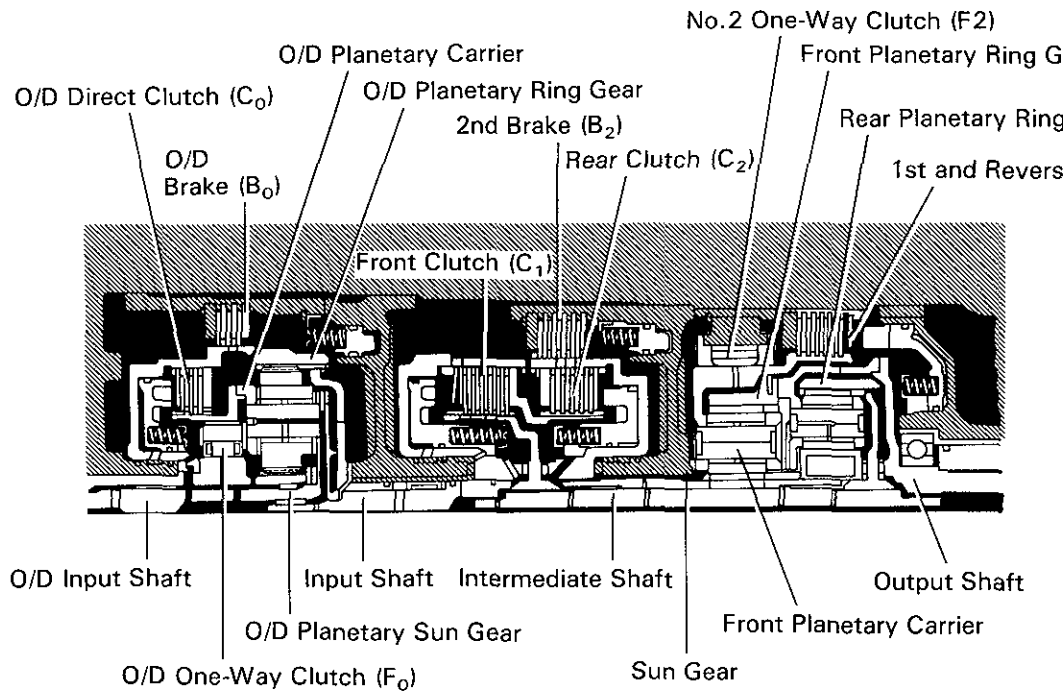
OPERATION

OPERATION



Q03056

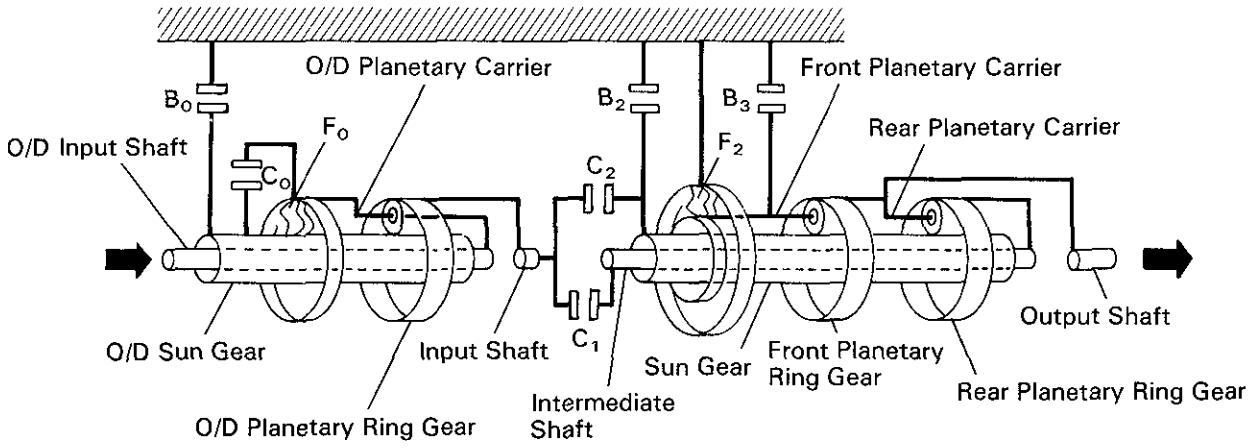
○....Operating

Shift lever position	Gear position	C_0	C_1	C_2	B_0	B_2	B_3	F_0	F_2
P	Parking	○						○	
R	Reverse	○		○			○	○	
N	Neutral	○						○	
D	1st	○	○					○	○
	2nd		○			○		○	
	3rd	○	○	○				○	
	O/D		○	○	○				
2	2nd	○	○			○		○	
L	1st	○	○				○	○	○

