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**GROUP 35C**

**TRACTION  
CONTROL SYSTEM  
(TCL)**

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# GENERAL DESCRIPTION

M2354000100011

## FEATURES

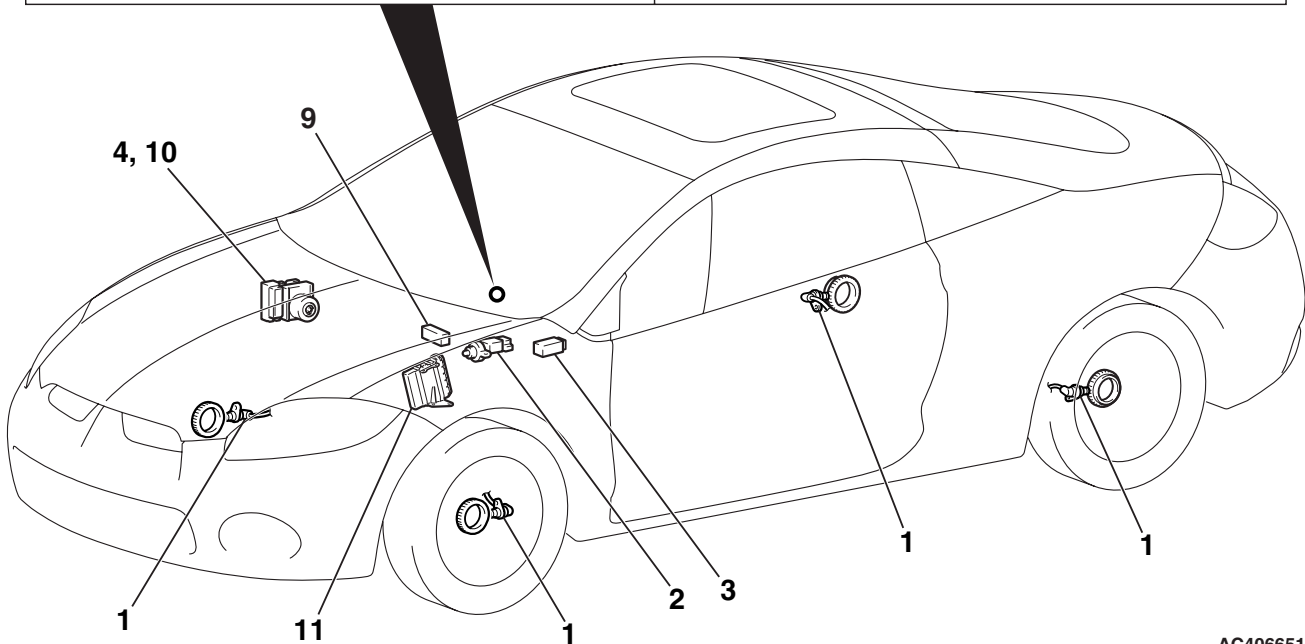
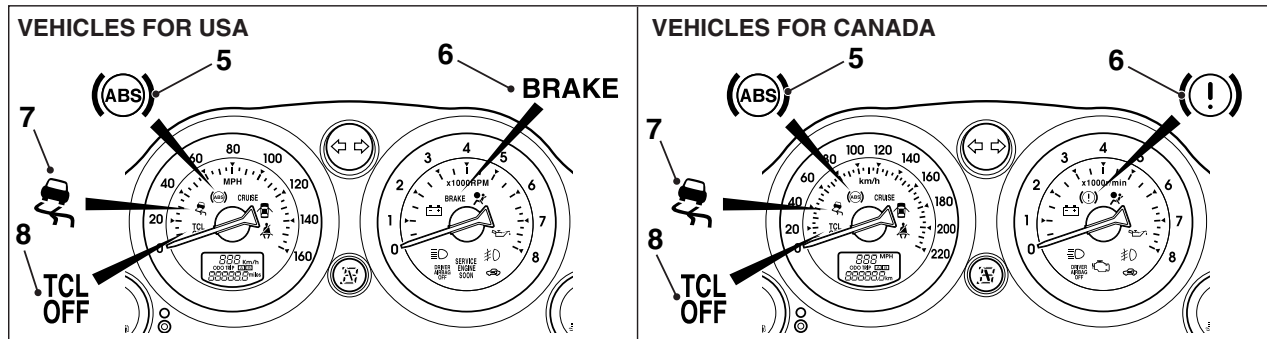
The traction control system (TCL) is available for vehicles with 3.8L engine.

When a drive wheel is judged to be slipping due to excessive accelerator pedal depression on a low friction road or similar situations, the TCL applies braking force to the slipping drive wheel or lowers the engine output to suppress the drive wheel slippage.

The engine output is controlled by communication with the engine control module (ECM) <M/T> or powertrain control module (PCM) <A/T>. CAN (Controller Area Network) communication between ECUs reduces the number of wiring harnesses and enhances data transmission reliability.

*NOTE: For further details on CAN communication, refer to GROUP 54C, CAN P.54C-13.*

