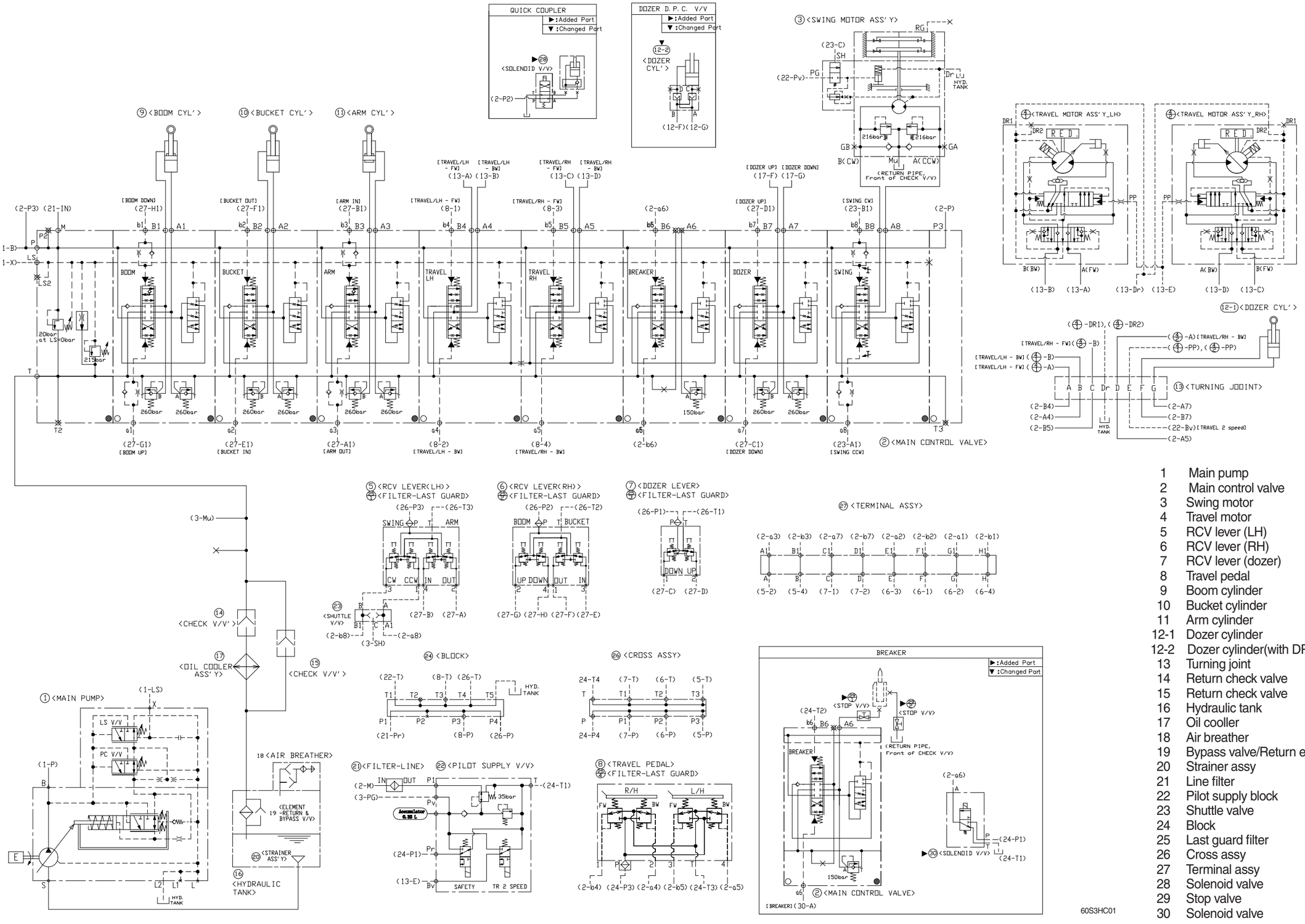
SECTION 3 HYDRAULIC AND ELECTRICAL SYSTEM

