

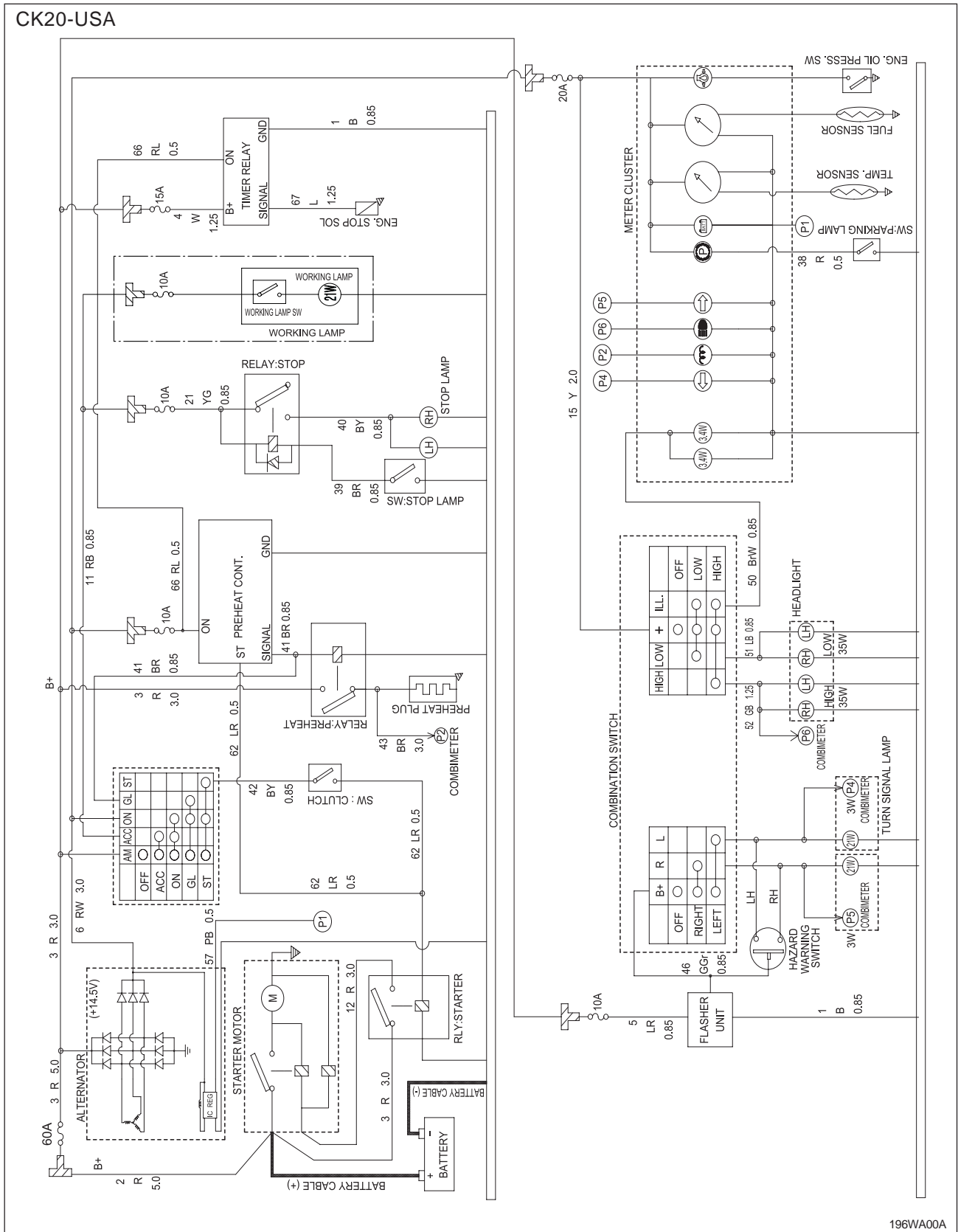
**CHAPTER 10**

**ELECTRIC SYSTEM**

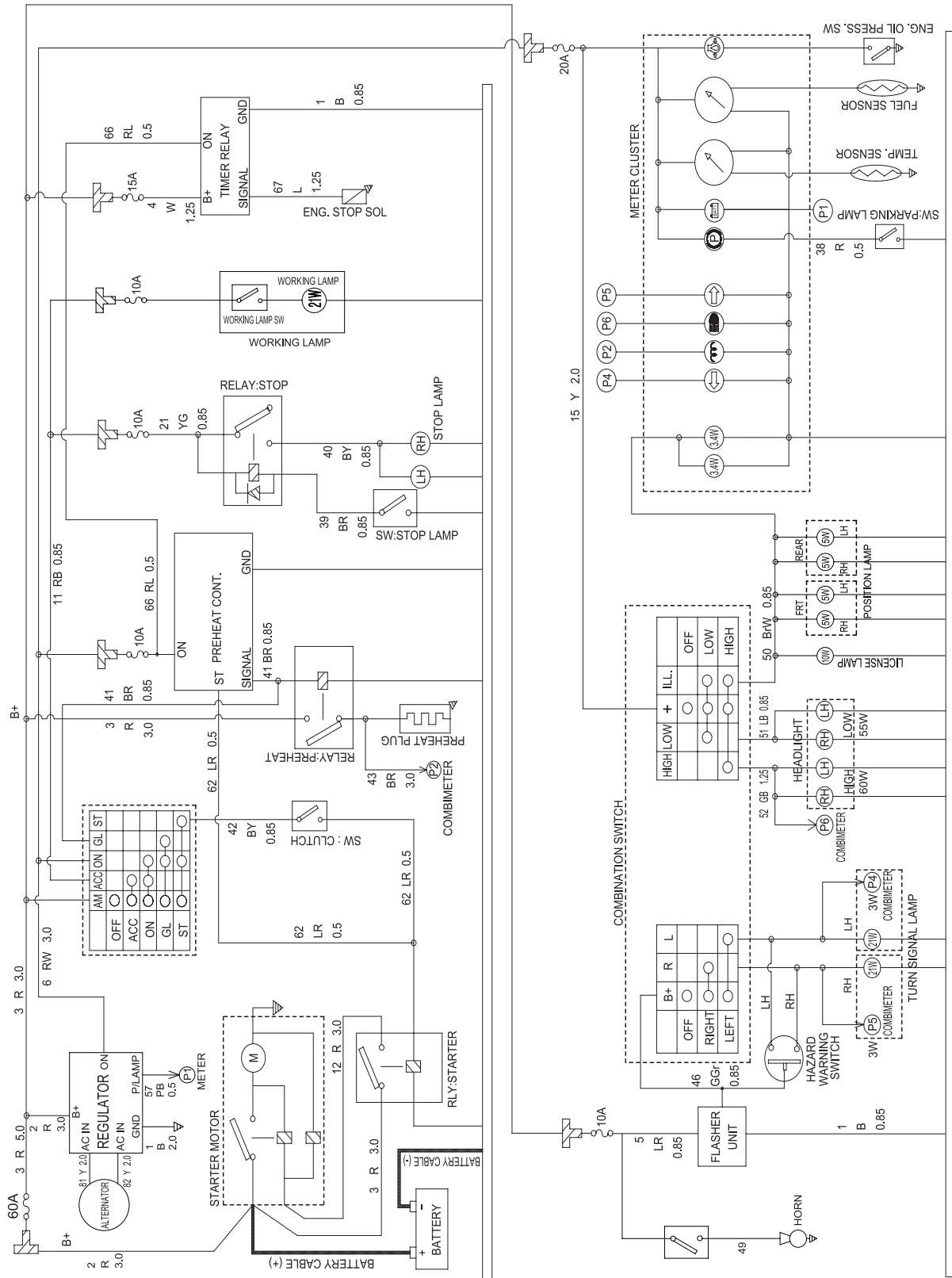


# 1. ELECTRIC SYSTEM

## 1.1 WIRING DIAGRAM



CK20-EU

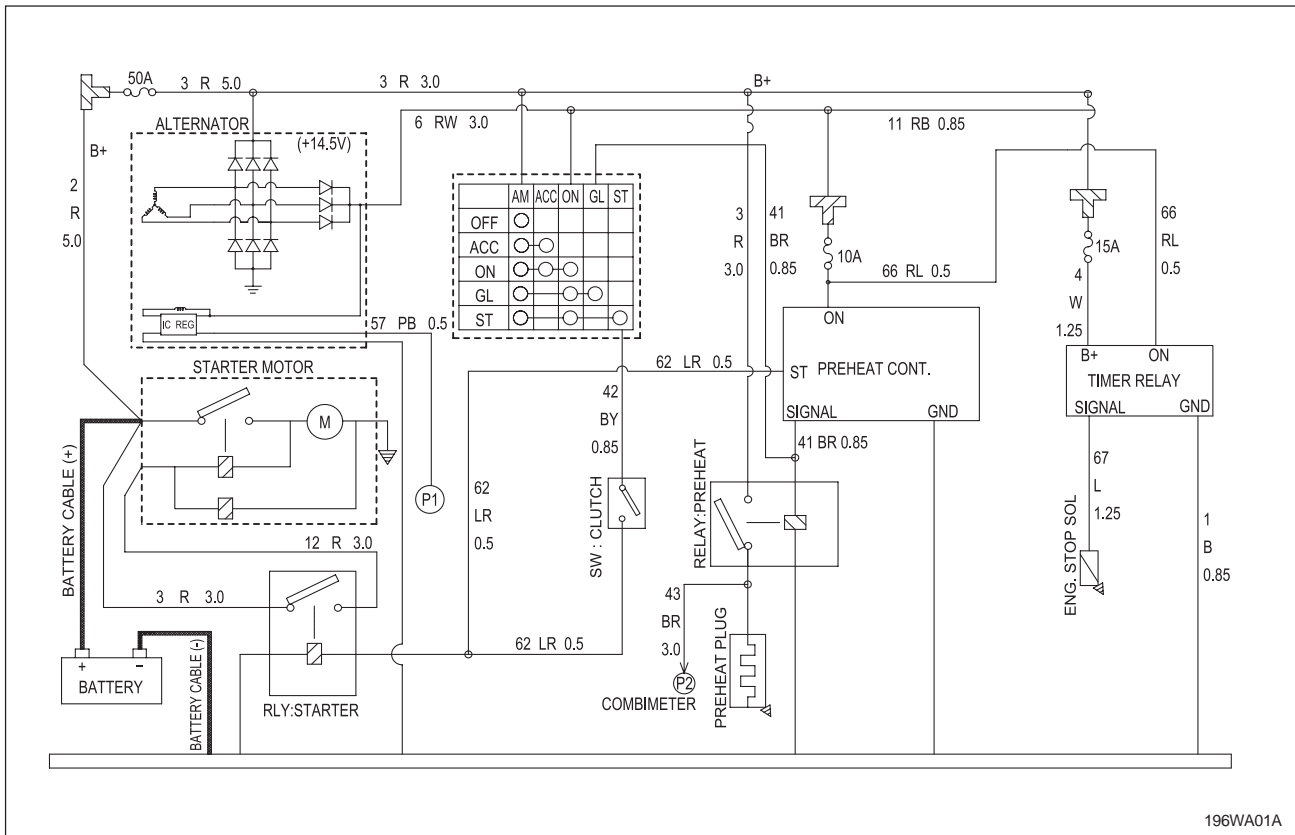


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## 1.2 BATTERY

The tractors are equipped with a 12-volt battery with a minimum cold cranking ability of 520-ampere at -18°C (0°F). The battery is located under the hood in front of the radiator. The battery connections must be tight and free of corrosion. If necessary, wash the battery's outside surface and terminals with a solution of baking soda and water, making sure the solution does not get inside the battery. After cleaning, wash the battery with clean water, then apply a small amount of petroleum jelly to the terminals to prevent corrosion. A good battery charge must be maintained in freezing temperatures. If the battery is allowed to become discharged or run down, the electrolyte will become weak and possibly freeze. This can result in damage to the case. If the water must be added, use distilled water. Add the water just before using the tractor. This ensures that the water will mix with the electrolyte during the charging process, preventing the water from freezing.

1.3 STARTING SYSTEM



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When the main key switch is turned to the PREHEAT position, the terminal AM is connected to the terminal ON and GL. The glow plugs become red-hot, and the preheat indicator lamp also lights on while preheating.