V01579

1. FUNCTION OF COMPONENTS

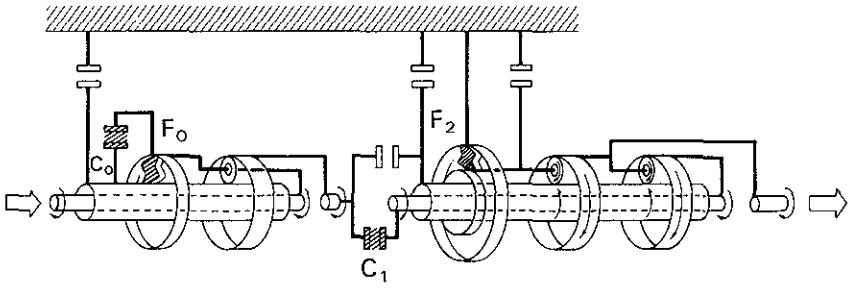
COMPONENT	FUNCTION
O/D Direct Clutch (C_0)	Connects overdrive sun gear and overdrive carrier
O/D Brake (B_0)	Prevents overdrive sun gear from turning either clockwise or counterclockwise
O/D One-Way Clutch (F_0)	When transmission is being driven by engine, connects overdrive sun gear and overdrive carrier
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_1)	Prevents front & rear planetary sun gear from turning either clockwise or counterclockwise
1st & Reverse Brake (B_2)	Prevents front planetary carrier from turning either clockwise or counterclockwise
No.2 One-Way Clutch (F_2)	Prevents front planetary carrier from turning counterclockwise



AT3917

The conditions of operation for each gear position are shown on the following illustration:

D Range 1st Gear



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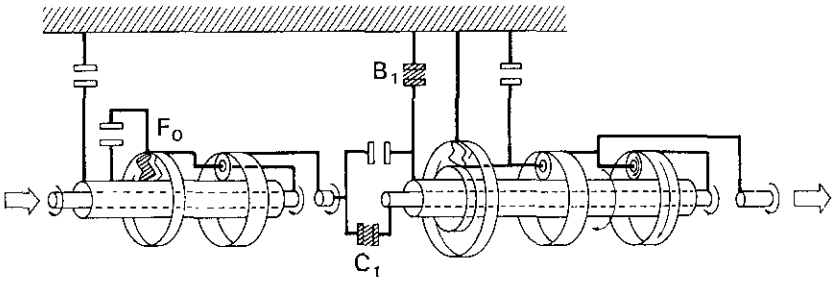
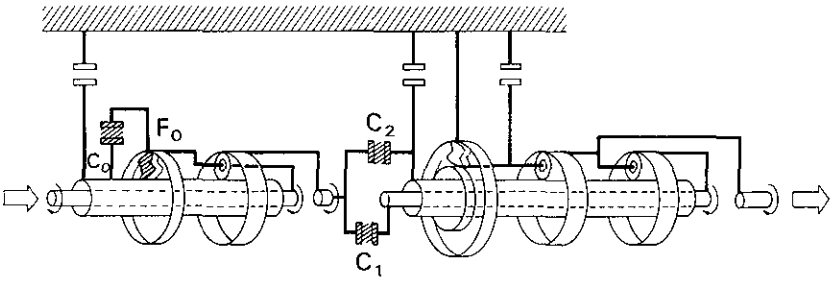
D Range 2nd Gear