GROUP 1 HYDRAULIC CIRCUIT



60S3HC01

1 Main pump
2 Main control valve
3 Swing motor
4 Travel motor
5 RCV lever (LH)
6 RCV lever (RH)
7 RCV lever (dozer)
8 Travel pedal
9 Boom cylinder
10 Bucket cylinder
11 Arm cylinder
12-1 Dozer cylinder
12-2 Dozer cylinder(with DPC valve)
13 Turning joint
14 Return check valve
15 Return check valve
16 Hydraulic tank
17 Oil cooler
18 Air breather
19 Bypass valve/Return element
20 Strainer assy
21 Line filter
22 Pilot supply block
23 Shuttle valve
24 Block
25 Last guard filter
26 Cross assy
27 Terminal assy
28 Solenoid valve
29 Stop valve
30 Solenoid valve

GROUP 2 MONITORING SYSTEM

1. Overview

The cluster consists of the LCD and switches, as shown below. The LCD is to warn the operator in case of abnormal machine operation or conditions for the appropriate operation and inspection. It is also to set and display modes, monitoring and functions.

※ If a device malfunctions, the indicator will be ON and an alarm will be sent. Turn off the buzzer to cancel the alarm. If the indicator is still ON after the buzzer is turned off, take appropriate measures.

2. Cluster

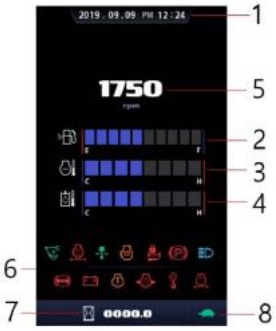
1) Structure

2) Gauge

(1) Operation screen

Default (A type)

Option (B type)

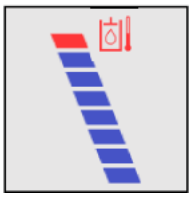


1. Clock 2. Fuel level gauge 3. Engine coolant temperature gauge
4. Hydraulic oil temperature gauge 5. Engine rpm 6. Warning lamp/indicator
7. Working hour gauge 8. Travel speed indicator

(2) Fuel level gauge

① This gauge indicates the amount of fuel in the fuel tank.
② Fill the fuel when the pointer is within the stage 1 or the red lamp is ON.
※ If this gauge indicates the red range or the warning lamp is ON, check the electrical device for poor contact and sensor for malfunction.

(3) Hydraulic oil temperature gauge



① This gauge indicates the temperature of hydraulic oil at 8 stages.

- Stage 0: 44 ℃ and below
- Stages 1-7: 45 ℃ to 104 ℃
- Stage 8: 105 ℃ and above

② The pointer normally indicates the stages 2-6 during driving.

③ The machine runs at the stages 2-6 during low-speed idling after startup.

④ Reduce the load when the pointer indicates the stages 7-8. If the pointer still indicates the stages 7-8 after load reduction, stop the machine and check it.

(4) Engine coolant temperature gauge

① This gauge indicates the temperature of hydraulic oil at 8 stages.

- Stage 0: 44 ℃ and below
- Stages 1-7: 45 ℃ to 114 ℃
- Stage 8: 115 ℃ and above

② The engine must not be shut down if the red warning lamp is ON. Instead, the engine should be shut down after cooling at an intermediate speed.

※ If the engine is shut down without adequate cooling its temperature will rise rapidly, which may cause damage to internal parts.

(5) Current time

① Indicate the current time.

(6) Working hour gauge

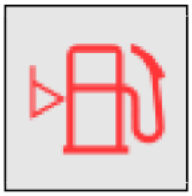
① Indicate the total working hours of the machine.

(7) Engine rpm

① Indicate the engine speed in rpm.

3) Warning lamps

(1) Fuel level warning lamp



① Indicate the amount of fuel in the fuel tank.
② Fill fuel immediately if this lamp flickers.