## CONSTRUCTION DIAGRAM



AC406651AB

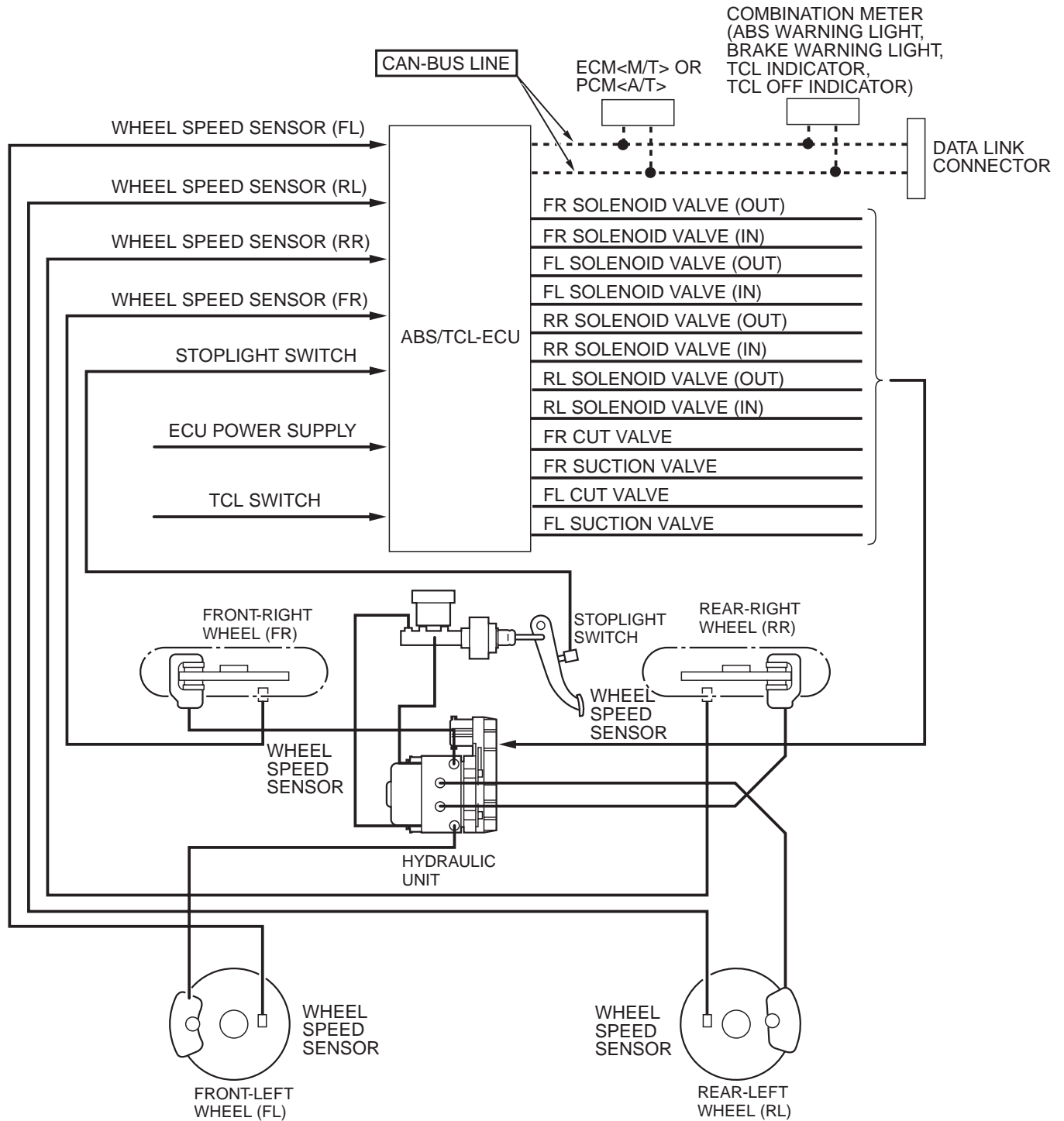
NAME OF PART		NUMBER	OUTLINE OF FUNCTION
Sensor	Wheel speed sensor	1	Sends alternating current signals at frequencies which are proportional to the rotation speeds of each wheel to the ABS/TCL-ECU.
	Stoplight switch	2	Sends a signal to the ABS/TCL-ECU to indicate whether the brake pedal is depressed or not.
	TCL switch	3	Sends a signal to the ABS/TCL-ECU to indicate whether the TCL switch is pushed or not.

**TRACTION CONTROL SYSTEM (TCL)  
GENERAL DESCRIPTION**

**35C-3**

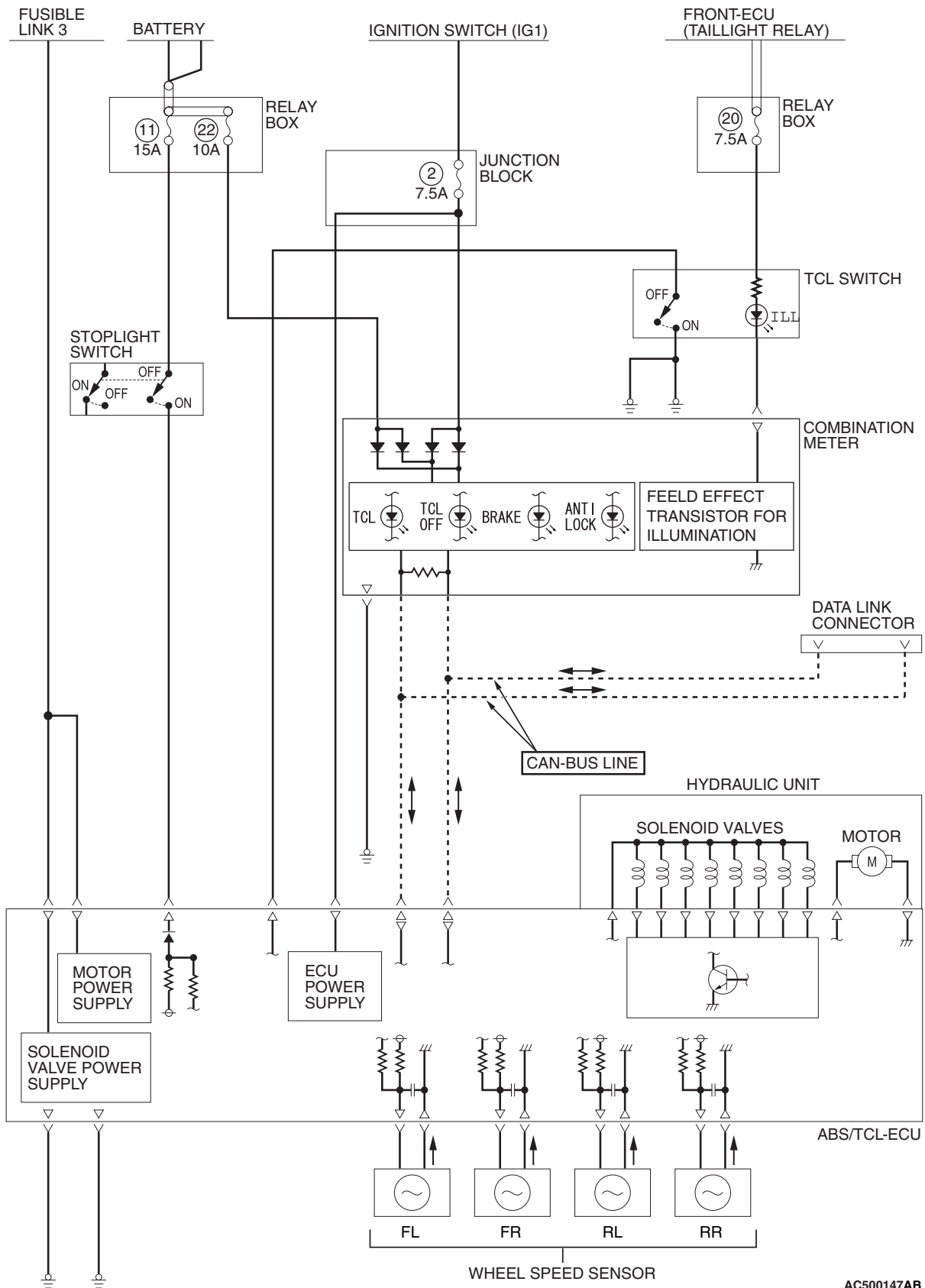
NAME OF PART		NUMBER	OUTLINE OF FUNCTION
Actuator	Hydraulic unit	4	Drives the solenoid valves according to signals from the ABS/TCL-ECU in order to control the brake hydraulic pressure for each wheel.
	ABS warning light	5	Illuminates in response to signals from the ABS/TCL-ECU when a problem develops in the ABS/TCL system.
	Brake warning light	6	Illuminates in response to signals from the ABS/TCL-ECU when a problem develops in the EBD system.
	TCL indicator	7	Flashes when the TCL is activated. Illuminates when the ABS/TCL-ECU is defective.
	TCL OFF indicator	8	Illuminates when the TCL is OFF. Illuminates when the ABS/TCL-ECU is defective.
Data link connector		9	Outputs the diagnostic trouble codes and allows communication with the scan tool.
ABS/TCL-ECU		10	Controls actuators (described above) based on the signals coming from each sensor.
			Controls the self-diagnosis and fail-safe functions.
			Controls the diagnostic function (scan tool compatible).
ECM <M/T>		11	Receives signals from ABS/TCL-ECU to control the engine output.
PCM <A/T>			Controls the self-diagnosis and fail-safe functions.
			Controls the diagnostic function (scan tool compatible).

