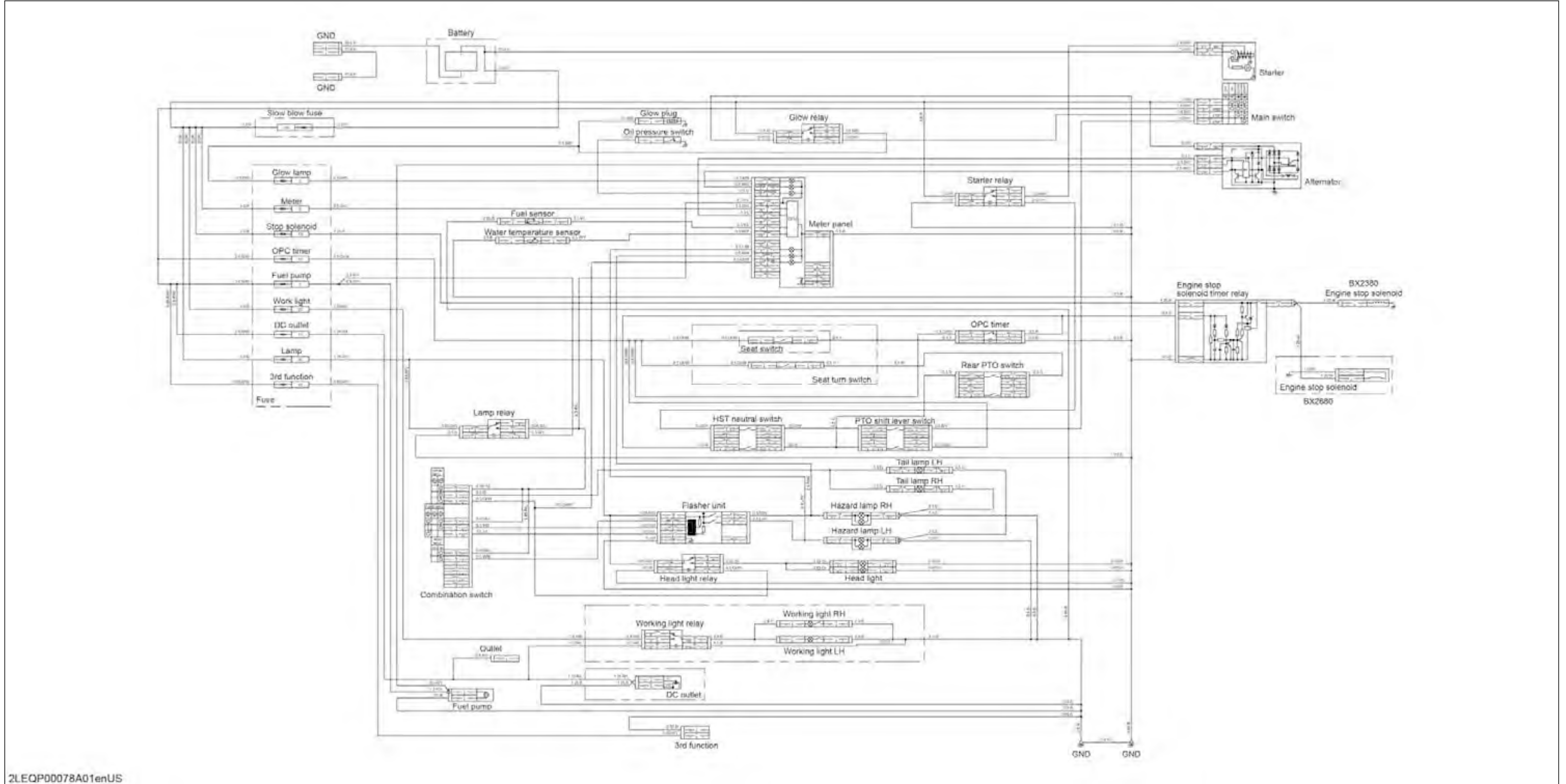


8. ELECTRICAL SYSTEM

MECHANISM

1. Wiring diagram of BX tractor



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8. ELECTRICAL SYSTEM

2. Electrical connector chart

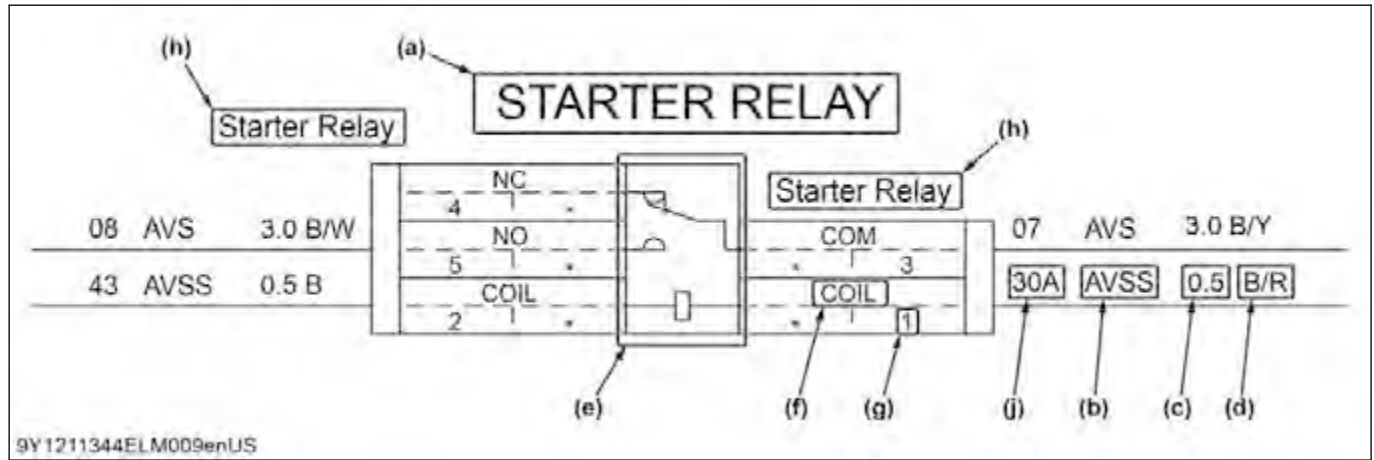
<p>3RD_FUNC AMP_EJ- 174352-2</p>	<p>FLASHER_UNIT SUMITOMO_MT090 6240-5051</p>	<p>HAZARD_LAMP(L-) BULLET_TERMINAL_PLUG CA *1055 7056</p>	<p>REAR_PTO_SW MOLEX_MX150 33472-0601</p>	<p>STARTER_S YAZAKI_CN(A) 7123-2115</p>	<p>TO_MAIN(-) BULLET_TERMINAL_RECEPTACLE CB</p>
<p>A1_BATTERY(+) YAZAKI 7100-3105</p>	<p>FUEL_PUMP SUMITOMO_250 6070-2481 *1010 7011</p>	<p>HAZARD_LAMP(R+) BULLET_TERMINAL_RECEPTACLE CB</p>	<p>RLY(GLOW) BOSCH 3334-485-007</p>	<p>TAIL_LIGHT(L+) BULLET_TERMINAL_RECEPTACLE CB</p>	<p>TO_WORK_LIGHT(-) BULLET_TERMINAL_PLUG CA</p>
<p>ALT_B RING_TERMINAL LA_M0</p>	<p>FUEL_SSR(+) AMP_POSITIVE_LOCK(MARK /) 154719-1</p>	<p>HAZARD_LAMP(R-) BULLET_TERMINAL_PLUG CA *1050 7059</p>	<p>RLY(HLIGHT) BOSCH 3334-485-007</p>	<p>TAIL_LIGHT(L-) BULLET_TERMINAL_RECEPTACLE CB</p>	<p>TO_MAIN_H(OUTLET) SUMITOMO_MT090 6187-2171</p>
<p>ALT_S SUMITOMO_T6090 6180-0442</p>	<p>FUEL_SSR(-) AMP_POSITIVE_LOCK(MARK /) 154719-0</p>	<p>HEAD_LIGHT(L) DELPHI_Metr-Pack280 12124819</p>	<p>RLY(LAMP) BOSCH 3334-485-007</p>	<p>TAIL_LIGHT(R+) BULLET_TERMINAL_RECEPTACLE CB</p>	<p>TO_OUTLET_H SUMITOMO_MT090 6180-2181</p>
<p>B2_STARTER EARTH_TERMINAL BA_M8</p>	<p>FUSE_BOX PKC E-0433 *3010 7110</p>	<p>HEAD_LIGHT(R) DELPHI_Metr-Pack280 12124819</p>	<p>RLY(STARTER) BOSCH 3334-485-007</p>	<p>TAIL_LIGHT(R-) BULLET_TERMINAL_RECEPTACLE CB</p>	<p>TO_MAIN_H(SEAT) AMP_EJ- 174259-2</p>
<p>BATT(+) YAZAKI_SRL 7123-4113-30</p>	<p>GLOW_PLUG RING_TERMINAL LA_M0</p>	<p>MAIN_SW SUMITOMO_58_260 6101-5041</p>	<p>SAFETY_SW(SEAT) SUMITOMO_MT090 6187-2171</p>	<p>TIMER(OPC) SUMITOMO_MT090 6180-4182</p>	<p>TO_SEAT_H AMP_EJ- 174257-2</p>
<p>BODYEARTH(FRAME) RING_TERMINAL LA_M0</p>	<p>FORK_TERMINAL LE_M1</p>	<p>NEUTRAL_SW MOLEX_MX150 33472-0601</p>	<p>SAFETY_SW(SEAT_TURN_OVER) DELTA 96526</p>	<p>TIMER(STOP) SUMITOMO_250 6070-4481</p>	<p>WATER_TEMP_SSR AMP_EJ- 2822362-2</p>
<p>BODYEARTH(STARTER) RING_TERMINAL LA_M8</p>	<p>GND(U1) RING_TERMINAL LA_M0 *1033 7081</p>	<p>OIL_PRESS_SW YAZAKI_250 7116-2030</p>	<p>PANEL JAE_MX34 MX340205F1</p>	<p>TO_MAIN(+) BULLET_TERMINAL_PLUG CA</p>	<p>WORKLIGHT_RLY BOSCH 3334-485-007</p>
<p>COMBI_SW SUMITOMO_MT090 6244-5121</p>	<p>GND(L2) RING_TERMINAL LA_M8 *1053 7071</p>	<p>PTO_SW MOLEX_MX150 33472-0601</p>	<p>SOLENOID YAZAKI_CN(A) 7123-2115</p>	<p>TO_WORK_LIGHT(+)*1 BULLET_TERMINAL_RECEPTACLE CB</p>	<p>WORK_LIGHT(L) SUMITOMO_250 6070-2481</p>
<p>DC_OUTLET YAZAKI_POSITIVE_LOCK 7123-8322</p>	<p>HAZARD_LAMP(L+) BULLET_TERMINAL_RECEPTACLE CB</p>			<p>TO_MAIN(+COIL) BULLET_TERMINAL_PLUG CA</p>	<p>WORK_LIGHT(R) SUMITOMO_250 6070-2481</p>
				<p>TO_WORK_LIGHT(+)*2 BULLET_TERMINAL_RECEPTACLE CB</p>	

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3. Reading electrical circuit diagrams

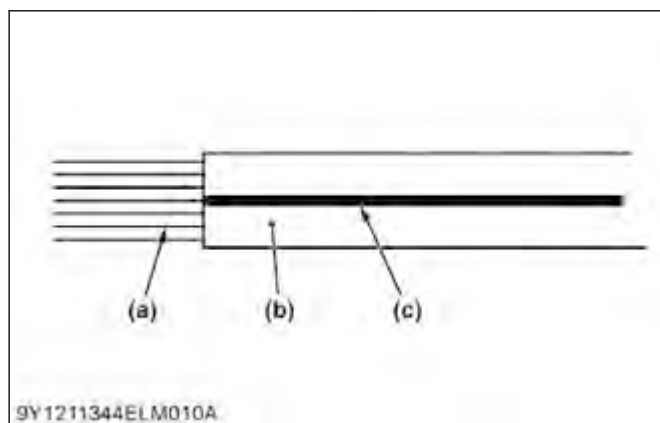
3.1 How to read wiring diagram

Electrical wiring chart symbols for harnesses and wires



	Item	(Example) Contents of illustration	Reference
(a)	Name of part	STARTER RELAY	
(b)	Wire specification code	All use (common)	
(c)	Wire size	0.50 mm ²	
(d)	Wire color	Black/Red	Wire color page
(e)	Unit symbol	Relay	Unit symbol page
(f)	Pin name	Coil	
(g)	Pin No.	1	
(h)	Connector name	Starter relay	Connector diagram
(i)	Wire number	30 A	

Color of wiring



- (a) Wire size (mm²)
- (b) Insulation base color
- (c) Stripe color

(Ex.)

1.25-Y/R means :

- 1.25 : Wire size (mm²)
- Y : Base color (yellow)
- R : Stripe color (red)

8. ELECTRICAL SYSTEM

3. Reading electrical circuit diagrams

Color of wiring	Color code
Black	B
Green	G
Blue	L
Pink	P
Red	R
White	W
Yellow	Y
Brown	BR
Gray	GY
Light green	LG
Orange	OR
Sky blue	SB

Unit symbol

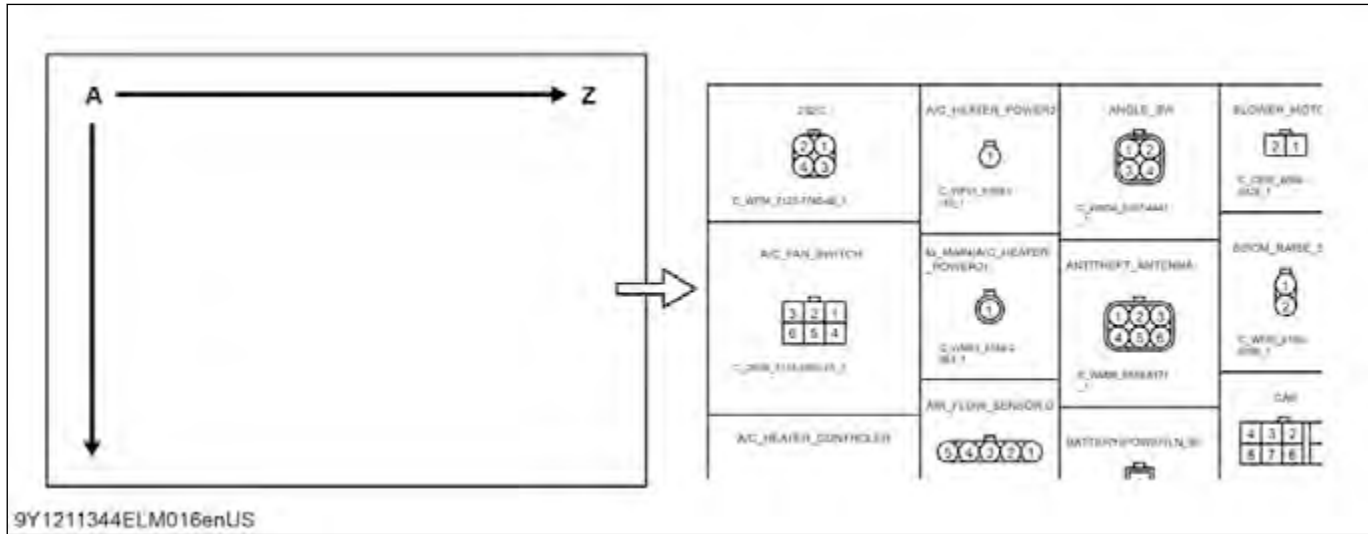
	(A)	(B)		(A)	(B)		(A)	(B)																							
(1)			(14)			(27)																									
(2)			(15)			(28)																									
(3)			(16)			(29)																									
(4)			(17)			(30)																									
(5)			(18)			<table border="1"> <tr> <td>(31)</td> <td colspan="3"> <table border="1"> <tr> <td></td> <td>(32)</td> <td>(33)</td> <td>(34)</td> </tr> <tr> <td>1</td> <td>↙</td> <td>↘</td> <td>→</td> </tr> <tr> <td>2</td> <td>○</td> <td>○</td> <td>○</td> </tr> <tr> <td>3</td> <td>○</td> <td>○</td> <td>○</td> </tr> </table> </td> <td></td> </tr> <tr> <td colspan="4"> </td> </tr> </table>	(31)	<table border="1"> <tr> <td></td> <td>(32)</td> <td>(33)</td> <td>(34)</td> </tr> <tr> <td>1</td> <td>↙</td> <td>↘</td> <td>→</td> </tr> <tr> <td>2</td> <td>○</td> <td>○</td> <td>○</td> </tr> <tr> <td>3</td> <td>○</td> <td>○</td> <td>○</td> </tr> </table>				(32)	(33)	(34)	1	↙	↘	→	2	○	○	○	3	○	○	○					
(31)	<table border="1"> <tr> <td></td> <td>(32)</td> <td>(33)</td> <td>(34)</td> </tr> <tr> <td>1</td> <td>↙</td> <td>↘</td> <td>→</td> </tr> <tr> <td>2</td> <td>○</td> <td>○</td> <td>○</td> </tr> <tr> <td>3</td> <td>○</td> <td>○</td> <td>○</td> </tr> </table>				(32)		(33)	(34)	1	↙	↘	→	2	○	○	○	3	○	○	○											
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(13)			(26)																												

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- | | | | |
|---|---------------------------------|-------------------------------|-------------------------|
| (1) Variable | (11) Heating element | (22) Auto resetting b-Contact | (33) ON |
| (2) Non-linear variable | (12) Condenser | (23) Auto-resetting a-Contact | (34) START (auto reset) |
| (3) Fixed setting | (13) Electrolytic capacitor | (24) Relay coil | (A) New symbol |
| (4) Step variable | (14) Magnetic core inductance | (25) Fuse | (B) Old symbol |
| (5) Non ionizing radiation (NIR) | (15) PNP transistor | (26) Lamp | |
| (6) Body GND | (16) NPN transistor | (27) Buzzer | |
| (7) Thermistor | (17) Semiconductor diode | (28) Horn | |
| (8) Resistor | (18) Light-emitting diode (LED) | (29) Speaker | |
| (9) Variable resistor | (19) Two-way breakdown diode | (30) AC voltage source | |
| (10) Potentiometer with sliding contact | (20) Coil | (31) Switch | |
| | (21) a-Contact | (32) OFF (no auto reset) | |

3.2 Layout of connector diagrams

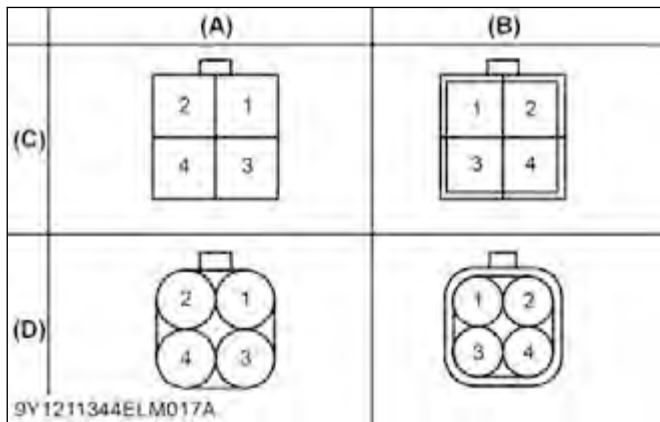
Connector arrangement sequence



Depiction of connectors

NOTE

- In principle, the connector locking part is shown on the top side.
- Female connector terminal numbers start from 1 in the top right corner, looking at the connecting face.
- Male connector terminal numbers start from 1 in the top left corner.



(A) Female connector terminal

(B) Male connector terminal

(C) Not waterproof

(D) Waterproof

3.3 Precautions on handling electrical connectors

1. When disconnecting connectors, grasp the body of the connector and pull it out; do not pull on the wiring harness. If the connector is the locking type, release the lock and then pull to disconnect.
2. When removing a connector's plastic cover (for water protection) to inspect it, be careful not to let any water get in the connector. If water does get in, dry it thoroughly before reassembling the connector and putting its plastic cover securely in place.
3. Straighten any bent connector terminals and make sure none are sticking out or missing. Also make sure there is no corrosion on the connector's terminals before connecting it.
4. When connecting a locking connector, be sure to press it in until you hear it click and then pull gently on the harness close to the connector and make sure the harness does not come out.

