# SHOP MANUAL

KOMATSU

# HD325-6
# HD405-6
# HD465-5
# HD605-5
# HD785-5

## DUMP TRUCK

| MACHINE MODEL | SERIAL NUMBER |
|---|---|
| HD325-6 | 5680 and up |
| HD405-6 | 1055 and up |
| HD465-5 | 4626 and up |
| HD605-5 | 1013 and up |
| HD785-5 | 4001 and up |

## TRANSMISSION CONTROL SYSTEM (FAIL TO RANGE)

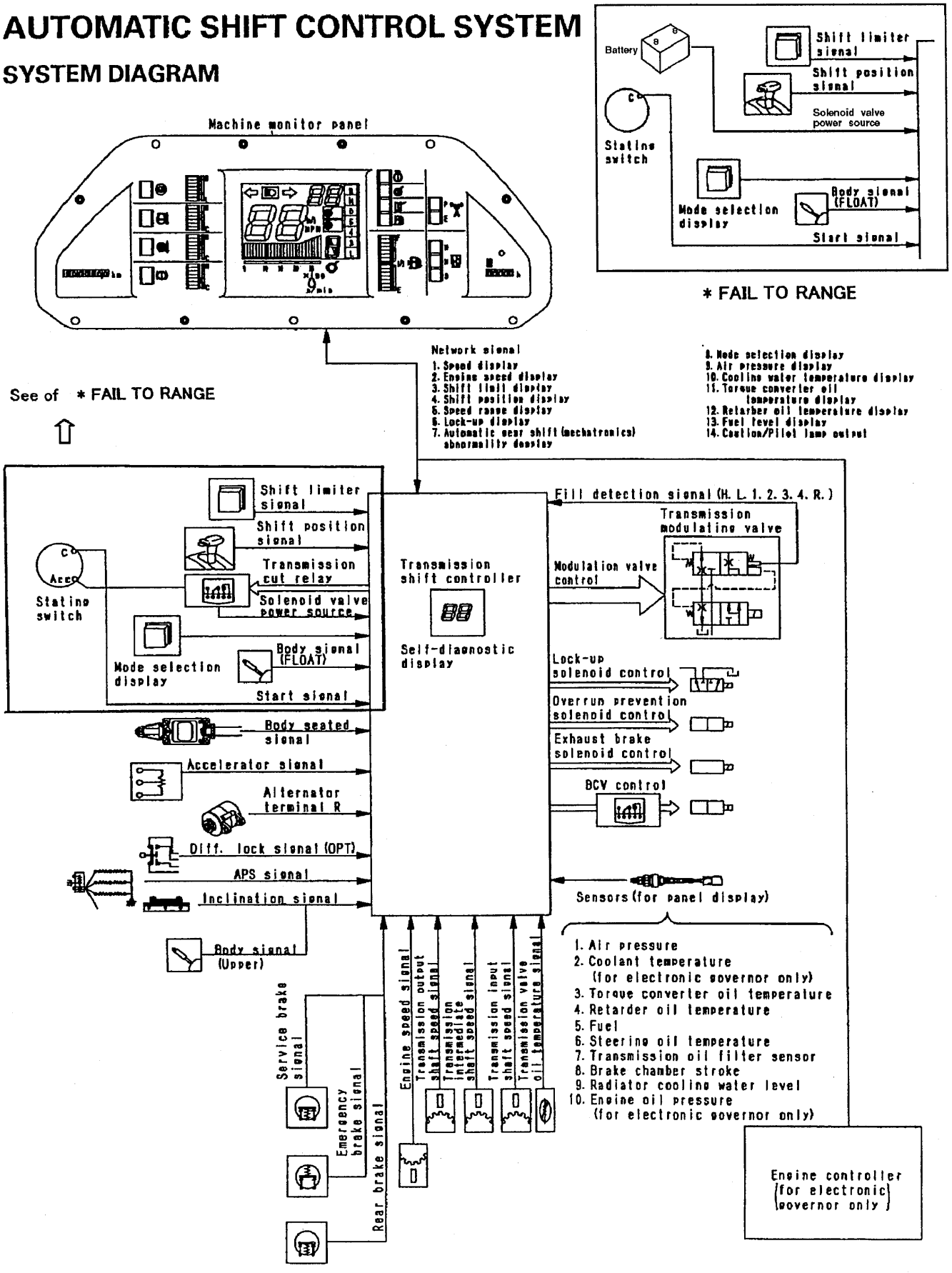
- This shop manual may contain attachments and optional equipment that are not available in your area. Please consult your local Komatsu distributor for those items you may require.
  Materials and specifications are subject to change without notice.

# CONTENTS

# 10 STRUCTURE AND FUNCTION

# AUTOMATIC SHIFT CONTROL SYSTEM

## SYSTEM DIAGRAM



## OUTLINE

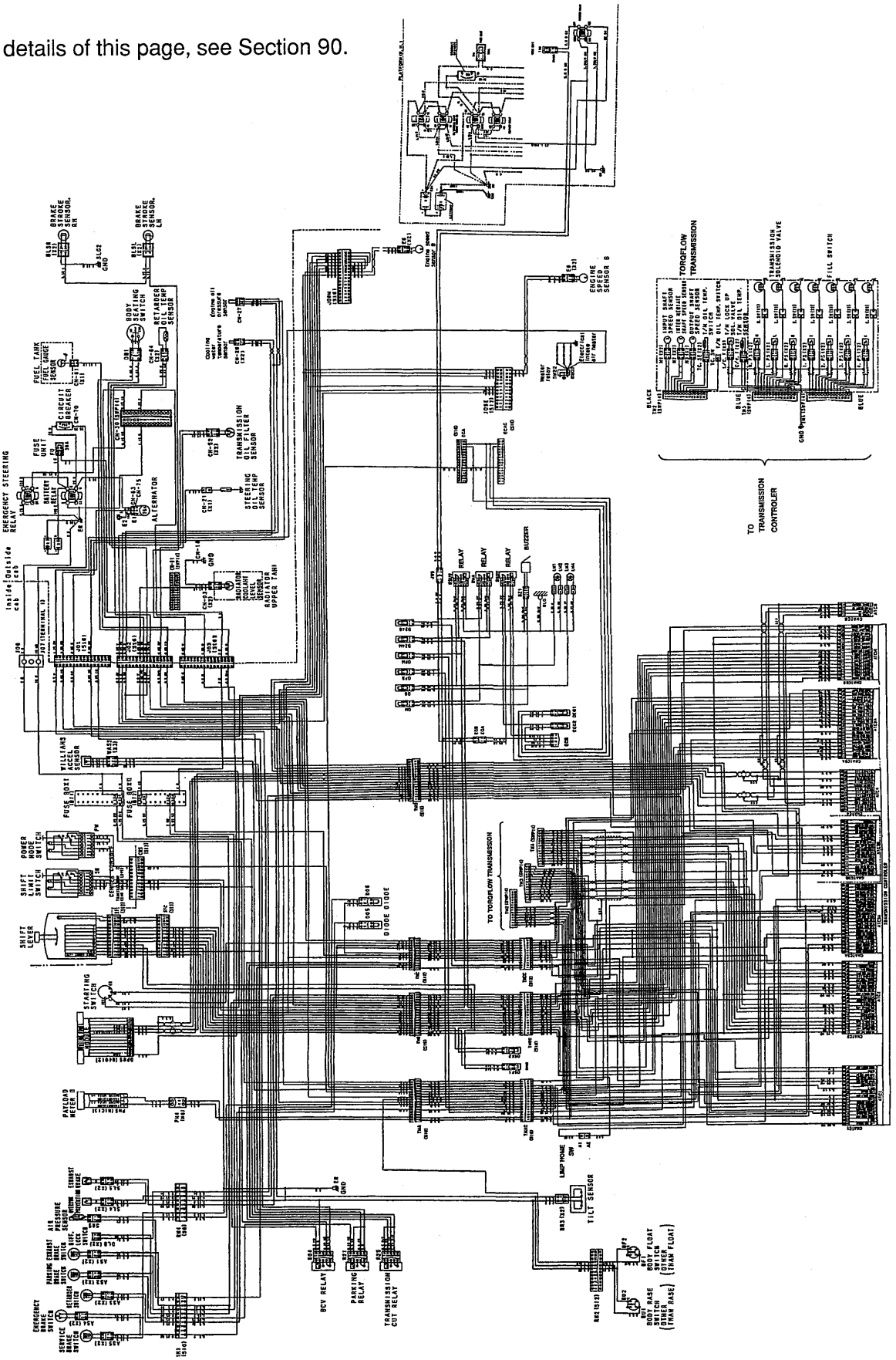
The automatic shift control system receives the shift lever position signal, accelerator pedal acceleration signal, transmission speed signal, and signals from other switches and sensors are received, and the shift controller acts to automatically control the shift of the transmission to the optimum speed range. The shift controller also drives and controls the torque converter lockup solenoid and overrun prevention solenoid valve in addition to the shift control. Each clutch in the transmission is equipped with an electronically controlled modulation valve, and each clutch is independently controlled.

In this way, the initial pressure for each clutch, build-up ratio, and torque-off time are controlled to match the condition of the machine (the hydraulic wave pattern for each clutch, each acceleration angle, each shift up, and each shift down are changed). As a result, it contributes to the reduction of shock when shifting gears, prevention of shift hunting, and improvement in the durability of the clutches.

