

# ELECTRIC SYSTEM

## CHAPTER 5

# ELECTRIC SYSTEM

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## 1. SPECIFICATIONS

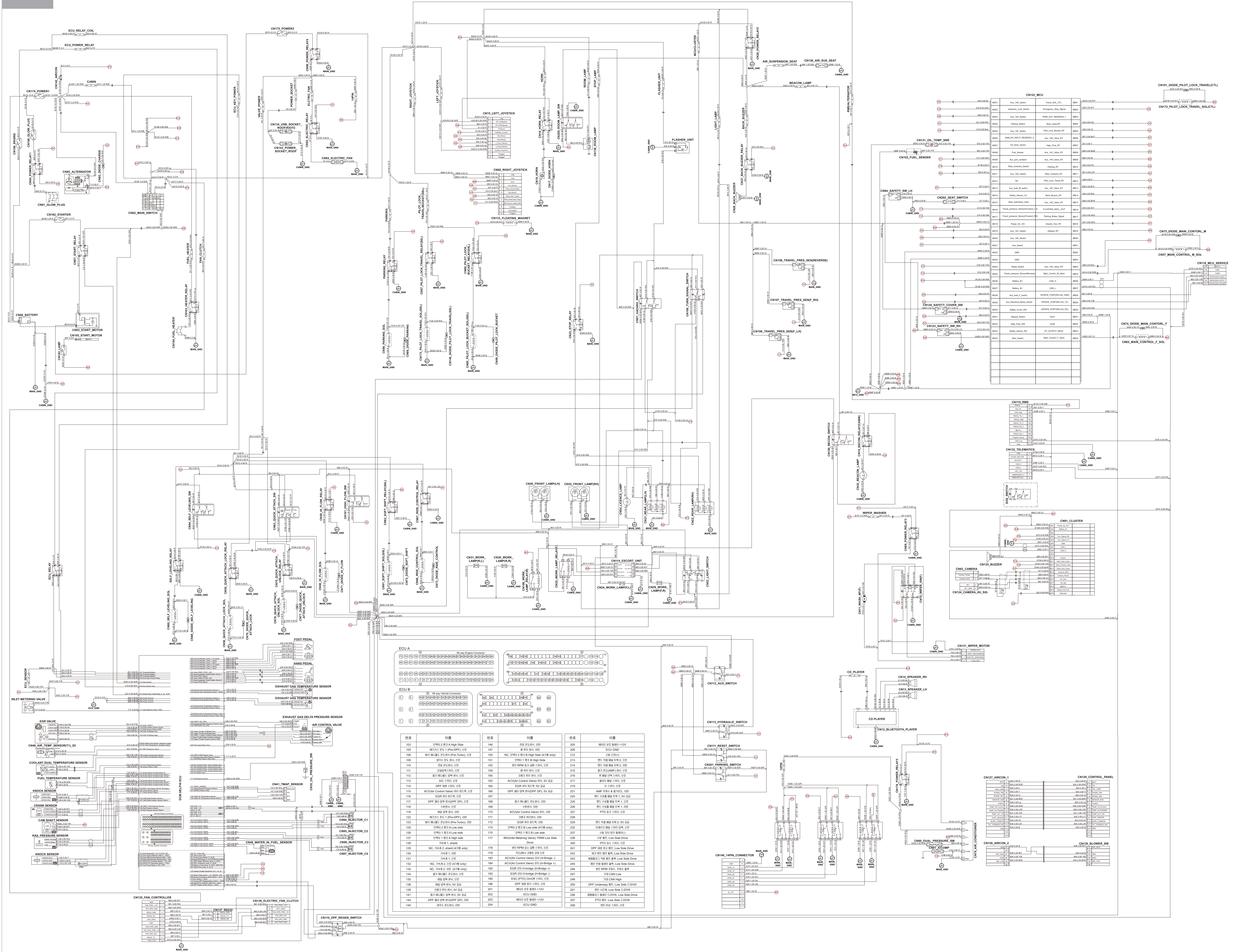
| ITEM                                    | SPECIFICATION                                                                    |
|-----------------------------------------|----------------------------------------------------------------------------------|
| Battery                                 | 12V 110Ah                                                                        |
| Alternator                              | 13.5V 75A                                                                        |
| Starter motor                           | 12V 2.5kW                                                                        |
| Slow-blow fuse                          | 30A(Start), 40A(Engine), 60A(Lamp),<br>70A(Power 2), 80A(Preheat), 100A(Power 1) |
| Engine oil pressure switch              | 0.5 kgf/cm <sup>2</sup>                                                          |
| Crankshaft wheel sensor                 | Operating voltage : 4 ~ 24 VDC                                                   |
| DPF differential pressure sensor        | Operating voltage : 4.75 ~ 5.25 VDC                                              |
| Intake air temperature sensor (T1)      | Temperature range : -40°C ~ 250°C                                                |
| MCU                                     | Operating voltage : 8 ~ 16 VDC                                                   |
| Buzzer                                  | Rated voltage : 6 ~ 24 VDC                                                       |
| Twin relay (For motor)                  | Operating voltage : 10 ~ 15 VDC                                                  |
| Oil temperature sensor                  | Operating temperature : -30°C ~ 130°C                                            |
| Escort unit                             | Operating voltage : 10 ~ 16 VDC                                                  |
| Relay (70A)                             | Operating voltage : 9 ~ 16 VDC                                                   |
| Flash unit                              | Operating voltage : 9 ~ 15 VDC                                                   |
| Horn                                    | 12V 2.5A 105 ~ 118 dB(A)                                                         |
| Turn signal lamp, tail lamp             | 12V P21W, 5W                                                                     |
| Brake lamp, turn signal lamp, tail lamp | 12V P21W, P21/5W                                                                 |
| Work lamp                               | LED                                                                              |
| Number plate lamp                       | 12V 3W                                                                           |
| Room lamp                               | 12V 10W                                                                          |



## 2. CIRCUIT AND COMPONENT LOCATION

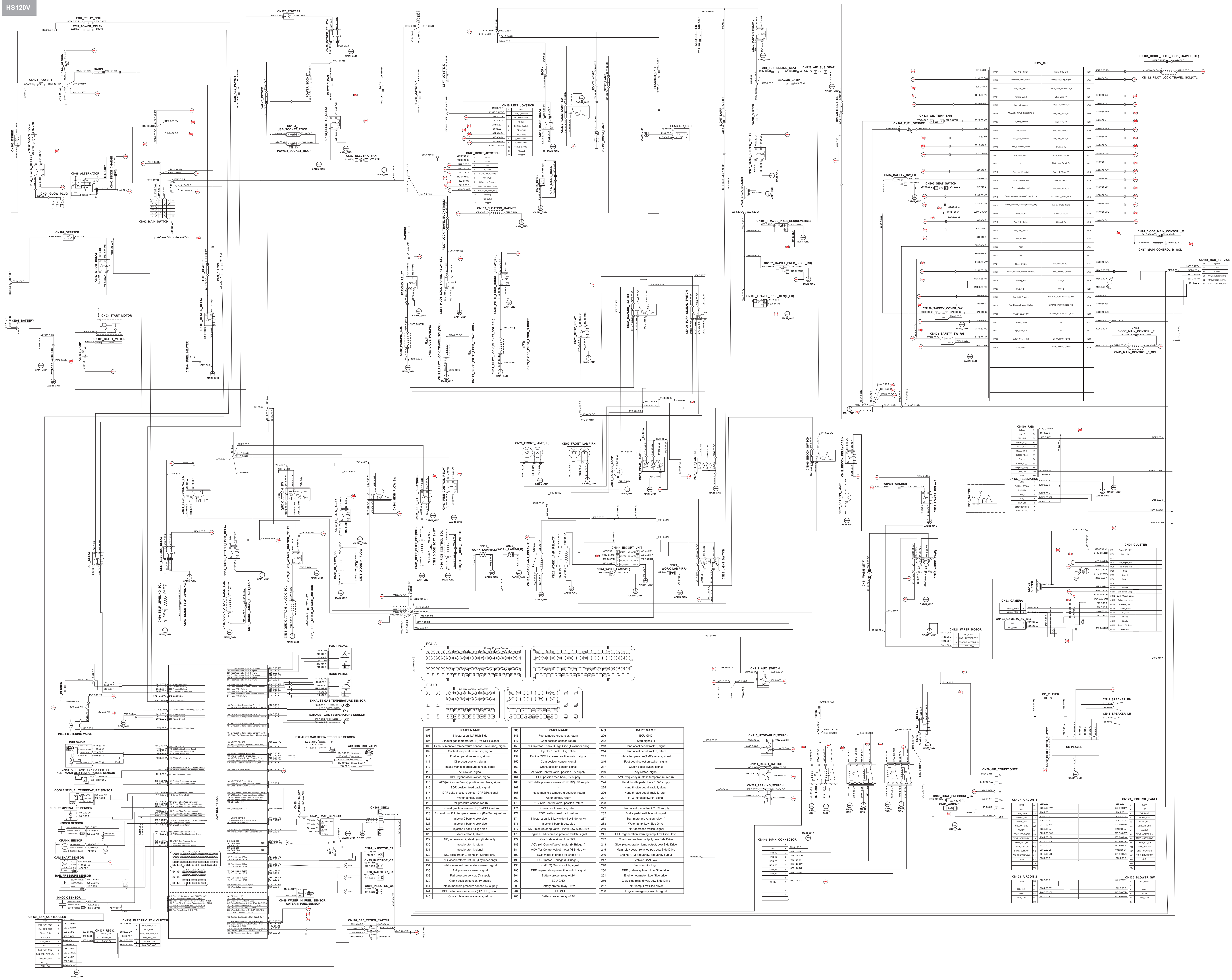
### 2.1 ELECTRIC CIRCUIT DIAGRAM (HS80V)

## HS80V





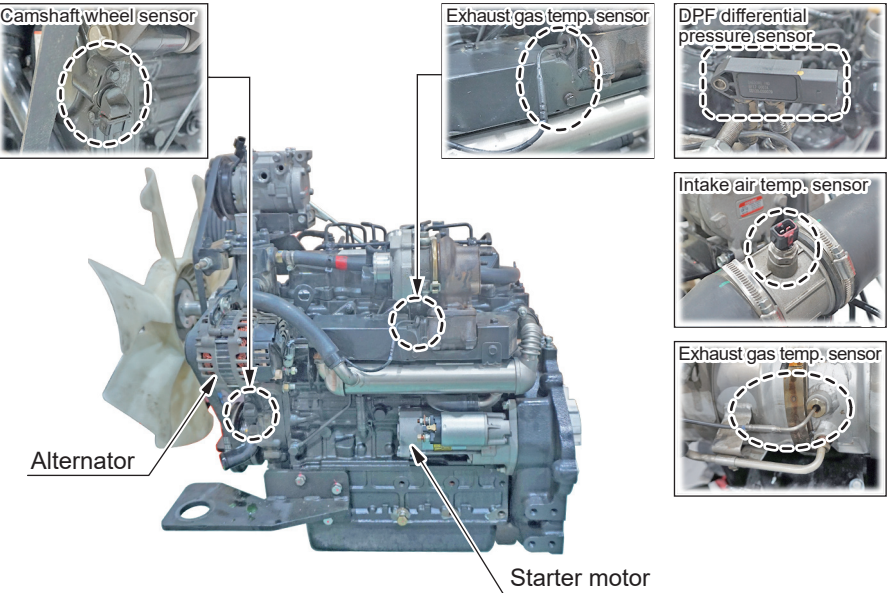
HS120V



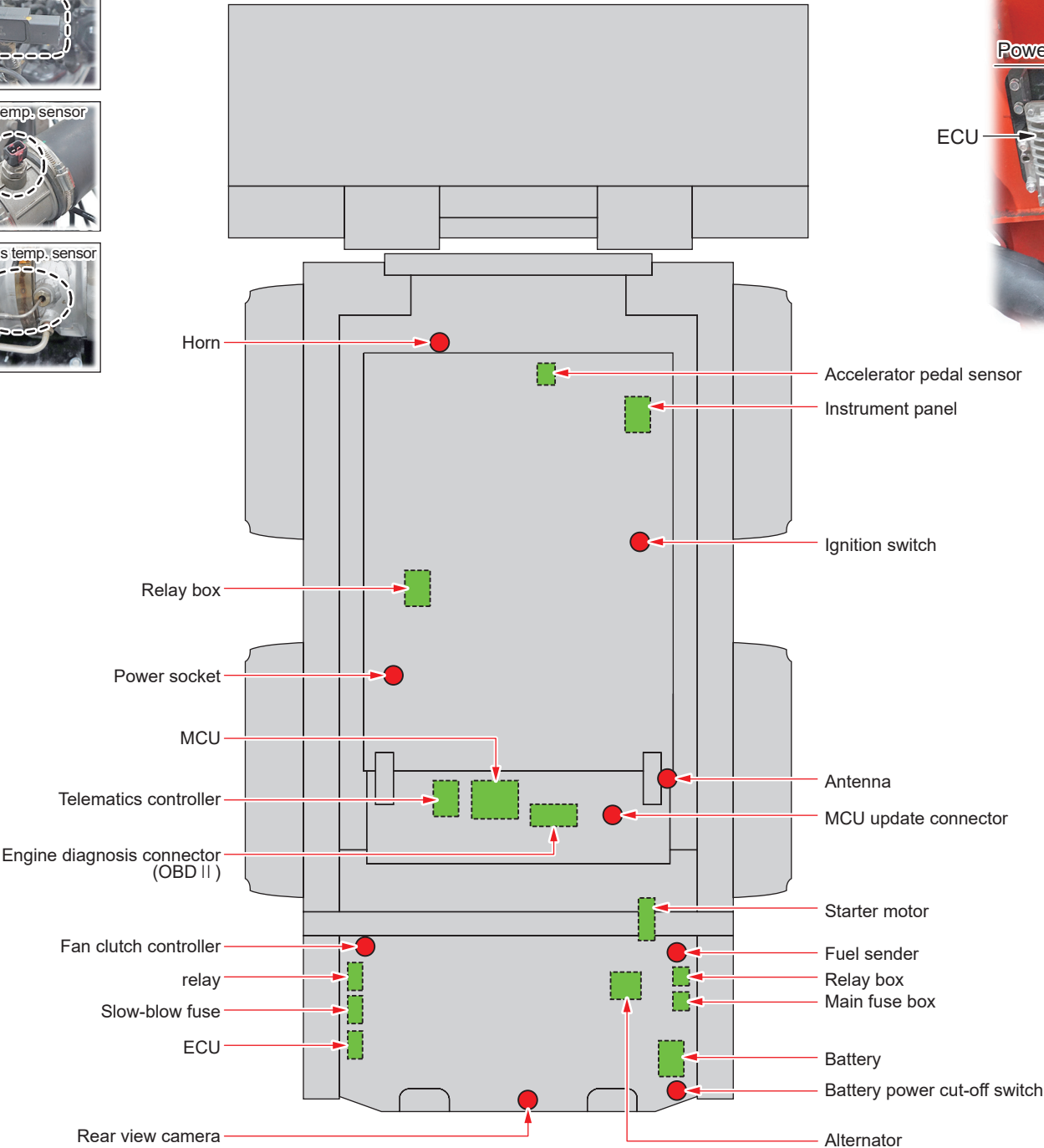
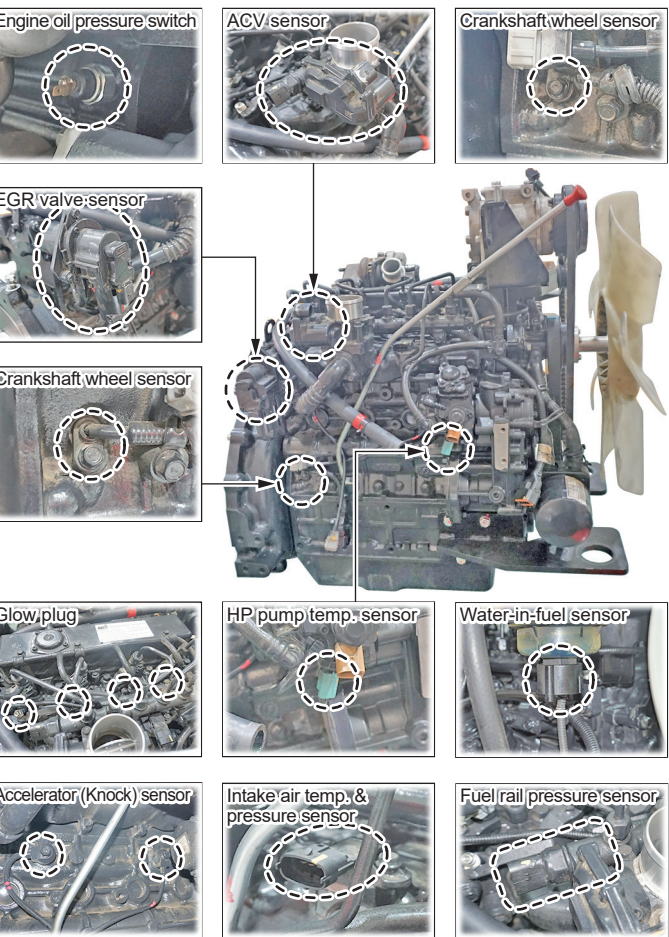


2.2 LOCATION OF ELECTRONIC COMPONENTS

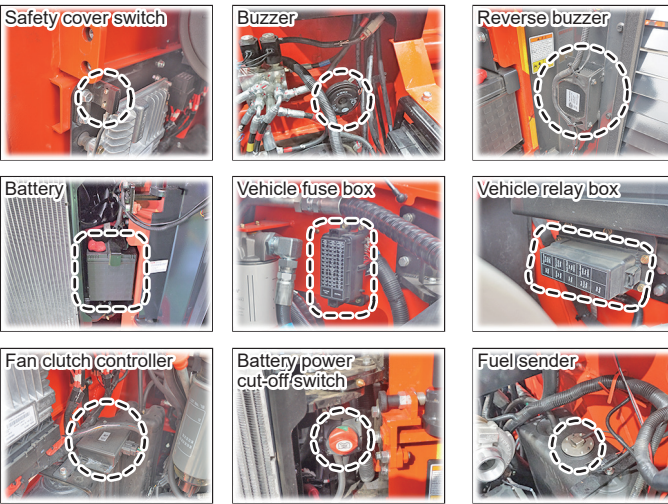
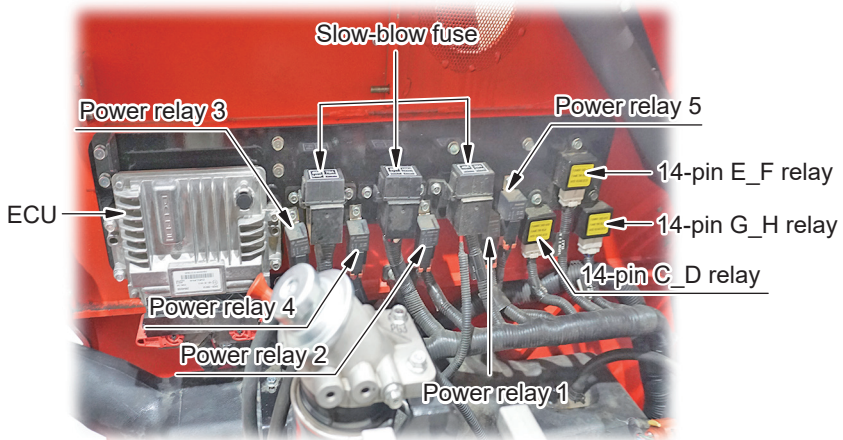
ENGINE (LH)



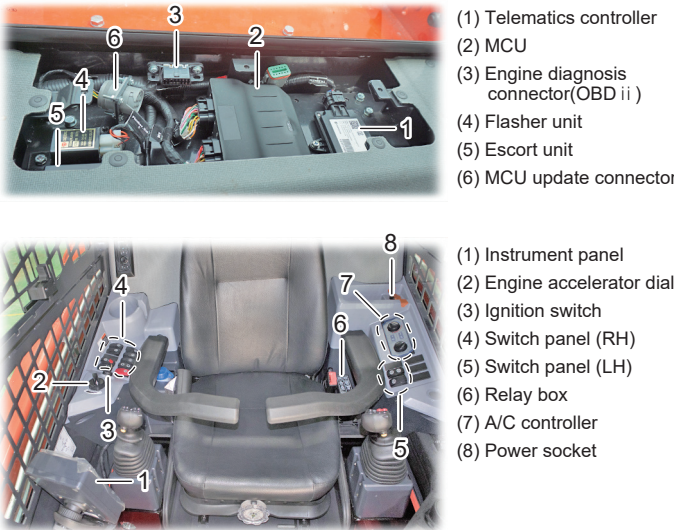
ENGINE (RH)



ENGINE ROOM



DRIVER'S SEAT









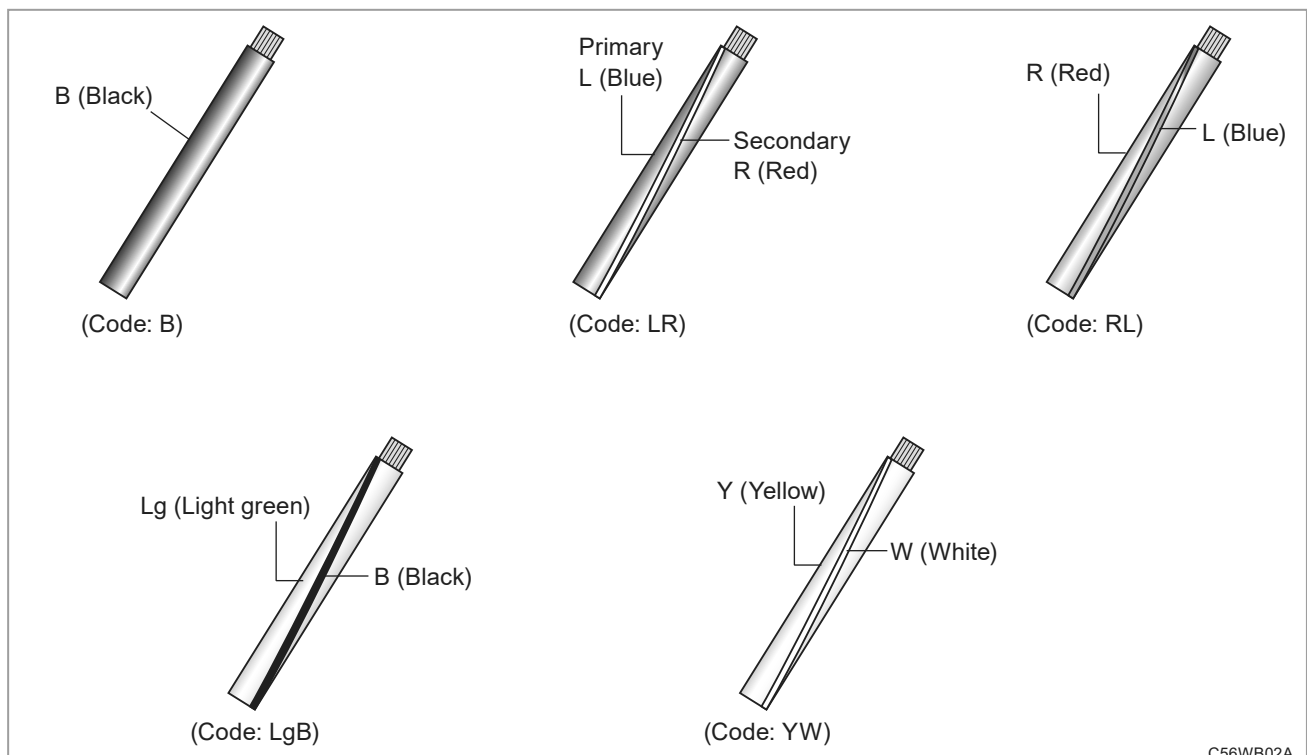
### 3. WIRING IDENTIFICATION

#### 3.1 WIRING COLOR IDENTIFICATION

The color codes in the following table are marked on every wiring in the wiring diagrams. It is necessary to have full knowledge of the color codes in order to understand circuit diagrams when checking actual wirings based on circuit diagrams.

| Code | Color             | Code | Color              |
|------|-------------------|------|--------------------|
| B    | Black             | R    | Red                |
| Lg   | Light Green       | Gr   | Gray               |
| W    | White             | G    | Green              |
| L    | Blue              | Y    | Yellow             |
| P    | Pink              | Br   | Brown              |
| Or   | Orange            | BR   | Black/Red          |
| BW   | Black/White       | BG   | Black/Green        |
| BY   | Black/Yellow      | RB   | Red/Black          |
| RW   | Red/White         | RG   | Red/Green          |
| RL   | Red/Blue          | RY   | Red/Yellow         |
| LgB  | Light Green/Black | LgR  | Light Green/Red    |
| LgW  | Light Green/White | LgY  | Light Green/Yellow |
| GrY  | Gray/Yellow       | WB   | White/Black        |
| WR   | White/Red         | WL   | White/Blue         |
| WY   | White/Yellow      | GR   | Green/Red          |
| GW   | Green/White       | GL   | Green/Blue         |
| GOr  | Green/Orange      | LW   | Blue/White         |
| LY   | Blue/Yellow       | YB   | Yellow/Black       |
| YR   | Yellow/Red        | YW   | Yellow/White       |
| YG   | Yellow/Green      | YL   | Yellow/Blue        |
| YBr  | Yellow/Brown      | PB   | Pink/Black         |
| BrR  | Brown/Red         | BrW  | Brown/White        |

The following figures are examples for colors according to the codes.



C56WB02A

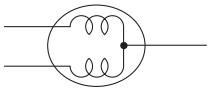
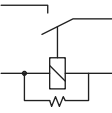
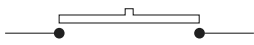
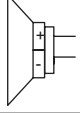
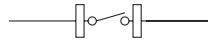
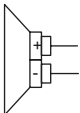
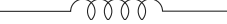
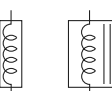
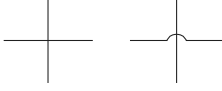
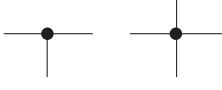
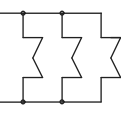
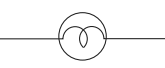
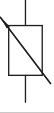


### 3.2 CROSS SECTIONAL AREA OF WIRING

All wirings in circuit diagrams are marked with their colors and cross sectional area so that mechanics can understand wiring thickness with ease.

For example, "5.0 R" refers to a red wiring with 5 mm<sup>2</sup> of cross sectional area. Therefore, the diameter of the wiring with 5 mm<sup>2</sup> of the cross sectional area is 2.523 mm.

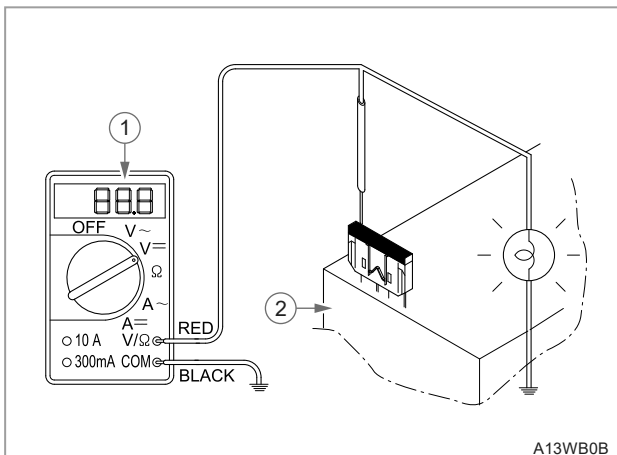
### 3.3 SYMBOLS FOR ELECTRIC COMPONENTS

| SYMBOL                                                                              | DESCRIPTION                  | SYMBOL                                                                               | DESCRIPTION              |
|-------------------------------------------------------------------------------------|------------------------------|--------------------------------------------------------------------------------------|--------------------------|
|    | Fuse                         |    | Double bulb              |
|    | Fuse (15 A)                  |    | Diode                    |
|    | Motor                        |    | Relay                    |
|   | Switch (Normally Open Type)  |   | Buzzer                   |
|  | Switch (Normally Close Type) |  | Safety switch            |
|  | Ground (Wire)                |  | Reverse buzzer           |
|  | Ground (Chassis)             |   | Resistor                 |
|  | Coil                         |  | Solenoid                 |
|  | Battery                      |  | Horn                     |
|  | Disconnected wire            |  | Speaker                  |
|  | Connected wire               |  | Glow plug<br>Fuel heater |
|  | Lamp                         |   | Sensor                   |



### 3.4 FUSE

#### 3.4.1 INSPECTION

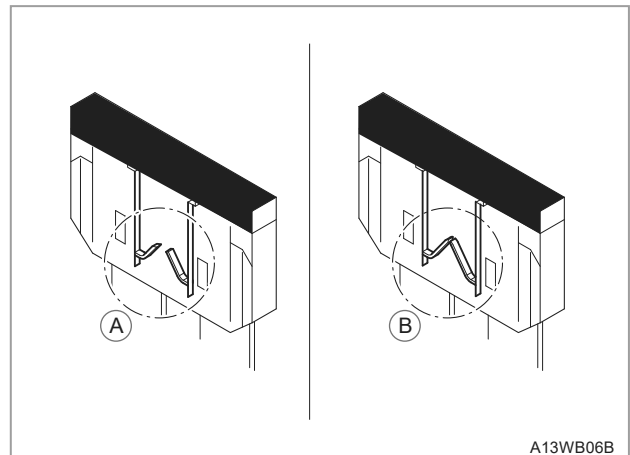


(1) Tester

(2) Fuse box

The blade type fuse can be checked without pulling it out from the fuse box. When connecting the lead wires from the test lamp to the test lead wire and grounding, the test lamp should light up.

#### 3.4.2 CAUSE FOR BLOWN FUSE



(1) Blown fuse due to excessive current

(2) Blown fuse due to heat fatigue

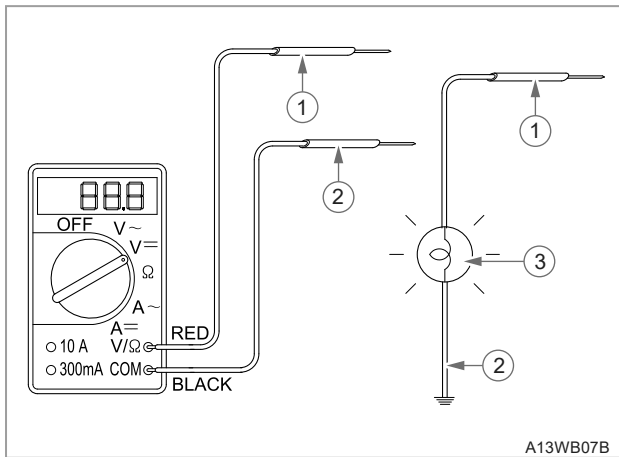
#### OVER-CURRENT

1. When a fuse is blown due to over-current, do not simply replace the fuse.
2. Check if there is any abnormal condition or open circuit in any electric device.
3. Correct the cause for a blown fuse first, and then replace the blown fuse with a new one with the rated capacity.
4. If using a fuse with a different capacity, its wiring or related components can be damaged.

#### FREQUENTLY REPEATED ON/OFF STATUS CHANGE

1. This can degrade parts' durability. Avoid excessively repeated operation.
2. Replace the fuse with a new one with the rated capacity.

### 3.5 ELECTRIC DEVICE DIAGNOSIS



(1) Tester

(2) Ground

(3) Test lamp

An electric circuit consists of power, switch, relay, load, ground, etc. It can be checked by various methods, such as voltage check, open circuit check and continuity check.

#### VOLTAGE INSPECTION

With the ignition switch in the "ON" position, measure the voltage between the terminals to be tested with a tester. Connect the red lead of a tester to the electric load and the black lead to the chassis or ground to measure voltage.

#### TEST LAMP CHECK

Ground one lead of a test lamp and connect the other lead to an electric load. The test lamp should turn on and a voltage value should be detected by a tester. If a circuit is intact but an electric device is faulty, start troubleshooting from the closest connector with the voltage test and visual check.



## 4. ELECTRIC COMPONENTS

### 4.1 ENGINE ROOM

#### 4.1.1 BATTERY

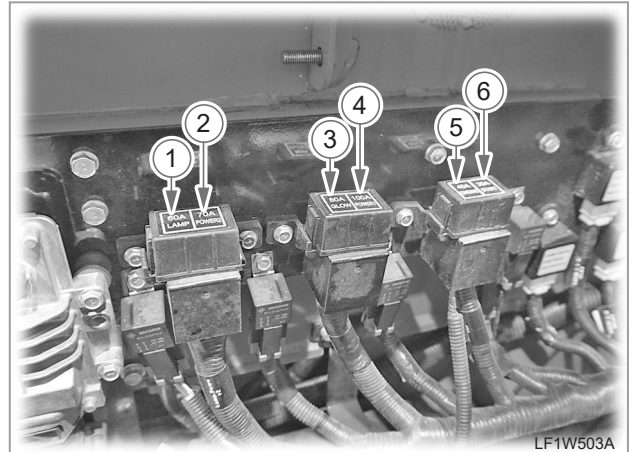


Open the rear cover, the battery is installed on the right hand side. A lead-acid battery is used, which is rechargeable by supplying electricity from outside.

- Capacity : 12V 110Ah

#### 4.1.2 FUSE BOX

##### SLOW-BLOW FUSE

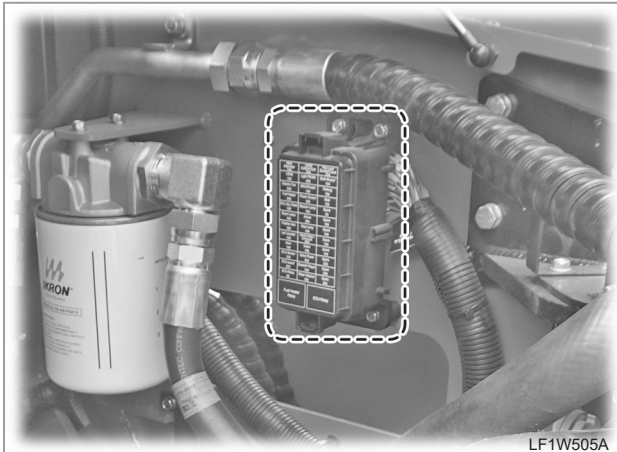


- (1) Lamp power fuse (60A)
- (2) Power 2 fuse (70A)
- (3) Preheat power fuse (80A)
- (4) Power 1 fuse (100A)
- (5) Engine power fuse (40A)
- (6) Ignition power fuse (30A)

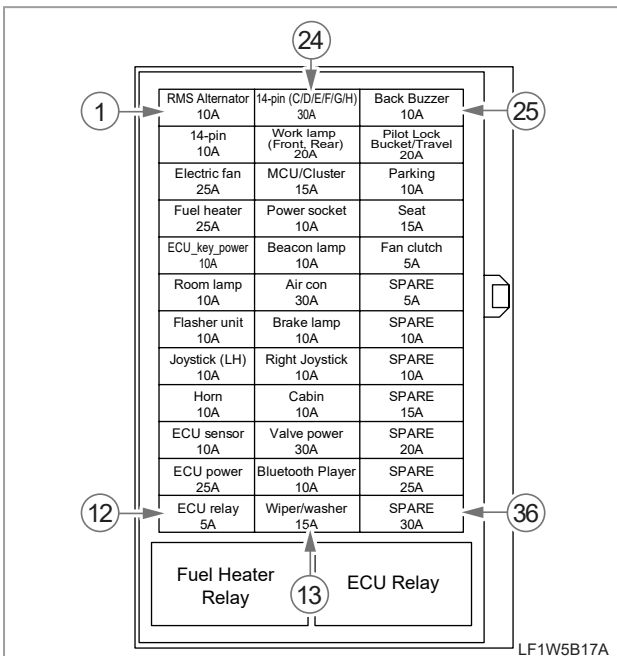
Six slow-blow fuses are installed on the frame in the left side of the engine compartment and they are connected to the main wiring. If any electric system does not operate while the battery operates properly, the slow-blow fuse should be checked. If the replaced fuse is blown again, there is a short circuit between the direct B line (power from the battery) and the chassis.

| FUSE     | COMPONENT TO DIAGNOSE                                        |
|----------|--------------------------------------------------------------|
| Lamp     | RCV (LH), Horn relay, Flasher unit, Room lamp, Power relay 2 |
| Power 2  | Power relay 4, Power socket, 14-pin                          |
| Preheat  | Power relay 1, Glow plug                                     |
| Power 1  | Alternator, Ignition switch, A/C, Cabin, Fuel heater         |
| Engine   | ECU relay, ECU                                               |
| Ignition | Starter relay                                                |

## MAIN FUSE BOX



LF1W505A



LF1W5B17A

The main fuse box is installed on the right side of the engine room.

It protects systems from excessive electric load.

If the current through the fuse is over the specified capacity, the conductor of the fuse is blown to protect controller and circuit.

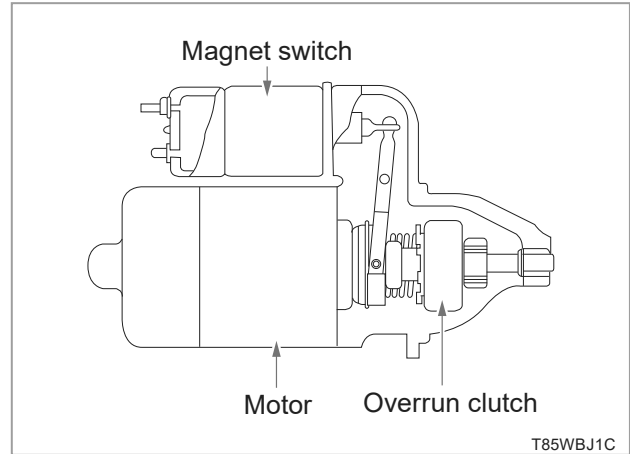
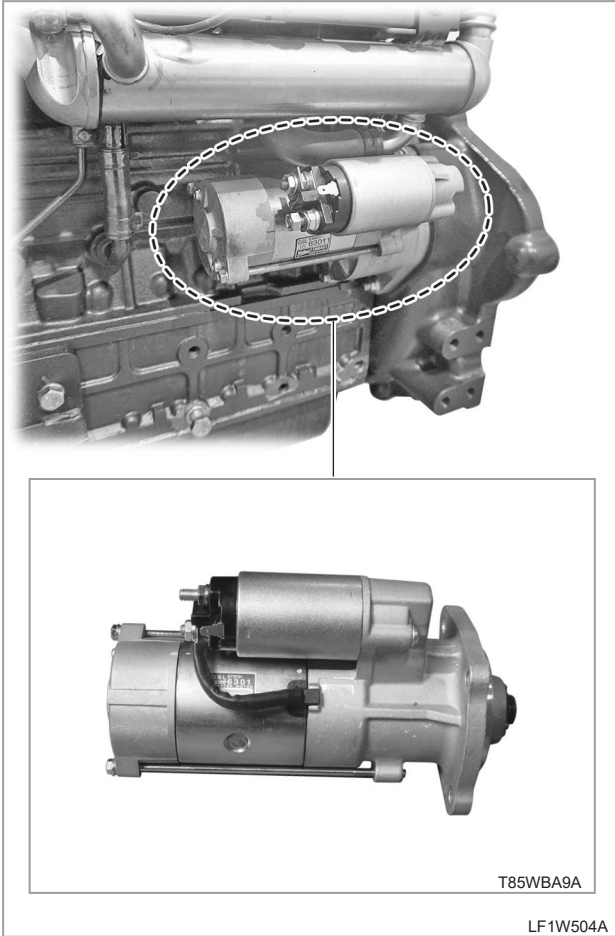
If the fuse is blown, find the cause and replace it with new one with the same capacity.

| CONDITIONS                       | RESULT                                                                                             |
|----------------------------------|----------------------------------------------------------------------------------------------------|
| 110% of rated current is applied | The fuse is not blown.                                                                             |
| 130% of rated current is applied | The fuse is blown within 60 seconds.                                                               |
| 150% of rated current is applied | The regular fuse is blown within 15 seconds and the fuse for over 30 A is blown within 30 seconds. |

| NO | CAPACITY | FUNCTION                 |
|----|----------|--------------------------|
| 1  | 10A      | RMS Alternator           |
| 2  | 10A      | 14-pin                   |
| 3  | 25A      | Electric fan             |
| 4  | 25A      | Fuel heater              |
| 5  | 10A      | ECU_key_power            |
| 6  | 10A      | Room lamp                |
| 7  | 10A      | Flasher unit             |
| 8  | 10A      | Joystick (LH)            |
| 9  | 10A      | Horn                     |
| 10 | 10A      | ECU sensor               |
| 11 | 25A      | ECU power                |
| 12 | 5A       | ECU relay                |
| 13 | 15A      | Wiper/washer             |
| 14 | 10A      | Bluetooth Player         |
| 15 | 30A      | Valve power              |
| 16 | 10A      | Cabin                    |
| 17 | 10A      | Right Joystick           |
| 18 | 10A      | Brake lamp               |
| 19 | 30A      | Air con                  |
| 20 | 10A      | Beacon lamp              |
| 21 | 10A      | Power socket             |
| 22 | 15A      | MCU/Cluster              |
| 23 | 20A      | Work lamp (Front, Rear)  |
| 24 | 30A      | 14-pin (C/D/E/F/G/H)     |
| 25 | 10A      | Back buzzer              |
| 26 | 20A      | Pilot lock Bucket/Travel |
| 27 | 10A      | Parking                  |
| 28 | 15A      | Seat                     |
| 29 | 5A       | Fan clutch               |
| 30 | 5A       | SPARE                    |
| 31 | 10A      | SPARE                    |
| 32 | 10A      | SPARE                    |
| 33 | 15A      | SPARE                    |
| 34 | 20A      | SPARE                    |
| 35 | 25A      | SPARE                    |
| 36 | 30A      | SPARE                    |



### 4.1.3 STARTER MOTOR



The start motor is divided by three sections:

- Motor - Generates torque for cranking the engine.
- Magnet switch - Engages the ring gear with the pinion gear and turns current ON and OFF.
- Overrun clutch - Transfers torque from the start motor to the engine, and blocks engine turning torque to the start motor if the engine rotates faster than the start motor, i.e. the engine is started, for protection of the start motor.

### ENGINE START SYSTEM INSPECTION

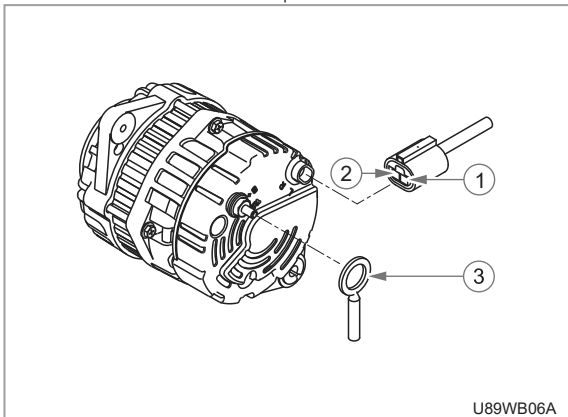
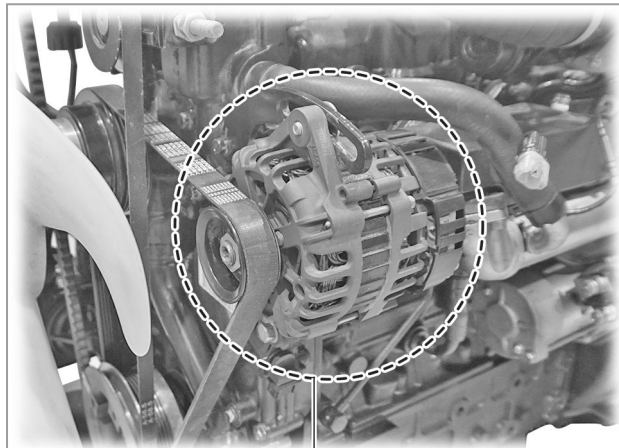
| ITEM                                               | CAUSE                                               | SOLUTION                             |
|----------------------------------------------------|-----------------------------------------------------|--------------------------------------|
| The start motor runs but the engine does not crank | Damaged clutch pinion gear or defective start motor | Replace the start motor              |
|                                                    | Damaged flywheel ring gear                          | Replace the flywheel                 |
|                                                    | Open related circuit                                | Repair                               |
| The start motor keeps running                      | Defective start motor                               | Repair or replace                    |
|                                                    | Defective ignition switch                           | Replace                              |
| The engine cannot crank                            | Low battery charging voltage                        | Charge or replace                    |
|                                                    | Loose, corroded or worn battery cable               | Repair or replace                    |
|                                                    | Defective start motor or open circuit               |                                      |
|                                                    | Defective ignition switch or blown power fuse       | Replace the ignition switch or fuse. |
|                                                    | Poor engine ground                                  | Repair                               |
| The engine cranks slowly                           | Low battery charging voltage                        | Charge or replace                    |
|                                                    | Loose, corroded or worn battery cable               | Repair or replace                    |
|                                                    | Defective start motor                               |                                      |

#### 4.1.4 ALTERNATOR

There are some components, such as Head lamp, start motor, engine stop solenoid and glow plug, which need a lot of electricity. The alternator supplies power to such components and charges the battery which stores electricity for the tractor.

Therefore, the alternator correlates with the battery and electric loads and it is an original source of electricity for the entire tractor.

##### TEST

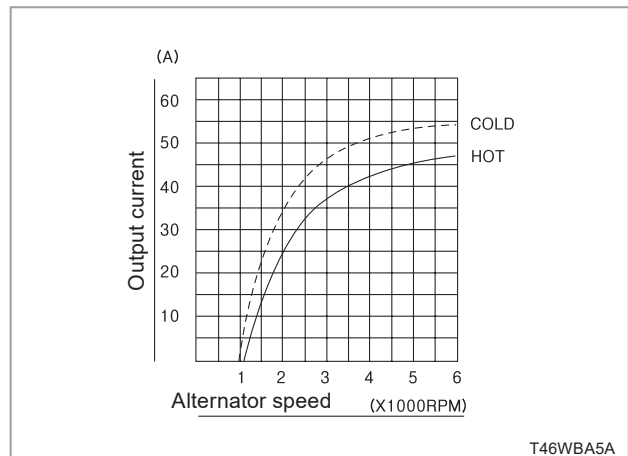


U89WB06A

LF1W507A

- (1) 2P No. 1 connector      (3) Battery power  
(2) 2P No. 2 connector

#### PERFORMANCE CURVE OF ALTERNATOR



As shown in the performance curve in the above figure, the alternator does not generate power until its speed reaches 1,200 rpm. This minimum revolution speed is called "Cut In Speed".

If the alternator's speed is below the cut in speed, the alternator does not generate power and the charge warning lamp does not go off.

Also, the output performance changes as the output current (A) changes according to the coil's temperature (cold and hot). Therefore, the average curve for the cold and hot conditions is presented as guaranteed performance.

In general, the alternator's pulley ratio is determined to maximize the alternator output in the rated maximum output of the engine.

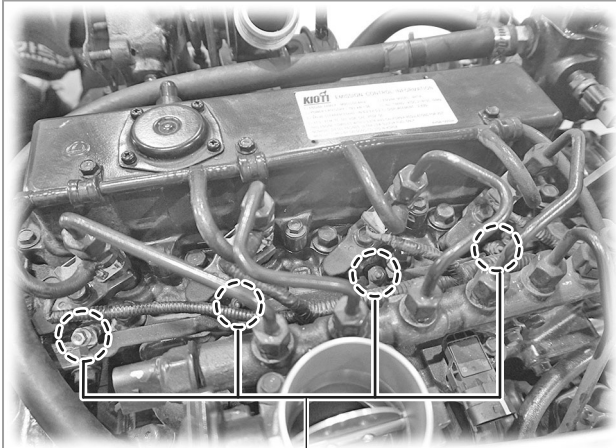
| Item       | Tester Connection  |                    | Location              | Result        |
|------------|--------------------|--------------------|-----------------------|---------------|
|            | Red Lead           | Black Lead         |                       |               |
| DC Voltage | 2P No. 1 connector | Chassis (GND)      | Ignition switch ON    | DC 12V        |
|            | 2P No. 2 connector | Chassis (GND)      | Ignition switch in ST | DC12 ~ 14.7 V |
|            | 2P No. 1 connector | 2P No. 2 connector | Ignition switch ON    | DC 12 V       |



## CHARGING SYSTEM INSPECTION

| ITEM                                                                                                     | CAUSE                                              | SOLUTION                                       |
|----------------------------------------------------------------------------------------------------------|----------------------------------------------------|------------------------------------------------|
| The charge warning lamp does not illuminate with the ignition switch in the ON position (engine stopped) | Defective alternator regulator                     | Replace the alternator                         |
|                                                                                                          | Open/Blown charge warning lamp, fuse or wiring     | Replace or repair the charge warning lamp/fuse |
|                                                                                                          | Defective ignition switch                          | Replace the ignition switch                    |
|                                                                                                          | Poor alternator circuit ground                     | Repair                                         |
| The charge warning lamp does not go off after the engine is started (frequent battery charging required) | Defective alternator regulator                     | Replace the alternator                         |
|                                                                                                          | Corroded or worn battery cable                     | Repair or replace the cable                    |
|                                                                                                          | Loose alternator drive belt                        | Adjust the belt tension or replace the belt    |
|                                                                                                          | Defective wiring                                   | Repair or replace                              |
| The battery is discharged                                                                                | Loose alternator drive belt                        | Adjust the belt tension or replace the belt    |
|                                                                                                          | Poor connection of related circuit or open circuit | Tighten the connection or repair open circuit  |
|                                                                                                          | Defective alternator regulator                     | Replace the alternator                         |
|                                                                                                          | Expired battery                                    | Replace the battery                            |
|                                                                                                          | Poor ground                                        | Repair                                         |
| The battery is over-charged                                                                              | Defective alternator regulator                     | Replace the alternator                         |
|                                                                                                          | Defective alternator regulator                     | Replace the alternator                         |
|                                                                                                          | Defective voltage detecting wiring                 | Repair or replace                              |

## 4.1.5 GLOW PLUG



LF1W508A

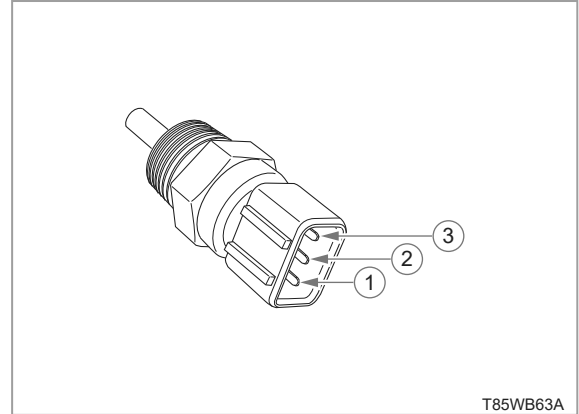
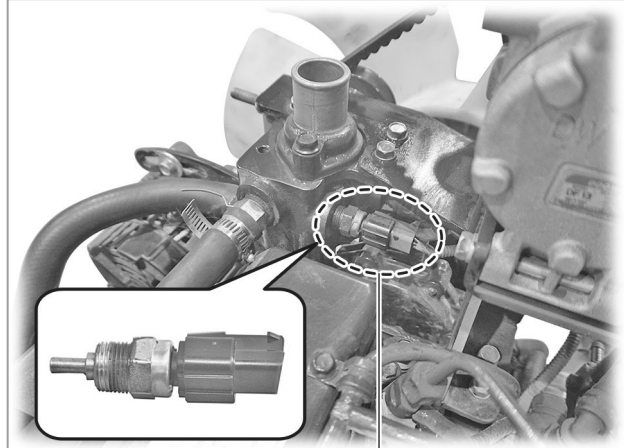
The glow plug is installed in the engine cylinder head close to the nozzle.

It is installed in each cylinder as one of the ignition system component to heat air in the combustion chamber for cold start. Max. 20 A of current flows through the glow plug in 4 seconds after voltage is generated. When its temperature rises to 800°C at this time, it is normal.

**TEST**

| Item       | Location                       | Tester Connection |            | Result  |
|------------|--------------------------------|-------------------|------------|---------|
|            |                                | Red Lead          | Black Lead |         |
| Resistance | Connector disconnected         | Connector No. 1   | Ground     | 0.5 Ω   |
| DC Voltage | Ignition switch ON (below 0°C) | Connector No. 1   | Ground     | DC 12 V |

## 4.1.6 COOLANT TEMPERATURE SENSOR



LF1W509A

- (1) Temperature sensor terminal (-)
- (2) Gauge unit terminal (+)
- (3) Temperature sensor terminal (+)

The coolant temperature sensor is installed to the side of the coolant flange.

This sensor detects the engine coolant temperature and sends the automatic preheat signal to the cluster temperature gauge and display unit.

This sensor is used to show the driver the current engine temperature.