4. Starting system

4.1 Electrical circuit of starting system

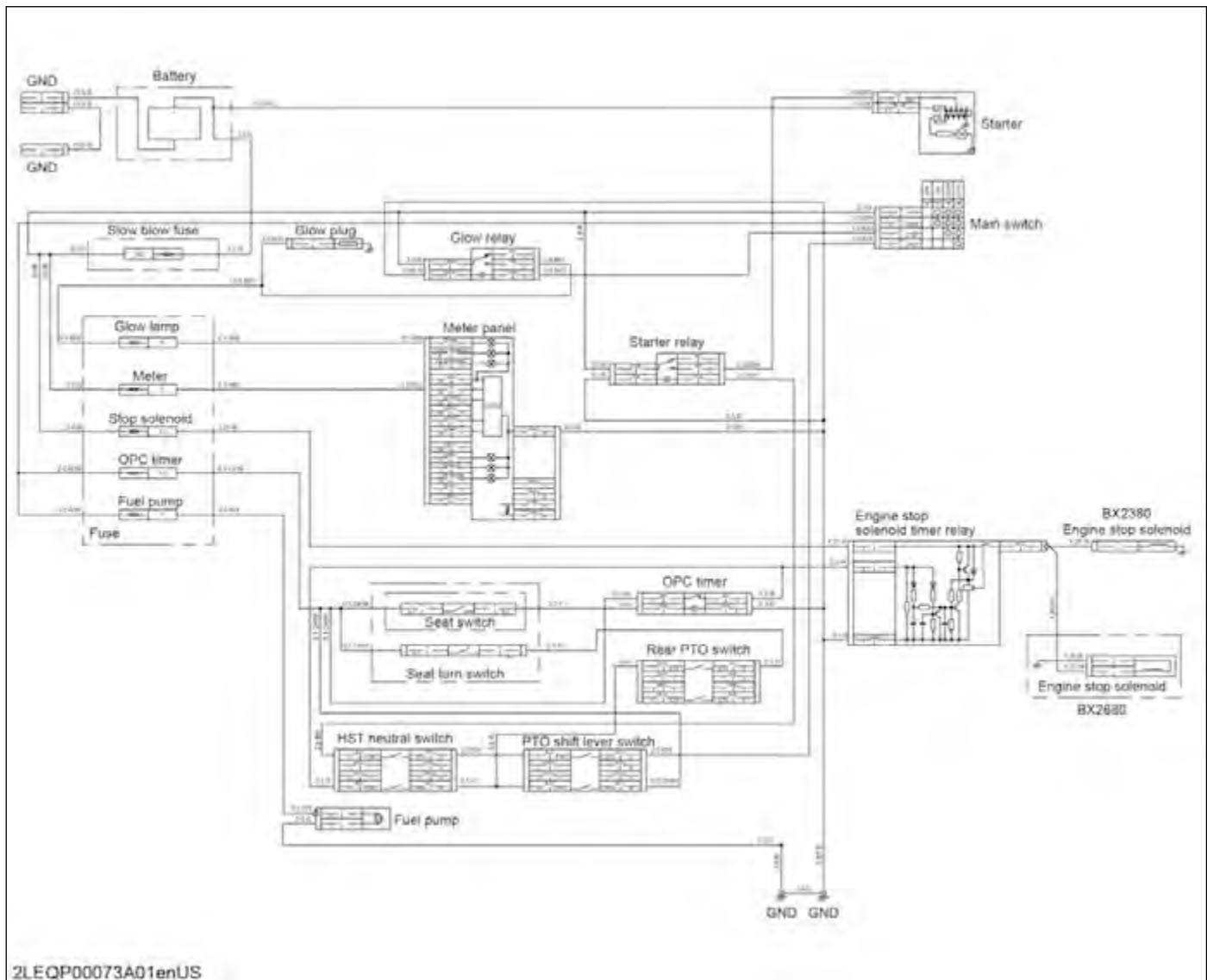
When the main switch is turned to the **GLOW** position, the terminal BAT is connected to the terminal ON and AC. The glow plugs become red-hot, and the preheat indicator lamp also lights on while preheating.

When the main switch is then turned to the **START** position with the safety switches on, the terminal BAT is connected to the terminals GLOW and ST. Consequently, battery current flows to the starter motor and start the engine.

The main switch automatically returns to the **ON** position, the terminal BAT is connected only to the terminal GLOW, thereby causing the starting circuit to be opened, stopping the starter motor.

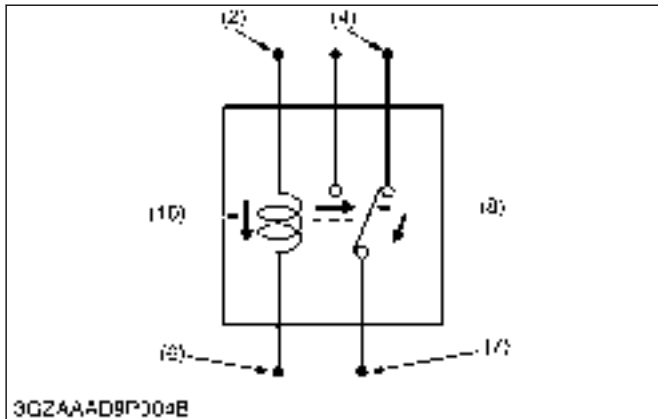
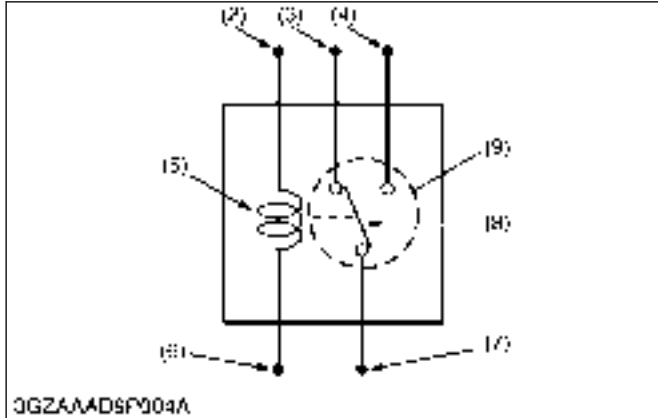
When the main switch turned from the **ON** position to the **OFF** position, the fuel cut-off solenoid moves the fuel injection pump control rack to the **no fuel injection** position and stops the engine.

The OPC timer equipped is the operator presence control (OPC) system which automatically stops the engine in approximately one second when operator stands from the seat while shifting the PTO clutch lever and range gear shift lever.



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4.2 Function of relay



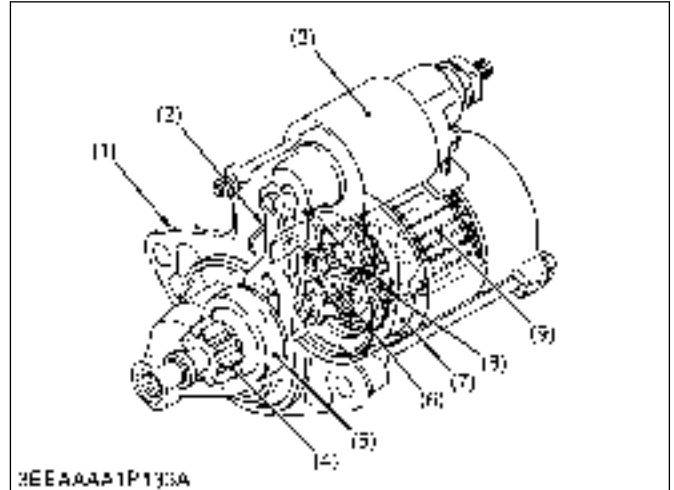
- | | |
|-------------------|-------------------------------|
| (1) Relay | (6) Terminal 1 |
| (2) Terminal 2 | (7) Terminal 3 |
| (3) Terminal 4 | (8) Contact lever |
| (4) Terminal 5 | (9) Mechanical contact points |
| (5) Relay winding | (10) Winding (Energized) |

A relay (1) is an electrically operated switch. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal.

Current flowing from switch to relay winding (5) cause **ON (Close)** or **OFF (Open)** of mechanical contact points (9).

When current is applied to the winding (energized) (10), a magnetic field pushes the contact lever (8) and normally open terminal is connected.

4.3 Function of starter

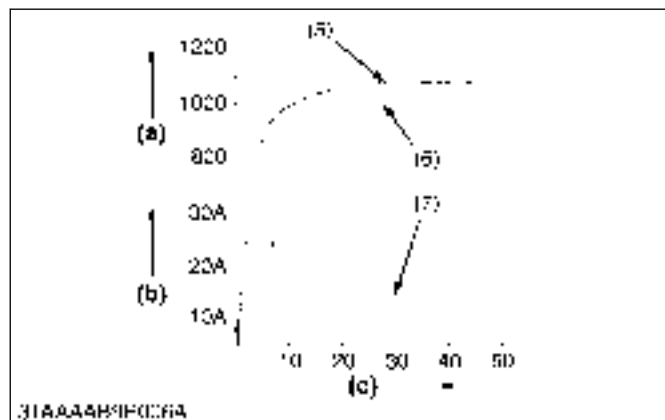
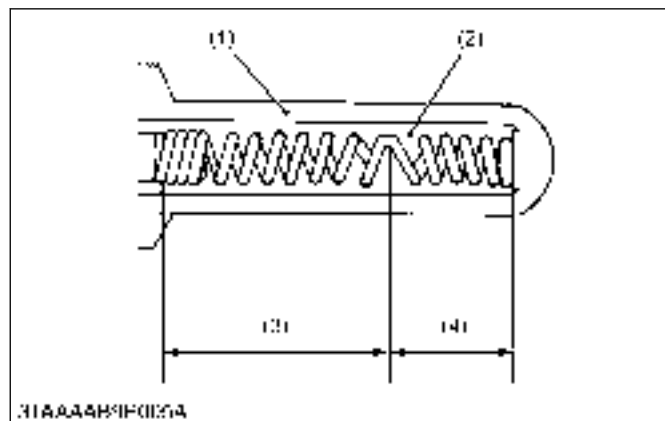


- | | |
|------------------------|--------------------|
| (1) Front bracket | (6) Gear shaft |
| (2) Drive lever | (7) Internal gear |
| (3) Magnetic switch | (8) Pinion gear |
| (4) Pinion gear | (9) Armature shaft |
| (5) Overrunning clutch | |

The reduction system is used planetary gears, and the speed of gear shaft (6) is reduced to approximately one-fifth of the armature shaft (9).

The pinion gear (4) is pushed against the ring gear with the overrunning clutch (5) by the drive lever (2).

4.4 Function of glow plug



- (1) Sheath tube
- (2) Insulation powder
- (3) Heater also functioning as a resistor
- (4) Heater
- (5) Super glow plug
- (6) Conventional quick-heating type glow plug
- (7) Glow plug current
- (a) Glow plug temperature (°C)
- (b) Current (A)
- (c) Time (Sec.)

This plug is a two-material type QGS (Quick Glow System) for quick temperature rise, and has self-controlling function as well as excellent durability.

The heater (4) connected in series to the heater (3), which also functions as the resistor, is incorporated in the sheath tube (1) of the super glow plug.

The resistance of this heater (3) cum resistor is small when the temperature is low, while the resistance becomes large when the temperature rises.

Therefore, because sufficient current is flown to the heater (4) during the initial period of energization, the temperature rises quickly and the resistance grows with the rise in the temperature of the resistor, the flowing current is reduced to prevent the heater (4) from being heated.

The ignition point is in the area of 2 to 3 mm (0.079 to 0.118 in.) from the tip of the plug in order to reduce its projection into the combustion chamber.

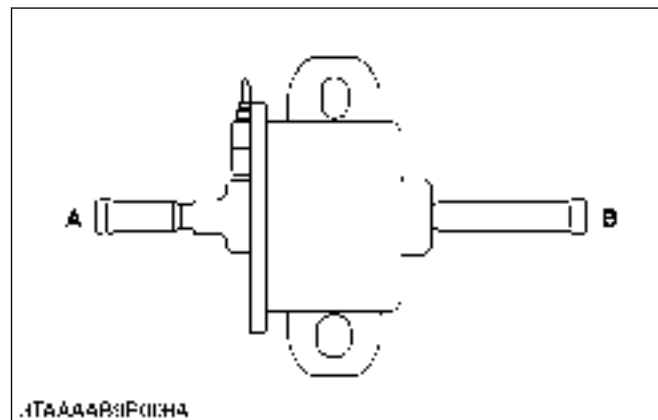
4.5 Function of safety switch

The safety switch is electrically closed in normal condition (normally closed type). The switch operates as sensor detecting and transmitting the position of

HST pedal, PTO lever, independent PTO lever, and seat to engine stop solenoid.

Type of switch	Safety switch name	Number of switch contact
Normal open type	Seat switch	1
	Seat turnover switch	1
	PTO shift lever switch	1
	Independent PTO lever switch (Rear PTO switch)	2
	HST pedal neutral switch	2

4.6 Function of fuel pump



A: Inlet B: Outlet

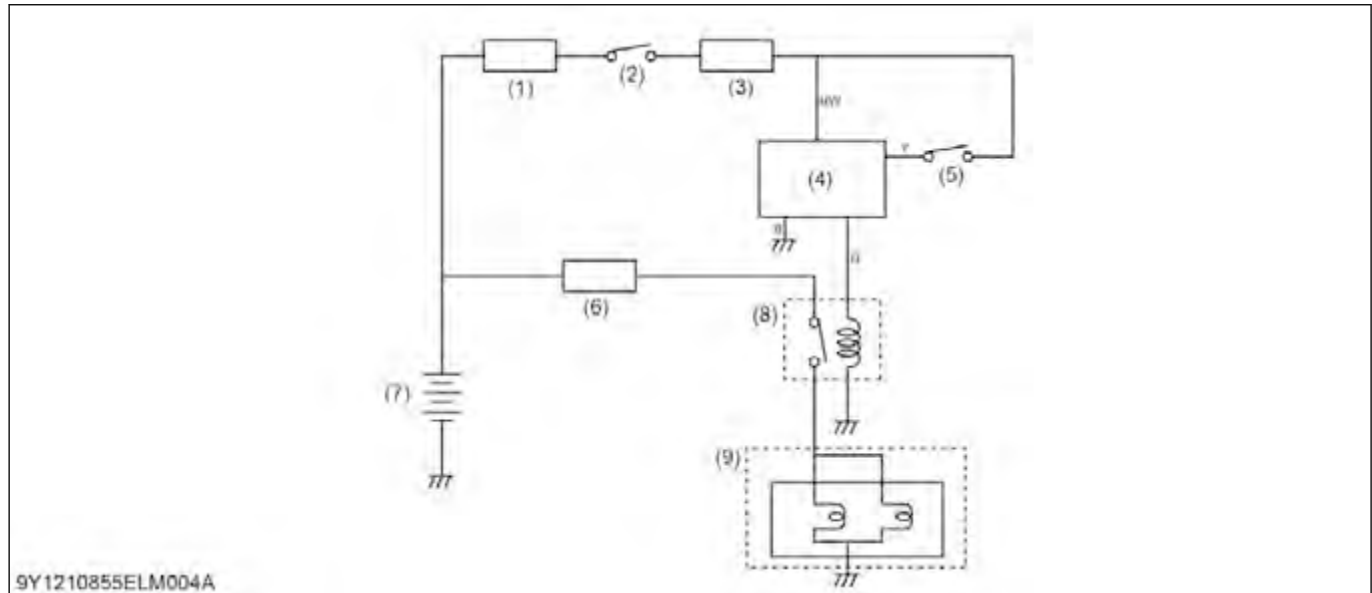
An electromagnetic fuel pump uses a transistor that causes the pump to start pumping fuel when the main switch is turned to the **ON** position. Therefore, fuel is supplied to the fuel injection pump regardless of engine speed. This pump is driven by the battery. It can therefore be operated even with the engine being stopped.

5. OPC (Operator Presence Control) system

5.1 Electrical circuit of OPC timer

General electrical circuit of the tractor OPC timer is shown in the figure.

1. When sitting on the operator's seat with the main switch is in the **ON** position, the battery voltage passes to the seat switch and OPC timer (4), and keep the solenoid relay (8).
2. When standing up from the operator's seat, the circuit from the seat switch to the OPC timer is cut. However, if the PTO lever (or the speed control pedal) are set at **NEUTRAL** position, the circuit from the battery to the solenoid relay (8) is formed with the PTO switch (or HST switch).
3. When standing up from the operator's seat while shifting the levers, the circuit from the battery to the solenoid relay (8) is cut, and the engine is stopped by function of the solenoid (9).



(1) Slow blow fuse

(2) Main switch

(3) Fuse (10 A)

(4) OPC timer

(5) Seat switch (from seat switch ON or OFF)

(6) Fuse (15 A)

(7) Battery

(8) Engine stop solenoid timer relay

(9) Engine stop solenoid

Seat switch

The seat switch has two positions.

When the operator's seat is occupied, the switch contact point is at **ON** position. When the operator's seat is not occupied, its contact point is at **OFF** position.

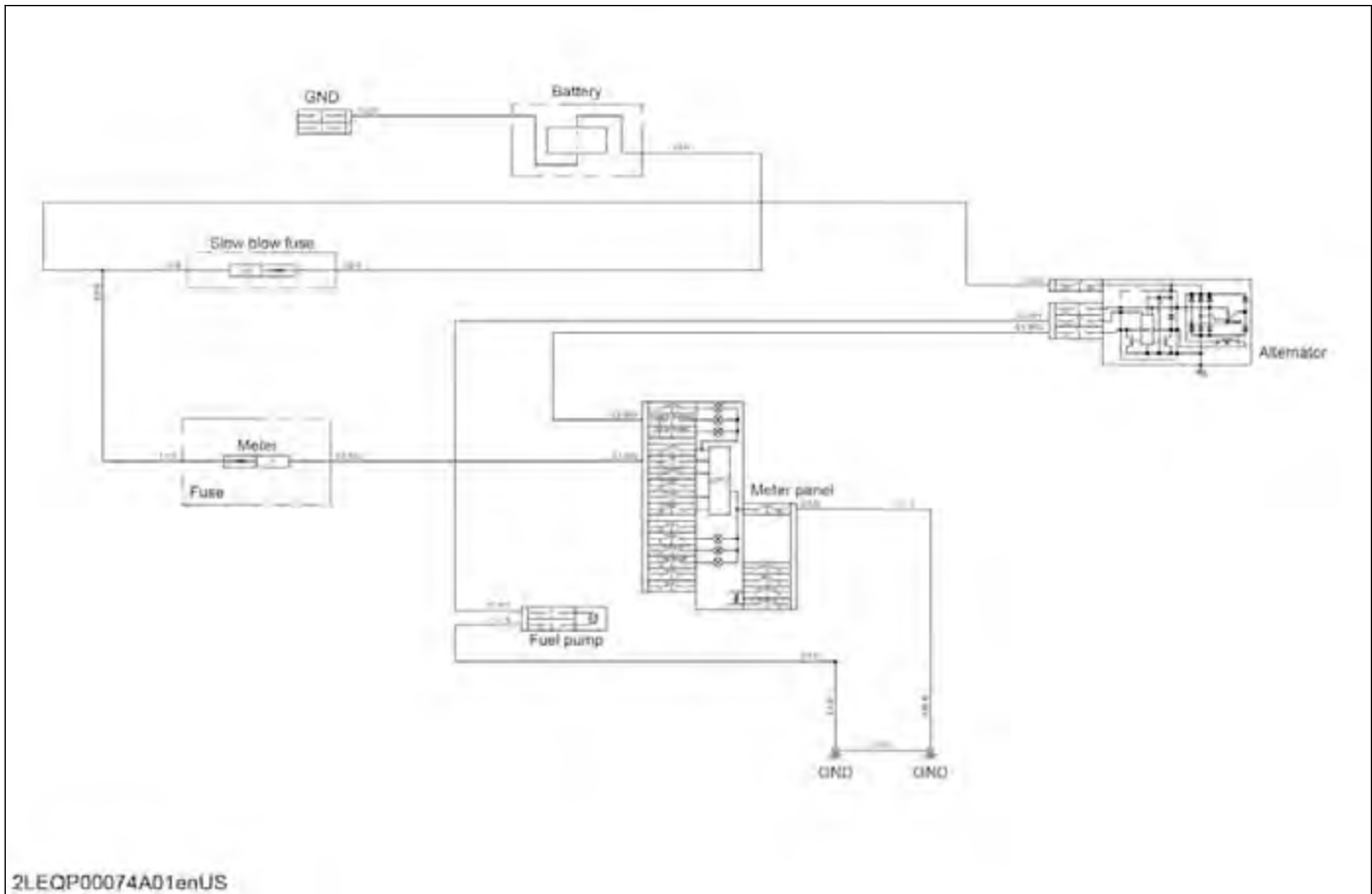
OPC timer

OPC timer is located electrically at between the seat switch (5) and the solenoid relay (8).

When the current supply from the seat switch (5) is cut, the OPC timer (4) adopted for the OPC system has kept the state of **ON** position for approximately one second.

