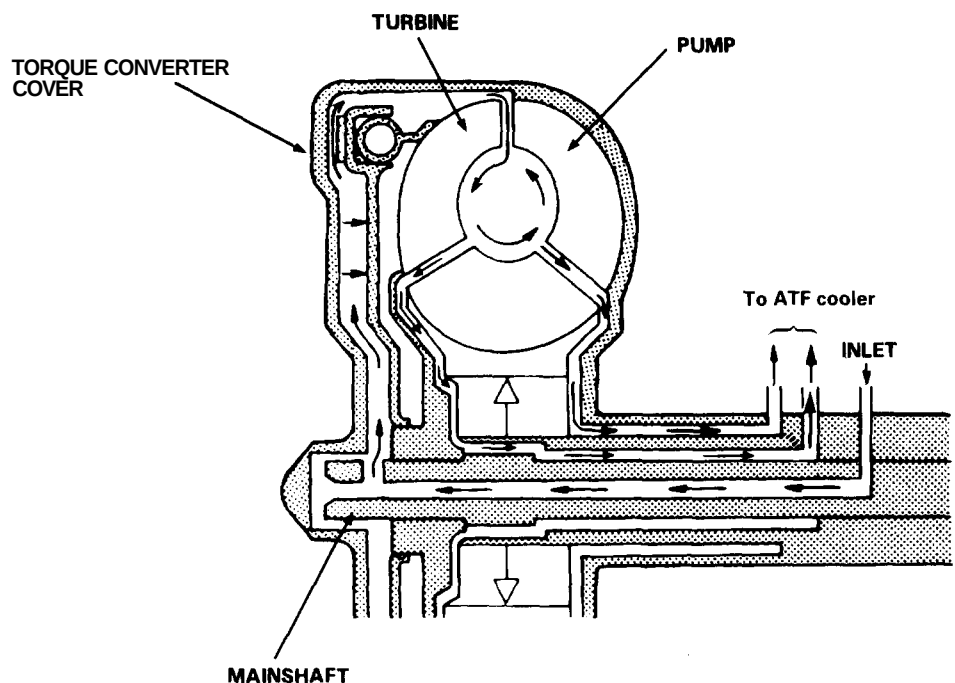


2. Operation (clutch off)

With the lock-up clutch off, the fluid flows in the reverse of CLUTCH ON. As a result, the lock-up piston moves away from the converter cover, and the torque converter lock-up is released.

