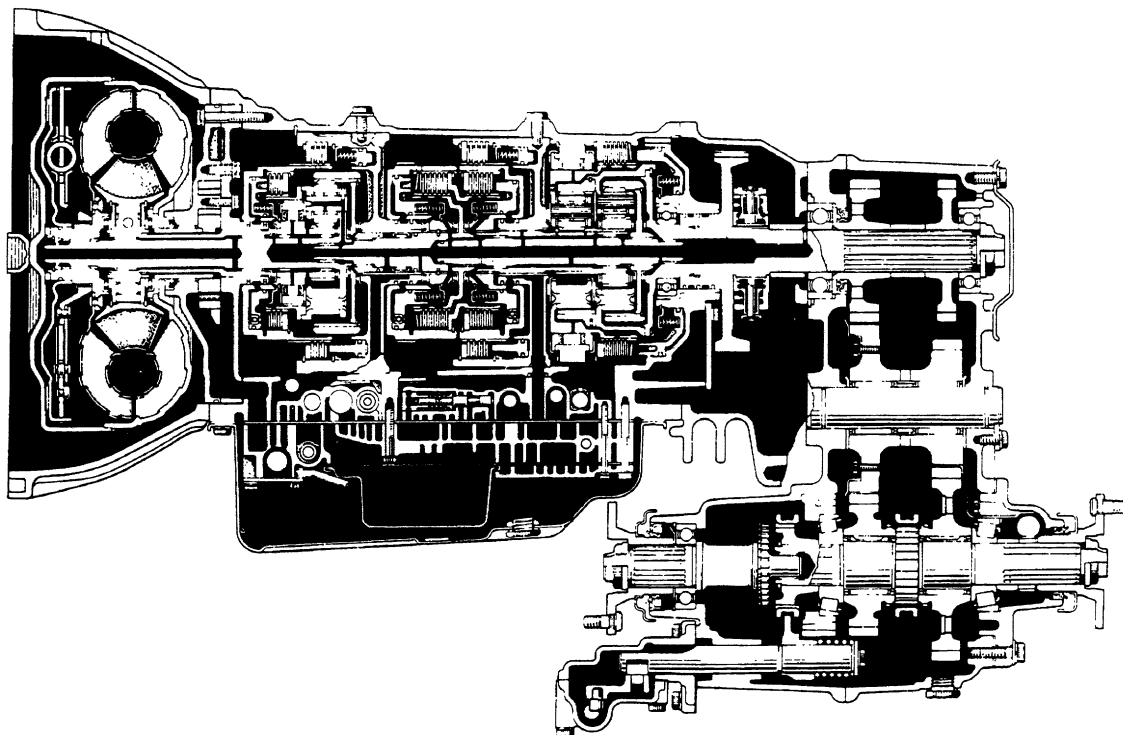

AUTOMATIC TRANSMISSION (A440F)

DESCRIPTION

GENERAL

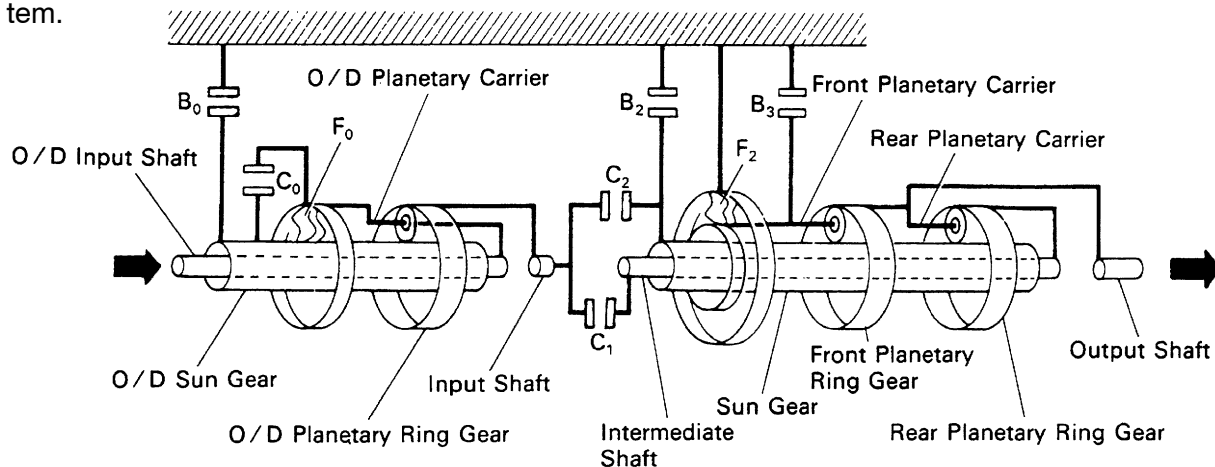
The A440F automatic transmission is a four-speed automatic transmission with a two-speed transfer, developed with the aim of producing an easy-driving 4WD vehicle. A lock-up mechanism is built into the torque converter.