6. Charging system

6.1 Electrical circuit for charging system



6.2 Function of IC regulator (3P connector type)

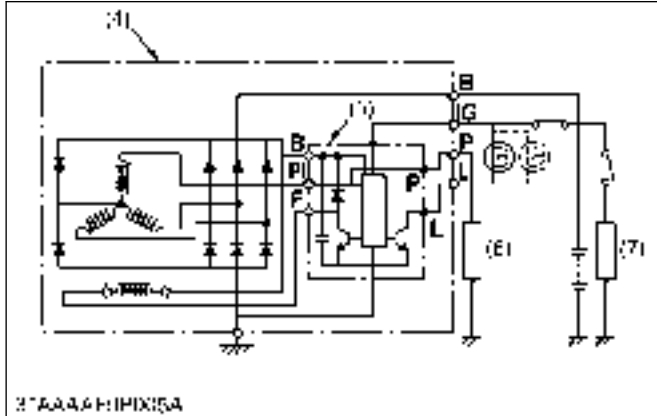
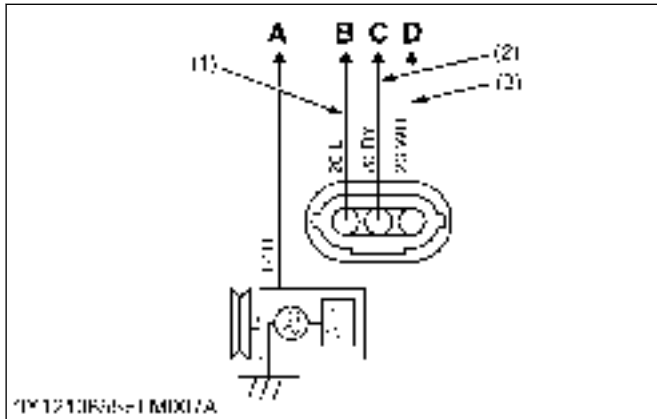
3P connector is connected to the IC regulator. 3P connector consists of three leads, L (blue) lead (1), RY (red / yellow) lead (2), and WR (white / red) lead (3).

L (blue) lead (1) is a lead to transmit the pulse from the alternator to hour meter and tachometer. When the main switch is in the **ON** position, the hour meter indicates operated hours.

While the engine operates, the tachometer indicates the present engine revolutions.

RY (red / yellow) lead (2) is a lead to chassis.

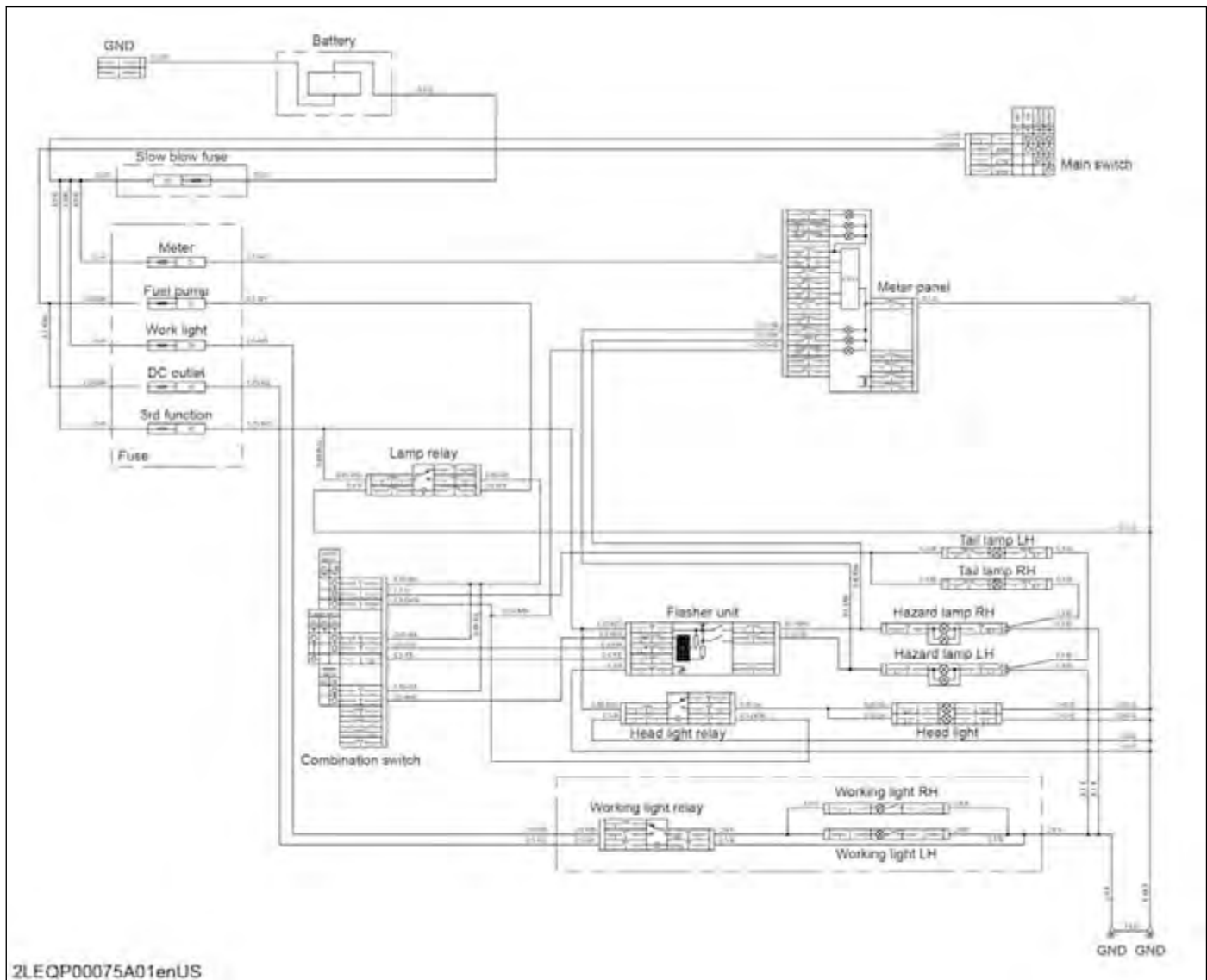
WG (white / green) lead (3) is a lead to the charge lamp.



- | | |
|-----------------------------|---------------------------------|
| (1) L (blue) lead | (7) Load |
| (2) RY (red / yellow) lead | A: To the battery |
| (3) WG (white / green) lead | B: To hour meter and tachometer |
| (4) Alternator assembly | C: To main switch |
| (5) IC regulator | D: To charge indicator |
| (6) Load | |

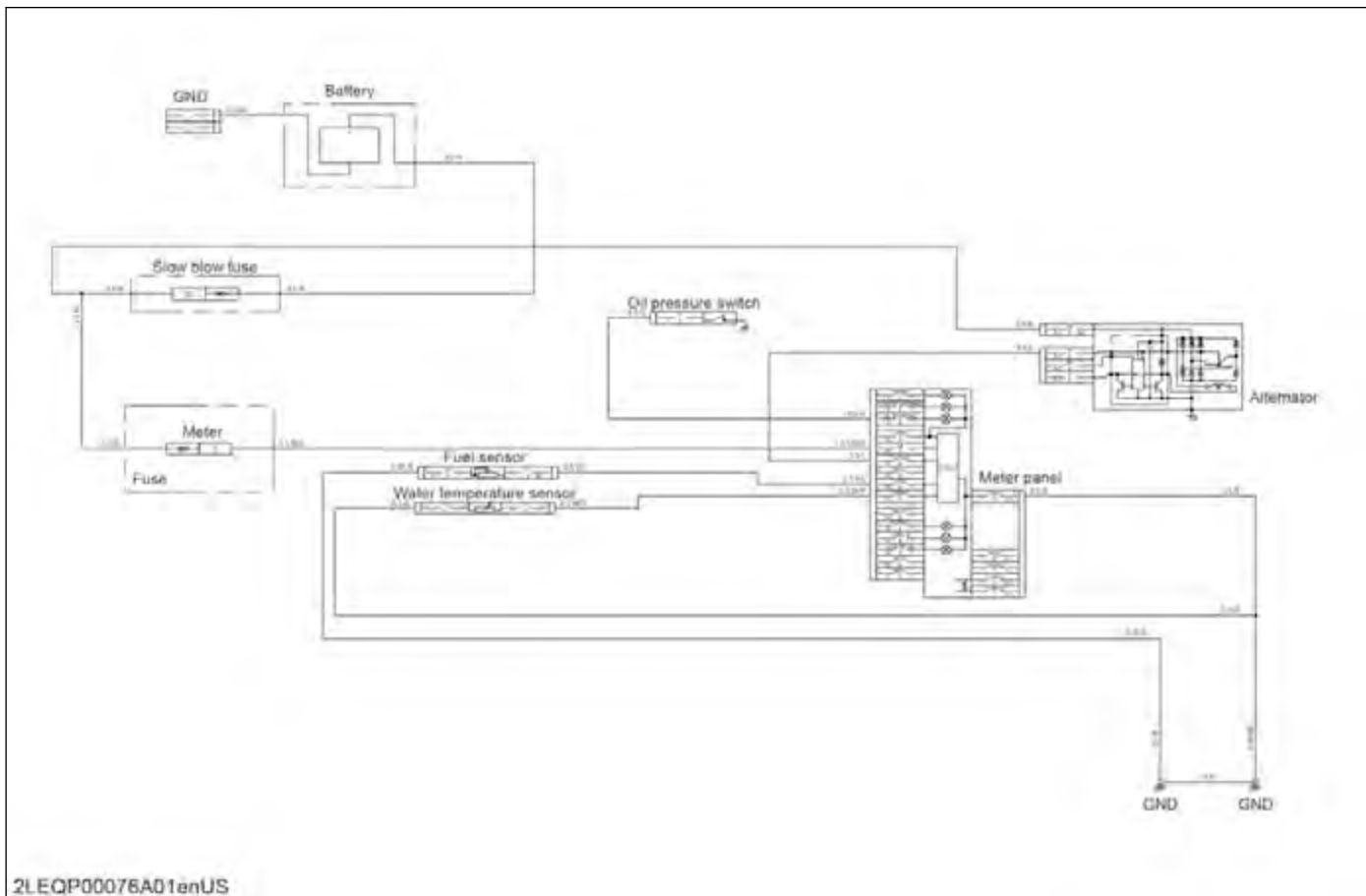
7. Lighting system

7.1 Electrical circuit for lighting system



8. Gauges

8.1 Electrical circuit of gauge system



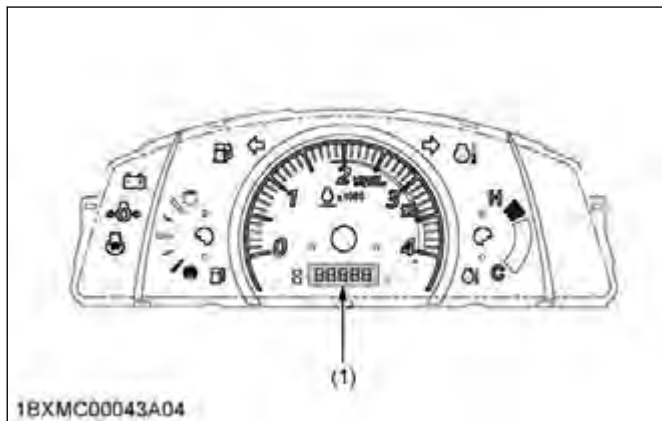
8. ELECTRICAL SYSTEM

8.2 Meter panel

8.2.1 Function of hour meter

The meter panel on this machine is equipped with a digital hour meter.

The hour meter indicates in five digits the operated hours when the main switch is turned to the **ON** position.



(1) Hour meter

Tractor operated hours	The step that the display operates
From 0.0 to 9999.9 Hr.	Every 0.1 Hr. step
10000 to 99999 Hr.	Every 1 Hr. step
After 99999 Hr.	99999 Hr. stays on

8.2.2 Function of tachometer

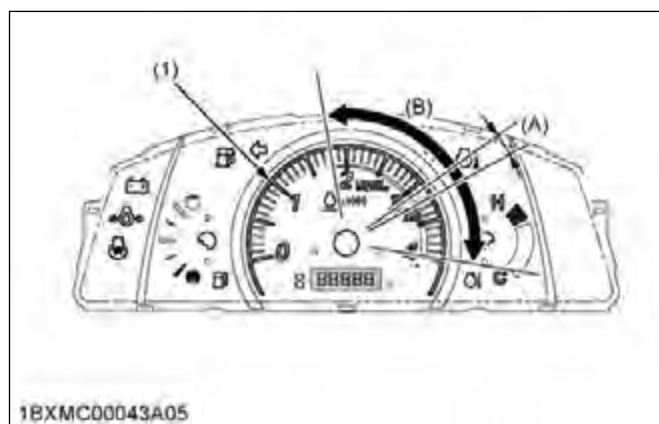
The meter panel on this machine is equipped with a tachometer.

When the key switch is in the **ON** position and the engine operates, the tachometer indicates the engine revolution per minute.

The meter picks up the voltage from the IC regulator located in the alternator.

The IC regulator sends a signal of the engine revolution to the meter.

The meter calculates the signal. It changes and indicates the signal to the engine revolution in cooperation with the voltage.



(1) Tachometer
(A) Yellow range
(B) Orange range

Implement	Recommended engine speed
PTO 540	Use within the yellow range (A)
Loader	Use within the orange range (B)

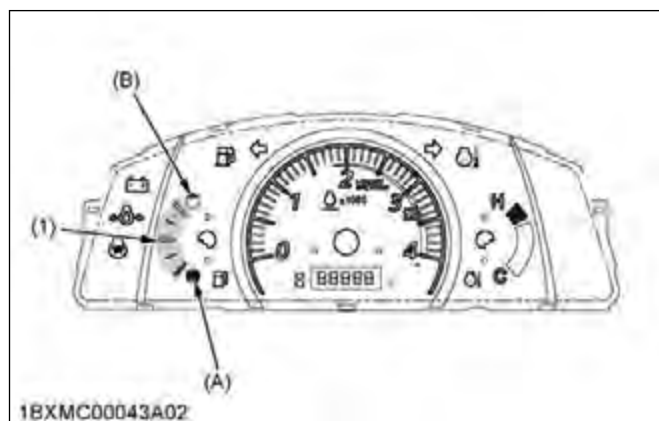
8.2.3 Function of fuel gauge

The meter panel on this machine is equipped with a fuel gauge.

The fuel level gauge and fuel level sensor are connected by the wire harness.

The fuel gauge detects the resistance from the fuel level sensor and indicates the fuel level in the fuel tank.

- When the fuel is close to empty level, the low fuel indicator lamp comes on.



(1) Fuel gauge
(A) Empty
(B) Full

8.2.4 Function of coolant temperature gauge

The meter panel on this machine is equipped with a coolant temperature gauge.

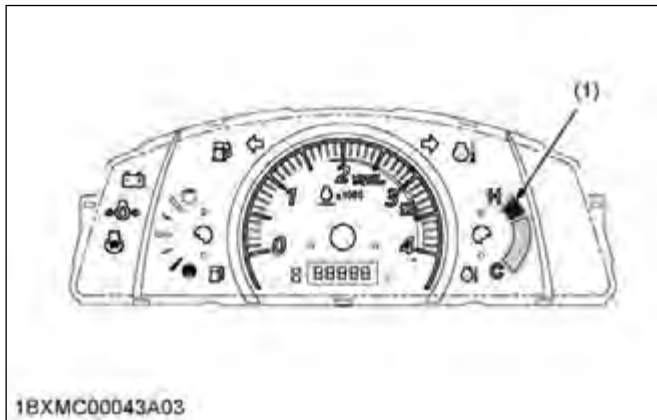
The coolant temperature gauge and coolant temperature sensor are connected by the wiring harness.

The coolant temperature gauge detects the resistance from the coolant temperature sensor.

The coolant temperature gauge indicates the coolant temperature in the thermostat housing.

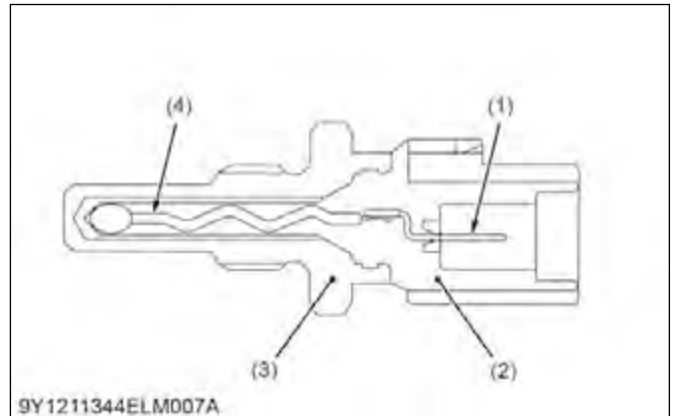
The relationship between the resistance of coolant temperature sensor and reading on the coolant temperature gauge is as follows.

- When the coolant temperature stays at 123 °C (253 °F), the coolant temperature indicator lamp comes on.
- When the coolant temperature stays below 118 °C (244 °F), the coolant temperature indicator lamp turns off.



(1) Coolant temperature gauge

Current varies with changes in the coolant temperature. When the coolant temperature is increased, the electrical resistance will become small, and when the coolant temperature is decreased, it will become large.

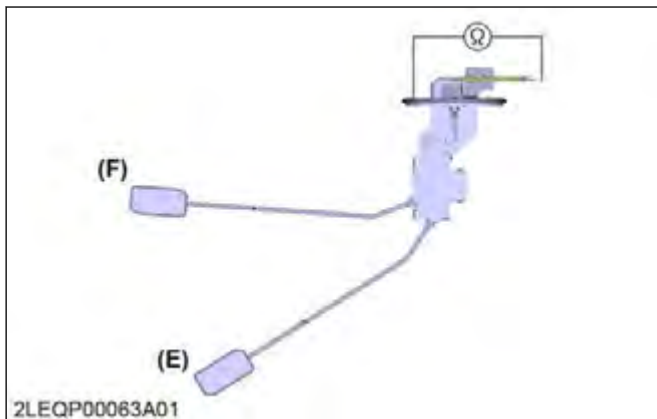


- | | |
|---------------|----------------|
| (1) Terminal | (3) Body |
| (2) Insulator | (4) Thermistor |

8.3 Function of fuel level sensor

The remaining fuel quantity is detected by the fuel level sensor installed in the fuel tank and indicated on the fuel gauge. For detection, a float and a resistor are used.

As the float lowers, the resistance of the variable resistor varies.



(E) Empty (F) Full

8.4 Function of coolant temperature sensor

The coolant temperature sensor is installed to the water pump housing, and its tip is in touch with the coolant. It contains a thermistor (4) whose electrical resistance decreases as the temperature increases.

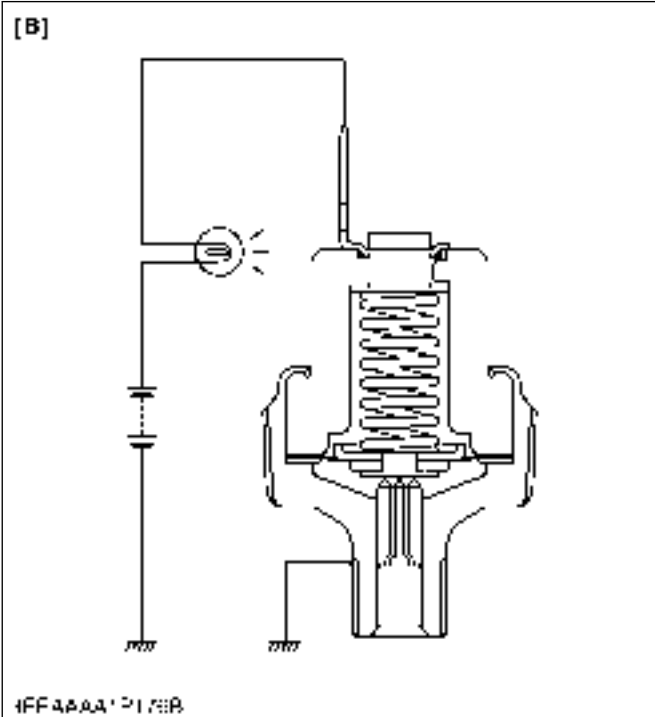
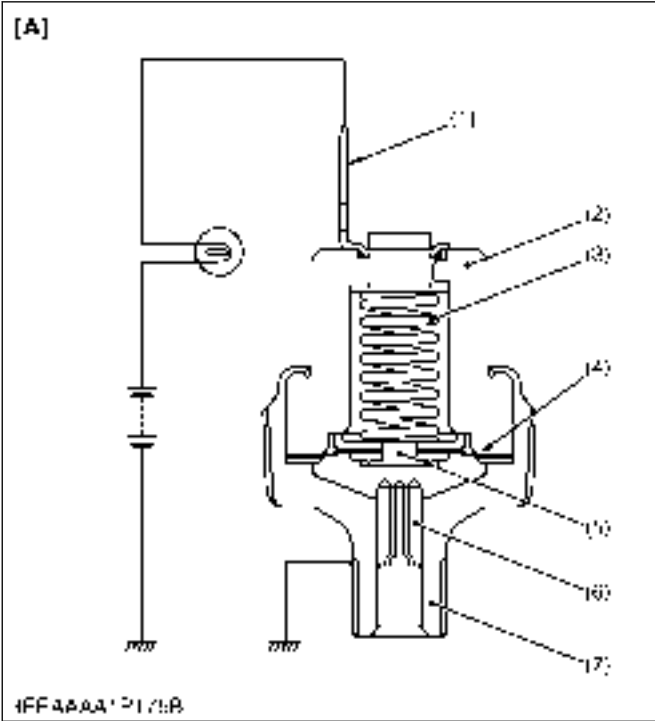
8.5 Function of oil pressure switch

[A] At the proper oil pressure

When the engine is started and as the proper oil pressure builds, the diaphragm (4) is pushed up. This separates the contact rivet (5) and breaks the circuit, causing the lamp to go out.