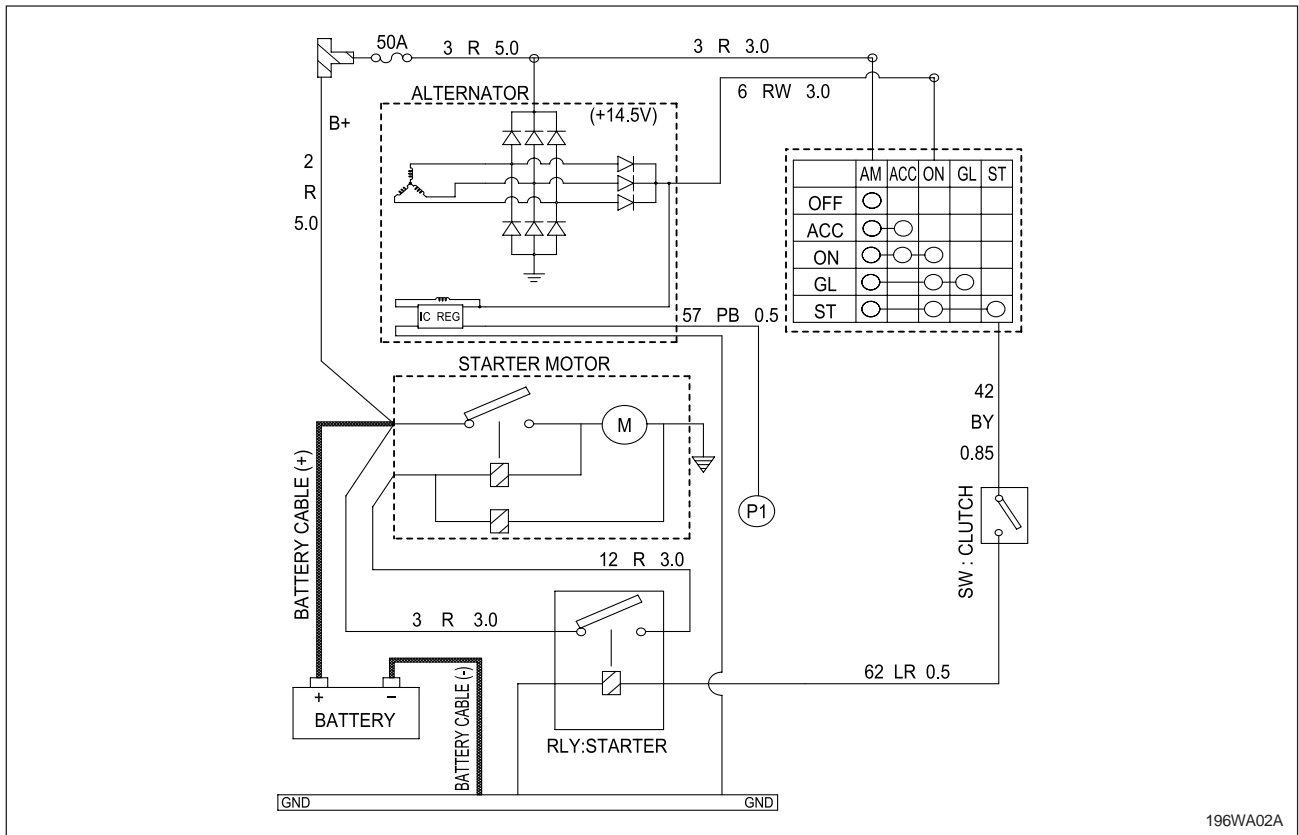
When the main switch is turned to the START position with the safety switch on, the terminal AM is connected to the terminal ON and ST.

Consequently battery current flows to the starter motor and start the engine.

The main key switch automatically returns to the ON position, the terminal AM is connected only to the terminal ACC and ON, thereby causing the starting circuit to be opened, stopping the starter motor.

When the main key switch turned from the ON position to the OFF position, the engine stop solenoid moves the fuel injection pump control rack to the "NO FUEL" position and stop the engine.

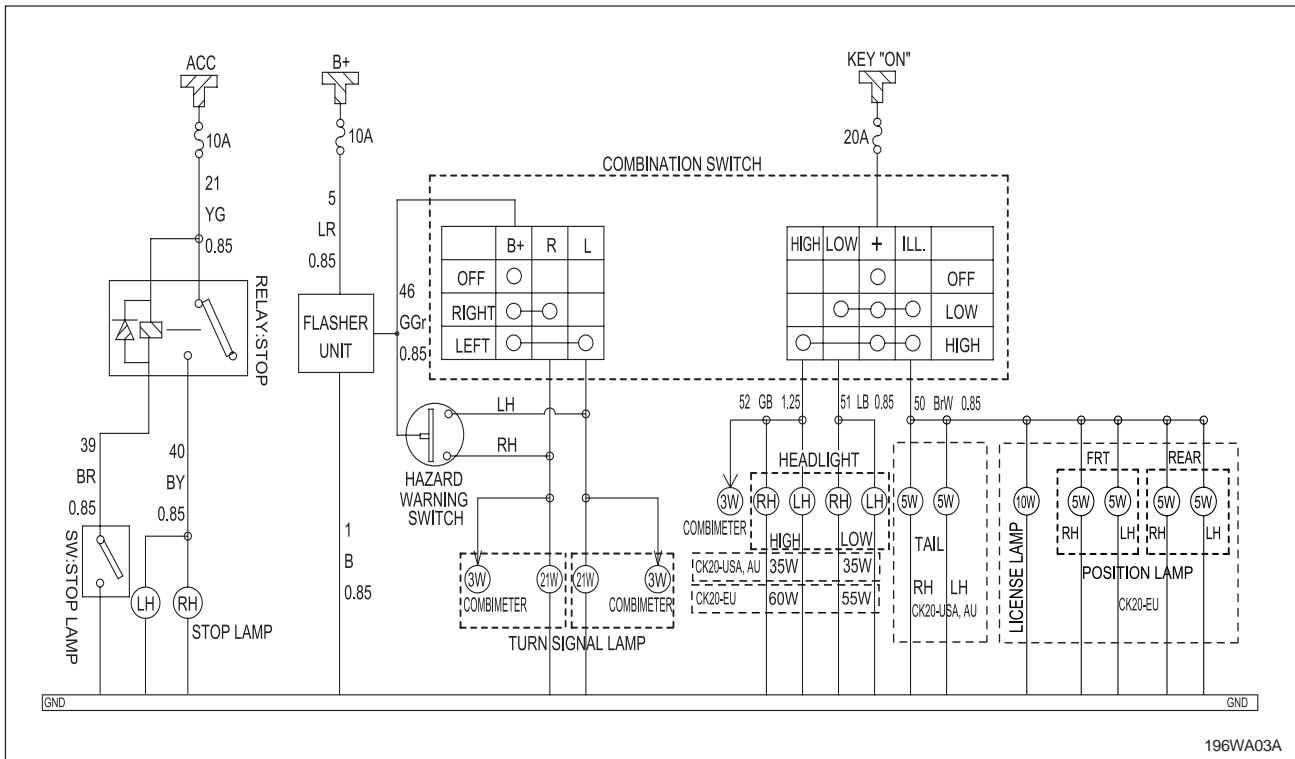
1.4 CHARGING SYSTEM



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The charging system supplies electric power to various electrical devices and also charges the battery while the engine runs.

1.5 LIGHTING SYSTEM



The lighting system consists of combination switch, hazard warning switch, flasher unit, stop lamp relay, stop switch, head lights, turn signal lamps, tail lamps and stop lamps.

**A. COMBINATION SWITCH**

The light switch is located on the left-hand side of the dash.

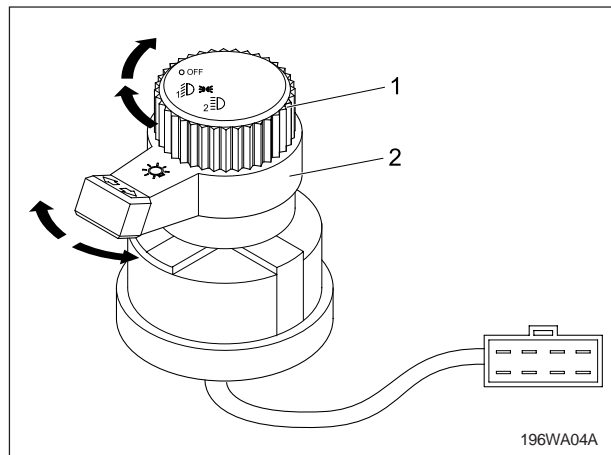
The three position of the light switch are;

OFF

Taillight/Headlight (low-beam)

Headlights (high beam)

When the switch is in the “Headlights (high beam)” position, the blue indicator will light.



- (1) Head Light Switch
- (2) Turn Signal Light Switch



**B. HAZARD WARNING SWITCH**

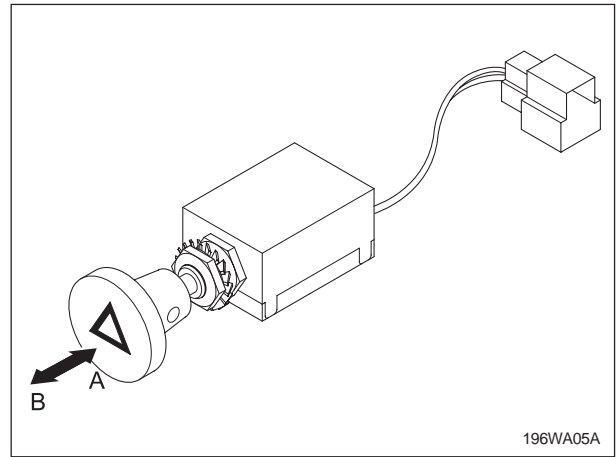
The hazard light switch is a push-pull type switch located on the left-hand side of the dash below of the main light switch. The two positions of the hazard light switch are;

OFF(Push)

ON (Pull)

When the hazard light switch is in the "ON" position, the turn signal symbol located in combination meter will illuminate green and flash.

Important ; The hazard lights can be activated with the key switch in the "OFF" position.



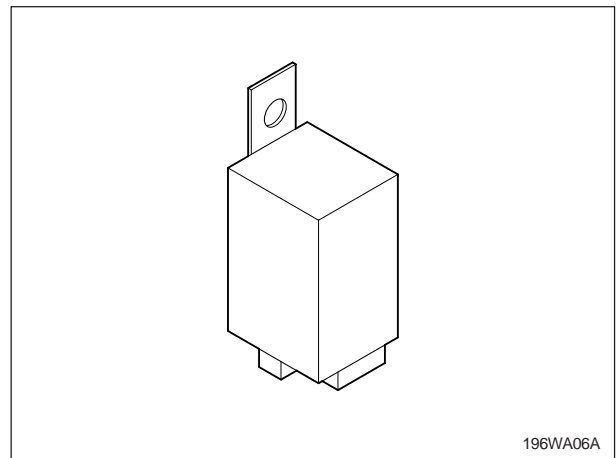
(A) OFF (Push)

(B) ON (Pull)

**C. FLASHER UNIT**

The flasher unit controls the flashing of the hazard lights. This flasher unit is located under the combination meter.

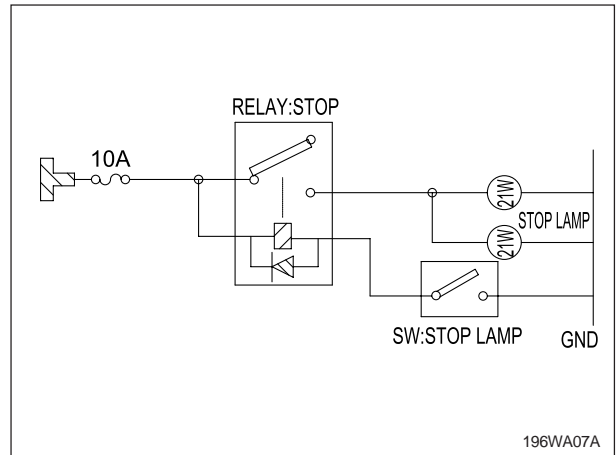
Control the blinking time of the hazard flasher lamp.



**D. STOP AND TAIL LIGHTING COMPONENTS**

**a. Stop Relay**

Relays monitor the current in a circuit. If current is present, the relay activates a single pole, double throw switch, causing it to flip over to its other position. The relays are located under the combination meter.

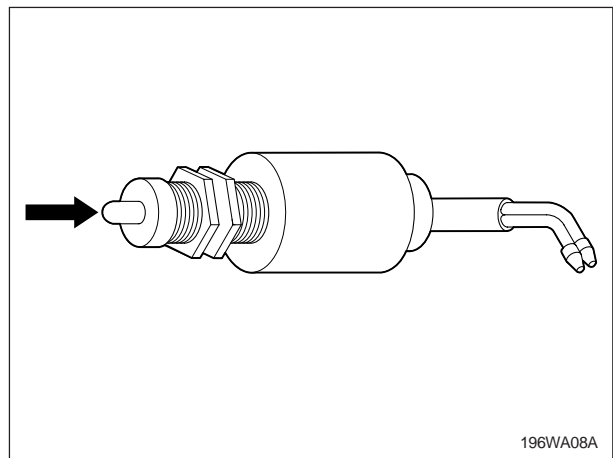


**b. Stop Switch**

When the operator put the brake pedal, the load of the pedal push the switch.