AT3916

The A440F transmission is mainly composed of the torque converter, the overdrive (hereafter called O/D)

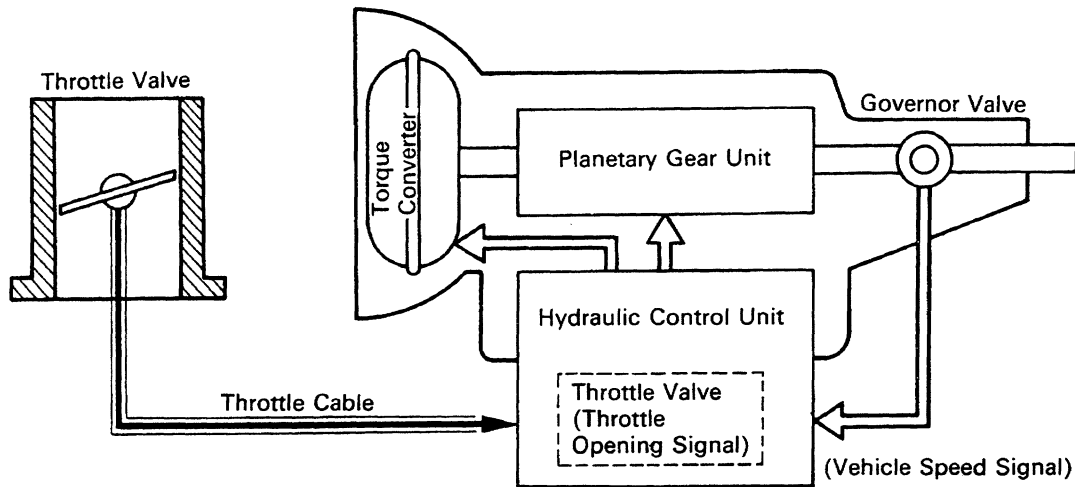
planetary gear unit, 3-speed planetary gear unit, 2-speed transfer and the hydraulic control system.



AT3917

SHIFT CONTROL

Shifting in the fully hydraulic controlled automatic transmission is carried out by the hydraulic control unit in the following way: ,



AT3254

THROTTLE VALVE

The throttle valve in the hydraulic control unit generates hydraulic pressure in proportion to the amount that the accelerator pedal is depressed; this pressure (called "throttle pressure") acts as a throttle opening "signal" to the hydraulic control unit.

GOVERNOR VALVE

The governor valve generates hydraulic pressure in proportion to the speed of the vehicle; this pressure (called "governor pressure") acts as a vehicle speed "signal" to the hydraulic control unit.