SYSTEM CONFIGURATION DIAGRAM



AC407156AB

TCL ELECTRICAL CIRCUIT DIAGRAM



AC500147AB

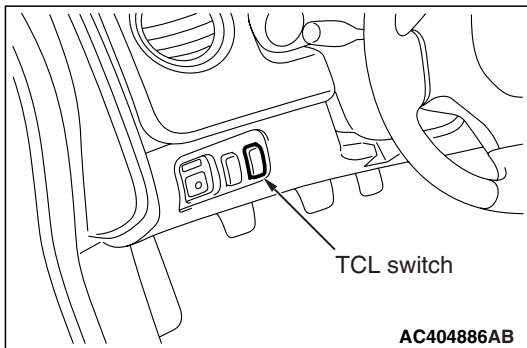
## CONSTRUCTION DESCRIPTION

M2354000200018

### SENSOR

#### TCL SWITCH

This switch is mounted on the left side of the instrument panel, and turns on and off the TCL system.



#### TCL SWITCH POSITION AND THEIR RESPECTIVE CONTROL

TCL SWITCH POSITION	TRACTION CONTROL	
	BRAKE CONTROL	ENGINE CONTROL
ON	Active	Active
OFF	Inactive	Inactive

**NOTE:**

- If the TCL switch is switch "ON" while traction control is in action, it will run down TCL after having accomplished its operation.
- Traction control is performed by controlling the brake and engine jointly in the range between 0 – 120 km/h (0 – 75 mph), and by controlling the engine only at speeds of 75 mph (120 km/h) or higher.

## ACTUATOR

### TCL INDICATOR AND TCL OFF INDICATOR

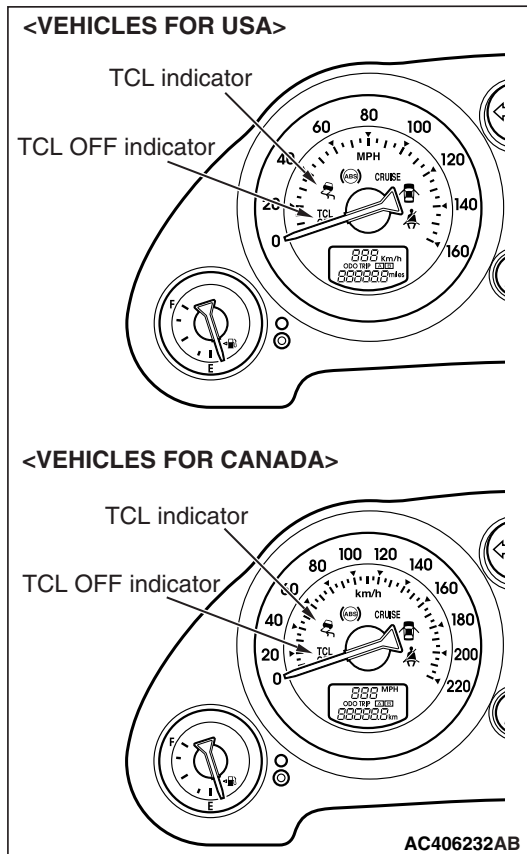
The TCL indicator and TCL OFF indicator illuminate under the conditions below to inform the driver.

#### TCL INDICATOR

- When the traction control is active, the indicator blinks.
- When there is a failure in the traction control system, the indicator illuminates steadily.

#### TCL OFF INDICATOR

- When the traction control is inactive, the indicator illuminates.
- When there is a failure in the traction control system, the indicator illuminates steadily.



### TCL INDICATOR, TCL OFF INDICATOR AND THEIR OPERATION PATTERN

	CONDITION	TCL INDICATOR	TCL OFF INDICATOR
Normal	Bulb check	Illuminates for three seconds after the ignition is on.	Illuminates for three seconds after the ignition is on
	Normal	off	off
	Traction control is in operation	Blinks.	off
	ABS/TCL-ECU is warning the driver that the traction control will be disabled to protect the solenoid valve.	–	–
Defective	Traction control is defective.	Illuminates	Illuminates
Scan tool is connected	Actuator test not executed	–	–
	Actuator test executed	off	Illuminates

**HYDRAULIC UNIT**

The hydraulic unit includes a cut valve and suction valve for traction control an additional, compared with the conventional hydraulic unit for the ABS control.

*NOTE: For the internal hydraulic circuit of the hydraulic unit, refer to P.35C-13.*

**ABS/TCL-ECU**

The ECU incorporates the ABS-ECU and traction control-ECU. The integral design allows joint operation of the TCL-ECU with the ABS and coordinated control of the driving force and braking force.

**OVERVIEW OF CONTROL**

The ABS/TCL-ECU detects vehicle movement based on information from wheel speed sensors and calculates a model of ideal vehicle movement. After comparing actual and ideal movements, it acts to bring the actual vehicle movement closer to the ideal model by controlling specific wheel brake force and governing engine output.