**RESISTANCE OF GAUGE UNIT SENSOR**

|                         |     |     |     |     |
|-------------------------|-----|-----|-----|-----|
| <b>Temperature (°C)</b> | 60  | 85  | 110 | 125 |
| <b>(°F)</b>             | 140 | 185 | 230 | 257 |
| <b>Resistance (Ω)</b>   | 125 | 48  | 24  | 15  |

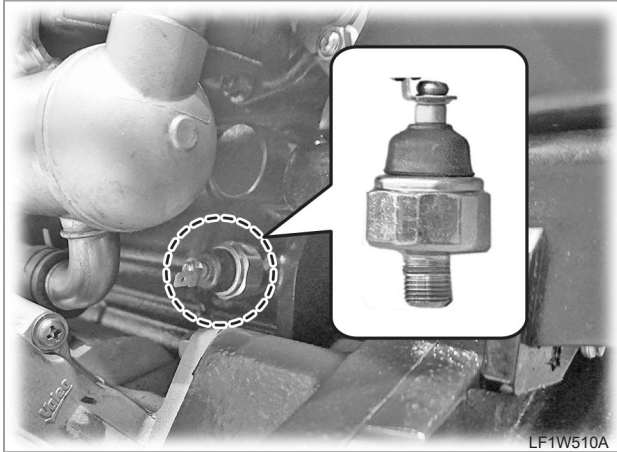
**RESISTANCE OF TEMPERATURE SENSOR**

| <b>Temperature (°C)</b> | <b>Resistance (kΩ)</b> |
|-------------------------|------------------------|
| -40                     | 48.14                  |
| -20                     | 15.48 ± 1.35           |
| 0                       | 5.790                  |
| 20                      | 2.45 ± 0.14            |
| 40                      | 1.148                  |
| 60                      | 0.5865                 |
| 80                      | 0.3222                 |
| 100                     | 0.1884                 |
| 110                     | 0.1471 ± 0.002         |
| 120                     | 0.1163                 |

※ The reference value of the temperature sensor for preheat relay output is 30°C (86°F).



## 4.1.7 ENGINE OIL PRESSURE SWITCH



LF1W510A

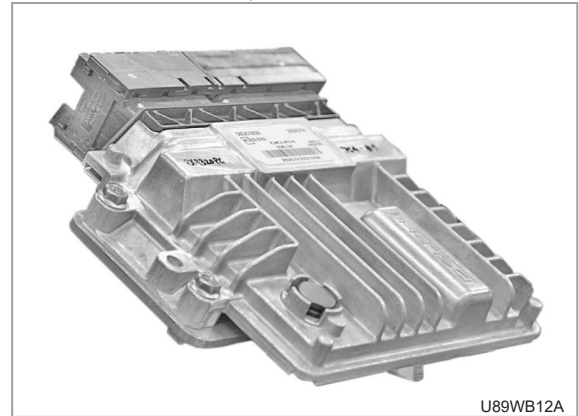
The engine oil pressure switch is installed to the top of the start motor on the left rear section of the engine.

When  $0.5 \pm 0.1 \text{ kg/cm}^2$  (7 psi  $\pm$  1.4 psi) or less of pressure is built in the engine oil system, this switch's contact point is connected to send a warning signal to the instrument cluster.

**TEST**

| Item       | Tester Connection  |               | Position                          | Result                   |
|------------|--------------------|---------------|-----------------------------------|--------------------------|
|            | Red Lead           | Black Lead    |                                   |                          |
| Resistance | Oil switch contact | Chassis (GND) | Oil lamp ON on instrument cluster | Continuity ( $0\Omega$ ) |

## 4.1.8 ECU

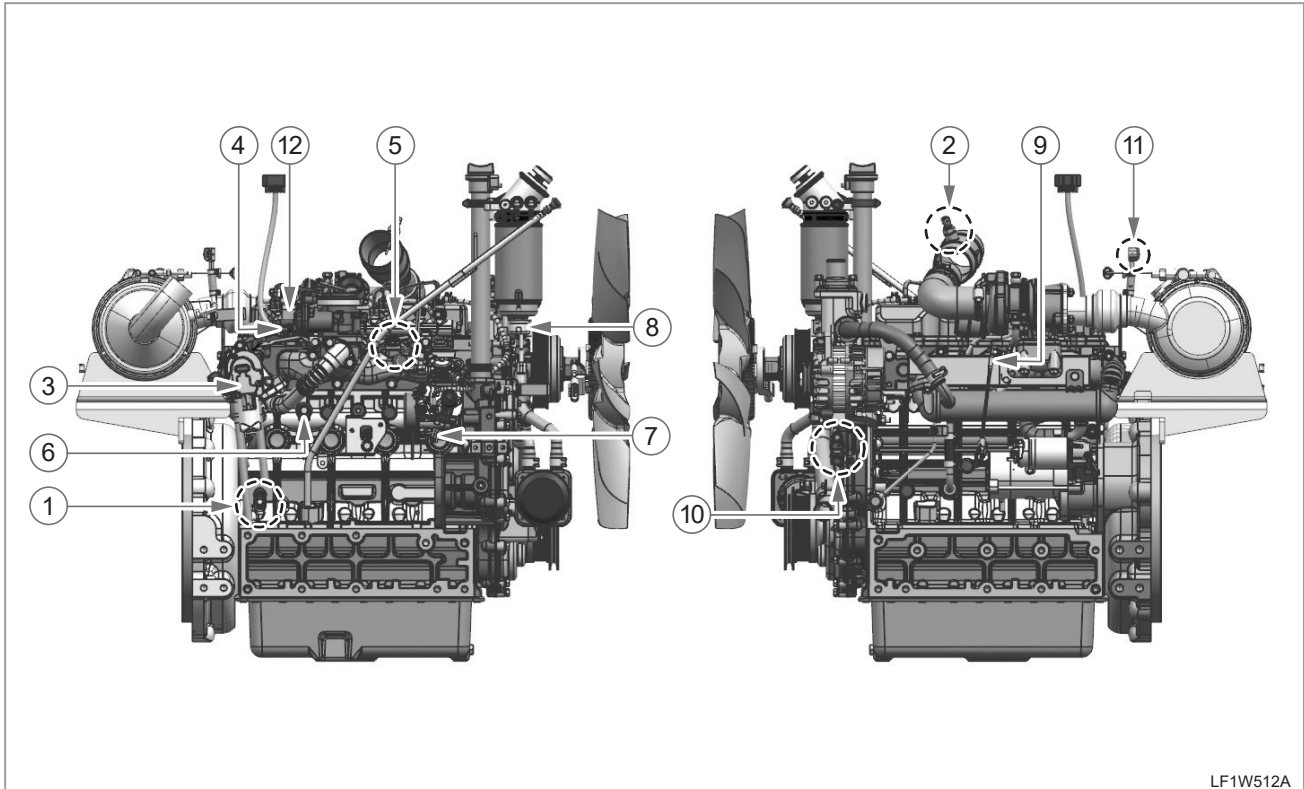


U89WB12A

LF1W511A

The ECU (Electronic Control Unit) is installed on the rear right side of the engine. The ECU receives information from various sensors installed in the engine to optimize combustion in order to enhance engine performance and fuel consumption.

#### 4.1.9 SENSORS AND RELAYS



LF1W512A

- |                                                |                                       |
|------------------------------------------------|---------------------------------------|
| (1) Crankshaft wheel sensor                    | (8) Water-in-fuel sensor              |
| (2) Intake air pressure sensor (T1)            | (9) Exhaust gas temperature sensor    |
| (3) EGR valve sensor                           | (10) Camshaft wheel sensor            |
| (4) Fuel rail pressure sensor                  | (11) DPF differential pressure sensor |
| (5) Intake air temperature & pressure sensor   | (12) Air control valve sensor         |
| (6) Accelerator (Knock) sensor                 |                                       |
| (7) High-pressure fuel pump temperature sensor |                                       |

SAFETY FIRST

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DRIVING & CHASSIS

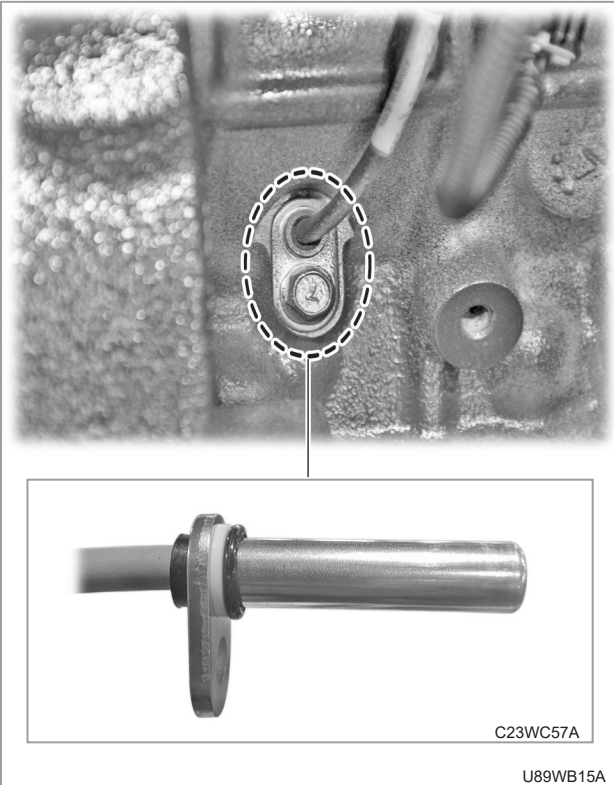
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## CRANKSHAFT WHEEL SENSOR



The crankshaft wheel sensor is installed to the edge on the lower right side of the engine next to the transmission.

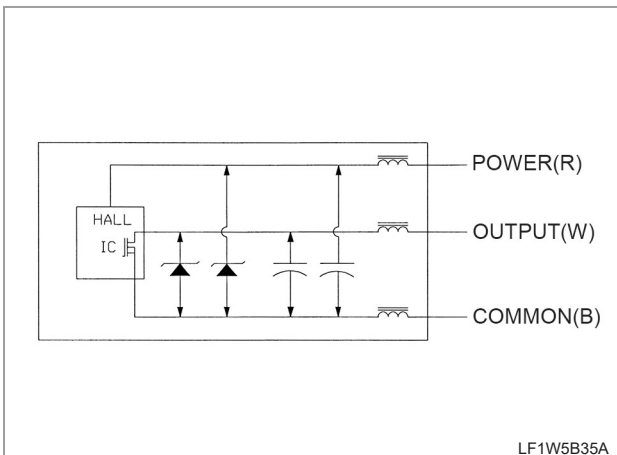
- Supplied power: 4 ~ 24 VDC
- Supplied current: 6 mA
- Output current: 30 mA



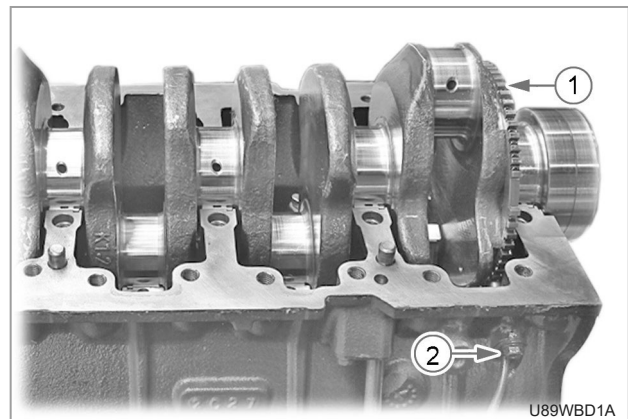
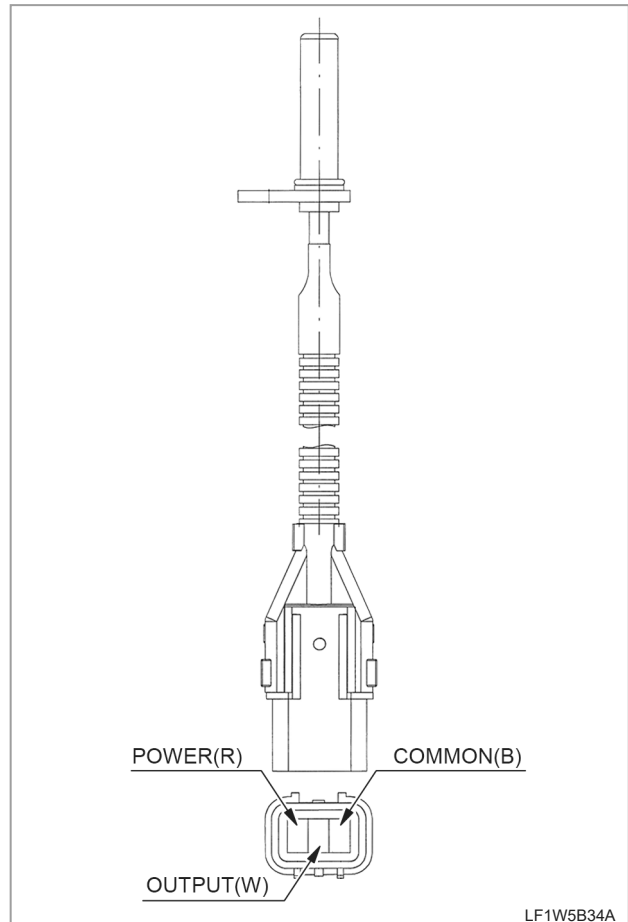
### CAUTION

- When installing the crankshaft wheel sensor to the engine block, be careful not to miss the O-rings.

## ► CIRCUIT DIAGRAM



## ► CONNECTOR



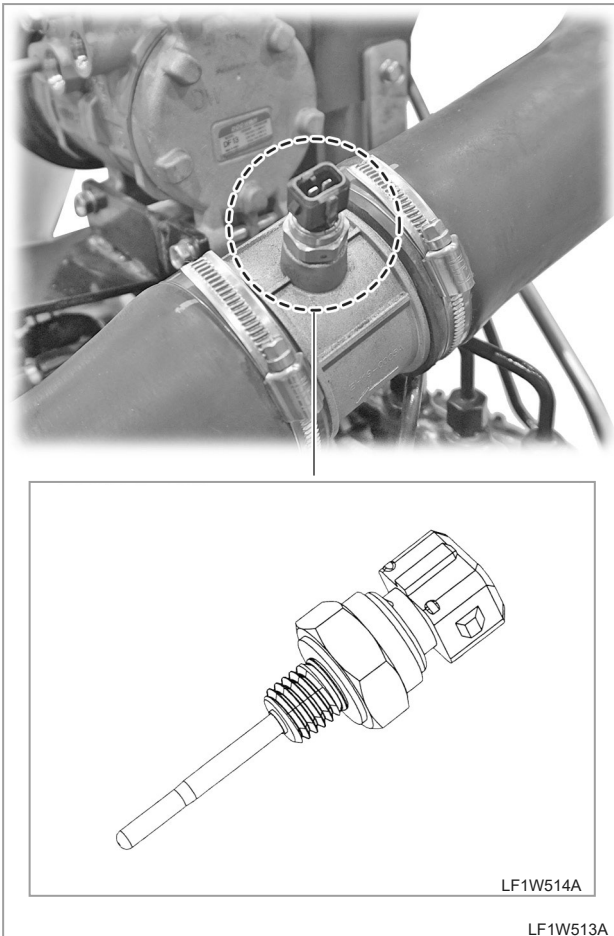
- (1) Crankshaft sensitive wheel
- (2) Crankshaft wheel sensor

The crankshaft wheel sensor is a magnetic pick-up type and it is supplied with 5 V power. It outputs sine waveform according to the change in magnetic field occurred by rotation of the crankshaft. Then, the position/speed of the crankshaft can be determined by the current value through the changed resistance value.

The crankshaft wheel sensor detects the position of each piston and sends this information to the ECU which then uses this information to set the injection timing and amount.



## INTAKE AIR TEMPERATURE SENSOR (T1)



The intake air temperature sensor is installed on the intake hose which is connected the turbo charger.

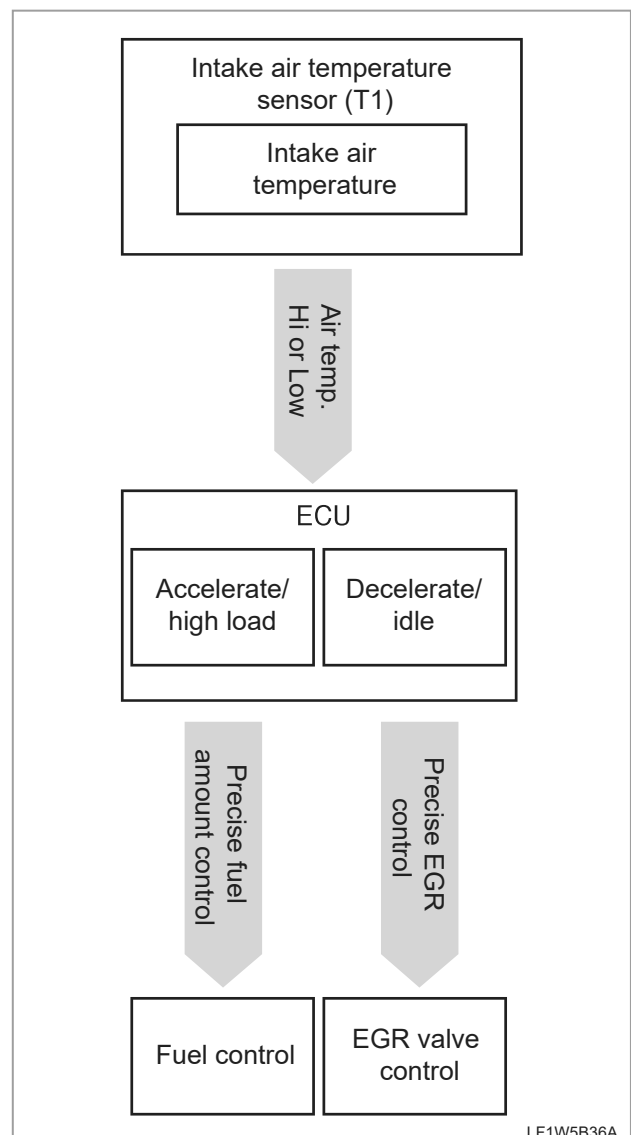
It measures the amount and temperature of the intake air and sends these information to the ECU which then uses these information to set the injection amount and timing. The intake air amount information is also used as a primary condition for the EGR control.

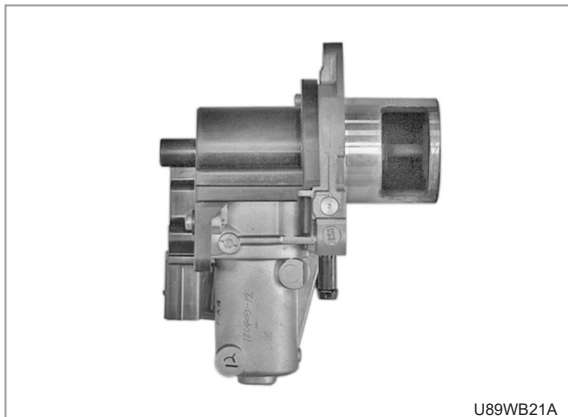
- It measures the amount and temperature of the air drawn into the engine.
- Its measurement is used as an important information to determine the fuel injection amount for theoretical air-fuel ratio control.
- Its measurement is also used as a feedback signal for EGR valve control.
- Intake air temperature - output as digital/analogue
- Temperature detection range of the element :  
-40°C ~ 250°C

### ► RESISTANCE BY TEMPERATURE

| Temp<br>[°C] | R min<br>[kΩ] | R cent<br>[kΩ] | R max<br>[kΩ] |
|--------------|---------------|----------------|---------------|
| -40          | 192.11        | 204.12         | 216.68        |
| 0            | 26.500        | 27.598         | 28.716        |
| 25           | 9.7000        | 10.000         | 10.300        |
| 85           | 1.3810        | 1.4510         | 1.5240        |
| 100          | 0.9165        | 0.9672         | 1.0200        |
| 150          | 0.2741        | 0.2927         | 0.3123        |
| 200          | 0.1022        | 0.1102         | 0.1187        |
| 250          | 0.0451        | 0.0490         | 0.0532        |

### ► INPUT/OUTPUT DIAGRAM

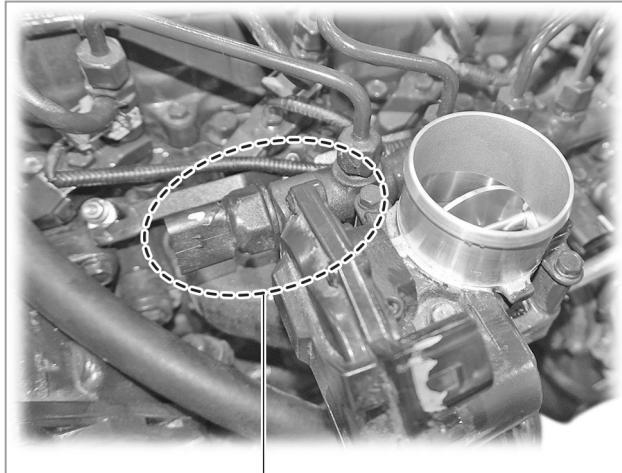


**EGR VALVE SENSOR**

U89WB21A

LF1W515A

The EGR (Exhaust Gas Recirculation) valve sends some of exhaust gas back into the cylinder through the intake port to decrease the combustion temperature during ignition in order to decrease NOx (Nitrogen Oxides) in exhaust gas. The EGR valve sensor detects the position of the valve so that the EGR valve can control the air intake amount.

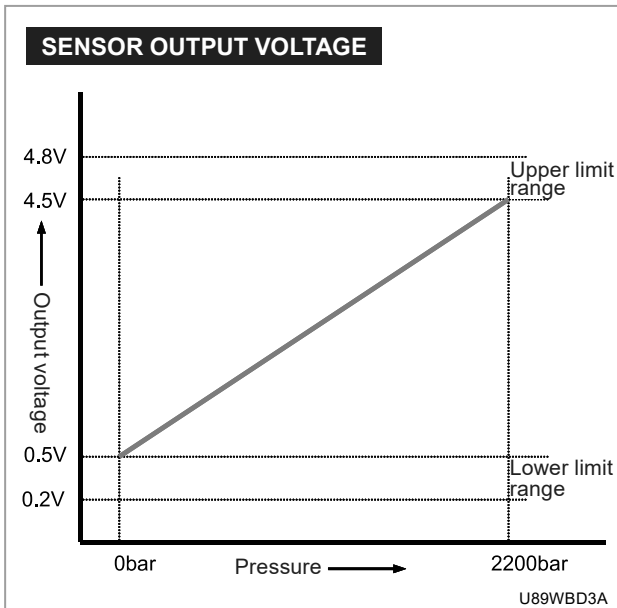
**FUEL RAIL PRESSURE SENSOR**

U89WB23A

LF1W516A

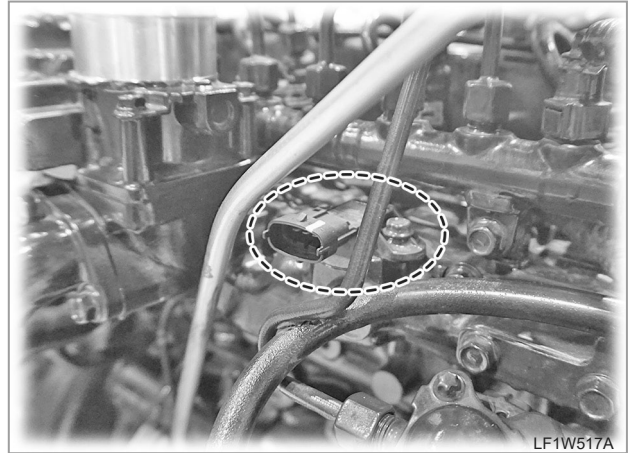
The fuel rail pressure sensor is installed to the side of the fuel rail. The fuel rail is a device to convert the fuel pressure signal into a electric signal, amplify it and supply it to the ECU. The fuel rail pressure is determined based on the engine RPM, engine torque, barometric pressure, coolant temperature, intake air temperature, etc. Once the fuel rail pressure is determined, it is controlled by the IMV. Then, the fuel rail pressure sensor is used to detect the fuel rail pressure and set the opening amount of the IMV. The fuel rail pressure sensor can measure the fuel pressure from 0 up to 2,200 bars.

## ► FUEL RAIL PRESSURE SENSOR CHARACTERISTICS



|                              |                       |                           |
|------------------------------|-----------------------|---------------------------|
| <b>Sensor supply voltage</b> |                       | $5 \pm 0.1 \text{ V}$     |
| <b>Sensor output voltage</b> | At 2,200 bars         | $4.5 \pm 0.125 \text{ V}$ |
|                              | At 0 bar              | $0.5 \pm 0.04 \text{ V}$  |
| <b>Faulty range</b>          | At 0 - 1,000 bars     | $\pm 1.0\%$ or more       |
|                              | At 1,000 - 1,800 bars | $\pm 1.6\%$ or more       |

## INTAKE AIR TEMPERATURE &amp; PRESSURE SENSOR



The intake air pressure sensor and temperature sensor are installed on the intake manifold side by side.

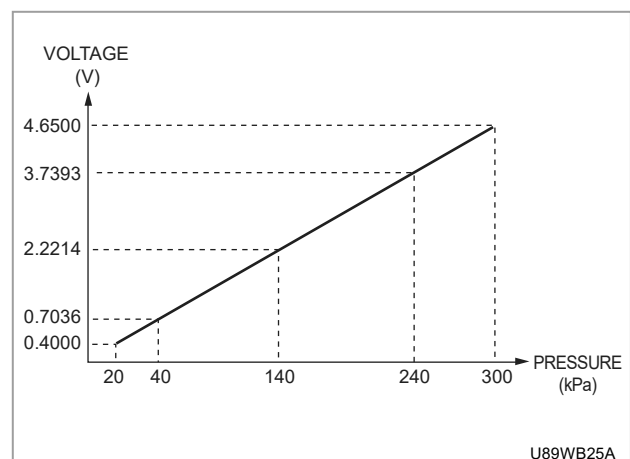
The intake air pressure sensor detects the pressure of air drawn in forcibly by the turbocharger precisely for use as important information to determine the optimal fuel injection amount.

Also, the intake air temperature sensor detects the temperature of the intake air by its resistor which its resistance value is changed by changes in the air temperature. This information is used to identify the exact air mass and adjust the fuel injection amount accordingly for optimum operation.

## ► INTAKE AIR TEMPERATURE &amp; PRESSURE SENSOR (PRESSURE SENSING)

|                                     |               |
|-------------------------------------|---------------|
| <b>Guaranteed pressure range</b>    | 20 ~ 300 kPa  |
| <b>Guaranteed temperature range</b> | -40°C ~ 125°C |
| <b>Guaranteed supplying power</b>   | 4.75 ~ 5.25 V |
| <b>Max. current consumption</b>     | 12.5 mA       |

- Pressure sensor output characteristics  $V_s = 5 \text{ V}$



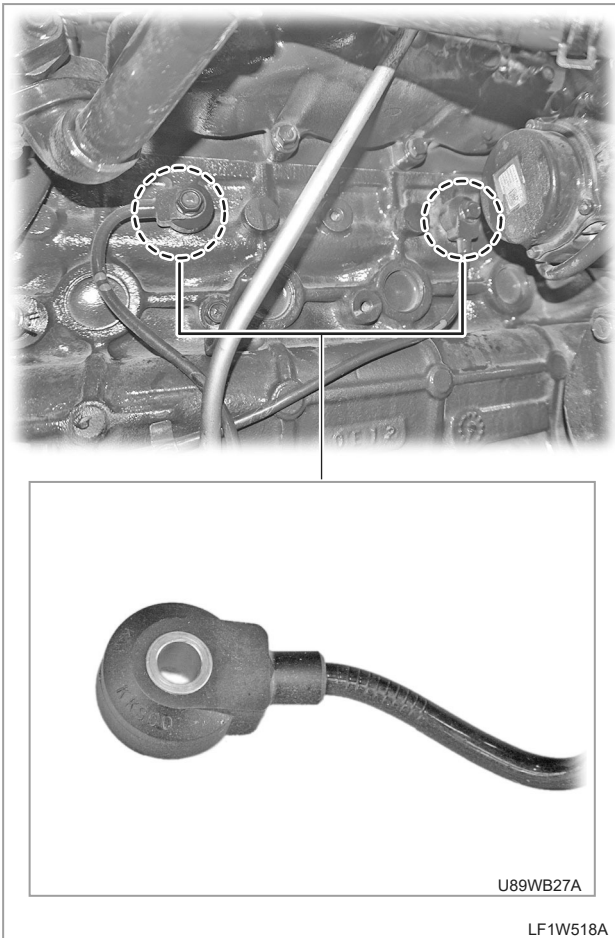
## ► INTAKE AIR TEMPERATURE SENSOR

|                                        |               |
|----------------------------------------|---------------|
| Applied temperature range (continuous) | -40°C ~ 200°C |
| Supplied power                         | 5 ± 4% VDC    |

## • PROBE CHARACTERISTICS

| TEMPERATURE (°C) | RESISTANCE (Ω) |        |         | TEMP. TOL. (± °C) |
|------------------|----------------|--------|---------|-------------------|
|                  | MINIMUM        | NORMAL | MAXIMUM |                   |
| -40              | 36,308         | 39,650 | 42,992  | 1.5               |
| -20              | 12,890         | 13,844 | 14,798  | 1.4               |
| 0                | 5,179          | 5,489  | 5,799   | 1.3               |
| 20               | 2,316          | 2,419  | 2,522   | 1.1               |
| 25               | 1,925          | 2,000  | 2,075   | 1.0               |
| 50               | 805.8          | 833    | 860.2   | 1.0               |
| 80               | 326.7          | 336.1  | 345.5   | 1.0               |
| 100              | 190.7          | 197.3  | 203.8   | 1.3               |
| 150              | 60.93          | 63.77  | 66.61   | 2.2               |
| 180              | 34.45          | 36.26  | 38.08   | 2.8               |
| 200              | 24.49          | 25.87  | 27.25   | 3.3               |



**ACCELERATOR (KNOCK) SENSOR**

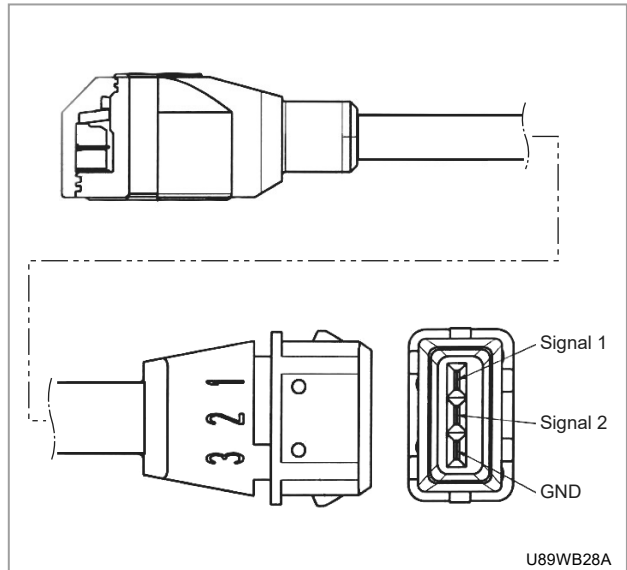
Two acceleration (knock) sensors are installed to the engine cylinder block (intake manifold side).

When engine knocking occurs, the piston or connecting rod is vibrated and, in a severe condition, hitting a metallic object is heard. The knock sensor is to detect this knocking condition due to abnormal combustion.

This sensor has a piezo-electric element fixed to the diaphragm to detect vibration of the engine occurred by abnormal combustion, and the diaphragm is fixed to the base.

Also, it is also used to control idle stability and detect injector's faulty condition to illuminate the engine warning lamp and adjust the pilot injection amount precisely.

If the acceleration (knock) sensor malfunctions, the ECU calibrates the injection timing based on the engine RPM, intake air amount and coolant temperature.

**► CONNECTOR****► KNOCK SENSOR CHARACTERISTICS**

When the engine temperature is low, it outputs a high value due to a large fuel injection amount and vibration. However, after the engine is warmed up, its signal value is decreased.

The 1st knock sensor outputs signals for the 1st and 2nd cylinders while the 2nd knock sensor outputs signals for the 3rd and 4th cylinders.

|                                    |                         |
|------------------------------------|-------------------------|
| <b>Insulation resistance</b>       | Min. 1 MΩ               |
| <b>Resonance frequency</b>         | 25 kHz                  |
| <b>Operating temperature range</b> | -40 ~ 150°C             |
| <b>Output voltage</b>              | 26 ± 8 mV/g (at 5 kHz)  |
|                                    | 22 ~ 37 mV/g (3~10kHz)  |
|                                    | 22 ~ 57 mV/g (10~20kHz) |

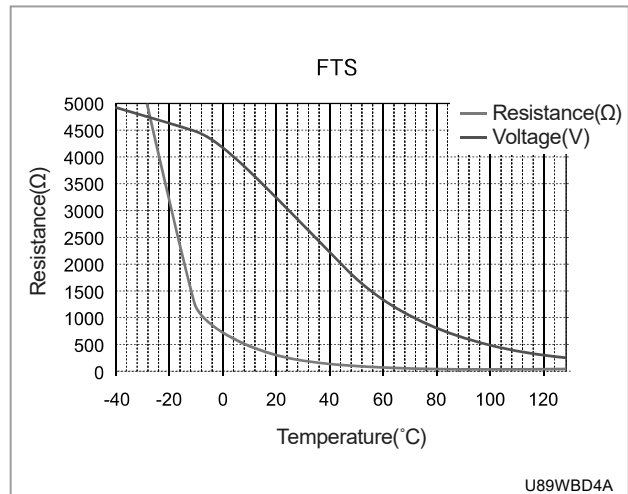
## HIGH-PRESSURE FUEL PUMP TEMPERATURE SENSOR



The high-pressure fuel pump temperature sensor is installed right below the IMV (Inlet Metering Valve) of the high-pressure fuel pump. This temperature sensor detects the inlet temperature of the high-pressure fuel pump and sends this information to the ECU. Generally, the temperature of returning fuel rises quite a lot in the common rail diesel engine. In this case, lubrication film of fuel is destroyed so its lubricating performance is deteriorated, resulting in possible damage of the high-pressure fuel pump. Therefore, when the fuel temperature rises over the specified level, this information is sent from the temperature sensor to the ECU which then adjusts the fuel injection amount to control the engine RPM in order to prevent further fuel temperature increase.

It also measures the fuel temperature to decrease the opening amount of the IMV in case of overheating condition in order to decrease the amount of compressed fuel and prevent a further rise of the fuel temperature. The fuel temperature sensor is a NTC resistor type and is installed between the low-pressure line and high-pressure line in the high-pressure pump. It uses 5 V power to generate its output voltage.

## ► FUEL TEMPERATURE SENSOR CHARACTERISTICS

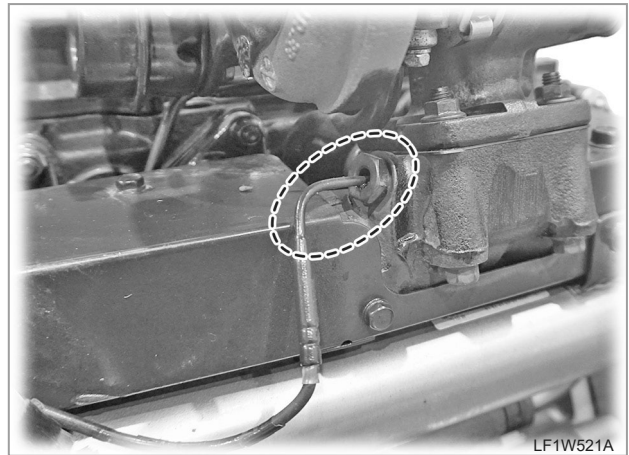


| Temperature (°C) | Resistance (Ω) | Voltage (V) |
|------------------|----------------|-------------|
| -40              | 75,789         | 4.903       |
| -10              | 12,462         | 4.463       |
| 0                | 7,355          | 4.153       |
| 10               | 4,481          | 3.746       |
| 20               | 2,812          | 3.261       |
| 40               | 1,199          | 2.221       |
| 70               | 394            | 1.040       |
| 90               | 206            | 0.604       |
| 120              | 87             | 0.276       |
| 140              | 52             | 0.171       |

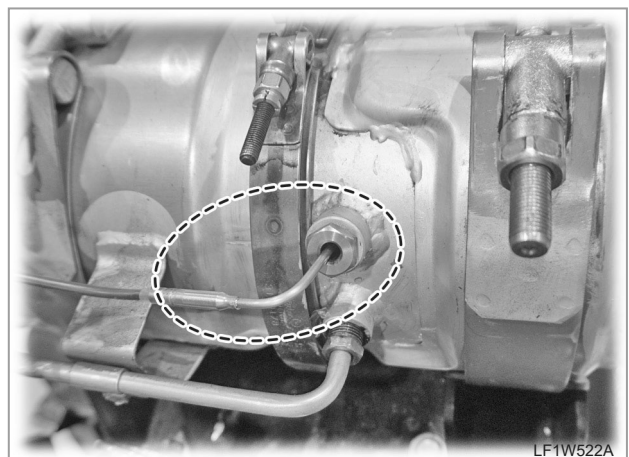
**WATER-IN-FUEL SENSOR**

LF1W520A

The water-in-fuel sensor is installed under the fuel filter. When water enters the engine fuel system, it can damage the high-pressure fuel pump, filter and injector and cause poor engine starting performance and malfunction. Therefore, when water is collected (45cc or more) on the bottom of the fuel filter, this water-in-fuel sensor sends a signal to the instrument cluster which then turns on the water-in-fuel warning lamp. Make sure to drain water from the pre-filter in this case.

**EXHAUST GAS TEMPERATURE SENSOR**

LF1W521A



LF1W522A

The exhaust gas temperature sensors are installed to the side of the exhaust manifold (front exhaust temperature sensor) and to the CCRT (Catalyzed Continuously Regenerating Trap) (rear exhaust temperature sensor).

It is also installed to the outlet of the DOC (Diesel Oxidation Catalyst) to detect the temperature in the DOC for determination of overheating condition.

When the engine is overheated (over 900°C to 950°C), the DOC is melted, increasing soot in exhaust gas.

Therefore, when the exhaust gas temperature rises over a certain level, the exhaust gas temperature sensor sends a signal to the ECU which then controls the EGR operation to decrease the temperature in the combustion chamber in order to prevent overheating of the catalyst and decrease the exhaust gas temperature.

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- FRONT EXHAUST TEMPERATURE SENSOR

The front exhaust temperature sensor is installed in the exhaust manifold. It uses the change in resistance occurred by the exhaust gas temperature change, converts it to the voltage value, and send this information to the engine ECU.

To prevent turbocharger damage in the post-injection process, it is used to limit the fuel injection amount at a high exhaust gas temperature.

- REAR EXHAUST TEMPERATURE SENSOR

The rear exhaust temperature sensor measures the temperature of exhaust gas passing through the DPF. If this temperature in the DPF regenerating section is low (below approx. 600°C), the engine ECU decreases the amount of intake air and increases the post-injection duration based on this information to increase the temperature of exhaust gas.

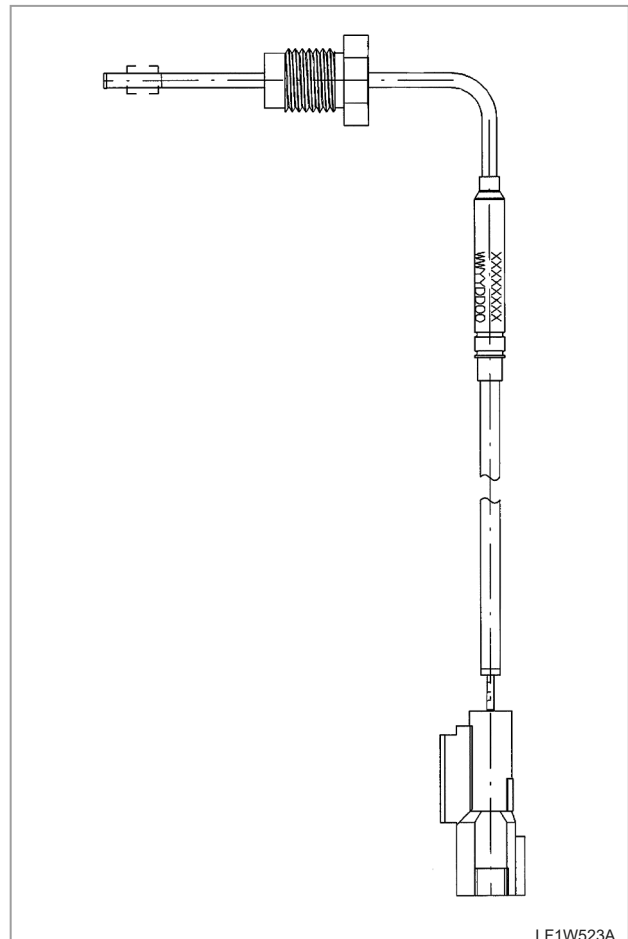
In other words, this sensor determines whether the CCRT is at a proper temperature for regeneration and sets the post-injection amount accordingly.

- Input data
  - Min. operating temperature of probe tip: 1000°C
  - Supplied power: 5 ± 0.1 VDC
- Output data
  - Type: passive
  - Max. current: 2.5 mA

## ► RESISTANCE BY MEASURED TEMPERATURE

| Temp (°C) | RT(Ω)<br>RW = 1.0 Ω | VO (V) |
|-----------|---------------------|--------|
| -40       | 170.20              | 0.727  |
| 0         | 201.27              | 0.838  |
| 25        | 220.07              | 0.902  |
| 50        | 239.30              | 0.965  |
| 100       | 276.78              | 1.084  |
| 150       | 313.62              | 1.194  |
| 200       | 349.90              | 1.296  |
| 250       | 385.59              | 1.391  |
| 300       | 420.75              | 1.481  |
| 400       | 488.72              | 1.641  |
| 500       | 554.88              | 1.784  |
| 600       | 618.07              | 1.910  |
| 700       | 678.91              | 2.022  |
| 800       | 739.02              | 2.125  |
| 850       | 767.46              | 2.171  |

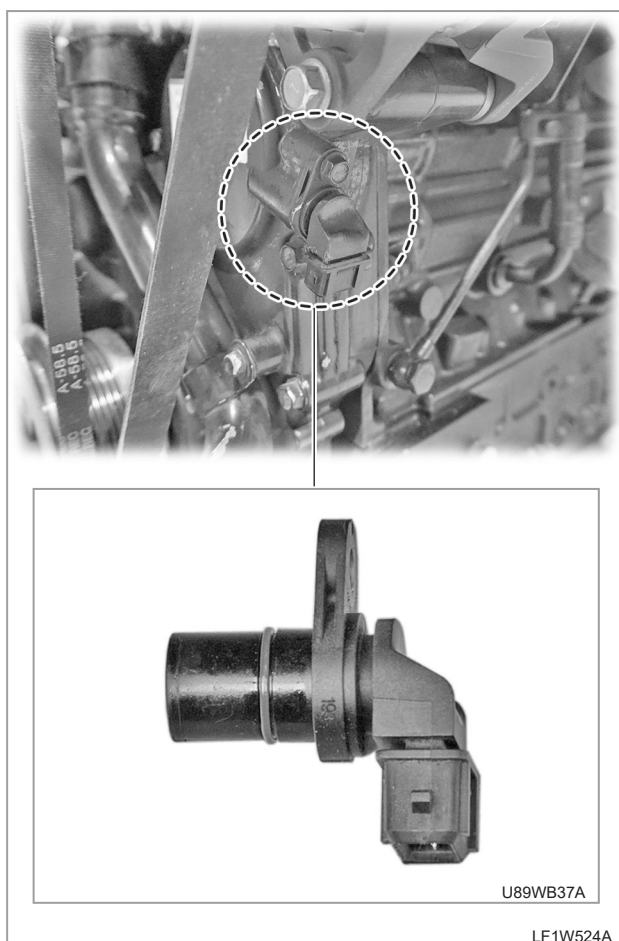
## ► CONNECTOR



LF1W523A



## CAMSHAFT WHEEL SENSOR



The camshaft wheel sensor is installed to the side of the gear case in the front section of the engine.

This sensor is aligned with the operating trajectory of the camshaft wheel to detect the rotating condition of the camshaft. It supplies information about cylinder stroke or position to the ECU to control the fuel injection timing.

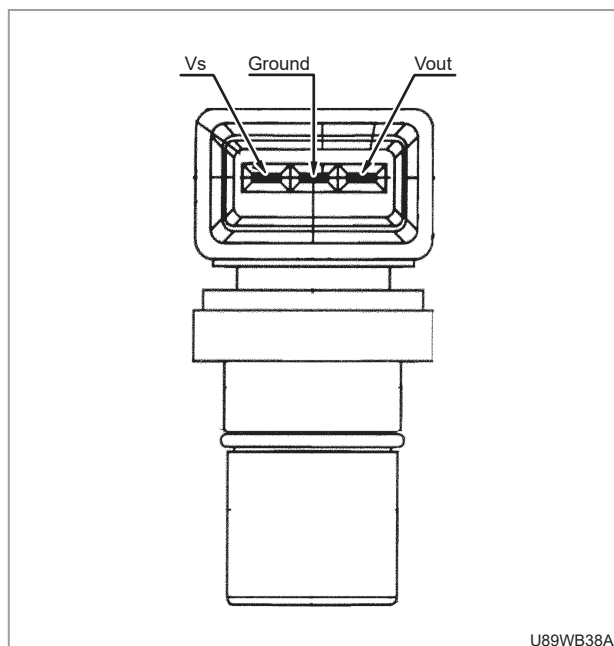
The camshaft rotates at a half speed of the crankshaft. When the piston moves toward TDC while controlling the intake and exhaust valves of the engine, this sensor detects the position of the camshaft to check whether a particular cylinder is at the compression stroke or exhaust stroke.

Especially, when the engine is initially started, it is hard to identify the stroke condition of a particular cylinder only with information from the crankshaft wheel sensor. Therefore, information from the camshaft wheel sensor is necessary to identify the accurate stroke condition of cylinders after the engine is initially started.

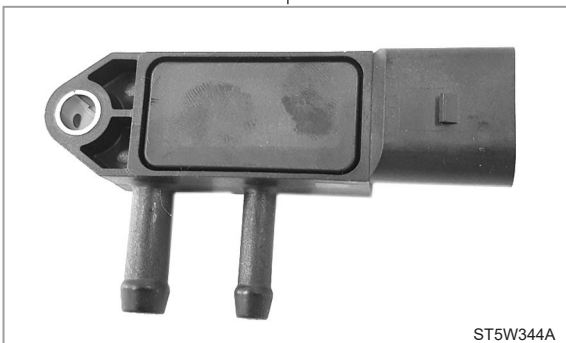
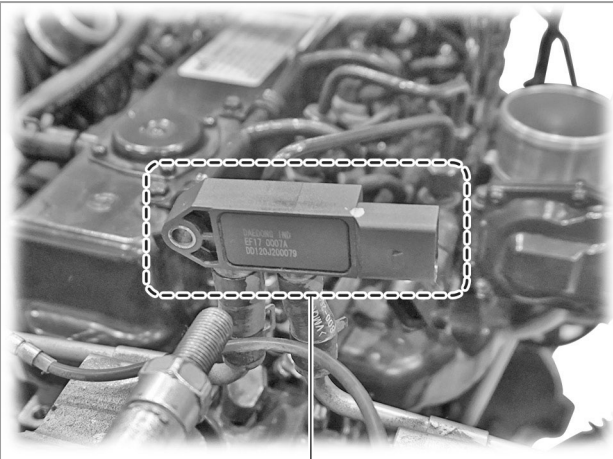
On the other hand, after the engine is started, information from the crankshaft wheel sensor is fed to the ECU which then learns conditions of every cylinder in the engine. Therefore, afterwards the engine can keep running even when the camshaft wheel sensor is malfunctioning.

- Operating temperature range:  $-40^{\circ}\text{C} \sim 150^{\circ}\text{C}$
- Possible speed range: 15 ~ 4,000 rpm
- Supplied power (Vs): 6 ~ 24 VDC
- Supplied current: Max. 10 mA
- Output (Vout): Max. 24 VDC  
Max. 20 mA

## ► CONNECTOR



## DPF DIFFERENTIAL PRESSURE SENSOR

ST5W344A  
LF1W525A

The DPF differential pressure sensor is installed on the top of the CCRT (Catalyzed Continuously Regenerating Trap).

The CCRT is mainly composed of the DOC (Diesel Oxidation Catalyst) and DPF (Diesel Particulate Filter). When exhaust gas passes through this trap, hydrocarbon soot called PM (Particulate Material) is accumulated in the DPF.

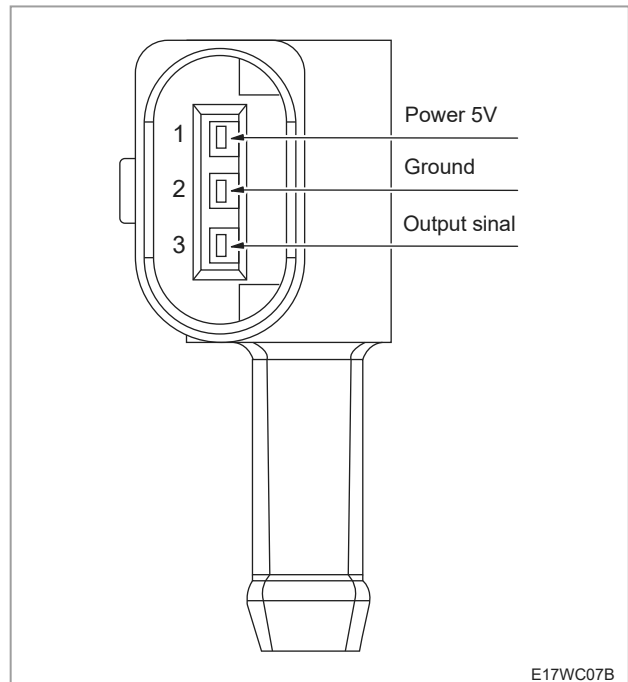
If excessive PM is accumulated, air passage is blocked, resulting in high pressure difference between the front and back of the DPF. The differential pressure sensor detects this pressure difference and sends this information to the ECU.

If a certain amount of PMs is detected in the CCRT, the post-injection is performed to increase the temperature of the DOC to 450 to 500°C in order to regenerate (oxidize) PMs.

The post-injection process is activated only when the amount of PMs is over the specification. In a normal condition, the PM amount is monitored.

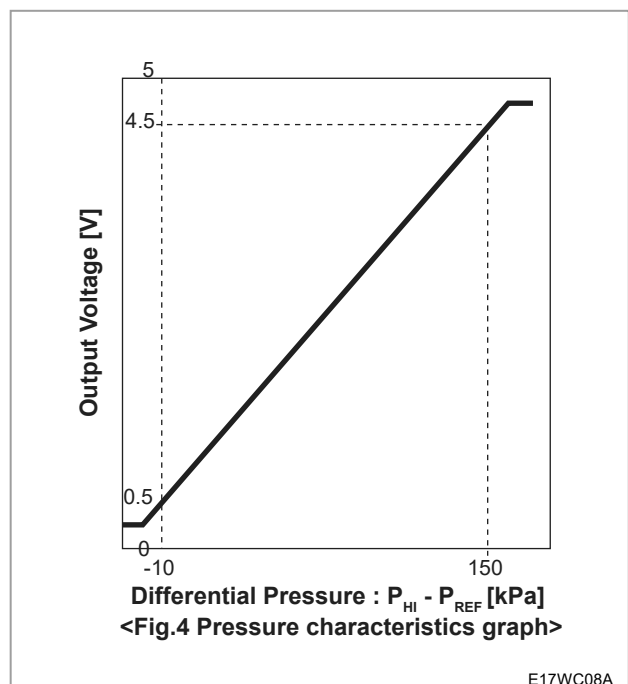
- Supplied power: 4.75 ~ 5.25 VDC
- Supplied current: Max. 10 mA
- Operating temperature range: -40°C ~ 145°C
- Operating pressure range (difference between ports): -10 ~ 150 kPa
- Pressure range in normal mode (each port): 50 ~ 250 kPa

## ► CONNECTOR



E17WC07B

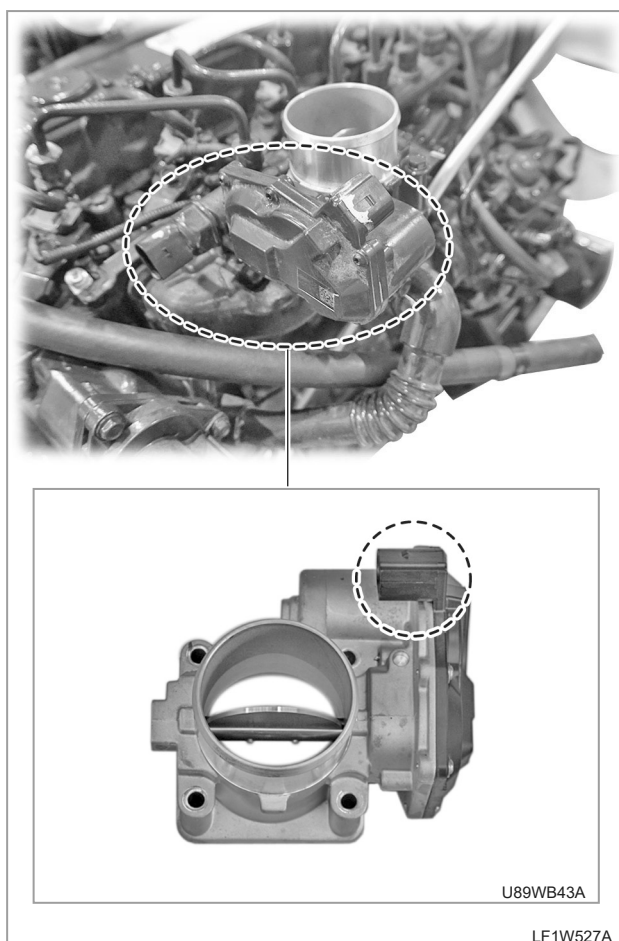
## ► DIFFERENTIAL PRESSURE SENSOR CHARACTERISTICS



E17WC08A

The differential pressure sensor detects the pressure difference between the inlet and outlet of the CCRT and sends a signal value of 0.5 to 4.5 V to the ECU. The larger the pressure difference between the inlet port and outlet port is, the closer the signal value gets to 4.5 V. The smaller the pressure difference is, the closer the signal value gets to 0.5 V.