HYDRAULIC CONTROL UNIT

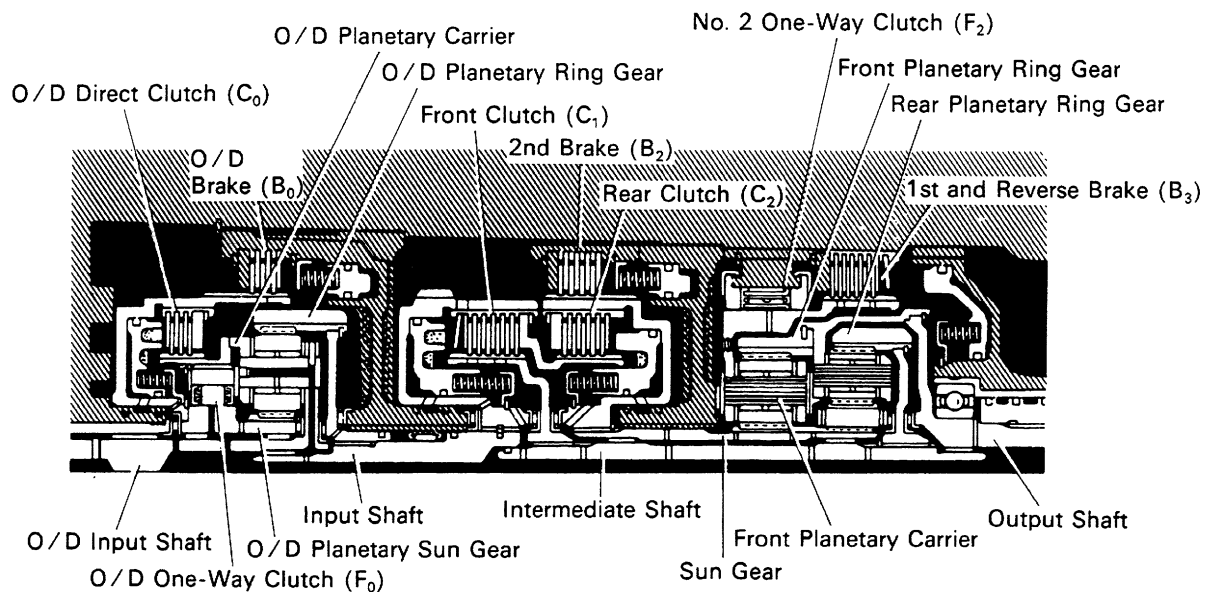
Governor pressure and throttle pressure cause the shift valves in the hydraulic control unit to operate; the strengths of these pressures control the movements of these valves, and these valves control the fluid passage to the clutches and brakes in the planetary gear unit, which in turn control the shifting of the transmission.

PLANETARY GEAR UNIT

The planetary gear unit is composed of three sets of planetary gears, three clutches which transmit power to the planetary gears, and three brakes and two one-way clutches which immobilize the planetary carrier and planetary sun gear.

Power from the engine transmitted the input shaft via the torque converter is then transmitted to the planetary gears by the operation of the clutches. By operation of the brakes and one-way clutches, either the planetary carrier or the planetary sun gear is immobilized, altering the speed of revolution of the planetary gear unit. Shift change is carried out by altering the combination of clutch and brake operation.

Each clutch and brake operates by hydraulic pressure; gear position is decided according to the throttle opening angle and vehicle speed, and shift change automatically occurs.



AT3918

OPERATION OF EACH ELEMENT

NOMENCLATURE	OPERATION
O/D Direct Clutch (C ₀)	Connects overdrive sun gear and overdrive carrier
O/D Brake (B ₀)	Prevents overdrive sun gear from turning either clockwise or counterclockwise
O/D One-Way Clutch (F ₀)	When transmission is being driven by engine, connects overdrive sun gear and overdrive carrier
Front Clutch (C ₁)	Connects input shaft and intermediate shaft
Rear Clutch (C ₂)	Connects input shaft and front & rear planetary sun gear
2nd Brake (B ₂)	Prevents front & rear planetary sun gear from turning either clockwise or counterclockwise
1 st & Reverse Brake (B ₃)	Prevents front planetary carrier from turning either clockwise or counterclockwise
No. 2 One-Way Clutch (F ₂)	Prevents front planetary carrier from turning counterclockwise

OPERATING CONDITIONS FOR EACH GEAR

(See page [AT-11](#))

HYDRAULIC CONTROL SYSTEM

The hydraulic control system is composed of the oil pump, the valve body, and the clutches and brakes, as well as the fluid passages which connect all of these components. Based on the hydraulic pressure created by the oil pump, the hydraulic control system governs the hydraulic pressure acting on the torque converter, clutches and brakes in accordance with the vehicle driving conditions.