**EXAMPLE OF OPERATION OF TRACTION CONTROL**

The Traction Control prevents drive force loss during slipping of the drive wheels by automatically applying the brakes and sending engine torque reduction signal to the ECM<M/T> or PCM<A/T> when the drive wheels slip or when driving on partly low-friction surfaces.

**FAIL-SAFE AND DIAGNOSTIC FUNCTIONS**

The ABS/TCL-ECU regularly monitors input and output signals. If an error is detected in the system, the ECU sends a fail signal and the Anti-lock braking system warning light, Brake warning light, TCL indicator and TCL OFF indicator is illuminated or blinks. Various controls are processed depending on the cause of malfunction as shown below. When the ABS system fails, the TCL system is also suspended. However, when the TCL system fails, no other system is suspended. The appropriate indicator and warning lights are illuminated/blinked. The ABS/TCL-ECU includes the following functions to make system inspection easier.

- Diagnostic trouble code
- Displays Data list
- Actuator test

All of the above operations can be carried out using the scan tool.

FAIL-SAFE FUNCTION

DTC NO.	INSPECTION ITEM	ABS	EBD	TRACTION CONTROL	
				CONTROL BY ENGINE OUTPUT	CONTROL BY BRAKING FORCE
C1200 <FR> C1205 <FL> C1210 <RR> C1215 <RL>	Wheel speed sensor system <ul style="list-style-type: none"> <li>Wheel speed sensor line break</li> <li>Wheel speed sensor short circuit</li> </ul>	Control disabled	Control disabled if both of the rear wheels are affected	Control disabled	Control disabled
C1201 <FR> C1206 <FL> C1211 <RR> C1216 <RL>	Wheel speed sensor system <ul style="list-style-type: none"> <li>Wheel speed sensor transmitting error</li> <li>ABS/EBD control timing error</li> </ul>	Control disabled	Control disabled if both of the rear wheels are affected	Control disabled	Control disabled
C1226 <FR> C1236 <FL> C1246 <RR> C1256 <RL>	Inlet valve system <ul style="list-style-type: none"> <li>Inlet valve short circuit</li> <li>Inlet valve ON error</li> <li>Inlet valve OFF error</li> </ul>	Control disabled	Control disabled	Control disabled	Control disabled
C1231 <FR> C1241 <FL> C1251 <RR> C1261 <RL>	Outlet valve system <ul style="list-style-type: none"> <li>Outlet valve short circuit</li> <li>Outlet valve ON error</li> <li>Outlet valve OFF error</li> </ul>	Control disabled	Control disabled	Control disabled	Control disabled
C1271	Motor system <ul style="list-style-type: none"> <li>Motor lock</li> <li>Motor OFF error</li> <li>Motor ON error</li> </ul>	Normal control	Control disabled	Control disabled	Control disabled
C1276	Inlet valve system and outlet valve system <ul style="list-style-type: none"> <li>Inlet valve system and outlet valve system internal circuit damage</li> </ul>	Control disabled	Control disabled	Control disabled	Control disabled

DTC NO.	INSPECTION ITEM	ABS	EBD	TRACTION CONTROL	
				CONTROL BY ENGINE OUTPUT	CONTROL BY BRAKING FORCE
C1300<FR> C1305<FR> C1310<FL> C1315<FL>	Cut valve system and suction valve system <ul style="list-style-type: none"> <li>Cut valve and suction valve short circuit</li> <li>Cut valve and suction valve ON error</li> <li>Cut valve and suction valve OFF error</li> </ul>	Control disabled	Control disabled	Control disabled	Control disabled
C1607	ABS/TCL-ECU system (valve relay cannot activate)	Control disabled	Control disabled	Control disabled	Control disabled
	ABS/TCL-ECU system (valve relay can activate)	Normal control	Normal control	Control disabled	Control disabled
C1640	Variant Code unable to communicate/data abnormal	Normal control	Control disabled	Control disabled	Control disabled
C1860	Electrical system <ul style="list-style-type: none"> <li>ECU power supply or voltage problem (high voltage)</li> </ul>	Control disabled	Control disabled	Control disabled	Control disabled
C1861	Electrical system <ul style="list-style-type: none"> <li>ECU power supply or voltage problem (low voltage)</li> </ul>	Control disabled	Normal control	Control disabled	Control disabled
U1073	CAN communications system <ul style="list-style-type: none"> <li>Bus off</li> </ul>	Control disabled	Normal control	Control disabled	Control disabled
U1100	Engine CAN Timeout/Not equipped	Normal control	Normal control	Control disabled	Control disabled
U1101*	Transaxle CAN Timeout/Not equipped	Normal control	Normal control	Control disabled	Control disabled
U1120	Engine (CAN message)	Normal control	Normal control	Control disabled	Control disabled

NOTE: \*: A/T model only

**INDICATOR AND WARNING LIGHT AND THEIR OPERATION PATTERN**

<b>DTC NO.</b>	<b>INSPECTION ITEM</b>	<b>BRAKE WARNING LIGHT</b>	<b>ABS WARNING LIGHT</b>	<b>TCL INDICATOR</b>	<b>TCL OFF INDICATOR</b>
C1200 <FR> C1205 <FL> C1210 <RR> C1215 <RL>	Wheel speed sensor system <ul style="list-style-type: none"> <li>• Wheel speed sensor line break</li> <li>• Wheel speed sensor short circuit</li> </ul>	Illuminates if both of the rear wheels are affected	Illuminates	Illuminates	Illuminates
C1201 <FR> C1206 <FL> C1211 <RR> C1216 <RL>	Wheel speed sensor system <ul style="list-style-type: none"> <li>• Wheel speed sensor transmitting error</li> <li>• ABS/EBD control timing error</li> </ul>	Illuminates if both of the rear wheels are affected	Illuminates	Illuminates	Illuminates
C1226 <FR> C1236 <FL> C1246 <RR> C1256 <RL>	Inlet valve system <ul style="list-style-type: none"> <li>• Inlet valve short circuit</li> <li>• Inlet valve ON error</li> <li>• Inlet valve OFF error</li> </ul>	Illuminates	Illuminates	Illuminates	Illuminates
C1231 <FR> C1241 <FL> C1251 <RR> C1261 <RL>	Outlet valve system <ul style="list-style-type: none"> <li>• Outlet valve short circuit</li> <li>• Outlet valve ON error</li> <li>• Outlet valve OFF error</li> </ul>	Illuminates	Illuminates	Illuminates	Illuminates
C1271	Motor system <ul style="list-style-type: none"> <li>• Motor lock</li> <li>• Motor OFF error</li> <li>• Motor ON error</li> </ul>	off	Illuminates	Illuminates	Illuminates
C1276	Inlet valve system and outlet valve system <ul style="list-style-type: none"> <li>• Inlet valve system and outlet valve system internal circuit damage</li> </ul>	Illuminates	Illuminates	Illuminates	Illuminates