## AIR CONTROL VALVE SENSOR

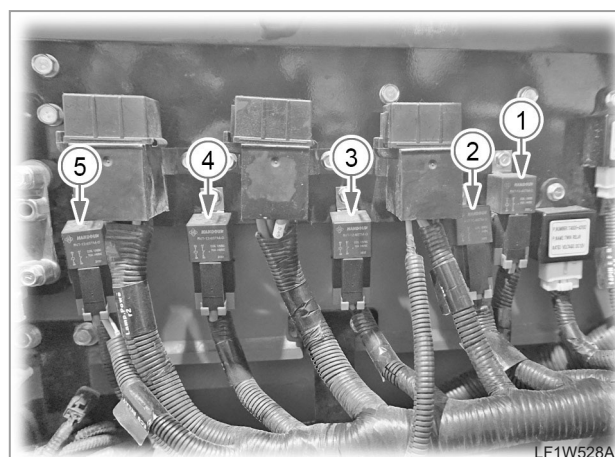


The air control valve sensor is installed to the air control valve between the turbocharger intake hose and intake manifold flange.

The air control valve adjusts the amount of air entering the intake manifold. The operating angle of the blade at its inlet is changed according to the depressed amount of the accelerator pedal to control the intake air amount into the engine.

Therefore, this sensor detects the opening angle of the blade and sends this information to the ECU which then adjust the fuel injection amount accordingly.

## RELAY (70A)

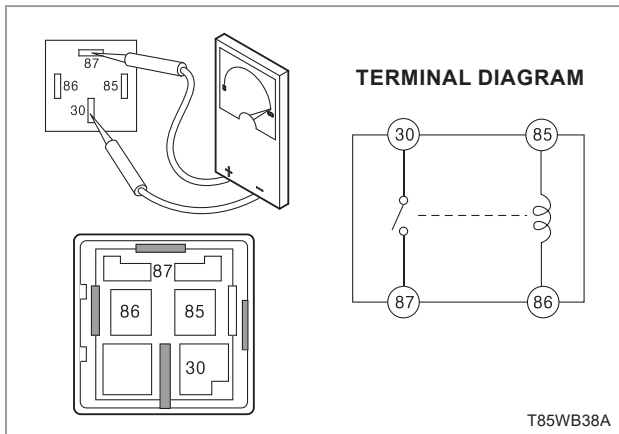


- |                   |                   |
|-------------------|-------------------|
| (1) Power relay 5 | (4) Power relay 4 |
| (2) Power relay 1 | (5) Power relay 3 |
| (3) Power relay 2 |                   |

Relays (70A) are installed side by side on the panel at the left side of the engine compartment and supply power to individual elements.

|                      |                                                     |
|----------------------|-----------------------------------------------------|
| <b>Power relay 1</b> | Glow plug                                           |
| <b>Power relay 2</b> | Reverse buzzer,<br>Air suspension seat, Beacon lamp |
| <b>Power relay 3</b> | Wiper motor                                         |
| <b>Power relay 4</b> | 14-pin, Power socket, Motor fan                     |
| <b>Power relay 5</b> | Air conditioner                                     |

## TEST



To perform the relay test, disconnect the relay from the wiring.

Check the resistance and continuity within the resistance range ( $\Omega$ ) of a tester.

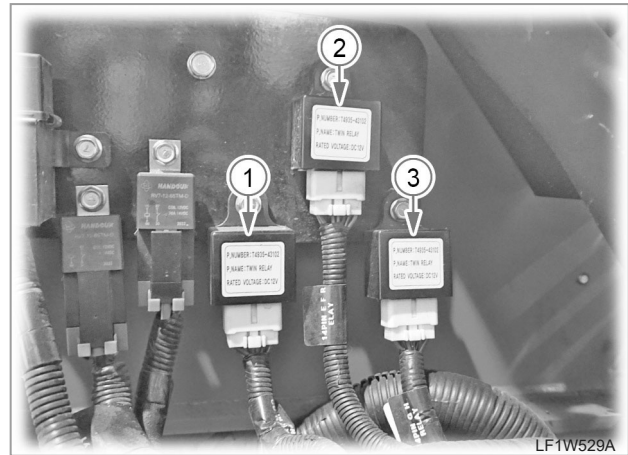
Numbers on the auxiliary relay terminals indicate corresponding coil and contact.

- Capacity: 12 V 70 A

| Item                    | Measuring point with tester |              | Result        |
|-------------------------|-----------------------------|--------------|---------------|
|                         | Red Lead                    | Black Lead   |               |
| Resistance ( $\Omega$ ) | Relay No. 85                | Relay No. 86 | 86 $\Omega$   |
|                         | Relay No. 30                | Relay No. 87 | No continuity |

※ When measuring resistance, red and black tester leads can be interchangeable.

## TWIN RELAY

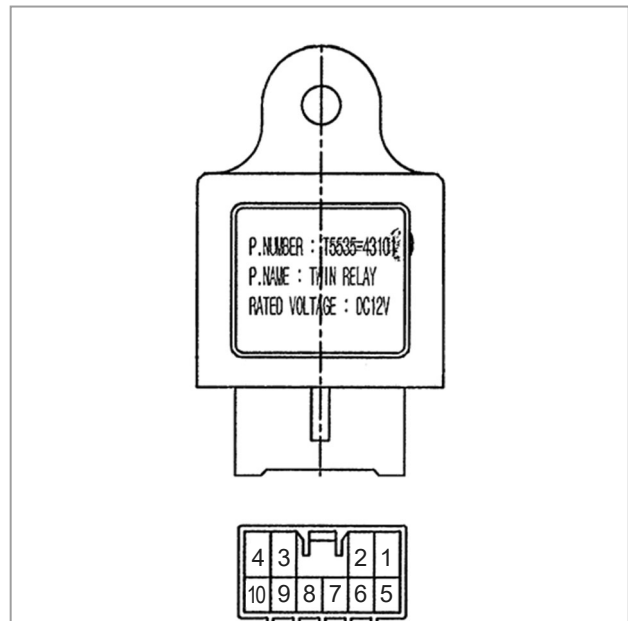


- (1) 14-pin C-D relay
- (2) 14-pin E-F relay

- (3) 14-pin G-H relay

Twin relays are installed on the upper panel at the left side of the engine compartment and supply power to the corresponding 14-pin connectors.

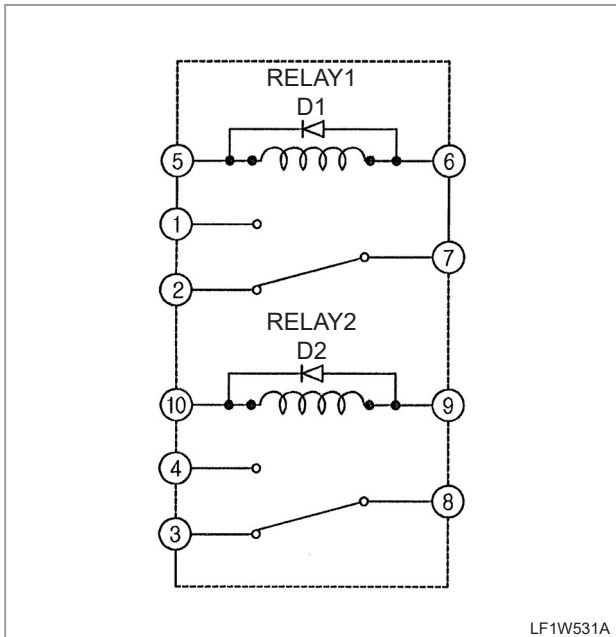
## ► CONNECTOR



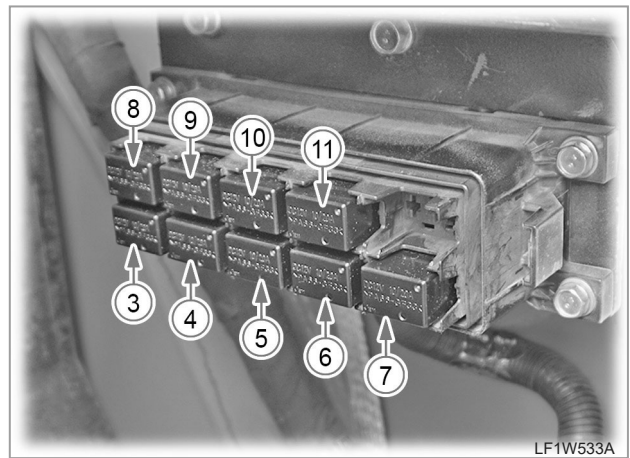
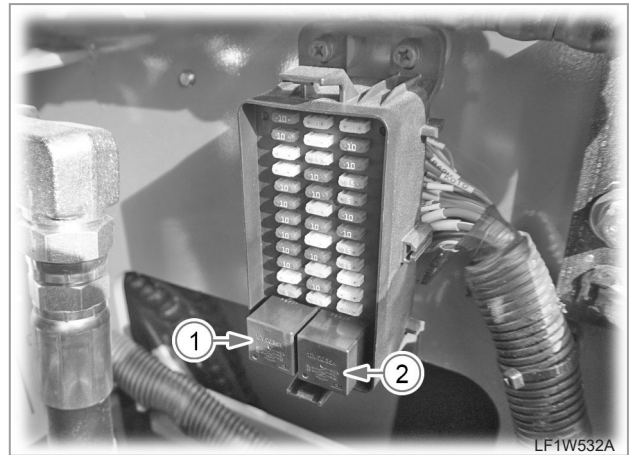
| PIN NO. | DESCRIPTION  | PIN NO. | DESCRIPTION  |
|---------|--------------|---------|--------------|
| 1       | RELAY1 N.O   | 6       | RELAY1 COIL- |
| 2       | RELAY1 N.C   | 7       | RELAY1 COM.  |
| 3       | RELAY2 N.C   | 8       | RELAY2 COM.  |
| 4       | RELAY2 N.O   | 9       | RELAY2 COIL- |
| 5       | RELAY1 COIL+ | 10      | RELAY2 COIL+ |

LF1W530A

► CIRCUIT



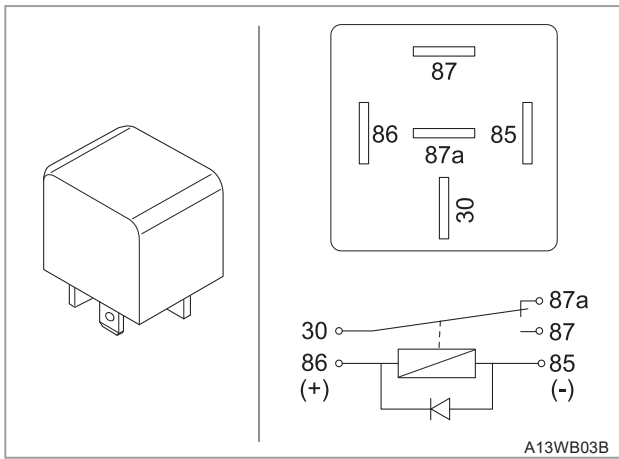
5P / 4P RELAY



- (1) Fuel heater relay (5P)
- (2) ECU relay (5P)
- (3) Start relay (4P)
- (4) Electric fan relay (4P)
- (5) Horn relay (4P)
- (6) Reverse buzzer relay (4P)
- (7) Stop relay(4P)
- (8) Pilot lock driving relay (4P)
- (9) Pilot lock bucket relay (4P)
- (10) Quick attachment lock relay (Option)(4P)
- (11) Quick attachment release relay (Option)(4P)

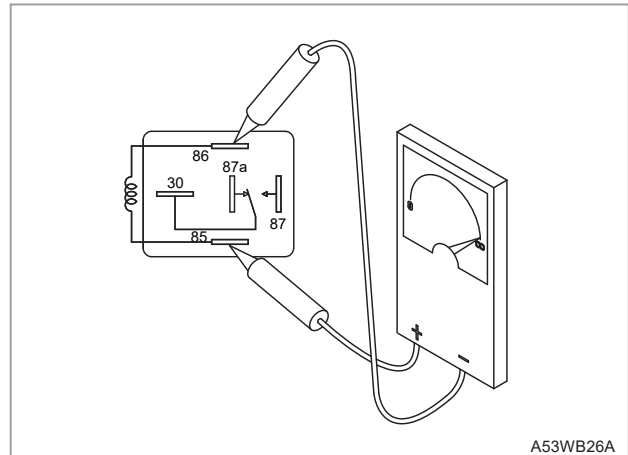
These relays are installed at the right side of engine compartment to supply power to the fuel heater, ECU and start motor.



**5P RELAY**

The 5P relay consists of 3 terminals, and terminal 30 and 87a, and the terminal No. 30 and 87 are decoupled in a normal condition (relay "OFF"). When supplying power (DC 12 V) to the terminal No 86 and 85, the terminal 30 and 87a will be decoupled, and the terminal 30 and 87 will be coupled, resulting in continuity.

| Terminal \ Load                        | Resistance | Lamp | Inductance |
|----------------------------------------|------------|------|------------|
| N.O. type<br>(Terminal No. 30 and 87)  | 40 A       | 30 A | 30 A       |
| N.C. type<br>(Terminal No. 30 and 87a) | 30 A       | 20 A | 20 A       |

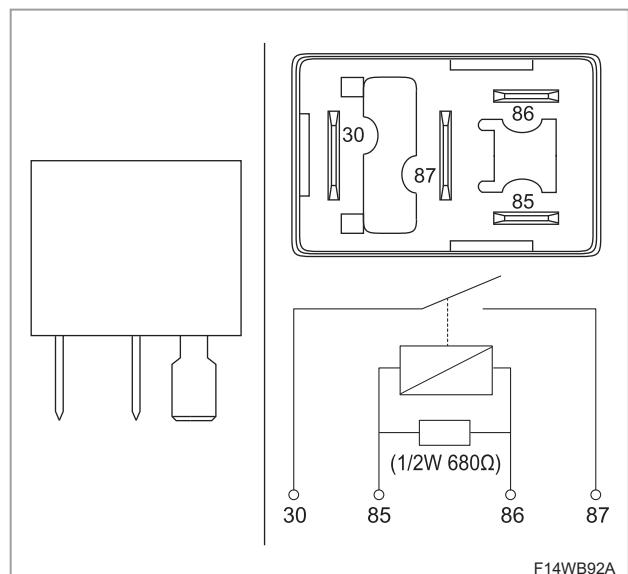
**► TEST**

To perform the relay test, disconnect the relay from the wiring.

Check the resistance and continuity within the resistance range ( $\Omega$ ) of a tester.

Numbers on the auxiliary relay terminals indicate corresponding coil and contact.

| Item       | Measuring point with tester |               | Result        |
|------------|-----------------------------|---------------|---------------|
|            | Red Lead                    | Black Lead    |               |
| Resistance | Relay No. 85                | Relay No. 86  | 84 $\Omega$   |
|            | Relay No. 30                | Relay No. 87a | Continuity    |
|            | Relay No. 30                | Relay No. 87  | No continuity |

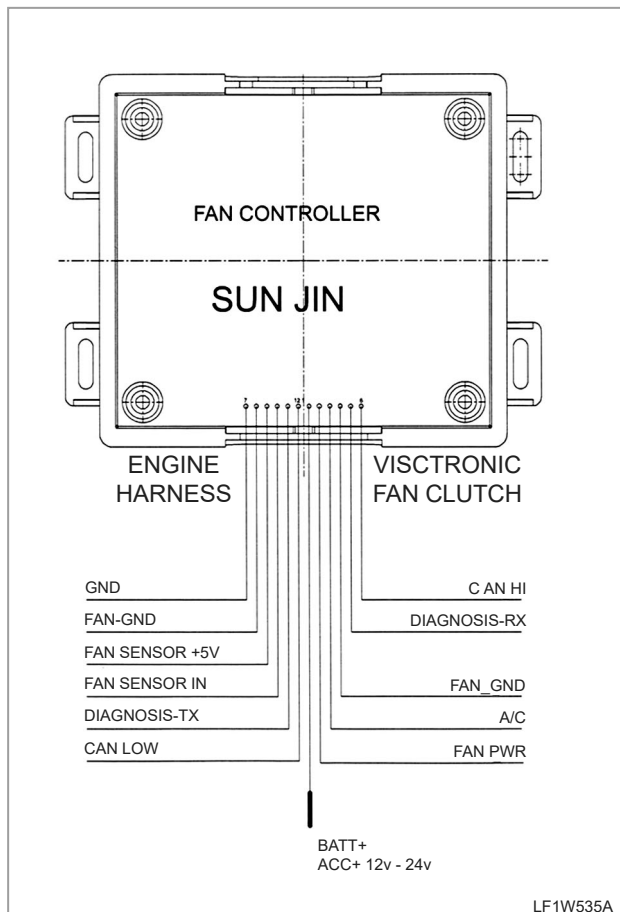
**4P RELAY**

## FAN CLUTCH CONTROLLER

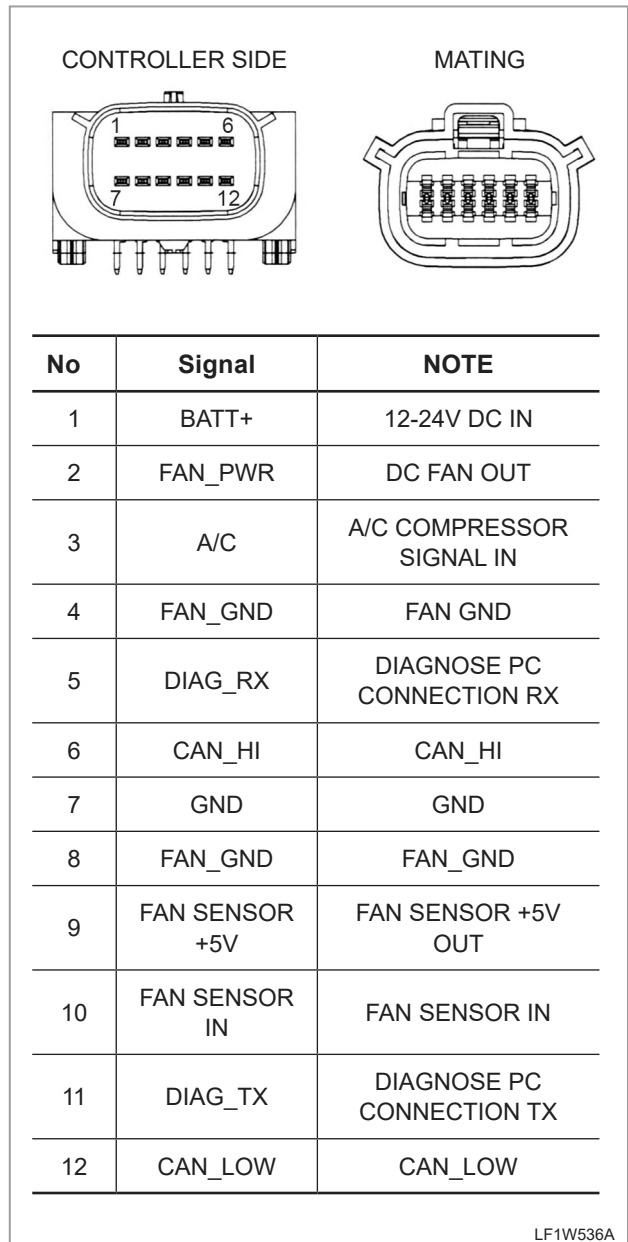


The fan clutch controller is installed at the lower left side of the engine compartment.

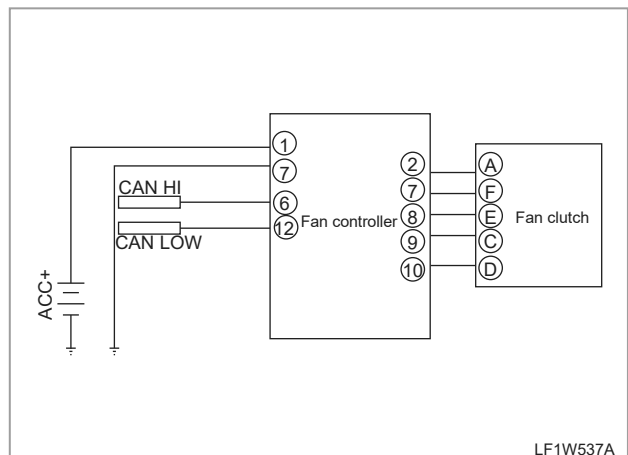
This controller is connected to the engine wiring and fan clutch wiring, to control the fan clutch according to the input signals reflecting temperature changes.



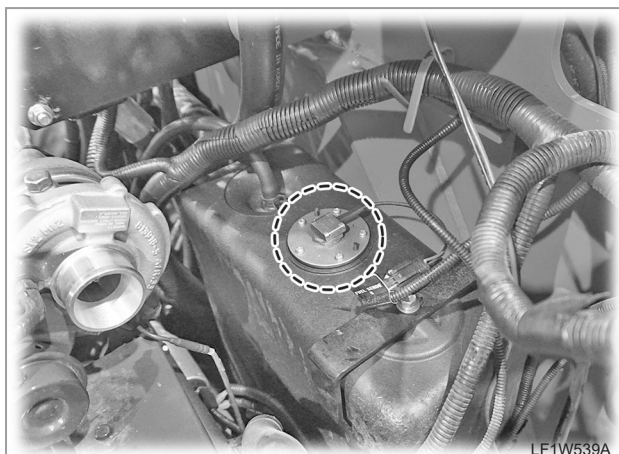
## ► CONNECTOR



## ► CIRCUIT



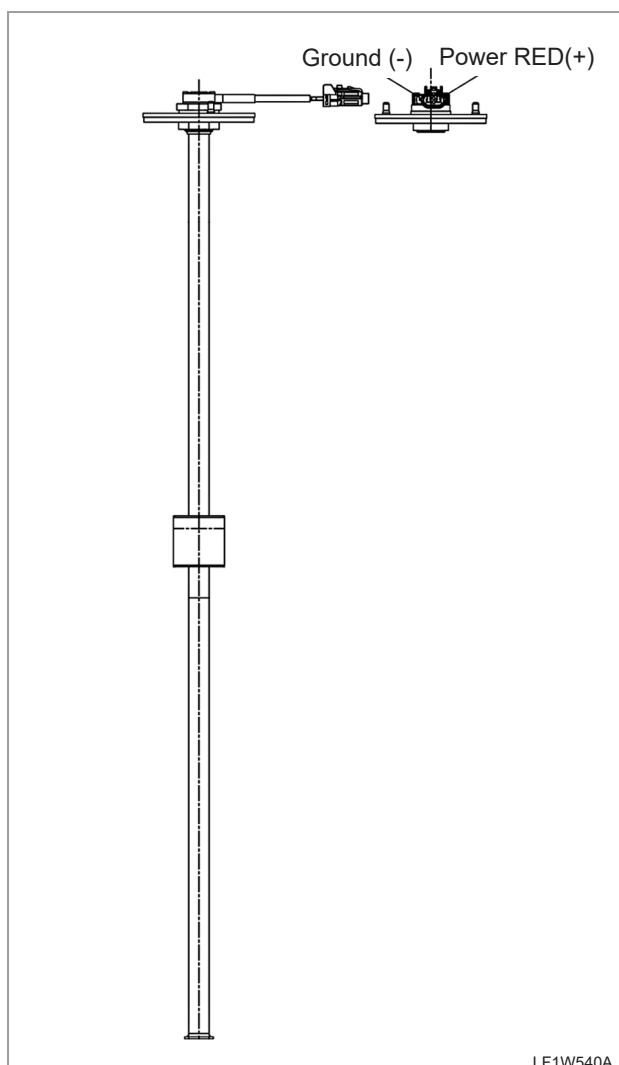
## FUEL SENDER



The fuel sender is installed on the top of the fuel tank from the right side of the engine room.

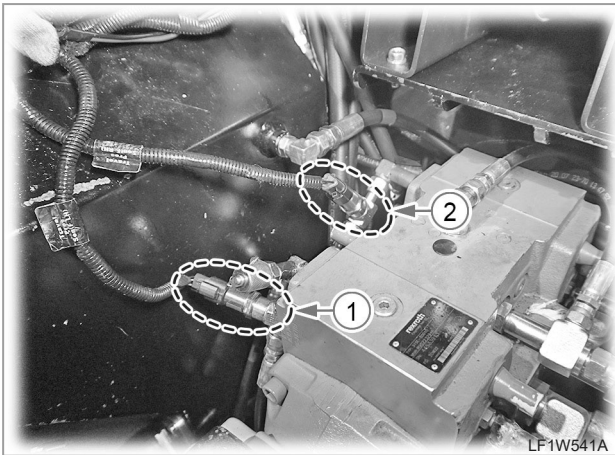
The sensor float goes up or down along with the fuel in the fuel tank as the resistance at the ground circuit of the fuel gauge changes.

## ► CONNECTOR

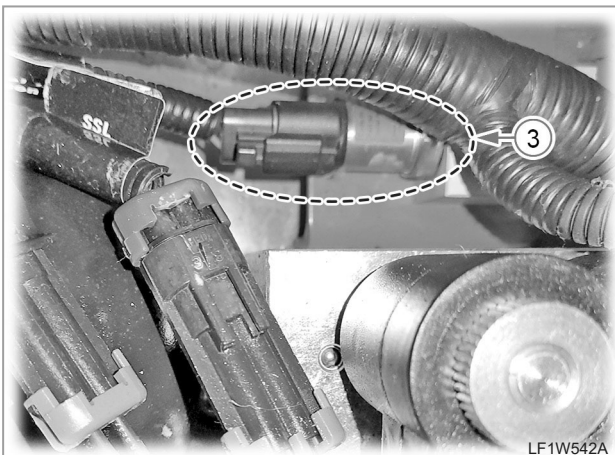


## ► RESISTANCE BY FLOATER POSITION

| Resistance by floater position (H) |                               |
|------------------------------------|-------------------------------|
| H (mm)                             | Resistance value ( $\Omega$ ) |
| <69                                | $3.3 \pm 1.05$                |
| 80                                 | $6.6 \pm 1.0$                 |
| 124                                | $9.9 \pm 1.15$                |
| 168                                | $15 \pm 1.23$                 |
| 189                                | $20.1 \pm 1.31$               |
| 210                                | $25.2 \pm 1.38$               |
| 231                                | $29.9 \pm 1.45$               |
| 252                                | $35 \pm 1.53$                 |
| 273                                | $40.1 \pm 1.61$               |
| 294                                | $44.8 \pm 1.68$               |
| 315                                | $49.9 \pm 1.75$               |
| 336                                | $55 \pm 1.83$                 |
| 357                                | $60.1 \pm 1.91$               |
| 378                                | $64.8 \pm 7.98$               |
| 399                                | $69.9 \pm 2.05$               |
| 420                                | $75 \pm 2.13$                 |
| 441                                | $80.1 \pm 2.21$               |
| 462                                | $84.8 \pm 2.28$               |
| 483                                | $89.9 \pm 2.35$               |
| 504                                | $95 \pm 2.43$                 |
| 525                                | $100.1 \pm 2.51$              |
| 543                                | $110.1 \pm 2.66$              |

**DRIVING PRESSURE SENSER**

LF1W541A



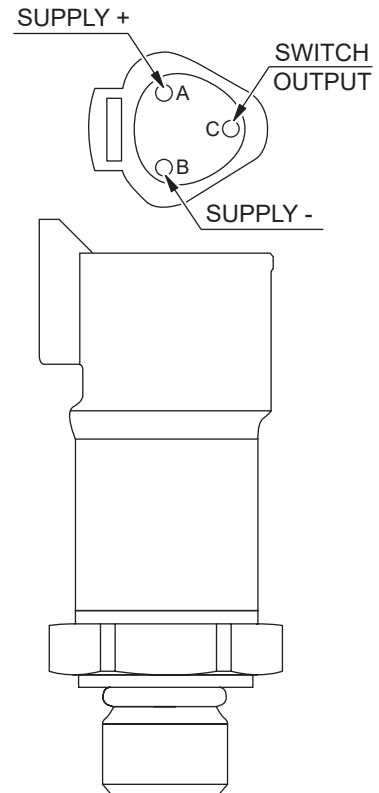
LF1W542A

(1) Forward (RH)  
(2) Forward (LH)

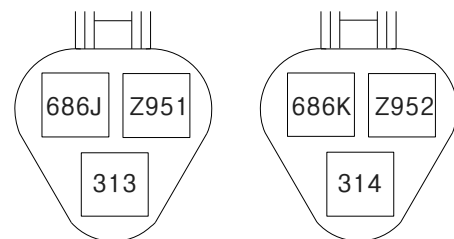
(3) Reverse

The forward LH/RH driving pressure sensor is installed on the hydraulic hose that is connected to the forward driving side of the RCV (LH) on the right side of the HST pump, while the reverse driving pressure sensor is installed on the block in the pilot rock valve, connected to the reverse driving side of the RCV (LH) with the hydraulic hose. These sensors detect the pressure of the discharged flow according to the operation displacement of the RCV (LH) operating lever.

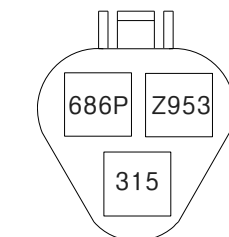
(Switch point : 5 bar)

**► CONNECTOR****SENSOR**

LF1W543A

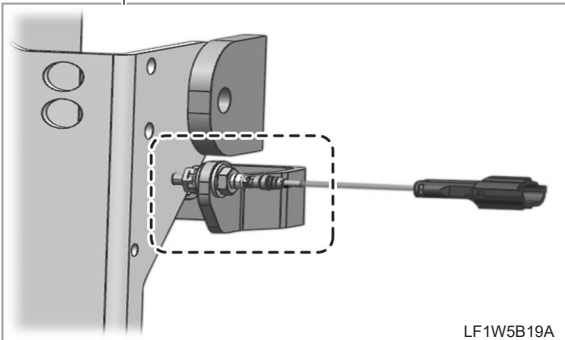
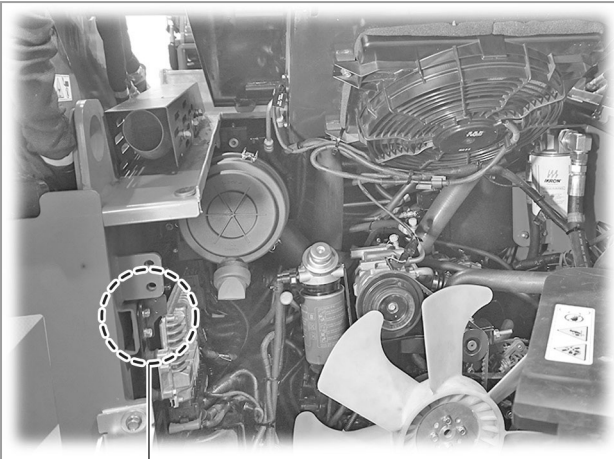
**WIRING**

Driving pressure senseDriving pressure sensor  
forward (LH) forward (RH)



Driving pressure sensor  
reverse

LF1W544A

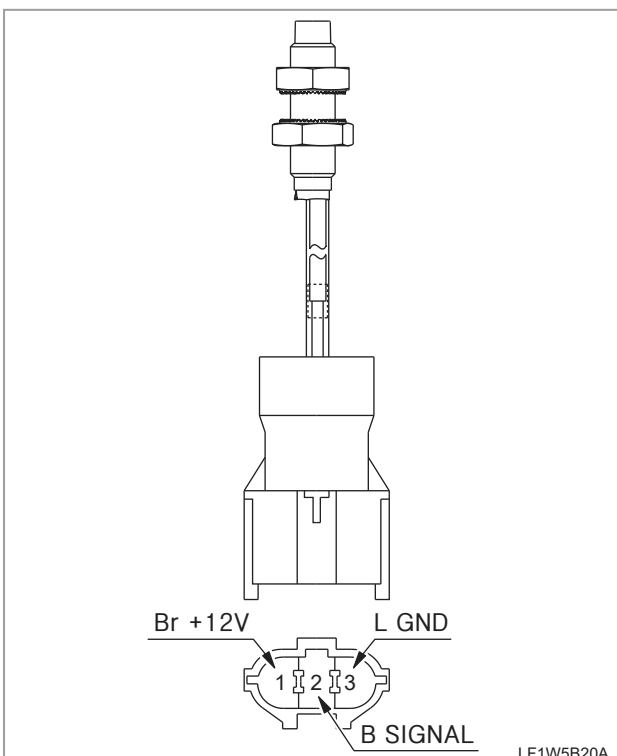
**SAFETY COVER SWITCH (SAFETY SENSOR)**

LF1W5B19A

LF1W5B18A

The safety cover switch is installed at the upper left side at the engine compartment entrance. This can be accessed by opening the rear cover.

This switch automatically stops the engine when the rear cover and then the cooler unit are opened.

**► CONNECTOR**

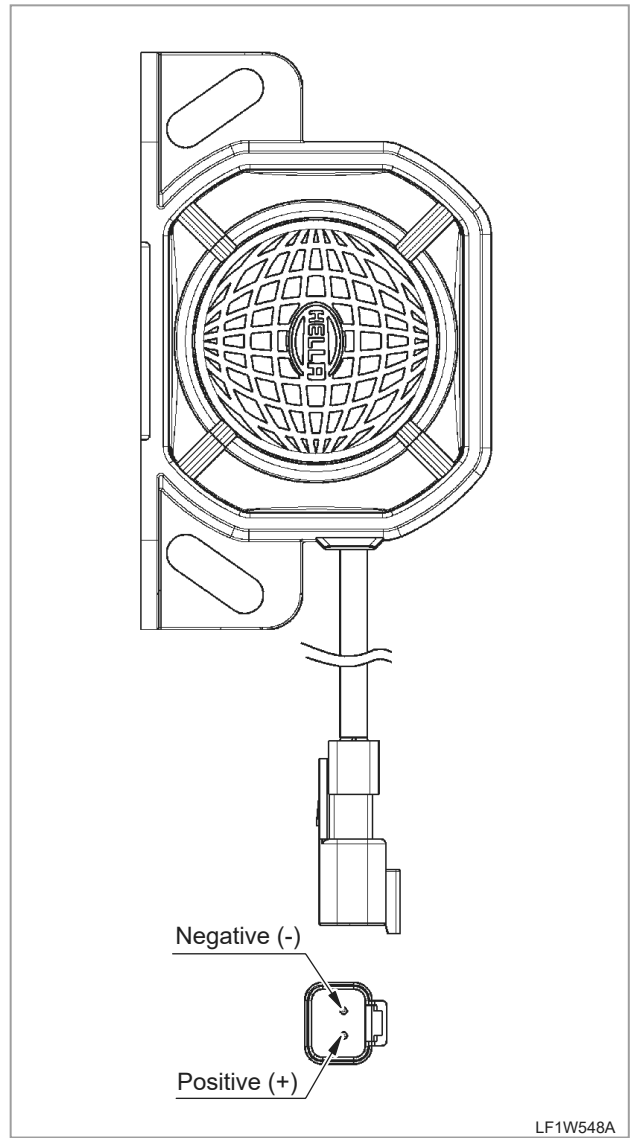
LF1W5B20A

**REVERSE BUZZER**

LF1W547A

The reverse driving buzzer is installed on the edge inside of the rear cover and it automatically sounds the alarm when the equipment is moving backwards.

- Warning volume : 107 ±5 dB(A)

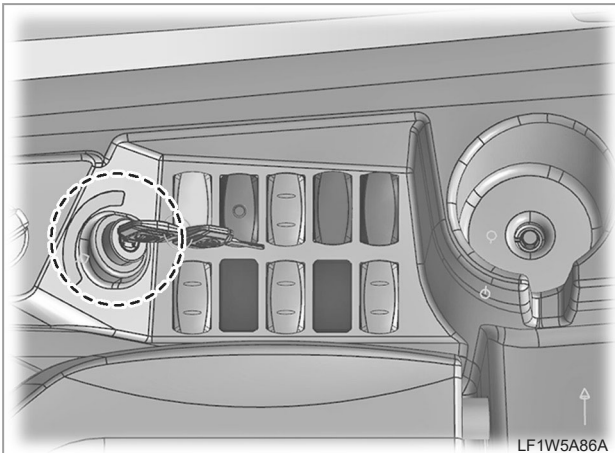
**► CONNECTOR**

LF1W548A



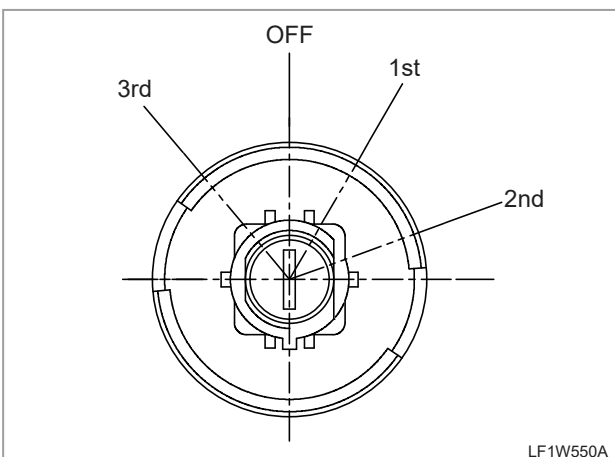
## 4.2 CABIN & CHASSIS

### 4.2.1 IGNITION SWITCH



The ignition switch is installed on the right side panel of the driver's seat.

#### IGNITION SWITCH OPERATION



1. The "Preheat (3 steps)" position is on the left from the "OFF" position while the other positions are on the right from it.
2. When the key switch is released and returned from the "PREHEAT (3rd)" position to the "OFF" position or from the "START (ST)" position to the "ON" position, it is automatically returned to the corresponding position by the load of its spring.

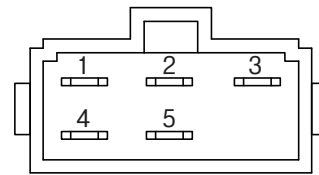
#### IGNITION SWITCH TEST

Disconnect the ignition switch from the wiring connector.

Use an ohmmeter ( $\Omega$ ) to test the switch.

- With the ignition switch in the "3rd" position, there will be continuity between the (BR), (ACC) and (RI) terminals.
  - With the ignition switch in the "OFF" position, the continuity will not exist between any of the terminals.
  - With the ignition switch in the "1st" position, there will be continuity between the (B), (BR) and (ACC) terminals.
  - With the ignition switch in the "2nd" position, there will be continuity between the (B), (BR), (ACC) and (C) terminals.
- ※ If the test results are not as outlined above, replace the ignition switch.

#### CONNECTOR & CIRCUIT



|   |     |                  |               |
|---|-----|------------------|---------------|
| 1 | B   | Battery          | AUX 3.0 R     |
| 2 | R1  | Glow             | AVSS 0.85 B/R |
| 3 | ACC | Light, radio etc | AVSS 1.25 R/L |
| 4 | BR  | Battery relay    | AVX 3.0 W     |
| 5 | C   | Start relay      | AVSS 0.85 B/W |

LF1W551A

| Key    | Terminal (Symbol) |                    |                        |                |                 |
|--------|-------------------|--------------------|------------------------|----------------|-----------------|
|        | Battery (B)       | Battery relay (BR) | Light, radio etc (ACC) | Glow plug (R1) | Start relay (C) |
| 3 Step | ○                 | ○                  | ○                      | ○              |                 |
| OFF    | ○                 |                    |                        |                |                 |
| 1 Step | ○                 | ○                  | ○                      |                |                 |
| 2 Step | ○                 | ○                  | ○                      |                | ○               |

## 4.2.2 ESCORT UNIT



The escort unit (1) is installed under the top cover behind the driver's seat.

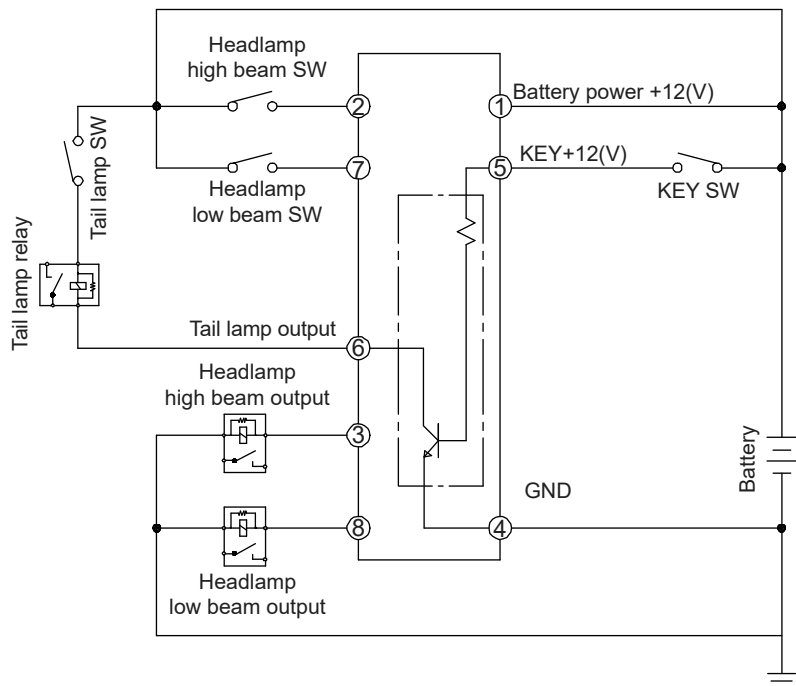
The escort unit keeps the headlamps (work lamp) ON for approx. 30 seconds and then turns them off if the engine is stopped with them ON.

- Rated voltage : DC 12V
- Operating voltage : DC 10 ~ 16V

## CONNECTOR &amp; CIRCUIT

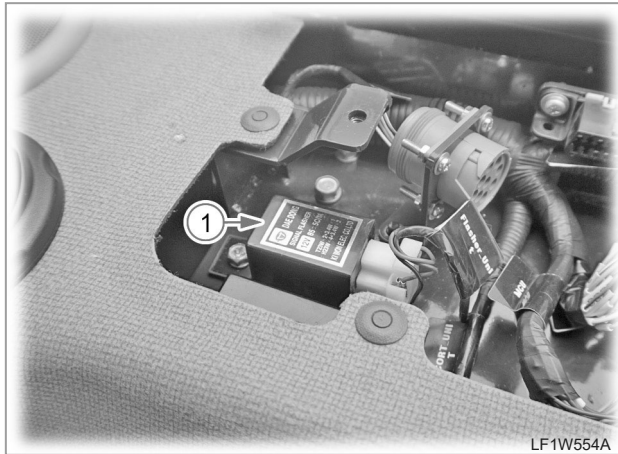
|   |   |   |   |   |
|---|---|---|---|---|
| 1 |   | 2 | 3 |   |
| 4 | 5 | 6 | 7 | 8 |

| No. | Function                  |
|-----|---------------------------|
| 1   | Battery power +12V        |
| 2   | Headlamp high beam SW     |
| 3   | Headlamp high beam output |
| 4   | GND                       |
| 5   | KEY +12[V]                |
| 6   | Tai lamp output (-)       |
| 7   | Headlamp low beam SW      |
| 8   | Headlamp low beam output  |



LF1W553A

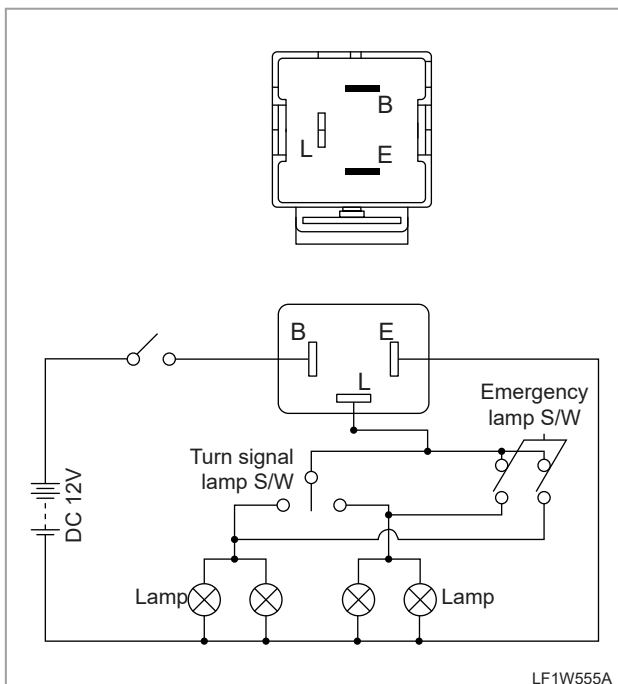
## 4.2.3 FLASHER



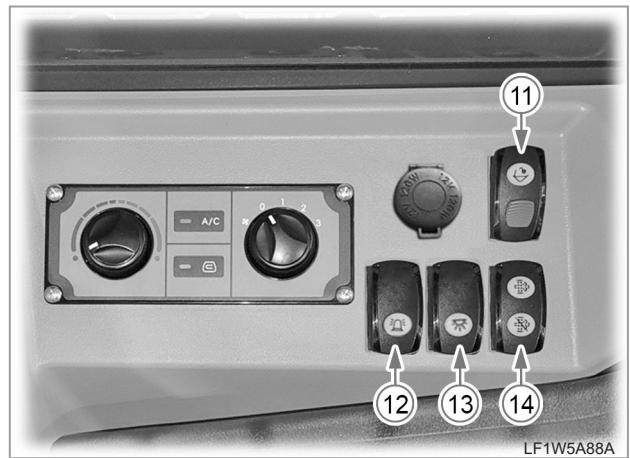
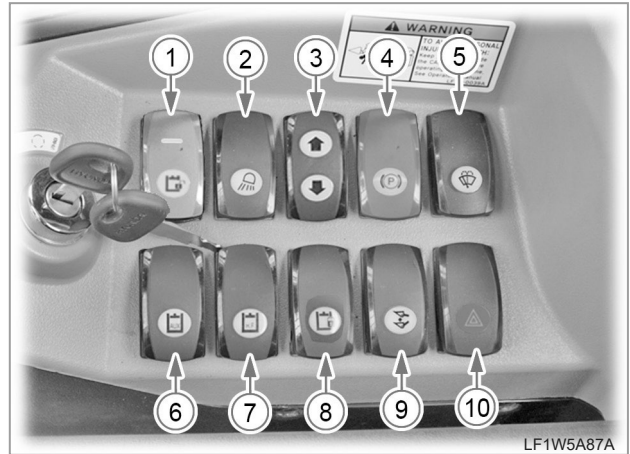
The flasher unit (1) is installed under the top cover behind the driver's seat; this flickers the lamps when the hazard warning flasher switch or turn signal lamp switch is operated.

As the flasher unit is directly connected to the battery, it can operate without the key in the ignition switch. It is designed to flash the lamp faster to inform a driver if a bulb of any turn signal lamp is blown.

## CONNECTOR &amp; CIRCUIT

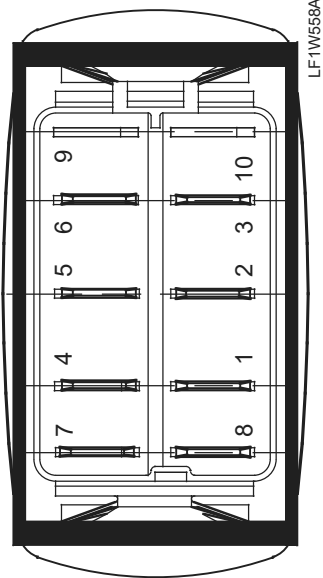


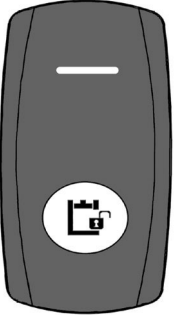
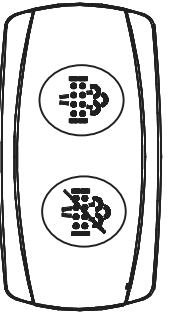
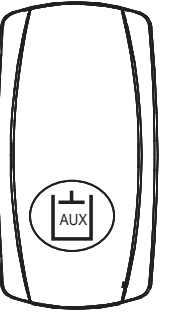
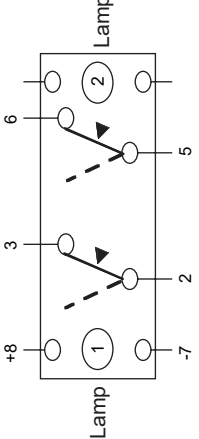
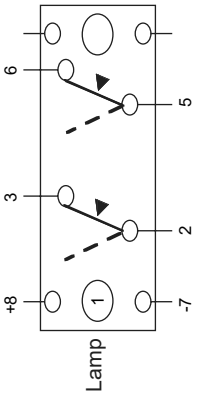
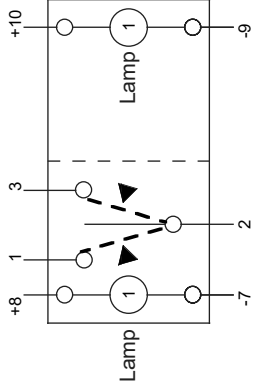
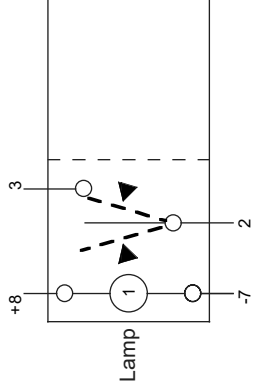
## 4.2.4 SWITCH PANEL



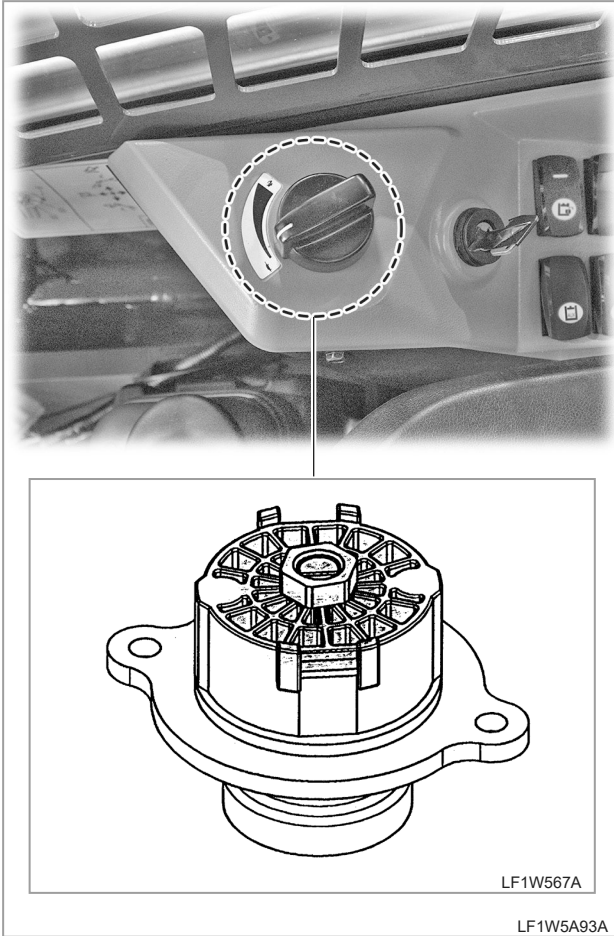
| No | Switch                 | Function                                                |
|----|------------------------|---------------------------------------------------------|
| 1  | Reset (Green)          | Driving system release                                  |
| 2  | Main light             | Front, Rear work lamp ON, OFF                           |
| 3  | Turn signal lamp       | Turn signal lamp operation                              |
| 4  | Parking (Red)          | Parking brake emgagement                                |
| 5  | Wiper/Washer           | Wiper, washerr operation                                |
| 6  | AUX                    | External implement flow rate / power supply             |
| 7  | High flow (Option)     | Supplying additional flow to equipment when needed      |
| 8  | Hydraulic lock         | Blocking operating hydraulic line                       |
| 9  | Self leveling (Option) | Maintaining balance when lifting or lowering the bucket |
| 10 | Hazard lamp            | Emergency lamp operation                                |
| 11 | Quick attachment       | Loader removal, installation                            |
| 12 | Beacon lamp            | Beacon lamp operation                                   |
| 13 | Room lamp              | Room lamp ON, OFF                                       |
| 14 | DPF regeneration       | DPF regeneration and stop                               |

SWITCH CIRCUIT DIAGRAM



| RESET SWITCH                                                                                                                | PARKING BRAKE SWITCH                                                                                                        | DPF SWITCH                                                                                                                 | AUX. HYDRAULIC SWITCH                                                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
| <br>POS 1    POS 2    POS 3<br>LF1W5A89A | <br>POS 1    POS 2    POS 3<br>LF1W5A90A | <br>POS 1    POS 2    POS 3<br>LF1W5A60A | <br>POS 1    POS 2    POS 3<br>LF1W5A64A |
| <br>Lamp    Lamp<br>LF1W5A92A          | <br>Lamp    Lamp<br>LF1W5A91A          | <br>Lamp    Lamp<br>LF1W5A62A          | <br>Lamp    Lamp<br>LF1W5A65A          |

## 4.2.5 ENGINE ACCELERATOR DIAL

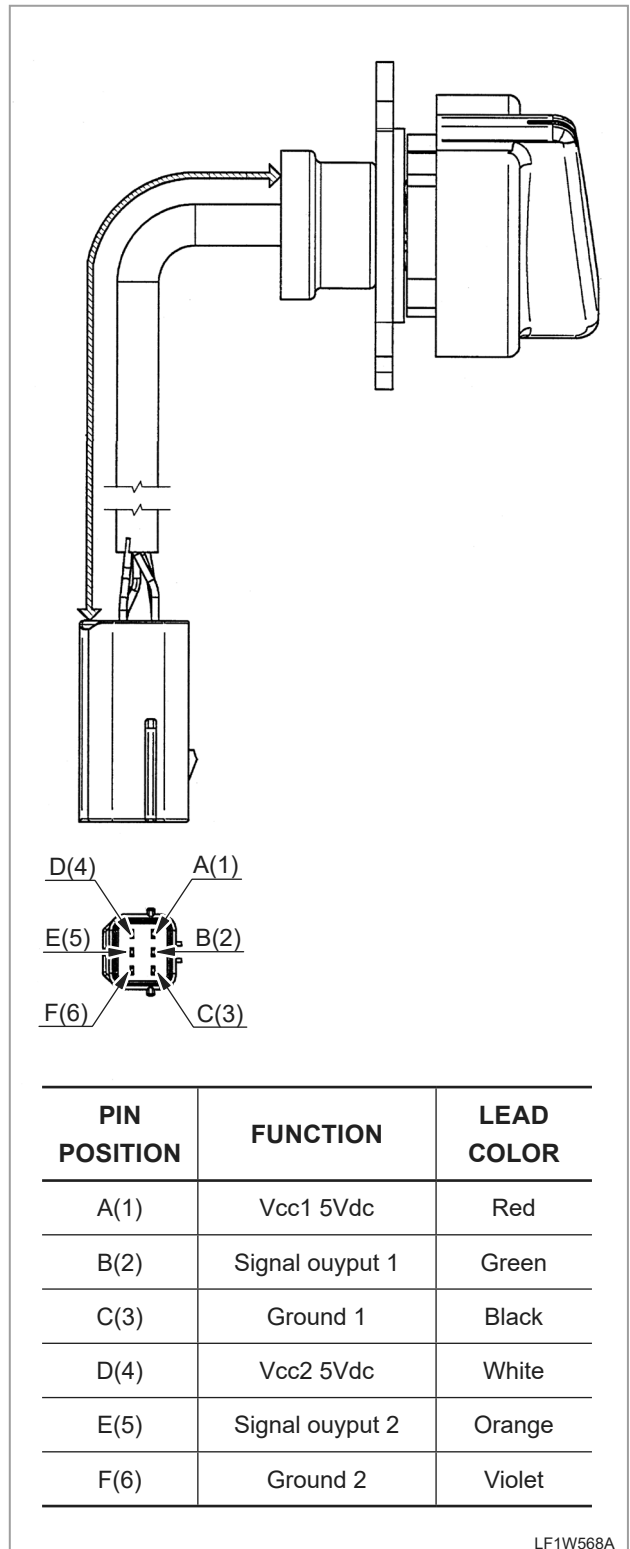


The engine accelerator dial is installed on the panel on the right side of the driver's seat. It detects the amount of movement of the accelerator dial and sends this information to the ECU which then adjusts the fuel injection amount and timing accordingly.