OPERATION

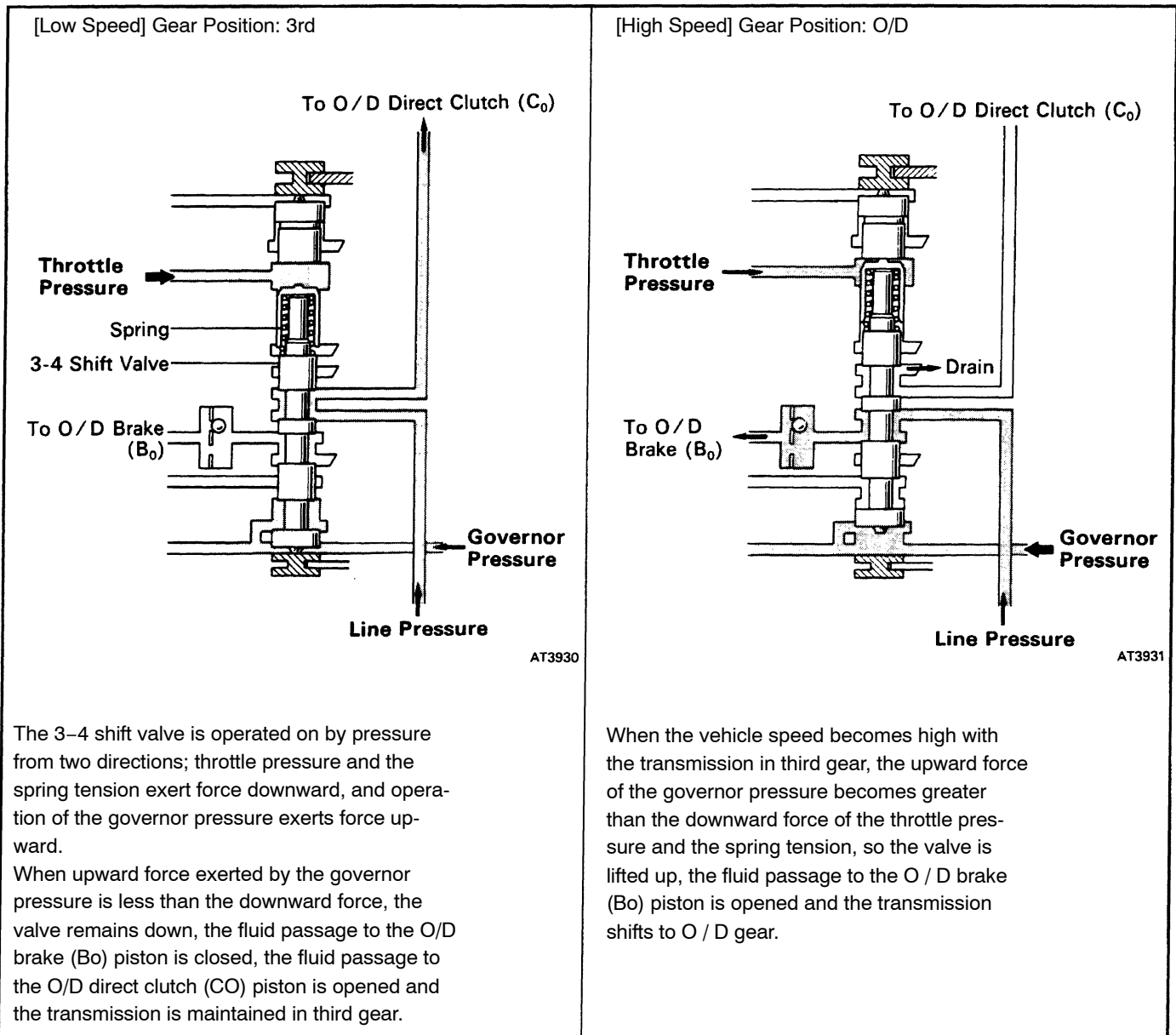
Hydraulic pressure supplied by the oil pump is controlled by the regulator valve; the resulting oil pressure controlled by the regulator valve is called the "line pressure".

Line pressure produces the hydraulic pressure for throttle pressure and governor pressure. Also, line pressure produces hydraulic pressure for the operation of each brake and clutch in the planetary gear unit.