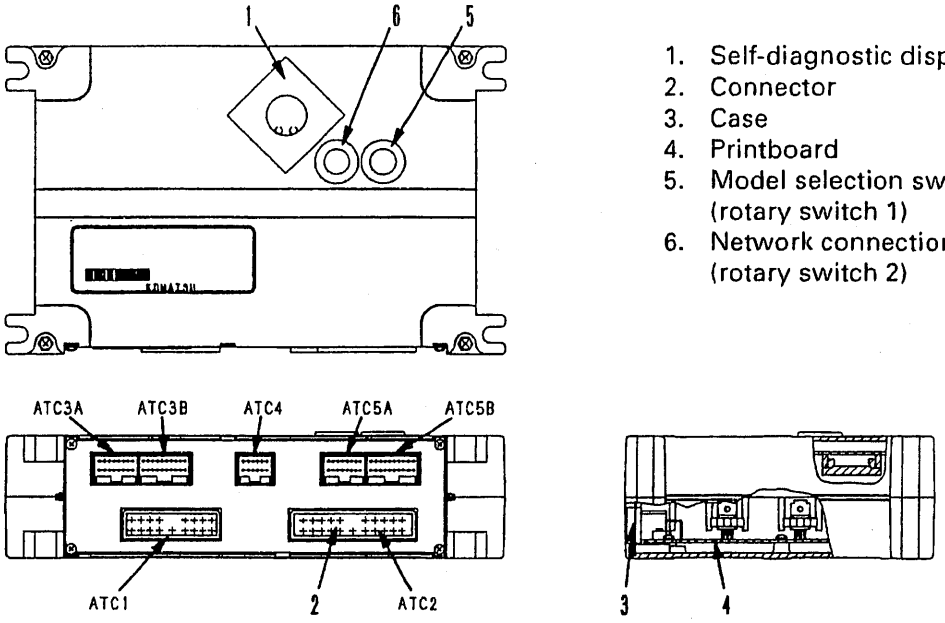
The transmission controller also receives the signals from the switches and sensors in order to drive the displays, cautions, and pilot lamps on the machine monitor panel, and sends these data to the network.

# ELECTRICAL CIRCUIT DIAGRAM FOR TRANSMISSION CONTROLLER SYSTEM

★ For details of this page, see Section 90.



## TRANSMISSION CONTROLLER




1. Self-diagnostic display window
2. Connector
3. Case
4. Printboard
5. Model selection switch (rotary switch 1)
6. Network connection switch (rotary switch 2)

SVH00511

### OUTLINE

- This transmission controller is designed to control the system, so it has a built-in computer.
  It has the following features and functions.

1. It has a high-power mode and economy mode and it changes the shift pattern. (Machines not equipped with an electronic governor have only the high-power mode.)
2. The braking mode is the mode when the brake is used. The gear shifting point is raised and the brake cooling pump speed is also increased to improve the cooling effect for the retarder. At the same time it also enables the braking force of the engine to be used effectively.
3. It drives and controls the torque converter lock-up solenoid valve, overrun prevention solenoid valve, exhaust brake solenoid valve, and BCV solenoid valve.
4. Speed sensors are located at three points (transmission input shaft, intermediate shaft, and output shaft) to make it possible to detect any slipping of the transmission clutches. It also acts to protect the transmission when there is any abnormality in the hydraulic system.
5. It is connected to the network and makes various data common with other controllers.
6. It receives the input of model selection data (what machine the controller is mounted on) and network data (what controller is connected to the network), and contacts the other controllers through the network. (For details of the method of setting, see TESTING, ADJUSTING, AND TROUBLESHOOTING.)
7. It has finely divided self-diagnostic functions for both the input and output systems.
8. The content of the self-diagnostic display is shown with 2-digit numbers.
9. When any failure is detected, it sends details to the network, and displays this on the other display panels.
10. The content of the self-diagnosis is recorded in memory, so even when the main switch is turned off it is possible to check details of failures.
11. It sends the trouble data to the network, and displays this on the other display panels.
12. The location of any existing failure is displayed on the monitor panel.
13. It has an emergency travel function for use if there is any failure in the electrical system.
14. It is located separately from the gearshift lever.

## CONNECTOR SIGNALS

### ATC1

| | | |
|---|---|---|
| | 1 | L/C SOL |
| | 2 | — |
| | 3 | — |
| | 4 | Overrun SOL (+) |
| | 5 | Exhaust brake SOL (+) |
| | 6 | AISS relay |
| | 7 | Battery direct power source |
| | 8 | GND |
| * | 9 | Main power source 24 V |
| | 10 | — |
| | 11 | BCV |
| | 12 | — |
| | 13 | Overrun SOL (–) |
| | 14 | Exhaust brake SOL (–) |
| * | 15 | — |
| | 16 | GND |
| * | 17 | Sub power source 24 V |

### ATC3A

| | |
|---|---|
| 1 | Connector check |
| 2 | Transmission input shaft speed |
| 3 | Transmission output shaft speed |
| 4 | — |
| 5 | Throttle correction |
| 6 | Potentiometer power source 5V |
| 7 | — |
| 8 | — |
| 9 | — |
| 10 | Emergency escape switch |
| 11 | Steering oil temperature |
| 12 | Transmission intermediate shaft speed |
| 13 | Engine speed |
| 14 | GND (pulse) |
| 15 | — |
| 16 | GND (analog) |
| 17 | — |
| 18 | — |
| 19 | — |
| 20 | — |

### ATC4

| | |
|---|---|
| 1 | RS422 TX (+) |
| 2 | RS422 RX (+) |
| 3 | RS232C TX |
| 4 | RS232C RX |
| 5 | RS485 (+) |
| 6 | S-NET (+) |
| 7 | RS422 TX (–) |
| 8 | FLASH switch |
| 9 | RS422 RX (–) |
| 10 | GND (serial) |
| 11 | RS485 (–) |
| 12 | S-NET (–) |

### ATC5A

| | |
|---|---|
| 1 | Connector check |
| 2 | Rear brake signal |
| 3 | Body FLOAT signal |
| 4 | Body seated signal |
| 5 | Machine tilt angle |
| 6 | Transmission filter clogging |
| 7 | — |
| 8 | Brake stroke signal |
| 9 | — |
| 10 | Fill switch L |
| 11 | Fill switch 4th |
| 12 | Fill switch H |
| 13 | Fill switch 1st |
| 14 | Fill switch 2nd |
| 15 | Fill switch 3rd |
| 16 | Fill switch R |
| 17 | — |
| 18 | Start signal |
| 19 | Emergency steering |
| 20 | Heater relay ON/OFF |

### ATC2

| | |
|---|---|
| 1 | Proportional SOL power source 24 V |
| 2 | ECMV 1st (+) |
| 3 | ECMV 3rd (+) |
| 4 | ECMV 2nd(+) |
| 5 | ECMV R (+) |
| 6 | — |
| 7 | ECMV L (+) |
| 8 | ECMV 4th (+) |
| 9 | ECMV H (+) |
| 10 | — |
| 11 | — |
| 12 | Proportional SOL power source 24 V |
| 13 | ECMV 1st, 3rd (–) |
| 14 | Sensor power source 12 V |
| 15 | ECMV 2nd, R (–) |
| 16 | — |
| 17 | ECMV L (–) |
| 18 | ECMV 4th (–) |
| 19 | ECMV H (–) |
| 20 | — |
| 21 | GND |

### ATC3A

| | |
|---|---|
| 1 | Alternator terminal R |
| 2 | Brake air pressure |
| 3 | — |
| 4 | Fuel level |
| 5 | Engine water temperature |
| 6 | — |
| 7 | Torque converter oil temperature |
| 8 | Retarder oil temperature |
| 9 | Transmission valve inlet port oil temperature |
| 10 | — |
| 11 | Accelerator angle |
| 12 | Engine oil pressure |
| 13 | — |
| 14 | — |
| 15 | Differential lock switch |
| 16 | — |

### ATC5B

| | |
|---|---|
| 1 | Exhaust brake ON/OFF |
| 2 | Shift lever R signal |
| 3 | Shift lever N signal |
| 4 | Shift lever D signal |
| 5 | Shift lever 5 signal |
| 6 | Shift lever 4 signal |
| 7 | Shift lever 3 signal |
| 8 | Shift lever L signal |
| 9 | Shift limit switch |
| 10 | Model selection 1 |
| 11 | Model selection 2 |
| 12 | Model selection 3 |
| 13 | Model selection 4 |
| 14 | Parking brake ON/OFF |
| 15 | Cooling water level |
| 16 | Mode switch |

## SELF-DIAGNOSTIC FUNCTION

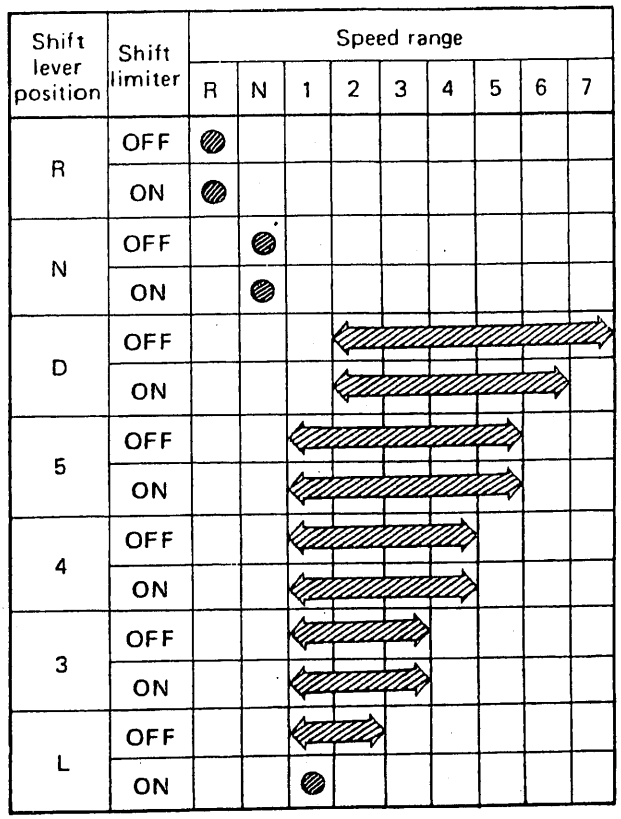
The controller carries out self-diagnosIS of the system, displays any abnormalities, and writes them to memory.

The content of the self-diagnostic display is shown with a 2- digit code by LEDs..... When any failure is detected, it sends data about the abnormality to the network, and displays the user code on the monitor panel. In some cases, the mechatronics abnormality display, warning lamp, or buzzer may be actuated.

* : FAIL TO RANGE

## SHIFT LEVER POSITIONS AND AUTOMATIC GEAR SHIFTING RANGES

The automatic gear shifting ranges for each position of the gearf shift lever are as shown in the table below.