DTC NO.	INSPECTION ITEM	BRAKE WARNING LIGHT	ABS WARNING LIGHT	TCL INDICATOR	TCL OFF INDICATOR
C1300<FR> C1305<FR> C1310<FL> C1315<FL>	Cut valve system and suction valve system <ul style="list-style-type: none"> <li>• Cut valve and suction valve short circuit</li> <li>• Cut valve and suction valve ON error</li> <li>• Cut valve and suction valve OFF error</li> </ul>	Illuminates	Illuminates	Illuminates	Illuminates
C1607	ABS/TCL-ECU system (valve relay cannot activate)	Illuminates	Illuminates	Illuminates	Illuminates
	ABS/TCL-ECU system (valve relay can activate)	off	off	Illuminates	Illuminates
C1640	Variant Code unable to communicate/data abnormal	off	Illuminates	Illuminates	Illuminates
C1860	Electrical system <ul style="list-style-type: none"> <li>• ECU power supply or voltage problem (high voltage)</li> </ul>	Illuminates	Illuminates	Illuminates	Illuminates
C1861	Electrical system <ul style="list-style-type: none"> <li>• ECU power supply or voltage problem (low voltage)</li> </ul>	off	Illuminates	Illuminates	Illuminates
U1073	CAN communications system <ul style="list-style-type: none"> <li>• Bus off</li> </ul>	off	Illuminates	Illuminates	Illuminates
U1100	Engine CAN Timeout/Not equipped	off	off	Illuminates	Illuminates
U1101*	Transaxle CAN Timeout/Not equipped	off	off	Illuminates	Illuminates
U1120	Engine (CAN message)	off	off	Illuminates	Illuminates

NOTE: \*: A/T model only

### DIAGNOSTIC TROUBLE CODE READING PROCEDURE

The diagnostic function encompasses 30 items, and the DTCs can be read using the scan tool (Refer to Service Manual).

### DIAGNOSTIC TROUBLE CODE MEMORY ERASING PROCEDURE

Diagnostic trouble codes can be cleared from memory by using the scan tool (Refer to Service Manual).

**DATA LIST OUTPUT**

Among the ABS/TCL-ECU input data, the following items can be read by using MUT-III scan tool ABS data list.

MUT-III SCAN TOOL DISPLAY	ITEM NO.	CHECK ITEM	DISPLAY OR UNIT
FL wheel speed sensor	01	Front-left wheel speed sensor	km/h or mph
FR wheel speed sensor	02	Front-right wheel speed sensor	km/h or mph
RL wheel speed sensor	03	Rear-left wheel speed sensor	km/h or mph
RR wheel speed sensor	04	Rear-right wheel speed sensor	km/h or mph
Power supply voltage	05	ABS-ECU power supply voltage	V
Stoplight switch (input)	06	Stoplight switch	ON/OFF
TCL off switch	28	TCL off switch	ON/OFF

**ACTUATOR TEST**

Solenoid valves can be activated forcibly by using the MUT-III scan tool ABS data list.

The actuator test is suspended when the ABS/TCL system fails.

**ACTUATOR TEST SPECIFICATIONS**

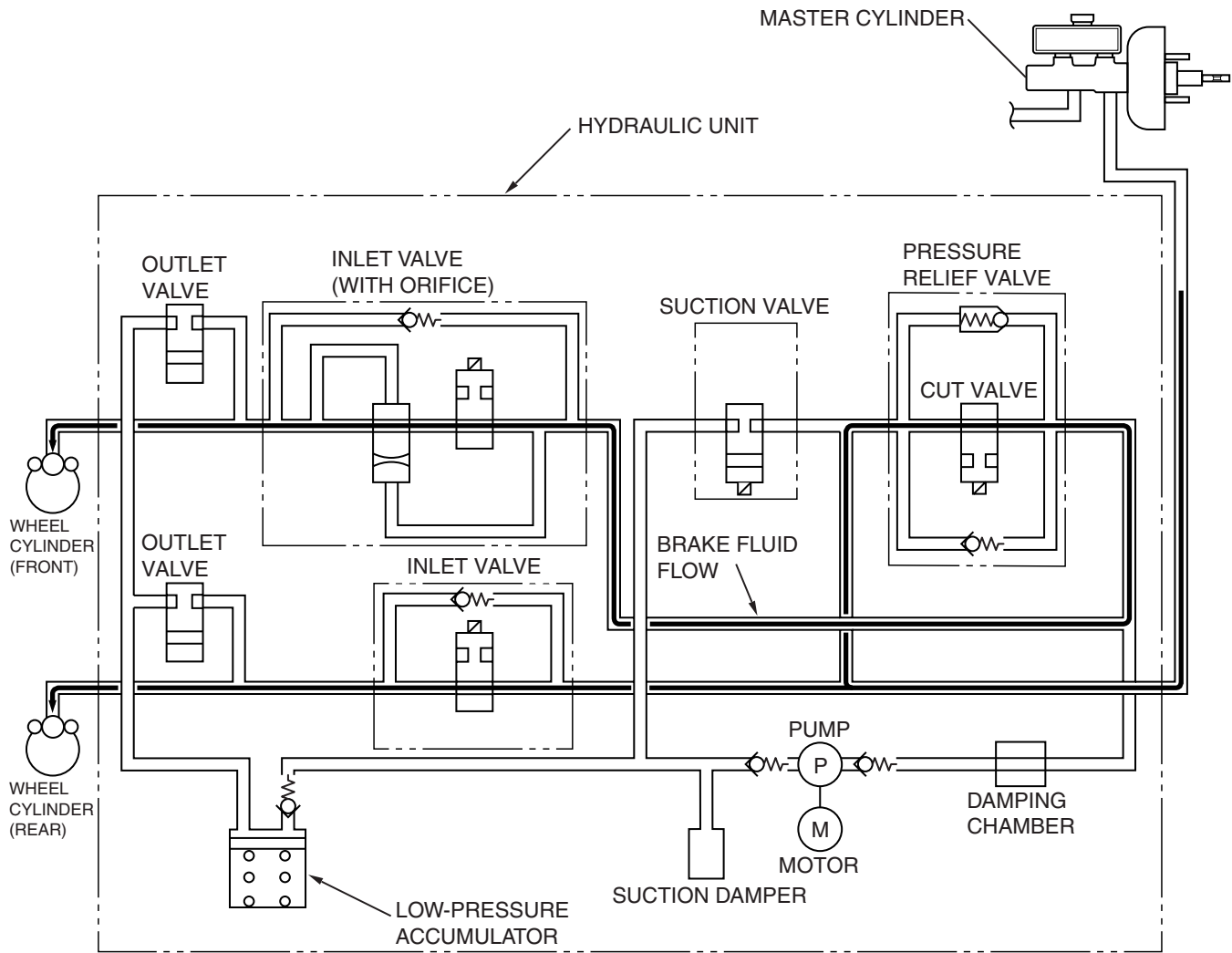
MUT-III SCAN TOOL DISPLAY	ITEM NO.	ITEM	PARTS TO BE ACTIVATED
FL wheel ABS drive	01	Solenoid valve for front-left wheel	Solenoid valves and pump motors in the hydraulic unit (simple inspection mode)
FR wheel ABS drive	02	Solenoid valve for front-right wheel	
RL wheel ABS drive	03	Solenoid valve for rear-left wheel	
RR wheel ABS drive	04	Solenoid valve for rear-right wheel	
FL wheel TCL drive	05	Solenoid valve for front-left wheel	Solenoid valves and pump motors in the hydraulic unit (simple inspection mode)
FR wheel TCL drive	06	Solenoid valve for front-right wheel	
Engine TCL Drive	09	TCL system operation check	Outputs the engine torque control signal (engine torque = 0) to ECM<M/T> or PCM<A/T> for three seconds.