The throttle valve acts to produce hydraulic pressure, called the "throttle pressure", which responds to accelerator pedal modulation. Throttle pressure increases as accelerator pedal is depressed.

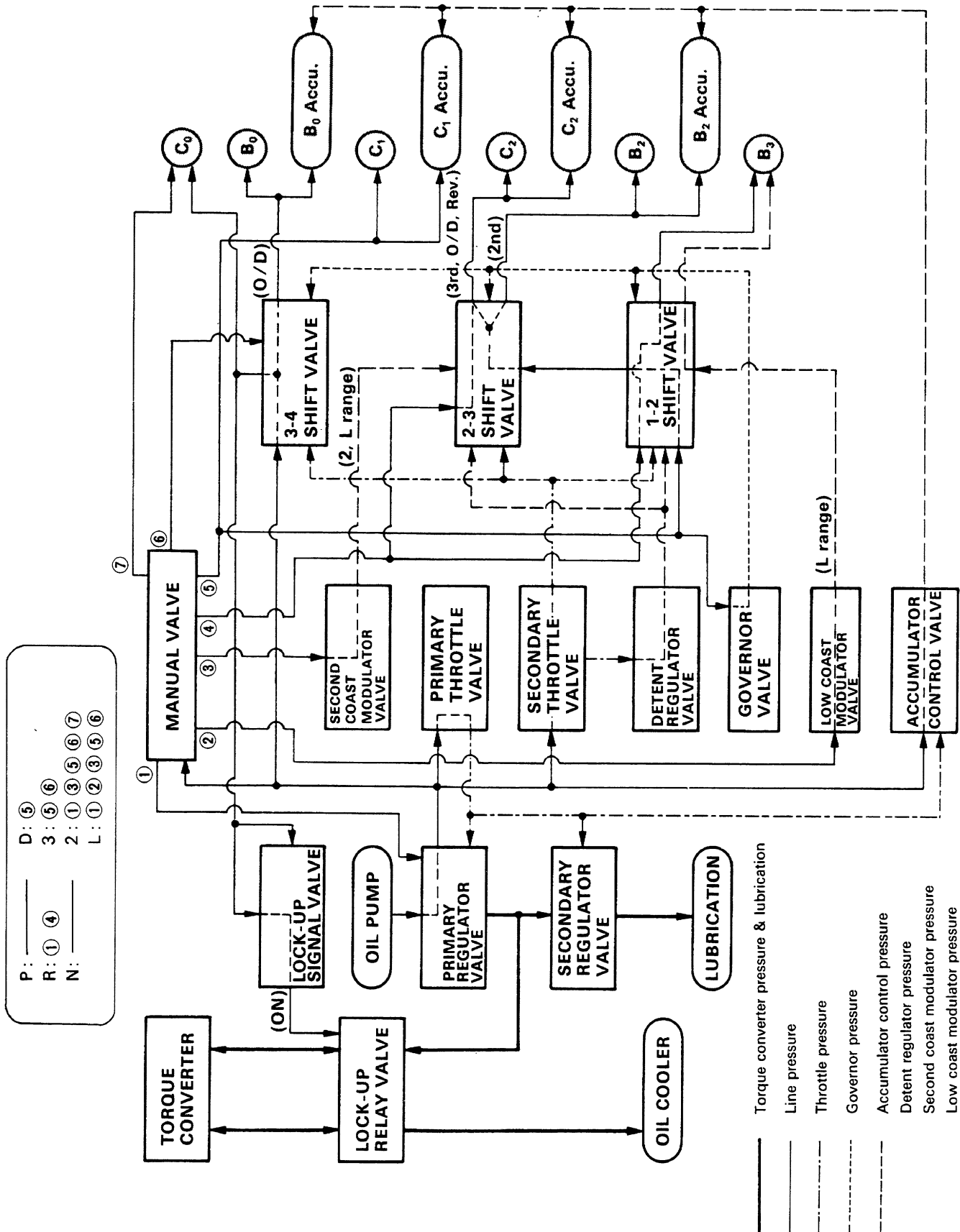
The governor valve produces hydraulic pressure, called the "governor pressure", in response to vehicle speed. Governor pressure increases as vehicle speed increases.