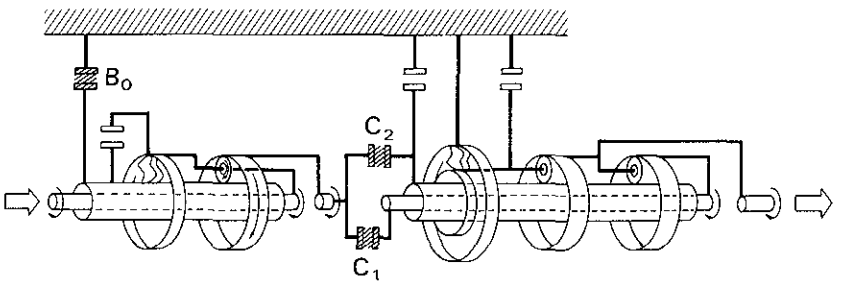
AT5950

D Range 3rd Gear



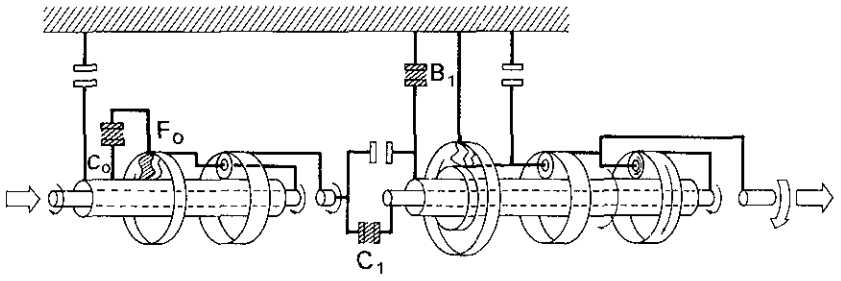
AT5951

D Range O/D



AT5952

2 Range 2nd Gear



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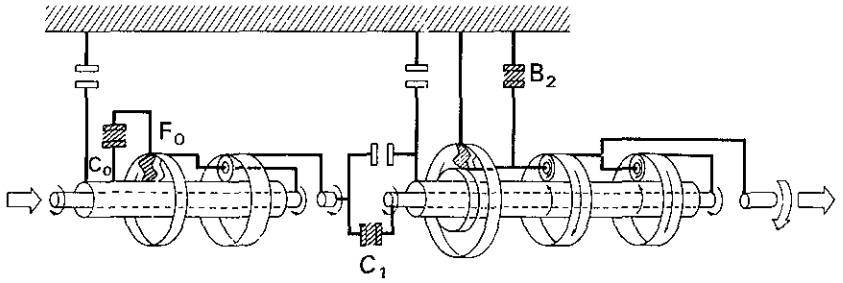
L Range 1st Gear



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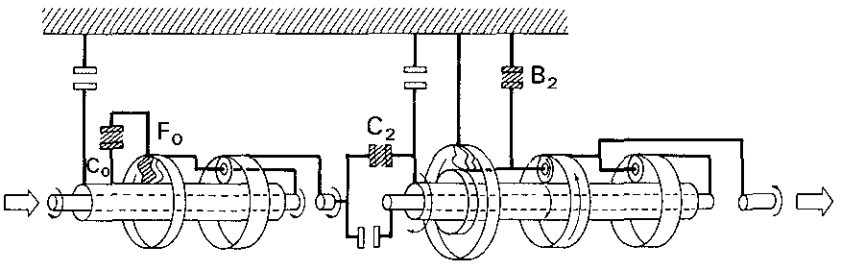
R Range Reverse Gear



AT5955

2. HYDRAULIC CONTROL SYSTEM

The hydraulic control system is composed of the oil pump, the valve body, the solenoid valves, the accumulators, the clutches and brakes, as well as the fluid passages which connect all of these components.