Power flow

Engine
↓
Drive plate
↓
Torque converter cover
↓
Pump
↓
Turbine
↓
Mainshaft

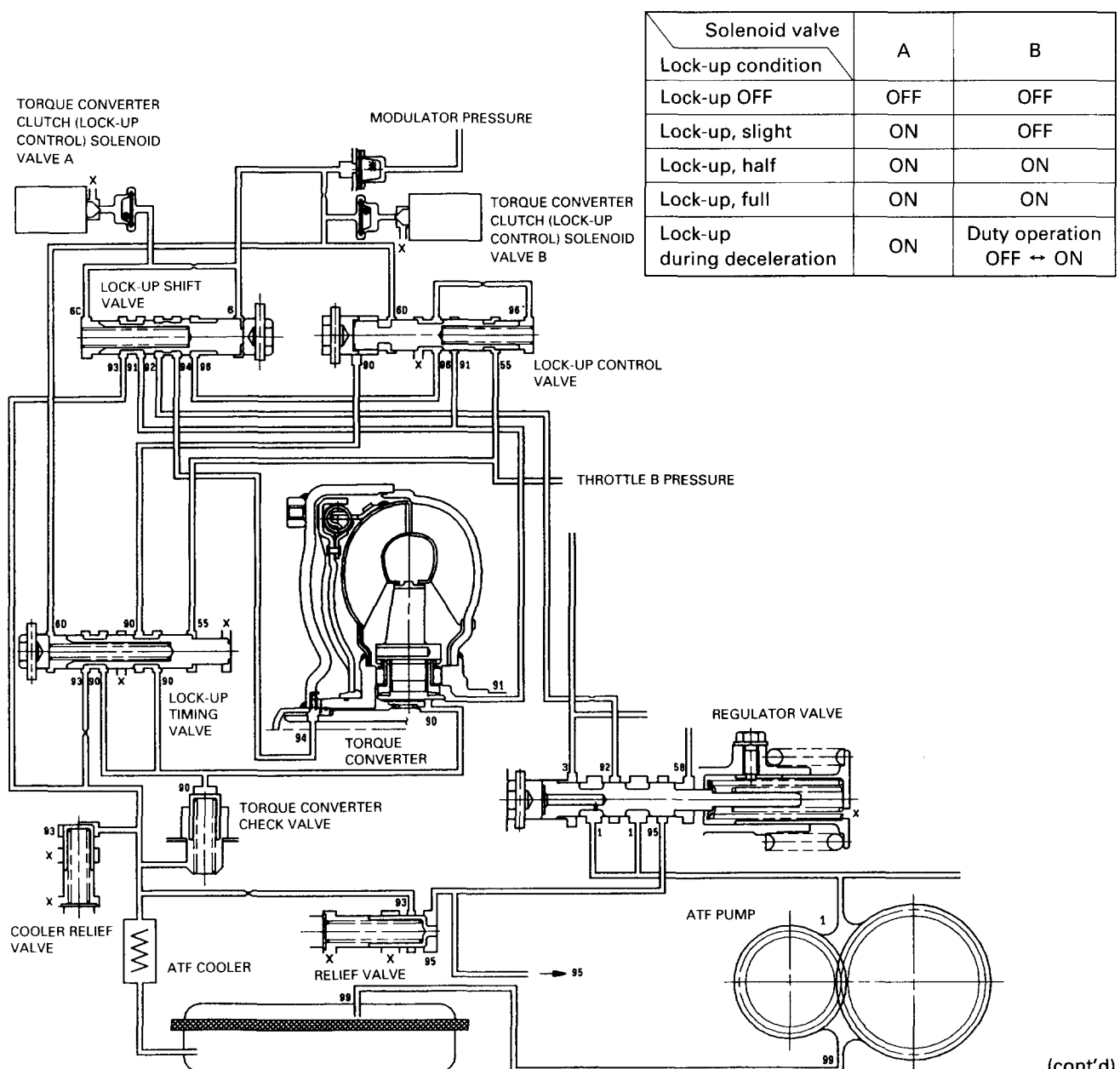




In **D₄** position in 2nd, 3rd and 4th, and **D₃** position in 3rd, pressurized fluid is drained from the back of the torque converter through a passage, causing the lock-up piston to be held against the torque converter cover. As this takes place, the main-shaft rotates at the same speed as the engine crankshaft. Together with hydraulic control, the PCM optimizes the timing of the lock-up system. Under certain conditions, the lock-up clutch is applied during deceleration in 3rd and 4th gear.

The lock-up system controls the range of lock-up according to torque converter clutch (lock-up control) solenoid valves A and B, and the throttle valve. When torque converter clutch solenoid valves A and B activate, modulator pressure changes. Torque converter clutch solenoid valves A and B are mounted on the torque converter housing, and are controlled by the PCM.

NOTE: When used, "left" or "right" indicates direction on the hydraulic circuit.