[B] At lower oil pressure, 49 kPa (0.50 kgf/cm², 7.1 psi) or less

If the oil pressure drops, the resulting deflection of the diaphragm (4) will close the contact rivet (5) and again complete the circuit. The lighted lamp warns that the pressure of the lubricating system has dropped below the pressure setting.

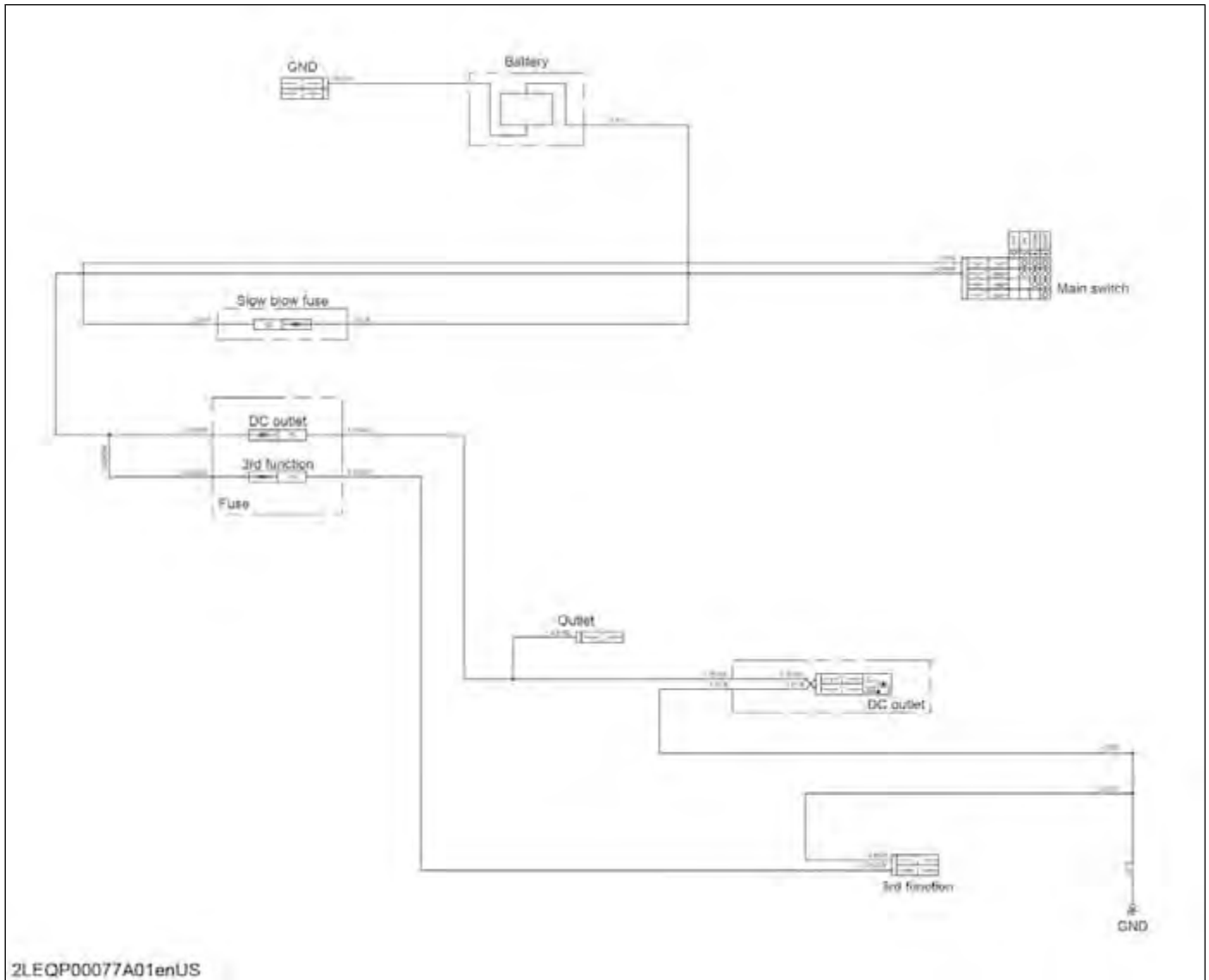


- (1) Terminal
 - (2) Insulator
 - (3) Spring
 - (4) Diaphragm
 - (5) Contact rivet
 - (6) Contact
 - (7) Oil switch body
- [A] At proper oil pressure
[B] At lower oil pressure

The oil pressure switch is mounted on the cylinder block and is led to the lubricating oil passage. When the oil pressure falls below the specified value, the oil pressure-warning lamp lights.

9. Others

9.1 Electrical circuit for accessory



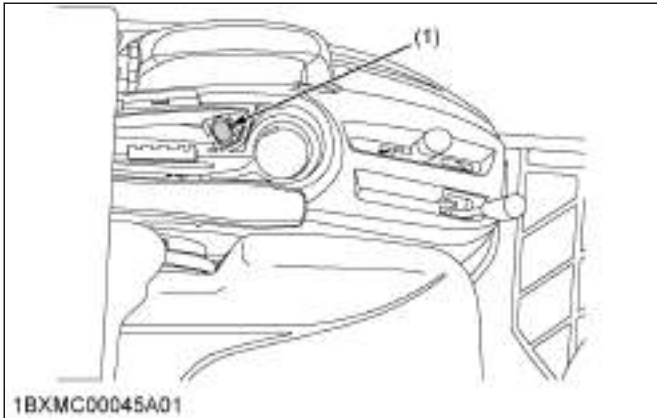
9.2 Function of DC outlet

■ IMPORTANT

- Do not use as cigarette lighter.
- Do not use when wet.

This machine is equipped with a DC outlet. It is located inside of the L.H. lever guide compartment.

The capacity of the outlet is 12 V / 120 W. Electrical device's such as an auxiliary light, mobile phone battery charger, or other 12 V components can be used with the outlet.



(1) DC outlet

SERVICING

1. Troubleshooting for electrical system

Fuse and wiring

Symptom	Probable cause and checking procedure	Solution	Reference page
All electrical equipment does not operate	1. Battery discharged or damaged	Recharge or replace	2-30
	2. Battery positive cable disconnected or improperly connected	Repair or replace	—
	3. Battery negative cable disconnected or improperly connected	Repair or replace	—
	4. Slow blow fuse blown	Replace	2-43
Fuse blown frequently	1. Short-circuited	Repair or replace	—

Battery

Symptom	Probable cause and checking procedure	Solution	Reference page
Battery discharges too quickly	1. Battery damaged	Replace	8-29
	2. Alternator damaged	Repair or replace	8-48
	3. IC regulator damaged	Replace	8-49
	4. Wiring harness disconnected or improperly connected (between battery positive terminal and regulator B terminal)	Repair or replace	—
	5. Cooling fan belt slipping	Adjust tension	2-33

8. ELECTRICAL SYSTEM

Starting system

Symptom	Probable cause and checking procedure	Solution	Reference page
Starter motor does not operate	1. Battery discharged or damaged	Recharge or replace	2-30
	2. Slow blow fuse blown	Replace	2-43
	3. Safety switch improperly adjusted or damaged	Repair or replace	8-33
	4. Wiring harness disconnected or improperly connected (between main switch 50 terminal and safety switches, between safety switches and starter motor, between battery positive terminal and starter motor)	Repair or replace	—
	5. Starter motor damaged	Repair or replace	8-47
	6. Main switch damaged	Replace	8-30
Engine does not stop when main switch is turned OFF	1. Fuse blown (15 A)	Replace	2-43
	2. Wiring harness disconnected or improperly connected (between main switch AC terminal and engine stop solenoid)	Repair or replace	8-1
	3. Engine stop solenoid damaged	Replace	8-36
	4. Timer relay damaged	Replace	8-37
Engine does not start	1. Engine stop solenoid damaged	Replace	8-36
	2. Timer relay damaged	Replace	8-37

Operator presence control (OPC)

Symptom	Probable cause and checking procedure	Solution	Reference page
Engine does not stop	1. Solenoid fuse blown (15 A)	Replace	2-43
	2. Engine stop solenoid relay damaged	Replace	8-36
	3. Engine stop solenoid damaged	Replace	8-36
	4. PTO shift lever switch damaged	Adjust or replace	8-33
	5. HST pedal switch damaged	Adjust or replace	8-34
	6. Wiring harness disconnected or improperly connected (between key stop solenoid relay and engine stop solenoid, between engine stop solenoid relay and battery positive terminal)	Repair or replace	8-1
Starter motor does not operate	1. Solenoid fuse blown (15 A)	Replace	2-43
	2. Engine stop solenoid damaged	Replace	8-36
	3. Engine stop solenoid relay damaged	Replace	8-36
	4. Seat switch or seat turnover switch damaged	Adjust or replace	8-34
	5. PTO shift lever switch damaged	Adjust or replace	8-33
	6. HST pedal switch damaged	Adjust or replace	8-34
	7. Wiring harness disconnected or improperly connected (between key stop solenoid relay and engine stop solenoid, between engine stop solenoid relay and battery positive terminal)	Repair or replace	8-1
Engine stops when HST pedal is pushed in forward or in reverse	1. Wrong wiring of seat switch and seat turn over switch	Proper wiring	8-1
Engine stops suddenly	1. Seat reverse switch	Adjust the switch position	8-34

8. ELECTRICAL SYSTEM

Charging system

Symptom	Probable cause and checking procedure	Solution	Reference page
Charging lamp does not light when main switch is turned ON	1. Fuse blown (15 A)	Replace	2-43
	2. Wiring harness disconnected or improperly connected (between main switch AC terminal and panel board, between panel board and alternator)	Repair or replace	8-1
	3. Alternator damaged	Repair or replace	8-48
	4. IC regulator damaged	Replace	8-49
Charging lamp does not go off when engine operates	1. Wiring harness disconnected or improperly connected (between main switch 30 terminal and dynamo, between panel board and alternator)	Repair or replace	8-1
	2. Alternator damaged	Repair or replace	8-48
	3. IC regulator damaged	Replace	8-49

Lighting system

Symptom	Probable cause and checking procedure	Solution	Reference page
Head light does not light	1. Fuse blown (15 A)	Replace	2-43
	2. Bulb blown	Replace	2-44
	3. Wiring harness disconnected or improperly connected (between main switch AC terminal and head light switch, between head light switch and head light)	Repair or replace	8-1
Tail light does not light	1. Fuse blown (15 A)	Replace	2-43
	2. Bulb blown	Replace	2-44
	3. Wiring harness disconnected or improperly connected (between main switch AC terminal and head light switch, between head light switch and tail light)	Repair or replace	8-1
Illumination light does not light	1. Fuse blown (15 A)	Replace	2-43
	2. Wiring harness disconnected or improperly connected (between main switch AC terminal and head light switch, between head light switch and illumination light)	Repair or replace	8-1
Hazard lamp does not light	1. Fuse blown (15 A)	Replace	2-43
	2. Bulb blown	Replace	2-44
	3. Wiring harness disconnected or improperly connected	Repair or replace	8-1
	4. Flasher unit damaged	Replace	8-41
	5. Hazard switch damaged	Replace	8-38
Hazard indicator lamp does not light	1. Wiring harness disconnected or improperly connected	Repair or replace	8-1
Hazard lamp does not flicker	1. Flasher unit damaged	Replace	8-41
Turn signal light does not light	1. Fuse blown (15 A)	Replace	2-43
	2. Bulb blown	Replace	2-44
	3. Wiring harness disconnected or improperly connected	Repair or replace	8-1
	4. Flasher unit damaged	Replace	8-41
	5. Turn signal switch damaged	Replace	8-38
Turn signal light indicator lamp does not light	1. Wiring harness disconnected or improperly connected (turn signal switch and indicator lamp)	Repair or replace	8-1

(Continued)

8. ELECTRICAL SYSTEM

Symptom	Probable cause and checking procedure	Solution	Reference page
Turn signal light does not flicker	1. Flasher unit damaged	Replace	8-41
	2. Turn signal switch damaged	Replace	8-38
Glow lamp does not light when main switch is in PRE-HEAT position	1. Battery discharged or damaged	Recharge or replace	8-29
	2. Slow blow fuse blown	Replace	2-43
	3. Wiring harness disconnected or improperly connected (between main switch 19 terminal and PRE-HEAT indicator, between PRE-HEAT indicator and glow plugs)	Repair or replace	8-1
	4. Main switch damaged	Replace	8-30
Oil pressure lamp lights up when engine operates	1. Engine oil pressure too low	Repair engine	—
	2. Engine oil insufficient	Fill	2-7
	3. Oil pressure switch damaged	Replace	8-44
	4. Short circuit between oil pressure switch lead and chassis	Repair	8-44
Oil pressure lamp does not light when main switch is turned ON and engine does not operate	1. Oil pressure switch damaged	Replace	8-44
	2. Wiring harness disconnected or improperly connected (between panel board and oil pressure switch)	Repair or replace	8-1

Gauges

Symptom	Probable cause and checking procedure	Solution	Reference page
Fuel warning lamp does not light	1. Fuel gauge damaged	Replace	8-46
	2. Fuel level sensor damaged	Replace	8-44
	3. Wiring harness disconnected or improperly connected (between fuel gauge and fuel level sensor)	Repair or replace	8-1
Coolant temperature gauge does not function	1. Coolant temperature gauge damaged	Replace	8-44
	2. Coolant temperature sensor damaged	Replace	8-44
	3. Wiring harness disconnected or improperly connected (between coolant temperature gauge and coolant temperature sensor)	Repair or replace	8-1

2. Servicing specifications for electrical system

Item		Factory specification	Allowable limit
Battery	Voltage	More than 12 V	—
	Potential difference	Less than 0.1 V	—
Glow plug	Resistance	Approx. 0.9 Ω	—
Alternator	Charging current / alternator speed	14 to 15 A / 5200 min ⁻¹ (rpm)	—
	Charging voltage / alternator speed	14 to 15 A / 5200 min ⁻¹ (rpm)	—
Head light switch	Switch OFF	Infinity	—
	Switch ON	0 Ω	—
Turn signal switch	Switch OFF	Infinity	—
	Switch R	0 Ω	—
	Switch L	0 Ω	—
Hazard lamp switch	Switch OFF	Infinity	—
	Switch ON	0 Ω	—
Starter • Commutator	O.D.	30.0 mm 1.181 in.	29.0 mm 1.142 in.
	Difference of O.D.'s	Less than 0.02 mm 0.0008 in.	0.05 mm 0.0020 in.
• Mica	Undercut	0.50 to 0.80 mm 0.0197 to 0.0315 in.	0.20 mm 0.0079 in.
• Brush	Length	14.0 mm 0.551 in.	9.0 mm 0.354 in.
Alternator	No-load voltage	More than 14 V	—
• Stator	Resistance	Less than 1.0 Ω	—
• Rotor	Resistance	2.9 Ω	—
• Slip ring	O.D.	14.4 mm 0.567 in.	14.0 mm 0.551 in.
• Brush	Length	10.5 mm 0.413 in.	8.4 mm 0.331 in.
Hand throttle lever	Operating force	89.0 to 111 N 9.08 to 11.3 kgf 20 to 25 lbf	—

3. Tightening torques for electrical system

Item	N · m	kgf · m	lbf · ft
Starter B terminal nut	5.9 to 11.8	0.6 to 1.2	4.3 to 8.7
Pulley nut	58.4 to 78.9	5.95 to 80.5	43.1 to 58.2

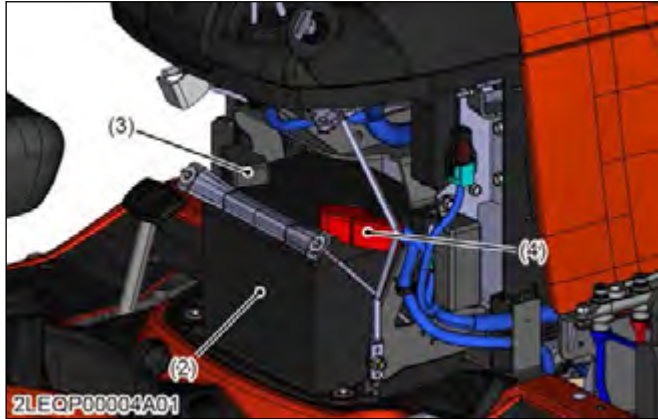
RELATED PAGE

[TIGHTENING TORQUES on page 2-13](#)

4. Checking and adjusting

4.1 Battery

4.1.1 Checking battery voltage

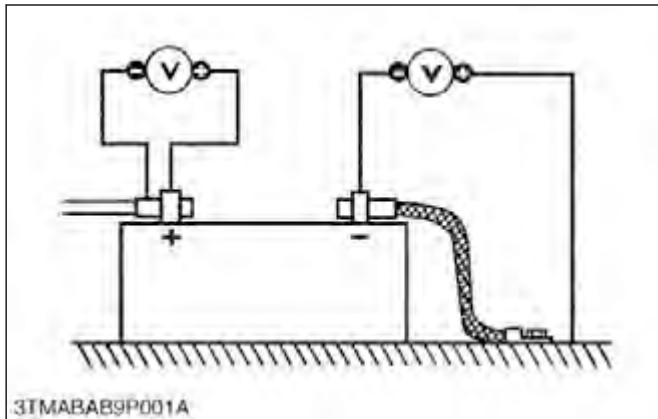


- (2) Battery (4) Positive cable
(3) Negative cable

1. Stop the engine and turn the main switch **OFF**.
2. Connect the COM (-) lead of the voltmeter to the battery's negative terminal post and the (+) lead to the positive terminal post, and measure the battery voltage.
3. If the battery voltage is less than the factory specification, check the battery specific gravity and recharge the battery.

Battery voltage	Factory specification	More than 12 V
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4.1.2 Checking battery terminal connection



1. Turn the main switch **ON**, and turn on the head light.
2. Measure the voltage with a voltmeter across the battery's positive terminal post and the cable terminal, and the voltage across the battery's negative terminal post and the chassis.

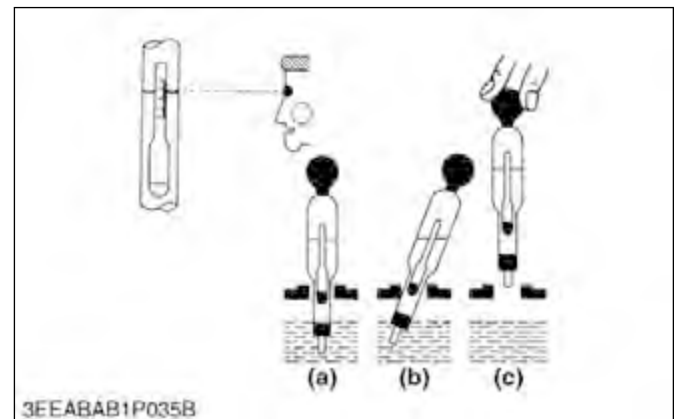
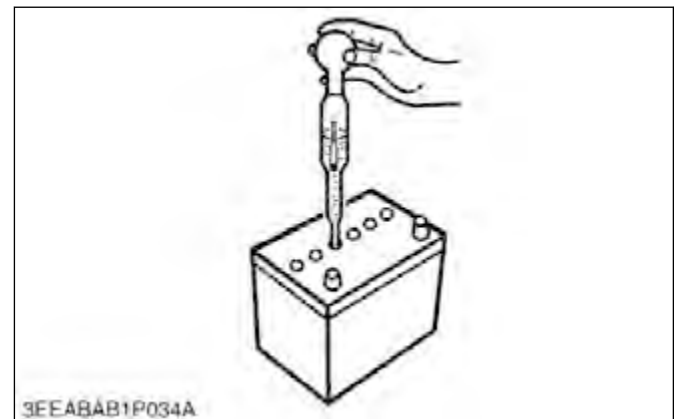
3. If the measurement exceeds the factory specification, clean the battery terminal posts and cable clamps, and tighten them firmly.

Potential difference	Factory specification	Less than 0.1 V
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4.1.3 Checking battery specific gravity

NOTE

- Hold the hydrometer tube vertical without removing it from the electrolyte.
- Do not suck too much electrolyte into the tube.
- Allow the float to move freely and hold the hydrometer at eye level.
- The hydrometer reading must be taken at the highest electrolyte level.



- (a) Good (c) Bad
(b) Bad

1. Check the specific gravity of the electrolyte in each cell with a hydrometer.

8. ELECTRICAL SYSTEM

- When the electrolyte temperature differs from that at which the hydrometer was calibrated, correct the specific gravity reading following the formula mentioned in (Reference).