(2) Hydraulic oil temperature warning lamp

① The lamp is ON and the buzzer sounds when the hydraulic oil temperature is over the reference temperature (105 ℃).
② When this lamp is ON, check the oil cooling system.
③ Check the oil cooler and radiator.

(3) Cooling water temperature warning lamp

④ The lamp is ON and the buzzer sounds when the cooling water temperature is over the reference temperature (115 ℃).
① Check the cooling water level if this warning lamp is ON.

(4) Engine oil pressure warning lamp

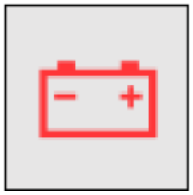
① The lamp is ON and the buzzer sounds due to low oil pressure before engine startup. The alarm will be canceled after startup.
② If the engine warning lamp is ON, reduce the engine speed or immediately shut down the engine, and check the engine oil level.

(5) Air cleaner warning lamp

① This lamp is ON and the buzzer sounds when the filter of the air cleaner is clogged.

② If this lamp is ON, check the filter and clean or replace it.

(6) Battery charging warning lamp



① Check whether the charging indicator is ON before starting the engine. If the warning lamp is ON and the buzzer sounds, ignition must not be performed.

② If the starting switch is made ON, the warning lamp will be ON and the buzzer will sound. After the engine is started, the warning lamp will be OFF. Check the battery charging line if the warning lamp is ON during engine operation.

(7) Engine check

① If the communication between the MCU and engine ECM is abnormal and the engine ECM sends a fault code to the cluster.

② Check the communication line. If communication is in good conditions, check the fault code on the cluster.

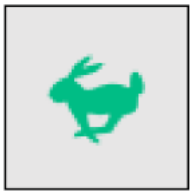
4) Pilot lamps

(1) Engine preheat pilot lamp

① When preheating is enabled automatically or manually, this lamp will be ON.

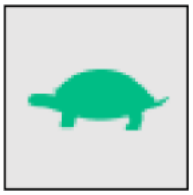
② Start the engine after this lamp is OFF.

(2) Travel speed pilot lamp (high speed)



① If this lamp is ON, the machine is running at a high speed.

(3) Travel speed pilot lamp (low speed)



① If this lamp is ON, the machine is running at a low speed.

5) Switches

(1) Travel speed switch

① Press the travel speed switch on the right side once to enable the high speed mode and again to enable the low speed mode.

(2) Buzzer stop switch

① When the starting switch is turned on, the alarm buzzer sound for 6 seconds under normal circumstances.
② If the machine fails, the red pilot lamp will be ON, and the buzzer will wound. In this case, press this switch to shut down the buzzer. Then the LED on this switch will be ON. Wait until it is OFF.

(3) ESC switch

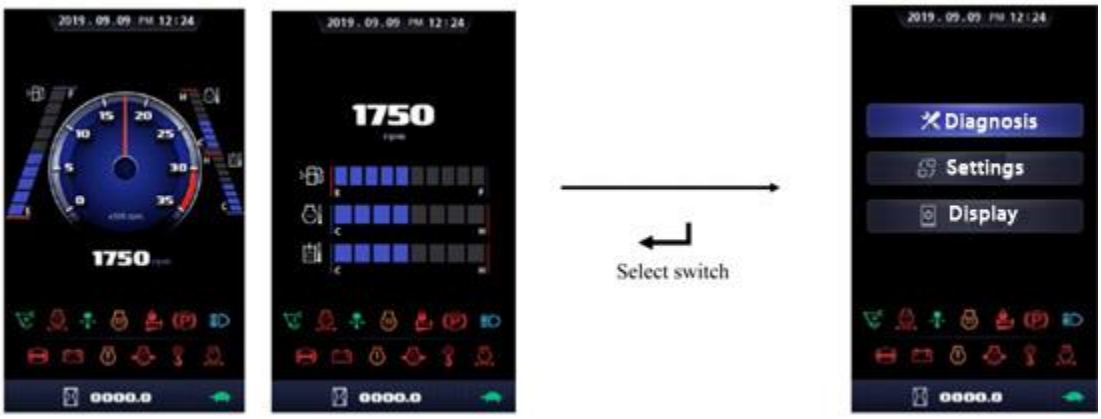
① Go back to the previous menu.