So, the contact is connected. This switch gives the stop signal to the stop relay.

Then the stop relay will be energized.



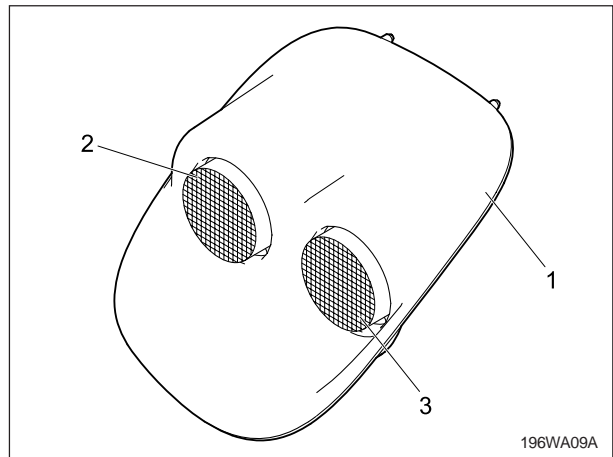
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**c. Stop Lights (Only CK20-USA)**

When the operator pushes the brake pedal, this lights will be illuminated.

It gives the information of the stop to following vehicle.

Rated watt of the bulb is 12 V 21 W. Use only rated watt of the bulb.

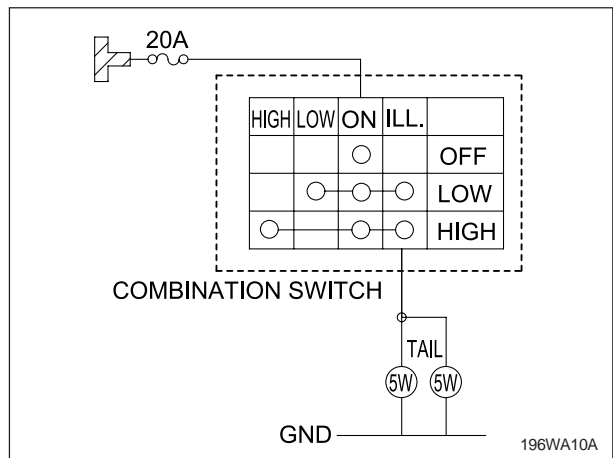


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(1) Rear Lamp Cover (LH) (3) Stop Light  
(2) Tail Light

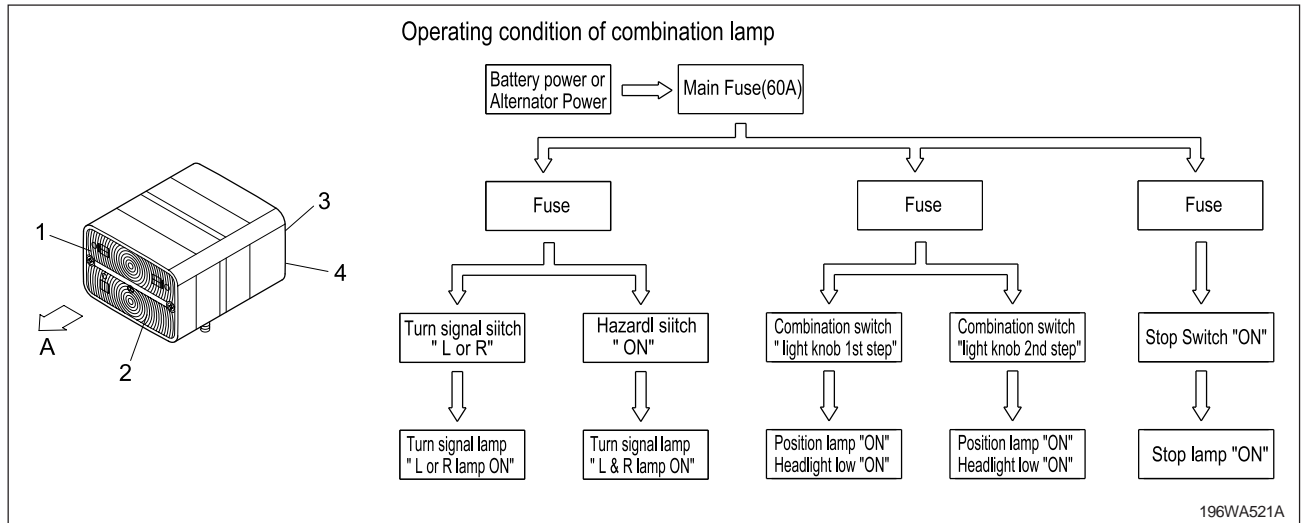
**d. Tail Light (Only CK20-USA)**

This lights only operates while the main light switch is "Tail light/head light". The lamp is mounted out side of the rear combination lamps.



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**e. Combination Lamps (CK20-EU)**



(1) Front Turn Signal Lamp    (2) Front Position Lamp    (3) Stop/Rear Position Lamp    (4) Rear Turn Signal Lamp

(A) Front

Five lamps are combined

(1) Front Turn Signal Lamp

(2) Front Position Lamp

(3) Stop/Rear Position Lamp

(4) Rear Turn Signal Lamp

(5) Hazardl Signal Lamp

**f. Head Lights**

This head lights help to make possible to drive during the night time.

**CK20-USA**

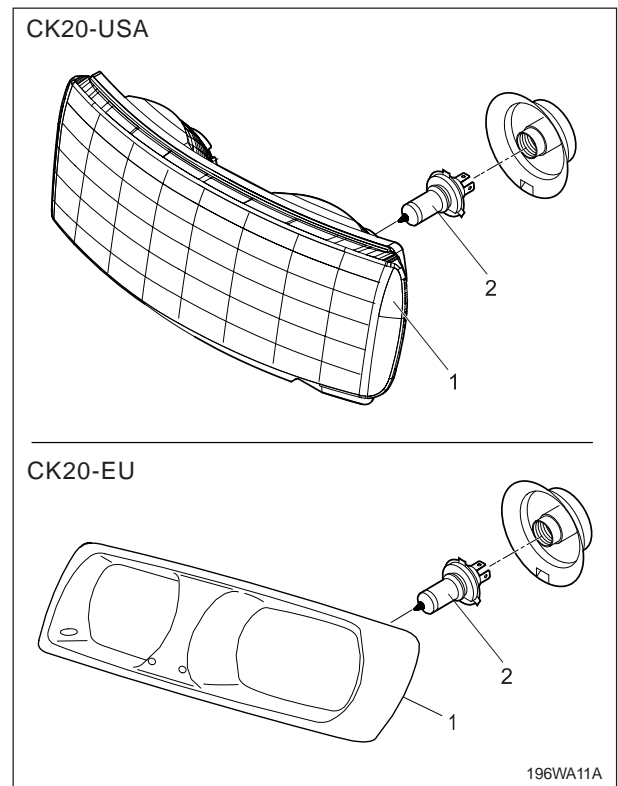
This head lights have 12 V 35 / 35 W bulbs.

Use only same capacity bulb.

**CK20-EU**

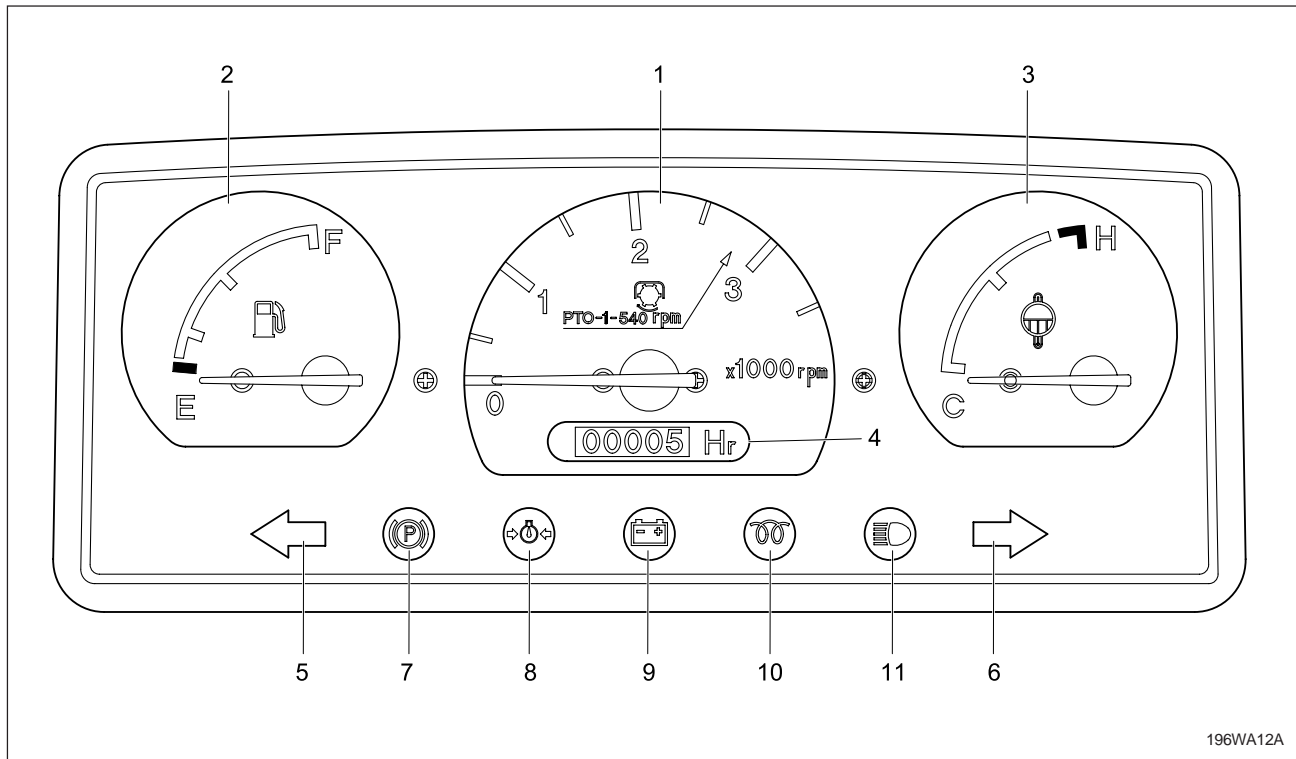
This head lights have 12 V 55 / 60 W bulbs.

Use only same capacity bulb.



(1) Head Lamp Ass'y    (2) Bulb

## 1.6 COMBINATION METER



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- |                                |  |
|--------------------------------|--|
| (1) Tachometer                 | (7) Parking Brake Operation Indicator    |
| (2) Fuel gauge                 | (8) Engine Oil Low Pressure Warning Lamp |
| (3) Engine Coolant Temp. Gauge | (9) Battery Discharging Warning Lamp     |
| (4) Hour Meter                 | (10) Pre-heat Operation Indicator        |
| (5) Turn Signal Indicator (LH) | (11) High Beam Operation Indicator       |
| (6) Turn Signal Indicator (RH) |  |

This shows entire condition of the tractor. It consists of 3 gauges, a hour meter and 7 warning lamps. They are;

### A. GAUGES AND INDICATORS

#### a. Tachometer

This shows the Engine RPM and PTO RPM. It operates mechanically by the cable.

#### b. Fuel Gauge

This gauge indicates the amount of fuel remaining in the tank. It must refill the fuel before fuel tank is empty.

#### c. Engine Coolant Temp. Gauge

This gauge indicates the temperature of the engine coolant. When the gauge indicates the red zone, it must check the cause. Never operates the tractor while the gauge indicates red zone.

#### d. Hour Meter

Record the hours and portions of the hours that the tractor has been operated based on an average engine speed of 2,200 RPM. Engine speeds below 2,200 RPM accumulate Engine hours at a slower rate than clock hours. engine speeds above 2,200 RPM accumulate engine hours faster than clock hours.

#### e. Turn Signal Indicator (LH)

#### f. Turn Signal Indicator (RH)

#### g. Parking Brake Operation Indicator

#### h. Engine Oil Low Pressure Warning Lamp

Light will illuminate when the engine oil pressure is below than set value. As soon as the light illuminates, stop the engine and investigate the cause.

(And visit the nearest maintenance facilities.)

**i. Battery Discharging Warning Lamp**

Illuminates when the key switch is in the "ON" position and goes out when the engine is started. If this bulb becomes lit during operation, it indicates that the charging system is not operation normally. As the battery can be fully discharged under this condition. Must check the cause as soon as possible.

**j. Pre-heat Operation Indicator**

When the key switch is in the "ON" position, light will illuminate. And the whether is cold, remain the key switch in the "ON" position before start for a while or until the lamp goes out. During the period, glow plug and combustion chambers are heated up and the engine becomes easier to start.