(Reference)

- Specific gravity slightly varies with temperature. To be exact, the specific gravity decreases by 0.0007 with an increase of 1 °C (0.0004 with an increase of 1 °F) in temperature, and increases by 0.0007 with a decreases of 1 °C (0.0004 with a decrease of 1 °F).

Therefore, using 20 °C (68 °F) as a reference, the specific gravity reading must be corrected by the following formula:

- Specific gravity at 20 °C = Measured value + 0.0007 × (electrolyte temperature -20 °C)
- Specific gravity at 68 °F = Measured value + 0.0004 × (electrolyte temperature -68 °F)

Specific gravity	State of charge
1.260 Sp. Gr.	100% charged
1.230 Sp. Gr.	75% charged
1.200 Sp. Gr.	50% charged
1.170 Sp. Gr.	25% charged
1.140 Sp. Gr.	Very little useful capacity
1.110 Sp. Gr.	Discharged

At an electrolyte temperature of 20 °C (68 °F)

- If the specific gravity is less than 1.215 (after it is corrected for temperature), charge or replace the battery.
- If the specific gravity differs between any two cells by more than 0.05, replace the battery.

4.2 Main switch

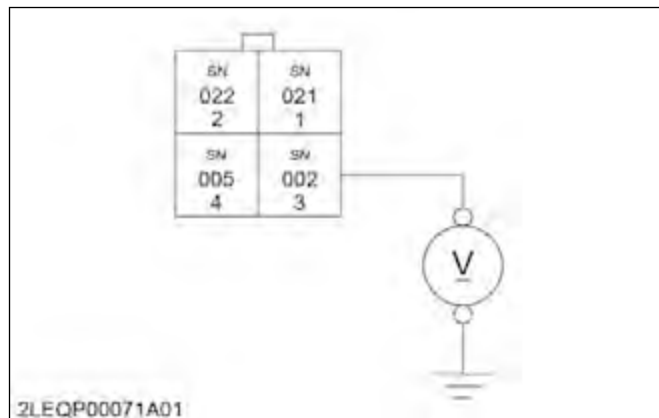
4.2.1 Checking main switch connector voltage

- Remove the under cover panel.
- Disconnect the 4P connector and remove the main switch (1).



(1) Main switch

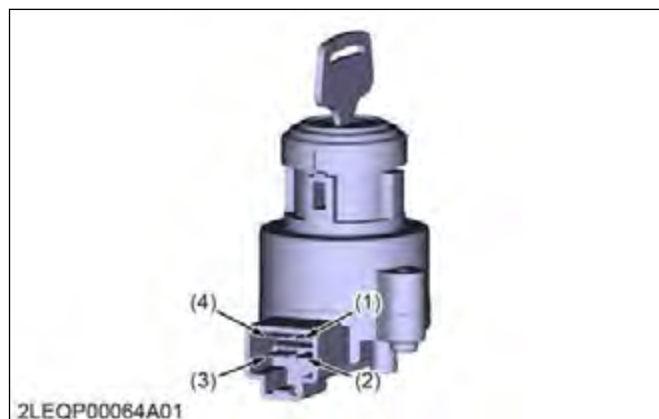
- Measure the voltage with a voltmeter across the 4P connector 3 terminal and the chassis.



- If the voltage differs from the battery voltage (11 to 14 V), the wiring harness is damaged.

Voltage	Connector 3 terminal – Chassis	Approx. battery voltage
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4.2.2 Checking main switch continuity at off position

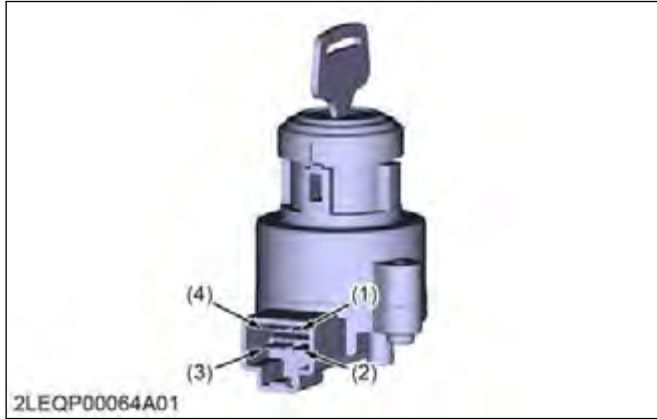


- (1) B terminal
(2) ST terminal
(3) ACC terminal
(4) G terminal

- Set the main switch to the **OFF** position.
- Measure the resistance with an ohmmeter across the B terminal and the ACC terminal, B terminal and ST terminal, B terminal and G terminal.
- If infinity is not indicated, the contacts of the main switch are damaged.

Resistance	B terminal – ACC terminal	Infinity
	B terminal – ST terminal	
	B terminal – G terminal	

4.2.3 Checking main switch continuity at on position

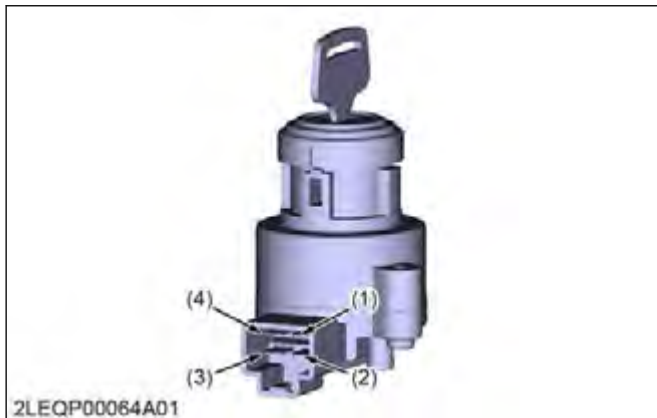


- (1) B terminal (3) ACC terminal
(2) ST terminal (4) G terminal

1. Set the main switch to the **ON** position.
2. Measure the resistance with an ohmmeter across the B terminal and the ACC terminal.
3. If 0 ohm is not indicated, the B – ACC contact of the main switch is damaged.

Resistance	B terminal – ACC terminal	0 Ω
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4.2.4 Checking main switch continuity at preheat position

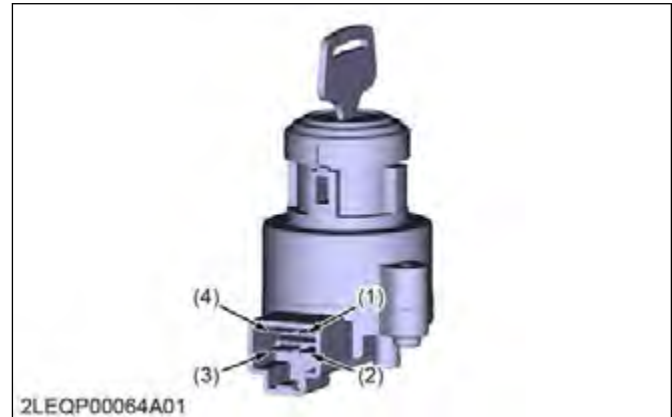


- (1) B terminal (3) ACC terminal
(2) ST terminal (4) G terminal

1. Set and hold the main switch key at the **PREHEAT** position.
2. Measure the resistance with an ohmmeter across the B terminal and the G terminal, and measure the resistance across the B terminal and the ACC terminal.
3. If 0 ohm is not indicated, these contacts of the main switch are damaged.

Resistance	B terminal – G terminal	0 Ω
	B terminal – ACC terminal	

4.2.5 Checking main switch continuity at start position



- (1) B terminal (3) ACC terminal
(2) ST terminal (4) G terminal

1. Set and hold the main switch key at the **START** position.
2. Measure the resistance with an ohmmeter across the B terminal and the G terminal, across the B terminal and the ST terminal, and across the B terminal and the ACC terminal.
3. If 0 ohm is not indicated, these contacts of the main switch are damaged.

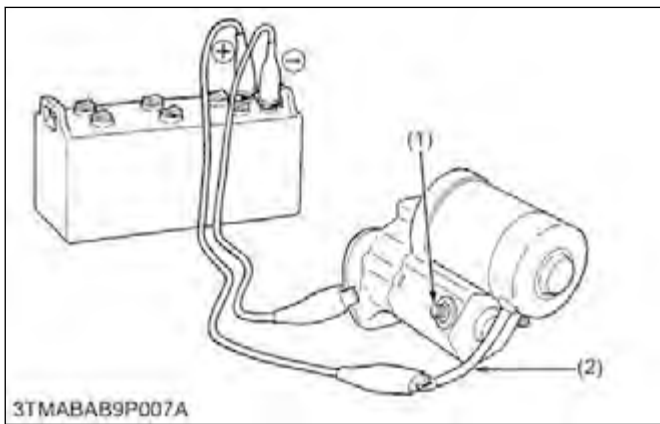
Resistance	B terminal – G terminal	0 Ω
	B terminal – ST terminal	
	B terminal – ACC terminal	

4.3 Starter

4.3.1 Checking motor

CAUTION

- Secure the starter to prevent it from jumping up and down while testing the motor.



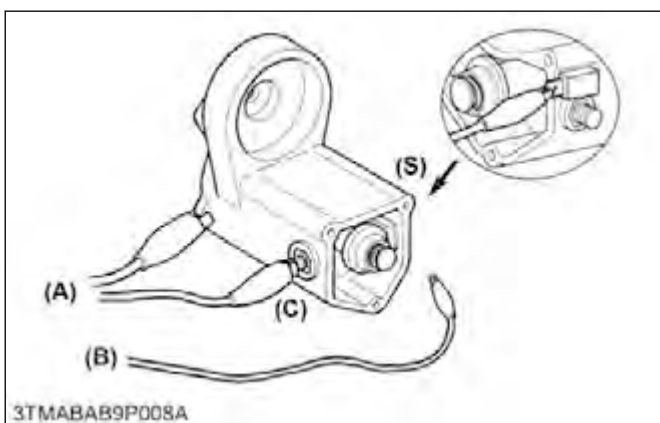
(1) C terminal (2) Connecting lead

1. Disconnect the battery negative cable from the battery.
2. Disconnect the battery positive cable and the leads from the starter.
3. Remove the starter from the engine.
4. Disconnect the connecting lead (2) from the starter C terminal (1).
5. Connect a jumper lead from the connecting lead (2) to the battery positive terminal post.
6. Connect a jumper lead momentarily between the starter motor housing and the battery negative terminal post.
7. If the motor does not operate, check the motor.

4.3.2 Testing starter magnet switch (pull-in, holding coils)

■ IMPORTANT

- Testing time must be 3 to 5 sec.



(A) To negative terminal (C) C terminal
(B) To positive terminal (S) S terminal

1. Remove the motor from the starter housing.
2. Prepare a 6 V battery for the test.
3. Connect jumper leads from the battery negative terminal to the housing and the starter C terminal.

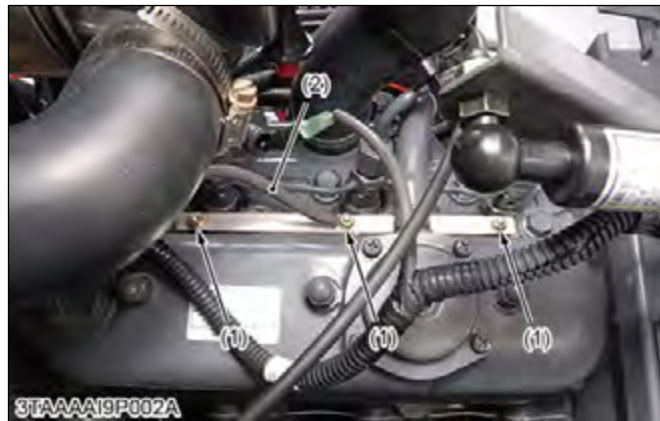
The plunger should be attracted and the pinion gear should pop out when a jumper lead is connected from the battery positive terminal to the S terminal.

4. Disconnect the jumper lead to the starter C terminal. Then the pinion gear should remain popped out.

4.4 Glow plug

4.4.1 Checking glow plug lead terminal voltage

1. Disconnect the wiring lead (2) from the glow plug (1) after turning the main switch **OFF**.

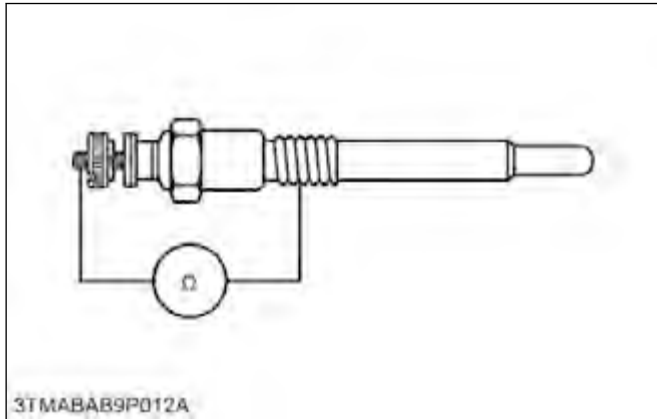


(1) Glow plug (2) Wiring lead (Positive)

2. Turn the main switch key to the **PREHEAT** position, and measure the voltage between the lead terminal and the chassis.
3. Turn the main switch key to the **START** position, and measure the voltage with a voltmeter between the lead terminal and the chassis.
4. If the voltage at either position differs from the battery voltage, the wiring harness or main switch is damaged.

Voltage (Lead terminal – Chassis)	Main switch key at PRE-HEAT	Approx. battery voltage
	Main switch key at START	Approx. battery voltage

4.4.2 Checking glow plug continuity



1. Disconnect the lead from the glow plugs.
2. Measure the resistance with an ohmmeter between the glow plug terminal and the chassis.
3. If 0 ohm is indicated, the screw at the tip of the glow plug and the housing are short-circuited.
4. If the factory specification is not indicated, the glow plug is damaged.

Glow plug	Factory specification	Approx. 0.9 Ω
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4.5 Safety switch

4.5.1 Checking PTO shift lever switch continuity



- | | |
|----------------------------|----------------|
| (1) PTO shift lever switch | (4) 8 terminal |
| (2) Plunger | (5) 5 terminal |
| (3) 4 terminal | (6) 1 terminal |

1. Remove the left rear wheel.
2. Remove the PTO shift lever switch (1).



- (1) PTO shift lever switch

3. Measure the resistance with an ohmmeter across the switch terminals.
4. If the resistance values specified below are not indicated, the safety switch is damaged.

Plunger is pushed into the switch body.

Resistance	4 terminal (3) – 8 terminal (4)	0 Ω
	5 terminal (5) – 1 terminal (6)	0 Ω

Plunger is released.

Resistance	4 terminal (3) – 8 terminal (4)	Infinity
	5 terminal (5) – 1 terminal (6)	Infinity

4.5.2 Checking HST neutral switch continuity



- (1) HST neutral switch
- (2) Plunger
- (3) 4 terminal
- (4) 8 terminal
- (5) 5 terminal
- (6) 1 terminal

1. Remove the right rear wheel.
2. Remove the HST neutral switch (1).



(1) HST neutral switch

3. Measure the resistance with an ohmmeter across the HST neutral switch terminals.
4. If the resistance values specified below are not indicated, the safety switch is damaged.

Plunger is pushed into the switch body.

Resistance	4 terminal (3) – 8 terminal (4)	0 Ω
	5 terminal (5) – 1 terminal (6)	0 Ω

Plunger is released.

Resistance	4 terminal (3) – 8 terminal (4)	Infinity
	5 terminal (5) – 1 terminal (6)	Infinity

4.6 Operator presence control (OPC) system

4.6.1 Checking seat switch and seat turnover switch continuity

1. Disconnect the 2P connectors (2), (3) from the seat switch and the seat turnover switch (1).



- (1) Seat switch / seat turnover switch
- (2) Seat turnover switch 2P connector
- (3) Seat switch 2P connector
- (4) Seat

2. Remove the seat switch and seat turnover switch (1).
3. Connect the circuit tester to the terminals (5).



(1) Seat switch / seat turnover (5) Terminal switch

(When switch is not pushed / when operator leaves the seat)

1. Measure the resistance between terminals (5).
2. If continuity is not as shown below, the switch is damaged. Replace it.

Resistance	When switch is not pushed. / when operator leaves the seat.	Infinity
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[A] Seat switch is not pushed.

(When switch is pushed / when operator sits on the seat)

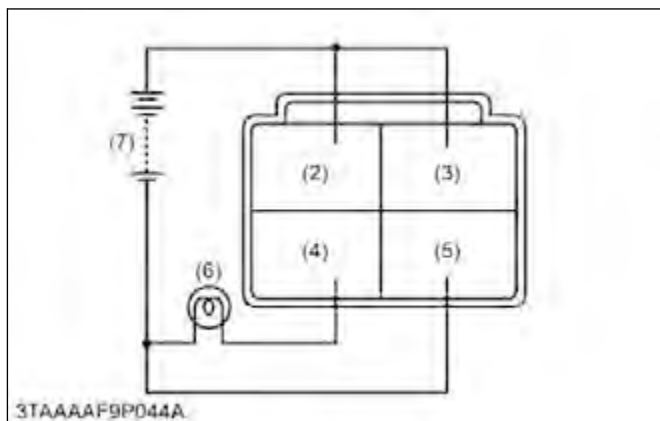
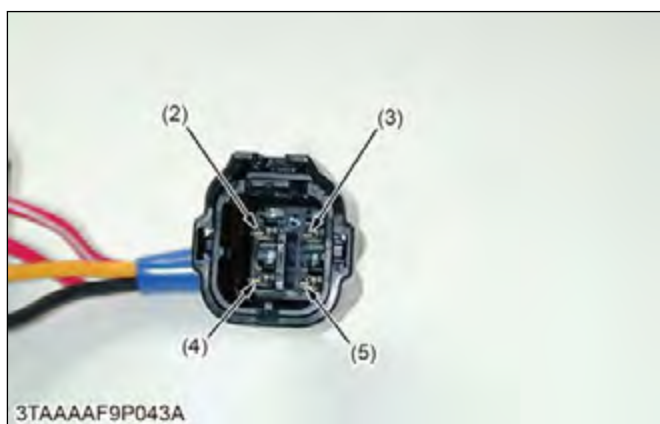
1. Measure the resistance between terminals (5).
2. If continuity is not as shown below, the switch is damaged. Replace it.

Resistance	When switch is pushed. / when operator sits on the seat.	0 Ω
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[B] Seat switch is pushed.

4.6.2 Checking OPC timer



- (2) Orange / white terminal (from battery)
- (3) Yellow terminal (from OPC switch)
- (4) Red terminal (to key stop solenoid)
- (5) Black terminal (to frame earth)
- (6) Bulb (Load)
- (7) Battery

1. Remove the OPC timer.
The OPC timer is located under the upper panel.

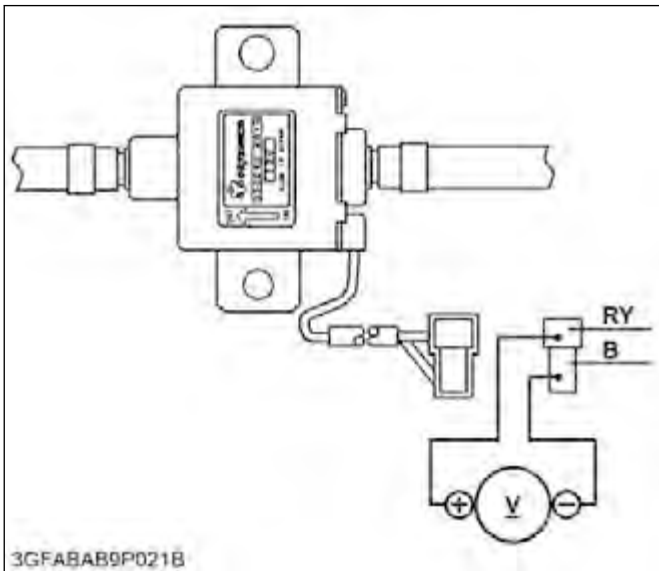


(1) OPC timer

2. Connect the jumper leads across the battery terminal and the red / white terminal (2), and across the battery positive terminal and the yellow terminal (3).
3. Connect the jumper lead across the battery negative terminal and the black terminal (5), and across the battery negative terminal and the bulb terminal.
4. Connect the jumper lead across the red terminal (4) and the bulb terminal.
5. If the bulb lights up when disconnecting the jumper lead from the red / white terminal (2), the OPC timer (1) is proper.