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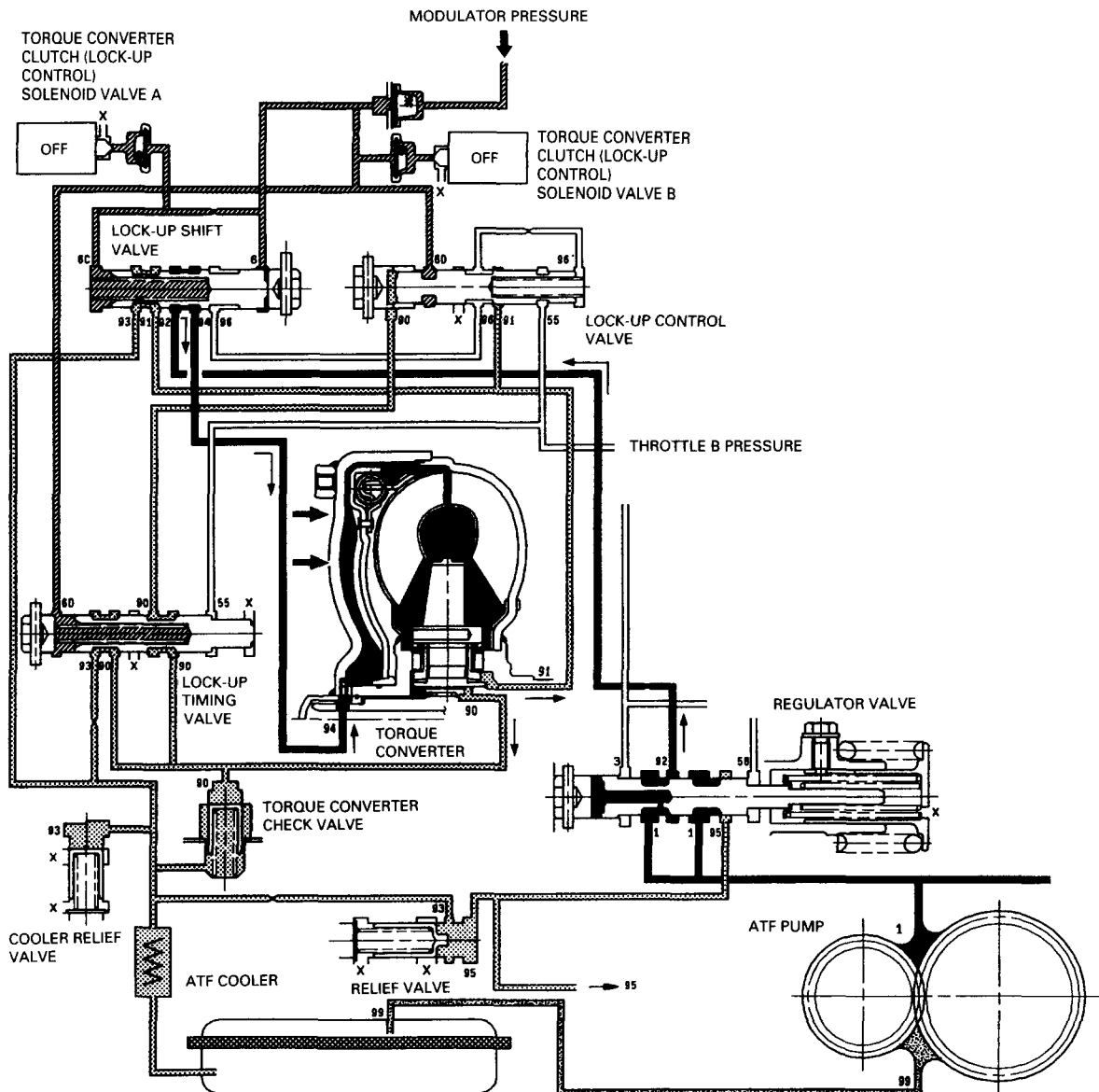
Description

Lock-up System (cont'd)

No Lock-up

The pressurized fluid regulated by the modulator works on both ends of the lock-up shift valve and on the left side of the lock-up control valve. Under this condition, the pressures working on both ends of the lock-up shift valve are equal, and the shift valve is moved to the right side by the tension of the valve spring alone. The fluid from the pump will flow through the left side of the lock-up clutch to the torque converter; that is, the lock-up clutch is in OFF condition.

NOTE: When used, "left" or "right" indicates direction on the hydraulic circuit.





Partial Lock-up

Torque Converter Clutch (Lock-up Control) Solenoid Valve A: ON Torque Converter Clutch (Lock-up Control) Solenoid Valve B: OFF

The PCM switches the solenoid valve A on to release the modulator pressure in the left cavity of the lock-up shift valve. The modulator pressure in the right cavity of the lock-up shift valve overcomes the spring force; thus the lock-up shift valve is moved to the left side.