**k. High Beam Operation Indicator****B. SENSORS****a. Engine Oil Pressure Switch**

The oil pressure switch is located on the rear right side of the engine. The switch opens under normal oil pressure (above  $0.5 \pm 0.1$  kgf/cm<sup>2</sup>) and closes when oil pressure is low ( $0.5 \pm 0.1$  kgf/cm<sup>2</sup>) to complete the ground circuit of the oil pressure warning light.

When the ground circuit is completed, the oil pressure warning light illuminates on the instrument panel when the key switch is turned to the "ON" position and goes out when the engine is started. If the light does not go out after the engine has started, first check the engine oil level. If the oil level is correct, check for a malfunctioning switch or engine oil pump.

**b. Engine Coolant Temperature Switch**

The coolant temperature switch 1, is located at the front top side of the engine inside the thermostat housing. This switch is open under normal operating temperatures and close when operating temperatures reach higher than normal limits, 53°C, illuminating the indicator bulb on the instrument panel.

**c. Engine Coolant Temperature Sensor**

The coolant temperature sensor is located at the left front side of the engine inside the thermostat housing. This sensor regulates a variable resistance to ground, which translate into the movement of the temperature gauge.

**d. Fuel Level Sensor**

The fuel level sensor, 1, is mounted on the top of the fuel tank. The sensor float moves up and down with the fuel in the tank, while changing the resistance to the ground circuit of the fuel gauge.

## 2. SERVICING

### 2.1 TROUBLESHOOTING

#### A. TROUBLE SHOOTING STARTING CIRCUIT

Condition	Possible Cause	Remedy
Start motor will not energize	<ul style="list-style-type: none"> <li>• Insufficient battery charge</li> <li>• Blown 60 amp fuse</li> <li>• Inoperative starter switch</li>   <li>• Malfunctioning safety start switch</li> <li>• Malfunctioning PTO switch</li>   <li>• Malfunctioning starter</li>   <li>• Malfunctioning starter relay</li> </ul>	<p style="text-align: center;">Recharge or replace the battery</p> <p style="text-align: center;">Replace the 60 amp fuse</p> <p style="text-align: center;">Test the switch and replace if necessary</p> <p style="text-align: center;">Replace the switch</p> <p style="text-align: center;">Check the switch</p> <p style="text-align: center;">Test the switch and replace if necessary.</p> <p style="text-align: center;">Check the circuit of the switch</p> <p style="text-align: center;">Check the starter</p> <p style="text-align: center;">Repair or replace the starter if necessary</p> <p style="text-align: center;">Check the starter relay</p> <p style="text-align: center;">Replace the starter relay if necessary</p>

#### B. TROUBLE SHOOTING GLOW PLUG CIRCUIT

Condition	Possible Cause	Remedy
Glow plug will not heat.	<ul style="list-style-type: none"> <li>• Insufficient charge</li> <li>• Blown 60 amp fuse</li> <li>• Inoperative starter switch</li> <li>• Corroded buss bar connection</li> <li>• Inoperative glow plug</li> </ul>	<p style="text-align: center;">Recharge or replace the battery</p> <p style="text-align: center;">Replace the 60 amp fuse</p> <p style="text-align: center;">Test the switch and replace if necessary</p> <p style="text-align: center;">Clean or replace the buss bar</p> <p style="text-align: center;">Check plug resistance and replace if necessary</p>
Glow plug indicator light not functioning properly.	<ul style="list-style-type: none"> <li>• Inoperative glow plug timer relay</li> <li>• Inoperative indicator light</li> </ul>	<p style="text-align: center;">Check for current and ground circuit to timer relay</p> <p style="text-align: center;">Test the timer relay and replace if necessary</p> <p style="text-align: center;">Check for current and ground circuit</p> <p style="text-align: center;">Replace the indicator bulb</p>
Glow plug indicator does not glow	<ul style="list-style-type: none"> <li>• Battery discharged or defective</li> </ul>	<p>Recharge or replace</p>

**C. TROUBLE SHOOTING LIGHTING CIRCUIT**

<b>Condition</b>	<b>Possible Cause</b>	<b>Remedy</b>
Lights will not illuminate.	<ul style="list-style-type: none"> <li>• Insufficient battery charge</li> <li>• Blown 60 amp. fuse</li> <li>• Inoperative starter switch</li> </ul>	Recharge or replace the battery Replace the 60 amp. fuse Test the switch and replace if necessary
Front lights will not illuminate.	<ul style="list-style-type: none"> <li>• Blown 20 amp fuse</li> <li>• Malfunctioning light switch</li> <li>• Improper connection at connector</li> <li>• Improper ground to headlight</li> <li>• Blown bulbs</li> </ul>	Replace the 20 amp fuse Test the switch and replace if necessary Check connection of terminals and correct if necessary Check ground source at terminal Replace the bulb
Rear lights will not illuminate	<ul style="list-style-type: none"> <li>• Blown 20 amp fuse</li> <li>• Malfunctioning light switch</li> <li>• Improper connection at connector</li> <li>• Improper ground to stop light</li> <li>• Blown bulbs</li> </ul>	Replace the 20 amp fuse Test the switch and replace if necessary Check connection of terminals and correct if necessary Check ground source at terminal Replace the bulb
Hazard lights not flashing	<ul style="list-style-type: none"> <li>• Inoperative flasher unit</li> <li>• Blown 10 amp fuse</li> </ul>	Test the unit and replace if necessary Replace the 10 amp fuse
Lights are dim or not illuminated	<ul style="list-style-type: none"> <li>• Improper ground circuit</li> <li>• Improper connection at harness</li> </ul>	Check ground source Check connections at harness connectors

**D. TROUBLE SHOOTING FUEL LEVEL CIRCUIT**

<b>Condition</b>	<b>Possible Cause</b>	<b>Remedy</b>
Inoperative fuel level gauge	<ul style="list-style-type: none"> <li>• Blown 20 amp fuse</li> <li>• Malfunctioning sending unit</li> <li>• Improper ground circuit</li> <li>• Malfunctioning fuel gauge</li> </ul>	Replace the 20 amp fuse Test the sending unit and replace if necessary Check the ground source. Test the fuel gauge and replace if necessary

**E. TROUBLE SHOOTING OIL PRESSURE CIRCUIT**

<b>Condition</b>	<b>Possible Cause</b>	<b>Remedy</b>
Oil pressure warning light stays "ON"	<ul style="list-style-type: none"> <li>• Blown 20 amp fuse</li> <li>• Low oil pressure</li> <li>• Malfunctioning sender</li> <li>• Short circuit of sensor wire to ground</li> <li>• Malfunctioning instrument panel</li> </ul>	Replace the 20 amp fuse Check the engine Test the sensor and replace if necessary Check the circuit Test the oil pressure gauge and replace if necessary

**F. TROUBLE SHOOTING COOLANT TEMP. CIRCUIT**

Condition	Possible Cause	Remedy
Inoperative coolant temp. gauge	<ul style="list-style-type: none"> <li>• Blown 20 amp fuse</li> <li>• Malfunctioning temp. sensor</li> <li>• Improper ground circuit</li> <li>• Malfunctioning temp. gauge</li> </ul>	<p>Replace the 20 amp fuse</p> <p>Test the temp. sensor and replace if necessary</p> <p>Check the ground source.</p> <p>Test the temp. gauge and replace if necessary</p>

**G. TROUBLE SHOOTING ENIGNE TACHOMETER CIRCUIT**

Condition	Possible Cause	Remedy
Engine tachometer does not function when engine is running	<ul style="list-style-type: none"> <li>• Tachometer cable defective or improperly connected</li> <li>• Gear in combination meter defective</li> </ul>	<p>Replace if necessary</p> <p>Check the connection</p> <p>Check the gear and replace if necessary</p>

**H. TROUBLE SHOOTING CHARGING SYSTEM**

Condition	Possible Cause	Remedy
Charging lamp does not light when main key switch turned ON.	<ul style="list-style-type: none"> <li>• Fuse blown (15A)</li> <li>• Wire harness disconnected or improperly connected</li> <li>• AC generator defective</li> <li>• Regulator defective</li> </ul>	<p>Replace the fuse</p> <p>Check the connection and repair if necessary.</p> <p>Repair or replace the generator</p> <p>Repair or replace the regulator</p>
Charging lamp dose not go off when Engine is running	<ul style="list-style-type: none"> <li>• Wiring harness disconnected or improperly connected.</li> <li>• AC generator defective</li> <li>• Regulator defective</li> </ul>	<p>Check the connection and repair if necessary.</p> <p>Repair or replace the generator</p> <p>Repair or replace the regulator</p>



## 3. CHECKING, DISASSEMBLING AND SERVICING

### 3.1 BATTERY

#### ⚠ CAUTION

- To avoid accidental short circuit, "be sure to attach the positive cable to the positive terminal before the negative cable is attached to the negative terminal.
- Never remove the battery cap while the engine is running.
- Keep electrolyte away from eyes, hands and clothes. If you are splattered with it, wash it away completely with water immediately.
- Keep open sparks and flames away from the battery at all times. Hydrogen gas mixed with oxygen becomes very explosive.

#### ⊕ IMPORTANT

- If the machine is to be operated for a short time without battery(using a slave battery for starting), use additional current(like lights) while engine is running and insulate terminal of battery. If this advice is disregarded, damage to AC generator and regulator may result.

### A.CHECKING

#### a. Battery Voltage

1. Stop the engine and turn off the main key switch.
2. Connect the Voltage meter like figure.

Sect.	Factory spec.
Battery voltage	More than 12 Volt

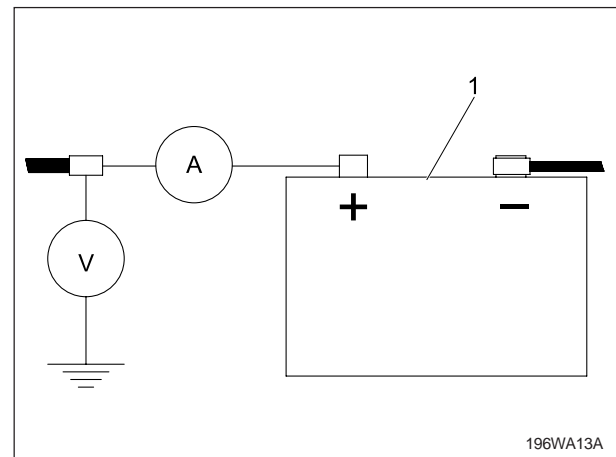
#### b. Charging Current Measuring

1. Start the engine then detach the positive cord of the battery.
2. Connect the Ampere meter like figure.
3. Operates all electrical system (like head lights ...).

#### ⚠ CAUTION

- Must connect the Ampere meter after engine start.
- If electric load is not enough or battery is fully charged, you can not get the following results.

Sect.	Rated spec.
Current	50 A
Voltage	14 ~ 15 V
Engine rpm	2,800 rpm



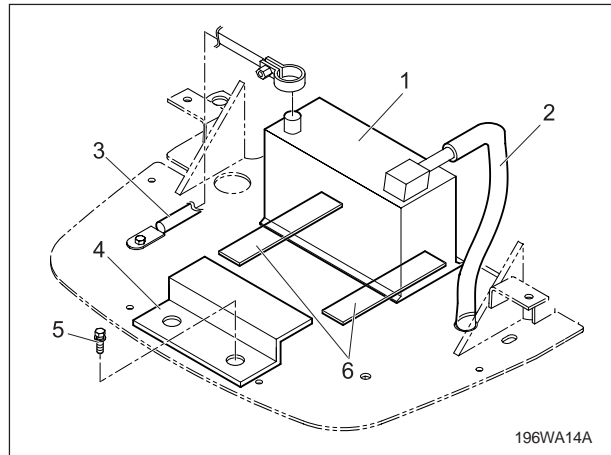
(1) Battery

(A) Amparemeter

(V) Voltmeter

### B. BATTERY REMOVAL

1. Raise the tractor hood by moving the latch release to the right and lifting the hood to its fully raised position.
2. Disconnect the negative (-) battery cable 3.
3. Disconnect the positive (+) battery cable 2.
4. Remove the battery hold-down hardware (4), (5), and remove the battery from the tractor.



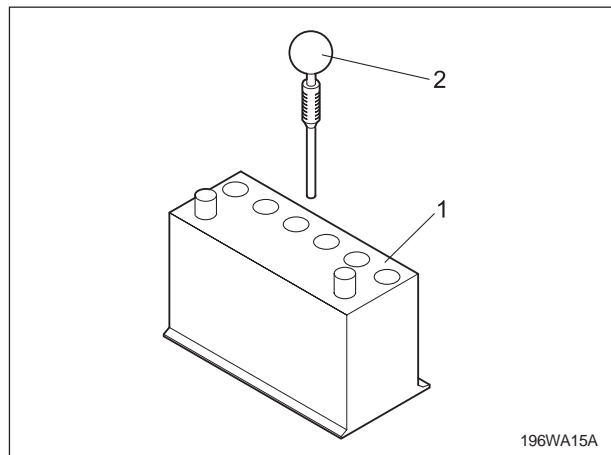
- |                      |                     |
|----------------------|---------------------|
| (1) Battery          | (4) Battery Bracket |
| (2) Battery Cord (+) | (5) Bolt            |
| (3) Battery Cord (-) | (6) Cushion Rubber  |

### C. BATTERY INSTALLATION

1. Orient the battery so that the posts are toward the rear of the tractor. Install the battery and the hold-down bracket (4), and hardware (3), positioning the hold-down strap so that it clear all other components.
2. Connect the positive (+) Red cable (3), to the positive (+) terminals and the negative (-) BLACK cable (3), to the negative (-) terminals.
3. Install the protective caps over the battery terminals and cable connections.