## SYSTEM OPERATION

M2354000300015

The TCL/ABS-ECU receives information from the ECM<M/T> or PCM<A/T> and the wheel speed sensor. If the ECU determines that a road wheel is spinning, it will control the fluid pressure to the spinning wheel to apply torque to the other road wheels. The system also controls the engine if the accelerator pedal is depressed excessively.

WHEN BRAKE FLUID PRESSURE INCREASES DURING NORMAL BRAKING AND ABS OPERATION



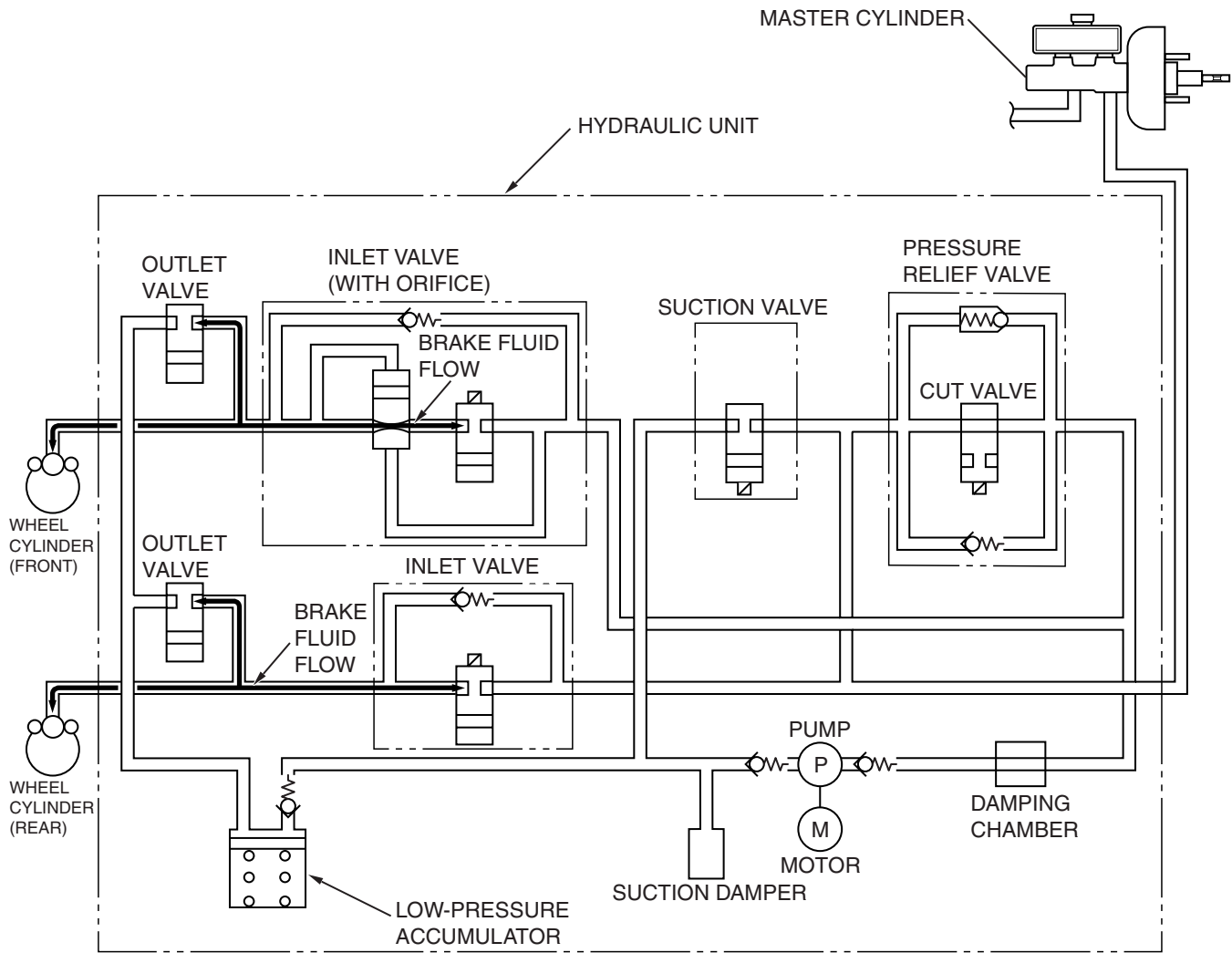
AC406950AB

The brake fluid flows from the master cylinder through the cut valve (front) and the inlet valve, increasing the brake fluid pressure in each wheel cylinder.