4.7 Fuel pump

4.7.1 Checking fuel pump connector voltage

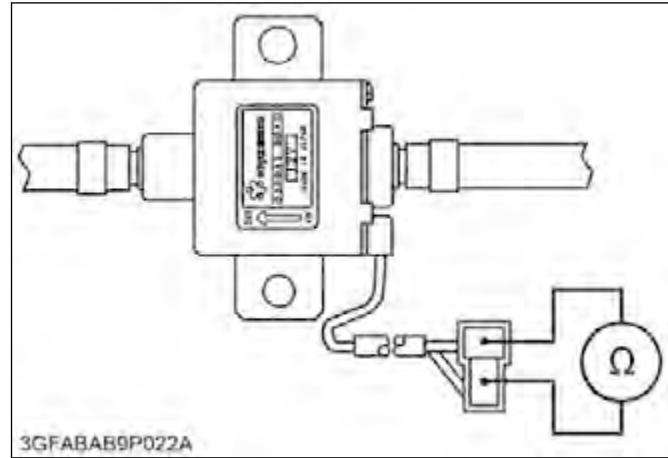


1. Disconnect the 2P connector from the fuel pump.

2. Turn the main switch key to the **ON** position, and measure the voltage with a voltmeter between the connector terminals.
3. If the voltage differs from the battery voltage, the wiring harness or main switch is damaged.

Voltage	Between connector terminals	Approx. battery voltage
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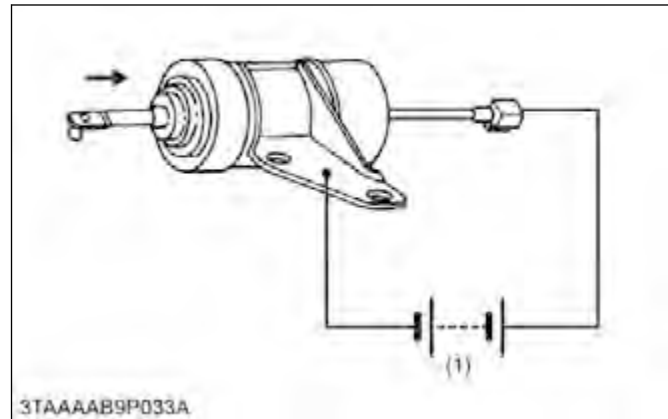
4.7.2 Checking fuel pump continuity



1. Disconnect the 2P connector from the fuel pump.
2. Check the continuity between the connector terminals with an ohmmeter.
3. If it does not conduct, the fuel pump is damaged.

4.8 Engine stop solenoid

4.8.1 Testing engine stop solenoid



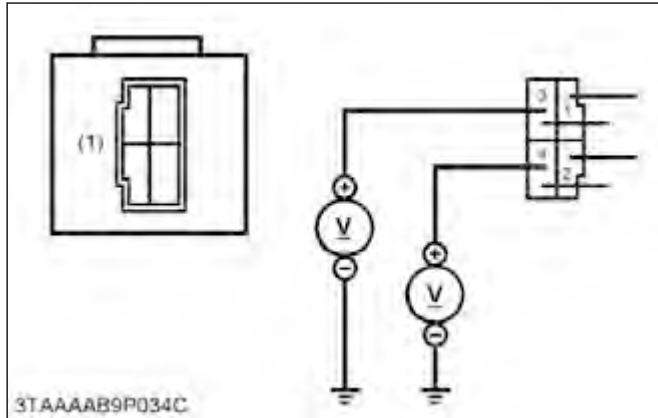
(1) Battery (12 V)

1. Disconnect the 1P connector from the engine stop solenoid.
2. Remove the engine stop solenoid from the engine.
3. Connect the jumper leads from the battery positive terminal to the 1P connector, and from the battery negative terminal to the engine stop solenoid body.

- If the solenoid plunger is not attracted, the engine stop solenoid is damaged.

4.9 Timer relay

4.9.1 Checking timer relay connector voltage

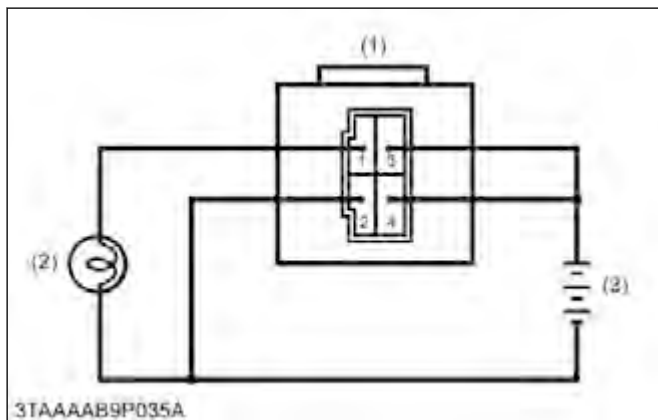


(1) Timer relay

- Disconnect the connector from the timer relay after turning the main switch **OFF**.
- Measure the voltage with a voltmeter across the connector terminal 4 and chassis.
- Turn the main switch **ON**, and measure the voltage across the connector terminal 3 and chassis.
- If these voltages differ from the battery voltage, the wiring harness or main switch is damaged.

Voltage	Connector terminal 4 – Chassis	Approx. battery voltage
	Connector terminal 3 – Chassis	Approx. battery voltage

4.9.2 Testing timer relay



(1) Timer relay (3) Battery (12 V)
(2) Load (Lamp)

- Remove the timer relay (1).



(1) Timer relay

- Connect jumper leads across the battery positive terminal and the timer relay terminal 3, and across the battery positive terminal and the timer relay terminal 4.
- Connect jumper leads across the battery negative terminal and the timer relay terminal 2, and across the battery negative terminal and the bulb terminal.
- Connect jumper lead across the timer relay terminal 1 and the bulb terminal.
- If the bulb lights up when disconnecting a jumper lead from the terminal 3 and goes off 6 to 13 seconds late, the timer relay is proper.

4.10 Charging system

4.10.1 Checking battery charging current

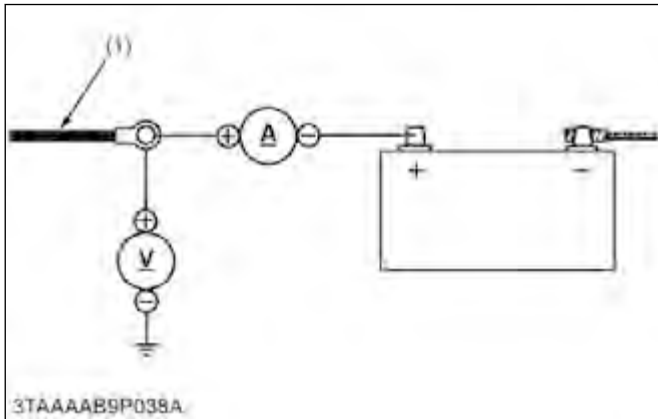
NOTE

- Connect an ammeter only after starting the engine.
- When the electrical loads is considerably low or the battery is fully charged, the specified reading may not be obtained.

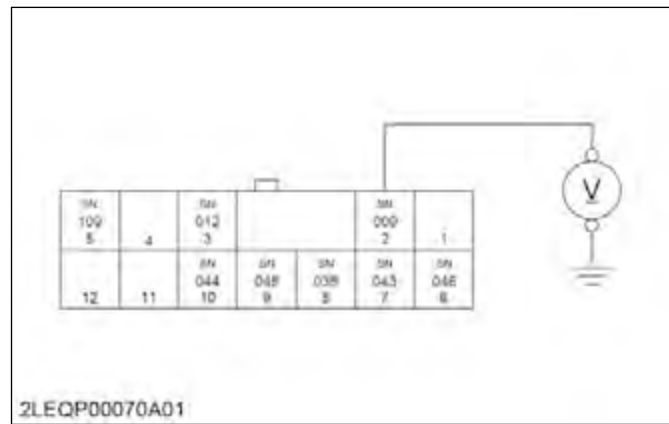
Current	Factory specification	14 to 15 A
Voltage		14 to 15 V
Alternator speed		5200 min ⁻¹ (rpm)

8. ELECTRICAL SYSTEM

1. After starting the engine, disconnect the battery positive cord (+), and connect an ammeter and voltmeter. Then switch on all electrical loads (such as head lights) and measure the charging current.



(1) Battery positive cord



2. If the voltage differs from the battery voltage, the wiring harness and main switch is damaged.

Voltage	Main switch at on position	2 terminal – Chassis	Battery voltage
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4.11 Combination switch

4.11.1 Removing combination switch



(1) Combination switch

1. Remove the under panel, and disconnect the combination switch connector.
2. Remove the combination switch (1).

4.11.2 Checking combination switch connector voltage

1. Measure the voltage with a voltmeter across the connector 2 terminal and chassis when the main switch is in the **ON** position.

4.11.3 Checking head light switch continuity when setting switch at OFF position



- | | |
|-----------------------|-----------------------------|
| (1) Red / yellow lead | (4) Orange lead |
| (2) Blue / white lead | (5) Red / white lead |
| (3) Yellow lead | (A) Head light OFF position |

1. Set the light switch to the **OFF** position.

- Measure the resistance with an ohmmeter across the red / yellow lead (1) to the orange lead (4), the red / yellow lead (1) to the yellow lead (3).
- If infinity is not indicated, the head light switch is damaged.

Resistance (Switch at OFF position)	Red / yellow lead (1) – Orange lead (4)	Infinity
	Red / yellow lead (1) – Yellow lead (3)	

Resistance (Switch at ON position)	Red / yellow lead (1) – Orange lead (4)	0 Ω
	Red / yellow lead (1) – Yellow lead (3)	

4.11.4 Checking head light switch continuity when setting switch at ON position



- | | |
|-----------------------|------------------------------------|
| (1) Red / yellow lead | (5) Red / white lead |
| (2) Blue / white lead | (A) Head light OFF position |
| (3) Yellow lead | (B) Head light ON position |
| (4) Orange lead | |

- Set the light switch to the **ON** position.
- Measure the resistance with an ohmmeter across the red / yellow lead (1) to the orange lead (4) and the red / yellow lead (1) to the yellow lead (3).
- If infinity is not indicated, the head light switch is damaged.

4.11.5 Checking turn signal light switch continuity when setting switch knob at OFF position



- | | |
|------------------------|--|
| (1) Green lead | (A) Turn signal light switch OFF position |
| (2) Red / white lead | |
| (3) Green / white lead | |

- Set the turn signal switch knob to the **OFF** position.
- Measure the resistance with an ohmmeter across the green lead (1) and red / white lead (2), and across to the green lead (1) and green / white lead (3).
- If infinity is not indicated, the combination switch is damaged.

Resistance (Switch knob at OFF position)	Green lead (1) – Red / white lead (2)	Infinity
	Green lead (1) – Green / white lead (3)	

4.11.6 Checking turn signal light switch continuity when setting switch knob at RIGHT position

4.11.7 Checking turn signal light switch continuity when setting switch knob at LEFT position



(1) Green lead
(2) Red / white lead
(3) Green / white lead
(A) Turn signal light switch **RIGHT** position

(1) Green lead
(2) Red / white lead
(3) Green / white lead
(A) Turn signal light switch **LEFT** position

1. Set the turn signal switch knob to the **RIGHT** position.
2. Measure the resistance with an ohmmeter across the green lead (1) and red / white lead (2), and across to the green lead (1) and green / white lead (3).
3. If 0 Ω is not indicated, the combination switch is damaged.

1. Set the turn signal switch knob to the **LEFT** position.
2. Measure the resistance with an ohmmeter across the green lead (1) and red / white lead (2), and across to the green lead (1) and green / white lead (3).
3. If 0 Ω is not indicated, the combination switch is damaged.

Resistance (Switch knob at RIGHT position)	Green lead (1) – Red / white lead (2)	0 Ω
	Green lead (1) – Green / white lead (3)	Infinity

Resistance (Switch knob at LEFT position)	Green lead (1) – Red / white lead (2)	Infinity
	Green lead (1) – Green / white lead (3)	0 Ω

4.11.8 Checking hazard switch continuity when setting switch knob at OFF position



(1) Black / blue lead (A) Hazard switch **OFF** position
(2) Blue / white lead

1. Set the hazard switch knob to the **OFF** position.
2. Measure the resistance with an ohmmeter across the black / blue lead (1) and blue / white lead (2).
3. If infinity is not indicated, the combination switch is damaged.

Resistance (Hazard switch at OFF position)	Black / blue lead (1) – Blue / white lead (2)	Infinity
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4.11.9 Checking hazard switch continuity when setting switch knob at ON position



(1) Black / blue lead (A) Hazard switch **ON** position
(2) Blue / white lead

1. Set the hazard switch knob to the **ON** position.
2. Measure the resistance with an ohmmeter across the black / blue lead (1) and blue / white lead (2).
3. If 0 Ω is not indicated, the combination switch is damaged.

Resistance (Hazard switch at ON position)	Black / blue lead (1) – Blue / white lead (2)	0 Ω
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4.11.10 Checking flasher unit connector voltage

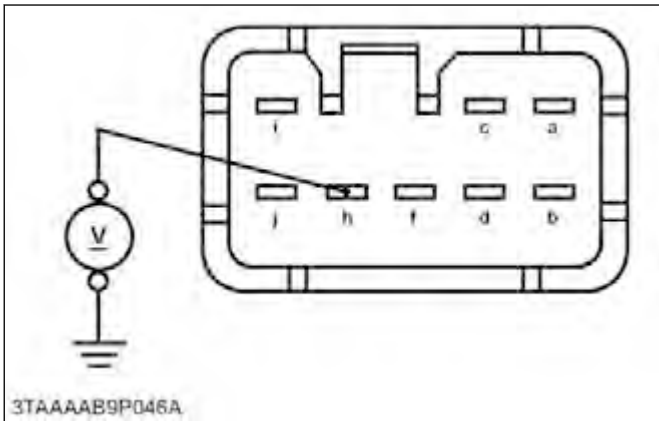
1. Remove the under panel.

2. Disconnect the connector from the flasher unit (1).



(1) Flasher unit

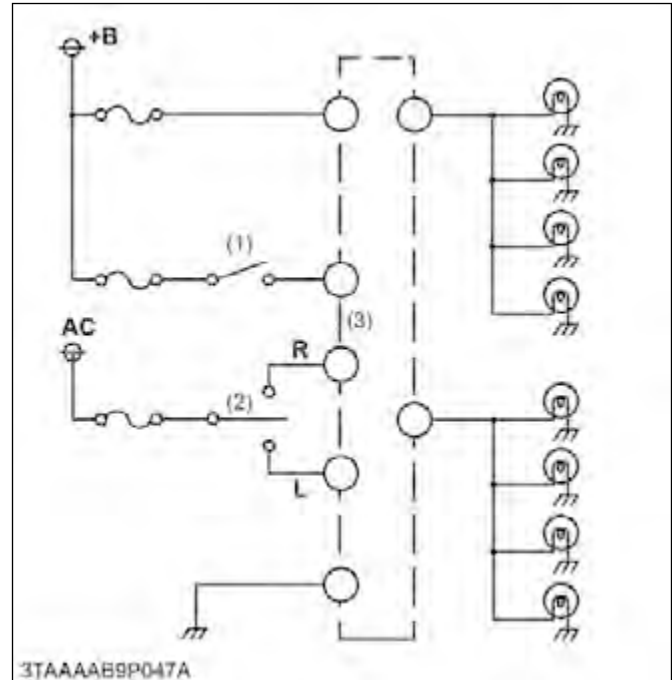
3. Measure the voltage with a voltmeter across the connector terminal h and chassis.



4. If the voltage differs from the battery voltage, the wiring harness is damaged.

Voltage	Terminal h – chassis	Approx. battery voltage
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4.11.11 Testing flasher unit actuation

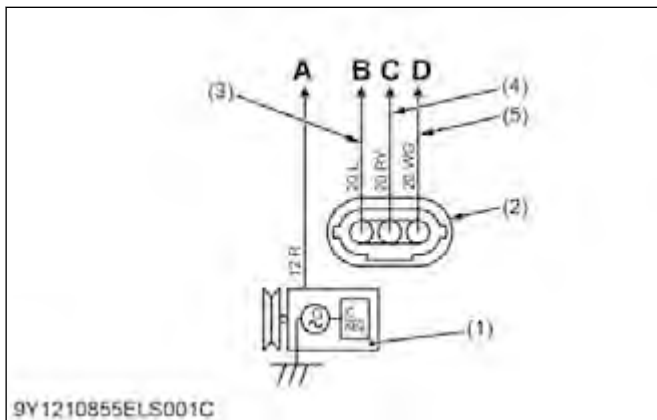


(1) Hazard lamp switch (3) Flasher unit
(2) Turn signal light switch

1. Set the hazard switch to the **ON** position, and make sure the hazard lamp gives 60 to 85 flashes for a minute.
2. With the main switch and the hazard switch at the **ACC** and **ON** positions, respectively, move the turn signal light switch to the left. Make sure that the right-hand light stays on and the left-hand light gives flashes earlier (by about 20 flashes) than when the hazard lamp is activated. Then move the turn signal light switch to the right and make sure the corresponding actions take place.
3. Now set the main switch to the **ACC** position and move the turn signal switch alone. Make sure the same actions as above result.
4. If both the hazard switch and the turn signal light switch function but the above actions do not take place, replace the flasher unit with new one.

4.12 Gauge

4.12.1 Checking charge lamp (charging circuit)



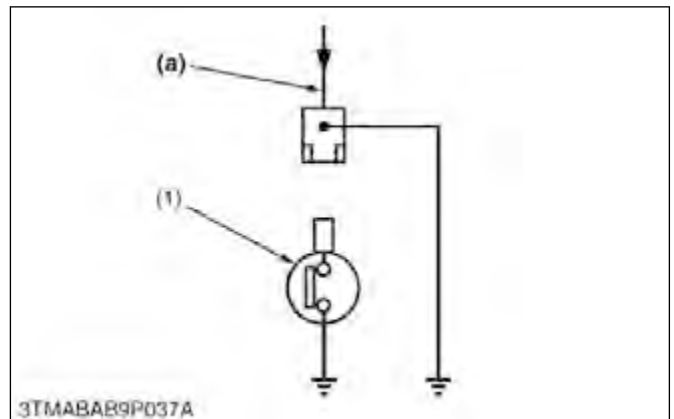
- | | |
|---------------------------------|---------------------------------|
| (1) Alternator | A: To the battery |
| (2) 3P connector | B: To hour meter and tachometer |
| (3) L (blue) terminal | C: To main switch |
| (4) RY (red / yellow) terminal | D: To charge indicator |
| (5) WG (white / green) terminal | |

1. Disconnect the 3P connector from the alternator after turning the main switch **OFF**.
2. Turn the main switch **ON** and connect a jumper lead from the wiring harness connector terminal (white / green) to the chassis.

NOTE

- If you connect the jumper lead from the wiring harness connector terminal (white / green) to the chassis, 15 A fuse will be blown. Do not connect the lead to red / yellow terminal.
3. If the charge lamp does not light, the wiring harness or fuse is damaged.

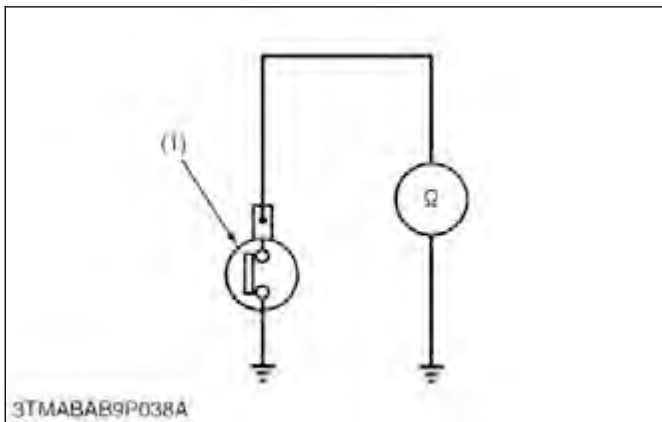
4.12.2 Checking engine oil pressure lamp



- (1) Engine oil pressure switch (a) From oil pressure lamp
(2) Lead

1. Disconnect the lead (2) from the engine oil pressure switch (1) after turning the main switch **OFF**.
2. Turn the main switch **ON** and connect a jumper lead from the lead to the chassis.
3. If the engine oil pressure indicator lamp does not light, the wiring harness is damaged.

4.12.3 Checking engine oil pressure switch continuity



(1) Engine oil pressure switch (2) Lead

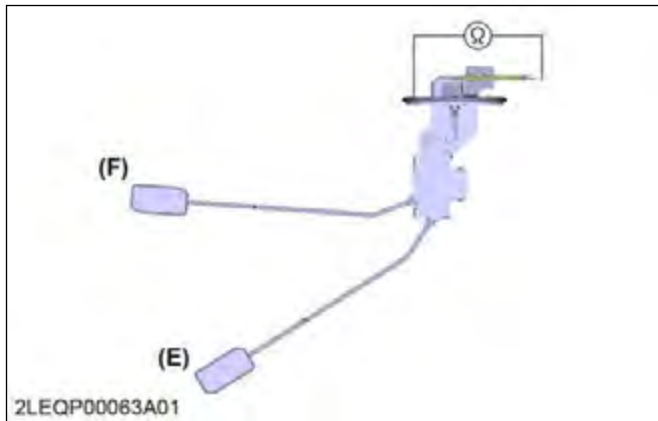
1. Disconnect the lead (2) from the engine oil pressure switch (1).
2. Measure the resistance with an ohmmeter across the switch terminal and the chassis.
3. If 0 ohm is not indicated in the normal state, the switch is damaged.