### D. BATTERY SPECIFIC GRAVITY

1. Check the specific gravity of the electrolyte in each cell with hydrometer.
2. When the electrolyte temperature differs from that at which the following the formula mentioned in (Reference)
3. If the specific gravity is less than 1.215 (after it is corrected for temperature), charge or replace the battery
4. If the specific gravity differs between any two cells by more than 0.05, replace the battery.



- |             |                |
|-------------|----------------|
| (1) Battery | (2) Hydrometer |
|-------------|----------------|

**NOTES:**

- 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.

**(Reference)**

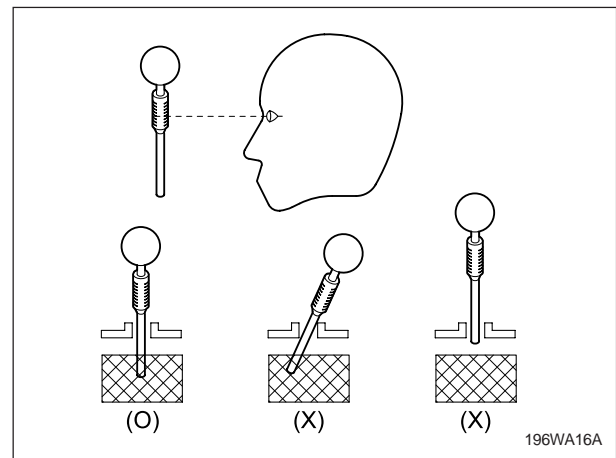
Specific gravity slightly varies with temperature.

To be exact, the specific gravity decreases by 0.0007 with an increase of 1°C in temperature, and increases by 0.0007 with a decrease of 1°C.

Specific gravity		Charging degree	Average battery voltage
at 15°C	at 25°C		
1.295	1.287	100 %	12.66 V
1.253	1.246	75 %	12.45 V
1.217	1.210	50 %	12.30 V
1.177	1.170	25 %	12.00 V
1.137	1.130	Discharged	11.84 V

**NOTES:**

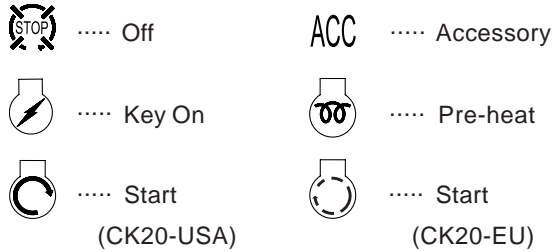
- Always keep the specific gravity more than 1.280.
- If specific gravity is less than 1.280, it must charge the battery.



### 3.2 STARTING SYSTEM

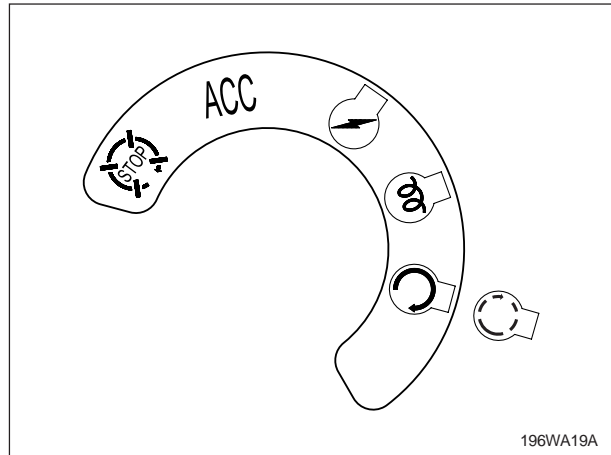
#### A. KEY SWITCH

The key switch is located on the right side of the operator's console. The five positions of the switch are:



**NOTE:**

- All positions are in a clockwise rotation.
- The "START" position is spring loaded to return to "ON" position.

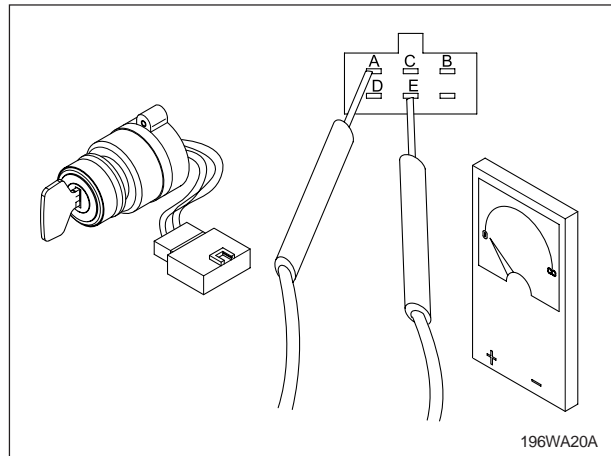


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#### a. Key Switch Testing

Disconnect the key switch from the wiring harness connector. Use an ohmmeter to test the switch.

- With the key in the "OFF" position, continuity will not exist between any of the terminals, not shown.
- With the key in the "ACCESSORY" position, there will be continuity between the (BATTERY) and (ACCESSORY) terminals of the switch, and (A) and (B) of the connector.
- With the key in the "ENGINE PREHEAT" position, there will be continuity between the (BATTERY) and (HEAT) terminal of the switch, and (A) and (C) of the connector.
- With the switch in the "ON" position, there will be continuity between (BATTERY) and (ON) terminal of the switch, and (A) and (D) of the connector.
- With the key in the "START" position, there will be continuity between the (BATTERY) and (START) terminals of the switch, and (A) and (D) of the connector. If the test results are not as outlined above, replace the key switch.



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- |                 |            |
|-----------------|------------|
| (A) Battery     | (D) Key ON |
| (B) Accessory   | (E) Start  |
| (C) Engine Heat |            |

## B. START RELAY AND PREHEAT RELAY

They are interchangeable.

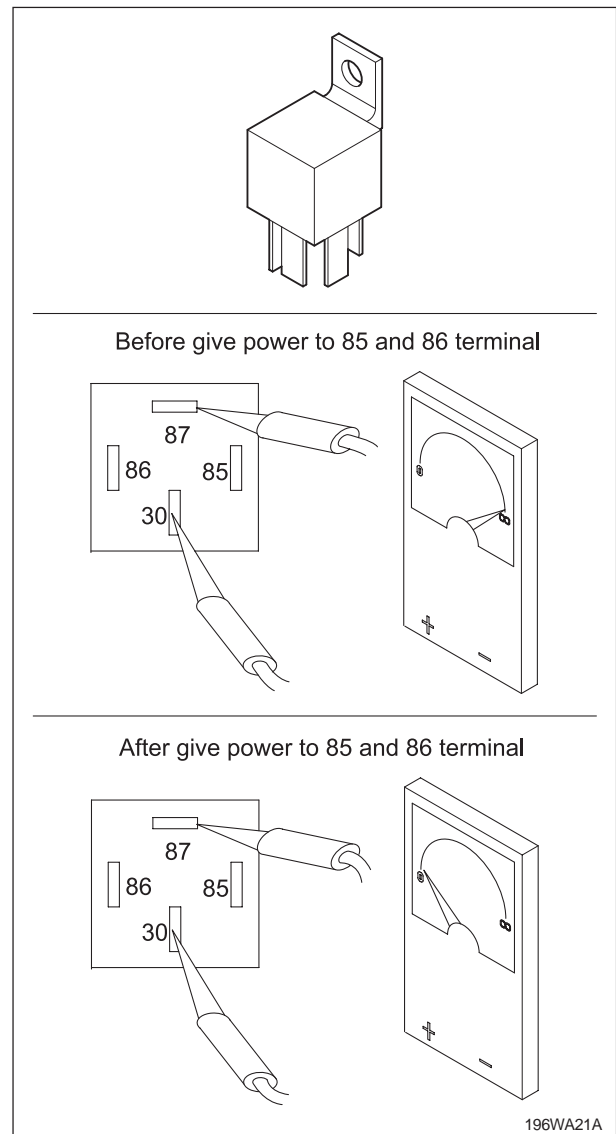
### a. Relay Testing

To test a relay, disconnect it from the circuit. Use an ohmmeter to verify non-energized conditions. Connect the ohmmeter leads to terminals 87 and 30.

- There will be no continuity between terminals 87 and 30 if the relay is working properly.

Next use the ohmmeter to verify energized conditions. Energize the coil by applying 12 volts of current across terminals 85 and 86. Connect the ohmmeter leads to terminals 87 and 30.

- There will be continuity between terminals 87 and 30 if the relay is working properly. Connect the ohmmeter leads to terminals 87a and 30.
- There will be no continuity between terminals 87a and 30 if the relay is functioning properly.
- If continuity readings do not match those stated in the above test procedures, replace the relay.



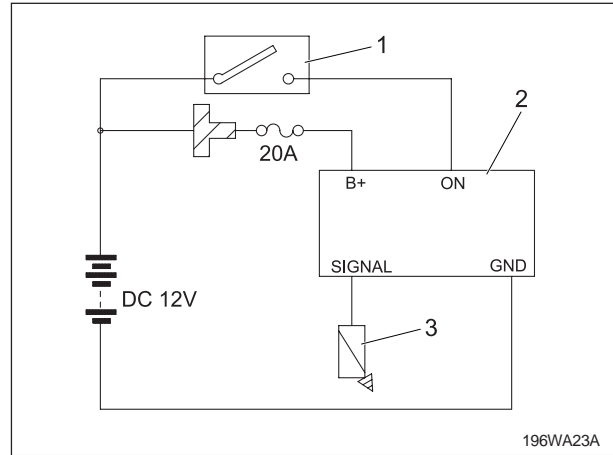
**C. ENGINE STOP SYSTEM**

The timer relay is located inside of the lower cover of the meter. This relays limits the time that engine stop solenoid operates.

Engine stop solenoid helps to stop engine easily. It operates about 8 sec. after key switch "OFF".

**a. Timer Relay and Engine Stop Solenoid Circuit and Testing**

1. Install the battery's positive (+) lead to terminal of the relay.
2. Install the battery's negative (-) lead to terminal of the relay.
3. Operate Key switch "OFF" then Eng. stop sol will be energized. (Engine stop sol. must be installed to engine or connect the negative (-) wire to engine stop sol. body.)
4. Replace the relay if the test result does not match above.



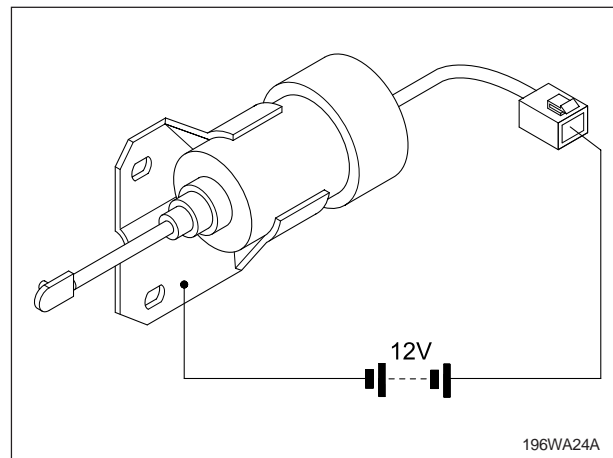
(1) Key S/W (ON)                      (3) Eng. Stop Sol.  
(2) Timer Relay

**b. Engine Stop Solenoid Operating Test**

1. Disconnect the 1P connector from the wiring harness
2. Remove the solenoid from the engine.
3. Connect the jumper wire from the battery positive terminal to the 1P connector, and from battery negative terminal to the solenoid body.
4. If the solenoid plunger is not attracted, the engine stop solenoid is faulty.