**Characteristics of gear shifting**
The shifting up or down of the transmission is carried out according to the shift map stored in the memory of the controller.
There are three types of shift map according to the condition of the input signals (for machines mounting an engine with mechanical governor, there are two types, excluding economy mode). The settings for each mode are as shown in the following table.

| Mode | Setting conditions |
|---|---|
| Braking mode | When either of the following conditions are satisfied.<br>1. Rear brake signal ON (foot brake, retarder, or emergency brake applied)<br>2. Accelerator pedal released. |
| High-power mode | When the following three conditions are satisfied.<br>1. Rear brake signal OFF (foot brake, retarder, or emergency brake not applied)<br>2. Accelerator pedal depressed.<br>3. Economy mode switch off |
| Economy mode (only machine equipped with electronic governor) | When the following three conditions are satisfied.<br>1. Rear brake signal OFF (foot brake, retarder, or emergency brake not applied)<br>2. Accelerator pedal depressed.<br>3. Economy mode switch off |

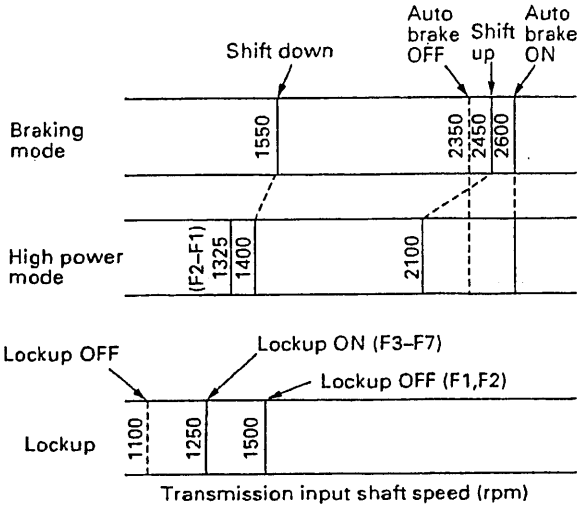
**Braking mode:**
The shift-down point and shift-up point are both raised, and the engine speed is kept higher to ensure the amount of oil for retarder cooling, and to increase the effect of using the engine as a brake.

**High-power mode:**
The mode is aimed at providing maximum production by using the machines power to its utmost limit. However, when the machine load is light (high acceleration), such as when the machine is traveling empty, the machine acceleration is detected and the gear is shifted up early to improve the acceleration. It uses an acceleration sensing shift point to improve fuel consumption, noise, and shock when shifting gear.

**Economy mode: (only machine equipped with electronic governor)**
When the machine is being used under light load, such as when traveling empty or when traveling on flat ground, the shift-up point and shift-down point are made lower to keep the engine speed low, thereby improving fuel consumption, noise, and shock when shifting gear. In this mode, the engine output is kept to 85% of the maximum engine output.

## AUTOMATIC GEAR SHIFTING LINE GRAPH

- The shift up/shift down points, torque converter lock-up ON/OFF points, and automatic brake ON/OFF points in each mode are as seen in the chart below.




**Note:**

1. In high power mode, the shift down point from F2 to F1 is 1325 rpm.
2. Lock-up
   - The lock-up is not actuated when traveling in reverse.
   - When reducing speed naturally (releasing the accelerator pedal but not applying the brake), the lock-up remains ON up to F4, but at F3 or below, the lock-up remains OFF.
   - When the accelerator pedal is released and the machine starts to travel downhill, the lock-up is not engaged until the accelerator pedal is depressed or the brake is applied.

**Automatic shifting method**

(1) Shift lever at D position

When shifting up (in high power mode)

i) If the shift lever is set to the D position, the transmission enters the F2 torque converter range.

ii) When the accelerator pedal is depressed, the engine speed rises and the machine accelerates. If the transmission input shaft speed reaches 1500 rpm, the lock-up clutch is engaged and the torque converter is directly connected to give direct travel.

iii) If the speed increases further, and the engine speed reaches 2,100 rpm, the transmission shifts up to F3.
At the shift-up point, the lock-up clutch is automatically disengaged momentarily to reduce the transmission shock.

iv) Immediately after shifting up, the engine speed will drop, but as the machine accelerates, it will rise again. In the same way as in Step iii) above, the transmission will shift up to F4 - F7 in turn.

When shifting down (in high power mode)

v) When the load increases and the engine speed drops below 1,400 rpm, the speed range is reduced by one level.
(For example, when traveling in F6, the transmission is shifted down to F5.)

ii) If the machine decelerates further, the speed range will be shifted down in turn to F2. If the engine speed goes down to 1,200 rpm in F2, the torque converter lock-up clutch is disengaged and the transmission shifts to torque converter drive.

★ The set speeds and actuation conditions in the above explanation may differ according to the travel conditions. For details, see the Automatic gearshifting chart.

(2) Shift lever at 5, 4, 3, or L position
These positions give an automatic shift range from F1 to F5 (F4, F3, or F2). The method for automatic shifting is the same as when the shift lever is at the **D** position.
(3) Shift lever at **R** position
This is the position for traveling in reverse. The lockup is not actuated.
The safety functions when traveling in reverse are the FORWARD/REVERSE inhibit and REVERSE safety, and if the operation is not correct, the transmission is held in neutral
(4) Shift lever at **N** position
This is the neutral position. None of the clutches in the transmission are actuated.

**Gearshifting time lag**
In the automatic shift range, to prevent any misoperation caused by excessive change in the rotating speed when shifting gear, there is a gearshifting time lag, and the transmission will not shift during this time.
The length of the gearshifting time lag is controlled by the individual electronically controlled modulation system, which controls each gearshifting pattern in fine detail.
The following table gives an outline of the gearshifting pattern and the gearshifting time lag.

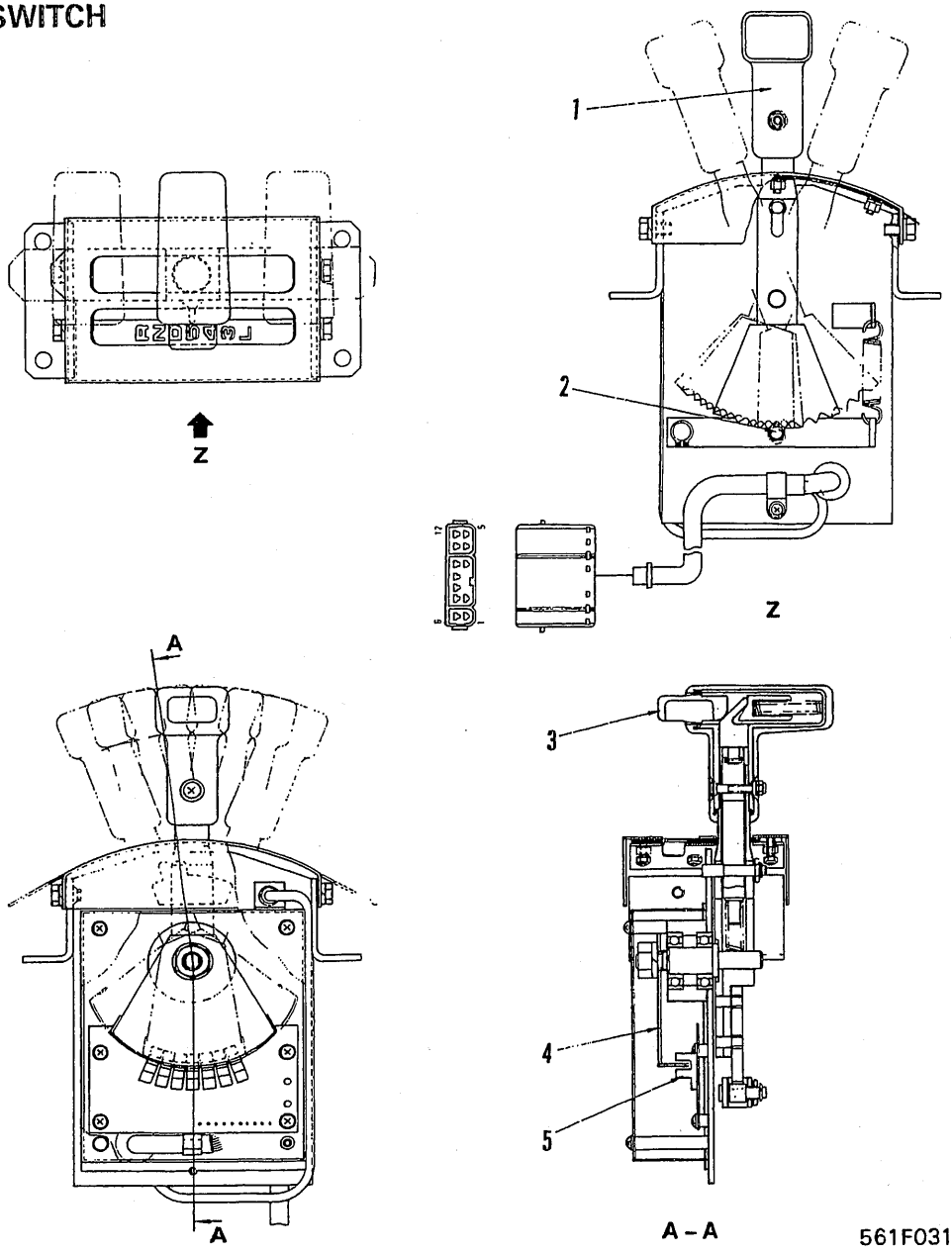
| Geashifiting pattern | Geashifiting Time lag (sec) | Example geashifiting ( ▨ :geashifiting time lag) |
|---|---|---|
| Shift up → Shift up | 0.2 | F3→F4 F4→F5 (short) |
| Shift up → Shift down | 2.55 | F3→F4 F4→F3 (long) |
| Shift down → Shift down | 0.2 | F5→F4 F4→F3 (short) |
| Shift down → Shift up | 2.55 | F5→F4 F4→F5 (long) |

* **Parking brake locking function**
When the parking brake or the emergency brake is being activated (parking state), the speed range will be compulsorily set to the neutral position regardless where the shift lever is being set to and the neutral state will be maintained until the shift lever is set to the **N** position.