STATUS OF THE OPERATION VALVE

ITEM	ENERGIZATION	Open/Close
Cut valve	OFF	open
Suction valve	OFF	Closed
Inlet valve	OFF	open
Outlet valve	OFF	Closed

WHEN BRAKE FLUID PRESSURE IS HELD BY ABS



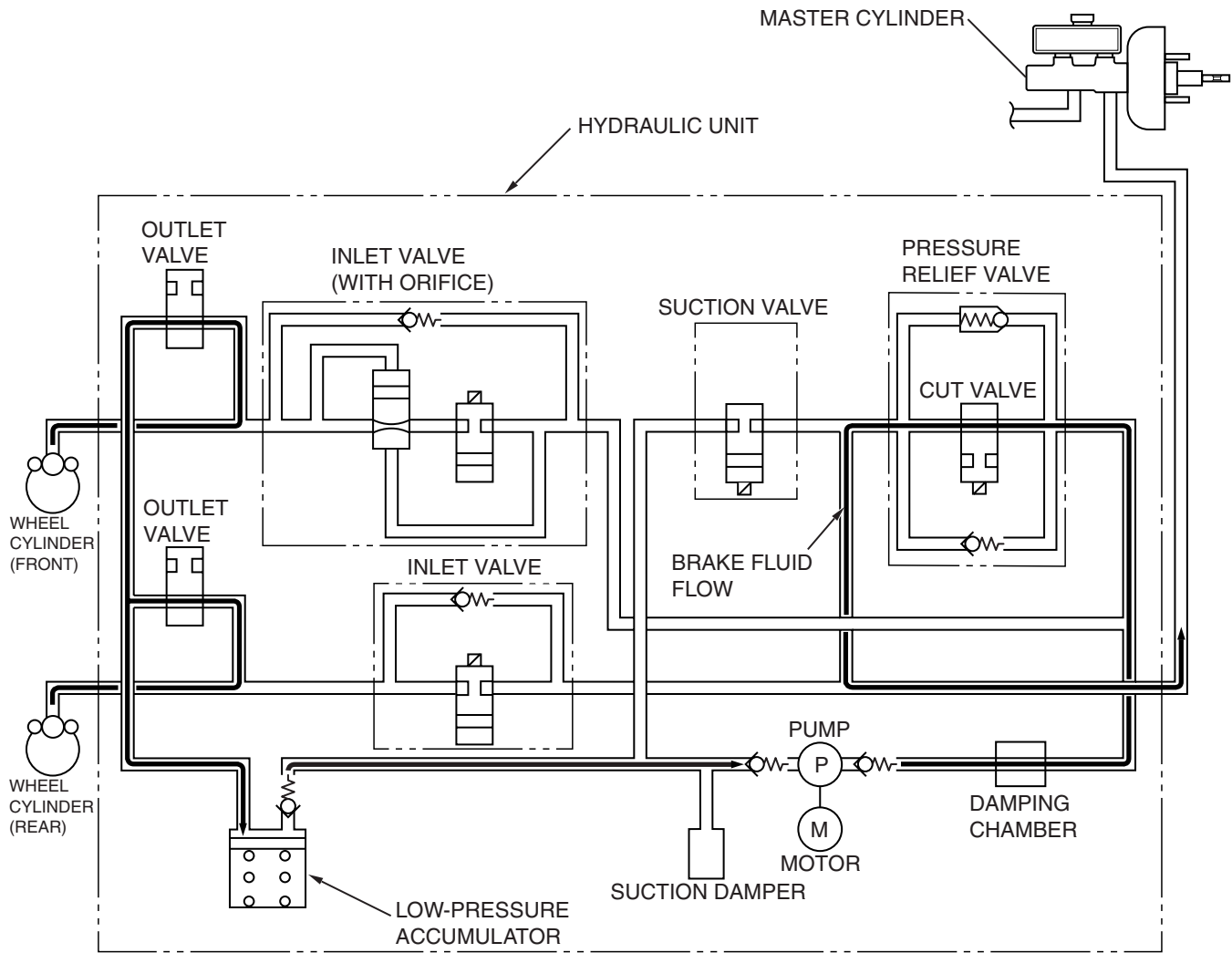
AC406967AB

The system closes the inlet valve, holding the brake fluid pressure in the wheel cylinder.

STATUS OF THE OPERATION VALVE

ITEM	ENERGIZATION	Open/Close
Cut valve	OFF	Open
Suction valve	OFF	Closed
Inlet valve	ON	Closed
Outlet valve	OFF	Closed