**! CAUTION**

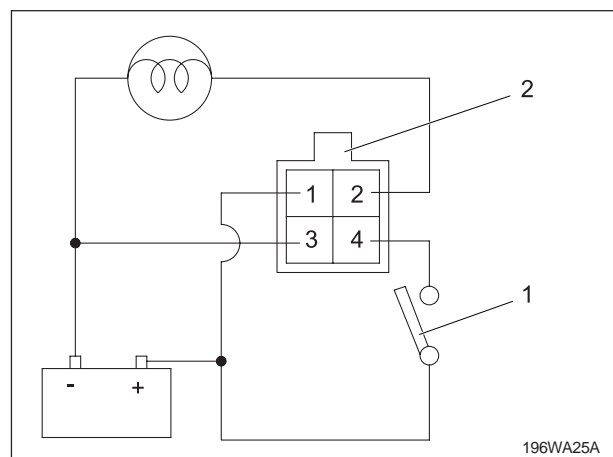
- **Secure the engine stop solenoid in a vise to prevent it from jumping up and down while testing the solenoid.**



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**c. Timer Relay Test**

1. Remove the timer relay from the tractor.
2. Connect jumper leads across the battery positive terminal and the timer relay terminal 1 and key switch.
3. Connect jumper leads across the battery negative terminal and the timer relay terminal 3 and bulb terminal.
4. Connect jumper leads across the timer relay terminal 2 and bulb terminal.
5. Connect jumper leads across the timer relay terminal 4 and key switch.
6. First the key switch "ON" and then the key switch "OFF", the bulb will light up.



(1) Key Switch                      (2) Timer Relay

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## D. PREHEATING SYSTEM

The pre-heat controller is fixed on left side of the this controller limits the length of time that the glow plug operates.

### a. Pre-heat Controller Testing

#### NOTES:

- Be carefully the polarity of the vattery.

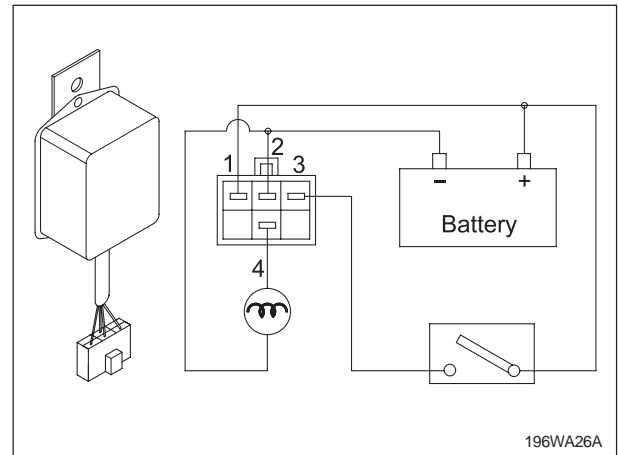
A 12-volt battery, test light, a switch and jumper wires are needed to test the pre-heat controller.

1. Install the battery's positive (+) lead to terminal 1 of the controller.
2. Install the test light to terminal 4 of the controller with its lead connected to the battery negative (-) terminal.
3. Install the test switch to terminal 3 of the controller with its lead connected to the battery positive (+) terminal.
4. Connect the lead to terminal 2 of the controller to the battery's negative terminal as the final step.

If the light does not illuminate, replace the controller.

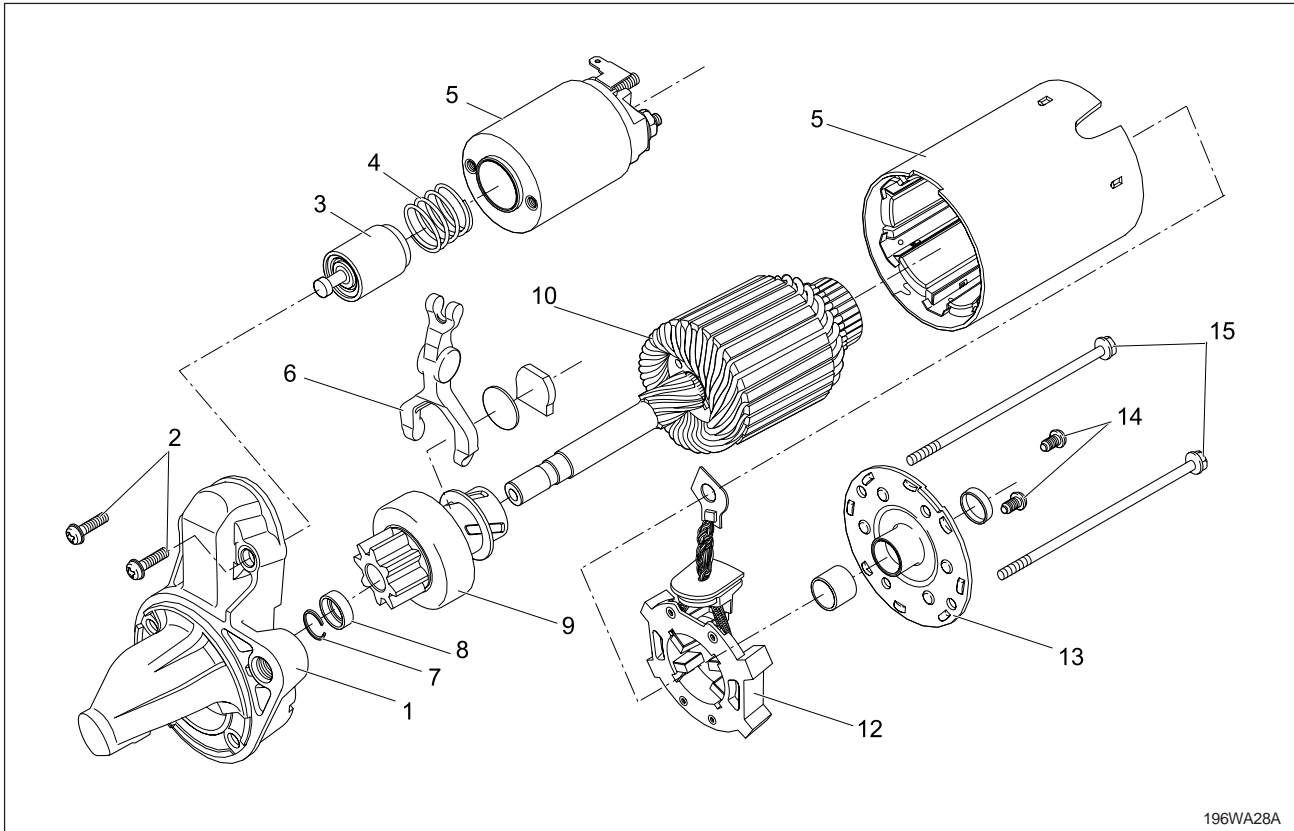
## E. GLOW PLUGS

Glow plugs are heating elements used to warm the air in the combustion chambers before and during engine startup. The glow plugs are located on the right side of the engine cylinder lead.



**F. STARTER MOTOR**

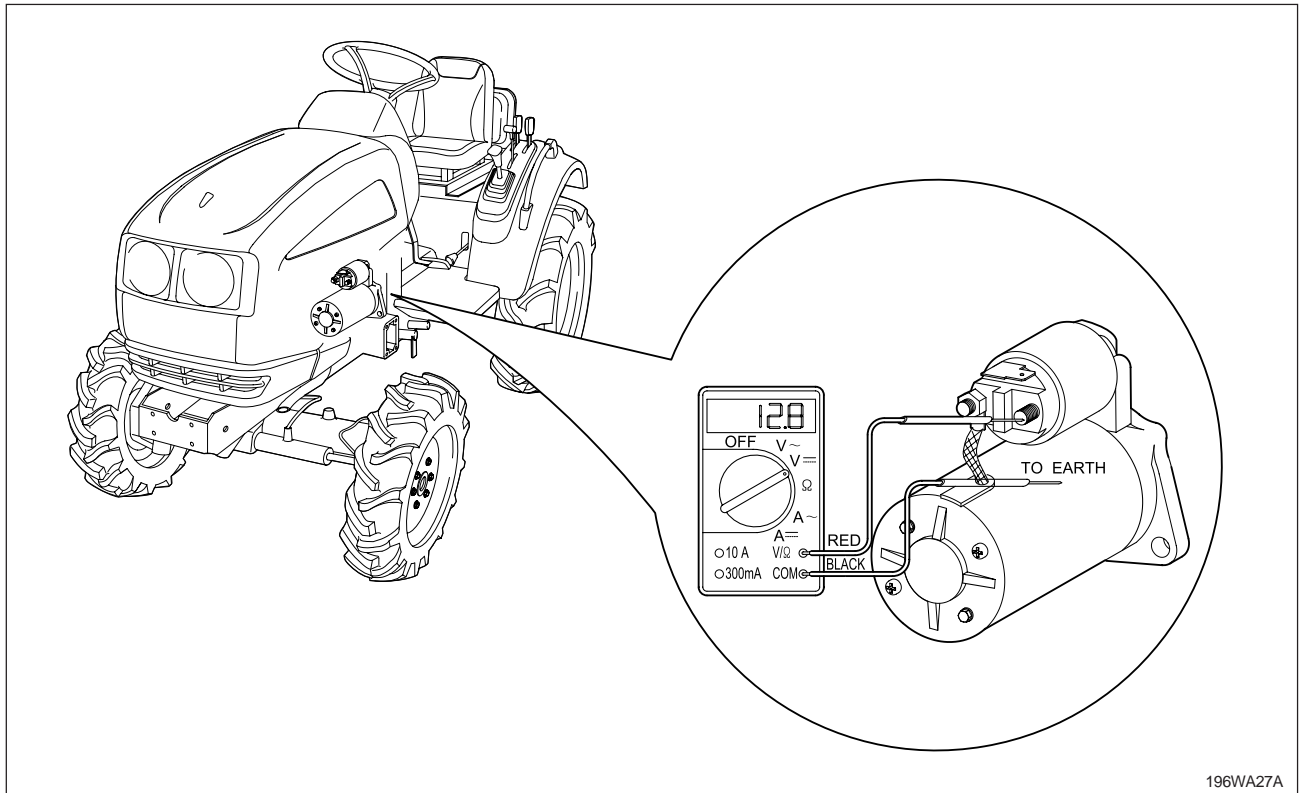
**a. Assembly and Disassembly**



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- |                   |                     |
|-------------------|---------------------|
| (1) Front Bracket | (9) Over Run Clutch |
| (2) Screw         | (10) Amateur        |
| (3) Plunger       | (11) Yoke Assembly  |
| (4) Spring        | (12) Brush Holder   |
| (5) Solenoid      | (13) Rear Frame     |
| (6) Lever         | (14) Screw          |
| (7) Stop Ring     | (15) Bolt           |
| (8) Stop Pin      |                     |





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### b. Voltage Test (B+ Terminal)

1. Measure the voltage with a voltmeter across the B terminal and chassis.
2. If the voltage differs from the battery voltage, the battery's positive cable or the battery negative cable is faulty.

#### NOTES:

- *If you can't start engine, must check here.*

### c. Motor Operating Test

#### ⚠ CAUTION

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

1. Disconnect the battery positive cable and the leads from the starter.
2. Remove the starter motor from the engine.
3. Connect a battery positive cable (at least 20sq) to starter motor B+ terminal and battery positive terminal.
4. Connect a jumper lead (at least 3sq) magnet switch terminal and battery positive terminal.
5. When you connect jumper lead to magnet switch, the starter motor operates.

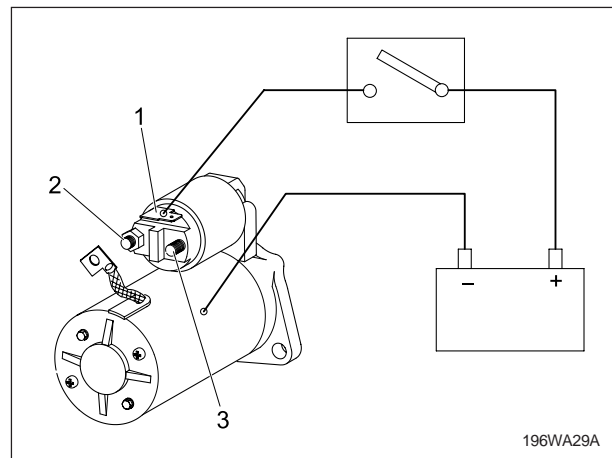
The test result is not like this, replace the starter motor.

**d. Hold in Test of Magnetic Switch**

1. Disconnect M terminal of the starter.
2. Connect battery negative terminal to M terminal of the starter motor.
3. Connect Battery positive terminal to S terminal use a switch
4. Switch "ON", the pinion will moves.
5. If the pinion does not move, change the magnetic switch.

**NOTES:**

- Do not test more than 5 sec caused fault of the coil.