**Safety functions**
1) Down-shift inhibitor function
When the gear shift lever is operated during travel from D to 5 — L, from 5 to 3 — L, from 4 to L, or from 3 to L:
For example, when traveling at position **D** (F7), and the shift lever is moved to position 5, the transmission is not shifted directly from F7 to F5. It is shifted down F7 to F6 to F5 in turn according to the engine speed.
(The engine overrun prevention circuit prevents the transmission from shifting down two gears at a time when the operator shifts down too far by mistake.)
2) Neutral safety function
If the shift lever is in any position other than **N**, this circuit prevents the engine from starting even when the key switch is turned to the START position.
(The safety circuit prevents the machine from moving off by mistake when the engine is started.)
3) FORWARD/REVERSE inhibitor function
When the machine is traveling forward at more than 4 km/h, the transmission will not enter in the **R** position by mistake.
(This improves durability and reliability by preventing any excess load on the power train.)
4) Rear brake function to prevent overrun of power train
If the engine speed goes above 2,500 rpm, the central warning lamp flashes and the alarm buzzer sounds.
If the engine speed goes above 2,600 rpm, the rear brake is automatically applied.
(This is to prevent overrun of the engine, torque converter, and transmission, and to improve the durability and reliability.)
5) REVERSE safety
The machine will not travel in reverse if the dump lever is not at FLOAT. (Roll-over prevention function)
6) Speed range limit with dump body raised
If the dump body is not seated properly, such as when it has not been fully lowered after dumping the load, the shift-up function is restricted: when the shift lever is at **D**, the machine will start in F2; when the shift lever is at 5, 4, 3, or L, the machine will start in F1. The transmission will not shift up until the dump body is properly seated.

* : FAIL TO RANGE

## SHIFT LEVER SWITCH




1. Lever
2. Detent
3. Lock button
4. Screening plate
5. Photo interruptor

**FUNCTION**

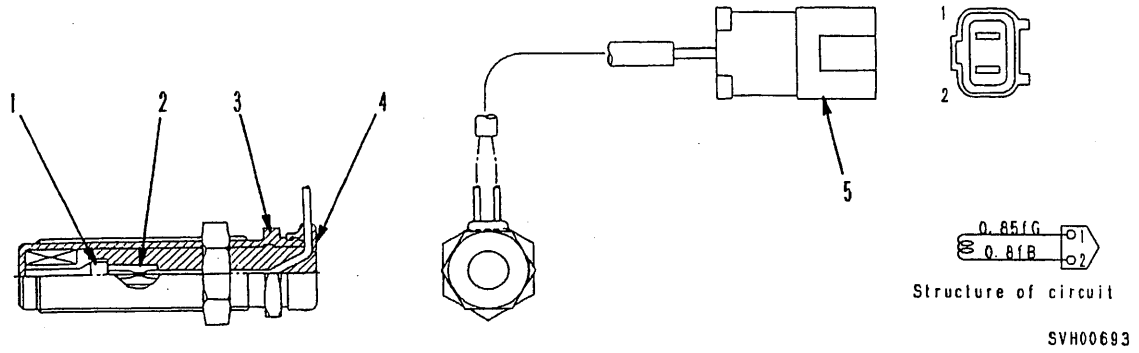
When the operator moves the lever to select the travel conditions, such as FORWARD or REVERSE, electric signal is sent to the shift controller. The lever position is displayed on the indicator (with night lighting) to the left of the shift lever.

The shift position is also displayed on the monitor panel.

In addition, to prevent mistaken operation, the gear shift lever is fitted with a lock button.

## SENSORS, SWITCHES

### ENGINE SPEED SENSOR
### TRANSMISSION SPEED SENSOR

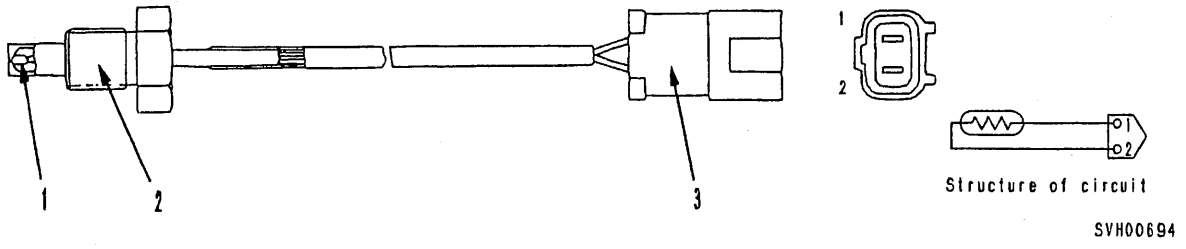



1. Magnet
2. Terminal
3. Case
4. Boot
5. Connector

**FUNCTION**

- The engine speed sensor is installed to the ring gear of the flywheel housing. When the gear teeth rotate, a pulse voltage is generated and the engine speed sensor sends a signal to the shift controller.
- The transmission speed sensor is installed to the transmission input, intermediate, and output gears. When the gear teeth rotate, a pulse voltage is generated and the transmission speed sensor sends a signal to the shift controller.

### TRANSMISSION OIL TEMPERATURE SENSOR

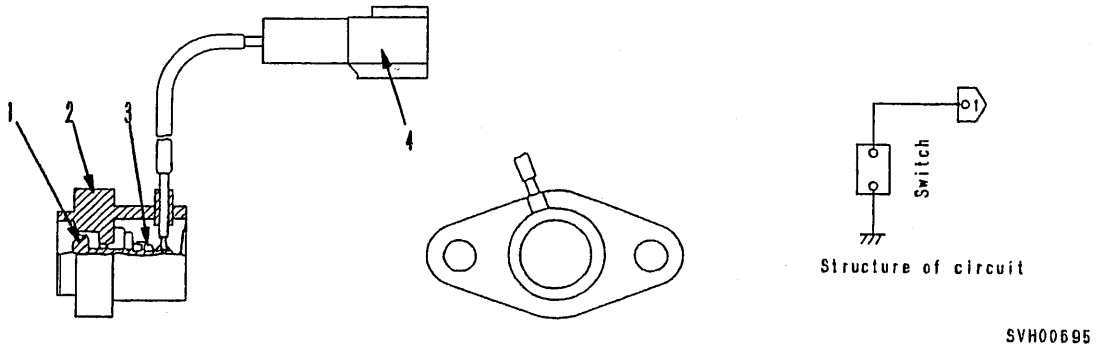



1. Thermistor
2. Body
3. Connector

**FUNCTION**

This sensor is installed to the transmission filter, and the change in temperature is taken as a change in resistance in the thermistor, and the signal is sent to the shift controller.

## FILL SWITCH

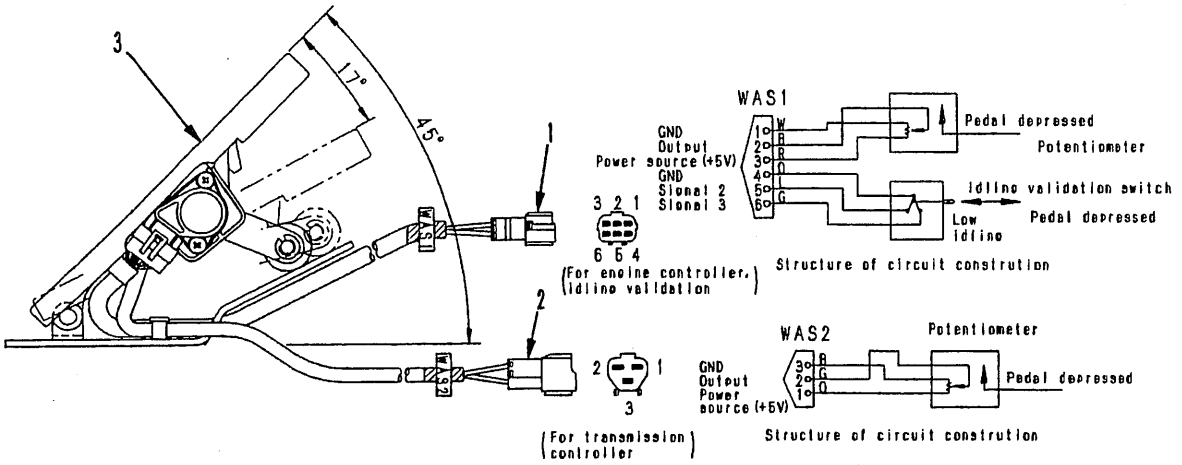



1. Terminal
2. Case
3. Nut
4. Connector

**FUNCTION**

This switch is installed to the side face at the flow sensor vavle end of the ECMV. When the clutch is engaged, the end face of the spool contacts the terminal of the switch and turns the switch ON. The fill completed signal is then sent to the shift controller.

## ACCELERATOR SENSOR



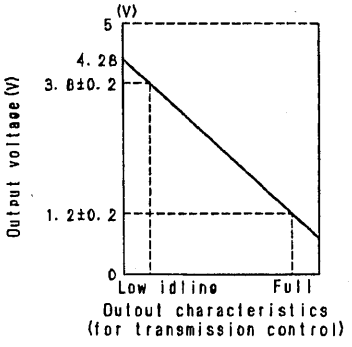

1. Connector
2. Connector
3. Pedal

SVH00696

### OUTLINE

**Accelerator signal**

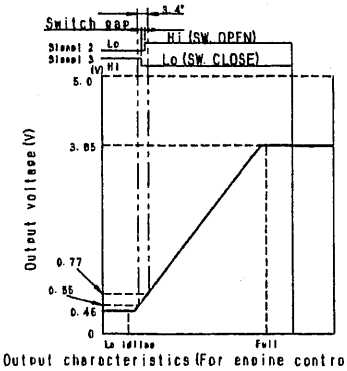
- This is installed under the operator's cab. The accelerator pedal and accelerator sensor are connected by a link. When the accelerator pedal is depressed, the movement is passed through the link and rotates the shaft of the potentiometer inside the accelerator sensor. As a result, the resistance changes. A fixed voltage is impressed between the No. 1 - 3 pins of the potentiometer. A voltage signal corresponding to the angle of the accelerator pedal is sent from the No. 2 pin to the transmission controller.




SVH00697

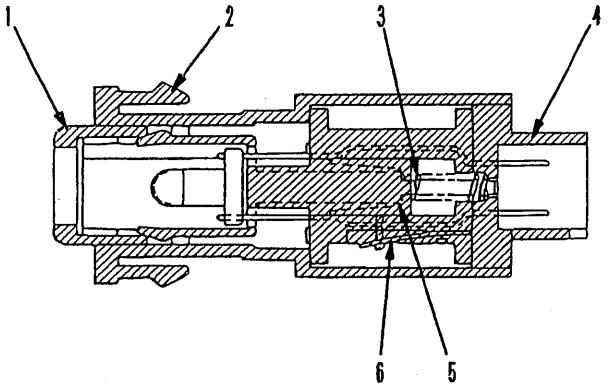
**Idling validation signal**

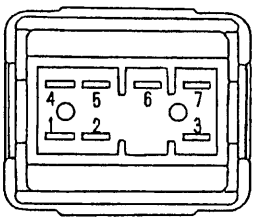
- This is installed under the operator's cab. When the accelerator pedal is released, signal 2 (No. 5 pin) is connected to the ground; when the accelerator pedal is depressed, signal 3 (No. 6 pin) is connected to the ground. The engine controller then detects the condition.