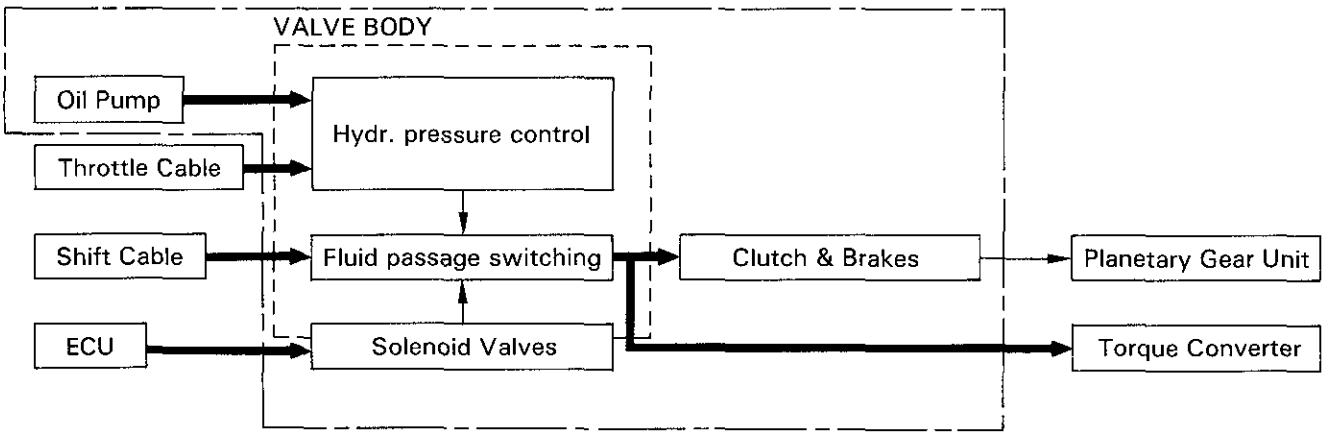
Based on the hydraulic pressure created by the oil pump, the hydraulic control system governs the hydraulic pressure acting on the torque converter, clutches and brakes in accordance with the vehicle driving condition.

There are four solenoid valves on the valve body.

These solenoid valves are turned on and off by signals from ECU to operate the shift valves.
These shift valves then switch the fluid passages so that fluid goes to the torque converter and planetary gear units.

(Except for the solenoid valves, the hydraulic control system of the electronically controlled transmission (hereafter called ECT) is basically the same as that of the fully hydraulic controlled automatic transmission.)

HYDRAULIC CONTROL SYSTEM



3. ELECTRONIC CONTROL SYSTEM

The electronic control system for the A442F automatic transmission provide extremely precise control of the gear shift timing and lock-up timing in response to driving conditions as sensed by various sensors located throughout the vehicle and in response to the engine's running condition.