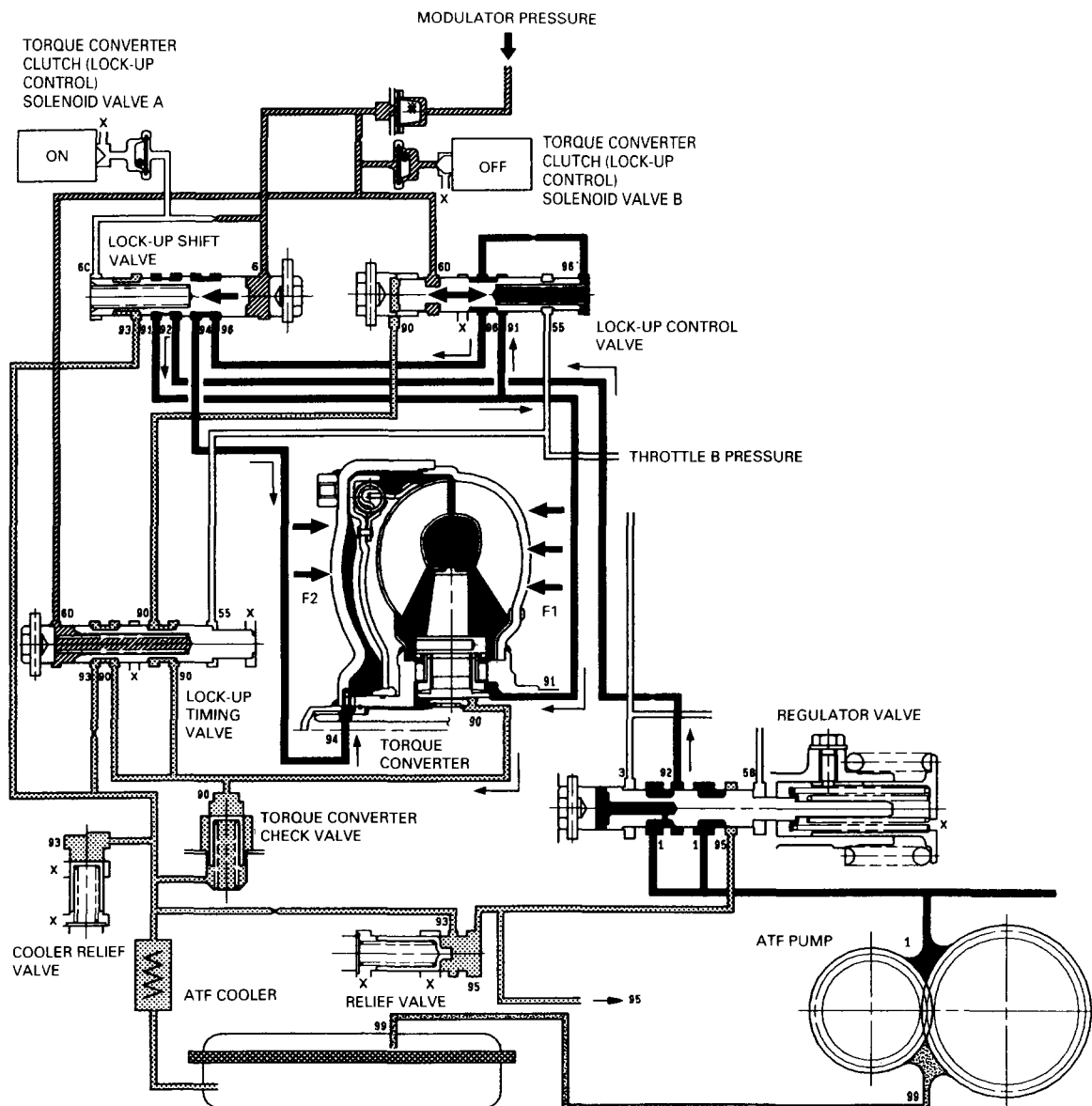
The line pressure is then separated into the two passages to the torque converter:

Torque Converter Inner Pressure: enters into right side to engage lock-up clutch

Torque Converter Back Pressure: enters into left side to disengage lock-up clutch

The back pressure (F2) is regulated by the lock-up control valve, whereas the position of the lock-up timing valve is determined by the throttle B pressure, tension of the valve spring, and pressure regulated by the modulator valve. Also the position of the lock-up control valve is determined by the back pressure of the lock-up control valve and torque converter pressure regulated by the check valve. With the torque converter clutch solenoid valve B kept off, the modulator pressure is maintained in the left side of the lock-up control valve; in other words, the lock-up control valve is moved slightly to the right side. This slight movement of the lock-up control valve causes the back pressure to be lowered slightly, resulting in partial lock-up.

NOTE: When used, "left" or "right" indicates direction on the hydraulic circuit.



Description

Lock-up System (cont'd)