SVH00698

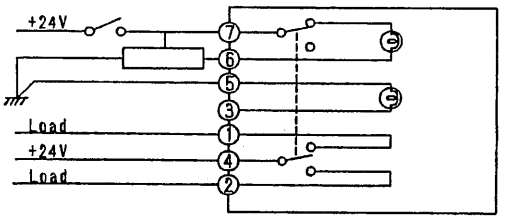
## SHIFT LIMIT SWITCH
## MODE SELECTOR SWITCH




Layout of terminals

★ The shift limiter switch and mode selector switch differ only in the color of the actuaion display lamp.
Shift limiter switch:Red
Mode selection switch:Green




Structure of circuit SVH00699

1. Knob
2. Body
3. Spring
4. Connector
5. Spring
6. Spring

**OUTLINE**

**Shift limit switch**

- This switch is installed at the rear of the shift lever switch. When the shift lever is in the **D** or **L** range, it controls the speed ranges that are covered by automatic gear shifting.
  This switch is very effective if used when going downhill or when working in jobsites where there are speed limits.

**Mode selector switch**

- This switch is installed on the top surface of the console, and it is used to change the output characteristics of the engine and the gear shifting map of the transmission to match the setting of the course and the conditions of the jobsite.

# 20 TESTING AND ADJUSTING

# TESTING AND ADJUSTING PARKING BRAKE PERFORMANCE

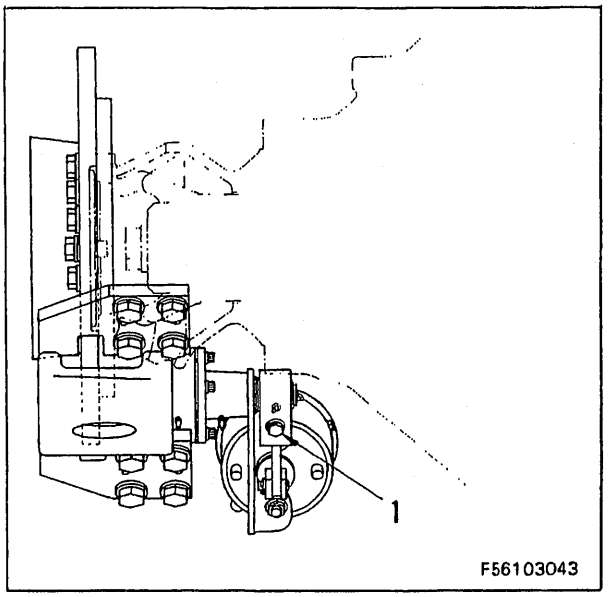
* **1. Testing by starting machine (when unloaded)**

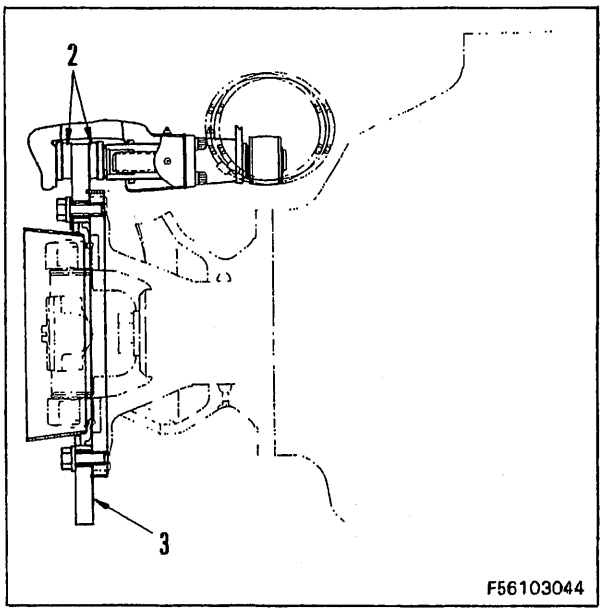
1) Stop the machine on level ground and apply the parking brake.
2) Raise the air pressure to the specified pressure.
3) Watching the shift indicator indication on the monitor panel, move the transmission shift lever in the sequence of **N→D→N→D→N→D→N** within 5 seconds.
4) Check and make sure if the transmission shift lever can be set to the **D (F2)** position. When it cannot be set to **F2**, repeat the operation according to the above Paragraph 3).
5) Raise the engine speed gradually and measure the engine speed when the machine starts to move.
   - ★ When the machine starts to move, release the accelerator pedal, and depress the brake pedal and return transmission shift lever to **N** at the same time.
   - ★ If the engine speed at the point where the machine starts to move is less than 1,430 rpm, adjust the parking brake as follows.
   - ★ When the parking brake is released (traveling state) or when the starting key is tuned off, the machine will go back to the original state, and unless the procedures according to the above Paragraph 3) are followed, the speed range will be compulsorily set to the neutral position when the parking brake is activated.

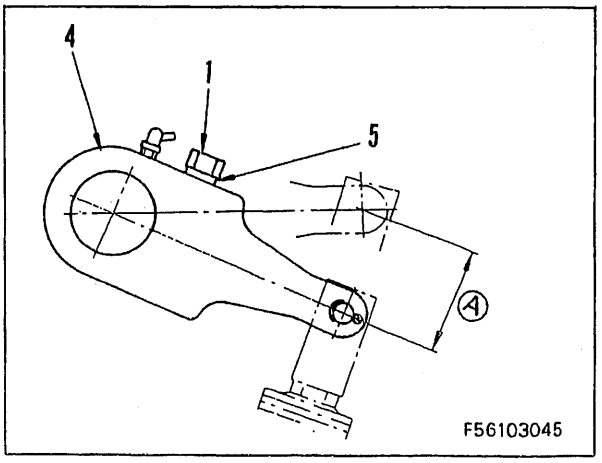
**2. Adjusting**

1) Turn bolt (1) clock wise to bring both pads (2) into close contact with disc (3).
   - ★ Push in bolt retainer ① of slack adjuster (4) until the bolt can turn, then turn bolt (5) clockwise.
2) Turn bolt (1) back from this position counterclockwise 360° ± 15°.
   - ★ Standard clearance:
     Total for both clearances: 1.88 ± 0.08 mm
   - ★ After adjusting the clearances, actuation stroke Ⓐ of the rod is approx. 50 mm.
   - ★ After adjusting, return bolt (1) to a position where it stops bolt (5) from turning.