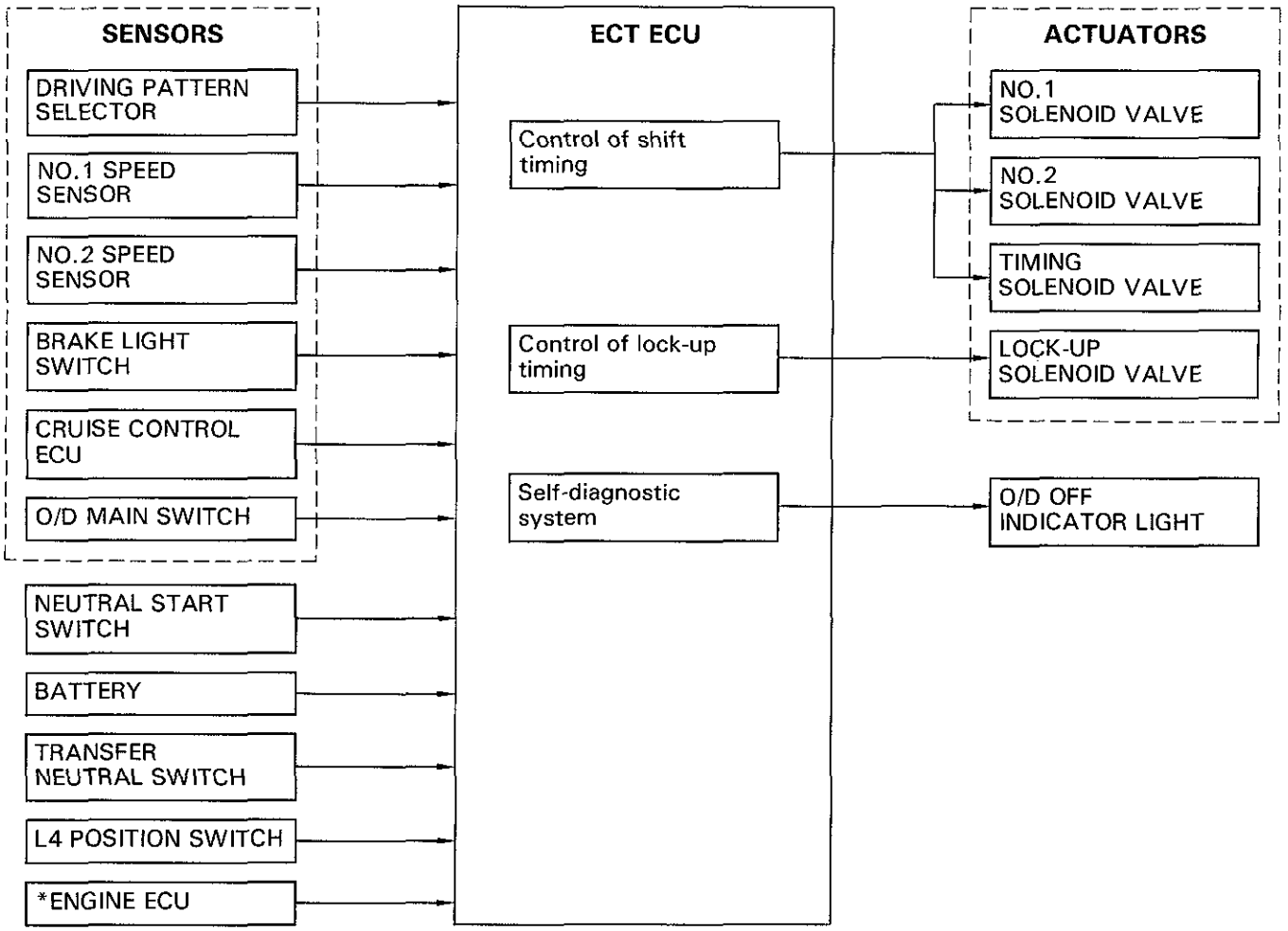
At the same time, the ECT ECU control reduces vehicle squat when the vehicle starts out and gear shift shock.

The electronic control system for controlling the shift timing and the operation of the lock-up clutch is composed of the following three parts:

(a) Sensors: These sense the vehicle speed and throttle position and send this data to the ECT ECU in the form of electronic signals.

(b) ECT ECU: This determines the shift and lock-up timing based upon the signals from the sensors.

(c) Actuators: Solenoid valves divert hydraulic pressure from one circuit of the hydraulic control unit to another thus controlling shifting and lock-up timing.



*: 1FZ-FE engine only

4. FUNCTION OF TCM

- **Control of Shift Timing**

The ECU has programmed into its memory the optimum shift pattern for each shift lever position (D, 2, L ranges) and driving mode (Normal or Power).

Based on the appropriate shift pattern, the ECU turns No.1, No.2 and timing solenoid valves on or off in accordance with the vehicle speed signal from the speed sensor and the throttle opening signal from the throttle position sensor. In this manner, the ECU operates each shift valve, opening or closing the fluid passages to the clutches and brakes to permit up-shift or down-shift of the transmission.

HINT: The electronic control system provides shift timing and lock-up control only while the vehicle is traveling forward. In REVERSE, and NEUTRAL, the transmission is mechanically, not electronically controlled.

- **Control of Overdrive**

Driving in overdrive is possible if the O/D main switch is on and the shift lever is in the D range. However, when the vehicle is being driven using the cruise control system (CCS), if the actual vehicle speed drops to about 4 km/h (2 mph) below the set speed while the vehicle is running in overdrive, the CCS ECU sends a signal to the ECT ECU to release the overdrive and prevent the transmission from shifting back into overdrive until the actual vehicle speed reaches the speed set in the CCS memory.

On this model, if the coolant temperature falls below 55°C (131°F), the engine ECU sends a signal to the ECT ECU, preventing the transmission from up-shifting into overdrive.