Half Lock-up

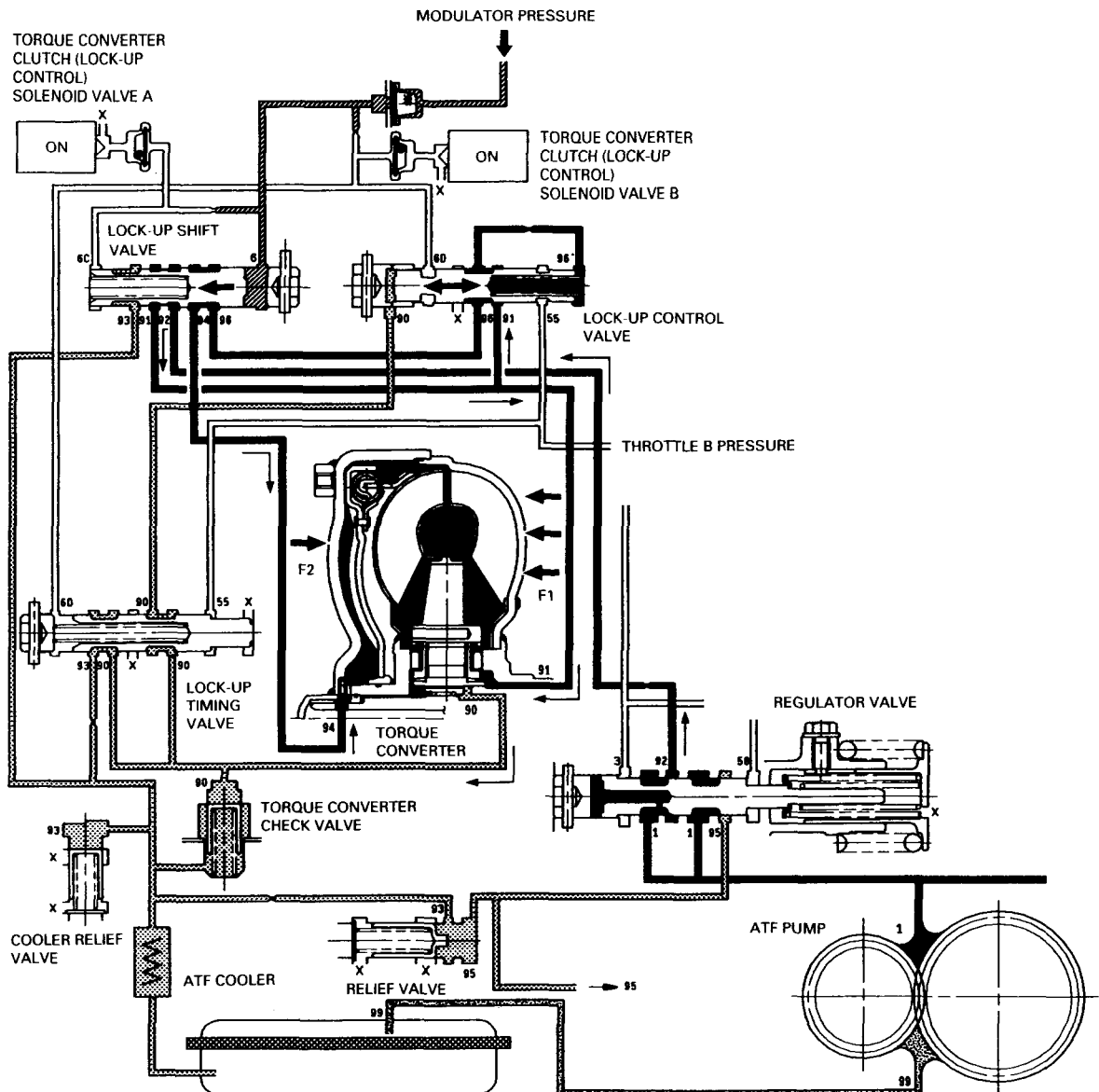
Torque Converter Clutch (Lock-up Control) Solenoid Valve A: ON Torque Converter Clutch (Lock-up Control) Solenoid Valve B: ON

The modulator pressure is released by the solenoid valve B, causing the modulator pressure in the left side of the lock-up control valve to lower.

Also the modulator pressure in the left cavity of the lock-up timing valve is low. However, throttle B pressure is still low at this time; consequently, the lock-up timing valve is kept on the right side by the spring force.

With the torque converter clutch solenoid valve B turned on, the lock-up control valve is moved somewhat to the left side, causing the back pressure (F2) to lower. This allows a greater amount of the fluid (F1) to work on the lock-up clutch so as to engage the clutch. The back pressure (F2) which still exists prevents the clutch from engaging fully.

NOTE: When used, "left" or "right" indicates direction on the hydraulic circuit.