* : FAIL TO RANGE



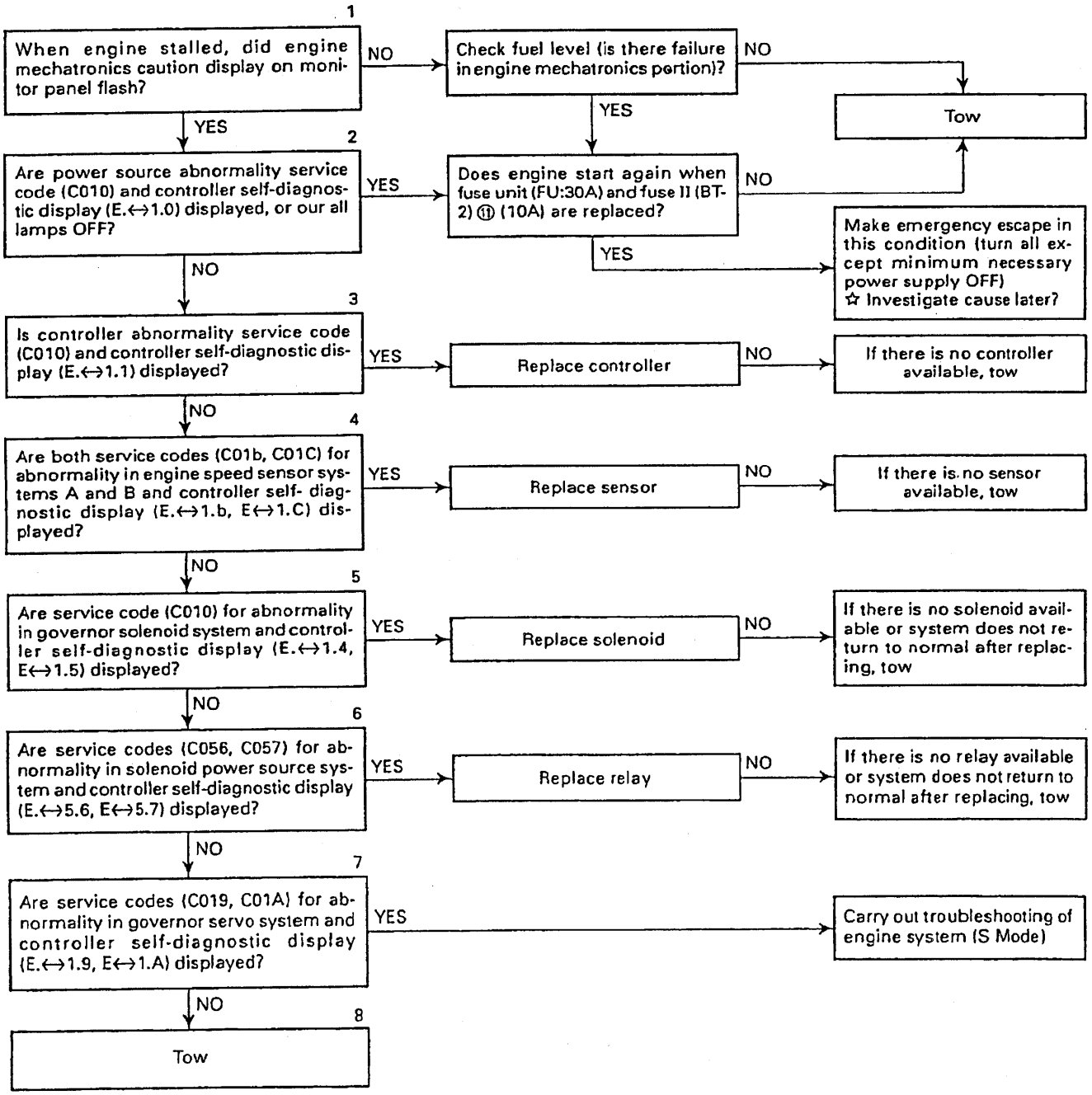



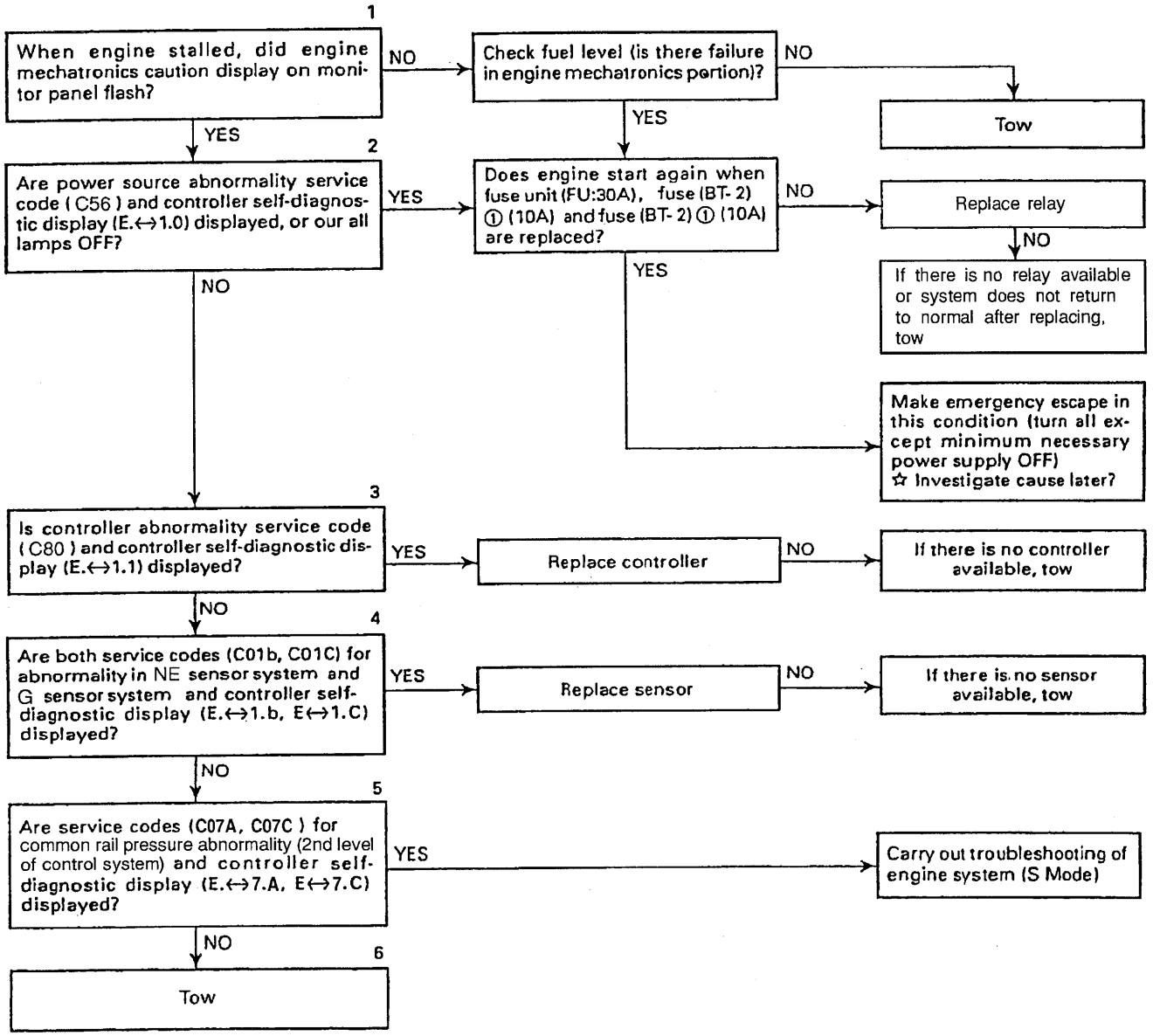
# METHOD FOR EMERGENCY ESCAPE WHEN THERE IS FAILURE IN ELECTRICAL SYSTEM

1. **Need for emergency escape**
   The following explains the action to take if it becomes impossible to drive the machine.
   If it becomes impossible to drive the machine, and a serious failure has occurred in the engine control or transmission control system, it is necessary to carry out repairs.
   Use the procedure in this section to move the machine to a safe place in order to carry out repairs.
2. **Self-diagnostic display and emergency escape method**
   1) Engine control system
      a) If the engine stops when the machine is traveling and cannot be started again, use the flowchart below to decide the method for emergency escape.

      **HD325-6 : Serial No. 5680 - 6000, HD405-6 : Serial No. 1055 - 2000**
      **HD456-5 : Serial No. 4626 and up, HD605-5 : Serial No. 1013 and up**
      **HD785-5 : Serial No. 4001 and up**



**HD325-6 : Serial No. 6001 and up**
**HD405-6 : Serial No. 2001 and up**




b) When the starting switch is turned ON, if the automatic shift (mechatronics related) abnormality display is flashing or the shift position display does not light up, or if any other abnormality occurs and the engine does not start, the engine can be started by taking the following action.
(With this procedure, the engine will start even when the shift lever is not at the N position, so be careful when starting.)

2) Transmission control system
- If the transmission suddenly returns to neutral when the machine is traveling and the machine does not move again, use the table below to decide the method for emergency escape. (If failure No. 2 occurs when the machine is traveling and the machine does not move again, do not stop the engine, but use the table below to carry out the method for emergency escape.)
- When emergency escape is carried out using method No. 1 or No. 2, the shift indicator display [E] on the machine monitor panel and the transmission shift range will be displayed in turn.
- If the emergency escape cannot be performed when carrying out the re-starting operation after taking the necessary action, the machine must be towed.

| No. | Emergency escape method | | Condition when failure occurs | Service code |
|---|---|---|---|---|
| 1. | Stop the machine, move the gearshift lever to the neutral position, then operate the lever to start the machine again.<br>(N → D.5 - 3.L or N → R)<br>Note: Remove your foot from your accelerator pedal when operating the lever. | | • Speed range remains fixed, and when machine is started again, it does not change from speed range in use when machine stopped.<br>(Returns to neutral when lever is at N.) | b010<br>b011<br>b012 |
| | | | | b052<br>b053 |
| | | | | b054<br>b055<br>b056<br>b057<br>b058 |
| | | | | b060<br>b061<br>b062<br>b071 |
| | | * | • Either one of the following trouble phenomenon ①, ② or ③ will occur depending on the combination of the traveling speed range, occurring trouble type and location of the defective clutch. | b022<br>b023 |
| | | | | b032<br>b033 |
| | | | ① In case the traveling speed ranges are effective, speed range remains fixed, and when machine is started again, it does not change from speed range in use when machine stopped.<br>(Returns to neutral when lever is at N.) | b034<br>b035<br>b036<br>b037<br>b038 |
| | | | | b042<br>b043 |
| | | | ② If the phenomenon is not according to the above Paragraph ① and in case higher traveling speed ranges than the currently traveling speed range are effective, the speed range comes up and speed range remains fixed, and when machine is started again, it does not change from speed range in use when machine stopped.<br>(Returns to neutral when lever is at N.) | b044<br>b045<br>b046<br>b047 |
| | | | | b048 |
| | | | | b072<br>b073 |
| | | | ③ If the phenomenon is not according to the above Paragraphs ① and ② and when the speed range abruptly goes into the neutral position while the machine is in travel. | b074<br>b075<br>b076<br>b077 |
| | | | | b078 |

* : FAIL TO RANGE

- If there are multiple occurrences of abnormality No. 2, the combination of failures may make it impossible to carry out the escape even when using the emergency escape method in the table below. In such cases, do as follows.
  (1) For past failures in the transmission that have already been reset, delete the failure (for details of deleting the failure, see MONITOR PANEL USER CODE AND SERVICE MODE FUNCTIONS), then carry out the escape operation again.
  (2) If it is still impossible to escape using the procedure in Step (1) above, or there is an error which cannot be restored, it is necessary to tow the machine.