- **Control of Lock-Up System**

The ECT ECU has programmed in its memory a lock-up clutch operation pattern for each driving mode (Normal or Power). Based on this lock-up pattern, the ECU turns lock-up solenoid valve on or off in accordance with the vehicle speed signals received from the speed sensor and the throttle opening signals from the the throttle position sensor.

Depending on whether lock-up solenoid valve is on or off, the lock-up relay valve performs changeover of the fluid passages for the converter pressure acting on the torque converter to engage or disengage the lock-up clutch.

(Mandatory Cancellation of Lock-Up System)

If any of the following conditions exist, the ECU turns off lock-up solenoid valve to disengage the lock-up clutch.

(1) The brake light switch comes on (during braking).

(2) The IDL points of the throttle position sensor close (throttle valve fully closed.).

(3) The vehicle speed drops 4 km/h (2 mph) or more below the set speed while the cruise control system is operating.

(4) The coolant temperature falls below 70°C (158°F).

The purpose of (1) and (2) above is to prevent the engine from stalling if the rear wheels lock up.

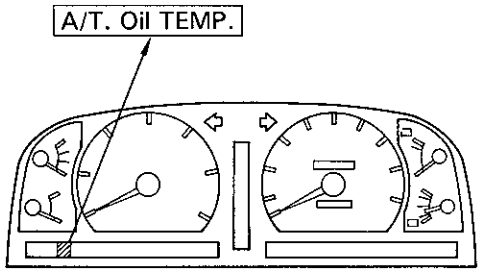
The purpose of (3) is to cause the torque converter operate to obtain torque multiplication.

The purpose of (4) is both to improve general driveability, and to speed up transmission warm-up.

Also, while the lock-up system is in operation, the ECU will temporarily turn it off during up-shift or down-shift in order to decrease shifting shock.

5. A/T. FLUID TEMPERATURE WARNING SYSTEM

The ECT ECU detects the A/T fluid temperature by means of a fluid temperature sensor fitted to the union. The A/T fluid may become extremely when the vehicle is under and extreme load, as when driving on sand or climbing uphill. Should the fluid temperature increase above 150°C (302°F), the ECT ECU lights the warning light located in the combination meter. The light goes off when temperature falls below 120°C (248°F).



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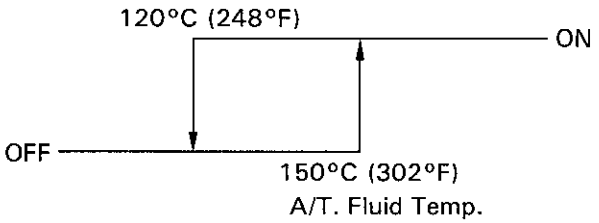
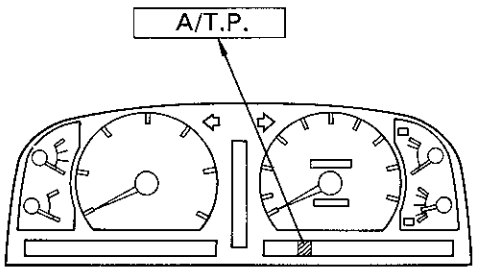


V01585

6. 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 out of "N" position.



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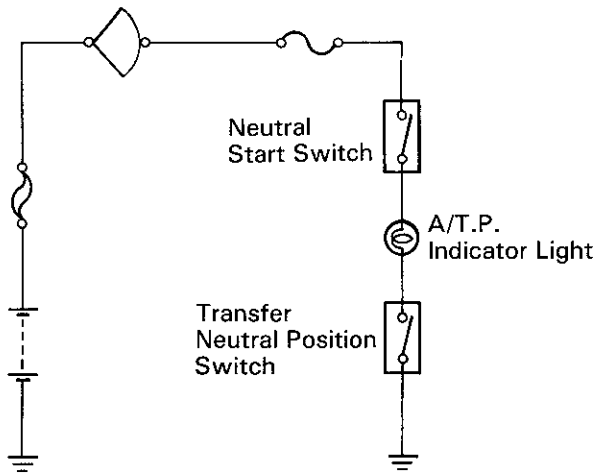

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