(4) Select switch

① Go back to the menu or use it after changing the input value.

3. Functions

1) Menu

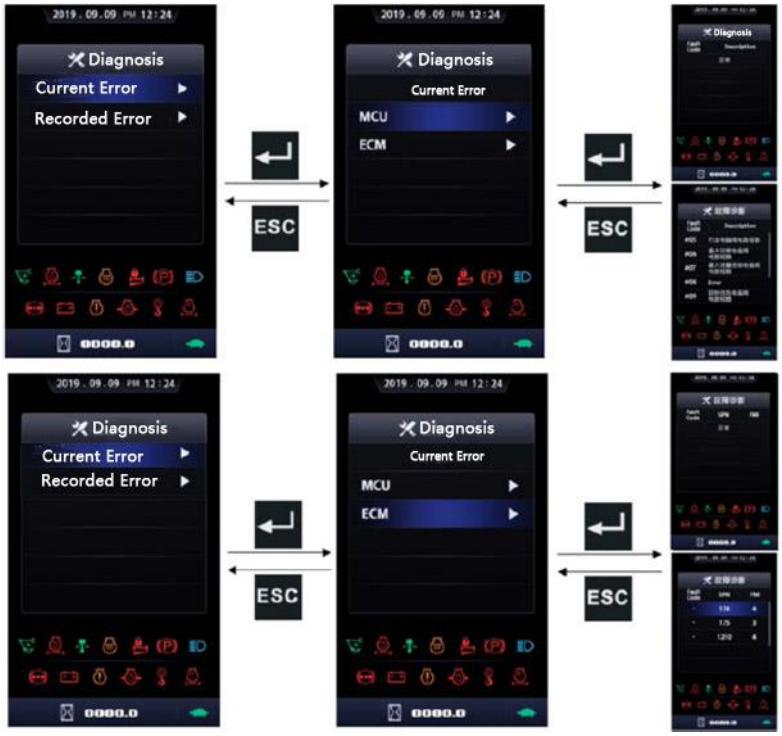


2) Structure

No	Main menu	Sub-menu	Description
1	Fault diagnosis	Active fault diagnosis Logged fault diagnosis	Confirmation and deletion of faults recorded in MCU and engine ECM
2	Change setting	Time setting Start limit	Time setting Start limit and password change
3	Screen setting	Operation screen Screen brightness Language Version Info	Working mode selection Brightness setting Language setting Device information confirmation