| Transmission controller □.□ service code is 2 digits or less (controller LED display) | User code | Speed range for starting after performing emergency escape operation (combination of clutches) |
|---|---|---|
| 1.0 Disconnection in engine shaft speed sensor system | 02 | 1.0: Operate lever N → R and start off in R, or operate lever N → D.5 - 3.L and start off in F2 |
| 1.1 Disconnection in transmission input shaft speed sensor system | 02 | 1.1: Operate lever N → R and start off in R, or operate lever N → D.5 - 3.L and start off in F2 |
| 1.2 Disconnection in transmission intermediate shaft speed sensor system | 02 | 1.2: Operate lever N → R and start off in R, or operate lever N → D.5 - 3.L and start off in F2 |
| 5.2 Failure in flow detection valve for H clutch | 02 | 5.2: Operate lever N → R and start off in equivalent of R (R, High), or operate lever N → D.5 - 3.L and start off in equivalent of F2 |
| 5.3 Failure in flow detection valve for L clutch | 02 | 5.3: Operate lever N → R, or operate lever N → D.5 - 3.L and start off in F2 |
| 5.4 Failure in flow detection valve for 1st clutch | 02 | 5.4: Operate lever N → D.5 - 3.L and start off in F1 |
| 5.5 Failure in flow detection valve for 2nd clutch | 02 | 5.5: Operate lever N → D.5 - 3.L and start off in F2 |
| 5.6 Failure in flow detection valve for 3rd clutch | 02 | 5.6: Operate lever N → D.5 - 3.L and start off in F4 |
| 5.7 Failure in flow detection valve for 4th clutch | 02 | 5.7: Operate lever N → D.5 - 3.L and start off in F6 |
| 5.8 Failure in flow detection valve for R clutch | 02 | 5.8: Operate lever N → R and start off in R |
| 6.0 Failure in engine speed sensor | 02 | 6.0: Operate lever N → R and start off in R, or operate lever N → D.5 - 3.L and start off in F2 |
| 6.1 Failure in transmission input shaft speed sensor system | 02 | 6.1: Operate lever N → R and start off in R, or operate lever N → D.5 - 3.L and start off in F2 |
| 6.2 Failure in transmission intermediate shaft speed sensor system | 02 | 6.2: Operate lever N → R and start off in R, or operate lever N → D.5 - 3.L and start off in F2 |
| 2.2 Failure in H clutch system | 02 | 2.2: Operate lever N → R and start off in R, or operate lever N → D.5 - 3.L and start off in F2 |
| 2.3 Failure in L clutch system | 02 | 2.3: Operate lever N → R and start off in equivalent of R (R, High), or operate lever N → D.5 - 3.L and start off in equivalent of F2 (1st ← High) |
| 3.2 Failure 1 in pressure control valve for H clutch | 02 | 3.2: Operate lever N → R and start off in equivalent of R (R ← High), or operate lever N → D.5 - 3.L and start off in equivalent of F2 (1st ← High) |
| 3.3 Failure 1 in pressure control valve for L clutch | 02 | 3.3: Operate lever N → R and start off in R, or operate lever N → D.5 - 3.L and start off in F2 |
| 3.4 Failure 1 in pressure control valve for 1st clutch | 02 | 3.4: Operate lever N → D.5 - 3.L and start off in F1 |
| 3.5 Failure 1 in pressure control valve for 2nd clutch | 02 | 3.5: Operate lever N → D.5 - 3.L and start off in F2 |
| 3.6 Failure 1 in pressure control valve for 3rd clutch | 02 | 3.6: Operate lever N → D.5 - 3.L and start off in F4 |
| 3.7 Failure 1 in pressure control valve for 4th clutch | 02 | 3.7: Operate lever N → D.5 - 3.L and start off in F6 |
| 3.8 Failure 1 in pressure control valve for R clutch | 02 | 3.8: Operate lever N → R and start off in R |
| 4.2 Failure 2 in pressure control valve for H clutch | 02 | 4.2: Operate lever N → R and start off in R, or operate lever N → D.5 - 3.L and start off in F2 |
| 4.3 Failure 2 in pressure control valve for L clutch | 02 | 4.3: Operate lever N → R and start off in equivalent of R (R → High), or operate lever N → D.5 - 3.L and start off in equivalent of F2 (1st ← High) |
| 4.4 Failure 2 in pressure control valve for 1st clutch | 02 | 4.4: Operate lever N → R and start off in R, or operate lever N → D.5 - 3.L and start off in F2 |
| 4.5 Failure 2 in pressure control valve for 2nd clutch | 02 | 4.5: Operate lever N → R and start off in R, or operate lever N → D.5 - 3.L and start off in F1 |
| 4.6 Failure 2 in pressure control valve for 3rd clutch | 02 | 4.6: Operate lever N → R and start off in R, or operate lever N → D.5 - 3.L and start off in F2 |
| 4.7 Failure 2 in pressure control valve for 4th clutch | 02 | 4.7: Operate lever N → R and start off in R, or operate lever N → D.5 - 3.L and start off in F2 |

| Transmission controller □.□ service code is 2 digits or less (controller LED display) | User code | Speed range for starting after performing emergency escape operation (combination of clutches) |
|---|---|---|
| 4.8 Failure 2 in pressure control valve for R clutch | 02 | 4.8: Operate lever N → D.5 - 3.L and start off in F2 |
| 7.1 Short circuit in lock-up solenoid output circuit | 02 | 7.1: Operate lever N → R and start off in R, or operate lever N → D.5 - 3.L and start off in F2 |
| 7.2 Short circuit in H clutch solenoid output circuit | 02 | 7.2: Operate lever N → R and start off in R, or operate lever N → D.5 - 3.L and start off in F2 |
| 7.3 Short circuit in L clutch solenoid output circuit | 02 | 7.3: Operate lever N → R and start off in equivalent of R (R → High), or operate lever N → D.5 - 3.L and start off in equivalent of F2 (1st ← High) |
| 7.4 Short circuit in 1st clutch solenoid output circuit | 02 | 7.4: Operate lever N → R and start off in R, or operate lever N → D.5 - 3.L and start off in F2 |
| 7.5 Short circuit in 2nd clutch solenoid output circuit | 02 | 7.5: Operate lever N → R and start off in R, or operate lever N → D.5 - 3.L and start off in F1 |
| 7.6 Short circuit in 3rd clutch solenoid output circuit | 02 | 7.6: Operate lever N → R and start off in R, or operate lever N → D.5 - 3.L and start off in F2 |
| 7.7 Short circuit in 4th clutch solenoid output circuit | 02 | 7.7: Operate lever N → R and start off in R, or operate lever N → D.5 - 3.L and start off in F2 |
| 7.8 Short circuit in R clutch solenoid output circuit | 02 | 7.8: Operate lever N → D.5 - 3.L and start off in F2 |

| | No. | Emergency escape method | Condition when failure occurs | Service |
|---|---|---|---|---|
| | 2. | Stop the machine, move the gearshift lever to the neutral position, then remove and insert the emergency escape connectors (A1, A2). (Leave the starting switch ON.)<br>After doing this, operate the lever to start the machine again. (N → D5 - 3.L or N → R)<br>Note: Remove your foot from your accelerator pedal when operating the lever. | • Speed range remains fixed and when machine is started again, it does not change from speed range in use when machine stopped. (Returns to neutral when lever is at N, but remains in neutral.) | b013<br>b063 |
| | | | • Suddenly returned to neutral when machine was traveling<br>• After machine stops, transmission remains in neutral even when lever is operated, and machine does not start | b024<br>b025<br>b026<br>b027 |
| | | | | b028 |
| | 3. | Check for blown fuse (BT2 (R) 30A), check circuit breaker, or replace controller | | – –<br>b001 |
| * | 4. | Use modulation checker | • Speed range remains fixed and when machine is started again, it does not change from speed range in use when machine stopped. (Returns to neutral when lever is at N, but remains in neutral.)<br>• Although the speed range indication remains the same as when the machine was traveling, the torque goes away. (Comes into the neutral state.) | b002 |
| | | | • Even when the shift lever is moved, the lever signal before the trouble has occurred remains as is. | b007<br>b016 |
| | | | • Depending on the defective lever signal and the lever position, the speed range goes into the neutral state or the lever signal changes. | b015 |
| | | | • After machine stops, transmission remains in neutral even when lever is operated, and machine does not start | b014<br>b0A1<br>b0C1 |
| | 5. | Tow | • Suddenly returned to neutral when machine was traveling<br>• After machine stops, transmission remains in neutral even when lever is operated, and machine does not start | b005 |

* : FAIL TO RANGE

| Transmission controller □.□ service code is 2 digits or less (controller LED display) | User code | Speed range for starting after performing emergency escape operation (combination of clutches) |
|---|---|---|
| 1.3 Disconnection in transmission output shaft speed sensor system<br>6.3 Failure in transmission output shaft speed sensor system | 02<br>02 | 1.3: Operate lever N → R and start off in R, or operate lever N → D.5 - 3.L and start off in F2<br>6.3: Operate lever N → R and start off in R, or operate lever N → D.5 - 3.L and start off in F2 |
| 2.4 Failure in 1st clutch system<br>2.5 Failure in 2nd clutch system<br>2.6 Failure in 3rd clutch system<br>2.7 Failure in 4th clutch system | 02<br>02<br>02<br>02 | 2.4: Operate lever N → R and start off in R, or operate lever N → D.5 - 3.L and start off in F2<br>2.5: Operate lever N → R and start off in R, or operate lever N → D.5 - 3.L and start off in F1<br>2.6: Operate lever N → R and start off in R, or operate lever N → D.5 - 3.L and start off in F2<br>2.7: Operate lever N → R and start off in R, or operate lever N → D.5 - 3.L and start off in F2 |
| 2.8 Failure in R clutch system | 02 | 2.8: Operate lever N → D.5 - 3.L and start off in F2 |
| □.□ Abnormality in power source voltage or failure in controller<br>0.1 Drop in power source voltage | --<br>04 | Normal travel possible in R, F1 - F7 if controller returns to normal display<br>(After 0.1 failure is reset, stays in neutral until lever is returned to N) |
| 0.2 Abnormality in solenoid power source system | 04 | |
| 0.7 Failure in 12V output system<br>1.5 Failure A in lever signal system<br>1.6 Failure B in lever signal system | 04<br>02<br>02 | Travel possible in desired speed range using modulation checker (but auto lock-up does not work) |
| 1.4 Failure in machine model selection signal system<br>A.1 Abnormality in machine model selection<br>B.1 Abnormality in connector connection | 04<br>02<br>02 | |
| 0.5 Double meshing detected | 04 | |

# TROUBLESHOOTING

# SELF-DIAGNOSTIC DISPLAY METHOD FOR MONITOR PANEL AND CONTROLLERS

★ For details of the display on the monitor panel, see Monitor panel user code and service mode function.

## 1. MONITOR PANEL

After the starting switch is turned ON, the monitor itself carries out self-diagnosis. After that, it goes to the normal display.

Check the bulbs of the pilot and caution lamps by pressing the switch at the right edge of the panel.

★ For details of the service codes, see SERVICE CODE TABLE.

## 2. TRANSMISSION CONTROLLER

### 1) Self-diagnostic display, warning display

The content of the self-diagnosis and warning is displayed by a 2-digit LED code.

.... If any abnormality is detected during self-diagnosis, the abnormality occurrence data is sent to the network and the user code is displayed on the monitor panel. The mechatronics abnormality display on the monitor panel may also light up and the warning lamp and buzzer may also be actuated.

.... The warning display is the detection of failures in the pilot lamp display sensor systems and warnings and warning actuations. If problems are detected, the warning lamp and buzzer may also be actuated.