Resistance (Switch terminal – Chassis)	In normal state	0 Ω
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4. If infinity is not indicated at pressure, the switch is damaged.

Resistance (Switch terminal – Chassis)	At pressure over approx. 49 kPa 0.50 kgf/cm ² 7.1 psi	Infinity
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4.12.4 Checking fuel level sensor continuity

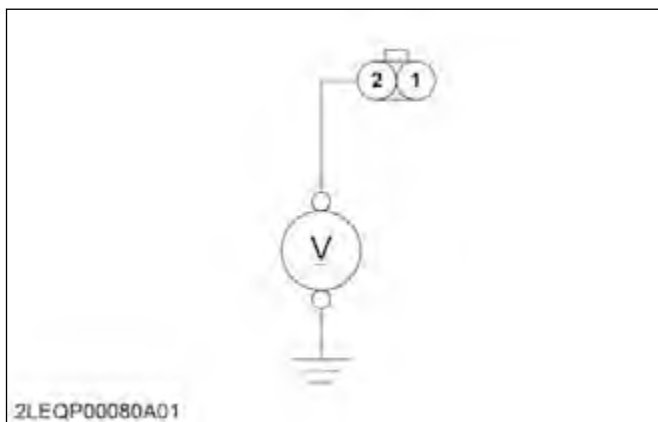


(E) Empty (F) Full

1. Remove the fuel level sensor from the fuel tank.
2. Measure the resistance with an ohmmeter across the sensor terminal and its body.
3. If the reference values are not indicated, the sensor is damaged.

Resistance (Sensor terminal – Sensor body)	Reference value	Float at upper-most position (Full)	2.75 to 3.15 Ω
		Float at lower-most position (Empty)	97 to 113 Ω

4.12.5 Checking coolant temperature sensor connector voltage

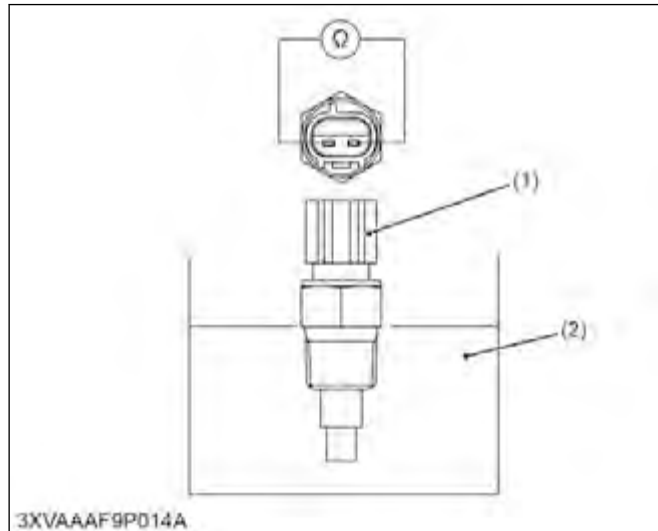


1. Disconnect the 2P connector from the coolant temperature sensor after turning the main switch **OFF**.
2. Turn the main switch **ON** and measure the voltage with a voltmeter across the 2 terminal (W/Y) and the chassis.

- If the voltage differs from the reference voltage, the wiring harness, fuse or coolant temperature gauge is damaged.

Voltage	2 terminal (W/Y) – Chassis	4.9 to 5.1 V
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4.12.6 Checking coolant temperature sensor continuity

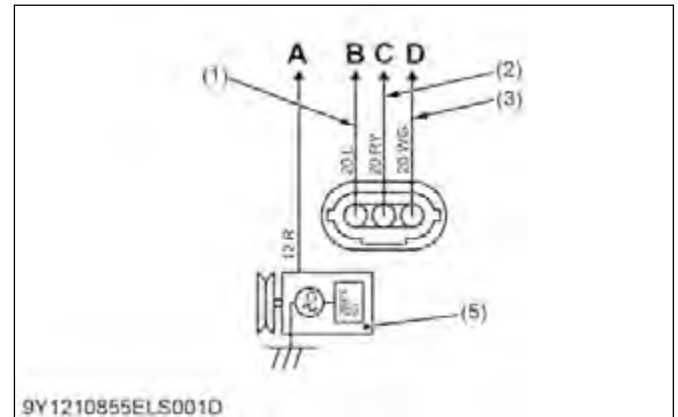


(1) Coolant temperature sensor (2) Coolant

- Measure the resistance with an ohmmeter across the sensor 1 terminal and 2 terminal.
- If the reference value is not indicated, the sensor is damaged.

Resistance (1 terminal – 2 terminal)	Reference value	Approx. 11.08 Ω at 120 °C (248 °F)
		Approx. 18.36 Ω at 100 °C (212 °F)
		Approx. 31.8 Ω at 80 °C (176 °F)
		Approx. 81.1 Ω at 50 °C (122 °F)

4.12.7 Checking hour meter and tachometer



- | | |
|--|----------------------------------|
| (1) L (blue) lead | (8) Charge lamp terminal |
| (2) RY (red / yellow) lead | (9) IC regulator |
| (3) WG (white / green) lead | (A) To the battery |
| (4) 3P connector | (B) To hour meter and tachometer |
| (5) Alternator | (C) To main switch terminal |
| (6) Hour meter and tachometer terminal | (D) To charge indicator |
| (7) Ground terminal | |

- Disconnect the 3P connector (4) from the IC regulator (9) located in the alternator (5) after starting the engine.
- Measure the voltage with a voltmeter across the hour meter terminal (6) and the alternator body when the hour meter or tachometer does not indicated the proper value.

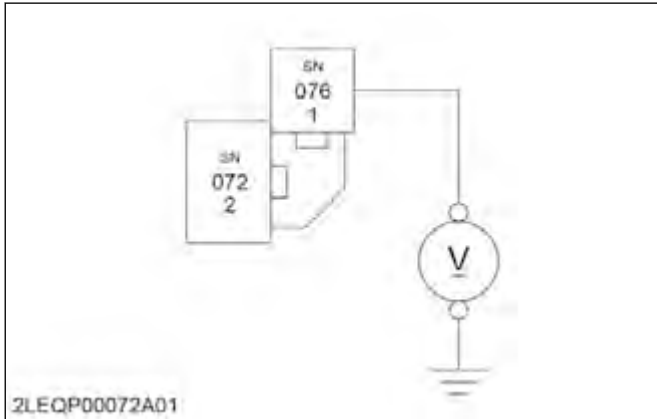
8. ELECTRICAL SYSTEM

- If the measured voltages differ from the specified voltage, the hour meter and tachometer are damaged.

Voltage while engine operates at idling speeds	Hour meter terminal – Alternator body	Approx. battery voltage
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4.13 Accessory

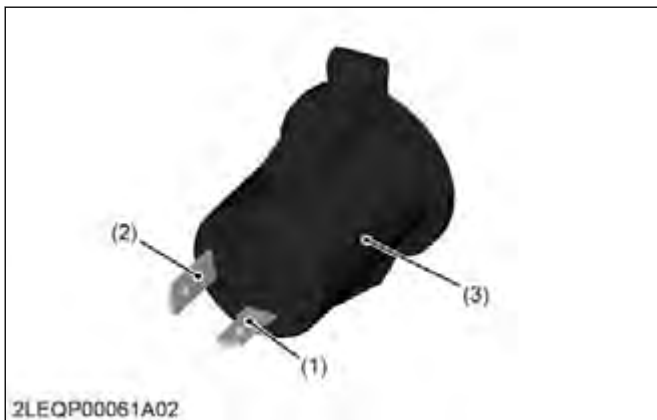
4.13.1 Checking DC outlet connector voltage



- Disconnect the connector from the DC outlet and turn the main switch **ON**.
- Measure the voltage with a voltmeter across the connector 1 terminal (R/L) and the chassis.
- If the voltage differs from the battery voltage the wiring harness is damaged.

DC outlet connector voltage	1 terminal (R/L) – Chassis	Battery voltage
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4.13.2 Checking DC outlet continuity



- (1) 1 terminal
(2) 2 terminal
(3) DC outlet

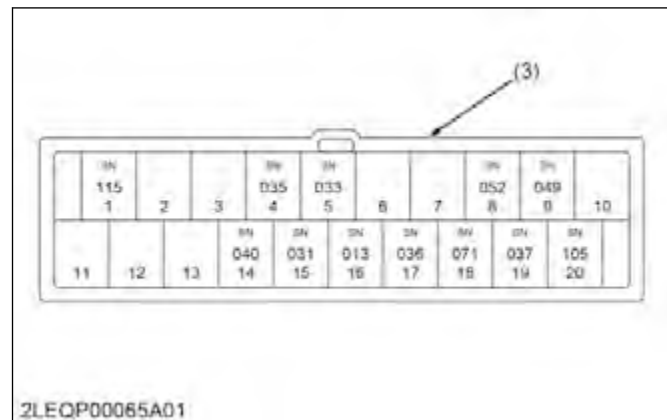
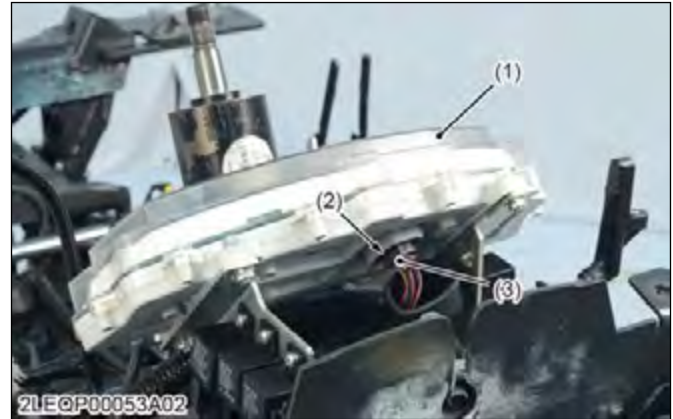
- Remove the DC outlet from the machine.
- Measure the resistance with an ohmmeter across outlet 1 terminal and 2 terminal.

- If infinity is not indicated, the outlet is damaged.

DC outlet continuity	1 terminal – 2 terminal	Infinity
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4.14 Meter panel

4.14.1 Checking connector voltage, sensor resistance and switch



- (1) Meter panel
(2) 20P connector meter panel side
(3) 20P connector wire harness side

- Disconnect the 20P connector (3) from the meter panel (1).

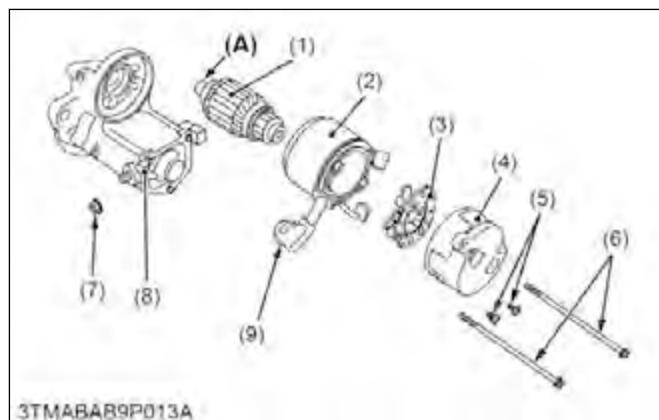
2. Check the main voltage (battery voltage) first and check the connector voltage, sensor resistance or switch continuity which related for damaged indication of meter panel as table below.

Terminal No.	Color of wiring	Terminal name (Related item)
T1	R / B	Glow plug
T2	—	—
T3	—	—
T4	W / G	Charge warning
T5	G	Oil warning
T6	—	—
T7	—	—
T8	L / W	Left turn
T9	R / W	Right turn
T10	—	—
T11	—	CAN L
T12	—	CAN H
T13	—	—
T14	Or / W	Low beam
T15	L	Tachometer
T16	R / L	Ignition
T17	Y / L	Fuel
T18	B	Ground
T19	W / Y	Temperature
T20	R / G	Battery

5. Disassembling and assembling

5.1 Starter

5.1.1 Disassembling starter motor



- | | |
|------------------|---------------------|
| (1) Armature | (6) Screw |
| (2) Yoke | (7) Nut |
| (3) Brush holder | (8) Magnet switch |
| (4) End frame | (9) Connecting lead |
| (5) Screw | (A) Spline teeth |

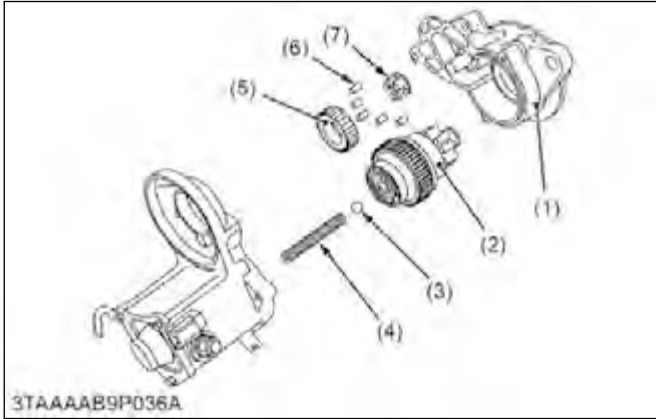
1. Disconnect the connecting lead (9) from the magnet switch (8).
2. Remove the screws (6), and then separate the end frame (4), yoke (2) and armature (1).
3. Remove the two screws (5), and then remove the brush holder (3) from the end frame (4).

(When reassembling)

- Apply grease to the spline teeth (A) of the armature (1).

Tightening torque	Nut (7)	5.9 to 11.8 N · m 0.6 to 1.2 kgf · m 4.3 to 8.7 lbf · ft
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5.1.2 Removing magnet switch



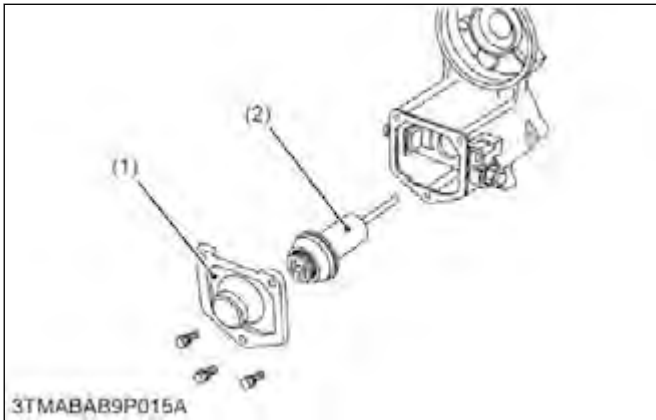
- (1) Drive end frame
- (2) Overrunning clutch
- (3) Ball
- (4) Spring
- (5) Gear
- (6) Roller
- (7) Retainer

1. Remove the drive end frame (1) mounting screws.
2. Remove the overrunning clutch (2), ball (3), spring (4), gears (5), rollers (6) and retainer (7).

(When reassembling)

- Apply grease to the gear teeth of the gears (5) and overrunning clutch (2), and ball (3).

5.1.3 Removing plunger



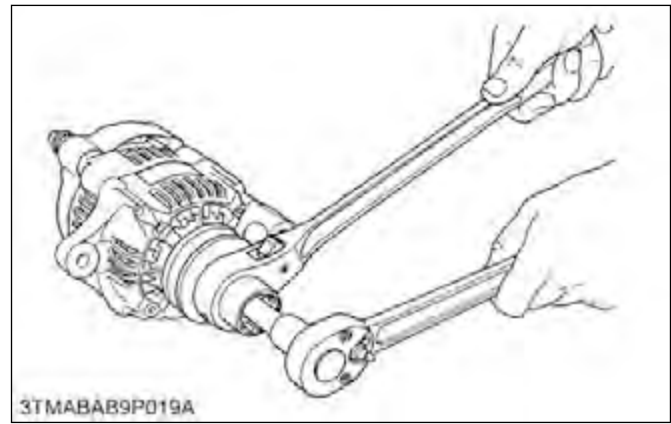
- (1) End cover
- (2) Plunger

1. Remove the end cover (1).
2. Remove the plunger (2).

5.2 Alternator

5.2.1 Removing pulley

1. Secure the hexagonal end of the pulley shaft with a double-ended ratchet wrench as shown in the figure, loosen the pulley nut with a socket wrench and remove it.

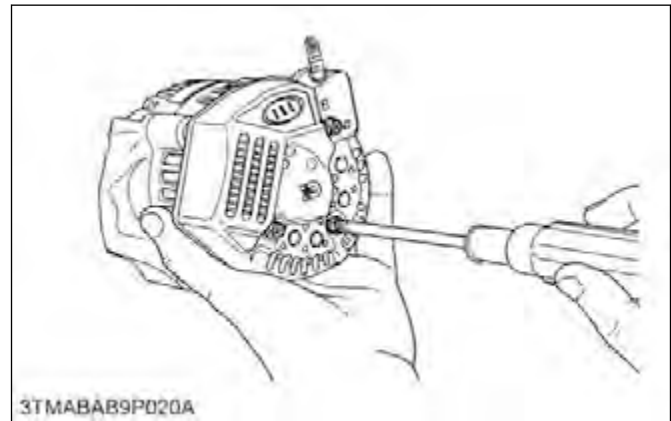


(When reassembling)

Tightening torque	Pulley nut	58.4 to 78.9 N·m
		5.95 to 8.05 kgf·m
		43.1 to 58.2 lbf·ft

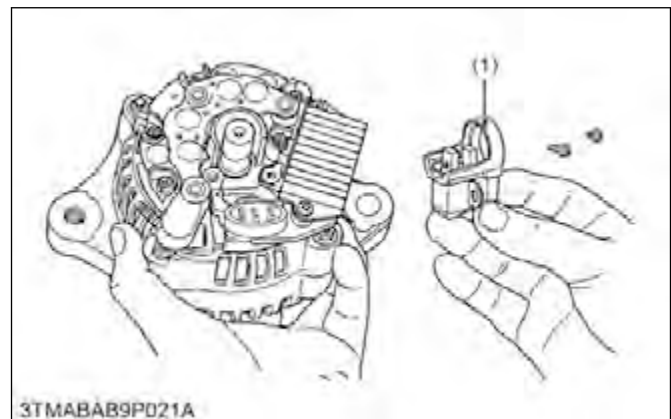
5.2.2 Removing rear end cover

1. Remove the three rear end cover screws and the B terminal nut, and remove the rear end cover.



5.2.3 Removing brush holder

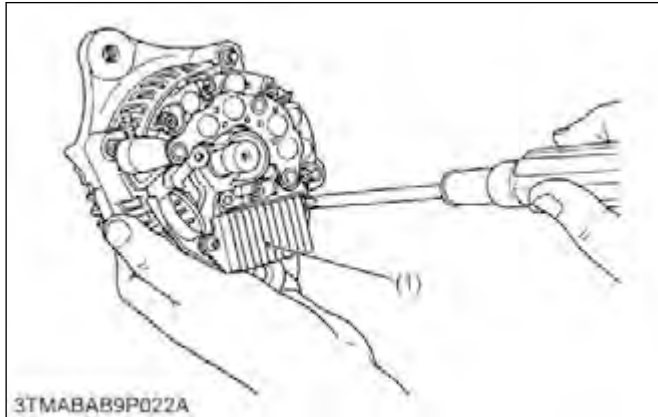
1. Remove the two screws holding the brush holder, and remove the brush holder (1).



(1) Brush holder

5.2.4 Removing IC regulator

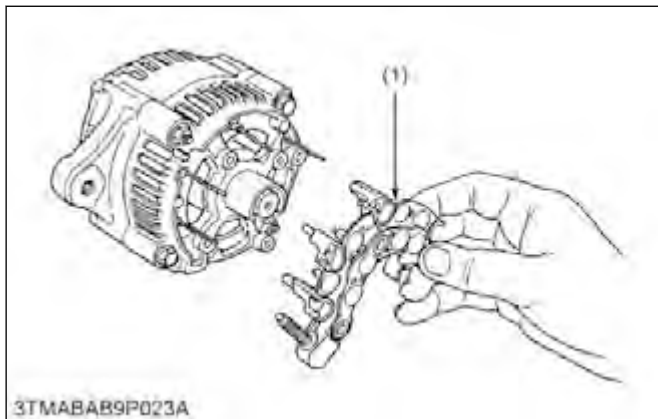
1. Remove the three screws holding the IC regulator, and remove the IC regulator (1).



(1) IC regulator

5.2.5 Removing rectifier

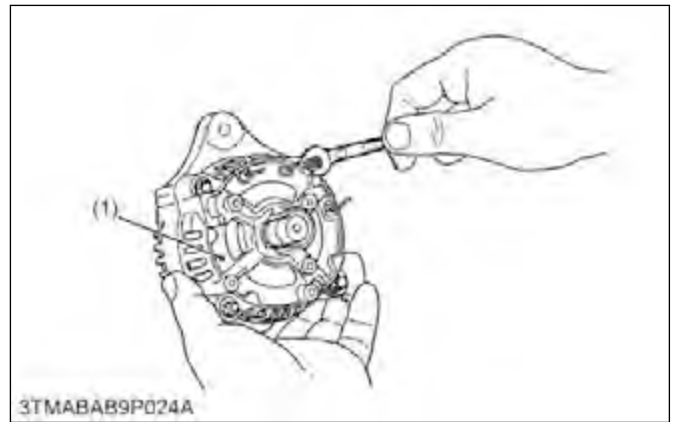
1. Remove the four screws holding the rectifier and the stator lead wires.
2. Remove the rectifier (1).