In accordance with difference between throttle pressure and governor pressure, each shift valve shifts, the fluid passages to the clutches and brakes in the planetary gear unit are opened and the clutches and brakes operate, and shift change occurs. The operation of the hydraulic control system, using the 3-4 shift valve as an example, is shown below:



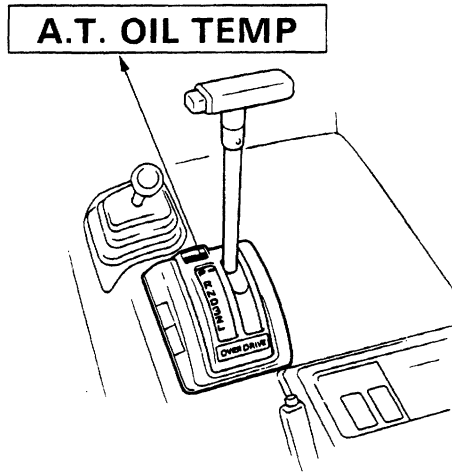
Hydraulic Circuitry

SYSTEM DIAGRAM

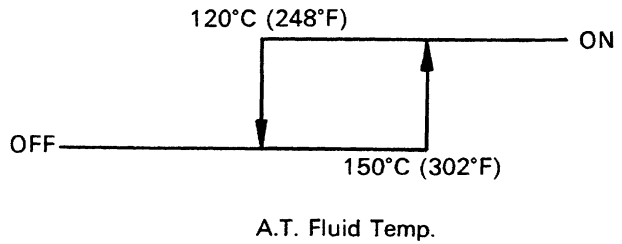


A. T. FLUID TEMPERATURE WARNING SYSTEM

The computer detects the A/T fluid temperature by means of a fluid temperature sensor fitted to the transfer front case. The A/T fluid may become extremely hot when the vehicle is under an extreme load, as when driving on sand or climbing uphill. Should the fluid temperature increase above 150°C (302°F), the computer lights the warning light located on the front side of shift indicator on the console. The light goes off when the temperature falls below 120°C (248°F).



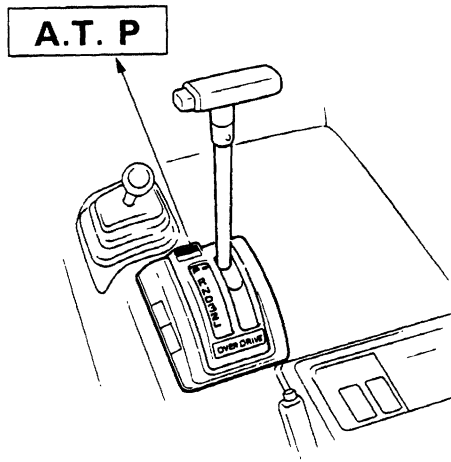
AT3919



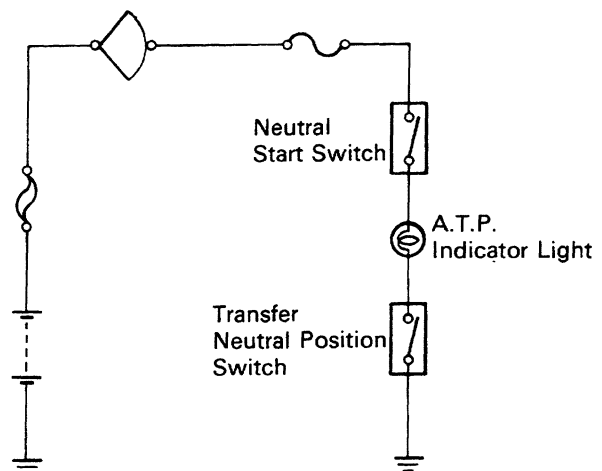
A.T. Fluid Temp.

A.T.P. (Automatic Transmission Parking) INDICATOR

The propeller shaft and wheels are free even when the transmission shift lever is set to "P" as long as the transfer shift lever is in "neutral" position. The A.T.P. indicator lights up to warn the driver that the propeller shaft and wheels are not locked. If the A.T.P. indicator light goes on, the transfer shift lever should be shifted to H2 or L4 position.



AT3919



AT3920