Two sensors are integrated into one unit. The sensor 1 detects the main displacement of the lever while the sensor 2 detects any faulty condition. If the difference between the main displacement signal and auxiliary displacement signal is over the specified level, the ECU sends a fault signal.

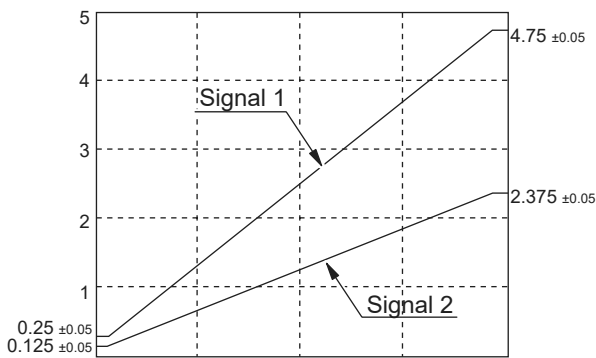
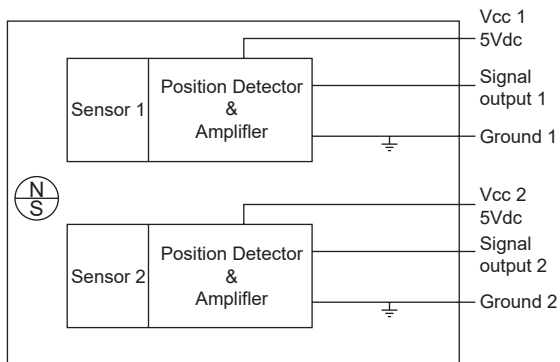
**REMARKS**

- If the difference between the signal 1 and signal 2 is over 15 %, it is determined as a fault and this error is displayed on the instrument cluster.

**CONNECTOR**

LF1W568A

## CIRCUIT



LF1W569B

## 4.2.6 ACCELERATOR PEDAL SENSOR



LF1W570A

The accelerator pedal sensor is installed on the accelerator pedal. This sensor detects the depressed amount of the accelerator pedal and sends this information to the ECU when then controls the engine accordingly. This sensor is a double potentiometer type with two sensors integrated into one unit for a complementary measure. The 1st sensor detects the depressed amount of the pedal for determination of the fuel injection amount and timing while the 2nd sensor compares its value with the value from the 1st sensor for accurate operation.

If the 1st or 2nd sensor is defective, the ECU stores the corresponding DTC and responsiveness to acceleration demand is deteriorated, resulting in difficult engine RPM rise.

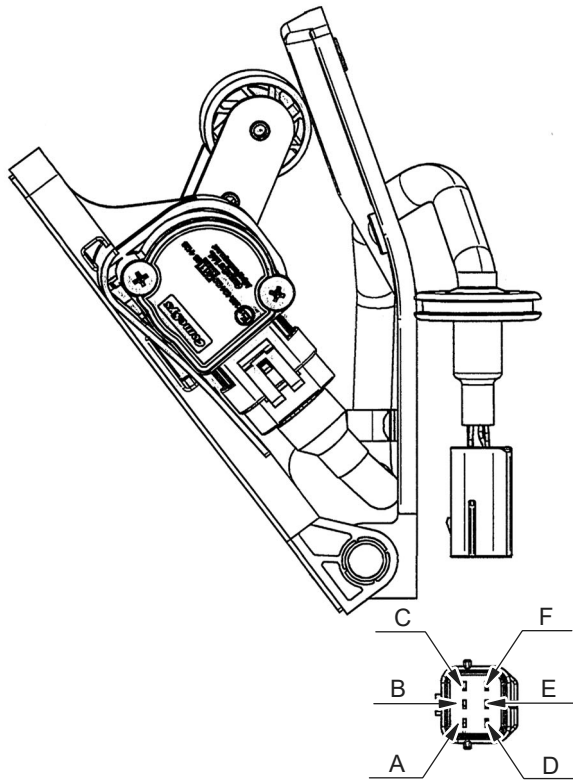


## REMARKS

- If the difference between the signal 1 and signal 2 is over 15 %, it is determined as a fault and this error is displayed on the instrument cluster.



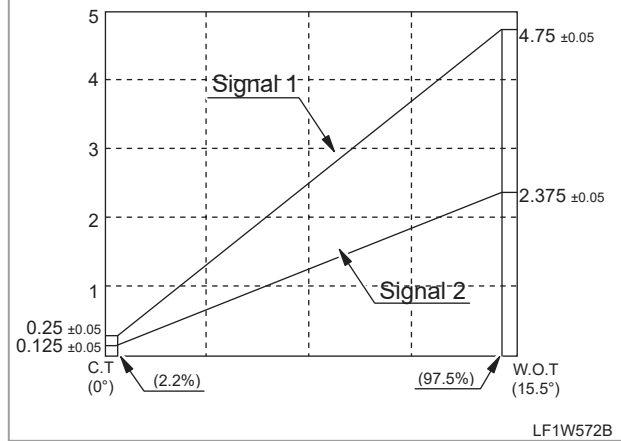
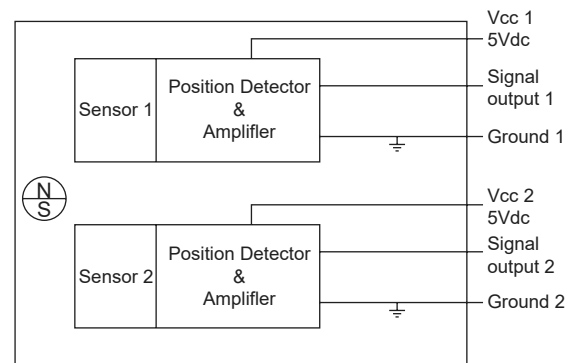
## CONNECTOR



| PIN LOCATION | DESCRIPTION              | COLOR  |
|--------------|--------------------------|--------|
| A            | Power Input, Vcc1        | Red    |
| B            | Pedal Signal Output, Vs1 | Green  |
| C            | Ground 1 (Signal 1)      | Black  |
| D            | Power Input, Vcc2        | White  |
| E            | Pedal Signal Output, Vs2 | Orange |
| F            | Ground 2 (Signal 2)      | Violet |

LF1W571A

## CIRCUIT

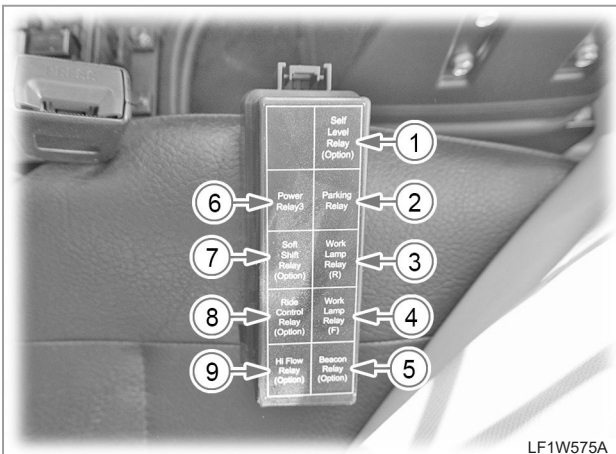
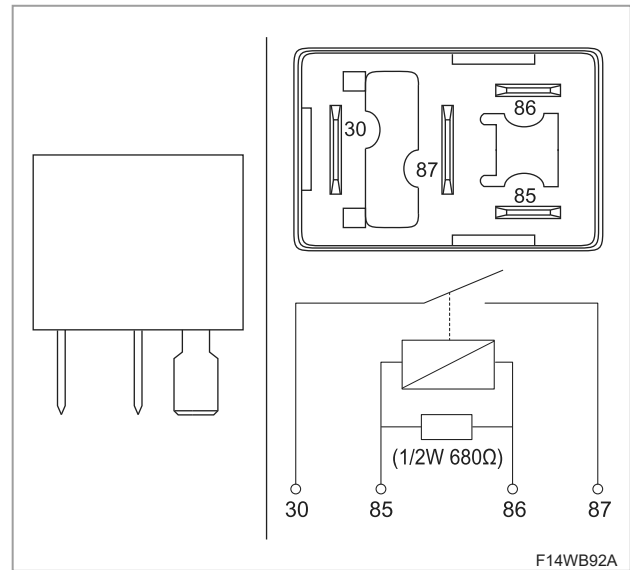


## 4.2.7 RELAY BOX



The relay box is installed on the left lower side of the driver's seat.

## CONNECTOR &amp; CIRCUIT



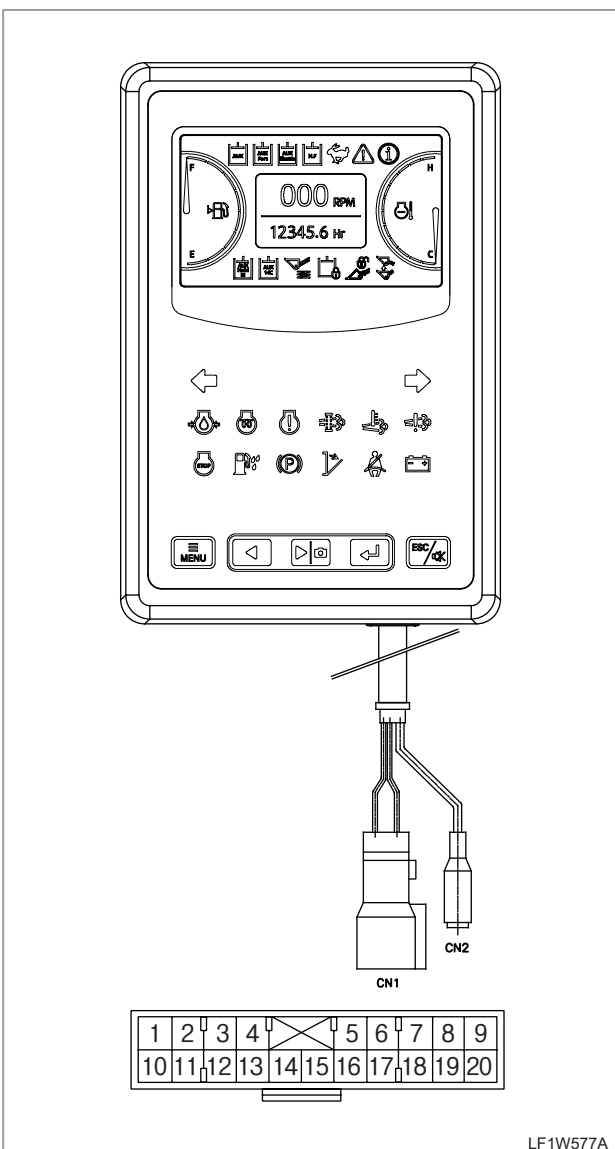
- (1) Self level relay (Option)
- (2) Parking relay
- (3) Work lamp relay (Rear)
- (4) Work lamp relay (Front)
- (5) Beacon lamp relay (Option)
- (6) Power relay 3
- (7) Soft shift relay (Option)
- (8) Ride control relay (Option)
- (9) High flow relay (Option)

## 4.2.8 INSTRUMENT PANEL

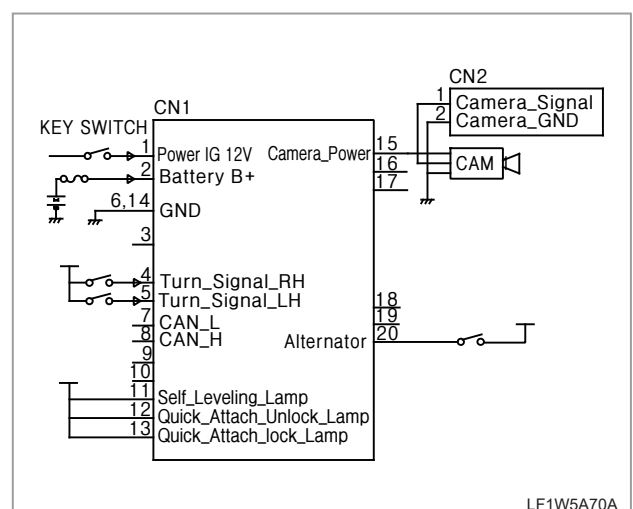


The instrument panel is installed on the right front side of the driver's seat.

## CONNECTOR &amp; CIRCUIT

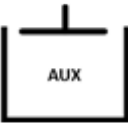
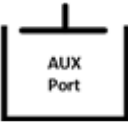
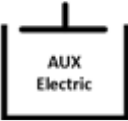
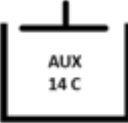
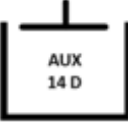
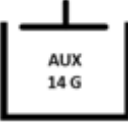
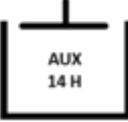
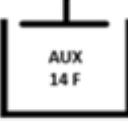


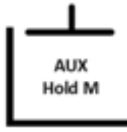
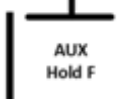
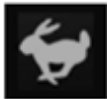
| NO | FUNCTION                 | LEAD COLOR |
|----|--------------------------|------------|
| 1  | Power IG 12V             | R          |
| 2  | Battery B+               | R/W        |
| 3  | -                        | -          |
| 4  | Turn Signal RH           | R/B        |
| 5  | Turn Signal LH           | Gr         |
| 6  | GND                      | B          |
| 7  | CAN_L                    | W/L        |
| 8  | CAN_H                    | Y          |
| 9  | -                        | -          |
| 10 | Buzzer                   | W/R        |
| 11 | Self Leveling Lamp       | G          |
| 12 | Quick Attach Unlock Lamp | Y/R        |
| 13 | Quick Attach lock Lamp   | Br/W       |
| 14 | GND                      | B          |
| 15 | Camera Power             | R/Y        |
| 16 | -                        | -          |
| 17 | -                        | -          |
| 18 | -                        | -          |
| 19 | -                        | -          |
| 20 | Alternator               | R/G        |



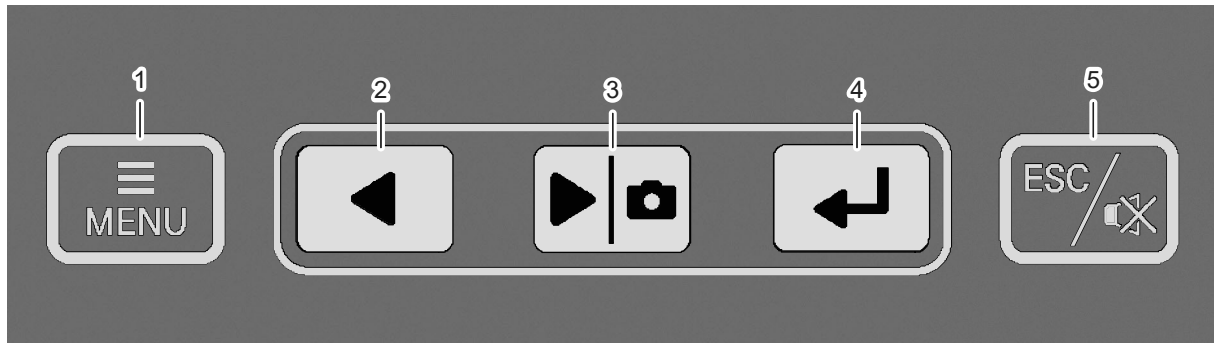
## CONFIGURATION AND SYMBOL

| SYMBOL                                                                              | FUNCTION                      | SYMBOL                                                                               | FUNCTION                    |
|-------------------------------------------------------------------------------------|-------------------------------|--------------------------------------------------------------------------------------|-----------------------------|
|    | Water-In-Fuel warning lamp    |     | Parking lamp                |
|    | Check engine warning lamp 1   |     | Safety cover lamp           |
|    | Check engine warning lamp 2   |     | Right turn signal lamp      |
|    | Emissions system warning lamp |     | Left turn signal lamp       |
|   | Glow lamp                     |    | Battery charge warning lamp |
|  | DPF regeneration lamp         |   | Engine coolant gauge        |
|  | DPF under way lamp(재생진행)      |   | Engine coolant lamp         |
|  | Oil pressure lamp             |   | Tachometer                  |
|  | Engine shut down              |   | Hoermeter                   |
|  | Caution lamp                  |  | Fuel level gauge            |
|  | Safety lamp                   |   | Fuel level lamp             |

| SYMBOL                                                                              | FUNCTION                      |
|-------------------------------------------------------------------------------------|-------------------------------|
|    | Fluid high temp. warning lamp |
|    | Ride control lamp             |
|    | Aux. lamp                     |
|    | Aux. hydraulic lamp           |
|   | Aux. electric port lamp       |
|  | 14-pin C lamp                 |
|  | 14-pin D lamp                 |
|  | 14-pin G lamp                 |
|  | 14-pin H lamp                 |
|  | 14-pin E lamp                 |
|  | 14-pin F lamp                 |

| SYMBOL                                                                               | FUNCTION                      |
|--------------------------------------------------------------------------------------|-------------------------------|
|    | Aux. hydraulic port M lamp    |
|    | Aux. hydraulic port F lamp    |
|     | 2 speed lamp                  |
|     | Self leveling lamp            |
|   | High flow lamp                |
|   | Hydraulic lock system lamp    |
|   | Quick attachment un-lock lamp |
|   | Quick attachment lock lamp    |
|   | Consumables replacement       |
|  | Communication warning light   |

## MAIN &amp; SUB MENU



LF1W5A71A

- (1) Menu switch  
 (2) Left menu button  
 (3) Right menu button / Camera button

- (4) Enter button  
 (5) ESC / Buzzer stop button

| No   | Item                                                                                                                                                                       | Function                                                                                                                                                                                              | Remarks                                                                                                                               |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| 1    | MENU                                                                                                                                                                       | When pressing this button on the home screen, the sub menu is displayed.<br>When pressing this button on the sub-menu screen, the corresponding item is selected and its input value can be adjusted. | While controlling the function within each sub menu, pressing this button lets you move to the next sub menu.                         |
| 2, 3 | <br> | The button to select functions and adjust (increase or decrease) input values within the sub-menu                                                                                                     | When the camera button is selected, the rear camera image is on regardless of the driving direction.                                  |
| 4    |                                                                                         | The button to enter the desired function and set input values within the sub menu                                                                                                                     | -                                                                                                                                     |
| 5    | ESC/<br>BUZZER OFF                                                                                                                                                         | The button to move back to the previous menu screen or to cancel the current function                                                                                                                 | Press and hold the button to move to the home screen immediately.<br>Press the button while the buzzer sounds to turn the buzzer off. |



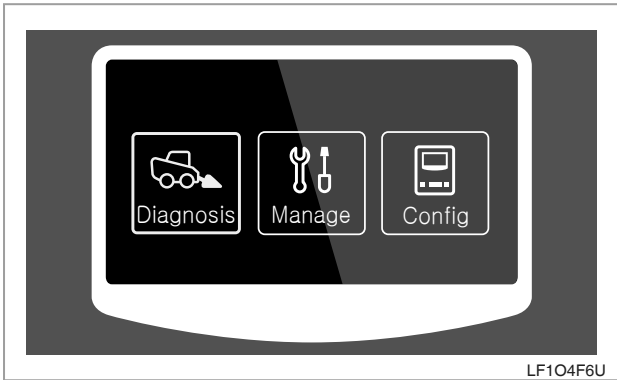
## ► STRUCTURE

| Main menu            | Sub menu                        | Description                                                          |
|----------------------|---------------------------------|----------------------------------------------------------------------|
| Diagnosis function   | Machine condition               | Displaying coolant temperature, hour meter, RPM, etc.                |
|                      | Machine information             | Displaying instrument panel & MCU version, model name, etc.          |
|                      | Current fault                   | Displaying current fault status list of the engine and machine       |
| Maintenance function | Engine start inhibition setting | Engine start inhibition setting, password change or password display |
|                      | Consumables management          | Changing oil/filters replacement intervals and checking elapsed time |
|                      | A/S contact                     | Displaying and changing A/S telephone number                         |
|                      | Administrator menu              | Displaying fault history and mode change                             |
| Configuration        | Brightness settings             | Brightness manual/automatic (day, night) settings                    |
|                      | Time settings                   | Current time settings                                                |
|                      | Unit settings                   | Temperature (°F/°C)                                                  |
|                      | Language settings               | Korean, English                                                      |
|                      | Camera settings                 | Reverse gear-linked function ON/OFF                                  |

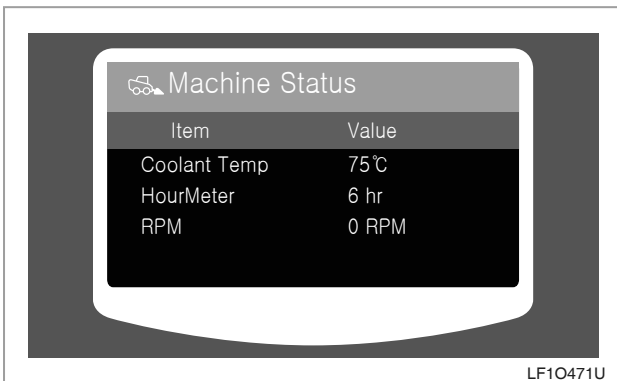
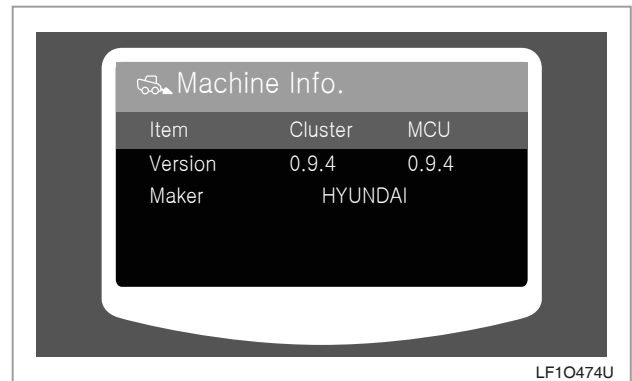
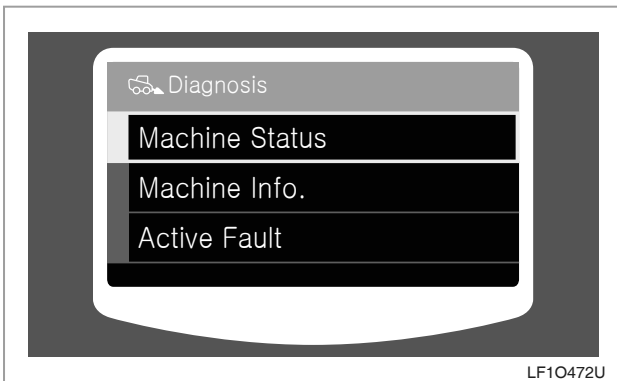
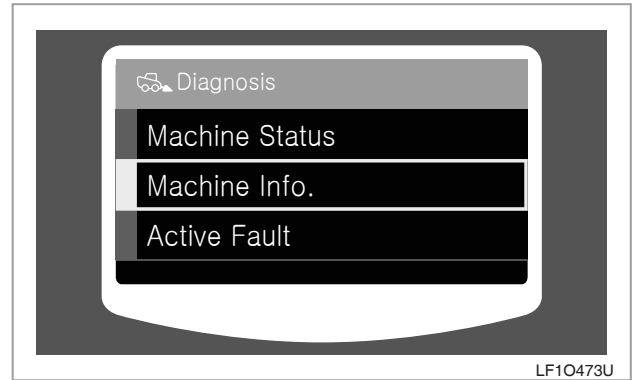
※ Press the menu button to activate the sub-menu.

► DIAGNOSIS FUNCTION

① MACHINE STATUS



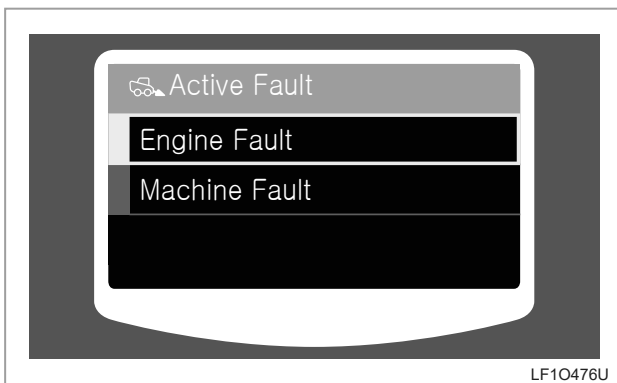
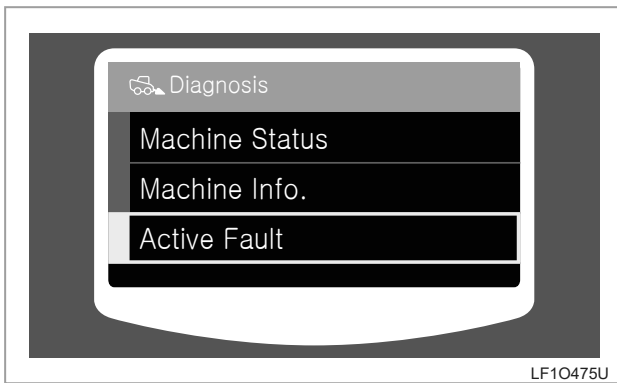
② MACHINE INFORMATION



- You can check the version of the instrument panel and MCU as well as the machine's model name.

- The status of the machine is displayed.

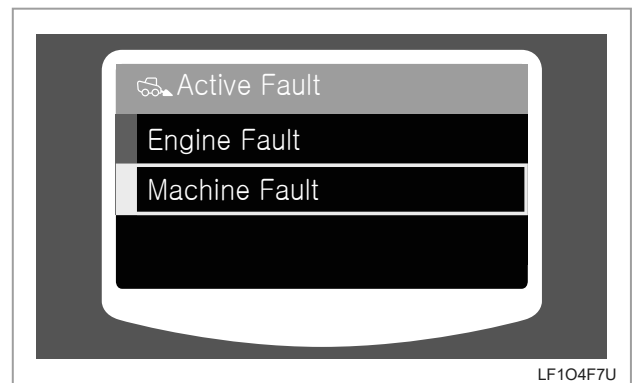
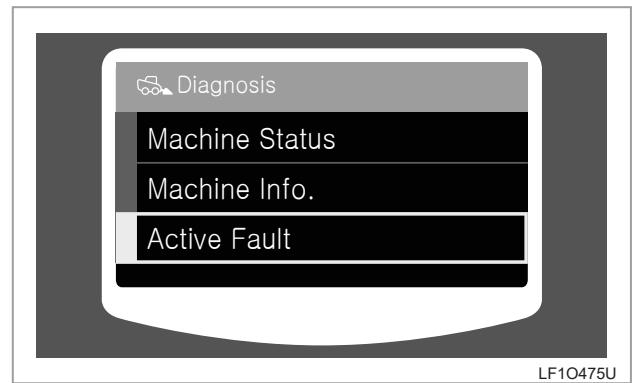
## ③ CURRENT FAULT



- You can check the current fault of the engine.

**REMARKS**

- In case of related codes, contact a dealer nearby to get it checked.



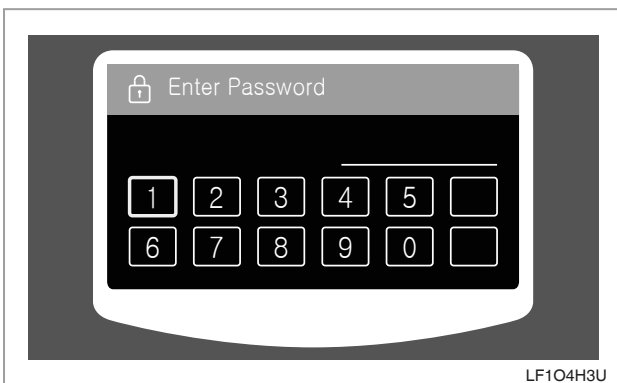
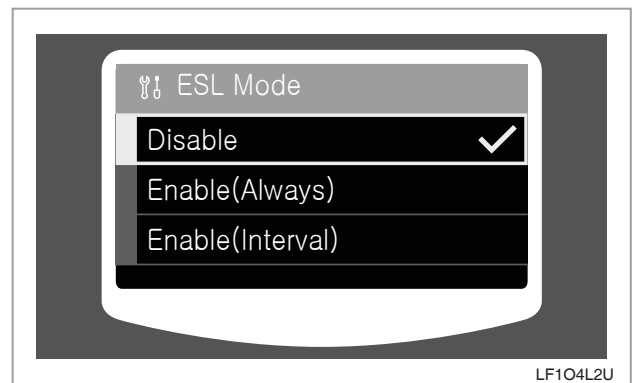
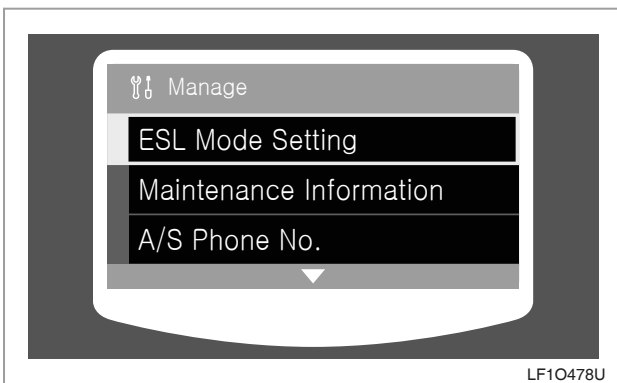
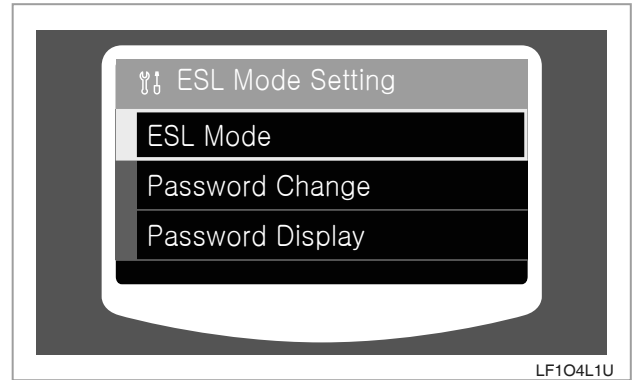
- You can check the current fault of the machine.

**REMARKS**

- In case of related codes, contact a dealer nearby to get it checked.

# ► MAINTENANCE FUNCTION

## ① ENGINE START INHIBITION SETTING



- Engine start inhibition setting

SAFETY FIRST

ENGINE

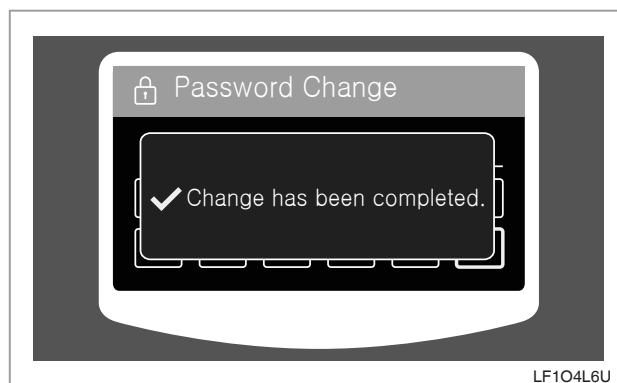
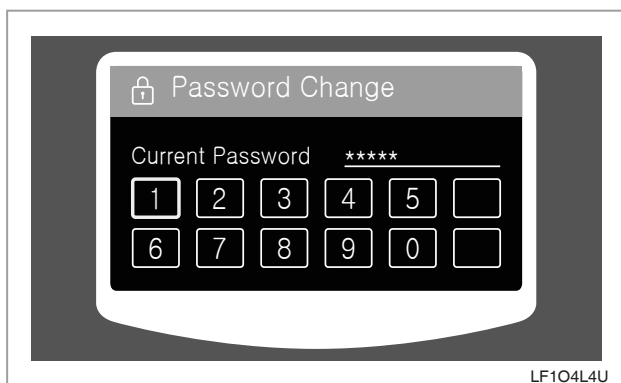
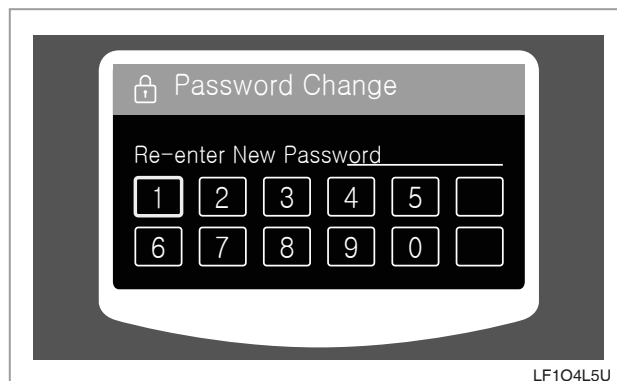
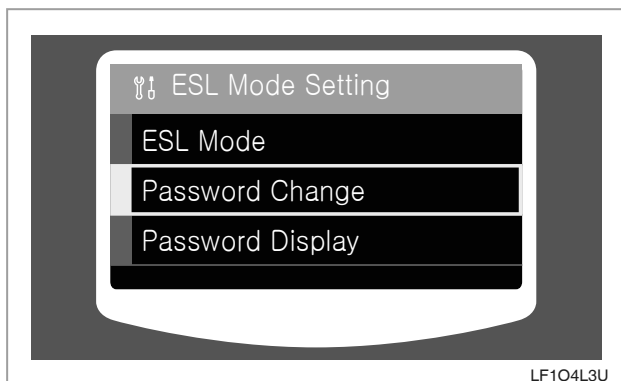
DRIVING &amp; CHASSIS

HYDRAULIC SYSTEM

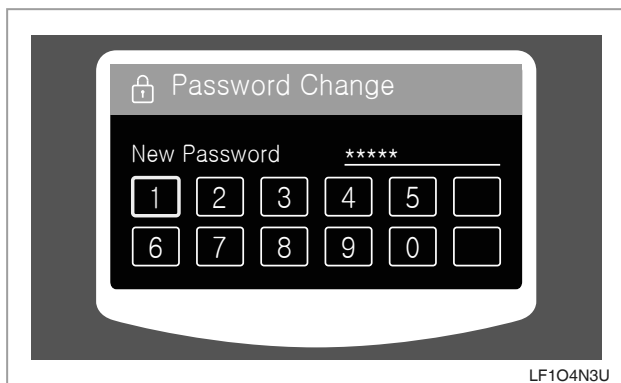
ELECTRIC SYSTEM

CABIN

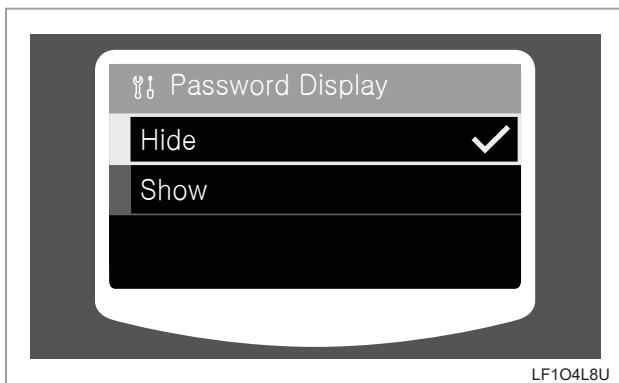
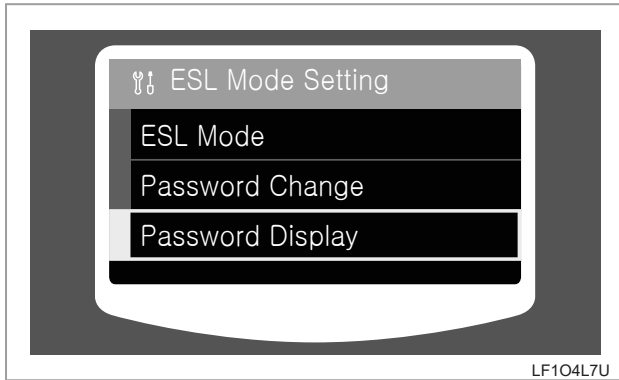
INDEX



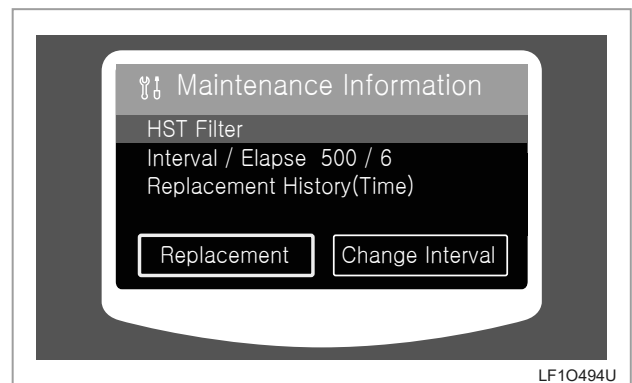
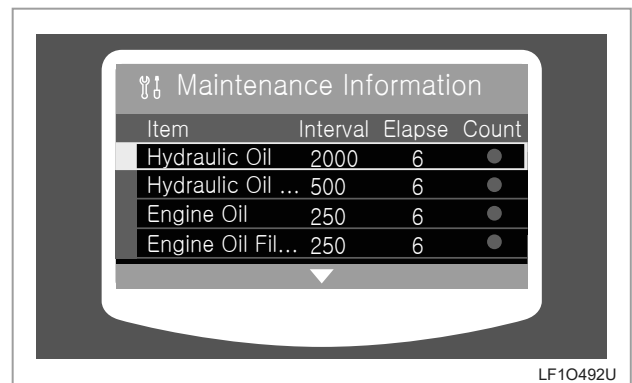
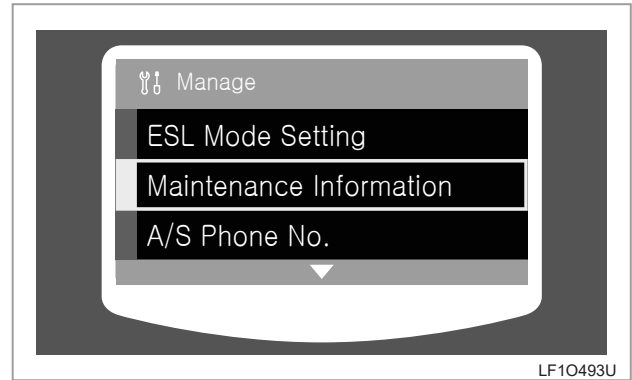
- Password change



## ② CONSUMABLES MANAGEMENT

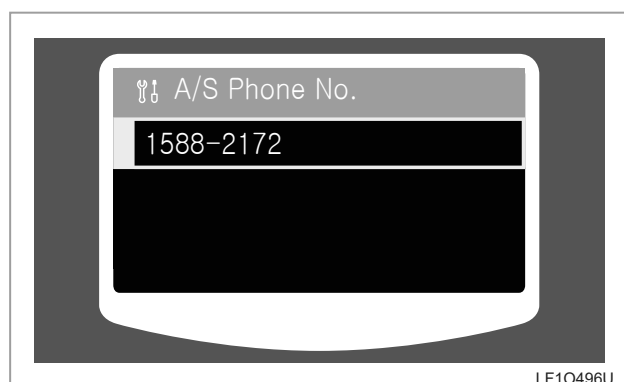
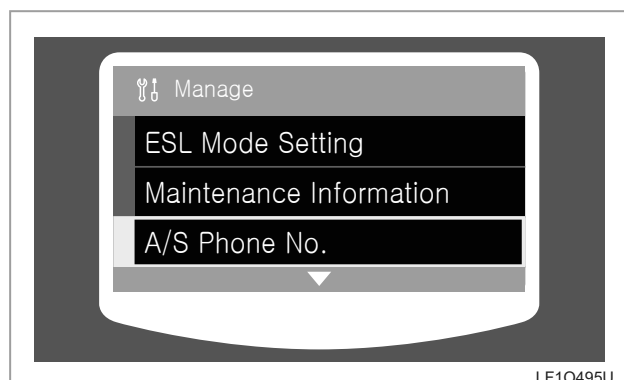


- Password display



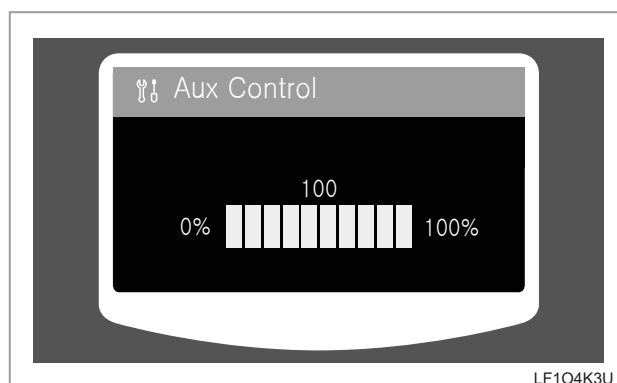
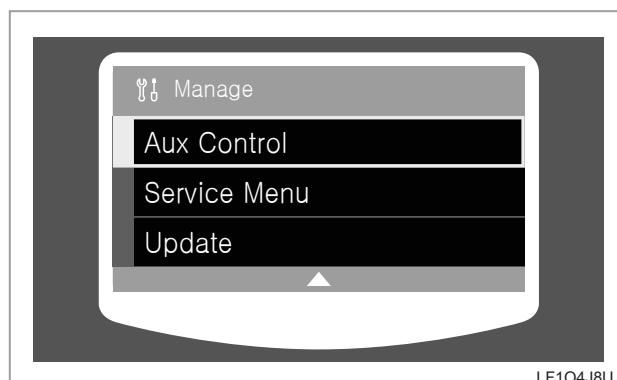
- Elapsed time
- Replacement interval
- Replacement frequency
- Replacement

### ③ A/S CONTACT



- You can check and change the A/S contact details.

### ④ HYDRAULIC CONTROL

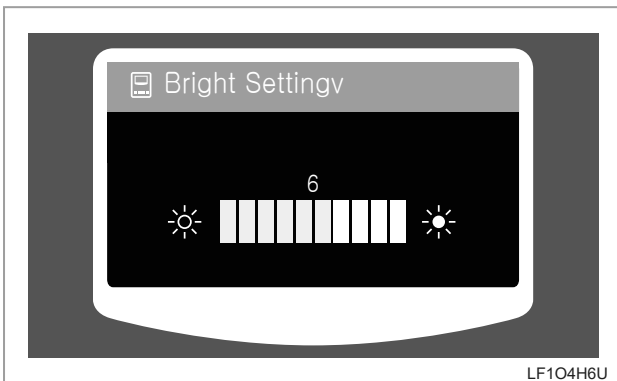
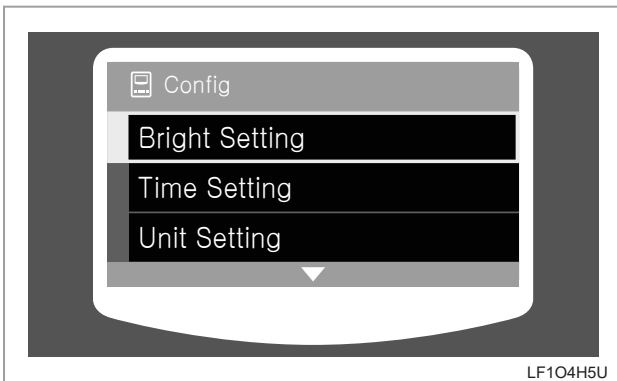
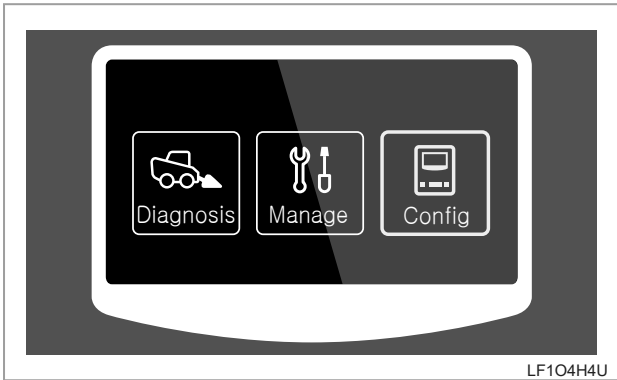


- Hydraulic control: The amount of hydraulic flow delivered to the external hydraulic implement can be controlled.
- AUX HOLD M : The amount of flow sent to the male coupler can be set by percentage, using the ◀ ▶ buttons in the instrument panel.
- AUX HOLD F: The amount of flow sent to the female coupler can be set by percentage, using the ◀ ▶ buttons in the instrument panel.



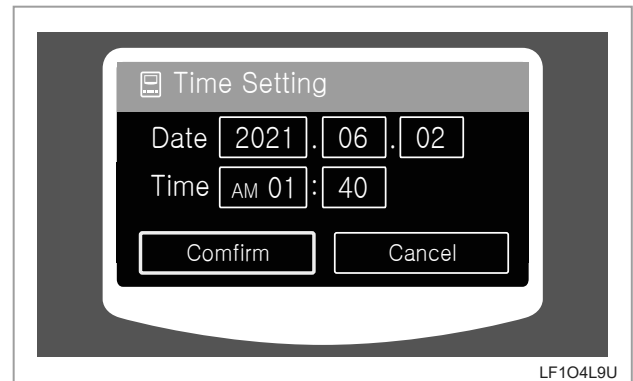
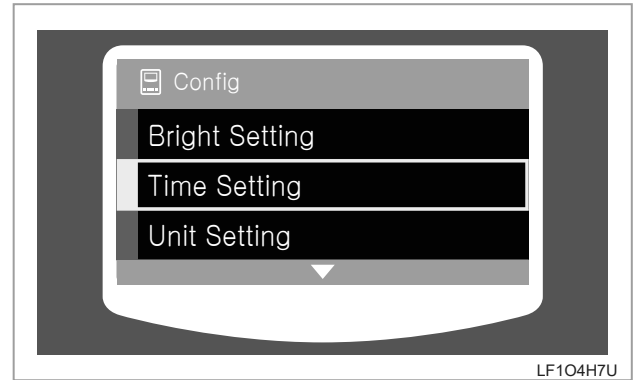
► CONFIGURATIONS

① BRIGHTNESS SETTINGS



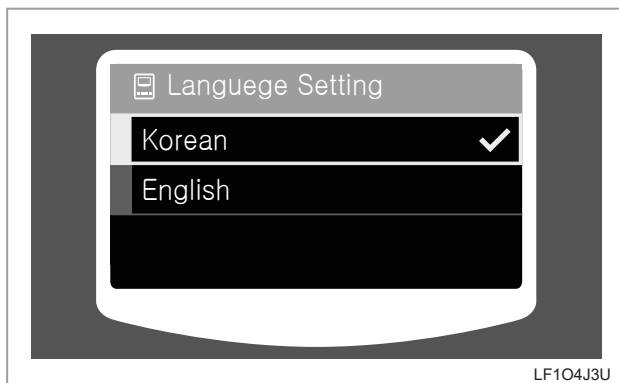
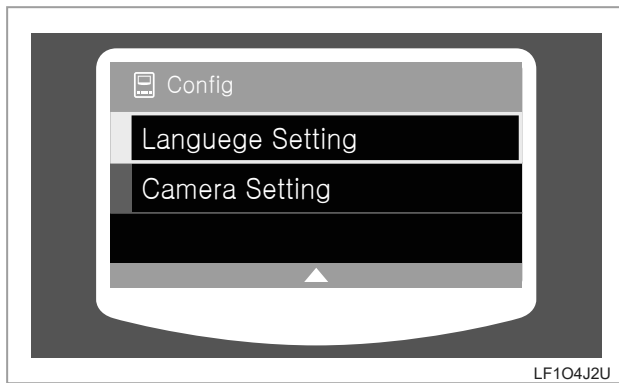
- Manual
- Automatic
- Daytime duration setting

② TIME SETTINGS



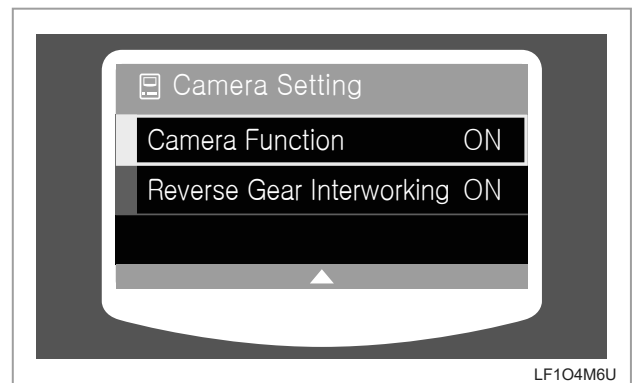
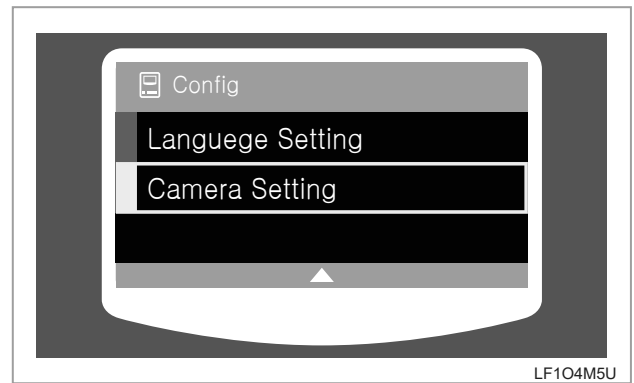
- The time can be set. (Year, Month, Day, Hour, Minute)

## ③ LANGUAGE SETTINGS



- The desired language can be selected. Once a language is selected, all information is displayed in that language.

## ④ CAMERA SETTINGS



- You can set the camera function on or off (optional).
- You can turn the reverse gear linked function on or off.
- Reverse gear linked function: When the vehicle is in reverse, the camera mode is automatically displayed on the main screen.