(1) Rectifier

5.2.6 Removing rear end frame

1. Remove the two nuts and two screws holding the drive end frame and the rear end frame.
2. Remove the rear end frame (1).



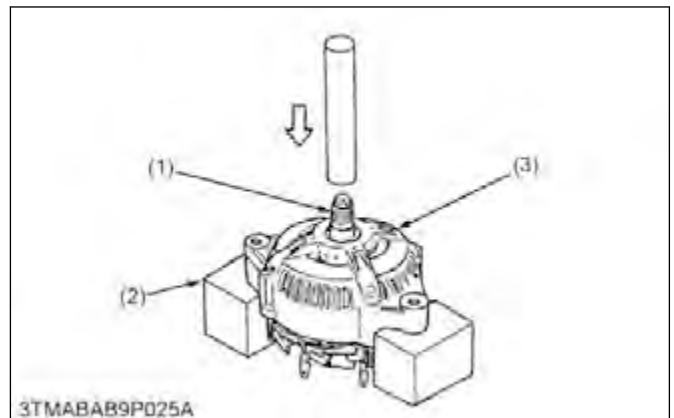
(1) Rear end frame

5.2.7 Removing rotor

■ IMPORTANT

- Take special care not to drop the rotor and damage the slip ring or fan, etc.

1. Press out the rotor (1) from drive end frame (3).

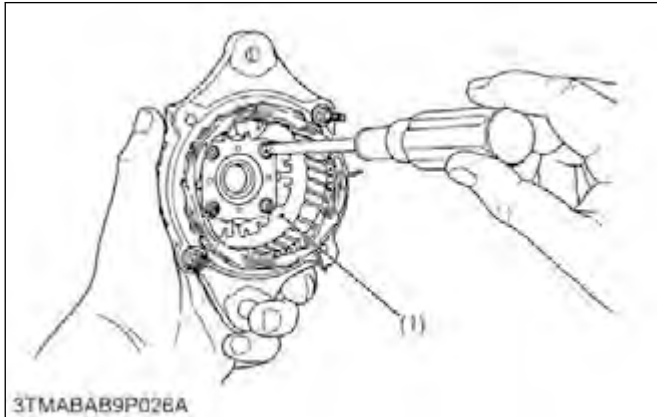


(1) Rotor
(2) Block

(3) Drive end frame

5.2.8 Removing retainer plate

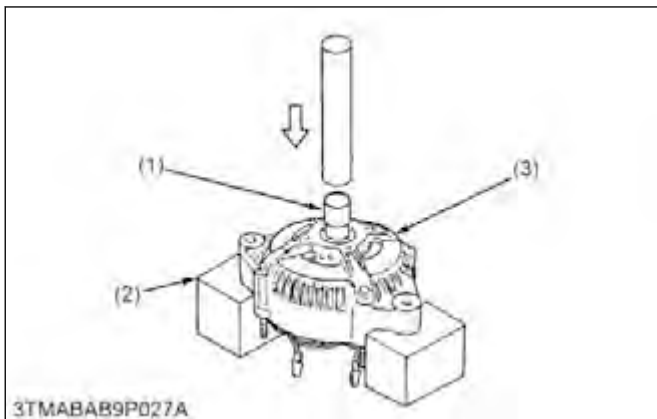
1. Remove the four screws holding the retainer plate, and remove the retainer plate (1).



(1) Retainer plate

5.2.9 Removing bearing on drive end side

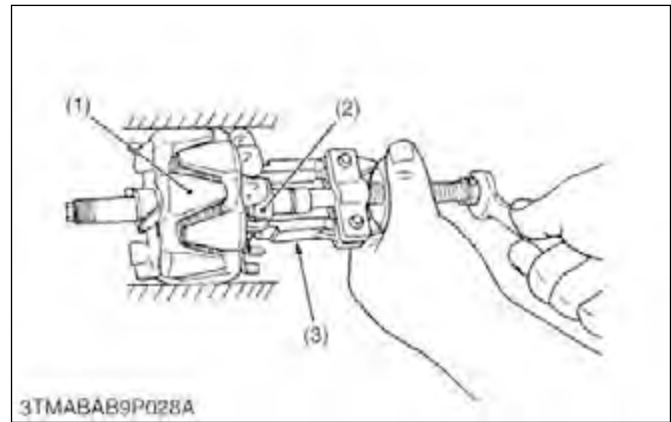
1. Press out the bearing from drive end frame (3) with a press and jig (1).



(1) Jig
(2) Block
(3) Drive end frame

5.2.10 Removing bearing at slip ring side

1. Lightly secure the rotor (1) with a vise to prevent damage, and remove the bearing (2) with a puller (3).

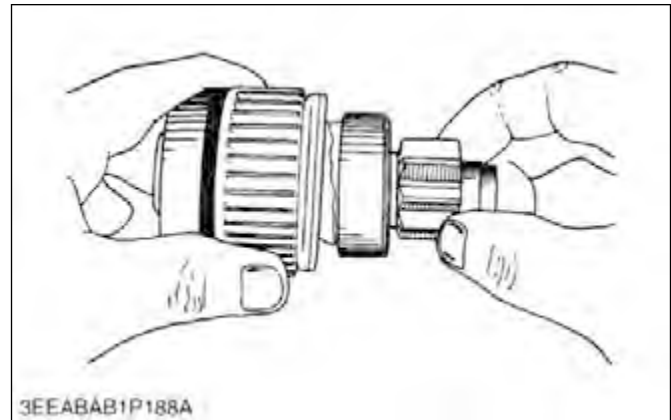


(1) Rotor
(2) Bearing
(3) Puller

6. Servicing

6.1 Starter

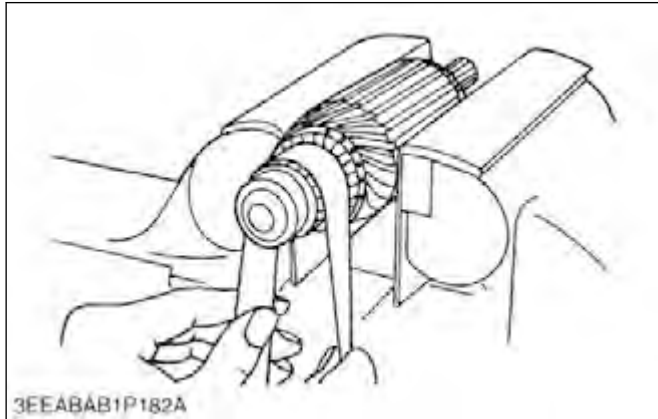
6.1.1 Checking overrunning clutch



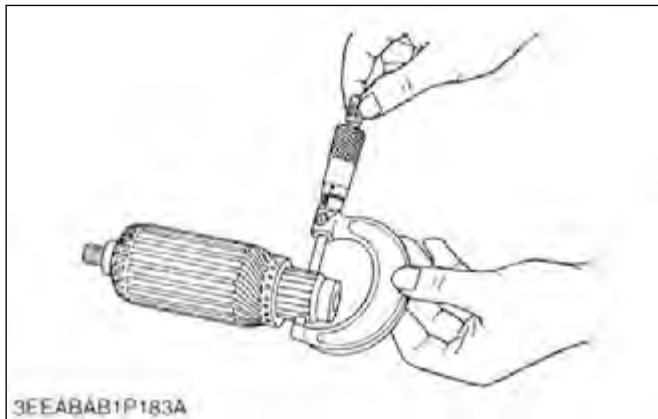
1. Inspect the pinion for wear or damage.
2. If there is any problem, replace the overrunning clutch assembly.
3. Check that the pinion turns freely and smoothly in the overrunning direction and does not slip in the cranking direction.
4. If the pinion slips or does not rotate in the both directions, replace the overrunning clutch assembly.

6.1.2 Checking commutator and mica

1. Check the contact face of the commutator for wear, and grind the commutator with emery paper if it is slightly worn.



2. Measure the commutator O.D. with an outside micrometer at several points.



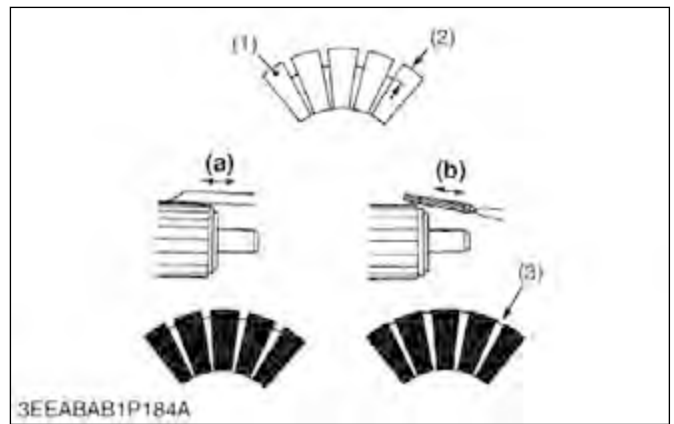
3. If the minimum O.D. is less than the allowable limit, replace the armature.

Commutator O.D.	Factory specification	30.0 mm 1.181 in.
	Allowable limit	29.0 mm 1.142 in.

4. If the difference of the O.D.'s exceeds the allowable limit, correct the commutator on a lathe to the factory specification.

Difference of O.D.'s	Factory specification	Less than 0.02 mm 0.0008 in.
	Allowable limit	0.05 mm 0.0020 in.

5. Measure the mica undercut.



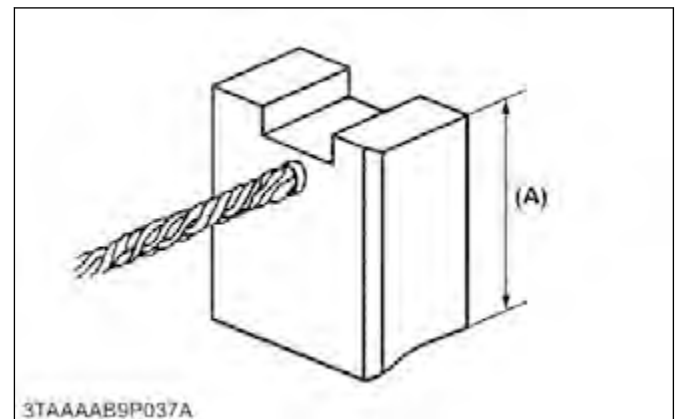
- (1) Segment
(2) Undercut
(3) Mica
- (a) Correct
(b) Incorrect

6. If the undercut is less than the allowable limit, correct it with a saw blade and chamfer the segment edges.

Mica undercut	Factory specification	0.50 to 0.80 mm 0.0197 to 0.0315 in.
	Allowable limit	0.20 mm 0.0079 in.

6.1.3 Checking brush wear

1. If the contact face of the brush is dirty or dusty, clean it with emery paper.
2. Measure the brush length (A) with vernier calipers.

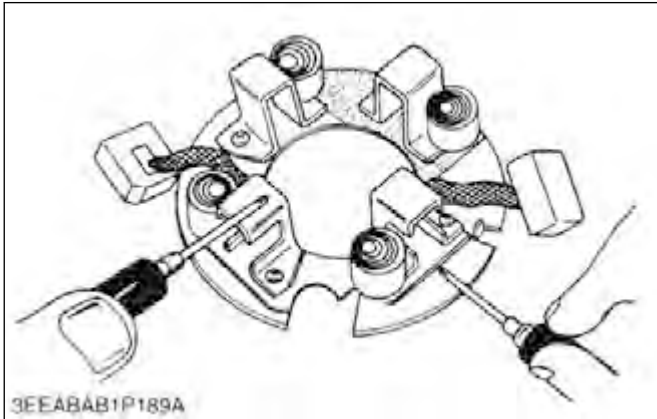


3. If the length is less than the allowable limit, replace the yoke assembly and brush holder.

Brush length (A)	Factory specification	14.0 mm 0.551 in.
	Allowable limit	9.0 mm 0.354 in.

6.1.4 Checking brush holder

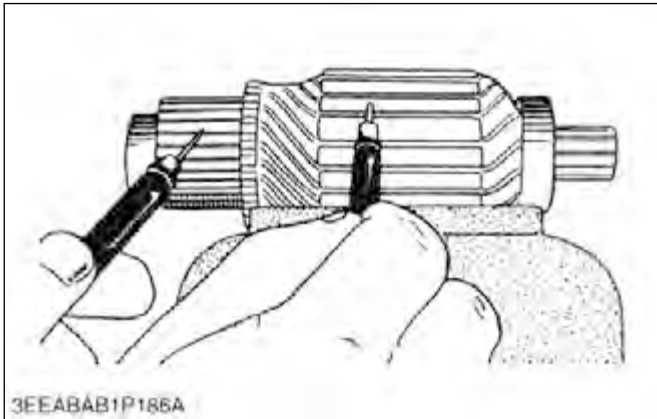
1. Check the continuity across the brush holder and the holder support with an ohmmeter.



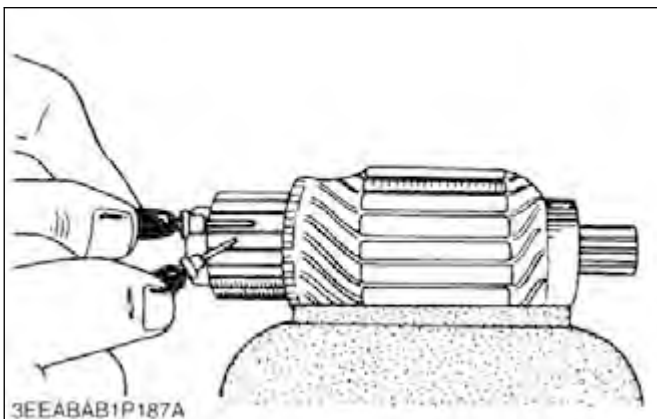
2. If it conducts, replace the brush holder.

6.1.5 Checking armature coil

1. Check the continuity across the commutator and armature coil core with an ohmmeter.



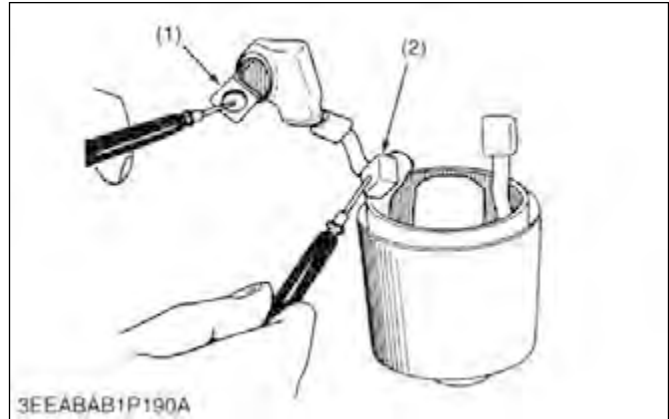
2. If it conducts, replace the armature.
3. Check the continuity across the segments of the commutator with an ohmmeter.



4. If it does not conduct, replace the armature.

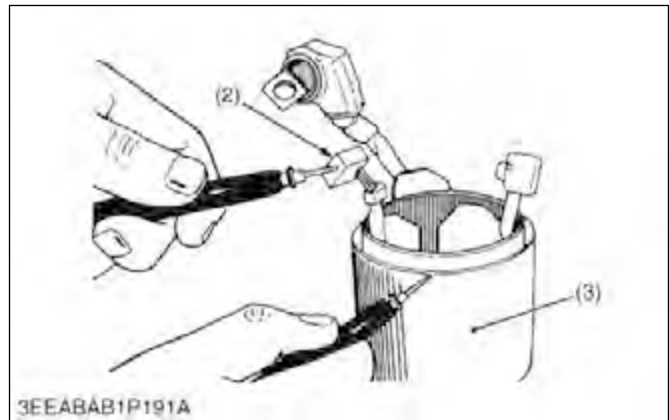
6.1.6 Checking field coil

1. Check the continuity across the lead (1) and brush (2) with an ohmmeter.



- (1) Lead (2) Brush

2. If it does not conduct, replace the yoke assembly.
3. Check the continuity across the brush (2) and yoke (3) with an ohmmeter.



- (2) Brush (3) Yoke

4. If it conducts, replace the yoke assembly.

6.2 Alternator

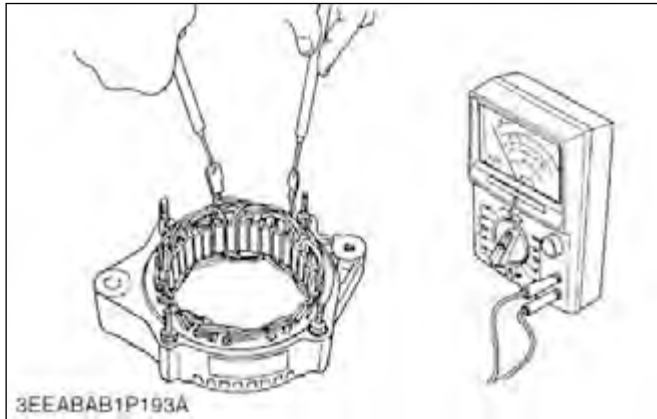
6.2.1 Checking bearing

1. Check the bearing for smooth rotation.



2. If it does not rotate smoothly, replace it.

6.2.2 Checking stator

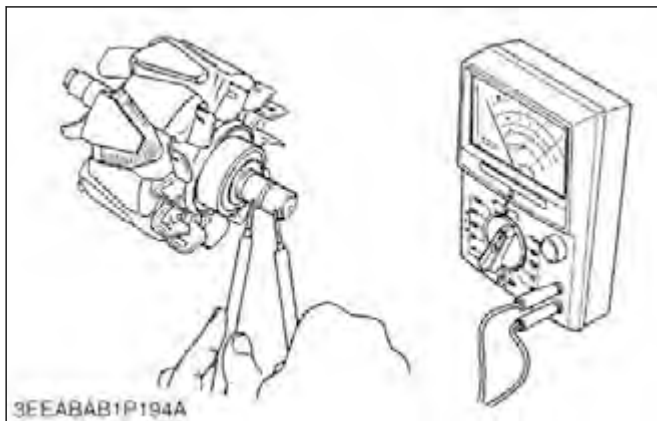


1. Measure the resistance across each lead of the stator coil with resistance range of circuit tester.
2. If the measurement is not within factory specification, replace it.

Resistance	Factory specification	Less than 1.0 Ω
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3. Check the continuity across each stator coil lead and core with resistance range of circuit tester.
4. If infinity is not indicated, replace it.

6.2.3 Checking rotor



1. Measure the resistance across the slip rings.
2. If the resistance is not the factory specification, replace it.

Resistance	Factory specification	2.9 Ω
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3. Check the continuity across the slip ring and core with resistance range of circuit tester.
4. If infinity is not indicated, replace it.

6.2.4 Checking slip ring

1. Check the slip ring for score.

2. If scored, correct with an emery paper or on a lathe.
3. Measure the O.D. of slip ring with vernier calipers.

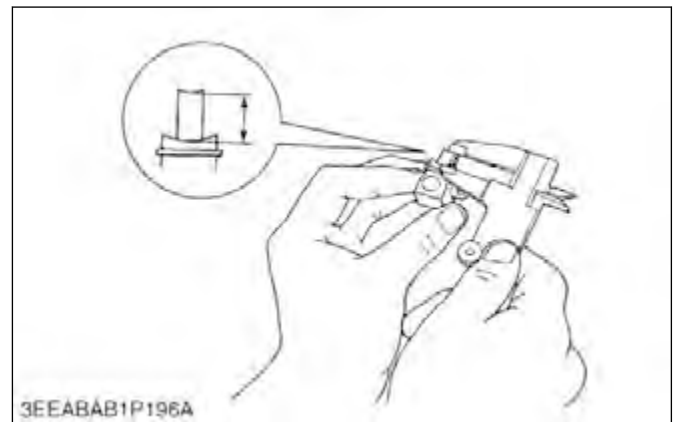


4. If the measurement is less than the allowable limit, replace it.

Slip ring O.D.	Factory specification	14.4 mm 0.567 in.
	Allowable limit	14.0 mm 0.551 in.

6.2.5 Checking brush wear

1. Measure the brush length with vernier calipers.



2. If the measurement is less than allowable limit, replace it.

Brush length	Factory specification	10.5 mm 0.413 in.
	Allowable limit	8.4 mm 0.331 in.

3. Make sure that the brush moves smoothly.
4. If the brush is damaged, replace it.

6.2.6 Checking rectifier

1. Check the continuity across each diode of rectifier with resistance range of circuit tester. The rectifier is normal if the diode in the rectifier conducts in one direction and does not conduct in the reverse direction.