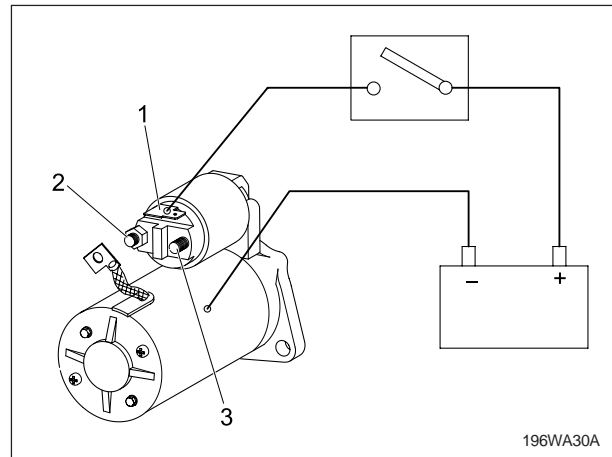
(1) S Terminal                      (3) B Terminal  
(2) M Terminal

**e. Hold in Test of Solenoid**

1. Disconnect M terminal of the starter.
2. Connect battery negative terminal to chassis of the starter motor.
3. Connect battery positive terminal to S terminal use a switch.
4. Pull the pinion out. If the pinion does not return quickly, the solenoid is faulty.

**NOTES:**

- Do not test more than 5 sec caused fault of the coil.

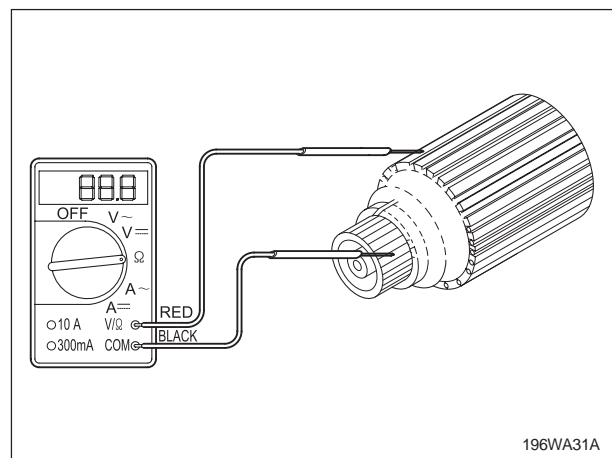


(1) S Terminal                      (3) B Terminal  
(2) M Terminal

**f. Connection Test of the Amateur**

Use the tester, check the resistor between amateur coil and commutator coil.

If it is short circuit, the amateur is faulty.

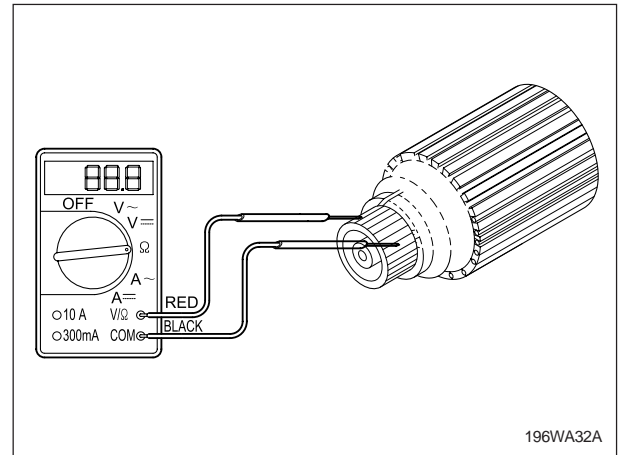


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**g. Open Circuit Test of Amateur Coil**

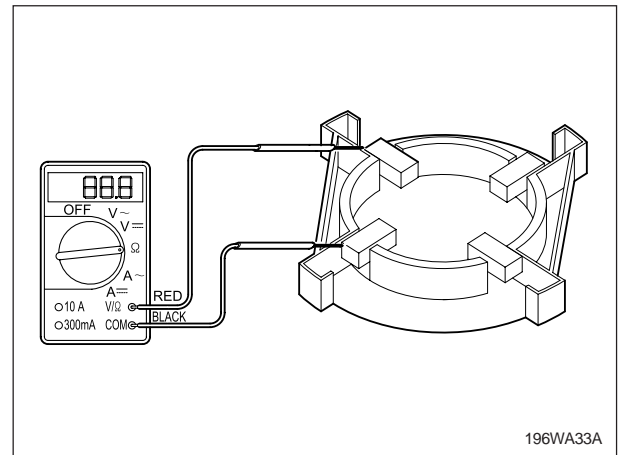
Using the tester, check the resistor among the commutators.

If there is no connection, the amateur is faulty.

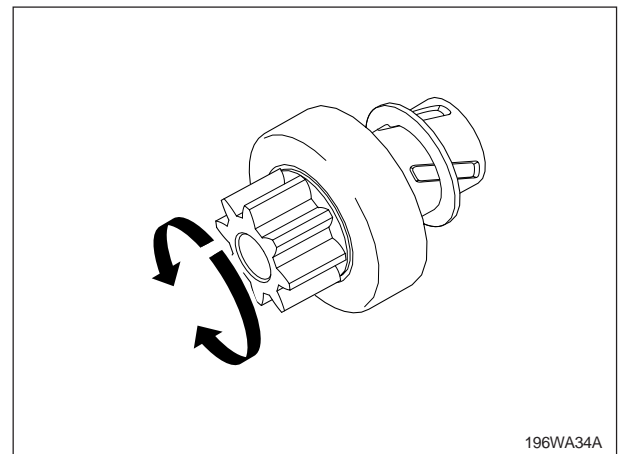
**h. Test of Brush**

Using the tester, check the resistor between the brushes.

If there is connection, the brush is faulty.

**i. Test of Over Run Clutch**

1. Check the teeth of the pinion and spline. If there are damages, replace the parts. Also check the teeth of the flywheel.
2. Rotate the pinion. Only rotate the pinion clockwise.



### 3.3 CHARGING SYSTEM

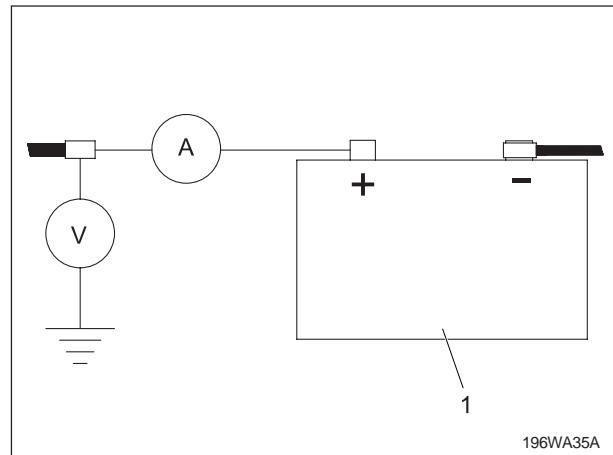
#### A. CHARGING CURRENT CHECK

1. After engine starts, disconnect battery positive cord, then connect the ampere meter like figure.
2. Operates all electric load (like lamps) and measure the charging current.

**NOTES:**

- Connect Ampere meter after engine starts.
- If electric load is not enough or battery is fully charged, it can not get expected test results.

Sect.	Spec.
Ampere	50 A
Voltage	14.7 ± 0.3 V
Engine rpm	2,500 rpm



(1) Battery

(A) Ampere Meter

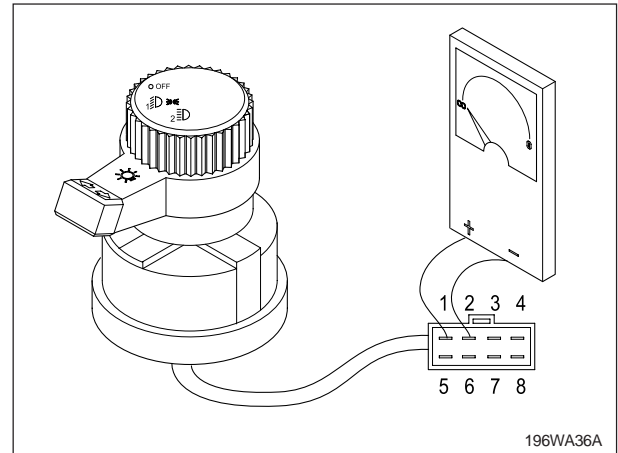
(V) Volt Meter

### 3.4 LIGHTING SYSTEM

#### A. HEAD LIGHT SWITCH TESTING

##### a. Use an Ohmmeter to Test the Light Switch

- With the switch in the "OFF" position, the continuity will not exist between any of the terminals.
- With the switch in the "HEADLIGHTS" position, there will be the continuity between terminals 1 and 2, 4.
- With the switch in the mid "TAILLIGHT" position, there will be the continuity between terminals 1 and 2, 3.



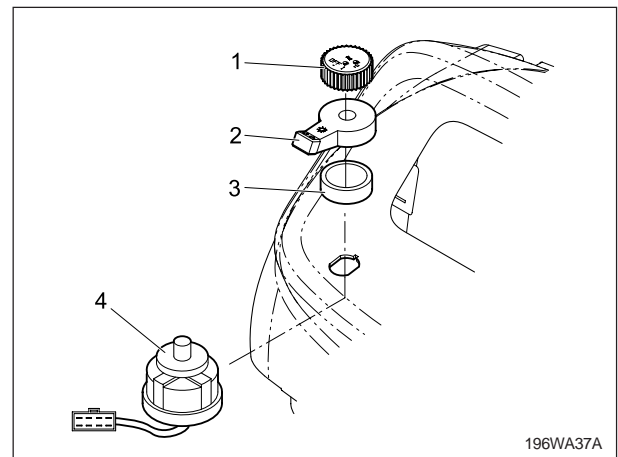
#### B. TURN SIGNAL SWITCH TESTING

##### a. Use an Ohmmeter to Test the Light Switch

- When turn the flasher switch knob to right, there will be the continuity between terminal 5 and 6.
- When turn the flasher switch knob to left, there will be the continuity between terminal 5 and 7.

##### b. Switch Removal

- Pull up the light knob (1).
- Pull up the flash lever (2).
- Loosen the ring nut (3), then pull down the body (4), from the console.



- |                 |                 |
|-----------------|-----------------|
| (1) Light Knob  | (3) Ring Nut    |
| (2) Flash Lever | (4) Switch Body |

#### C. HEADLIGHTS TEST

To replace a failed head light bulb:

1. Open the tractor hood.
2. Remove the connector connected to the bulb
3. Remove the rubber cap,3, then remove the spring retainer from the headlamp housing.

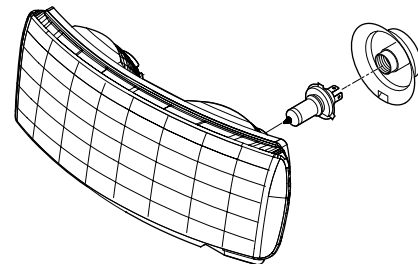
Replace a new bulb in the socket, then reinstall the socket into the housing.



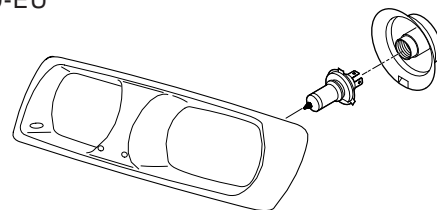
#### IMPORTANT

- *Replace with the bulb which has same capacity.*

CK20-USA



CK20-EU



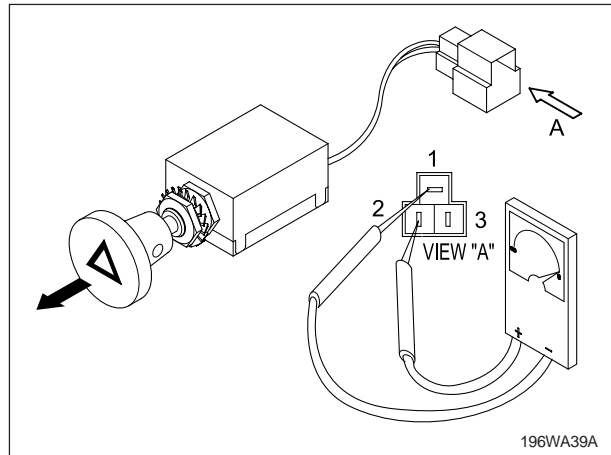
196WA11A

**D. HAZARD LIGHT SWITCH TEST**

Use the ohmmeter to test the hazard light switch.

- With the switch in the "OFF" position, there will be the continuity between terminals 1 and 2, 3.
- With the switch in the "O N" position, there will be the continuity between terminals 1 and 2, 3.

If test results are not as outlined above, replace the hazard light switch.



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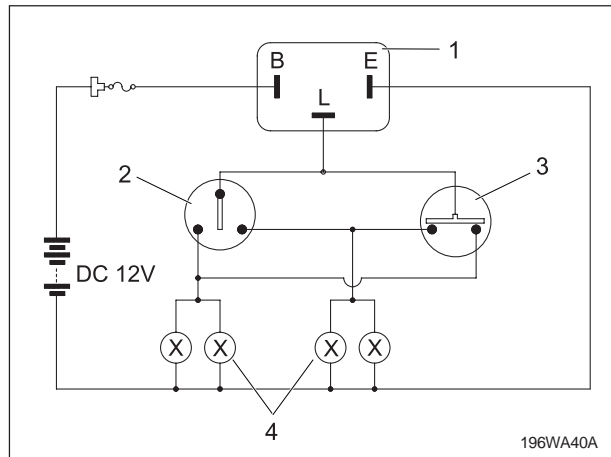
**E. FLASHER UNIT**

**a. Terminal Identification and Circuit**

This shows the terminal identification and the circuit of the flasher system.