## MACHINE DIAGNOSIS (DTC)

## 1) CHECKING THE MONITOR



1. Check if the  or  warning lamp is illuminated on the monitor.

3. Press the Enter button (  ) to select the 'Diagnosis' function.

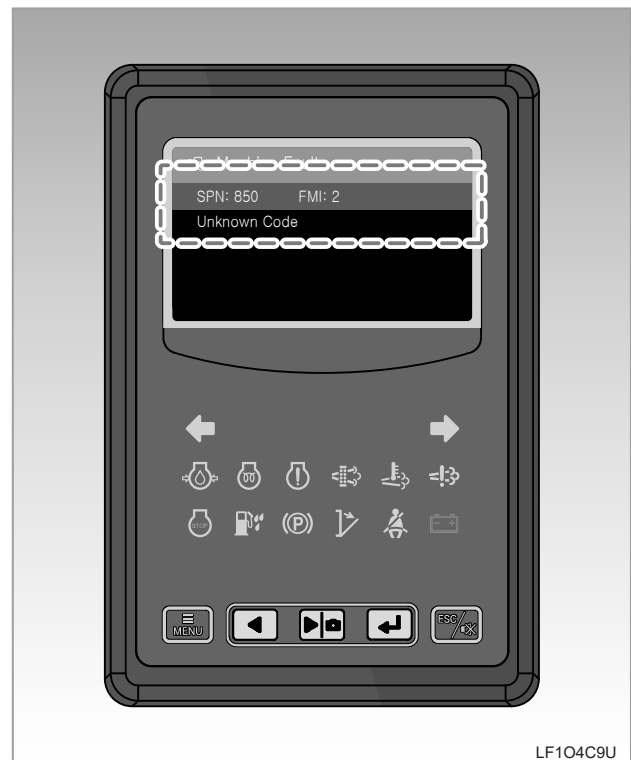


2. Press the MENU button.

4. Press the Enter button (  ) to select the 'Current fault'.



5. Press the Enter button (  ) to select the "Machine fault".



7. Verify and check the diagnosis details.



6. Check the DTC code and press the Enter button (  ).

## 2) DTC CODE

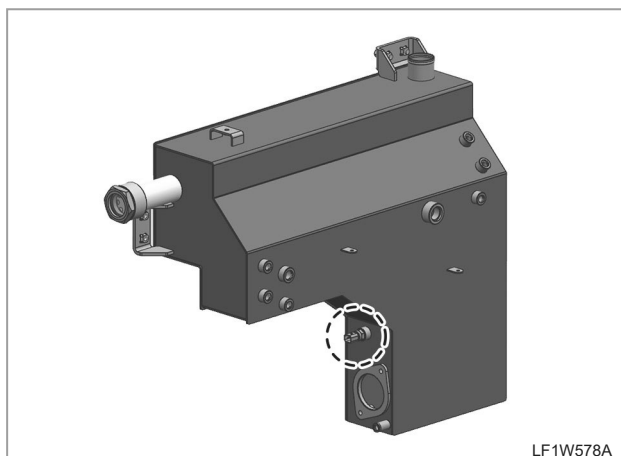
| NO | DTC   |     | Diagnosis                                                                                                     | Part that might have failed                  | Relative wiring No. |      |      | Warning lamp                                                                          |
|----|-------|-----|---------------------------------------------------------------------------------------------------------------|----------------------------------------------|---------------------|------|------|---------------------------------------------------------------------------------------|
|    | DDSPN | FMI |                                                                                                               |                                              |                     |      |      |                                                                                       |
| 1  | 101   | 3   | Oil temperature sensor and wiring voltage higher than normal range or having short circuit > 4.9 V maintained | Oil temp. sensor,<br>Oil temp. sensor wiring | 972                 | Z992 |      |                                                                                       |
|    |       | 4   | Oil temperature sensor and wiring voltage below normal range or having short circuit < 0.1V maintained        |                                              |                     |      |      |                                                                                       |
|    | -     | -   | Warning lamp ON when oil temperature exceeds 90°C                                                             |                                              |                     |      |      |    |
| 2  | 301   | 3   | Fuel level sensor circuit - Voltage above normal or shorted to high source (or open circuit)                  | Fuel sender wiring                           | 987                 | -    | -    |    |
|    |       | 4   | Fuel level sensor circuit - Voltage below normal or shorted to low source                                     |                                              |                     |      |      |                                                                                       |
| 3  | 705   | 0   | Battery voltage high                                                                                          | Battery wiring                               | B31A                | B10  | B13A |  |
|    |       | 1   | Battery voltage low                                                                                           |                                              |                     |      |      |                                                                                       |
| 4  | 707   | 1   | Alternator voltage low (or open circuit)                                                                      | Fuse (R-terminal power)                      | B13A                |      |      |  |
|    |       |     |                                                                                                               | ALTERNATOR                                   |                     |      |      |                                                                                       |
|    |       |     |                                                                                                               | WIRING HARNESS                               |                     |      |      |                                                                                       |
| 5  | 841   | 2   | ECU communication error                                                                                       | ECU                                          | 247A                | 248A |      |  |
|    |       |     |                                                                                                               | MCU                                          |                     |      |      |                                                                                       |
|    |       |     |                                                                                                               | CLUSTER                                      |                     |      |      |                                                                                       |
|    |       |     |                                                                                                               | WIRING HARNESS                               |                     |      |      |                                                                                       |

## 2-1) DIAGNOSIS BY DTC CODES

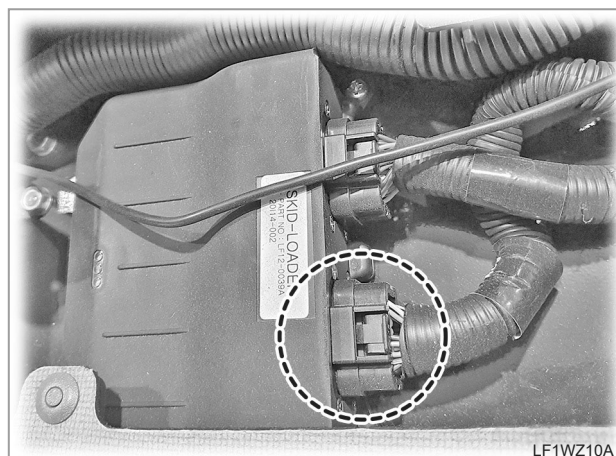
## 2-1-1) DDSPN - 101 / FMI - 3, 4

## FIGURE OF RELATED PART

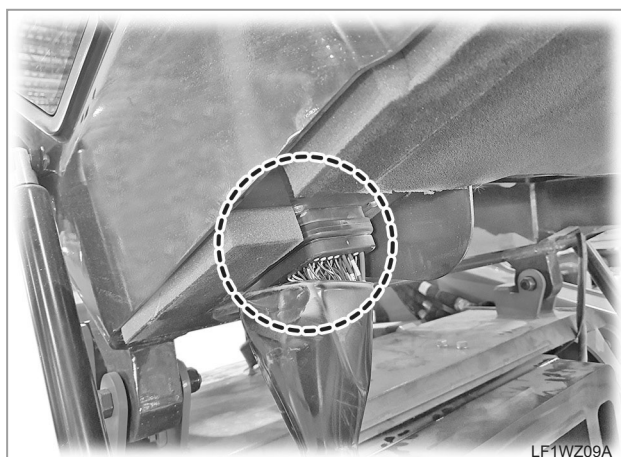
## ► OIL TEMPERATURE SENSOR CONNECTOR



## ► MCU WIRING CONNECTOR



## ► MIN WIRING + CABIN WIRING CONNECTOR



## DIAGNOSIS PROCEDURES

## ► CHECKING VOLTAGE OF THE OIL TEMPERATURE SENSOR

- Start key ON → Measure the voltage of the oil temperature sensor (if the measurement is over 4.9V) → Replace the oil temperature sensor
- Start key ON → Measure the voltage of the oil temperature sensor (if the measurement is below 0.1V) → Replace the oil temperature sensor

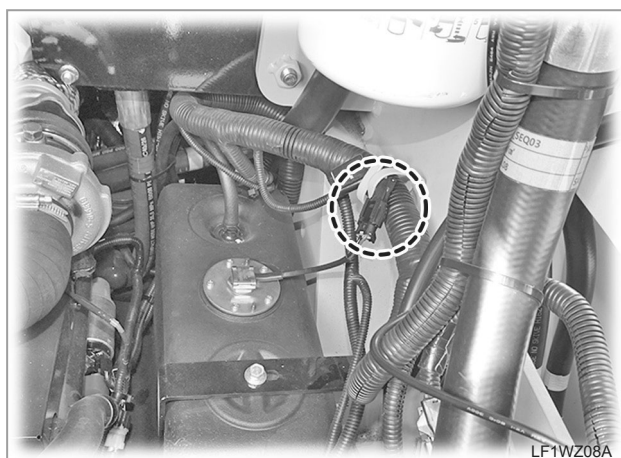




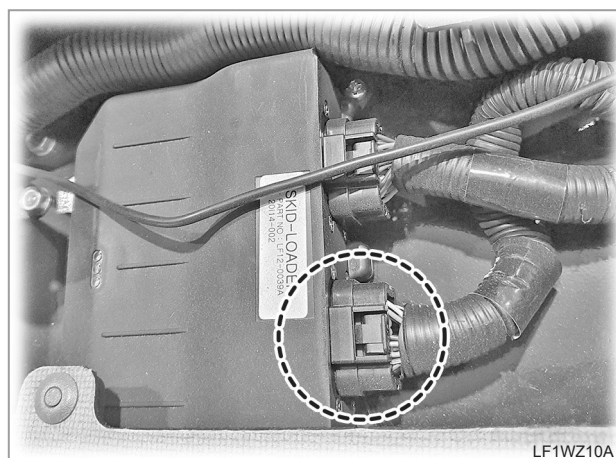
## 2-1-2) DDSPN - 301 / FMI - 3, 4

## FIGURE OF RELATED PART

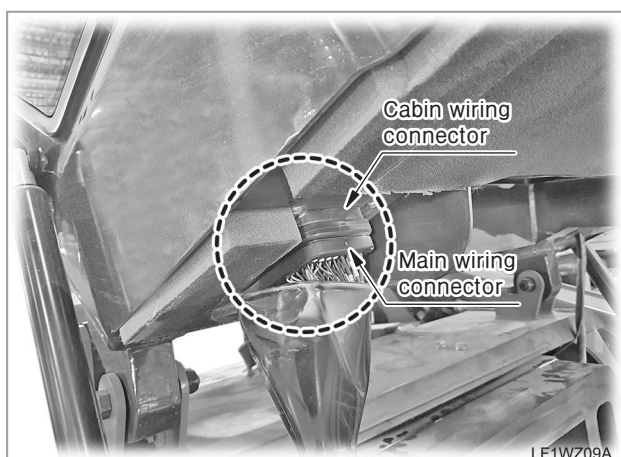
## ► FUEL SENDER CONNECTOR



## ► MCU WIRING CONNECTOR



## ► MAIN WIRING + CABIN WIRING CONNECTOR



## DIAGNOSIS PROCEDURES

## ► STEP 1 : CHECKING RESISTANCE OF THE FUEL SENDER

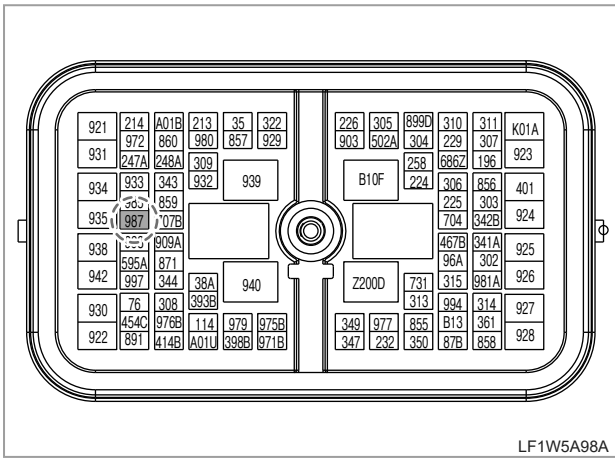
- Start key OFF → Disconnect the fuel sender connector → Measure the resistance ( $3\Omega \sim 110\Omega$ ) → Replace the fuel sender if the measurement is excessive.

## ► STEP 2 : CHECKING THE WIRING IF THE RESISTANCE IS NORMAL (PIN-TO-PIN INSPECTION)

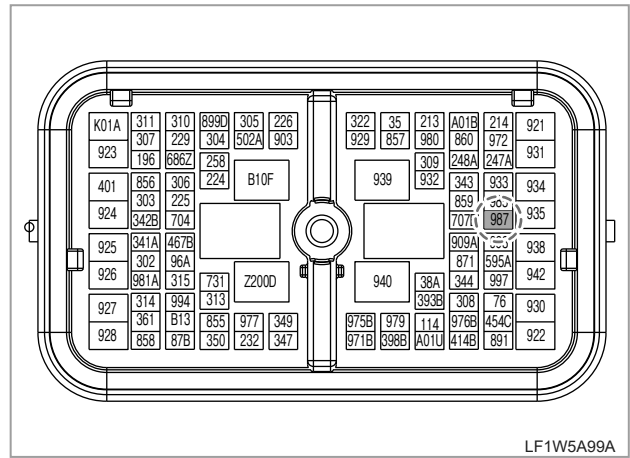
- Start key OFF → Check for continuity between the oil sender connector (Pin #987) and main (cabin) wiring connector (Pin #987)
- Start key OFF → Check for continuity between the cabin (main) wiring connector (Pin #987) and MCU wiring connector (Pin #987) → In case of no continuity, replace the wiring

## INFORMATION OF RELATED WIRING HARNESS

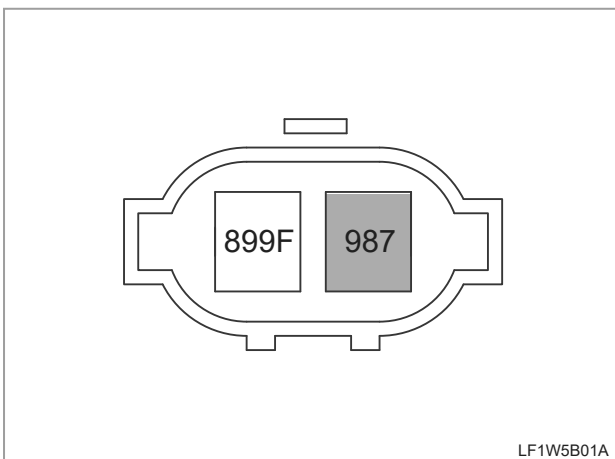
## ► MAIN WIRING (CABIN WIRING) CONNECTOR



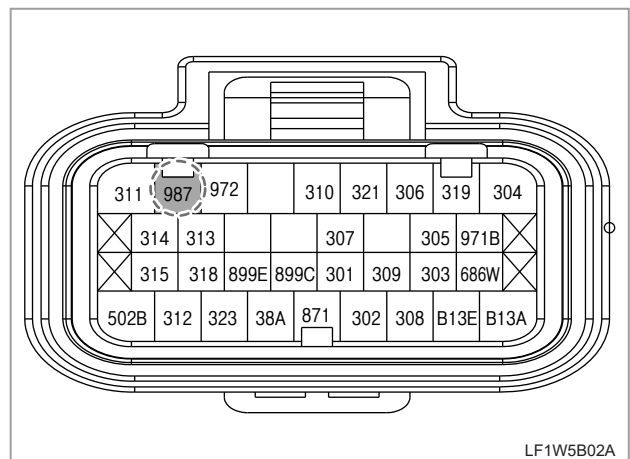
## ► CABIN WIRING (MAIN WIRING) CONNECTOR



## ► FUEL SENDER CONNECTOR



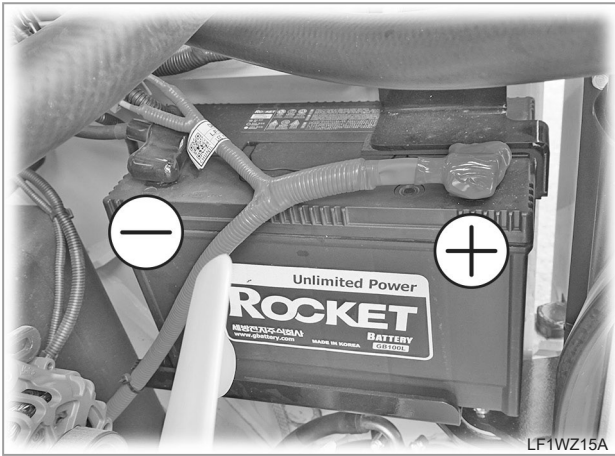
## ► MCU WIRING CONNECTOR



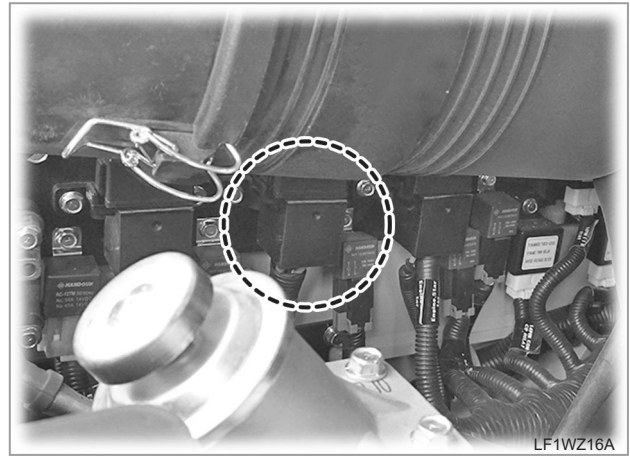
## 2-1-3) DDSPN - 705 / FMI - 0, 1

## FIGURE OF RELATED PART

## ► BATTERY



## ► SLOW BLOW FUSE



## DIAGNOSIS PROCEDURES

## ► STEP 1

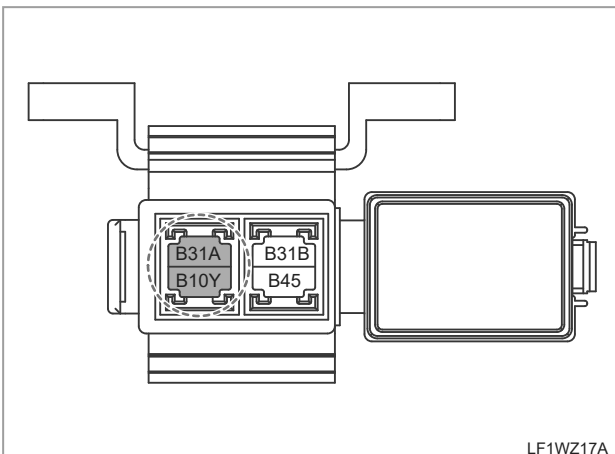
- Start key OFF → Disconnect the (-) and (+) battery terminals and measure the voltage (acceptable operation voltage for engine start: 12.3 ~ 12.9V) → Replace the battery if abnormal voltage is measured

## ► STEP 2

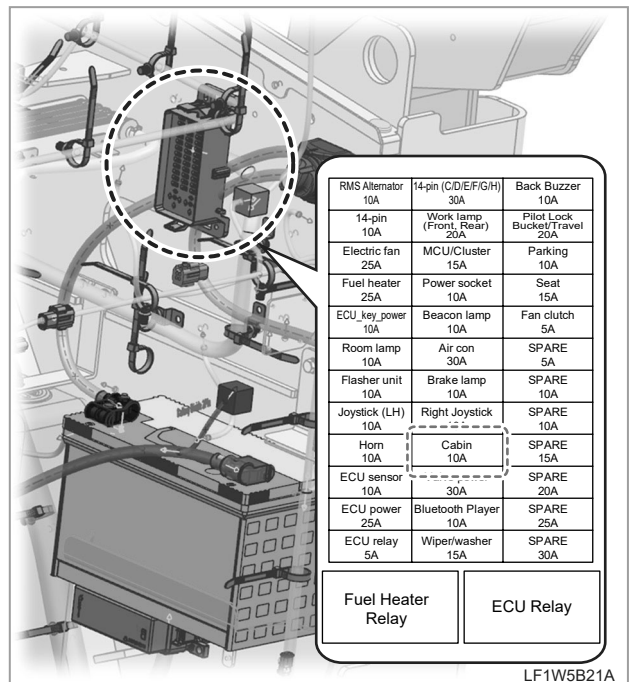
- If the voltage is acceptable, check the slow-blow fuse (power: 100A) and cabin fuse (10A) → If abnormal, replace them with those with the same capacity

## INFORMATION OF RELATED WIRING HARNESS

## ► SLOW BLOW FUSE (POWER : 100A)



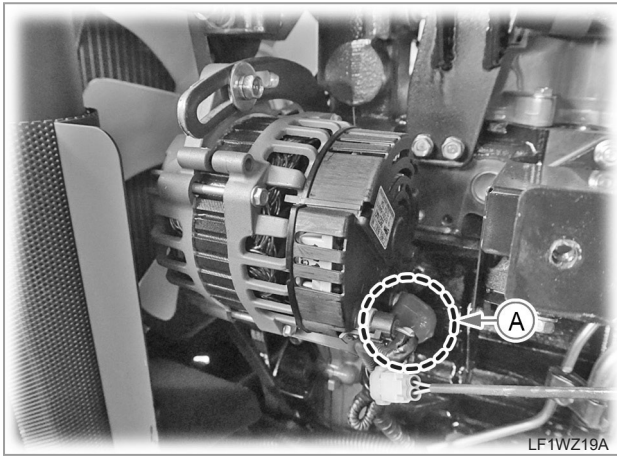
## ► CABIN FUSE (10A)



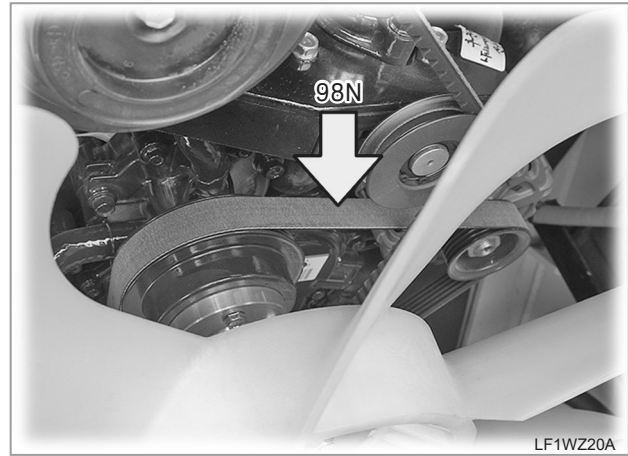
## 2-1-4) DDSPN - 707 / FMI - 1

## FIGURE OF RELATED PART

## ▶ ALTERNATOR BATTERY DIRECT B+



## ▶ FAN BELT



## FIGURE OF RELATED PART

## ▶ STEP 1

- Start key OFF → Check the tightening state of the B+ connection (A) of the alternator and battery

## ▶ STEP 2

- Check for continuity between the body of alternator and vehicle body

## ▶ STEP 3

- Check the tension of the fan belt (press the point between the fan drive pulley and alternator with force of 98N and see whether the belt is deflected for 7 ~ 9 mm)

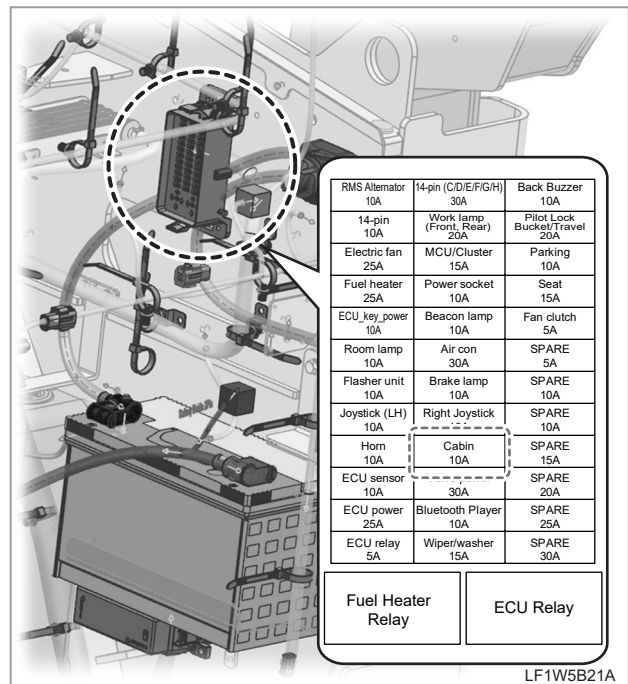
## ▶ STEP 4

- Check the cabin fuse (10A)

## ▶ STEP 5

- If normal, replace the alternator with a new one

## FIGURE OF RELATED PART



LF1W5B21A

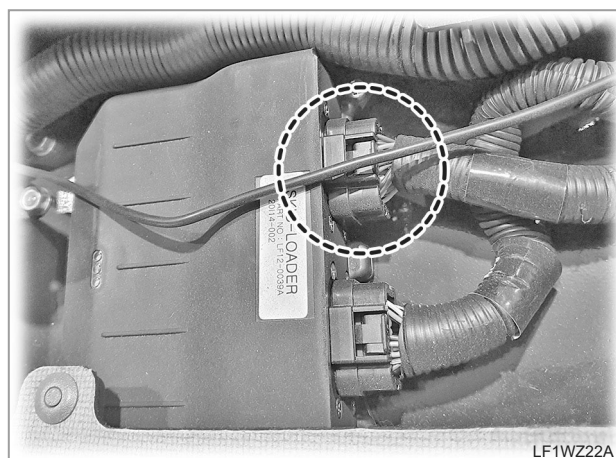
## 2-1-5) DDSPN - 841 / FMI - 2

## FIGURE OF RELATED PART

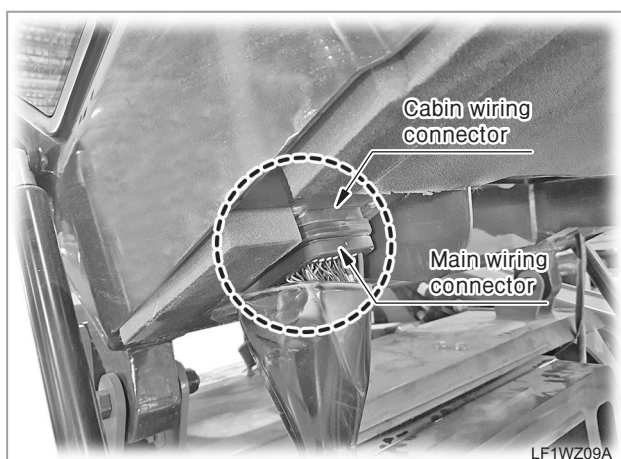
## ► ECU WIRING CONNECTOR



## ► MCU WIRING CONNECTOR



## ► MAIN WIRING + CABIN WIRING CONNECTOR



## DIAGNOSIS PROCEDURES

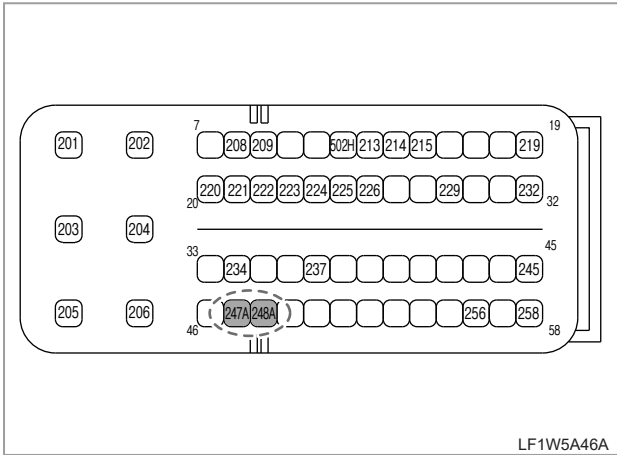
## ► STEP 1 : CHECKING THE WIRING (PIN TO PIN)

- Start key OFF → Check for continuity between the ECU wiring connector (Pin #247A) and main wiring connector (Pin #247A)
- Start key OFF → Check for continuity between the ECU wiring connector (Pin #248A) and main wiring connector (Pin #248A)
- Start key OFF → Check for continuity between the cabin wiring connector (Pin #247A) and MCU wiring connector (Pin #247A)
- Start key OFF → Check for continuity between the cabin wiring connector (Pin #248A) and MCU wiring connector (Pin #248A)

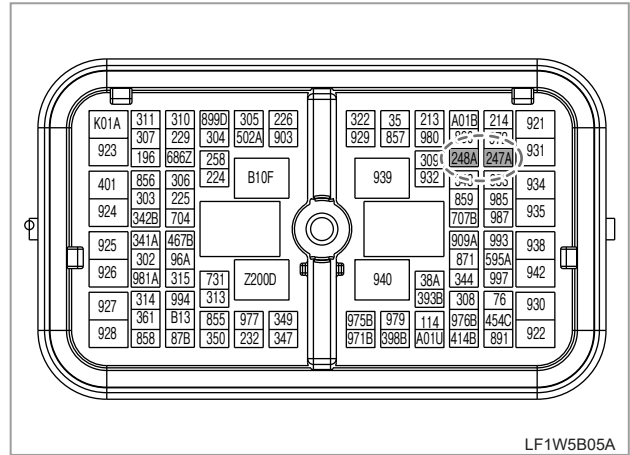
## ► STEP 2 : CHECKING THE ENGINE DTC CODES

## INFORMATION OF RELATED WIRING HARNESS

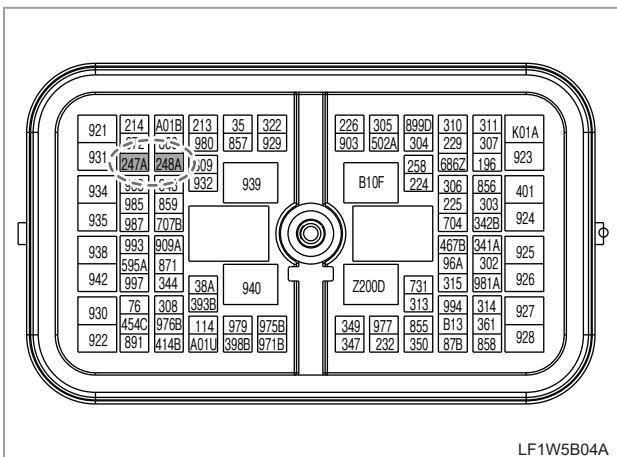
## ► ECU WIRING CONNECTOR



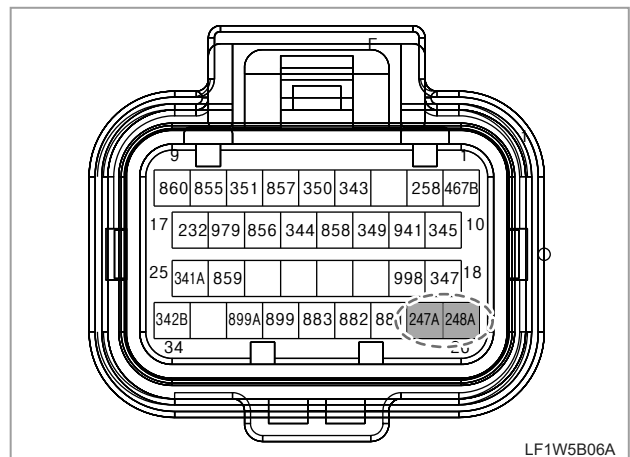
## ► CABIN WIRING (MAIN WIRING) CONNECTOR



## ► MAIN WIRING (CABIN WIRING) CONNECTOR



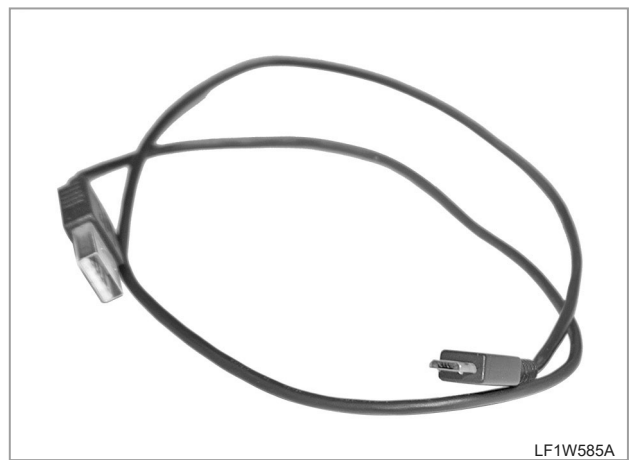
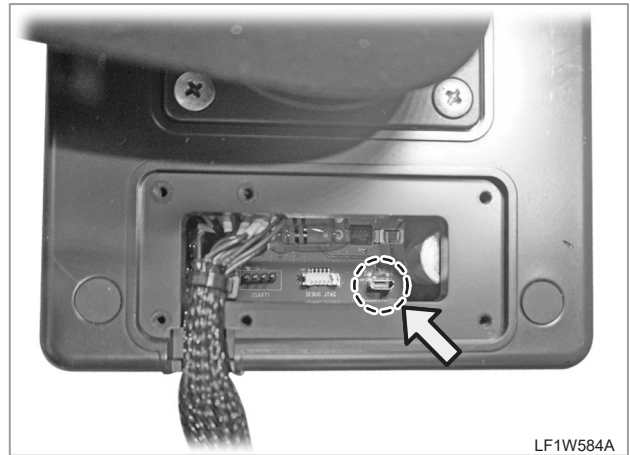
## ► MCU WIRING CONNECTOR



## UPDATE



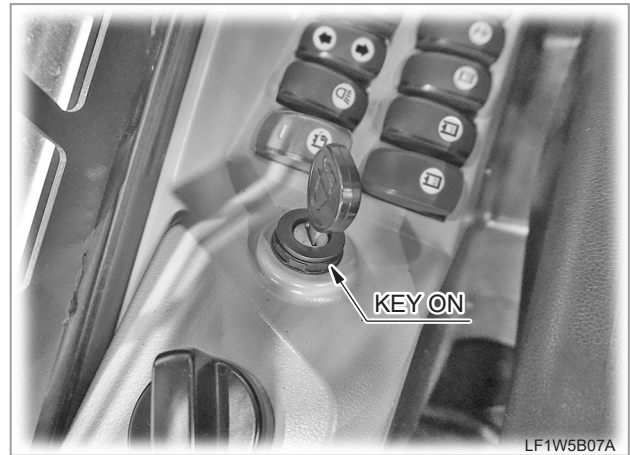
1. Unscrew the cover mounting screws (1) at the lower back of the dashboard to remove the cover (2).



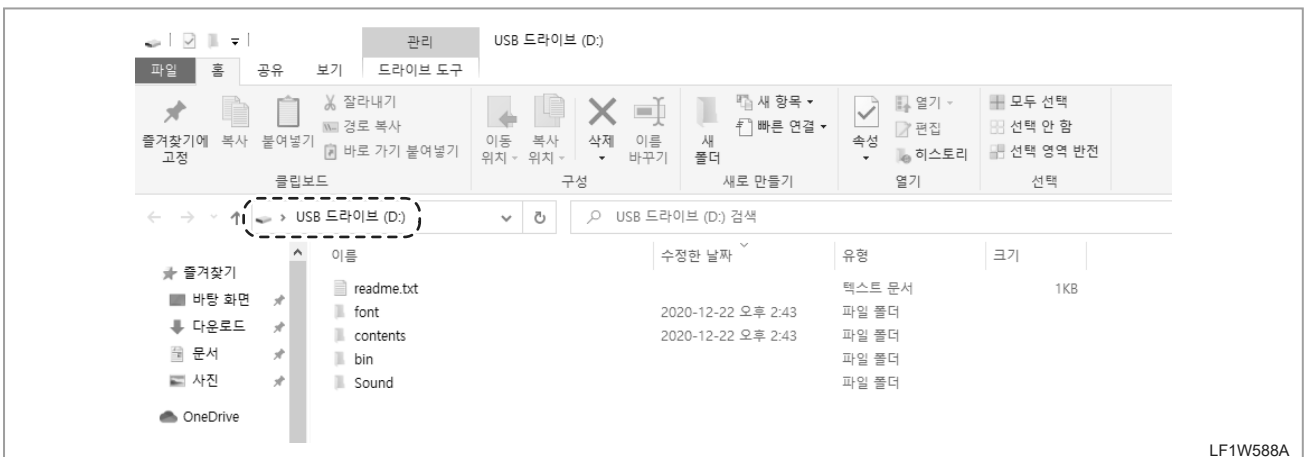
2. Insert a micro 5-pin USB cable to the USB port at the lower back of the dashboard, and then connect the cable to the PC.



LF1W586A

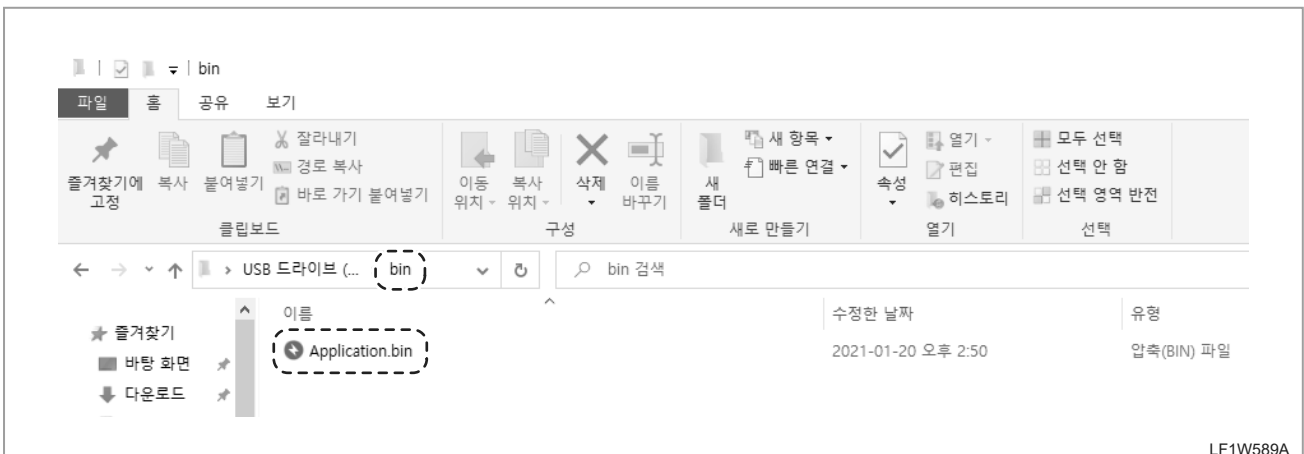


LF1W5B07A



LF1W588A

3. With the power off Press the two arrow buttons (◀, ▶) simultaneously. Then, supply the power (Key ON) and access the USB drive.



LF1W589A

4. Copy and paste the bin file to be downloaded into the “bin” folder of the USB drive. (Delete the old file.) At this time, the file name must be Application.bin.





5. With the power OFF, press the  and  buttons simultaneously for approx. 2 seconds and turn the power ON.

6. Once the update is started and completed, the system automatically restarts.

## REMARKS

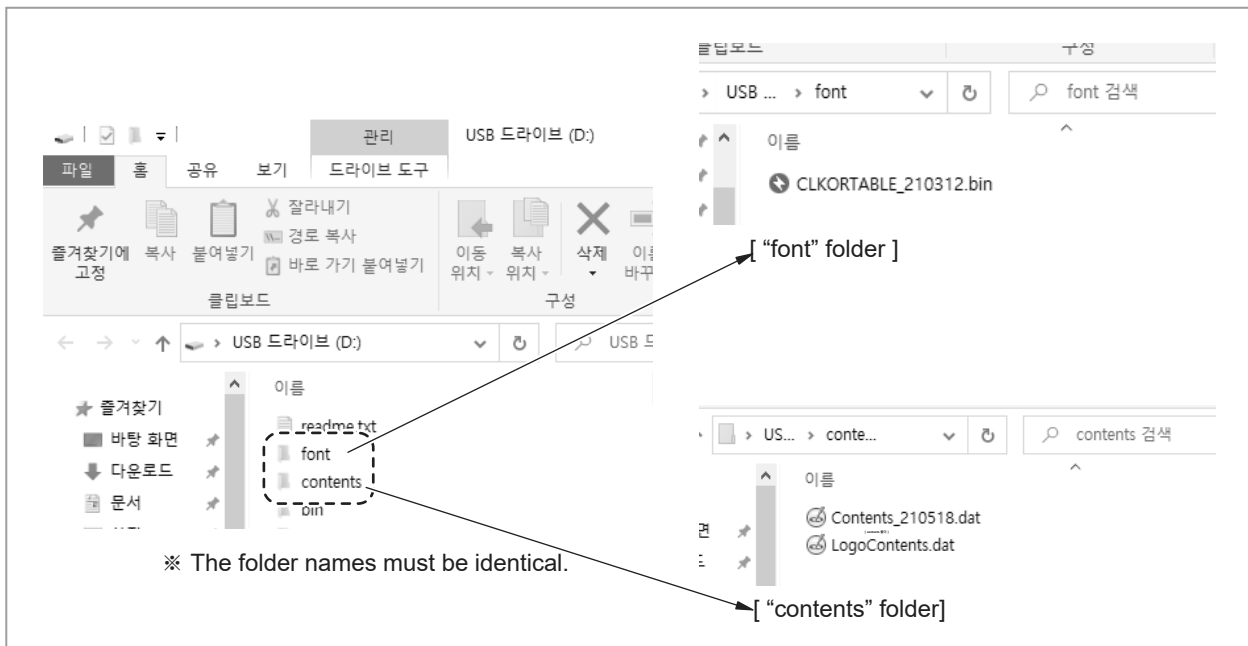
### COPYING AND PASTING THE IMAGE CONTENTS & FONT

#### ► FONT

1. Copy and paste the .bin file into the “font” folder of the USB drive. (Delete the old CLKORTABLE\_XXXXX.BIN file.)
2. Restart the power.

#### ► CONTENTS

1. Copy and paste the .dat file into the “contents” folder of the USB drive. (Delete the old contents\_xxxxx.dat file.)
2. Restart the power.



#### 4.2.9 MCU (MICRO CONTROLLER UNIT)

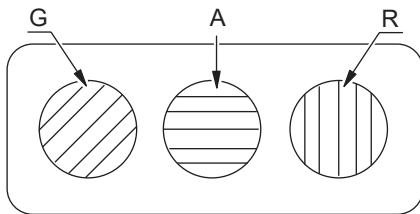


The MCU (1) is located under the top cover behind the driver's seat.

The MCU controls the operation of equipment components by receiving signals from various sensors, such as battery power, various switches and hydraulic system.

- Rated voltage: 12 VDC
- Operating voltage: 8 ~ 16 VDC
- Operating temperature: -40°C ~ 150°C

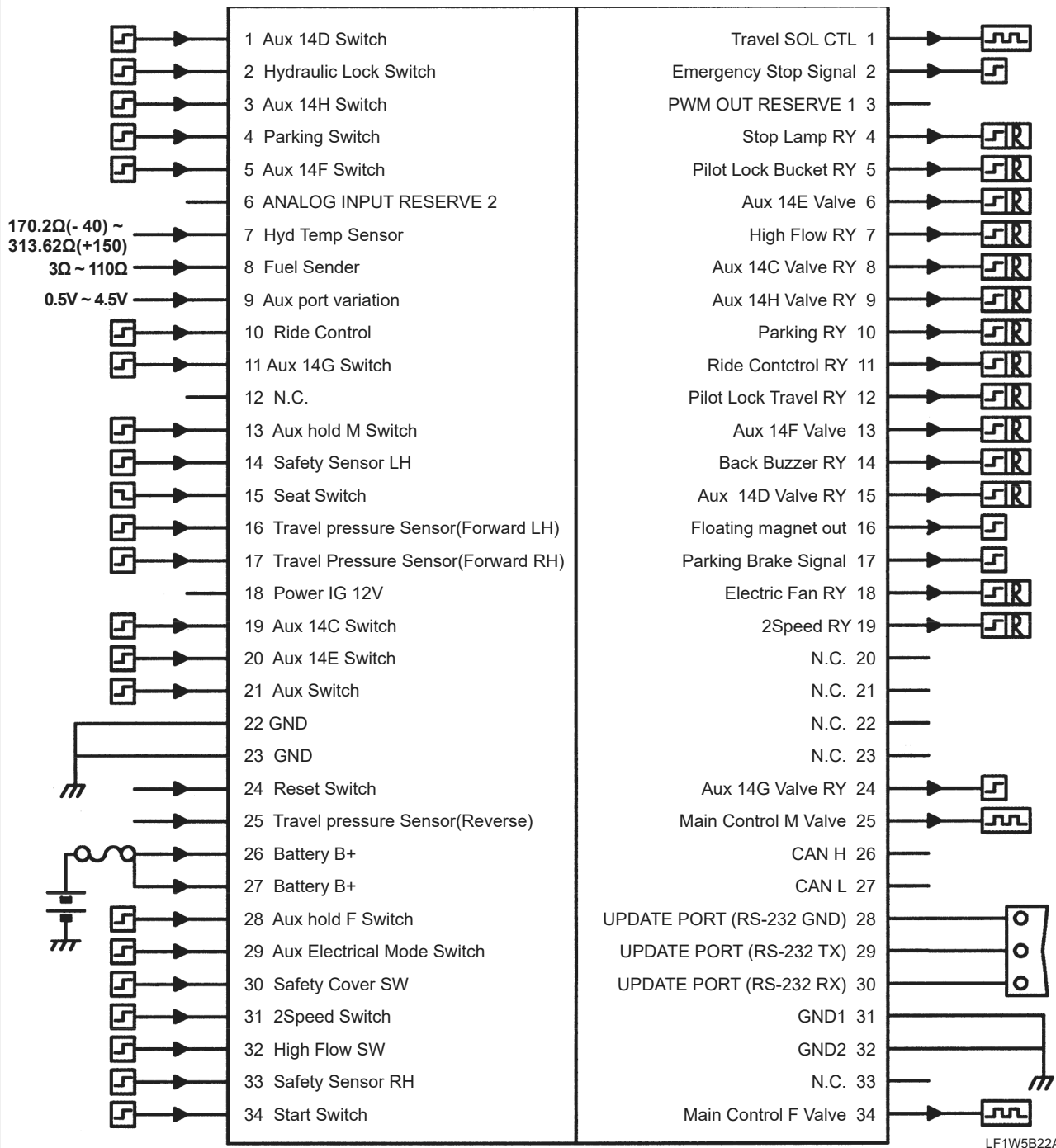
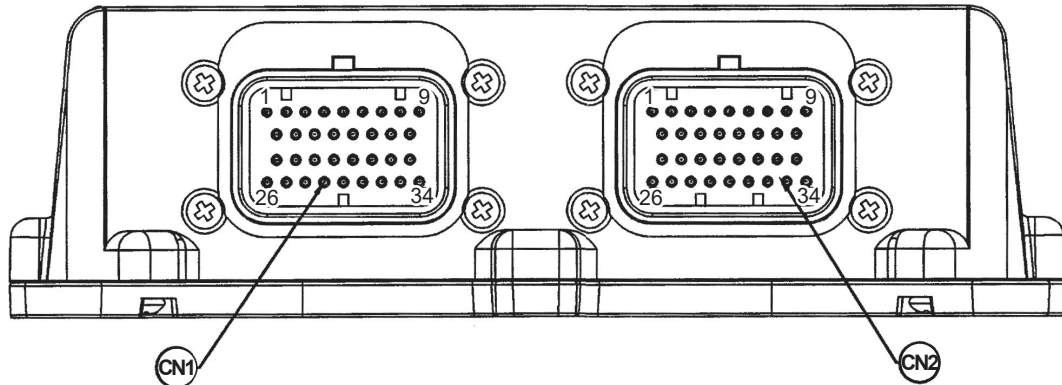
#### LED SPECIFICATIONS



| GREEN | AMBER | RED | Description         |
|-------|-------|-----|---------------------|
| ON    | OFF   | OFF | Normal Operation    |
| OFF   | OFF   | ON  | CPU Error           |
| ON    | ON    | OFF | Communication Error |
| OFF   | OFF   | OFF | Power Off           |

LF1W594A

## CONNECTOR &amp; CIRCUIT



LF1W5B22A

SAFETY FIRST

ENGINE

DRIVING &amp; CHASSIS

HYDRAULIC SYSTEM

ELECTRIC SYSTEM

CABIN

INDEX

## ► INPUT/OUTPUT SPECIFICATIONS

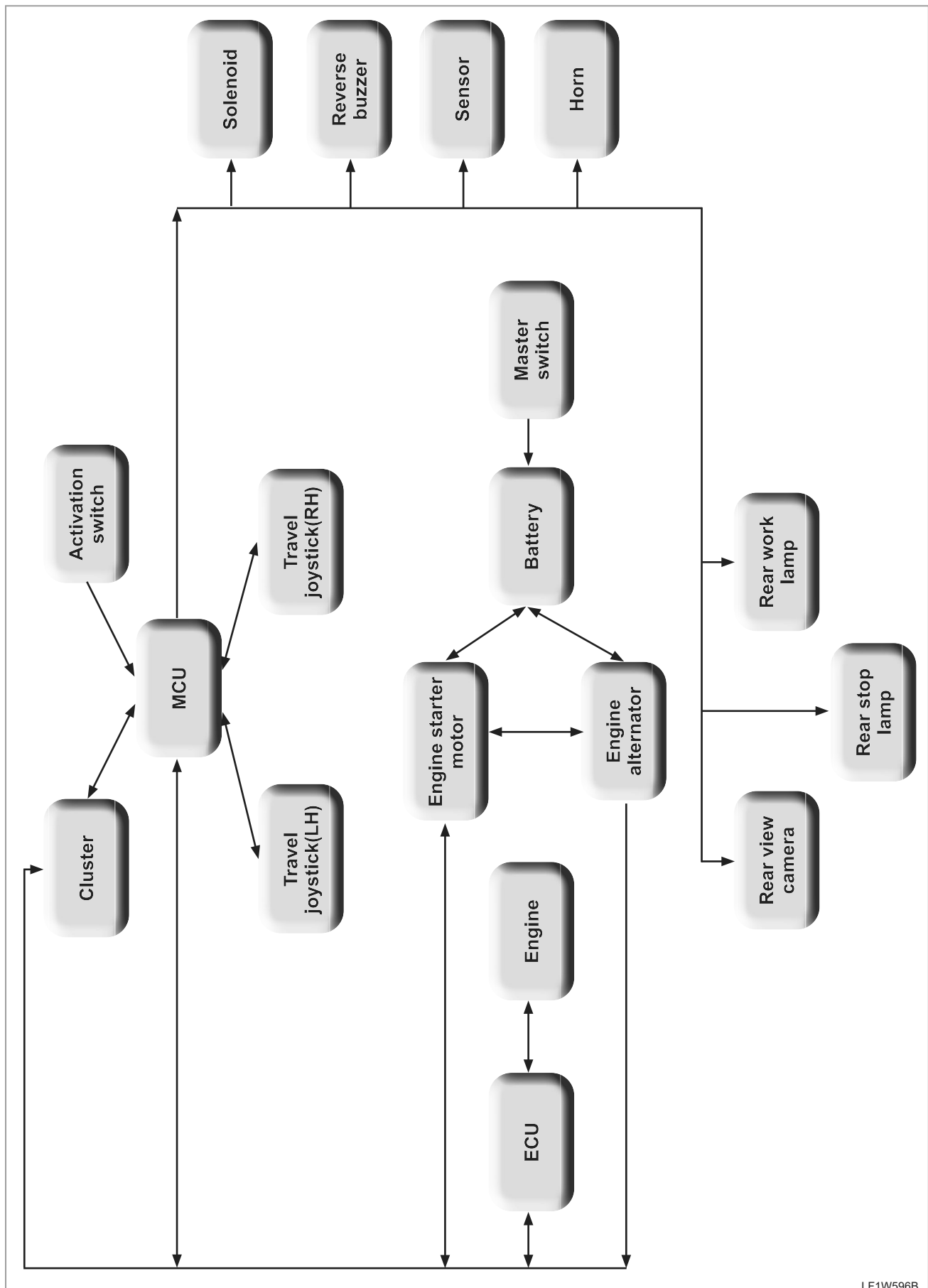
| Function   | INPUT (Connector CN1) |                                     |                 |                                            | REMARK                                                    |
|------------|-----------------------|-------------------------------------|-----------------|--------------------------------------------|-----------------------------------------------------------|
|            | NO.                   | Terminal name                       | Condition       | Logic                                      |                                                           |
| Power      | 26                    | Battery B+                          | 12V             | 8 ~ 16V                                    |                                                           |
|            | 27                    | Battery B+                          | 12V             | 8 ~ 16V                                    |                                                           |
| Key Switch | 18                    | Power IG 12V                        | OFF-> ON (12V)  | 8 ~ 16V                                    | LED lamp "ON" (Green)                                     |
| AUX        | 21                    | Aux Switch                          | OFF -> ON (12V) | Icon "ON" in the LCD                       |                                                           |
|            | 29                    | Aux Electrical Mode Switch          | OFF -> ON (12V) | Icon "ON" in the LCD                       |                                                           |
|            | 19                    | Aux 14C Switch                      | OFF -> ON (12V) | Icon "ON" in the LCD<br>CN2-8 +12V output  |                                                           |
|            | 1                     | Aux 14D Switch                      | OFF -> ON (12V) | Icon "ON" in the LCD<br>CN2-15 +12V output |                                                           |
|            | 20                    | Aux 14E Switch                      | OFF-> ON (12V)  | Icon "ON" in the LCD<br>CN2-6 +12V output  |                                                           |
|            | 5                     | Aux 14F Switch                      | OFF -> ON (12V) | Icon "ON" in the LCD<br>CN2-13 +12V output |                                                           |
|            | 11                    | Aux 14G Switch                      | OFF -> ON (12V) | Icon "ON" in the LCD<br>CN2-24+12V output  |                                                           |
|            | 3                     | Aux 14H Switch                      | OFF -> ON (12V) | Icon "ON" in the LCD<br>CN2-9 +12V output  |                                                           |
|            | 13                    | Aux hold M switch                   | OFF-> ON (12V)  | Icon "ON" in the LCD<br>CN2-25 +12V output |                                                           |
|            | 28                    | Aux hold F switch                   | OFF -> ON (12V) | Icon "ON" in the LCD<br>CN2-34 +12V output |                                                           |
| Travel     | 16                    | Travel Pressure Sensor (Forward Lh) | OFF -> ON (12V) |                                            | When "N" position,<br>Back Buzzer : OFF<br>Stop LAMP : ON |
|            | 17                    | Travel Pressure Sensor (Forward Rh) | OFF -> ON (12V) |                                            |                                                           |
|            | 25                    | Travel Pressure Sensor (Reverse)    | OFF-> ON (12V)  | CN2-14 +12V output                         | When "R" position,<br>Back Buzzer : ON<br>Stop LAMP : OFF |

|         |    |                      |                             |                                            |  |
|---------|----|----------------------|-----------------------------|--------------------------------------------|--|
| Digital | 2  | Hyd Lock Switch      | OFF -> ON (12V)             |                                            |  |
|         | 10 | Ride Control         | OFF-> ON (12V)              | Icon "ON" in the LCD<br>CN2-11 +12V output |  |
|         | 4  | Parking Switch       | OFF-> ON (12V)              | Icon "ON" in the LCD<br>CN2-10 +12V output |  |
|         | 24 | Reset Switch         | OFF -> ON (12V)             | CN2-5, 12, 17 +12V<br>output               |  |
|         | 30 | Safety Cover switch  | OFF -> ON (12V)             | LAMP "ON"<br>CN2-2 +12V output             |  |
|         | 31 | 2 Speed Switch       | OFF-> ON (12V)              | Icon "ON" in the LCD<br>CN2-7 +12V output  |  |
|         | 32 | High Flow switch     | OFF -> ON (12V)             | Icon "ON" in the LCD<br>CN2-19 +12V output |  |
|         | 15 | Seat switch          | OPEN -><br>LOW(0V)          | LAMP "ON"                                  |  |
|         | 14 | Safety Sensor LH     | OFF -> ON (12V)             | LAMP "ON"                                  |  |
|         | 33 | Safety Sensor RH     | OFF -> ON (12V)             | LAMP "ON"                                  |  |
|         | 34 | Start Switch         | OFF -> ON (12V)             | LAMP "ON"<br>CN2-18 +12V output            |  |
| Analog  | 7  | Hyd Temp Sensor      | 48K $\Omega$ ~ 160 $\Omega$ | Temperature display<br>on the LCD          |  |
|         |    | Hyd Temp Sensor High | 322 $\Omega$ or less        | Icon "ON" in the LCD                       |  |
|         | 8  | Fuel Sender          | 3 $\Omega$ - 110.3 $\Omega$ | Fuel level display<br>on the LCD           |  |
|         |    | Fuel Sender Empty    | 110 $\Omega$ or less        | Icon "ON" in the LCD                       |  |
|         | 9  | Aux Port Variation   | 0.5 - 4.5V<br>Center : 2.5V | Icon "ON" in the LCD                       |  |

## ► RESISTANCE VALUE OF THE HYD TEMP. SENSOR (Only reference value)

| Temp (°C)               | -40    | 0      | 25     | 50    | 100    | 150    | 200    |
|-------------------------|--------|--------|--------|-------|--------|--------|--------|
| RESISTANCE ( $\Omega$ ) | 170.20 | 201.27 | 220.07 | 5.790 | 276.78 | 313.62 | 349.90 |

## MCU DIAGRAM



LF1W596B

## MCU SAFETY SENSOR LOGIC

| INPUT                          |                                |                                             | OUTPUT                                                     |
|--------------------------------|--------------------------------|---------------------------------------------|------------------------------------------------------------|
| Safety Sensor LH (A14)         | Safety Sensor RH (A33)         | SEAT SWITCH (A15)                           |                                                            |
| ON<br>(Safety bar "DOWN", 12V) | ON<br>(Safety bar "DOWN", 12V) | ON<br>(When sit down, 1 sec or more, GND)   | Standby "Reset" signal<br>(A14 ON and A33 ON and A15 ON)   |
|                                |                                | OFF<br>(When stand up, 3 sec or more, OPEN) | Parking valve output ON,<br>Hydraulic lock valve output ON |
|                                | OFF<br>(Safety bar "UP", GND)  | ON<br>(When sit down, 1 sec or more, GND)   | Parking valve output ON,<br>Hydraulic lock valve output ON |
|                                |                                | OFF<br>(When stand up, 3 sec or more, OPEN) | Parking valve output ON,<br>Hydraulic lock valve output ON |
| OFF<br>(Safety bar "UP", GND)  | ON<br>(Safety bar "DOWN", 12V) | ON<br>(When sit down, 1 sec or more, GND)   | Parking valve output ON,<br>Hydraulic lock valve output ON |
|                                |                                | OFF<br>(When stand up, 3 sec or more, OPEN) | Parking valve output ON,<br>Hydraulic lock valve output ON |
|                                | OFF<br>(Safety bar "UP", GND)  | ON<br>(When sit down, 1 sec or more, GND)   | Parking valve output ON,<br>Hydraulic lock valve output ON |
|                                |                                | OFF<br>(When stand up, 3 sec or more, OPEN) | Parking valve output ON,<br>Hydraulic lock valve output ON |

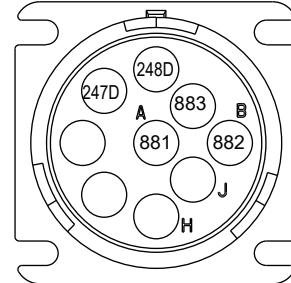
## MCU FIRMWARE UPDATE

## MCU UPDATE CONNECTOR



## COMPOSITION OF CONNECTOR PIN

CN118\_MCU\_Service



HD10-9-96P

## CONNECTING CABLE



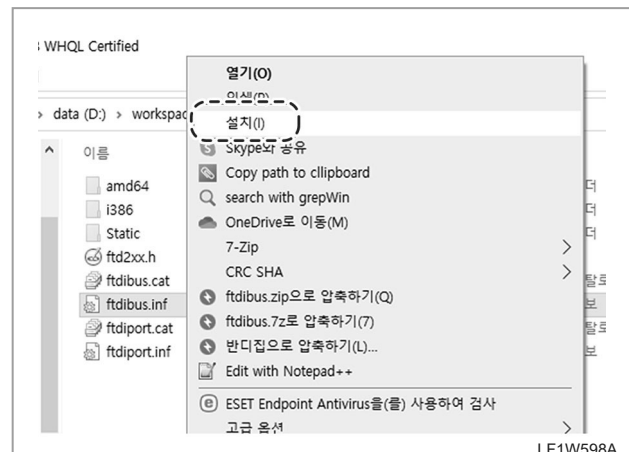
LF1W596A

## 1) PREPARING THE USB DRIVER

## 1-1) INSTALLING RS232 TO USB DRIVER (TO INSTALLATION FILE)

| 이름           | 수정한 날짜             | 유형      |
|--------------|--------------------|---------|
| amd64        | 2020-09-15 오후 1:39 | 파일 폴더   |
| i386         | 2020-09-15 오후 1:39 | 파일 폴더   |
| Static       | 2020-09-15 오후 1:39 | 파일 폴더   |
| ftd2xx.h     | 2017-09-19 오후 4:46 | H 파일    |
| ftdibus.cat  | 2017-09-19 오후 4:46 | 보안 카탈로그 |
| ftdibus.inf  | 2017-09-19 오후 4:46 | 설치 정보   |
| ftdiport.cat | 2017-09-19 오후 4:46 | 보안 카탈로그 |
| ftdiport.inf | 2017-09-19 오후 4:46 | 설치 정보   |

LF1W597A

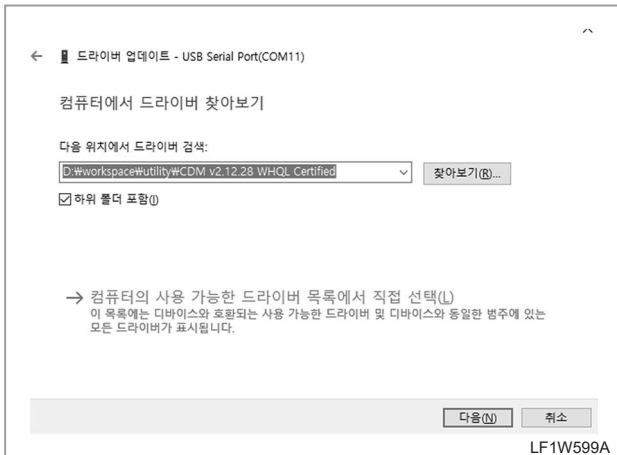


LF1W598A

If a COM port is recognized, this step can be omitted.