**Self-diagnostic display code table**

| Abnormal system | Display code | Re-enaction | Actuation of controller |
|---|---|---|---|
| Defective controller power source system | ⊔⊔<br>0.1, d.A<br>0.2, d.b | □ | ◬ |
| Neutral safety | 0.3 | □ | △ |
| * Double engagement for clutch | ⊔⊔<br>0.5 | | ▲ |
| Defective rear brake solenoid system | 0.8 | | ◬ |
| Defective exhaust brake solenoid system | 0.9 | ▣ | ◬ |
| Defective BCV rear solenoid system | C.4, C.6, C.8 | □ | ◬ |
| Defective engine speed sensor system | 1.0, 6.0 | ■ | ◬ |
| Defective transmission input shaft speed sensor system | 1.1, 6.1 | □ | ◬ |
| Defective transmission intermediate shaft speed sensor system | 1.2, 6.2 | ▣ | ◬ |
| Defective transmission output shaft speed sensor system | 1.3, 6.3 | □ | ◬ |
| Clutch slipping or defective speed sensor system | 2. □← 2 - 8 | ▣ | ▲ |
| Defective model selection signal system | 1.4, A.1 | □ | ◭ |
| Defective shift lever system | 0.7<br>1.5<br>1.6 | ◧ | ◬ |
| Defective accelerator sensor system | 1.7 | □ | ◬ |
| Defective transmission valve oil temperature sensor system | 1.9 | □ | ◬ |
| Defective pressure control valve system | 3. □← 2 - 8<br>4. □← 2 - 8 | ▣ | ▲ |
| Defective oil flow control valve system | 5. □← 2 - 8 | ▣ | ◬ |
| Defective pressure control solenoid system | 7. □← 1 - 8<br>9. □← 1 - 8 | ▣ | ◭<br>◬ |
| * Defective monitor panel display sensor system | A.2, A.3<br>b.3, b.4 | □ | ○ |
| Mistaken connector connection | C.1 | □ | ◭ |



* : FAIL TO RANGE

**Warning display table**

| | Abnormal system | Display code | Re-enaction | Actuation of controller |
|---|---|---|---|---|
| * | Pilot lamp warning | | | |
| | Transmission filter clogging | d.1 | — (□) | ○ |
| | Tilt warning | d.5 | — (□) | ○ |
| | Drop in radiator water level | d.6 | — (□) | ○ |
| | Battery charge | d.7 | — (□) | ○ |
| | Steering oil level (overheating) | E.5 | — (□) | ○ |
| | Drop in rear brake oil pressure | F.6 | — (□) | ○ |
| * | Actuation warning | | | |
| | Engine overrun actuated | d.8 | — | ○ |
| | Engine overrun short circuit actuated | d.9 | — | ○ |
| * | Overheat warning | | | |
| | Torque converter oil temperature | d.2 | — | ○ |
| | Retarder oil temperature | F.3 | — | ○ |
| * | Pressure drop warning | | | |
| | Drop in air pressure | E.9 | — | ○ |

**Explanation of symbols:** [ ] ← 1 – 8: indicates that there are display patterns from 1 to 8 that appear in the [ ] portion.

1 : Lock-up clutch related parts
2 : H clutch related parts
3 : L clutch related parts
4 : 1st clutch related parts
5 : 2nd clutch related parts
6 : 3rd clutch related parts
7 : 4th clutch related
8 : R clutch related parts
␣ : Blank (no display)

★ See the next page for explanation of the symbols used in the controller actuation column.

* : FAIL TO RANGE

- **Method of re-enacting failure display**
  Using the following procedure, it is possible to re-enact the abnormality display and carry out inspection.

  □ System: Turn the starting switch OFF → ON.

  ◧ System: Turn the starting switch OFF → ON, and operate the lever slowly in turn to N, R, N, D, 5, 4, 3, L. (Stop for at least 3 seconds at each position, then go to the next position.)

  ■ System: Set the lever to N and start the engine.

  ▣ System: Use the clutch specified in the failure display (set to the speed range using that clutch) and carry out a travel test.

| Display | | Applicable clutch | Speed range |
|---|---|---|---|
| Either 7 or 9 (inside [ ]) | □.1 | Lock-up clutch | L/U |
| One of 2, 3, 4, 5, 7, 9 (inside [ ]) | □.2 | H clutch | F3, F5, F7 |
| | □.3 | L clutch | F1, F2, F4, F6 |
| | □.4 | 1st clutch | F1 |
| | □.5 | 2nd clutch | F2, F3 |
| | □.6 | 3rd clutch | F4, F5 |
| | □.7 | 4th clutch | F6, F7 |
| | □.8 | R clutch | R |
| | 1.2 | — (intermediate shaft sensor) | F2 |

  ▣ System: Apply exhaust brake during travel test. (When traveling in lock-up, operate the brake with the accelerator released)

  (□) System: System: If there is a failure in the sensor system, turn the starting switch OFF → ON.

* • **Operation of controller when abnormality is detected**
  If an abnormality is detected, the transmission controller displays the failure and carries out the following action.

  △ System: Transmission neutral — there is a failure in the power source or controller, so the transmission is set to neutral.

  ◭ System: Transmission neutral or hold or shift-up — the electrical system on the machine and the controller may be broken, so the controller automatically turns off or holds or shifts up the output,but when lever is at N, N is held.

  ▲ System: Transmission shift-up or neutral — there is probably a failure in the hydraulic or mechanical system, so to avoid fatal damage to the transmission, the controller automatically turns off or shifts up the output.

  ◬ System: Speed range held, but when lever is at N, N is held ------- because of the abnormal condition, the controller judges that it is impossible to shift gear, so it holds the speed range.

  ◬ System: Travel possible, but some functions stopped ---------- the controller automatically stops the functions in the abnormal system.

  ○ System: Travel possible ---------- the controller works normally.

* : FAIL TO RANGE

2) **Actuation mode display**
The transmission controller always displays if the transmission is being controlled in the normal temperature mode or in the low temperature mode.

**Actuation mode display**

| | When normal | When abnormality is detected |
|---|---|---|
| Normal temperature mode | 0.0 | After E. ⊔ is displayed, code is displayed to show abnormality |
| Normal temperature mode | 0.C | After E.C is displayed, code is displayed to show abnormality |

3) **Saving self-diagnostic display to memory**
Once an abnormality is detected, even if the abnormality is removed, the self-diagnostic display remains displayed for 5 minutes.
(However, the user code display on the monitor panel, the mechatronics abnormality display, warning lamp, and buzzer stop when the abnormality is removed.)

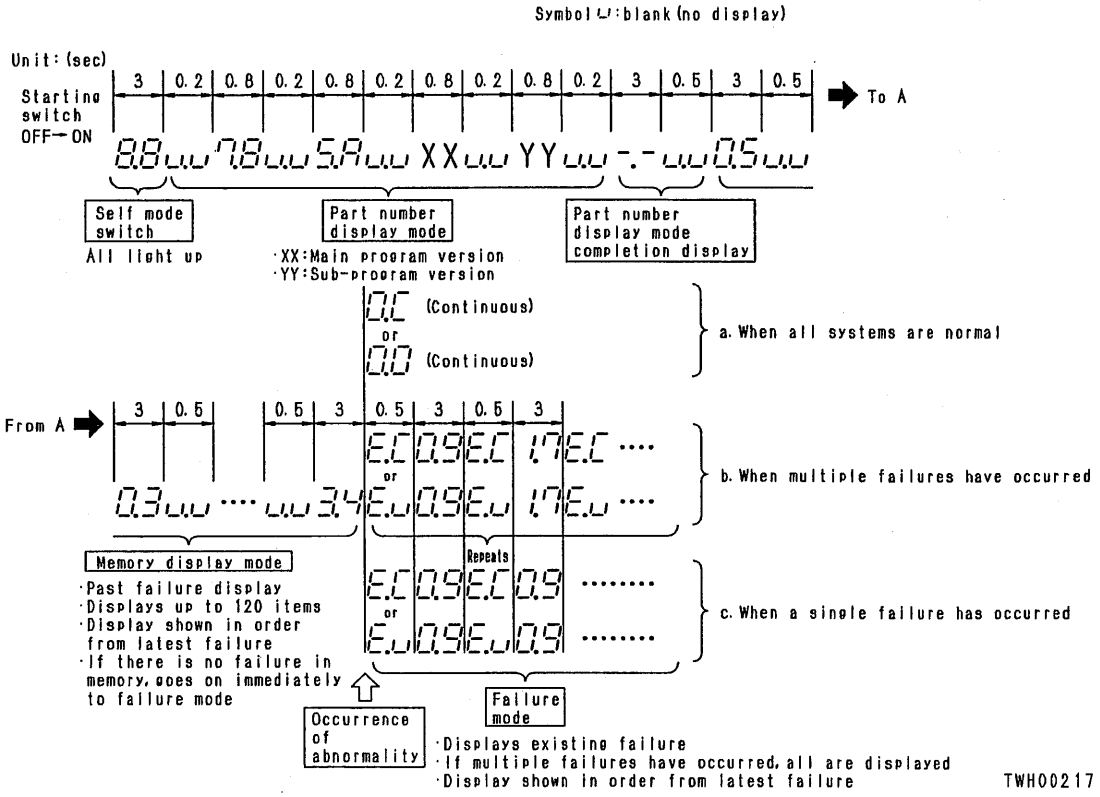
- Even when two or more failures occur at the same time, all the abnormality occurrence data are transmitted to the network and the self-diagnostic display is given.
  Display method: The code display starts with the abnormalities that have occurred in order, and after completing the display of the content of all the abnormalities, the display returns to the first code display.
  It continues to repeat this order. (If the abnormality is corrected, it returns to the normal display 5 minutes after the abnormality is corrected.)

4) **Saving service code to memory**

The transmission controller has a function to save the service code, time of occurrence (service data) and number of occurrences to memory, and keep them in memory even after the starting switch is turned OFF.

When the starting switch is turned ON, it is possible to check the details of the abnormalities that have occurred up to that point with the trouble data display mode of the monitor panel service function and the controller LEDs.

**Method of saving and displaying service code (transmission controller LED display)**




To make full use of the memory function to clearly display when the failure occurred and what failures have already been corrected, keep strictly to the procedure given below.

- **Deleting service code from memory**

For details of the method of deletion, see Method of deleting trouble data from memory (page 20-151).

Carry out troubleshooting, and when the failure has been corrected and the self-diagnostic display has returned to normal, delete the transmission controller service codes from memory.

Turn the starting switch OFF, then turn it ON again, and check that the past failures in memory have been deleted.

For details, see MONITOR PANEL USER CODES AND SERVICE MODE FUNCTION, Section 3.3-6 Method of deleting trouble data from memory (page 20-151).

(If the data have been deleted, 8.8 is displayed for 3 seconds, then the display shows the part number, and after 3.5 seconds, the display returns to the normal display of 0.0 or 0.C)