WHEN THE BRAKE FLUID PRESSURE IS REDUCED BY ABS



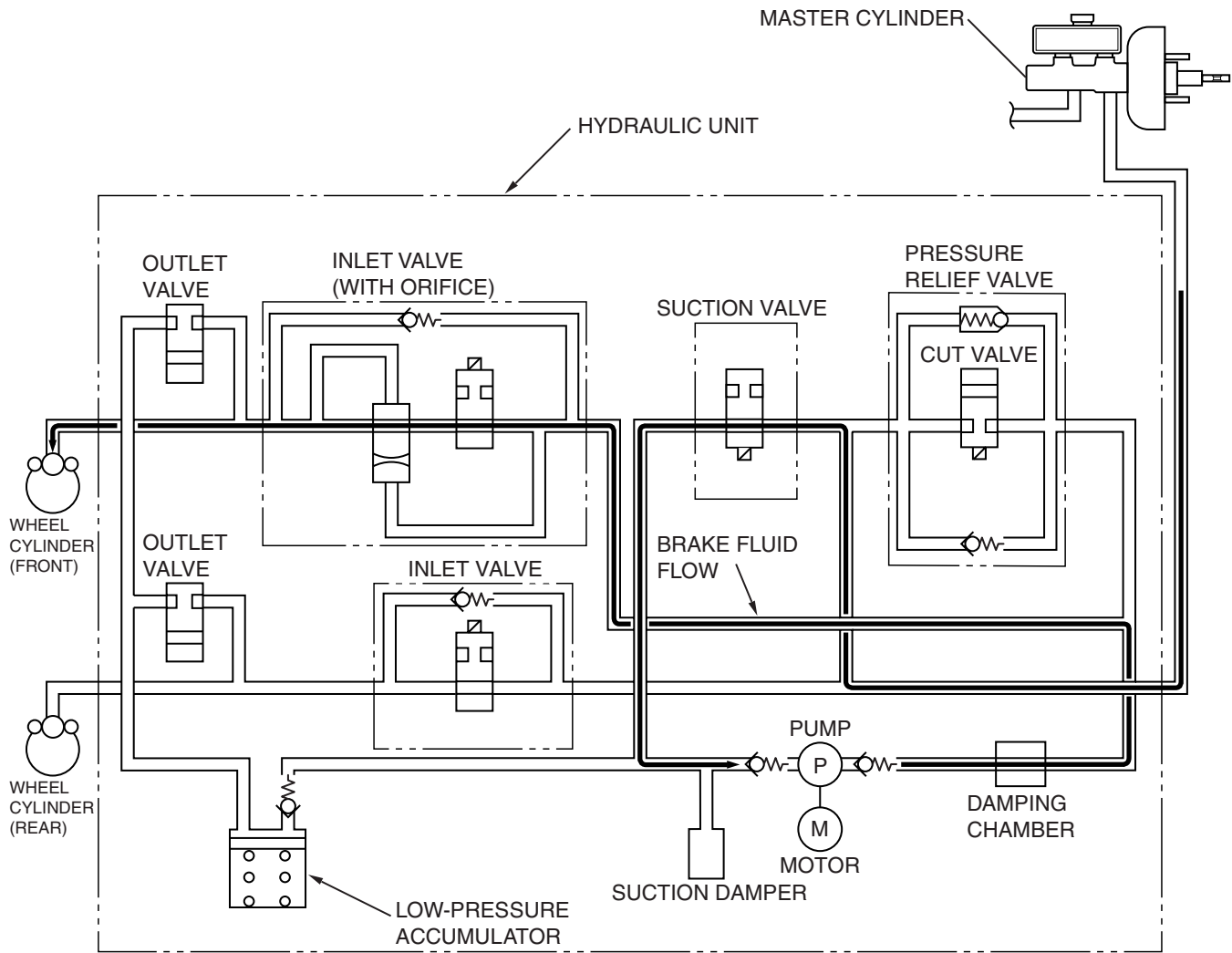
AC406969AB

The system opens the outlet valve while closing the inlet valve to reduce the brake fluid pressure in the wheel cylinder. In addition, the system operates the pump by the motor, to force the brake fluid from the wheel cylinder back to the master cylinder.

STATUS OF THE OPERATION VALVE

ITEM	ENERGIZATION	Open/Close
Cut valve	OFF	open
Suction valve	OFF	Closed
Inlet valve	ON	Closed
Outlet valve	ON	Open

WHEN BRAKE FLUID PRESSURE IS INCREASED BY TCL



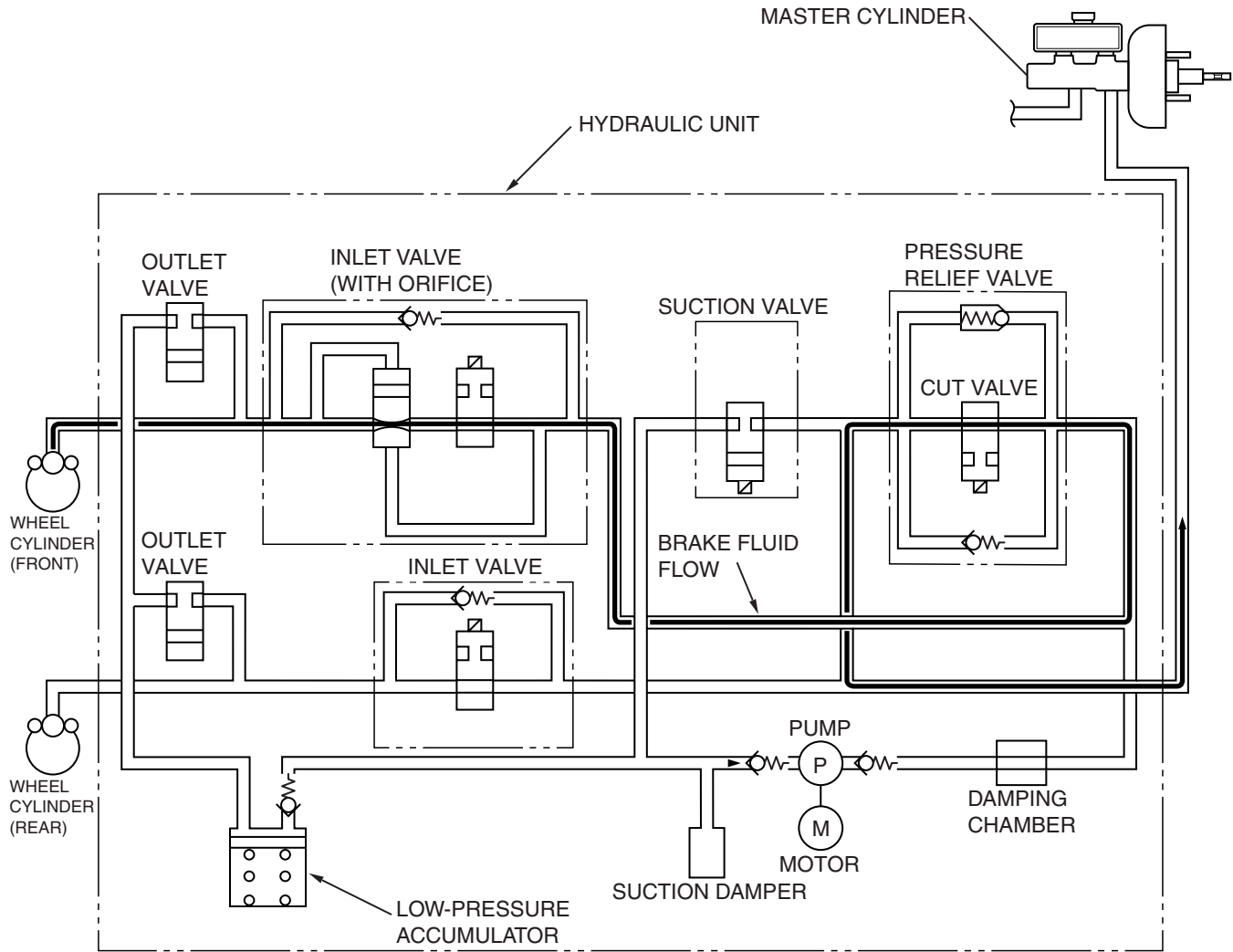
AC406978AB

The system closes the cut valve to block the passage from the pump outlet to the master cylinder, and opens the suction valve, connecting the passage from the master cylinder to the pump inlet. The brake fluid from the master cylinder is supplied to the front wheel cylinder.

**STATUS OF THE OPERATION VALVE**

ITEM	ENERGIZATION	Open/Close
Cut valve	ON	Closed
Suction valve	ON	Open
Inlet valve	OFF	Open
Outlet valve	OFF	Closed

WHEN THE BRAKE FLUID PRESSURE IS REDUCED BY TCL



AC406981AB

The system opens the inlet valve while closing the outlet valve, forcing the brake fluid in the wheel cylinder to flow back to the master cylinder.

STATUS OF THE OPERATION VALVE

ITEM	ENERGIZATION	Open/Close
Cut valve	OFF	Open
Suction valve	OFF	Closed
Inlet valve	OFF	Open
Outlet valve	OFF	Closed