### 1-2) INSTALLING RS232 TO USB DRIVER (DRIVER UPDATE)



If a COM port is recognized, this step can be omitted.

### 1-3) CONFIRMING INSTALLATION OF RS232 TO USB DRIVER (DEVICE MANAGER)

The USB serial port should be displayed under the port (COM & LPT) in the Device Manager of the Windows system. Otherwise, firmware update cannot proceed.

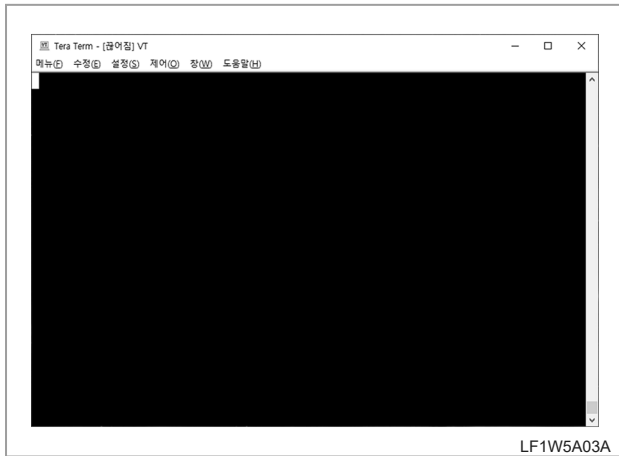
If this doesn't appear on the Device Manager, re-install the USB driver.



※ Here, the COM Port is port no.11 on the Device Manager.

## 2) INSTALLING THE EXECUTABLE PROGRAM AND CONNECTING TO THE PC

### 2-1) DOWNLOADING, INSTALLING AND RUNNING TERA TERM



The program can be downloaded at <https://tera-term.softonic.kr/>.

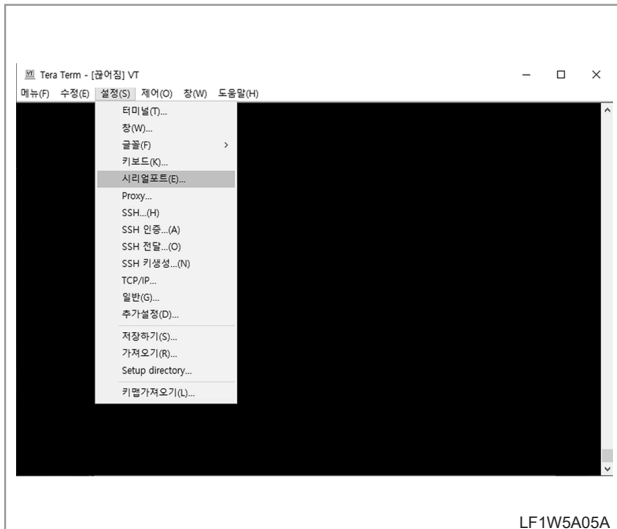
※ Install the program. (This free software is open to anyone for use.)

### 2-2) CONNECTING YOUR VEHICLE TO PC

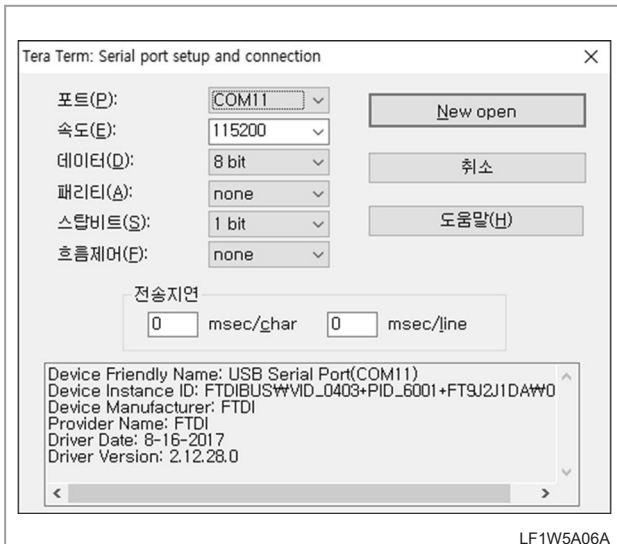


1. Unscrew the 3 bolts on the back of the seat and connect to the circular connector (HD16-9-96S).
2. Connect the RS232 connector (DB9-FEMALE) to the RS232-USB gender.
3. Connect to the PC with the USB drive.

## 3) SETUP



LF1W5A05A

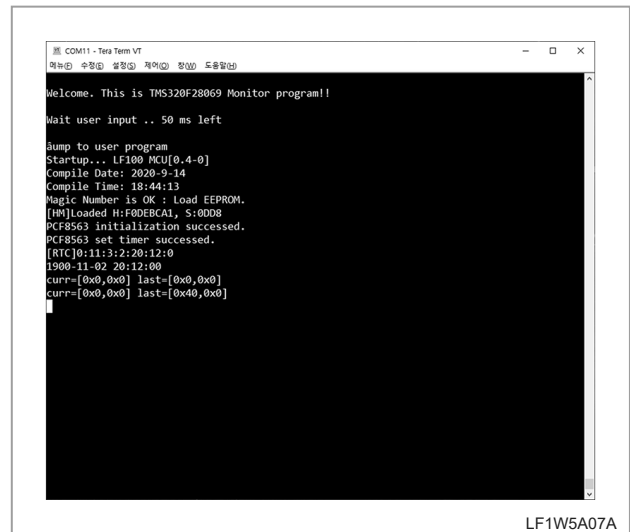


LF1W5A06A

Set the COM Port as shown in the above setup screen.

- The port number can be found at the Device Manager. (Refer to “1-3) Confirming installation of RS232 to USB driver (device manager).”)
- Set the Speed to “115200 bps.”
- Set the Data to “8 bit.”
- Set the Parity to “none.”
- Set the Stop Bit to “1 bit.”
- Set the Flow Control to “none.”
- After setup, press the “New open” button to open the port.

## 4) CHECKING CONNECTION BETWEEN PC AND MCU POWER

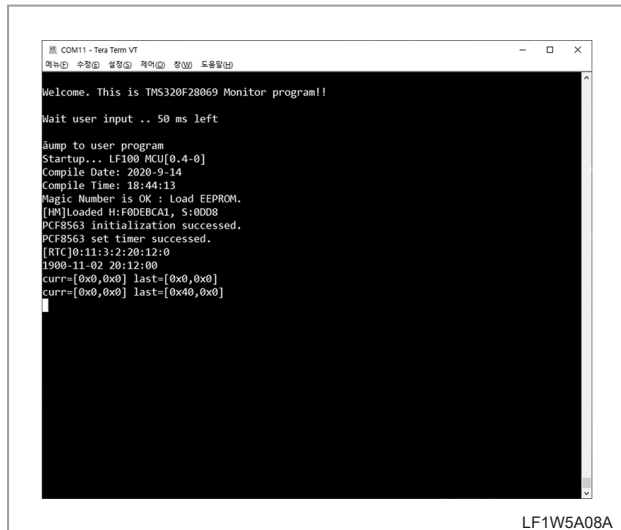


LF1W5A07A

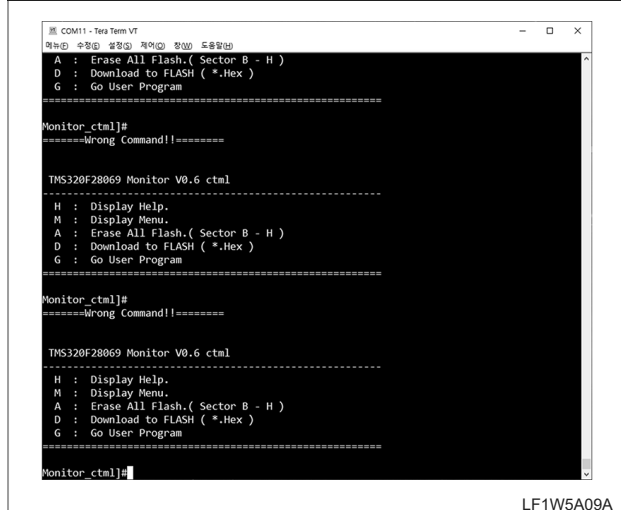
1. Once the COM Port is connected and the MCU board is supplied with 12V power, the logs are output on the screen through UART as shown in the figure. This screen confirms that the MCU board and PC are successfully connected.
2. Once this screen appears, you can move on to the next step.
3. Check the log starting with “Start...” on the screen.
4. Turn the start key to the OFF position.

## 5) ENTERING THE FIRMWARE UPDATE MODE

1. The MCU firmware can be updated only when the program enters the download mode during booting.
2. Press and hold the Ctrl+C keys on Tera Term while the MCU is turned off. This sends Ctrl+C command to the USB drive.
3. Once 12V power is supplied to the MCU, it enters the download mode during booting.

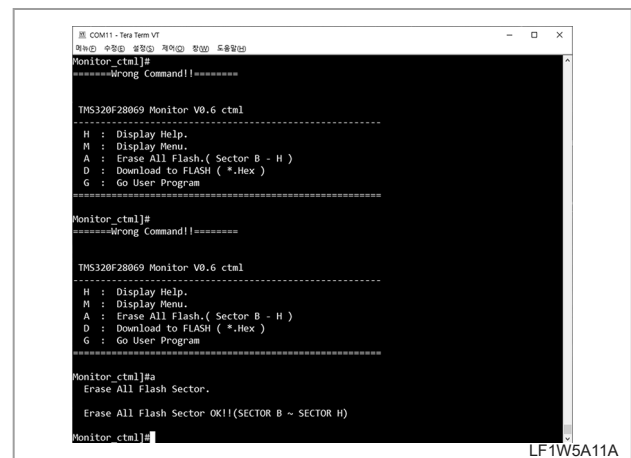
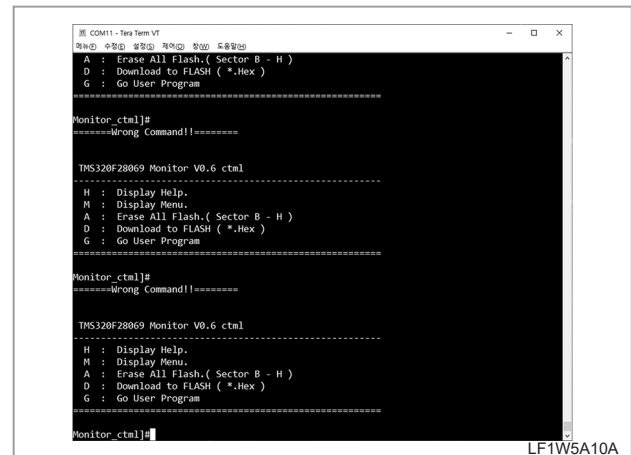


## ENTERING THE FIRMWARE UPDATE SCREEN

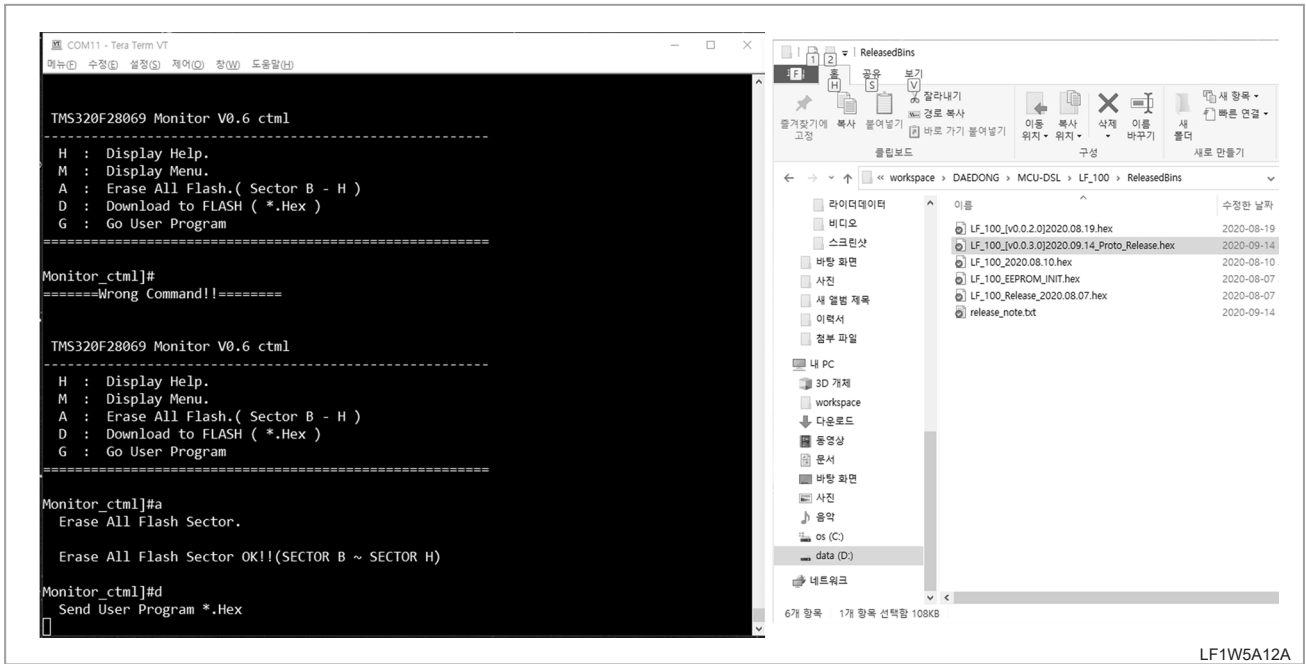


- An update screen will appear when power is supplied to the MCU while pressing and holding Ctrl+C keys on the keyboard.

## 6) DELETING THE USERS PROGRAM AND MEMORY AND ENTERING THE DOWNLOAD MODE

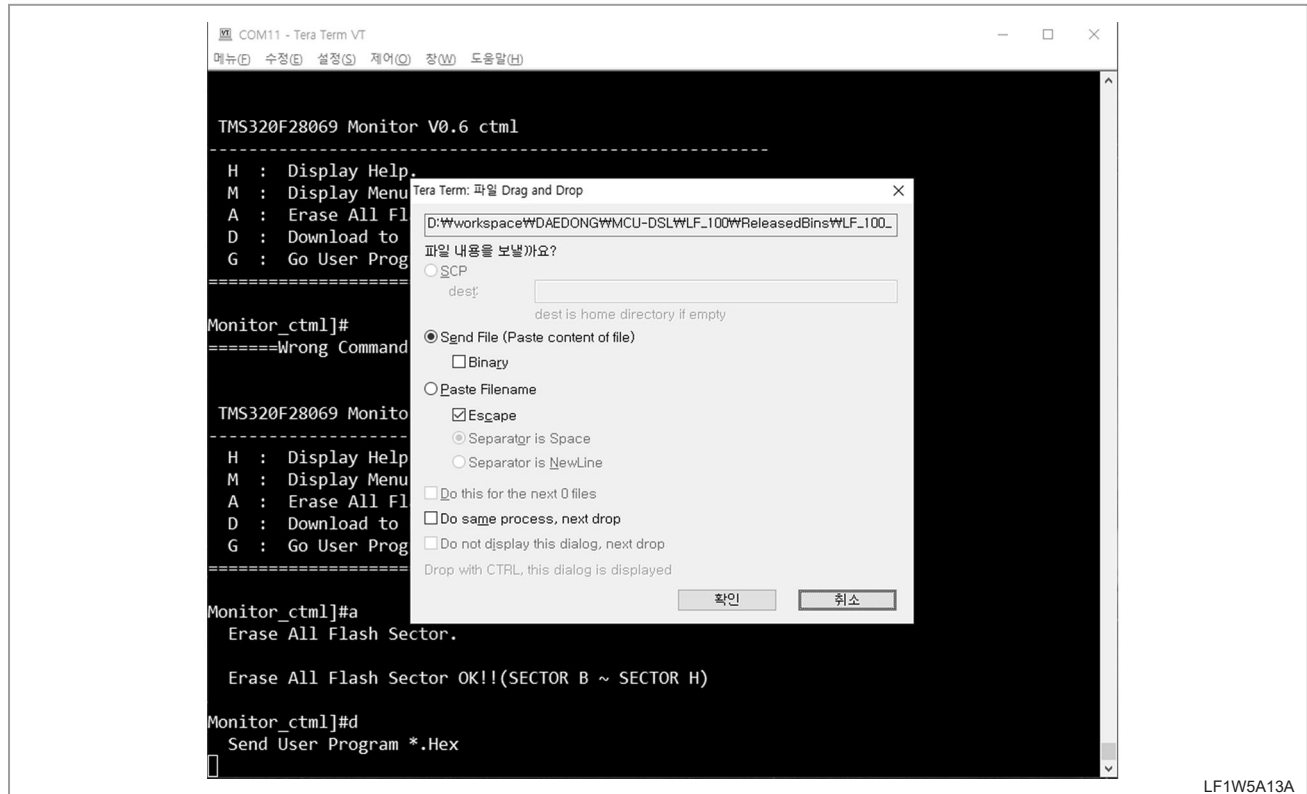


1. The program can be downloaded only if the old users program is deleted.  
Hence, press the 'A'/'a' key to execute the "Erase All Flash" command.
2. Pressing the 'A' or 'a' key will delete the users program. (Erase ALL)  
The old program must be first deleted to use the new program.  
Press the 'A' key to delete the users program.
3. When the following string appears, deletion is completed.  
To enter the download mode, press the 'D' or 'd' key.

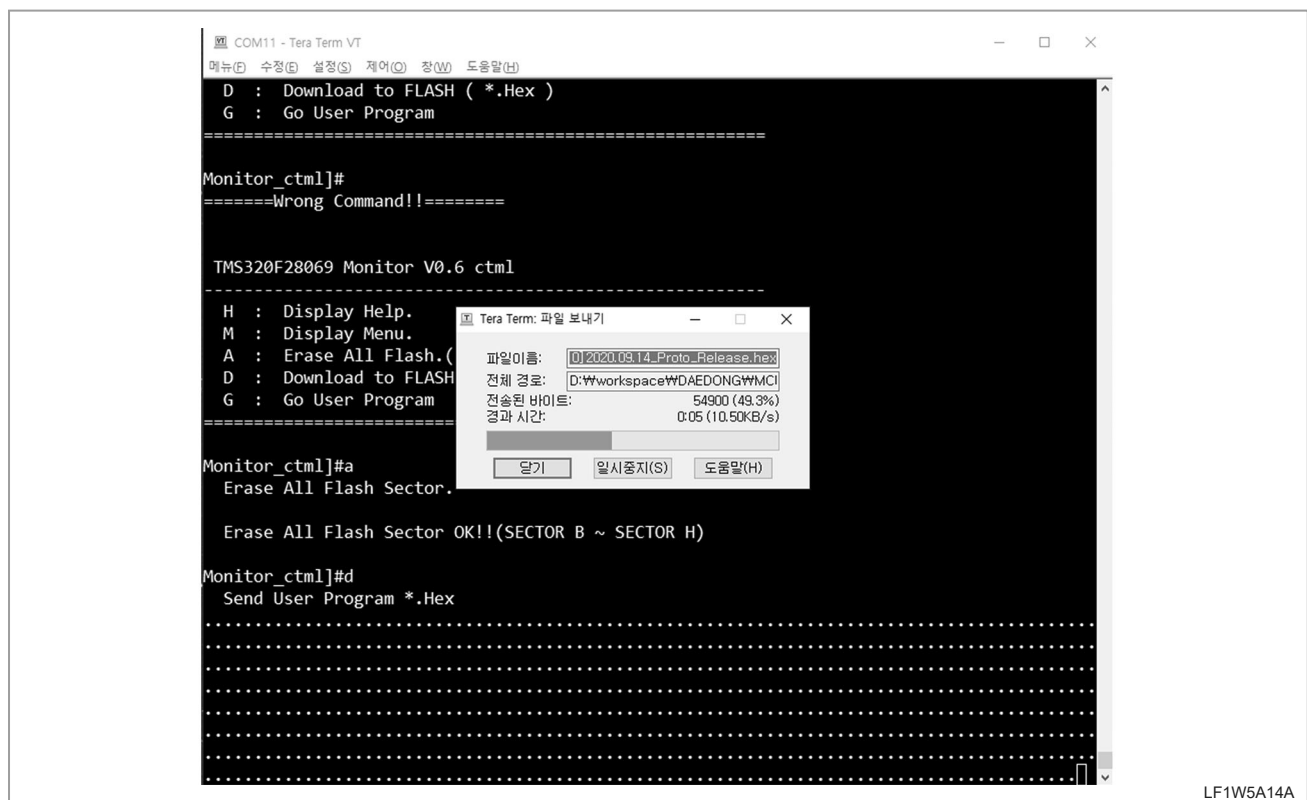


- Once the 'd' key is pressed, "Send User Program \*.Hex" is displayed on the screen. Then, drag and drop the Hex file to be downloaded onto the Tera Term.

## 7) SETTING THE FILE TRANSFER

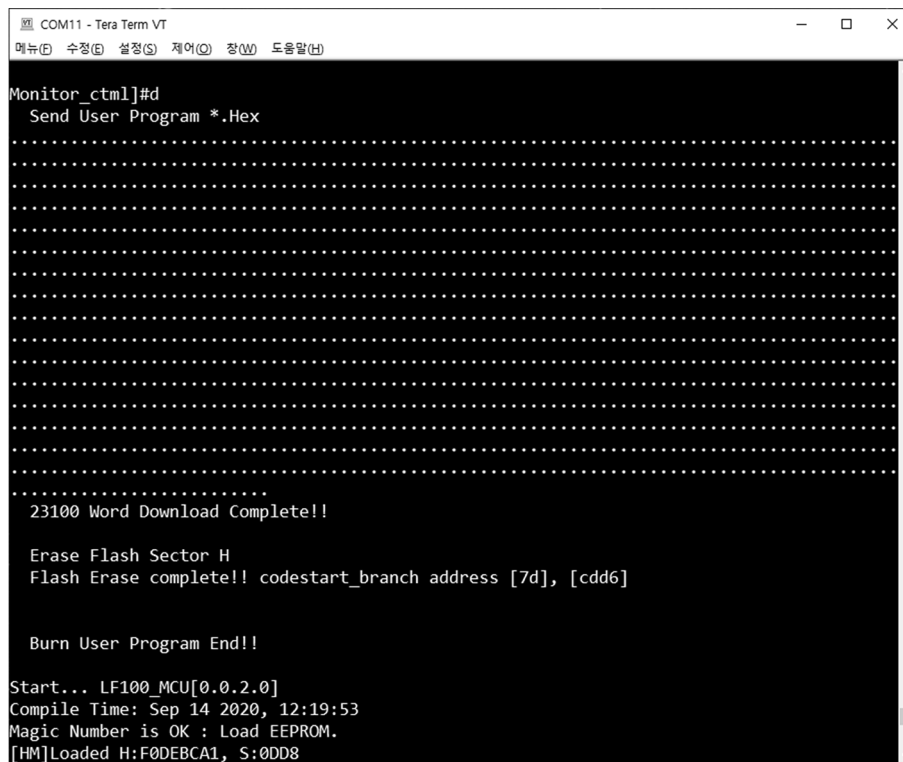


1. The default setting is shown in the figure. After confirming all the settings, press the OK button.



2. Wait until all the files are transferred.  
Wait until the Send file window disappears.  
Do not disconnect the cable or touch the USB cable while this task is ongoing. This may cause a download failure.  
If failed, the process has to be restarted from the beginning.

## 8) LAUNCHING THE PROGRAM



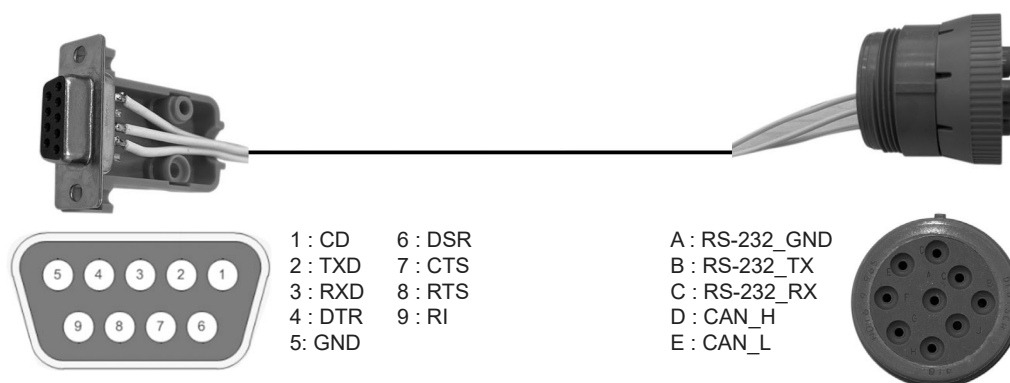
LF1W5A15A

1. Once the file transfer is completed, the firmware update is completed and the MCU will reboot.
2. If the firmware normally starts, the log will appear on the screen: Burn User Program End!! Start... LF100 MCU[0.0.2.0].

※ Check the updated features as download is successfully completed.

 **REMARKS**

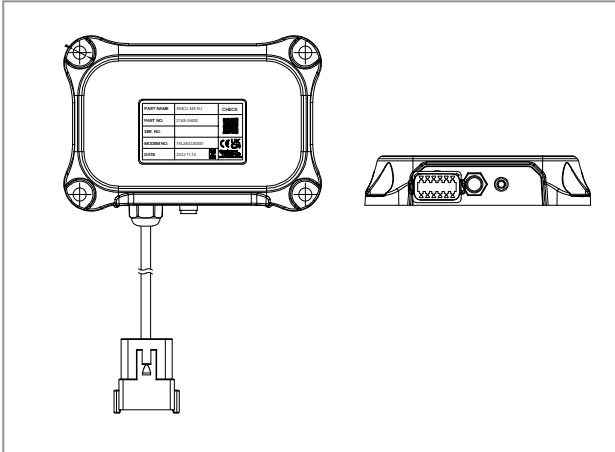
## DOWNLOAD CABLE



| Wiring     | RS-232 connector (Female) | HD16-9-96S plug Deutsch |
|------------|---------------------------|-------------------------|
| RS-232 GND | 5                         | A                       |
| RS-232 Rx  | 3                         | C                       |
| RS-232 Tx  | 2                         | B                       |

LF1W5A69A

## 4.2.10 TELEMETICS CONTROLLER

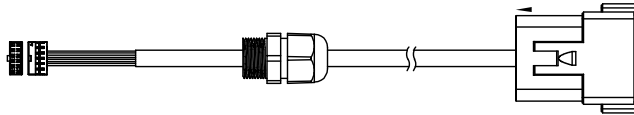


The telematics controller is located under the top cover behind the driver's seat.

This controller confirms the location of the equipment with GPS, controls remote operation and manages emergency states.

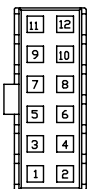
- Rated voltage: 12/24 VDC
- Operating voltage: 8 ~ 32 VDC
- Operating temperature: -40°C ~ 85°C

## CONNECTOR

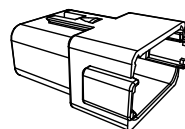
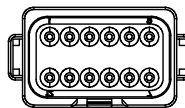


**CONNECTOR : MOLEX 51110-1251**  
**PIN : MOLEX 87396-8051**

Deutsch  
DT04-12P, AWG 18



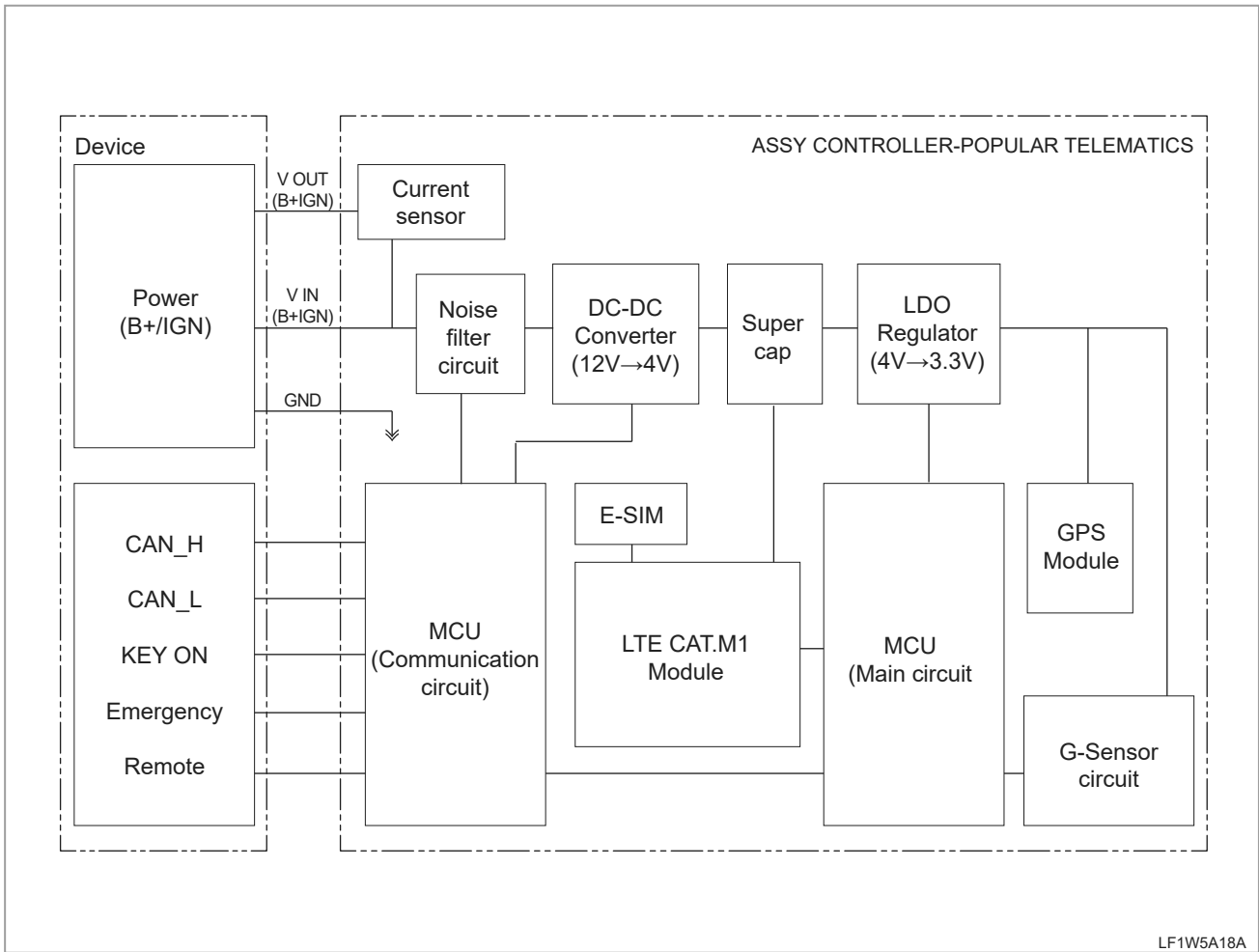
| NO. | NAME             |
|-----|------------------|
| 1   | Battery          |
| 2   | Key_IG           |
| 3   | RS232_TX_2       |
| 4   | RS232_RX_2       |
| 5   | RS232_GND        |
| 6   | MAIN GND         |
| 7   | D/O(KEY_CONTROL) |
| 8   | D/I(DOOR S/W)    |
| 9   | RS232_TX_1       |
| 10  | RS232_RX_1       |
| 11  | CAN_HIGH         |
| 12  | CAN_LOW          |



| NO. | NAME             |
|-----|------------------|
| 1   | Battery          |
| 2   | Key_IG           |
| 3   | CAN_High         |
| 4   | RS232_TX_1       |
| 5   | RS232_GND        |
| 6   | RS232_TX_2       |
| 7   | RS232_RX_2       |
| 8   | D/O(KEY_CONTROL) |
| 9   | RS232_RX_1       |
| 10  | D/I(DOOR S/W)    |
| 11  | CAN_Low          |
| 12  | MAIN GND         |



## SCHEMATIC DIAGRAM



SAFETY FIRST

ENGINE

DRIVING &amp; CHASSIS

HYDRAULIC SYSTEM

ELECTRIC SYSTEM

CABIN

INDEX

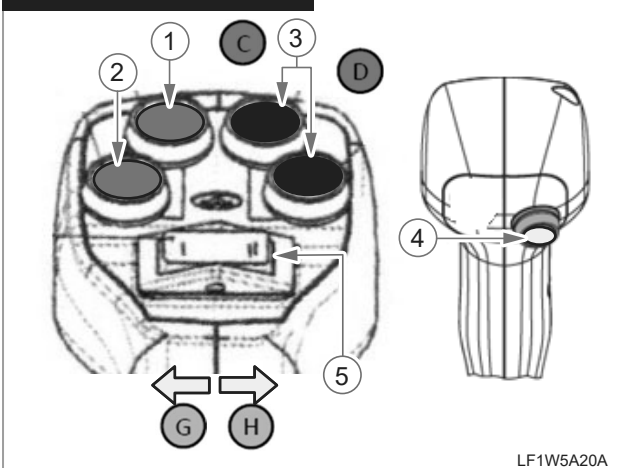
## 4.2.11 RCV ASSEMBLY (LH) (RH)



(1) RCV assembly (LH)

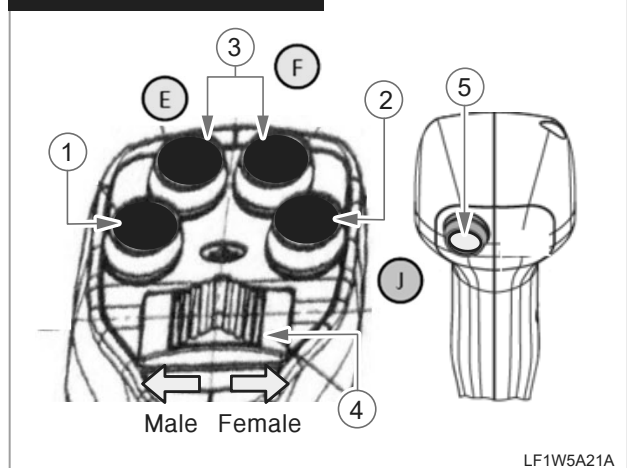
(2) RCV assembly (RH)

## RCV ASSEMBLY (LH)



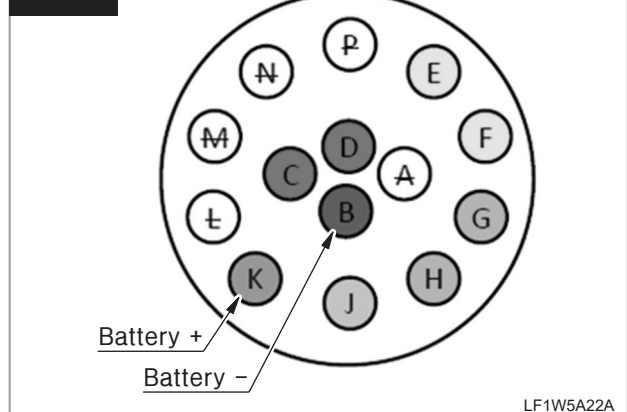
- (1) Horn (ON/OFF push button)
- (2) Ride control (ON/OFF push button)
- (3) Aux 1 (Electric, ON/OFF push button)
- (4) 2-speed (ON/OFF push button)
- (5) Aux 3 (Electric, on/off, FNR Rocker switch)

## RCV ASSEMBLY (RH)



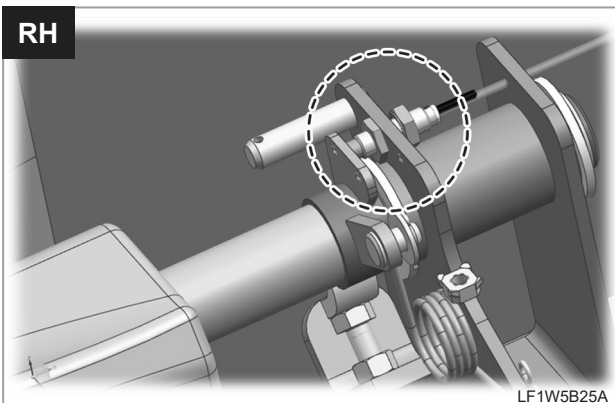
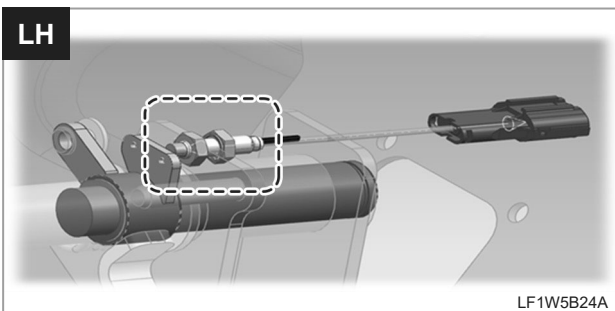
- (1) Aux hold switch (ON/OFF push button)
- (2) Aux hold switch (ON/OFF push button)
- (3) Aux 2(Electric, ON/OFF push button)
- (4) Aux port variable switch (Proportional roller)
- (5) Aux electrical mode change switch(ON/OFF push button)

## 14PIN

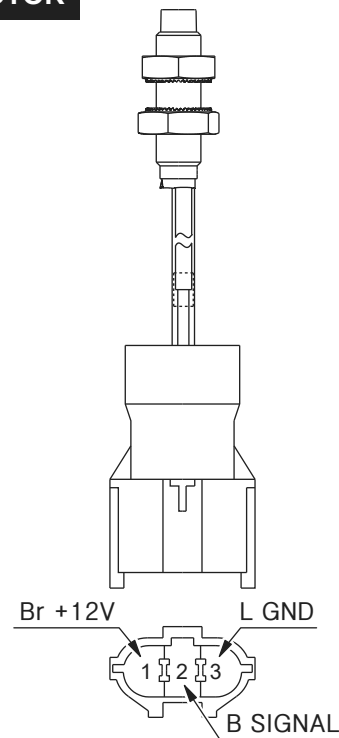


The RCV assembly (LH) operates the functions related to steering and driving while the RCV assembly (RH) operates the boom and bucket.

## 4.2.12 SAFETY SENSOR (SAFETY BAR)



## CONNECTOR



LF1W5B20A

The safety sensors are mounted on both ends of the safety bar of the driver's seat. The output of the parking valve and hydraulic lock valve is turned ON or OFF according to the raising or lowering state of the safety bar.

When the safety bar is raised, the parking brake is applied and the hydraulic line is locked to prevent unexpected accidents from operation of the machine.

## 4.2.13 SEAT SWITCH

SAFETY FIRST

ENGINE

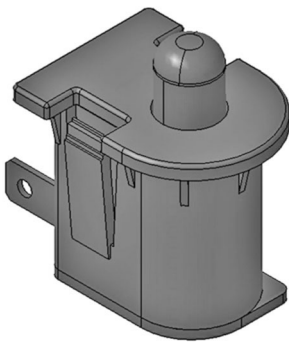
DRIVING &amp; CHASSIS

HYDRAULIC SYSTEM

ELECTRIC SYSTEM

CABIN

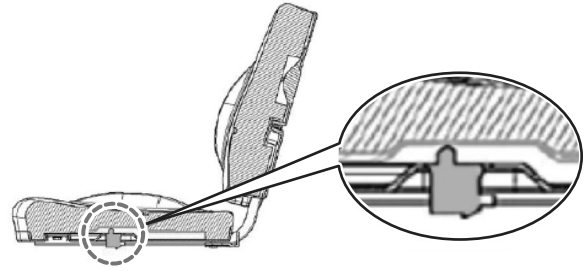
INDEX



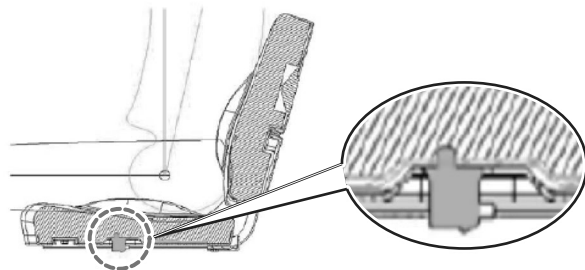
LF1W5B27A

LF1W578A

The seat switch is mounted inside of the seat bottom. When the driver is seated or not seated on the seat, the switch plunger is actuated to start the engine or to stop the engine. In addition, the engine stops automatically when the driver is not seated on the seat and it exceeds 3 seconds during driving.

**ENGINE OFF**

ST5WC06A

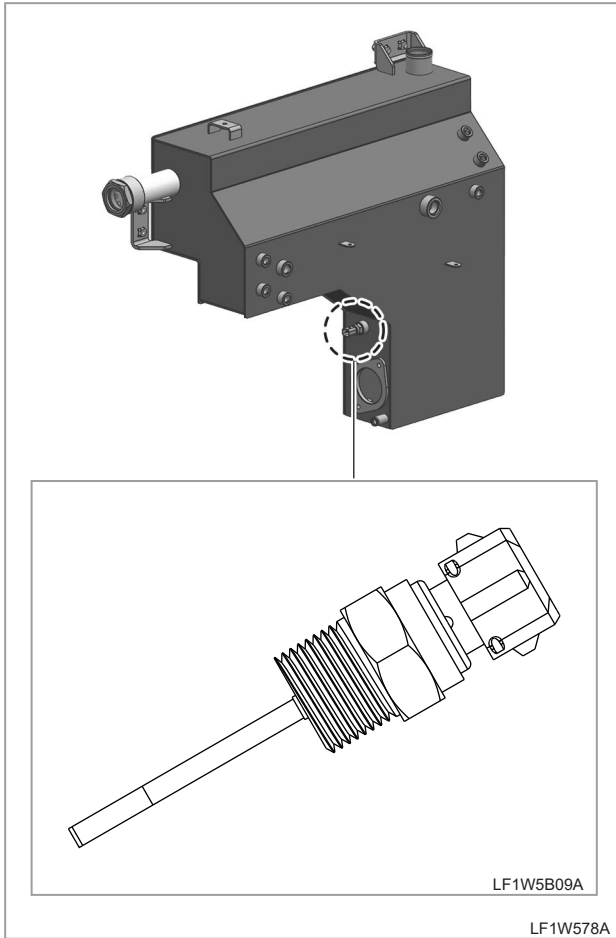
**ENGINE ON**

ST5WC07A

**TEST**

Connect the tester (ohmmeter) to the two terminals of the seat switch and check the continuity by pressing the plunger. If the plunger does not conduct when it is pressed, or conduction occurs when does not press the plunger, there is a problem with the seat switch. Replace the seat switch with a new one.

## 4.2.14 OIL TEMPERATURE SENSOR



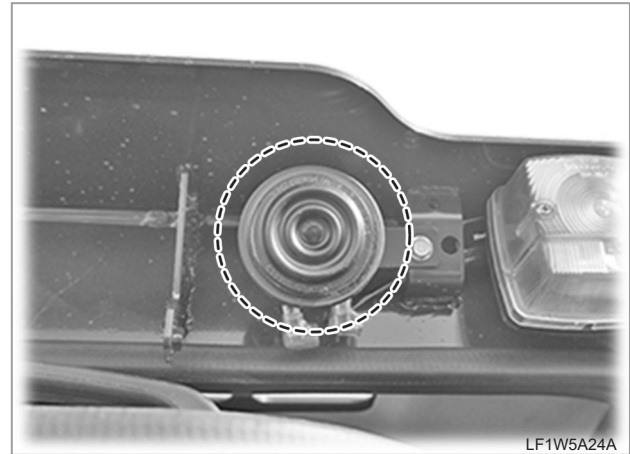
The oil temperature sensor is located on the front of the oil tank on the right side from the driver's seat. It detects oil temperature in the oil tank and sends a signal to the MCU. Normally, a warning lamp on the dashboard will be illuminated if the temperature exceeds 90°C.

- Operating temperature: -40°C ~ 150°C

**RESISTANCE BY TEMPERATURE**

| Temp. (°C) | Resistance value (Ω) |
|------------|----------------------|
| -40        | 170.20               |
| 0          | 201.27               |
| 25         | 220.07               |
| 50         | 239.30               |
| 100        | 276.78               |
| 150        | 313.62               |

## 4.2.15 HORN



The horn is installed on the front upper frame in the cabin.

- Horn volume : 105 ~ 118 dB(A)

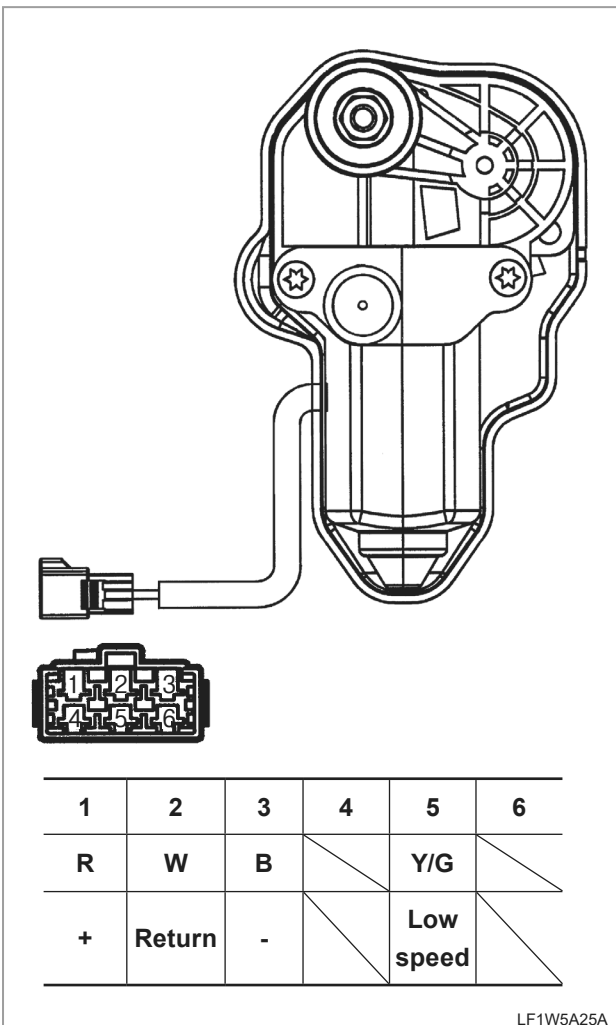
## 4.2.16 WIPER MOTOR



The wiper motor is installed on the side of the front glass door.