**b. Flasher Unit Testing**

A 12-volt battery and auxiliary light are needed to test the flasher unit. Install the battery's positive (+) lead to terminal B of the flasher unit. Install the light's positive (+) lead to terminal L of the flasher unit. Install the battery's positive (+) lead to the positive terminal of the battery. Install the light's negative (-) lead to the battery's negative terminal. The light will flash and the unit will make a clicking sound if the unit is functioning properly.



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- (1) Flasher Unit
- (2) Turn Signal S/W
- (3) Hazard S/W
- (4) Lamp

Replace the relay if the test result does not match above.

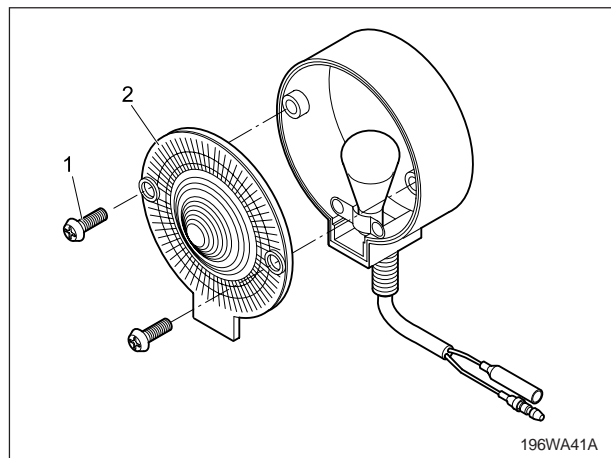
**F. FLASHER WARNING LIGHT(CK20-USA)**

To replace a flasher warning light bulb:

1. Remove the two screws, 1, then remove the lens, 2.
2. Push in on the bulb and rotate counterclockwise in the socket to remove the old bulb.
3. Insert a new bulb into the socket and turn the bulb clockwise until tightened.

**+ IMPORTANT**

- **Replace the bulb which has same capacity of the old one.**



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- (1) Screw
- (2) Lens

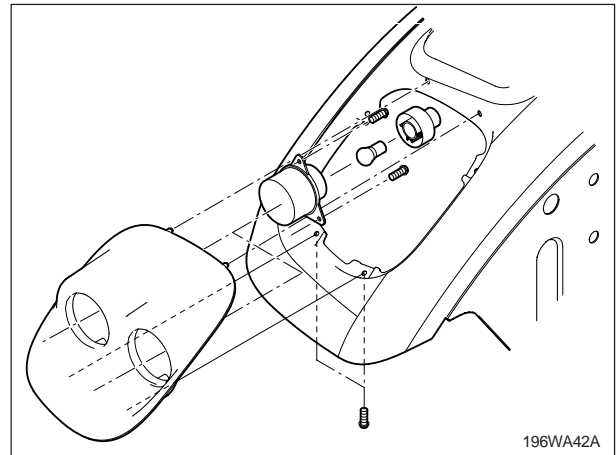
### G. STOP AND TAIL LIGHTS (INSIDE: STOP LIGHT, OUTSIDE: TAIL LIGHT) (CK20-USA)

To replace a faulty taillight bulb.

1. Push in on the bulb and rotate counterclockwise in the socket to remove the old bulb.
2. Insert a new bulb into the socket and turn the bulb clockwise until tightened.

#### **+** IMPORTANT

- *Replace the bulb which has same capacity of the old one.*



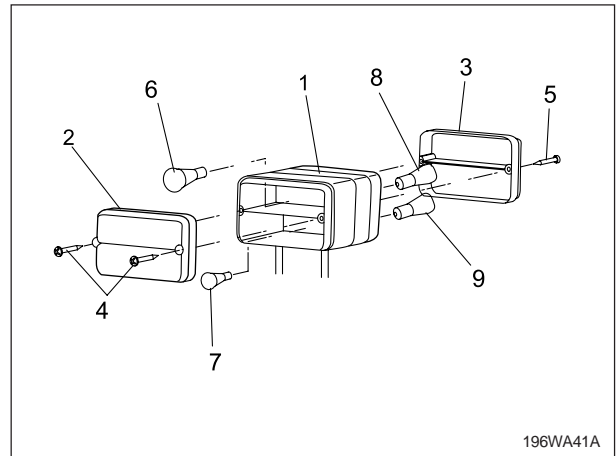
### H. FLASHER WARNING LIGHT(CK20-EU)

To replace a flasher warning light bulb:

1. Remove the two screws 4 and 5, then remove the lens 2 and 3.
2. Push in on the bulb 6 and 9, and rotate counterclockwise in the socket to remove the old bulb.
3. Insert a new bulb into the socket and turn the bulb clockwise until tightened.

#### **+** IMPORTANT

- *Replace the bulb which has same capacity of the old one.*



### I. STOP AND TAIL LIGHTS(CK20-EU)

To replace a faulty taillight bulb.

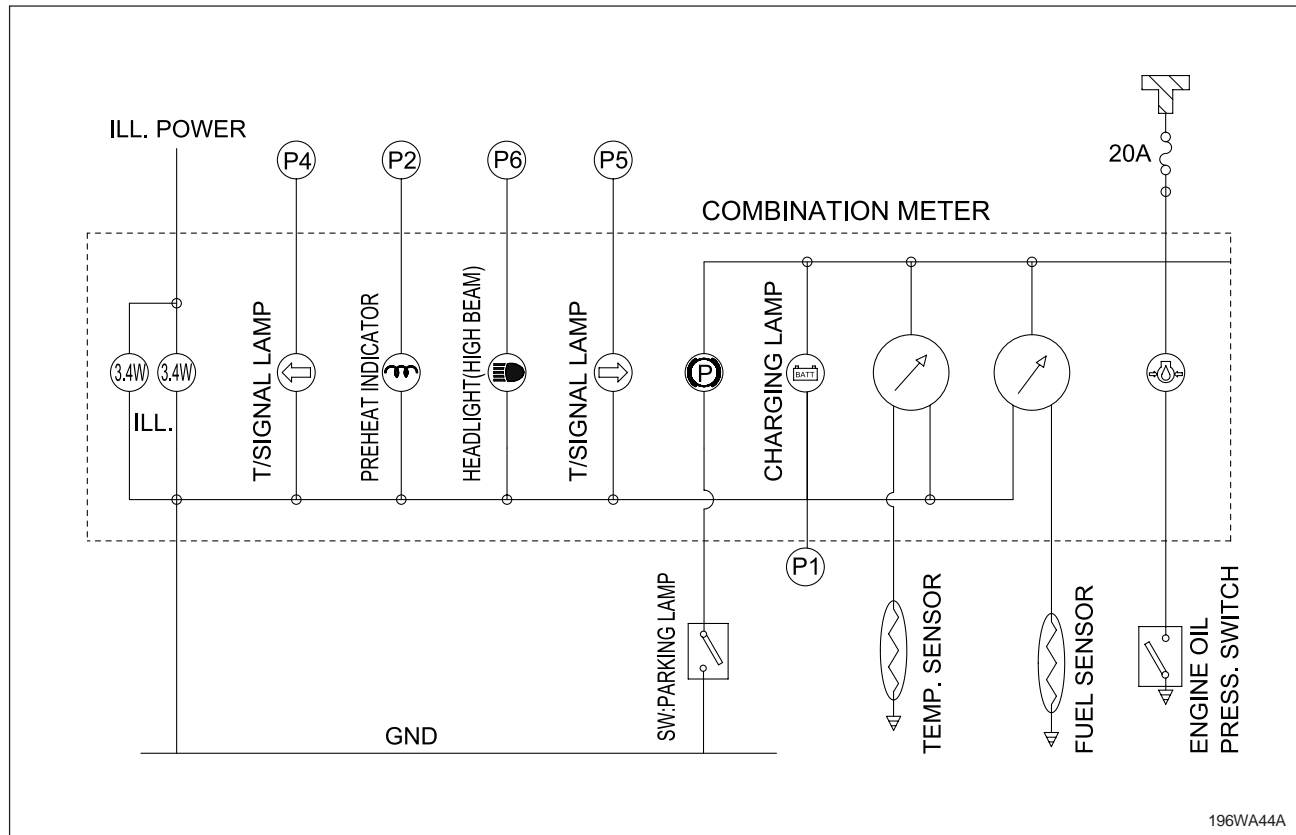
1. Release the rear lens (3).
2. Push in on the bulb (8) and rotate counterclockwise in the socket to remove the old bulb.
3. Insert a new bulb into the socket and turn the bulb clockwise until tightened.

#### **+** IMPORTANT

- *Replace the bulb which has same capacity of the old one.*

- |                |                          |
|----------------|--------------------------|
| (1) Body       | (6) Bulb (12 V 21 W)     |
| (2) Front Lens | (7) Bulb (12 V 5 W)      |
| (3) Rear Lens  | (8) Bulb (12 V 21 / 5 W) |
| (4) Screw      | (9) Bulb (12 V 21 W)     |
| (5) Screw      |                          |

### 3.5 COMBINATION METER



196WA44A

This shows circuit of the Combination meter system.

P1: from Alternator

P2: from Preheat controller

P4: from Combination switch (T/S switch, LH)

P5: from Combination switch (T/S switch, RH)

P6: from Combination switch (high beam)

#### A. ENGINE OIL PRESSURE SWITCH

The oil pressure switch is located on the rear right side of the engine. The switch opens under normal oil pressure (above  $0.5 \pm 0.1$  kgf/cm<sup>2</sup>) and closes when oil pressure is low ( $0.5 \pm 0.1$  kgf/cm<sup>2</sup>) to complete the ground circuit of the oil pressure warning light.

When the ground circuit is completed, the oil pressure warning light illuminates on the instrument panel when the key switch is turned to the "ON" position and goes out when the engine is started. If the light does not go out after the engine has started, first check the engine oil level. If oil level is correct, check for a malfunctioning switch or engine oil pump.

#### B. ENGINE COOLANT TEMPERATURE SWITCH

The coolant temperature switch is located at the front top side of the engine inside the thermostat housing. This switch is open under normal operating temperatures and close when operating temperatures reach higher than normal limits, 53°C, illuminating the indicator bulb on the instrument panel.



### C. ENGINE COOLANT TEMPERATURE SENDER

The coolant temperature sensor is located at the left front side of the engine inside the thermostat housing. This sensor regulates a variable resistance to ground, which translates into the movement of the temperature gauge.

#### Engine coolant temperature sensor testing

Coolant temperature	Sensor resistance
60°C	152.7 $\Omega$
80°C	74.2 $\Omega$
90°C	54.9 $\Omega$
110°C	30.2 $\Omega$
120°C	23.6 $\Omega$

### D. FUEL LEVEL SENSOR

The fuel level sensor is mounted on the top of the fuel tank. The sensor float moves up and down with the fuel in the tank, while changing the resistance to the ground circuit of the fuel gauge.

#### a. Fuel Level Sensor Testing

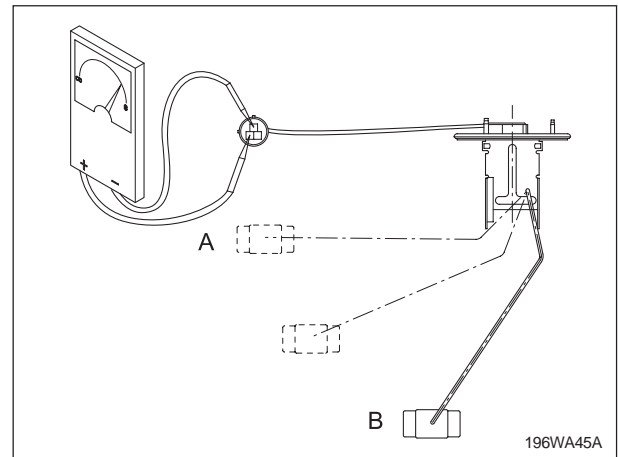
Use an ohmmeter to test the fuel level sensor. Remove the sensor from the fuel tank. Attach one of the meter leads to the wire (yellow-brown color) of the sensor.

Attach the other meter lead to the ground wire (black color), 2, of the sensor or sensor body.

With the sensor in the "EMPTY" position, the meter indicates 103 ~ 117  $\Omega$ .

With the sensor in the "FULL" position, the meter reading will be 1 ~ 5  $\Omega$ .

If the test results do not match the above, replace the fuel level sensor.



(A) Full

(B) Empty