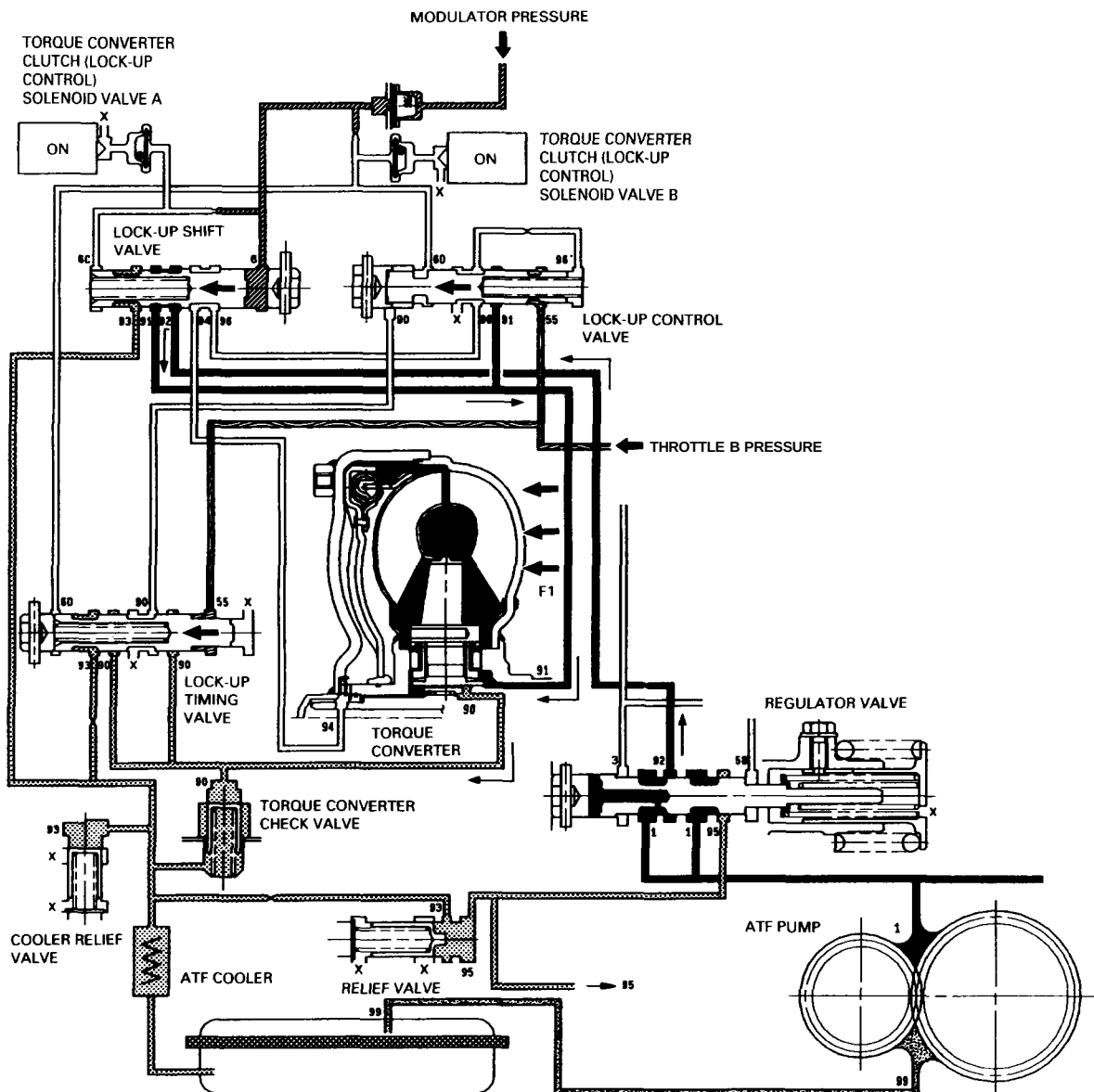


Full Lock-up

Torque Converter Clutch (Lock-up Control) Solenoid Valve A: ON Torque Converter Clutch (Lock-up Control) Solenoid Valve B: ON

When the vehicle speed further increases, throttle B pressure is increased in accordance with the throttle opening. Throttle B pressure (55) flows to the right side of the lock-up timing valve and the lock-up control valve, and they are moved to the left side. The lock-up timing valve covers the port leading torque converter pressure (90) from the torque converter to the lock-up control valve. The lock-up control valve uncovers the port to leak the torque converter pressure (94) and (96). As this takes place, torque converter back pressure is released fully, causing the lock-up clutch to be engaged fully.

NOTE: When used, "left" or "right" indicates direction on the hydraulic circuit.



(cont'd)

Description

Lock-up System (cont'd)

Deceleration Lock-up

Torque Converter Clutch (Lock-up Control) Solenoid Valve A: ON Torque Converter Clutch (Lock-up Control) Solenoid Valve B: Duty Operation (ON ↔ OFF)

The PCM switches solenoid valve B on and off rapidly under certain conditions. The slight lock-up and half lock-up regions are maintained so as to lock the torque converter properly.

NOTE: When used, "left" or "right" indicates direction on the hydraulic circuit.