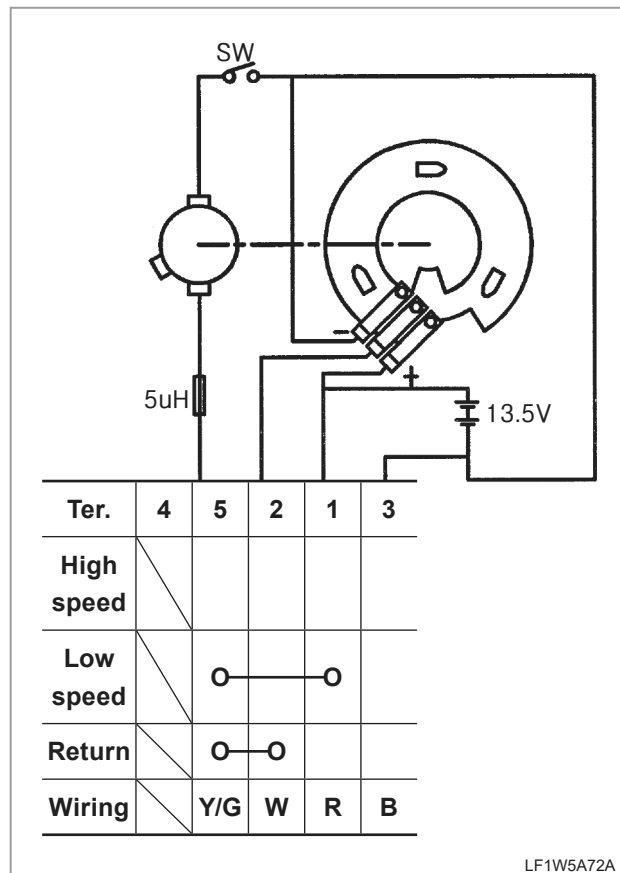
- Rotation angle :  $120^{\circ} \pm 3^{\circ}$

## CONNECTOR



LF1W5A25A

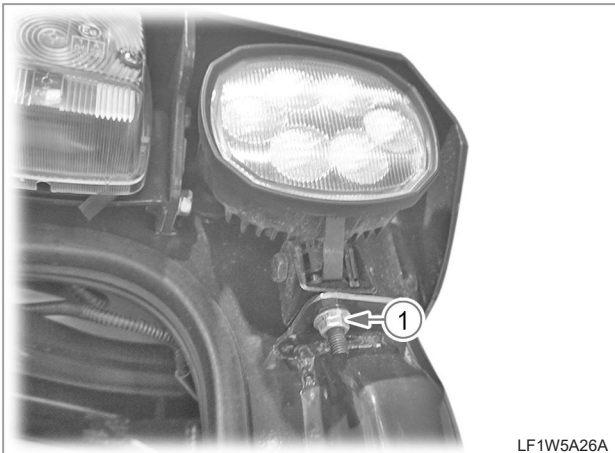
## CIRCUIT



LF1W5A72A

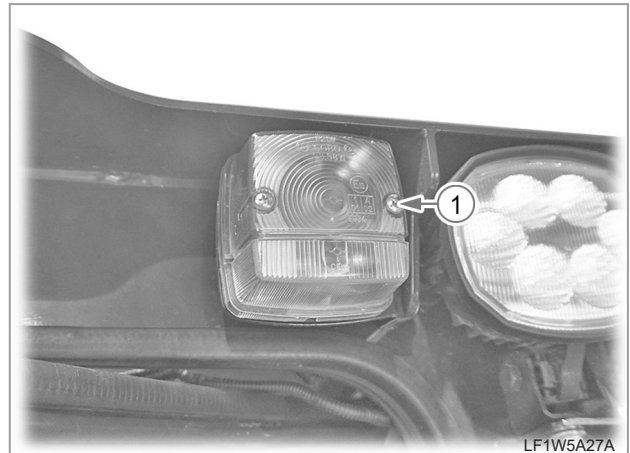
## 4.3 LAMPS (BULB REPLACEMENT)

### 4.3.1 LED WORK LAMP

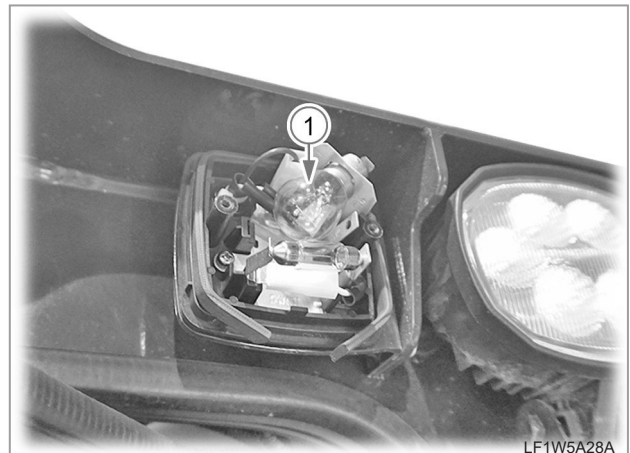


1. Unscrew the lower bracket mounting nut (1) of the work lamp.
2. Disconnect the wiring connector and replace the LED work lamp assembly.

### 4.3.2 TURN SIGNAL LAMP



1. Unscrew lens mounting screws (1) to remove the lens.



2. Remove the turn signal lamp bulb (1) by turning it and replace it with a new bulb if necessary.
  - Bulb specification: 12V 21W



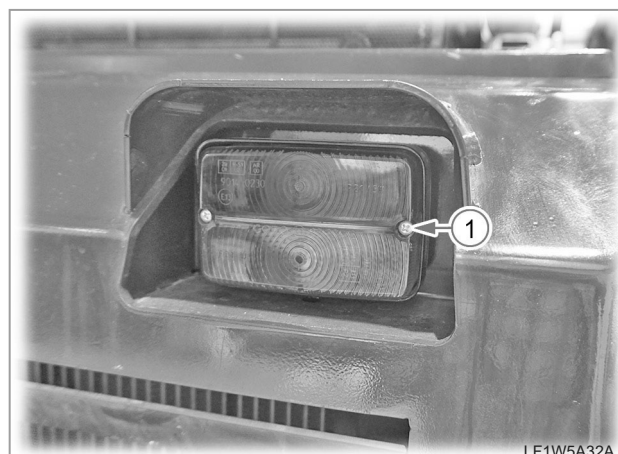
LF1W5A30A



LF1W5A31A

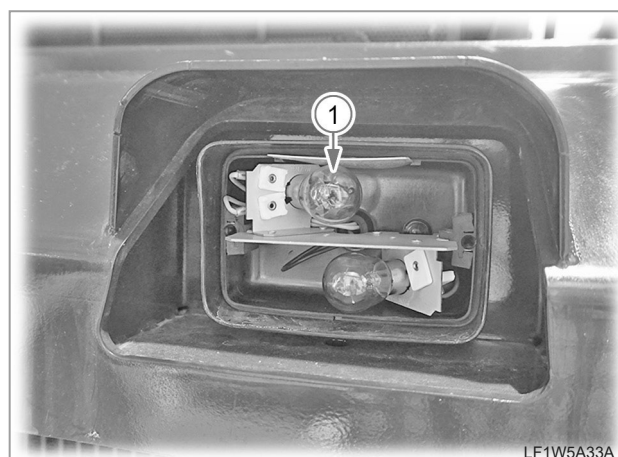
3. Remove the tail lamp bulb (2) and replace it with a new bulb if necessary.
  - Bulb specification: 12V 5W

#### 4.3.3 BRAKE LAMP (REAR LAMP) / TURN SIGNAL LAMP



LF1W5A32A

1. Unscrew the tail lamp lens mounting screws (1) on the rear cover.



LF1W5A33A

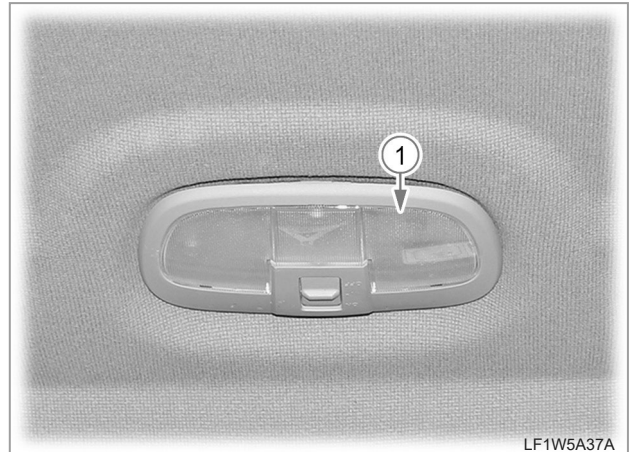
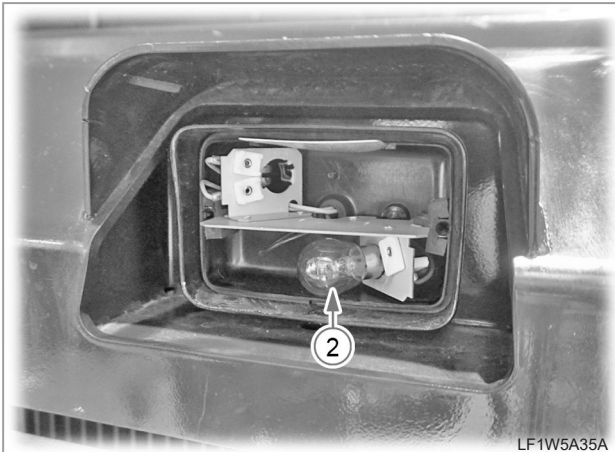


LF1W5A34A

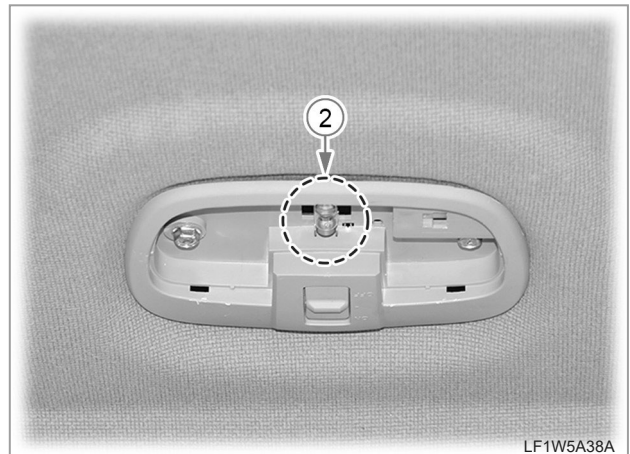
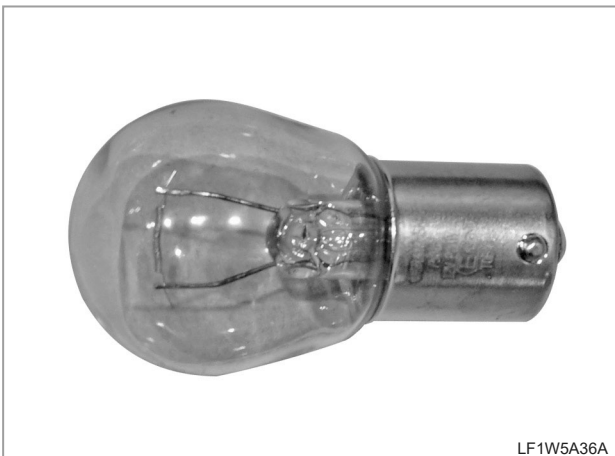
2. Remove the brake lamp (tail lamp) bulb (1) by turning it and replace it with a new one if necessary.
  - Bulb specification: 12V P21/5W



## 4.3.4 ROOM LAMP



1. Using a flat-bladed screwdriver, pry off the edge of the interior lamp lens to remove the lens (1).



3. Remove the turn signal lamp bulb (2) by pressing and turning it and replace it with a new one if necessary.

- Bulb specification: 12V P21W

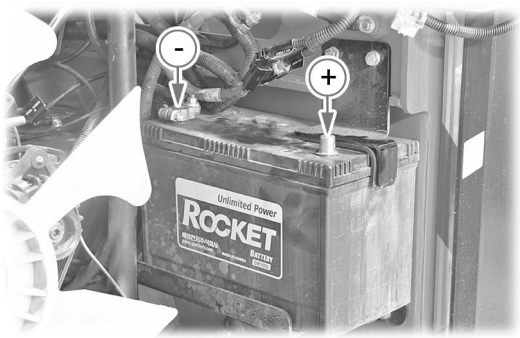
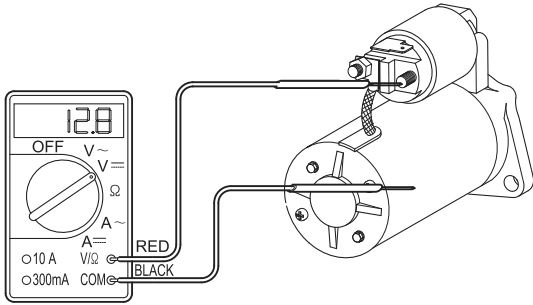
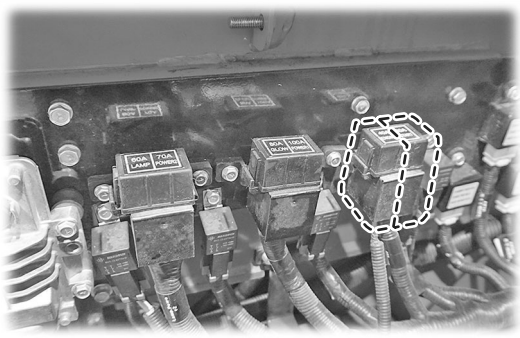
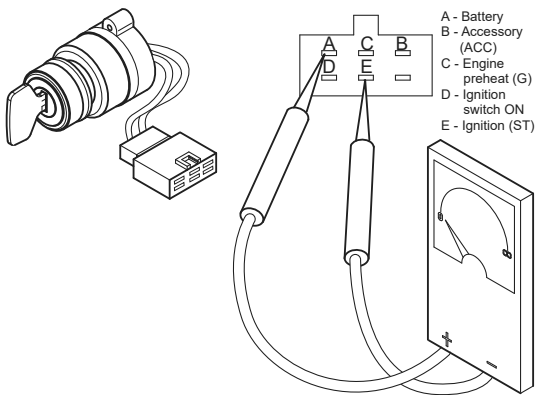


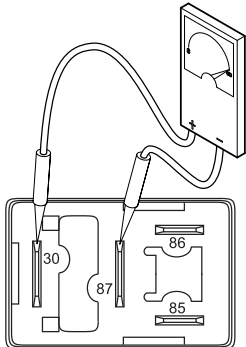
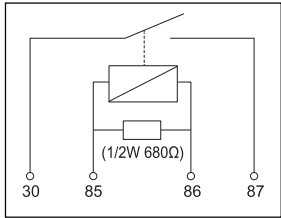
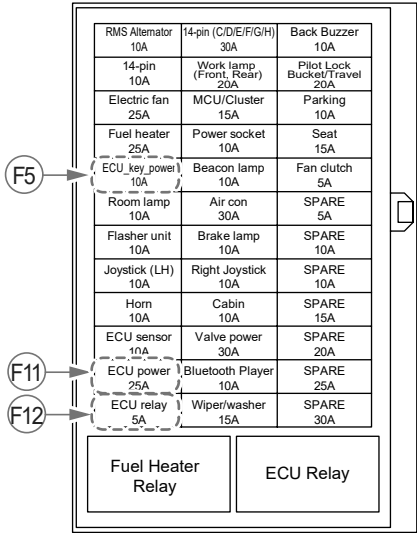
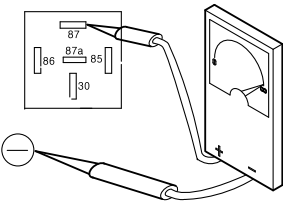
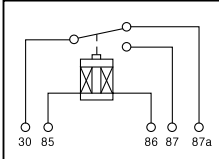
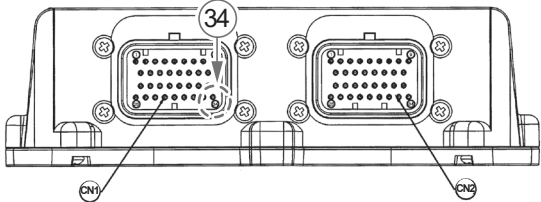
2. Remove the interior lamp lens (2) and replace it with a new one if necessary.

- Bulb specification: 12V 10W

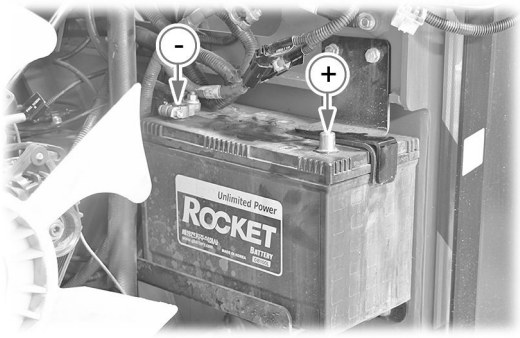
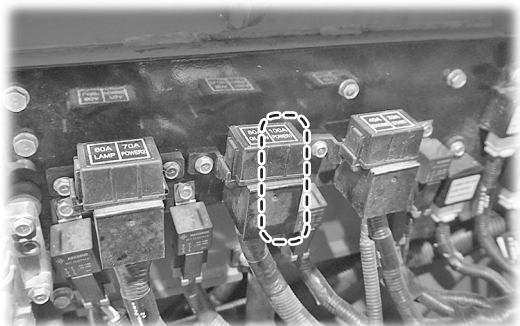
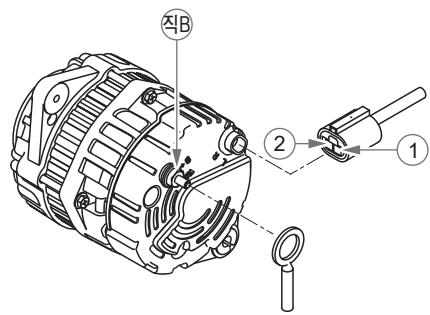
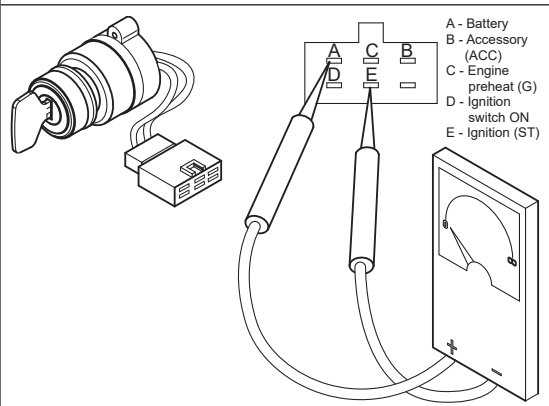
## 5. TROUBLESHOOTING

### 5.1 WHEN THE ENGINE CANNOT BE STARTED

| CHECK POINT                        | CHECK METHOD                                                                                                                                                                                                                                                                                                                                                                                                                                | REMARKS                                                                                               |
|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| 1. Check the battery voltage       | <ul style="list-style-type: none"> <li>- Measure the voltage between battery (+) and (-) terminals using a tester</li> </ul> <p>Result: 11.8 ~ 12.9 V.</p> <p>However, the voltage may be over this range if it is measured immediately after turning the engine off.</p>                                                                                                                                                                   |  <p>LF1W5A47A</p>   |
| 2. Battery terminal of start motor | <ol style="list-style-type: none"> <li>1. Check the battery cable connection. <ul style="list-style-type: none"> <li>- The voltage between the terminal M of start motor and chassis should be approximately same to the battery voltage.</li> <li>- Check for corrosion.</li> </ul> </li> <li>2. Checking when voltage is not supplied <ul style="list-style-type: none"> <li>- Check the battery cable connection.</li> </ul> </li> </ol> |  <p>T85WBD6A</p>   |
| 3. Slow-blow fuse                  | <ol style="list-style-type: none"> <li>1. Fuse engagement</li> <li>2. Check the main fuse for short circuit. <p>Rated capacity: 30 A (Start)</p> <p>Rated capacity: 40 A (Engine)</p> </li> </ol>                                                                                                                                                                                                                                           |  <p>LF1W5A48A</p> |
| 4. Ignition switch                 | <ul style="list-style-type: none"> <li>- Check for proper connection</li> </ul> <p>"OFF" position: No connection</p> <p>"ACC/ON" position: A-B-D</p> <p>"PREHEAT" position: A-C-D</p> <p>"ST" position: A-D-E</p>                                                                                                                                                                                                                           |  <p>T85WBD8A</p>  |

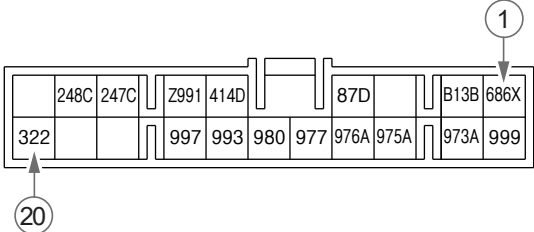
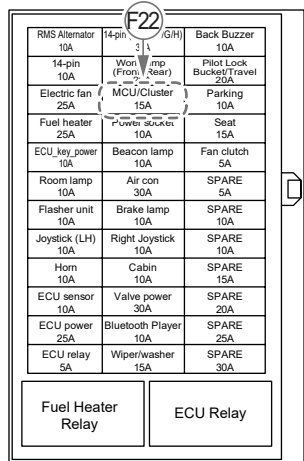
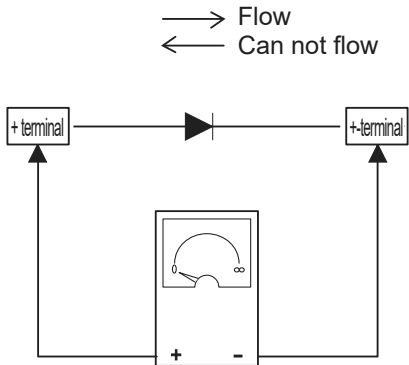
| CHECK POINT              | CHECK METHOD                                                                                                                                                                                                                                                              | REMARKS                                                                                                                                                                                                                                       |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5. Starter relay         | <ol style="list-style-type: none"> <li>When connecting power to terminals No. 85 and 86 : Check continuity between terminals No. 87 and 30.</li> <li>When do not connecting power to terminals No.85 and 86: Check contiuity between terminals No.87 and 30.</li> </ol>   |  <p>Terminal Diagram</p>  <p style="text-align: right;">LF1W5A49A</p>    |
| 6. Main fuse box         | <ol style="list-style-type: none"> <li>Check the fuse for short circuit.<br/>F12 : 5A (ECU_relay coil fuse)<br/>F11 : 25A (ECU_ Power fuse)<br/>F5 : 10A (ECU_key fuse)</li> <li>If it has a short circuit, replace it with a new one with the rated capacity.</li> </ol> |  <p style="text-align: right;">LF1W5B28A</p>                                                                                                               |
| 7. Check ECU power relay | <ol style="list-style-type: none"> <li>Voltage inspection<br/>With the ignition switch ON, measure the voltage between the connector No. 87 and vehicle body. It should be 12 V.</li> </ol>                                                                               |  <p>Terminal Diagram</p>  <p style="text-align: right;">H89WBM5A</p> |
| 8. Check MCU             | <ol style="list-style-type: none"> <li>Voltage inspection<br/>With the ignition switch ON, measure the voltage between the connector No. 34 (CN1) and vehicle body. It should be 12 V.</li> </ol>                                                                         |  <p style="text-align: right;">LF1W5A51A</p>                                                                                                              |
| 9. Check ECU             | <ul style="list-style-type: none"> <li>- ECU</li> <li>- Camshaft sensor</li> <li>- Crankshaft wheel sensor</li> <li>- IMV</li> <li>- Fuel rail pressure sensor</li> <li>- Injector</li> </ul>                                                                             | <p>Refer to the engine troubleshooting manual.<br/>(Check for error codes.)</p>                                                                                                                                                               |

## 5.2 WHEN THE SYSTEM IS NOT CHARGED

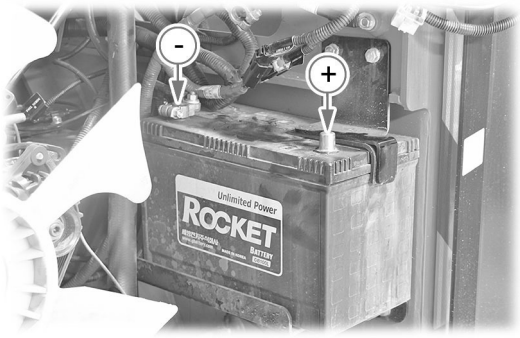
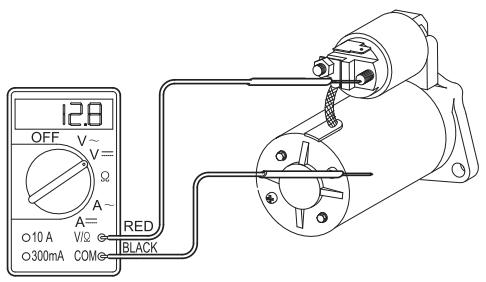
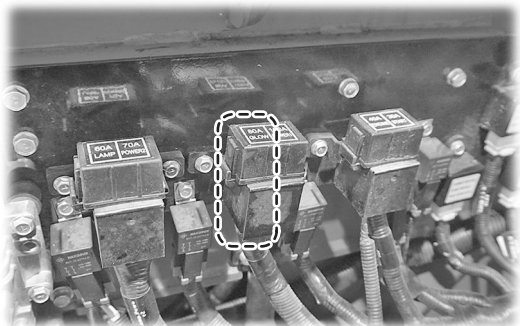
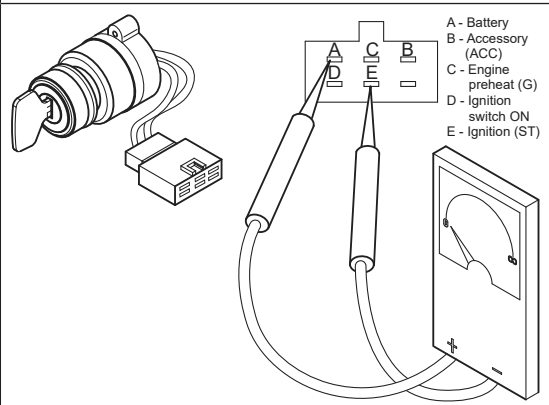
| CHECK POINT                  | CHECK METHOD                                                                                                                                                                                                                                                                                   | REMARKS                                                                                                                                                                                                                                                                                     |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Battery voltage           | <ul style="list-style-type: none"> <li>- Measure the voltage between the battery (+) and (-) terminals using a tester.</li> <li>- Result: 11.8 ~ 12.9 V.<br/>However, the voltage may be over this range if it is measured immediately after turning the engine off.</li> </ul>                |  <p>LF1W5A47A</p>                                                                                                                                                                                         |
| 2. Slow-blow fuse            | <ul style="list-style-type: none"> <li>- Check the fuse engagement status.</li> <li>- Check if the slow blow fuse is blown. Rated current: 100 A (Power1)</li> </ul>                                                                                                                           |  <p>LF1W5A53A</p>                                                                                                                                                                                         |
| 3. Regulator operating power | <ul style="list-style-type: none"> <li>- With the KEY ON, measure the voltage between the terminal No.1 (P) of the connector and alternator body (ground).<br/>Normal: 12 V</li> <li>- Measure the voltage between the terminal No.1 and No.2 of the connector 2P.<br/>Normal: 12 V</li> </ul> |  <p>H89WBK2A</p>                                                                                                                                                                                        |
| 4. Ignition switch           | Check proper connection with it in "ON" position: A-B-D                                                                                                                                                                                                                                        |  <p>T85WBD8A</p> <p>           A - Battery<br/>           B - Accessory (ACC)<br/>           C - Engine preheat (G)<br/>           D - Ignition switch ON<br/>           E - Ignition (ST)         </p> |

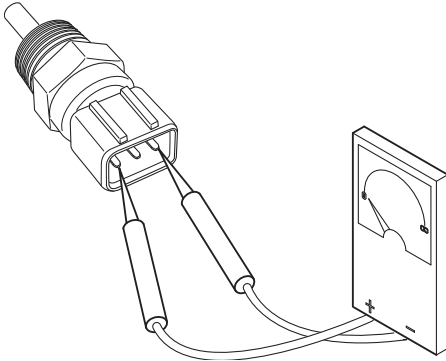
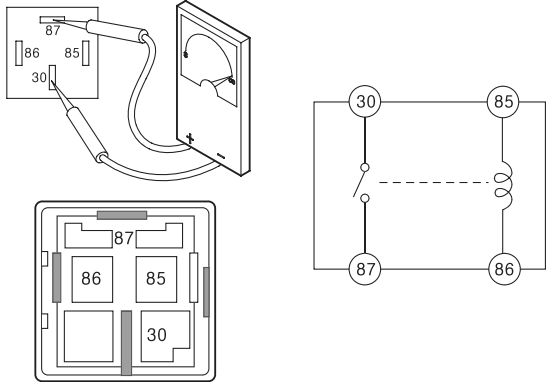
**NORMAL OPERATING CONDITION**

- Before starting the engine (ignition switch in "ON" position): Charge warning lamp ON
- After starting the engine: Charge warning lamp OFF

| Check point                            | Check method                                                                                                                                                                   | Remarks                                                                                                |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| 1. Charge warning lamp<br>(on cluster) | 1. Check the voltage.<br>- Voltage between the terminal No. 1 of the A connector (cluster) and terminal 20 of the A connector with the key "ON"<br>Voltage: It should be 12 V. |  <p>LF1W5A54A</p>    |
| 2. Charge warning lamp                 | 1. Visual check                                                                                                                                                                |  <p>LF1W5A55A</p>  |
| 3. Check the fuse.                     | 1. Check the F22 fuse : 15 A for MCU/Cluster                                                                                                                                   |  <p>LF1W5B29A</p> |
| 4. Diode                               | 1. Check the diode.<br>Check if current flows from the positive pole to the negative pole of the diode.                                                                        |  <p>T85WBF0A</p>   |

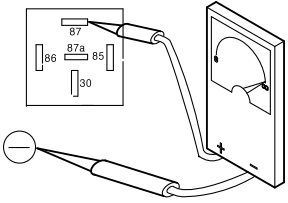
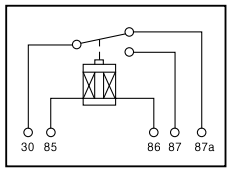
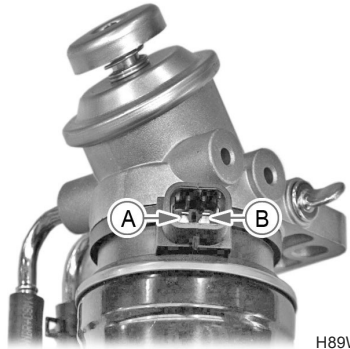
## 5.3 WHEN THE SYSTEM IS NOT PREHEATED AUTOMATICALLY

| Check point                          | Check method                                                                                                                                                                                                                                                                                                                                                                                                                                | Remarks                                                                                               |
|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| 1. Battery voltage                   | <ol style="list-style-type: none"> <li>1. Measure the voltage between the battery (+) and (-) terminals using a tester</li> <li>2. Result: 11.8 ~ 12.9 V.<br/>However, the voltage may be over this range if it is measured immediately after turning the engine off.</li> </ol>                                                                                                                                                            |  <p>LF1W5A47A</p>   |
| 2. Battery terminal of starter motor | <ol style="list-style-type: none"> <li>1. Check the battery cable connection. <ul style="list-style-type: none"> <li>- The voltage between the terminal M of start motor and chassis should be approximately same to the battery voltage.</li> <li>- Check for corrosion.</li> </ul> </li> <li>2. Checking when voltage is not supplied <ul style="list-style-type: none"> <li>- Check the battery cable connection.</li> </ul> </li> </ol> |  <p>T85WBD6A</p>    |
| 3. Slow-blow fuse                    | <ol style="list-style-type: none"> <li>1. Check the fuse engagement status.</li> <li>2. Check if slow-blow fuse is blown : Rated capacity - 80 A</li> </ol>                                                                                                                                                                                                                                                                                 |  <p>LF1W5A58A</p> |
| 4. Ignition switch                   | <ol style="list-style-type: none"> <li>1. Check the ignition switch connection.<br/>"ON" position: A-B-D<br/>"PREHEAT" position: A-C-D</li> </ol>                                                                                                                                                                                                                                                                                           |  <p>T85WBD8A</p>  |

| Check point                   | Check method                                                                                                                                               | Remarks                                                                                           |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| 5. ECU                        | - Check for the glow plug relay driver and glow lamp LSD of the ECU                                                                                        | Refer to "ECU troubleshooting" manual                                                             |
| 6. Coolant temperature sensor | 1. Check the coolant temperature sensor resistance.<br>Approx. 2.45 k $\Omega$ (at 20°C)                                                                   | <br>T85WBF5A    |
| 7. Preheat relay              | 1. When connecting power to terminals No. 85 and 86 (Preheating operation)<br>- Check continuity between terminals No. 87 and 30.                          | <br>T85WB38A   |
| 8. Glow plug                  | 1. Check resistance of the glow plug coil (0.43 $\Omega$ ).<br>- Resistance $\infty$ ( $\Omega$ ): Open coil<br>- Resistance 0 ( $\Omega$ ): short circuit | <br>T85WBF2A |
| 9. Check ECU                  | - ECU error                                                                                                                                                | Refer to the engine troubleshooting manual.<br>(Check for error codes.)                           |

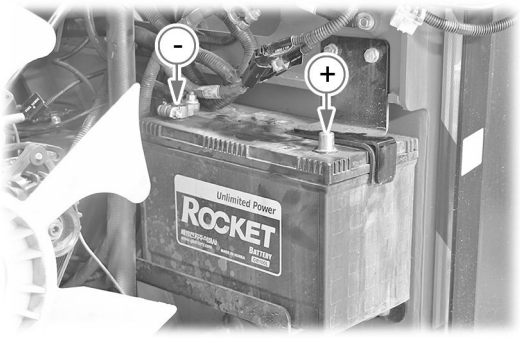
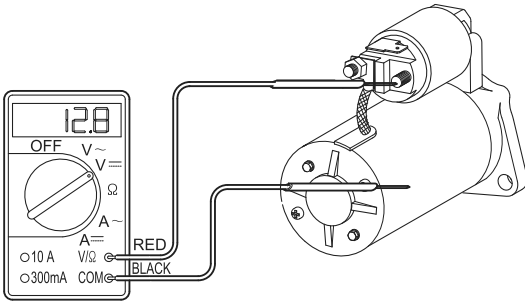
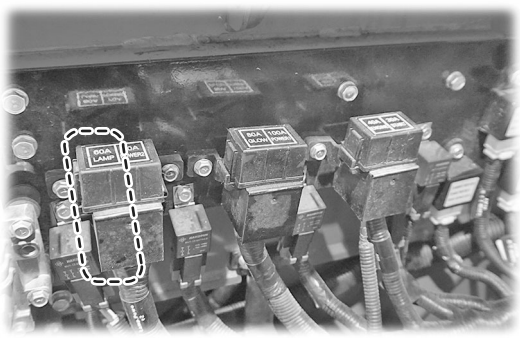
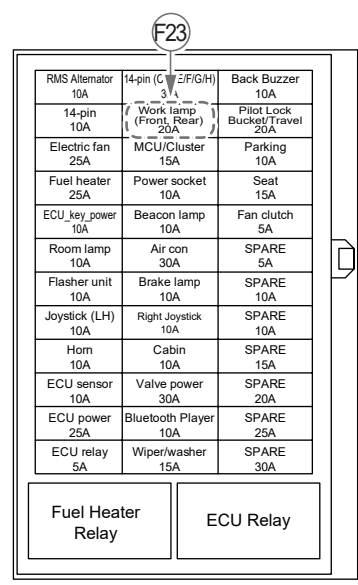


REMARKS

| Check point                     | Check method                                                                                                                                | Remarks                                                                                                                                                                               |
|---------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1. Check fuel heater relay (5P) | 1. Voltage inspection<br>With the ignition switch ON, measure the voltage between the connector No. 87 and vehicle body. It should be 12 V. | <br><br>H89WBM5A |
| 2. Check fuel heater            | 1. Voltage inspection<br>Measure the voltage between the terminals A and B with the ignition switch ON. It should be 12 V.                  | <br>H89WBM8A                                                                                       |



## 5.4 WHEN WORK LAMP CANNOT BE OPERATED

| Check point                        | Check method                                                                                                                                                                                                                                                                                                                                                                           | Remarks                                                                                               |
|------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
| 1. Check the battery voltage       | <ol style="list-style-type: none"> <li>1. Measure the voltage between the battery (+) and (-) terminals using a tester.</li> <li>- Result: 11.8 ~ 12.9 V</li> </ol> <p>However, the voltage may be over this range if it is measured immediately after turning the engine off.</p>                                                                                                     |  <p>LF1W5A47A</p>   |
| 2. Battery terminal of start motor | <ol style="list-style-type: none"> <li>1. Check the battery cable connection.</li> <li>- The voltage between the terminal M of the start motor and chassis should be approximately same to the battery voltage.</li> <li>- Corrosion</li> <li>2. Checking when voltage is not supplied</li> <li>- Check the battery cable connection.</li> <li>- Continue to the next step.</li> </ol> |  <p>T85WBD6A</p>    |
| 3. Slow-blow fuse                  | <ol style="list-style-type: none"> <li>1. Check the fuse engagement status.</li> <li>2. Check if slow-blow fuse is blown</li> </ol> <p>: Rated capacity - 60 A</p>                                                                                                                                                                                                                     |  <p>LF1W5A73A</p> |
| 4. Check the fuse                  | <ol style="list-style-type: none"> <li>1. Check the fuse engagement status.</li> <li>2. Check if the fuse is blown.</li> </ol> <p>Head lamp fuse 20 A (F23)</p>                                                                                                                                                                                                                        |  <p>LF1W5B30A</p> |

SAFETY FIRST

ENGINE

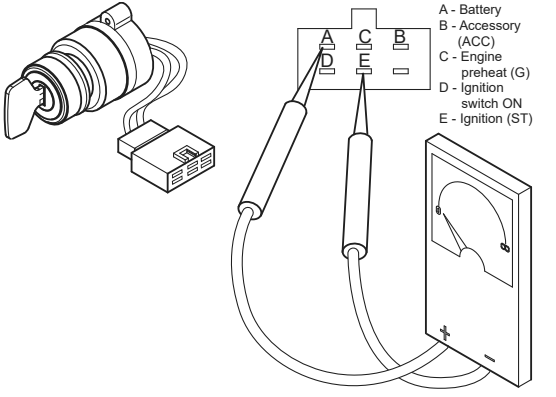
DRIVING & CHASSIS

HYDRAULIC SYSTEM

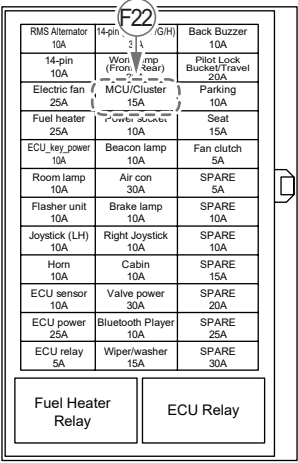
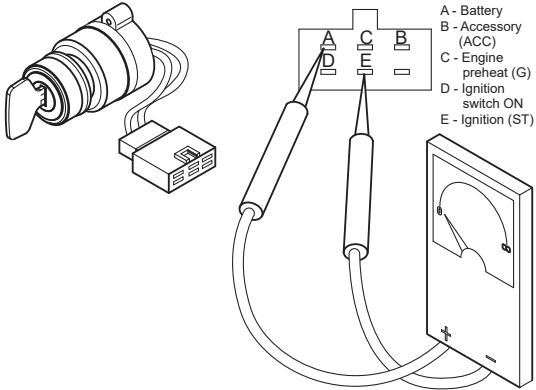
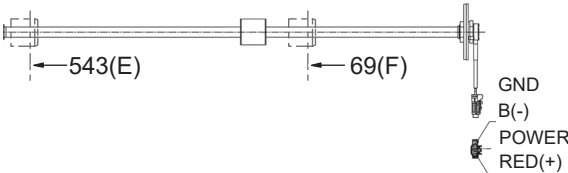
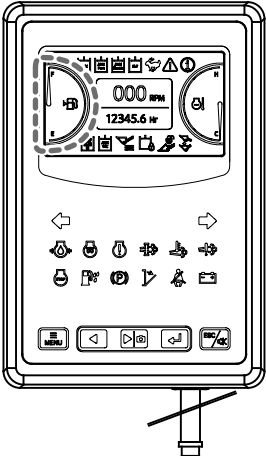
ELECTRIC SYSTEM

CABIN

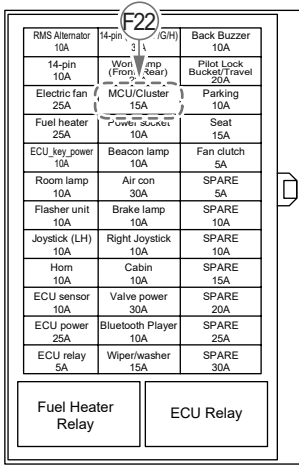
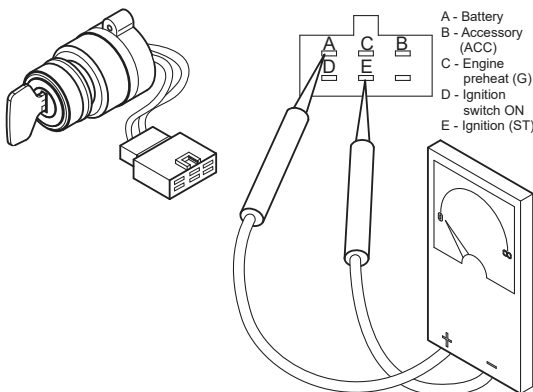
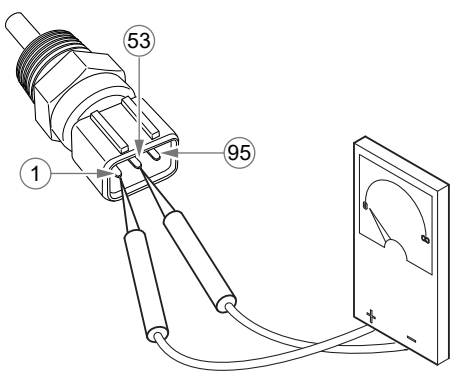
INDEX

| Check point        | Check method                                               | Remarks                                                                                                                                                                                                                   |
|--------------------|------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5. Ignition switch | 1. Check proper connection with it in "ON" position: A-B-D |  <p>A - Battery<br/>B - Accessory (ACC)<br/>C - Engine preheat (G)<br/>D - Ignition switch ON<br/>E - Ignition (ST)</p> <p>T85WBD8A</p> |

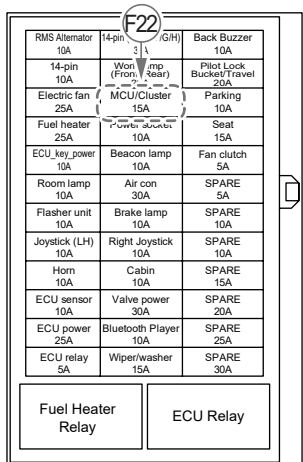
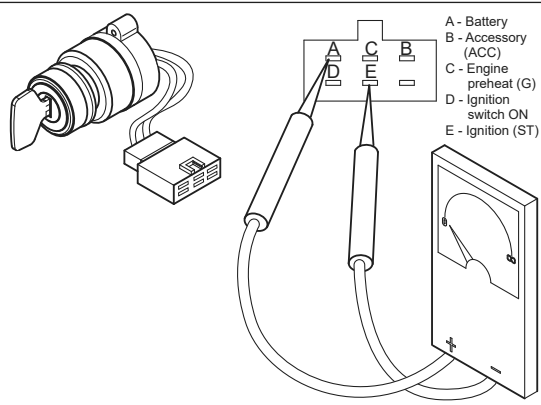
## 5.5 FUEL GAUGE OPERATION

| Check point                       | Check method                                                                                                                                                              | Remarks                                                                                                |
|-----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|
| 1. Fuse                           | 1. Check the fuse engagement status.<br>2. Check that the cluster fuse capacity is 15 A(F22).                                                                             |  <p>LF1W5B29A</p>   |
| 2. Ignition switch                | 1. Check proper connection with it in "ON" position: A-B-D                                                                                                                |  <p>T85WBD8A</p>    |
| 3. Fuel sender                    | 1. Measure the resistance between two terminals of the fuel sender connector after disconnecting wiring and fuel sender connector.<br>- Empty: 110 Ω<br>- Full: 3 Ω       |  <p>LF1W5A66A</p>  |
| 4. Fuel gauge on instrument panel | 1. Check the instrument cluster wiring (gauge signal wiring) and the ground wiring for proper connection<br>- The pointer moves slowly to the Full point if it is normal. |  <p>LF1W5A67A</p> |

## 5.6 TEMPERATURE GAUGE OPERATION

| Check point                                | Check method                                                                                                                                                                                                                                                                                                          | Remarks                                                                                                               |          |        |        |            |        |      |          |                                                                                                                     |
|--------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|----------|--------|--------|------------|--------|------|----------|---------------------------------------------------------------------------------------------------------------------|
| 1. Fuse                                    | <div>1. Check the fuse engagement status.</div> <div>2. Check that the cluster fuse capacity is 15 A (F22).</div>                                                                                                                                                                                                     | <div></div> <div>LF1W5B29A</div>   |          |        |        |            |        |      |          |                                                                                                                     |
| 2. Ignition switch                         | <div>1. Check proper connection with it in "ON" position: A-B-D</div>                                                                                                                                                                                                                                                 | <div></div> <div>T85WBD8A</div>    |          |        |        |            |        |      |          |                                                                                                                     |
| 3. Temperature sensor                      | <div>1. Measure the resistance of the temperature sensor after disconnecting the connector.</div> <table><tr><td>Temp.</td><td>85 °C</td><td>110 °C</td><td>125 °C</td></tr><tr><td>Resistance</td><td>48.4 Ω</td><td>24 Ω</td><td>(15.2 Ω)</td></tr></table> <div>* The value in the blank is reference value.</div> | Temp.                                                                                                                 | 85 °C    | 110 °C | 125 °C | Resistance | 48.4 Ω | 24 Ω | (15.2 Ω) | <div></div> <div>T85WBK5B</div> |
| Temp.                                      | 85 °C                                                                                                                                                                                                                                                                                                                 | 110 °C                                                                                                                | 125 °C   |        |        |            |        |      |          |                                                                                                                     |
| Resistance                                 | 48.4 Ω                                                                                                                                                                                                                                                                                                                | 24 Ω                                                                                                                  | (15.2 Ω) |        |        |            |        |      |          |                                                                                                                     |
| 4. Temperature gauge on instrument cluster | <div>1. Check the instrument cluster wiring (sensor signal wiring) and the ground wiring for proper connection</div> <div>- The pointer slowly moves up when it is normal.</div>                                                                                                                                      | <div></div> <div>LF1W5A68A</div> |          |        |        |            |        |      |          |                                                                                                                     |

## 5.7 HOUR METER OPERATION

| Check point        | Check method                                                                                       | Remarks                                                                                              |
|--------------------|----------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| 1. Fuse            | 1. Check the fuse engagement status.<br>2. Check that the cluster fuse capacity is 15 A (F22).     |  <p>LF1W5B29A</p> |
| 2. Ignition switch | 1. Check proper connection with it in "ON" position: A-B-D                                         |  <p>T85WBD8A</p>  |
| 3. Crank sensor    | 1. The engine revolution is calculated from the point without two teeth on the crank sensor wheel. | Refer to "ECU troubleshooting" manual                                                                |
| 4. ECU             | 1. Check for engine hour meter of the ECU                                                          | Refer to "ECU troubleshooting" manual                                                                |







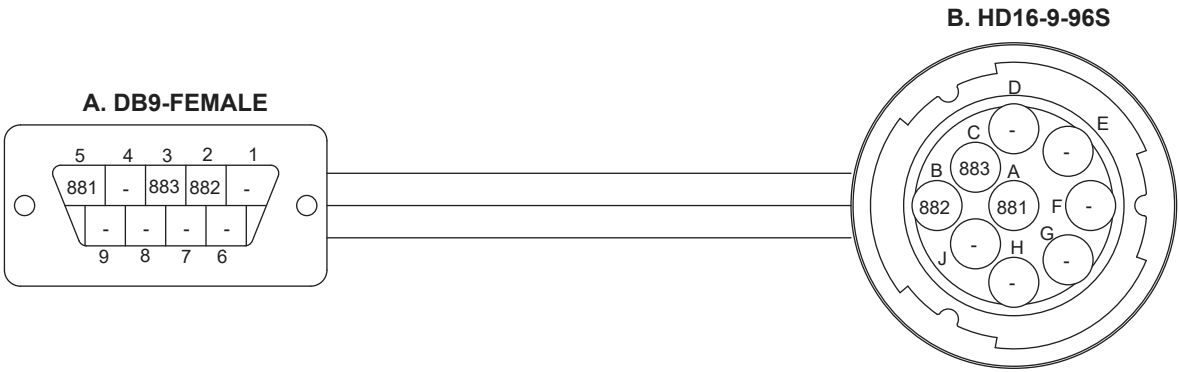
| Wire Label | Color | Signal Name                         | Wire Label | Color | Signal Name                         | Wire Label | Color | Signal Name                  | Wire Label | Color | Signal Name            | Wire Label | Color | Signal Name                | Wire Label | Color | Signal Name                | Wire Label | Color | Signal Name |
|------------|-------|-------------------------------------|------------|-------|-------------------------------------|------------|-------|------------------------------|------------|-------|------------------------|------------|-------|----------------------------|------------|-------|----------------------------|------------|-------|-------------|
| 35         | W     | Battery_12V_38                      | 159        | R/Y   | CAM_Shaft_Position_Sensor           | 308        | W     | Aux_Hold_F_Switch            | 713A       | R/G   | Diode2                 | 931        | Y/R   | AIRCON_PANEL               | B07H       | R     | Power2                     | Z30        | B     | GND         |
| 36         | L     | Battery_12V_36                      | 160        | R/B   | Crank_Sensor_Signal                 | 309        | Or    | 14PinE                       | 713B       | R/G   | Pilot_Lock_Travel_RY2  | 932        | L/Y   | AIRCON_PANEL               | B10F       | R/W   | Battery_12V                | Z31        | B     | GND         |
| 37         | L     | Battery_12V_37                      | 163        | G/R   | Intake_Throttle_Position_Sensor     | 310        | Br/L  | 14PinF                       | 715A       | Lg    | Diode2                 | 933        | Or    | AIRCON_PANEL               | B10H       | R/W   | Key_On1D                   | Z61A       | B     | GND         |
| 38A        | R     | UP_NO                               | 164        | P/B   | EGR(Sensor 5V)                      | 311        | W/G   | Aux_Port_Variable_Switch     | 715B       | Lg    | Pilot_Lock_Bucket_RY2  | 934        | L/R   | AIRCON_PANEL               | B10I       | R/W   | HEATER_RELAY               | Z61B       | B     | Diode1      |
| 51         | P     | Horn                                | 166        | R/G   | Exhaust Gas Delta Press. 5V         | 313        | Y/B   | Travel_Pressure_SNSR_FW_LH   | 731        | R/Y   | Room_Lamp              | 935        | B     | AIRCON_PANEL               | B10T       | R/W   | Battery_12V_3              | Z62A       | B     | GND         |
| 71         | P     | Charge Signal                       | 168        | B     | IMTS Return                         | 314        | G/B   | Travel_Pressure_SNSR_FW_RH   | 732        | R/G   | Horn_Relay1            | 938        | B/Y   | AIRCON_PANEL               | B10U       | R/W   | Alternator_Diode           | Z62B       | B     | Diode1      |
| 76         | Or    | Flasher_Unit_12V                    | 169        | B     | Water_In_Fuel_Sensor_Return         | 315        | L/B   | Travel_Pressure_SNSR_Reverse | 813        | G/R   | 14PIN D POW            | 939        | B     | AIRCON_PANEL               | B10W       | R/W   | Battery_12V_               | Z63A       | B     | GND         |
| 87B        | R/B   | Turn RH Signal1                     | 170        | B     | Intake_Throttle_Position_Sensor_Gnd | 322        | R/G   | Alternator                   | 814        | G/Y   | 14PIN C POW            | 940        | Y/B   | AIRCON_PANEL               | B10Y       | R/W   | Battery_12V_2              | Z63B       | B     | Diode1      |
| 96A        | W     | Lamp_Tail_Lamp1                     | 171        | B     | Crank_Sensor_Return                 | 341A       | W/B   | Main_Control_M_Valve         | 816        | G     | 14PIN E POW            | 942        | B/W   | AIRCON_PANEL               | B11        | R/G   | HEATER_RELAY               | Z103       | B     | GND         |
| 96K        | W     | Lamp 12V                            | 172        | B     | Gnd                                 | 341B       | W/B   | Diode2                       | 818        | G/Y   | 14PIN F POW            | 955A       | R     | Battery_12V_26             | B12        | R     | Key_On1D                   | Z103A      | B     | Diode1      |
| 96L        | W     | License_Lamp                        | 174        | B     | Fuel_Injector_LSD2B                 | 342A       | Y/L   | Diode2                       | 820        | G/L   | 14PIN G POW            | 955B       | R     | Battery_12V_26             | B12A       | R     | Aircon B+                  | Z104A      | B     | GND         |
| 96W        | W     | Rear_Tail_Lamp_RH                   | 175        | B     | Fuel_Injector_LSD1B                 | 342B       | Y/L   | Main_Control_F_Valve         | 822        | L/B   | 14PIN H POW            | 955K       | R     | Battery_12V_35             | B13        | R/B   | Battery_12V                | Z104B      | B     | Diode1      |
| 97A        | R/B   | Rear_Stop_Lamp_RH                   | 177        | B     | Inlet_Metering_Valve_PWM            | 343        | G/L   | Stop_Lamp                    | 851        | R/G   | FUEL_HEATER            | 955P       | R     | Battery_12V_25             | B20        | R     | Power_relay4_1             | Z111       | B     | GND         |
| 97B        | R/B   | Stop_Relay2                         | 183        | B/Y   | Intake_Throttle(H_Bridge_Neg)       | 344        | Br/L  | Back_Buzzer                  | 855        | Br/B  | 14PIN C COIL           | 960        | R/Y   | FAN_VCC                    | B21        | R     | Starter1                   | Z132       | B     | GND         |
| 97C        | R/B   | Rear_Stop_Lamp_LH                   | 184        | R/L   | Intake_Throttle(H_Brdige_Pos)       | 347        | W/G   | Electric_Fan_RY              | 856        | Br/R  | 14PIN D COIL           | 961        | R/G   | FAN_PWR                    | B22        | R     | Starter2                   | Z181       | B     | GND         |
| 100A       | W/R   | Oil SW signal                       | 192        | Gr    | EGR(H_Bridge_Pos)                   | 349        | P     | Rock_Travel_RY_Coil          | 857        | Br/Y  | 14PIN E COIL           | 962        | B/W   | FAN_SPD_GND                | B31A       | R     | Battery_B+                 | Z200A      | B     | GND         |
| 103        | R/G   | Fuel_Injector_HSDA2                 | 193        | W     | EGR(H_Bridge_Neg)                   | 350        | Or    | Lock_Bucket_RY_Coil          | 858        | Br/Y  | 14PIN F COIL           | 963        | L/W   | FAN_SPD_5V                 | B31B       | R     | Battery +12V               | Z200D      | B     | GND         |
| 105        | R     | Exhaust_Gas_Temperature_Sensor1     | 196        | Gr    | DPF_Regen_Inhibit_Switch            | 361        | Y/L   | Beacon_Relay1                | 859        | Br/L  | 14PIN G COIL           | 964        | P     | FAN_SPD_SIG                | B42A       | R     | Battery_12V_13             | Z210       | B     | Gnd         |
| 106        | R     | Exhaust_Gas_Temperature_Sensor2     | 201        | R     | Protected_Battery1                  | 393A       | Y     | Diode2                       | 860        | Br    | 14PIN H COIL           | 965        | B/Y   | FAN_PWR_GND                | B42C       | R     | Horn_Fuse                  | Z210A      | B     | Diode1      |
| 109        | Y/R   | Coolant_Temperature_Sensor          | 202        | B     | Gnd                                 | 393B       | Y     | Soft_Shift_Relay2            | 871        | G     | OPC SW                 | 966        | G     | RS232_GND                  | B42D       | R     | Room_Lamp_Fuse             | Z216       | B     | Gnd         |
| 110        | G/R   | Fuel_Temperature_Sensor             | 203        | R     | Protected_Battery2                  | 398A       | Y     | Diode2                       | 891        | Y     | RMS KEY IG             | 967        | L     | TX                         | B42G       | R     | Flasher_Unit_Fuse          | Z251       | B     | GND         |
| 112        | R/G   | Intake_Manifold_Pressure_Sensor     | 204        | B     | Gnd                                 | 398B       | Y     | Ride_Control_Relay2          | 891A       | Y     | Key_On10A              | 968        | W     | RX                         | B42H       | R     | VBB_L                      | Z252       | B     | GND         |
| 113A       | G     | Comp                                | 205        | R     | Protected_Battery3                  | 401        | R     | Wiper_Washer_Fuse            | 899D       | B     | MCU_GND                | 971B       | P     | Ride_Control               | B42K       | R     | Battery_12V_13             | Z253       | B     | GND         |
| 113B       | G     | A/C_Switch                          | 206        | B     | Gnd                                 | 402        | Gr    | Back_Buzzer_Relay1           | 899D       | B     | MCU_GND                | 972        | Y/R   | OIL_TEMP                   | B42M       | R     | Light_Lamp1_Fuse           | Z254       | B     | GND         |
| 114        | R/L   | Forced_DPF_Regeneration_Switch      | 208        | Y     | Foot_Accel                          | 414B       | Gr    | Turn LH Signal1              | 899F       | B     | MCU_GND                | 975B       | Y/R   | Quick_Attah_Unlock_RY_Coil | B45        | R     | Glow Power B+              | Z255       | B     | GND         |
| 115        | L/Y   | Intake_Throttle_Position_Feedback   | 209        | Y     | Foot_Accel                          | 454C       | Y/R   | OBD2_DPF_Switch_Input2       | 899G       | B     | MCU_GND                | 976B       | Br/R  | Quick_Attah_Lock_RY_Coil   | B46        | R     | Glow Plug ON Signal        | Z256       | B     | GND         |
| 116        | W     | EGR(Sensor Signal)                  | 213        | G     | Hand Accelerator Track 2, Signal    | 454G       | Y/R   | ECU_Sensor_Fuse2             | 899H       | B     | MCU_GND                | 977        | B     | Camera_GND                 | K01A       | R     | key_On1A                   | Z302       | B     | Gnd         |
| 117        | R     | Exhaust Gas Delta Press. Output     | 214        | B     | Hand Accelerator Track 2, Return    | 454H       | Y/R   | Inlet_Metering_Valve1        | 899J       | B     | MCU_GND                | 977A       | B     | Camera_GND                 | K01B       | R     | CLUSTER_FUSE               | Z341       | B     | Gnd         |
| 118        | R/Y   | Water_In_Fuel_Sensor_Signal         | 215        | W     | Air_Inlet_Temperature               | 454L       | Y/R   | Inlet_Metering_Valve2        | 899K       | B     | MCU_GND                | 979        | R/Y   | floating_mag.12v           | K01C       | R     | Key_On1C                   | Z344       | B     | Gnd         |
| 119        | B     | GND                                 | 219        | R/G   | Key_Switch_Input                    | 454T       | Y/R   | Glow_Relay_Coil              | 899L       | B     | MCU_GND                | 980        | R     | Camera_Power               | K01D       | R     | CLUSTER_FUSE               | Z345       | B     | Gnd         |
| 122        | B     | Exhaust Gas Temp. Sen. GND          | 220        | B     | Foot_Accel                          | 467A       | R/Y   | Travel_SoI_CTL               | 899M       | B     | MCU_GND                | 981A       | P     | Light_Switch_Input2A       | K01E       | R     | RIGHT_JOYSTICK_FUSE        | Z347       | B     | Gnd         |
| 123        | B     | Exhaust Gas Temp. Sen. GND          | 221        | B     | AMF_Frequency_Gnd                   | 467B       | R/Y   | Travel_SoI_CTL               | 899N       | B     | MCU_GND                | 985        | Lg    | ACC1B                      | K01F       | R     | Key_On1M                   | Z349       | B     | Gnd         |
| 125        | B     | Fuel_Injector_LSD2A                 | 222        | R/B   | Foot_Accel                          | 502A       | W/R   | Key_Start_2                  | 899P       | B     | MCU_GND                | 987        | Y/R   | FUEL_SENDEr                | K01G       | R     | Pilot_Lock_Travel_Fuse     | Z351       | B     | Gnd         |
| 126        | B     | Fuel_Injector_LSD1A                 | 223        | R/B   | Foot_Accel                          | 502H       | W/R   | Key_Start_3                  | 903        | Y     | Battery_12V_29         | 989        | Gr    | 14PIN 12V                  | K01H       | R     | Key_On10A                  | Z401       | B     | Gnd         |
| 127        | R/B   | Fuel_Injector_HSDA1                 | 224        | R/G   | Hand VREF1 PPS1 5V                  | 592A       | R     | Stop_Lamp_Fuse               | 903A       | Y     | Diode2                 | 993        | Vo    | AV1_GND                    | K01J       | R     | RMS_Fuse                   | Z421       | B     | Gnd         |
| 128A       | B     | Accelerometer1_Screen               | 225        | G     | Hand Pedal Position Sensor1         | 592B       | R     | Back_Buzzer_Fuse             | 905A       | L/Y   | Diode2                 | 994        | R/B   | SEAT_POWER                 | K01M       | R     | Key_On1M                   | Z602       | B     | Gnd         |
| 128B       | B     | Shield GND                          | 226        | B     | Hand PPS1 Return                    | 592C       | R     | Stop_Lamp_Fuse               | 905B       | L/Y   | Quick_Attah_Lock_RY2   | 995P       | R     | 14Pin                      | K01N       | R     | Key_On1N                   | Z602A      | B     | Diode1      |
| 129A       | B     | Accelerometer2_Screen               | 229        | R/G   | Hand VREF2 PPS2 5V                  | 592D       | R     | Stop_Lamp_Fuse               | 907A       | W     | Diode2                 | 996A       | Gr    | RIGHT_JOYSTICK_INPUT       | K01R       | R     | Left_Joystick_Fuse         | Z610       | B     | Gnd         |
| 129B       | B     | Shield GND                          | 232        | W/G   | Parking_Relay3                      | 592G       | R     | Beacon_Lamp_Fuse             | 907B       | W     | Quick_Attah_Unlock_RY2 | 996B       | Gr    | Key_On1W                   | K01S       | R     | Power_Relay5_Coil          | Z630       | B     | Gnd         |
| 130        | Y/B   | Accelerometer1_Return               | 234        | B     | Foot_Accel                          | 595A       | R/G   | Horn_Relay2                  | 909A       | Gr    | Hi_Flow_Relay2         | 996C       | Gr    | Key_On5K                   | K01T       | R     | FAN_KEY_ON                 | Z701       | B     | Gnd         |
| 131        | Y     | Accelerometer1                      | 237        | Br/R  | Stater_Motor_Inhibit_Relay          | 598        | Gr    | Back_Buzzer_Relay2           | 909B       | Gr    | Diode2                 | 997        | W     | AV1                        | K04A       | R/W   | ILL+                       | Z701A      | B     | Diode1      |
| 132        | Y     | Accelerometer2                      | 245        | B     | ECU_Main_Power_Relay                | 599        | Br    | Stop_Relay1                  | 921        | R     | Battery_12V_28         | A01B       | Lg    | ACC1B                      | K04B       | R/W   | ILL+                       | Z702       | B     | GND         |
| 133        | Y/B   | Accelerometer2_Return               | 247A       | W/L   | MCU_CAN_L                           | 685        | Y     | COMPRESSURE_PW               | 921        | R     | Battery_12V_28         | A01U       | Lg    | HEATER_RELAY_COIL          | K04C       | R/W   | KEY ON                     | Z711       | B     | Gnd         |
| 134        | Y/R   | Intake_Air_Temperature_Sensor       | 247G       | W/L   | FAN_CAN_L                           | 686        | Or    | MCU_IG                       | 921J       | R     | Quick_Attah_Lock_RY1   | B02A       | R     | Engine_B+                  | K04Z       | R/W   | Dual_Pressure_Switch_Input | Z711A      | B     | Diode1      |
| 135        | R/L   | Rail_Pressure_Sensor_Output_Signal  | 248A       | Y     | MCU_CAN_H                           | 686J       | Or    | Travel_Pres_Sen(F_LH)        | 921K       | R     | Quick_Attah_Unlock_RY1 | B02B       | R     | Engine_B+                  | K05        | G/R   | 14PIN D POW                | Z787       | B     | GND         |
| 138        | R/G   | Rail_Pressure_Sensor_Supply_Voltage | 248G       | Y     | FAN_CAN_H                           | 686K       | Or    | Travel_Pres_Sen(F_LH)        | 922        | R     | AIRCON_PANEL           | B02R       | R     | Battery_B+                 | K05A       | G/R   | 14PIN D POW                | Z800       | B     | GND         |
| 139        | R/Y   | VREF1_Crank_Sensor                  | 256        | B     | Glow_Plug_Relay_Driver              | 686P       | Or    | Travel_Pres_Sen(F_LH)        | 923        | R/W   | AIRCON_PANEL           | B03A       | R     | ECU_Relay_Coil             | K05B       | G/R   | 14PIN C POW                | Z951       | B     | GND         |
| 141        | R/B   | VREF_INPRES                         | 258        | R/Y   | Engine_Emergency_Stop_Signal        | 686R       | Or    | OPC SW                       | 924        | L     | AIRCON_PANEL           | B03B       | R     | ECU_Power_Relay            | K05C       | G/R   | 14PIN F POW                | Z952       | B     | GND         |
| 144        | B     | VREFGND                             | 302        | G     | Aux_Electrical_Mode_Change          | 686Z       | Or    | MCU_IG                       | 925        | Y     | AIRCON_PANEL           | B03C       | R     | ECU_Relay_Coil             | K05D       | G/R   | 14PIN E POW                | Z953       | B     | GND         |
| 145        | B     | Coolant_Temperature_Return          | 303        | R     | 14PinC                              | 704        | Br/B  | Parking_Relay1               | 926        | G     | AIRCON_PANEL           | B04        | W     | ECU_Relay_Coil             | K05E       | G/R   | 14PIN H POW                | Z989       | B     | GND         |
| 146        | B     | Sensor_Return_GND                   | 304        | Br    | 14PinD                              | 705        | R/B   | Pilot_Lock_Travel_RY1        | 927        | B/W   | AIRCON_PANEL           | B05        | R     | ECU_Power_Relay            | K05F       | G/R   | 14PIN G POW                | Z990       | B     | GND         |
| 147        | B     | CAM_Shaft_Position_Sensor_Return    | 305        | Lg    | 14PinG                              | 705A       | R/B   | Pilot_Lock_Bucket_RY1        | 928        | Lg    | AIRCON_PANEL           | B06        | R     | ECU_Relay2                 | K201A      | W/R   | LEFT_JOYSTICK_INPUT        | Z995       | B     | GND         |
| 150        | W/B   | Fuel_Injector_HSDB4                 | 306        | Gr    | 14PinH                              | 707A       | Y/R   | Diode2                       | 929        | G/W   | AIRCON_PANEL           | B06A       | R     | ECU_Sensor_Fuse1           | K201B      | W/R   | UP_NO                      | Z999       | B     | GND         |
| 151        | R/L   | Fuel_Injector_HSDA3                 | 307        | P     | Aux_Hold_M_Switch                   | 707B       | Y/R   | Parking_Relay2               | 930        | L/W   | AIRCON_PANEL           | B07        | R     | Starter_B+                 | K201C      | W/R   | Joystick_KeyOn             |            |       |             |





| Wire Label | Color | Signal Name                      | Wire Label | Color | Signal Name                  | Wire Label | Color | Signal Name            | Wire Label | Color | Signal Name                | Wire Label | Color | Signal Name                | Wire Label | Color | Signal Name |
|------------|-------|----------------------------------|------------|-------|------------------------------|------------|-------|------------------------|------------|-------|----------------------------|------------|-------|----------------------------|------------|-------|-------------|
| 31         | Br    | CD_Player3                       | 247B       | W/L   | OBD_CAN_L                    | 403        | R/Y   | Beacon_Lamp            | 891C       | Y     | Battery_B+                 | 980        | R     | Camera_Power               | Z05        | B     | GND         |
| 32         | B     | CD_Player4                       | 247C       | W/L   | CLUSTER_CAN_L                | 414A       | Gr    | FRONT_TURN_LAMP_LH     | 899        | B     | MCU_GND                    | 981A       | P     | Light_Switch_Input2A       | Z06A       | B     | GND         |
| 33         | Br    | CD_Player5                       | 247D       | W/L   | CANL                         | 414B       | Gr    | Turn LH Signal1        | 899A       | B     | MCU_GND                    | 981A       | P     | Light_Switch_F             | Z06B       | B     | GND         |
| 34         | B     | CD_Player6                       | 247E       | W/L   | RMS CAN L                    | 414C       | Gr    | Turn LH Signal2        | 899B       | B     | MCU_GND                    | 981B       | P     | Light_Switch_Input2A       | Z15        | B     | GND         |
| 35         | W     | Battery_12V_38                   | 247F       | W/L   | TEL_CAN_L                    | 414D       | Gr    | Turn_Signal_LH_Cluster | 899C       | B     | MCU_GND                    | 981C       | P     | Light_Switch_R             | Z15A       | B     | GND         |
| 35A        | W     | USB_POWER                        | 248A       | Y     | MCU_CAN_H                    | 454A       | Y/R   | DPF_Switch_Signal      | 899D       | B     | MCU_GND                    | 981C       | P     | FRONT_WORKING_LAMP(B+)     | Z15B       | B     | GND         |
| 38A        | R     | UP_NO                            | 248B       | Y     | OBC_CAN_H                    | 454B       | Y/R   | OBD2_DPF_Switch_Input1 | 899E       | B     | MCU_GND                    | 981D       | P     | Work_Lamp_Relay_R1         | Z20        | B     | GND         |
| 61A        | R     | Work_Lamp_Relay_R2               | 248C       | Y     | CLUSTER_CAN_H                | 454C       | Y/R   | OBD2_DPF_Switch_Input2 | 903        | Y     | Battery_12V_29             | 982        | R/Y   | ROOM_LAMP                  | Z32        | B     | GND         |
| 61B        | R     | Lamp 12V                         | 248D       | Y     | CANH                         | 467B       | R/Y   | Travel_Sol_CTL         | 909A       | Gr    | Hi_Flow_Relay2             | 983        | R/Y   | Work_Lamp_Relay_F_Coil     | Z34        | B     | GND         |
| 76         | Or    | Flasher_Unit_12V                 | 248E       | Y     | RMS CAN H                    | 502        | W/R   | Key_Start_1            | 921        | R     | Battery_12V_28             | 984        | Br    | Work_Lamp_Relay_R_Coil     | Z51        | B     | GND         |
| 81A        | R/G   | Hazard_Switch_Input2             | 248F       | Y     | TEL_CAN_H                    | 502A       | W/R   | Key_Start_2            | 921A       | R     | Battery_12V_27             | 985        | Lg    | ACC1B                      | Z110       | B     | GND         |
| 81B        | R/G   | Flasher_Unit_Signal              | 258        | R/Y   | Engine_Emergency_Stop_Signal | 502B       | W/R   | Start_Switch           | 921C       | R     | POWER                      | 987        | Y/R   | FUEL_SENDER                | Z112       | B     | GND         |
| 81C        | R/G   | Turn_Signal_Switch_Input         | 301        | Y     | Aux_Switch                   | 586        | P     | Beacon_Relay_Coil      | 921D       | R     | Hi_Flow_Fuse               | 990        | R/Y   | FRONT_WORK_LAMP_RELAY(+)   | Z113       | B     | GND         |
| 87A        | R/B   | Turn RH Signal2                  | 302        | G     | Aux_Electrical_Mode_Change   | 595A       | R/G   | Horn_Relay2            | 921E       | R     | Soft_Shift_Fuse            | 991        | Y/R   | REAR_WORKING_LAMP_RELAY(+) | Z152A      | B     | GND         |
| 87B        | R/B   | Turn RH Signal1                  | 303        | R     | 14PinC                       | 595B       | R/G   | Diode2                 | 921F       | R     | Self_Leveling_SW_Input2    | 992        | B/R   | WORK_LAMP_SWITCH_LED(-)    | Z153       | B     | GND         |
| 87C        | R/B   | FRONT_TURN_LAMP_RH               | 304        | Br    | 14PinD                       | 686A       | Or    | Safety_Switch_Input    | 921G       | R     | Quick_Attach_SW_Input2     | 992A       | B/R   | WORK_LAMP_SWITCH_LED(-)    | Z161       | B     | GND         |
| 87D        | R/B   | Turn_Signal_RH_Cluster           | 305        | Lg    | 14PinG                       | 686B       | Or    | Safety_Switch_Input    | 921H       | R     | Quick_Attach_SW_Input5     | 992B       | B/R   | TAIL_LAMP(-)               | Z200B      | B     | GND         |
| 96A        | W     | Lamp_Tail_Lamp1                  | 306        | Gr    | 14PinH                       | 686C       | Or    | Reset_Switch_Input     | 921L       | R     | High_Flow_SW_Input2        | 992C       | B/R   | TAIL_LAMP(-)               | Z200D      | B     | GND         |
| 96B        | W     | Work_Lamp_FR                     | 307        | P     | Aux_Hold_M_Switch            | 686D       | Or    | Reset_Switch_Input     | 922        | R     | AIRCON_PANEL               | 992D       | B/R   | TAIL_LAMP(-)               | Z303       | B     | Gnd         |
| 96C        | W     | OVERRIDE_SWTICH_LAMP             | 308        | W     | Aux_Hold_F_Switch            | 686G       | Or    | Safety_Switch_Input    | 923        | R/W   | AIRCON_PANEL               | 992E       | B/R   | TAIL_LAMP(-)               | Z304       | B     | GND         |
| 96E        | W     | Regen_SW_Lamp                    | 309        | Or    | 14PinE                       | 686H       | Or    | Safety_Switch_Input    | 924        | L     | AIRCON_PANEL               | 992F       | B/R   | TAIL_LAMP(-)               | Z342       | B     | Gnd         |
| 96E        | W     | Regen_SW_Lamp                    | 310        | Br/L  | 14PinF                       | 686L       | Or    | MCU_POWER              | 925        | Y     | AIRCON_PANEL               | 992G       | B/R   | TAIL_LAMP(-)               | Z348A      | B     | Gnd         |
| 96F        | W     | Regen_SW_Lamp                    | 311        | W/G   | Aux_Port_Variable_Switch     | 686Q       | Or    | BUZZER                 | 926        | G     | AIRCON_PANEL               | 992H       | B/R   | TAIL_LAMP(-)               | Z348B      | B     | Diode1      |
| 96G        | W     | HYD_LOCK_SW_LAMP                 | 312        | L/G   | Safety_Switch                | 686W       | Or    | MCU_IG                 | 927        | B/W   | AIRCON_PANEL               | 992I       | B/R   | TAIL_LAMP(-)               | Z601       | B     | Gnd         |
| 96H        | W     | Light_Switch_Lamp                | 313        | Y/B   | Travel_Pressure_SNSR_FW_LH   | 686X       | Or    | Key_On1V               | 928        | Lg    | AIRCON_PANEL               | 992J       | B/R   | TAIL_LAMP(-)               | Z603       | B     | Gnd         |
| 96I        | W     | SELF_LEVELING_SW_LAMP            | 314        | G/B   | Travel_Pressure_SNSR_FW_RH   | 686Y       | Or    | KEY_ON                 | 929        | G/W   | AIRCON_PANEL               | 992K       | B/R   | TAIL_LAMP(-)               | Z751       | B     | Gnd         |
| 96J        | W     | Wiper_Washer_SW_Lamp             | 315        | L/B   | Travel_Pressure_SNSR_Reverse | 686Z       | Or    | MCU_IG                 | 930        | L/W   | AIRCON_PANEL               | 992L       | B/R   | TAIL_LAMP(-)               | Z752       | B     | Gnd         |
| 96M        | W     | HI_FLOW_SW_LAMP                  | 316        | G     | Safety_SW_LH                 | 704        | Br/B  | Parking_Relay1         | 931        | Y/R   | AIRCON_PANEL               | 992M       | B/R   | TAIL_LAMP(-)               | Z791       | B     | GND         |
| 96N        | W     | QUICK_ATTACH_SW_LAMP             | 317        | L     | Seat_SW                      | 707B       | Y/R   | Parking_Relay2         | 932        | L/Y   | AIRCON_PANEL               | 992N       | B/R   | Turn Signal SW Lamp(L)     | Z792       | B     | GND         |
| 96P        | W     | AUX_SWITCH_LAMP                  | 318        | Y/W   | Reset_Switch                 | 731        | R/Y   | Room_Lamp              | 933        | Or    | AIRCON_PANEL               | 992P       | B/R   | PARKING_LAMP               | Z801       | B     | GND         |
| 96R        | W     | Beacon_SW_Lamp                   | 319        | G/W   | Hydraulic_Lock_Switch        | 752        | G     | Wiper_Relay1           | 934        | L/R   | AIRCON_PANEL               | 992U       | B/R   | Turn Signal SW Lamp(R)     | Z802       | B     | GND         |
| 96S        | W     | Front_Tail_Lamp_RH               | 321        | P/G   | Parking_Switch               | 761        | Y     | Wiper_Relay_Coil       | 935        | B     | AIRCON_PANEL               | 993        | Vo    | AV1_GND                    | Z803       | B     | GND         |
| 96T        | W     | Hazard_Switch_Lamp_Input         | 322        | R/G   | Alternator                   | 761B       | Y     | Wash_M(F) 12V          | 938        | B/Y   | AIRCON_PANEL               | 994        | R/B   | SEAT_POWER                 | Z850       | B     | Gnd         |
| 96U        | W     | Front_Tail_Lamp_LH               | 323        | Y/G   | High_Flow_Switch             | 761C       | Y     | Wiper_Relay2           | 939        | B     | AIRCON_PANEL               | 997        | W     | AV1                        | Z851       | B     | Gnd         |
| 96V        | W     | Front_Tail_Lamp_LH               | 341A       | W/B   | Main_Control_M_Valve         | 762        | R     | Wiper_Relay_Coil       | 940        | Y/B   | AIRCON_PANEL               | 998        | Gr    | 2Speed_Coil                | Z853       | B     | Gnd         |
| 96X        | W     | Front_Tail_Lamp_LH               | 342B       | Y/L   | Main_Control_F_Valve         | 806        | G/B   | Wash_M(F) SW           | 941        | L/W   | RIDE CONTROL RY            | 999        | B/Y   | BUZZER(-)                  | Z991       | B     | GND         |
| 96Y        | W     | Work_Lamp_Relay_F2               | 343        | G/L   | Stop_Lamp                    | 855        | Br/B  | 14PIN C COIL           | 942        | B/W   | AIRCON_PANEL               | A01A       | Lg    | ACC1A                      | Z998       | B     | GND         |
| 96Z        | R/B   | ROOM_LAMP                        | 344        | Br/L  | Back_Buzzer                  | 856        | Br/R  | 14PIN D COIL           | 971B       | P     | RIDE CONTROL               | A01B       | Lg    | ACC1B                      |            |       |             |
| 114        | R/L   | Forced_DPF_Regeneration_Switch   | 345        | P/L   | Parking_Sol_RY_Coil          | 857        | Br/Y  | 14PIN E COIL           | 972        | Y/R   | OIL_TEMP                   | A01C       | Lg    | ACC1C                      |            |       |             |
| 196        | Gr    | DPF_Regen_Inhibit_Switch         | 347        | W/G   | Electric_Fan_RY              | 858        | Br/Y  | 14PIN F COIL           | 973A       | G     | Self_Leveling_Lamp         | A01U       | Lg    | HEATER_RELAY_COIL          |            |       |             |
| 213        | G     | Hand Accelerator Track 2, Signal | 349        | P     | Rock_Travel_RY_Coil          | 859        | Br/L  | 14PIN G COIL           | 973B       | G     | Self_Leveling_Relay_Coil   | B10F       | R/W   | Battery_12V                |            |       |             |
| 214        | B     | Hand Accelerator Track 2, Return | 350        | Or    | Lock_Bucket_RY_Coil          | 860        | Br    | 14PIN H COIL           | 975A       | Y/R   | Quick_Attach_Unlock_Lamp   | B13        | R/B   | Battery_12V                |            |       |             |
| 224        | R/G   | Hand VREF1 PPS1 5V               | 351        | Y     | High_Flow_RY_Coil            | 871        | G     | OPC SW                 | 975B       | Y/R   | Quick_Attah_Unlock_RY_Coil | B13A       | R/B   | MCU_B+                     |            |       |             |
| 225        | G     | Hand Pedal Position Sensor1      | 361        | Y/L   | High_Flow_RY_Coil            | 881        | B     | GND                    | 976A       | Br/R  | Quick_Attach_lock_Lamp     | B13B       | R/B   | B+                         |            |       |             |
| 226        | B     | Hand PPS1 Return                 | 361        | Y/L   | High_Flow_RY_Coil            | 882        | Y/B   | 232TX                  | 976B       | Br/R  | Quick_Attah_Lock_RY_Coil   | B13C       | R/B   | RMS B+                     |            |       |             |
| 229        | R/G   | Hand VREF2 PPS2 5V               | 393B       | Y     | Soft_Shift_Relay2            | 883        | G/R   | 232RX                  | 977        | B     | Camera_GND                 | B13D       | R/B   | B+                         |            |       |             |
| 232        | W/G   | Parking_Relay3                   | 398B       | Y     | Ride_Control_Relay2          | 891        | Y     | RMS KEY IG             | 977C       | B     | CAMERA_GND(SHIELD)         | B13E       | R/B   | Battery_B+                 |            |       |             |
| 247A       | W/L   | MCU_CAN_L                        | 401        | R     | Wiper_Washer_Fuse            | 891B       | Y     | key_on                 | 979        | R/Y   | floating_mag.12v           | K01A       | R     | key_On1A                   |            |       |             |

6.2 MCU UPDATE



| Wire Label | Color     | Signal Name |
|------------|-----------|-------------|
| 881        | B         | GND         |
| 882        | TWIST Y/B | TX          |
| 883        | TWIST G/R | RX          |

LF1W5A76A

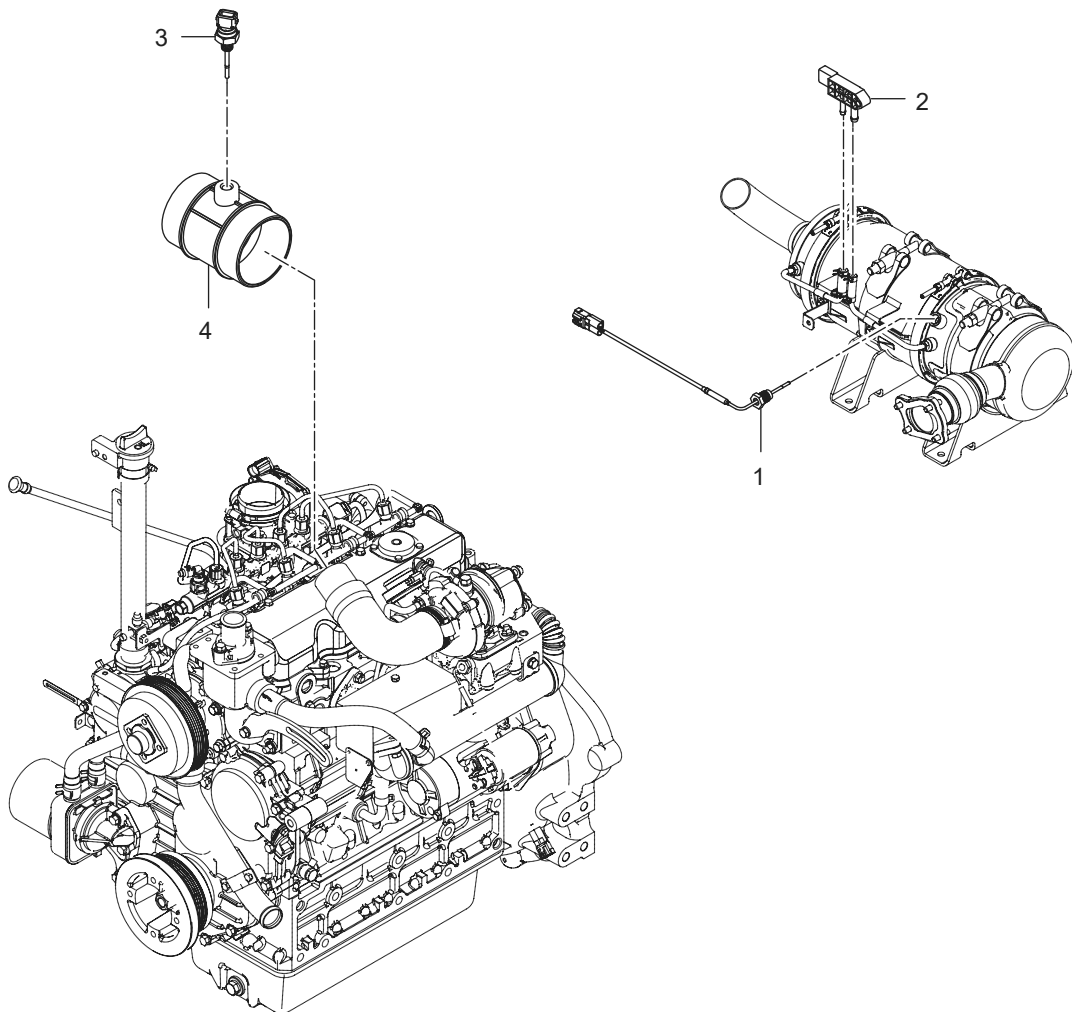
## 7. EXPLODED VIEW



## REMARKS

- The manufacturing parts are subject to change without notice. Therefore, check the parts catalog or electronic manual for latest information.

## 7.1 LF1-G311007 ENGINE ELECTRICAL GROUP



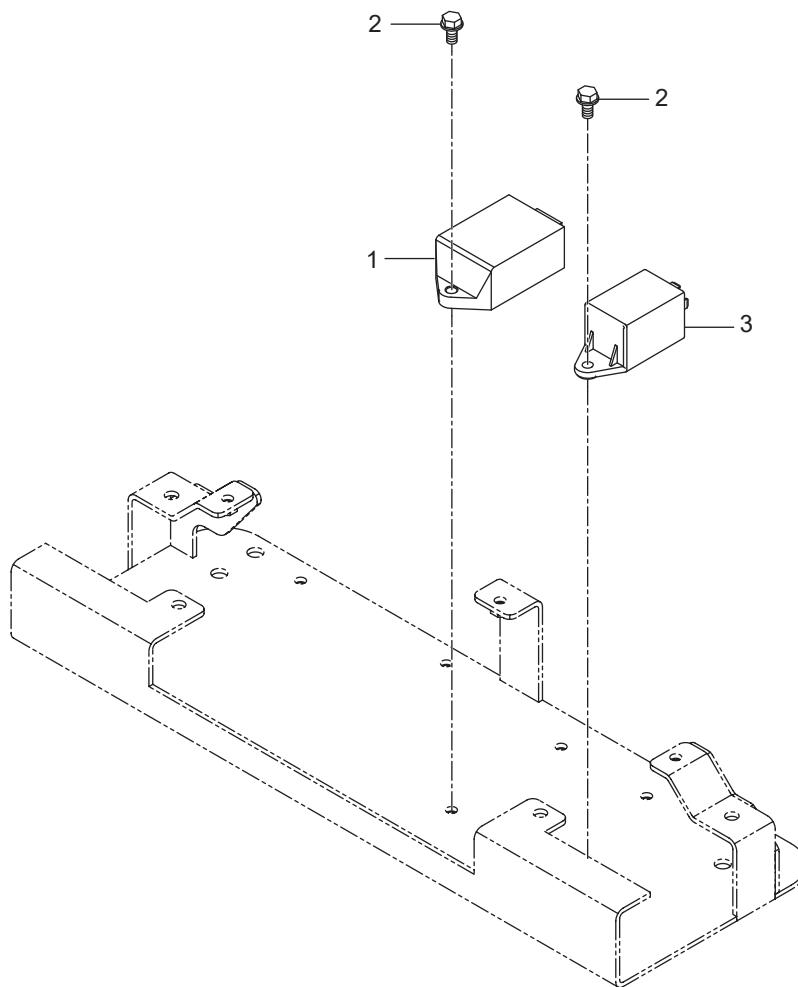
LF1W5A78A

## COMPONENTS

- |                                    |                                     |
|------------------------------------|-------------------------------------|
| (1) Exhaust Gas Temperature Sensor | (3) Assy Sensor, Intake Air Temp-T1 |
| (2) Sensor, DPF Diff Press         | (4) Housing-Intake Temp Sensor      |



## 7.2 LF1-G327001 LIGHT CONTROL GROUP



LF1W5A79A

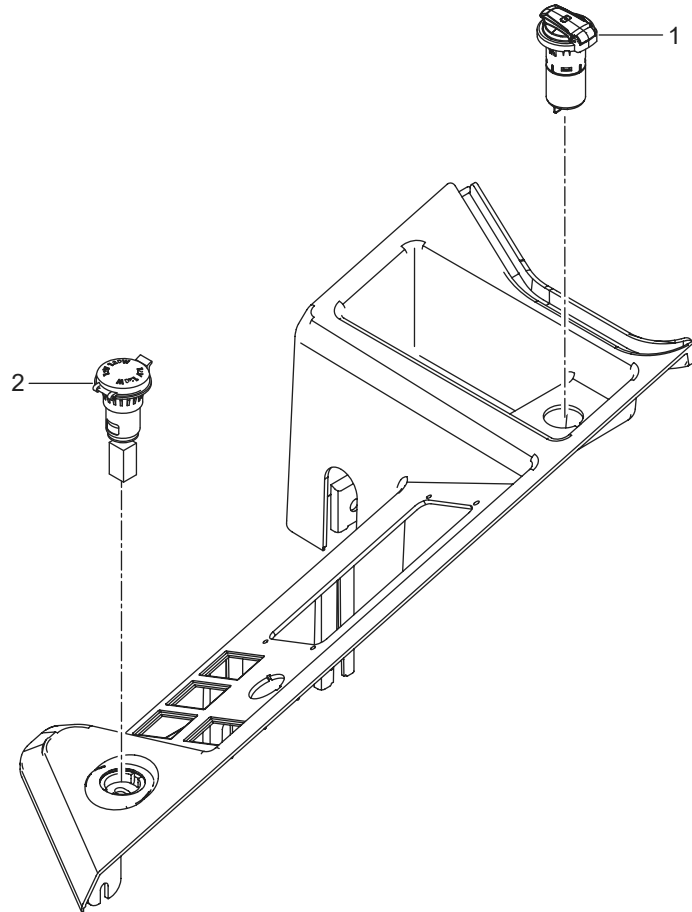
### COMPONENTS

(1) Escort Unit

(2) Flaner Bolt

(3) Unit, Flasher

## 7.3 LF1-G328002 POWER SOCKET GROUP



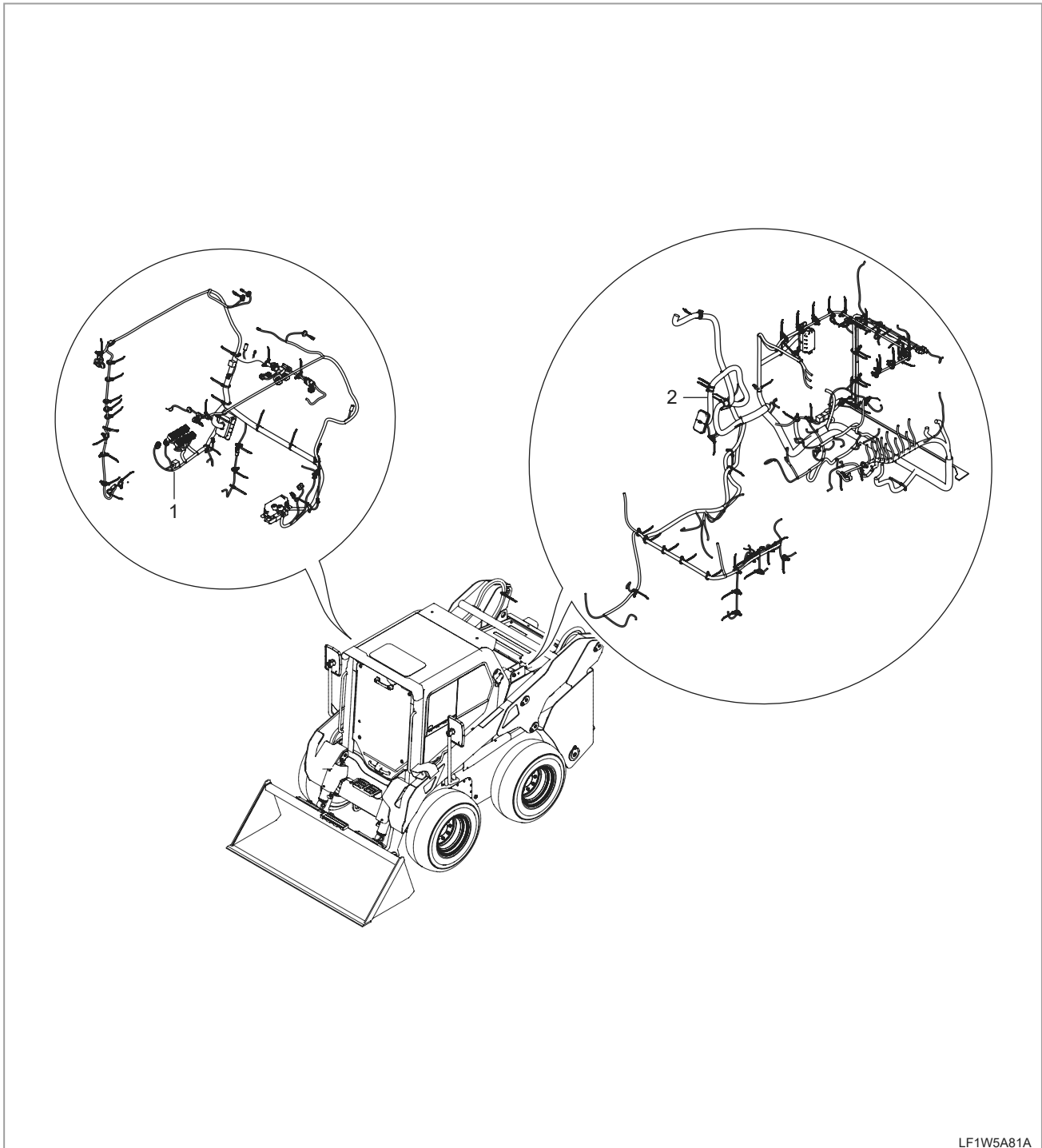
LF1W5A80A

**COMPONENTS**

(1) Power Outlet Ass'y(12V)

(2) Socket-USB

## 7.4 LF1-G331001 WIRE HARNESS GROUP



### COMPONENTS

(1) Wire Harness, Main

(2) Wire Harness, Cabin

SAFETY FIRST

ENGINE

DRIVING & CHASSIS

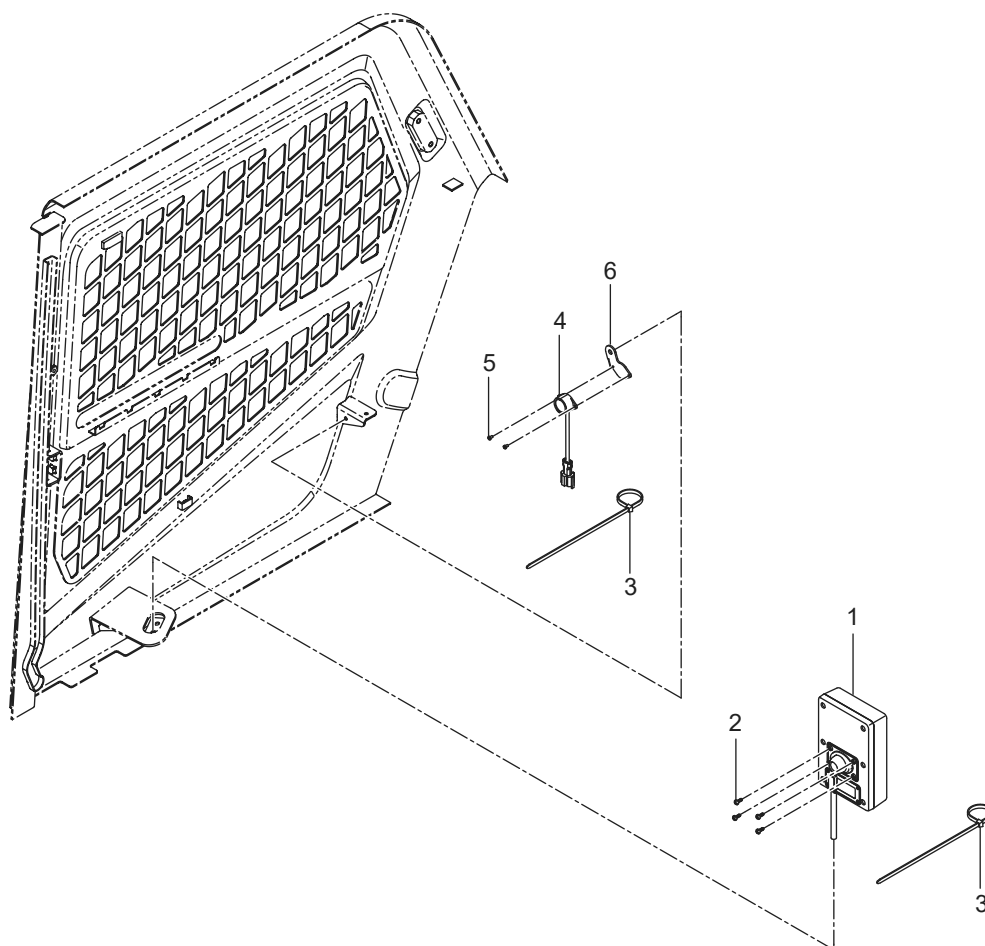
HYDRAULIC SYSTEM

ELECTRIC SYSTEM

CABIN

INDEX

## 7.5 LF1-G332001 CLUSTER CONTROL GROUP



LF1W5A82A

## COMPONENTS

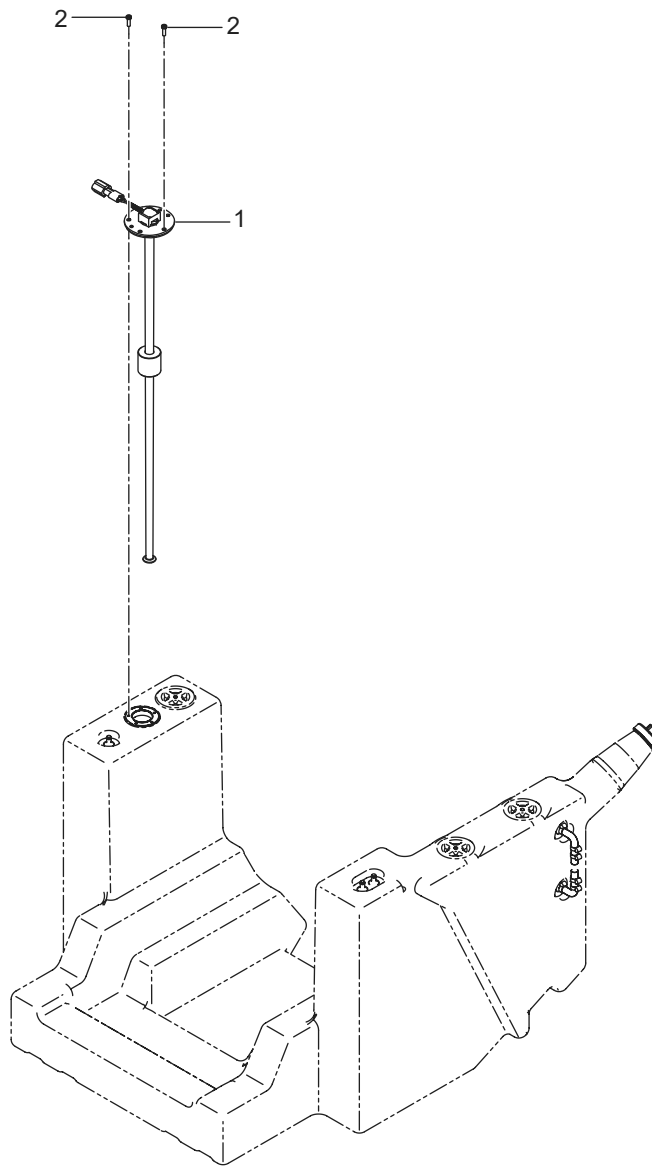
- (1) Cluster  
(2) Screw With Washer

- (3) Cord Band  
(4) Assy Buzzer

- (5) Screw  
(6) Plate, Buzzer



## 7.6 LF1-G332501 FUEL SENDER GROUP



LF1W5A83A

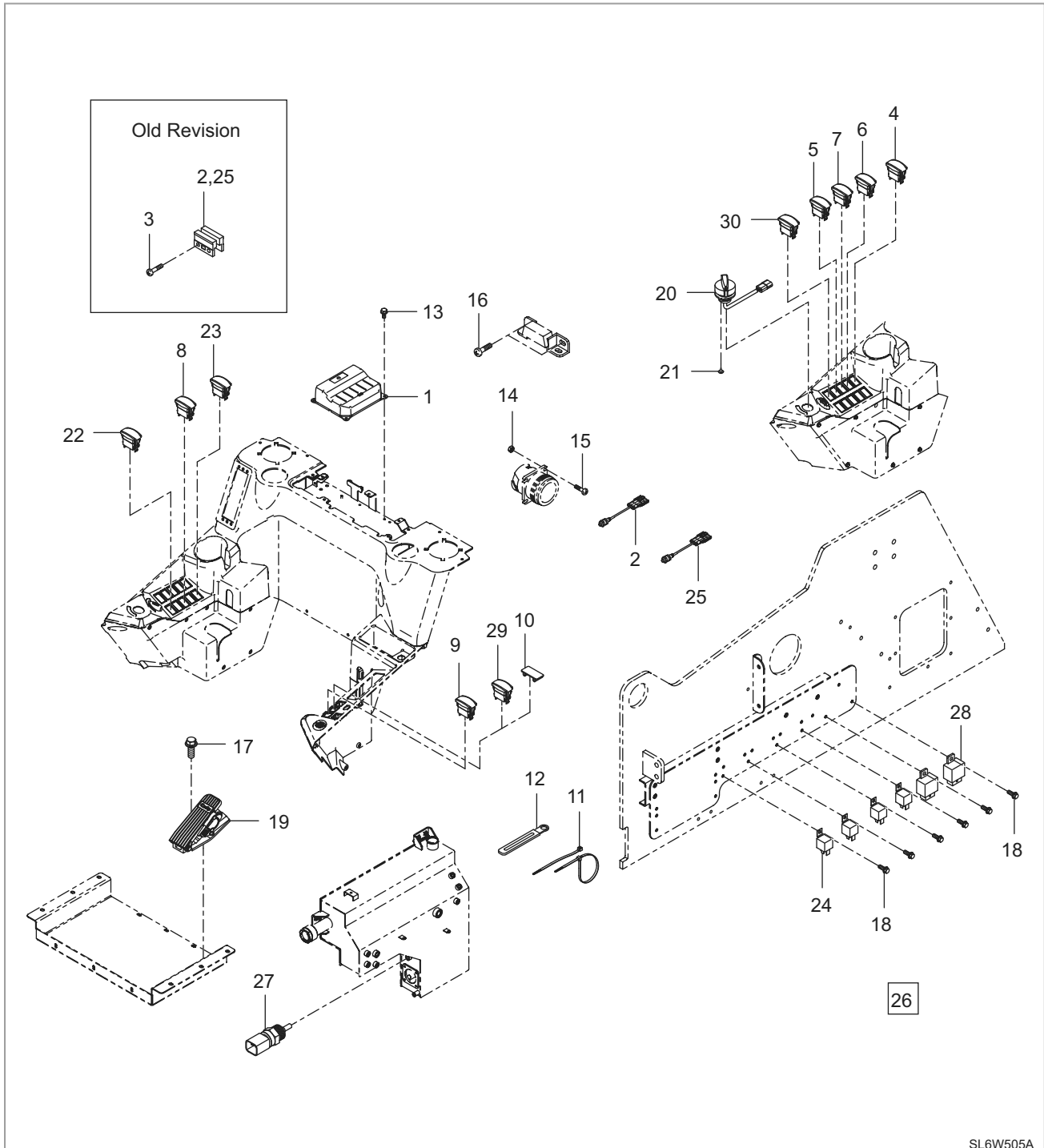
### COMPONENTS

(1) Sender, Fuel

(2) Screw with washer



## 7.7 MACHINE CONTROL GROUP (HS80V)



SL6W505A

## COMPONENTS

- |                           |                       |                             |
|---------------------------|-----------------------|-----------------------------|
| (1) MCU                   | (13) Flange bolt      | (25) Sensor, Safety         |
| (2) Sensor, Safety        | (14) Nut              | (26) Screw                  |
| (3) Screw                 | (15) Screw            | (27) Oil Thermometer Sensor |
| (4) Switch, Wiper         | (16) Screw            | (28) Twin Relay, Motor      |
| (5) Switch, Light         | (17) Bolt             | (29) Switch, Room lamp      |
| (6) Switch, Parking       | (18) Bolt, Flange     | (30) Switch, Reset          |
| (7) Switch, Turn Signal   | (19) Foot accel pedal |                             |
| (8) Hydraulic Lock Switch | (20) Accel dial       |                             |
| (9) Switch, DPF-Regen     | (21) Tapping switch   |                             |
| (10) Plug                 | (22) Switch, Aux      |                             |
| (11) Code band            | (23) Hazard Switch    |                             |
| (12) Wiring clamp         | (24) Relay 70A        |                             |