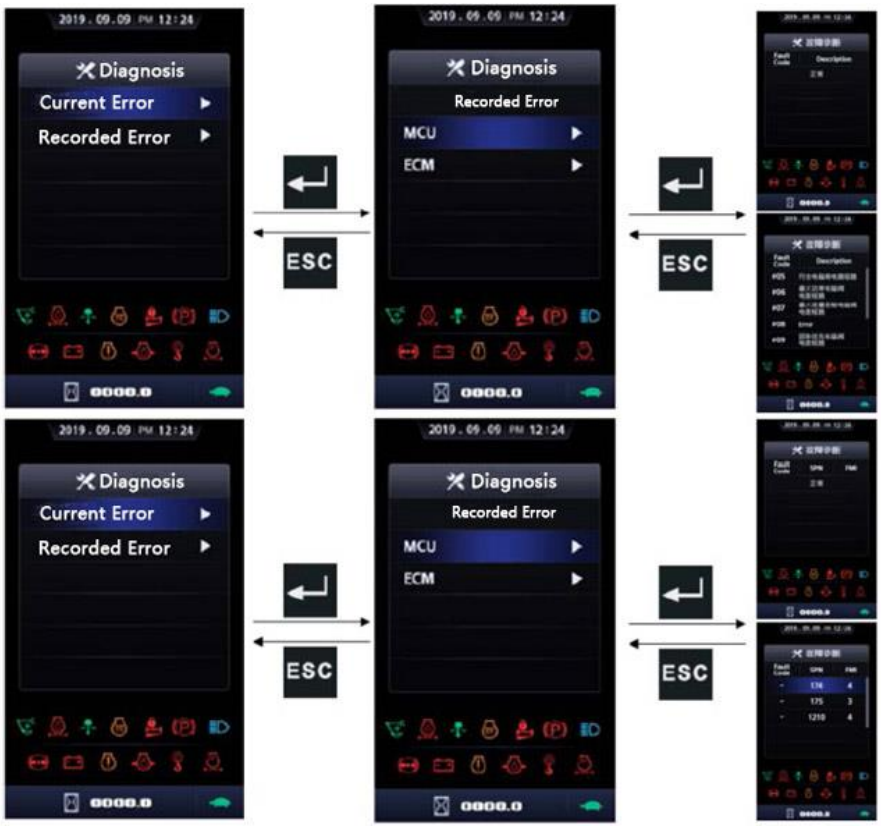
3) Fault diagnosis

(1) Active fault diagnosis



① The active fault of the MCU or engine ECM can be checked.

(2) Logged fault diagnosis



① The logged fault of the MCU or engine ECM can be checked.

4) Change setting

(1) Time setting

① The year, month, day, hour and minute can be set.

(2) Start limit

a. Start limit setting

① This is designed against stealing and for the device that is not permitted to work.

② If the starting switch is ON during the start limit setting, it is required to enter the password.

- This function is disabled when not used.
- The operator needs to enter the password each time before startup.
- To set the start delay, it is required to enter the password after the first startup, but not required to restart the machine during the delay period. The maximum delay period is 7 days.

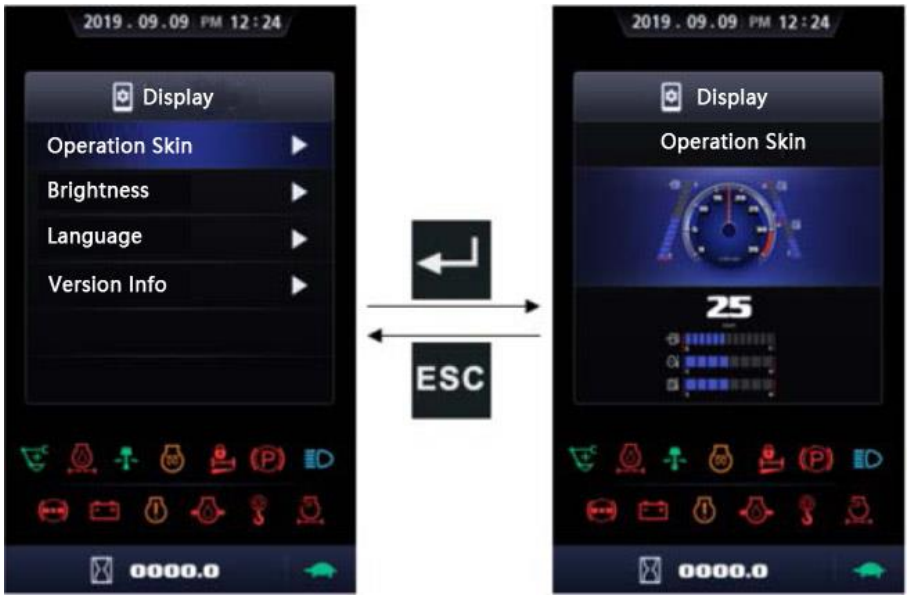
b. Change password

① The password consists of 4 digits. Press "↵" after entering the password.

② The initial password is "0000".

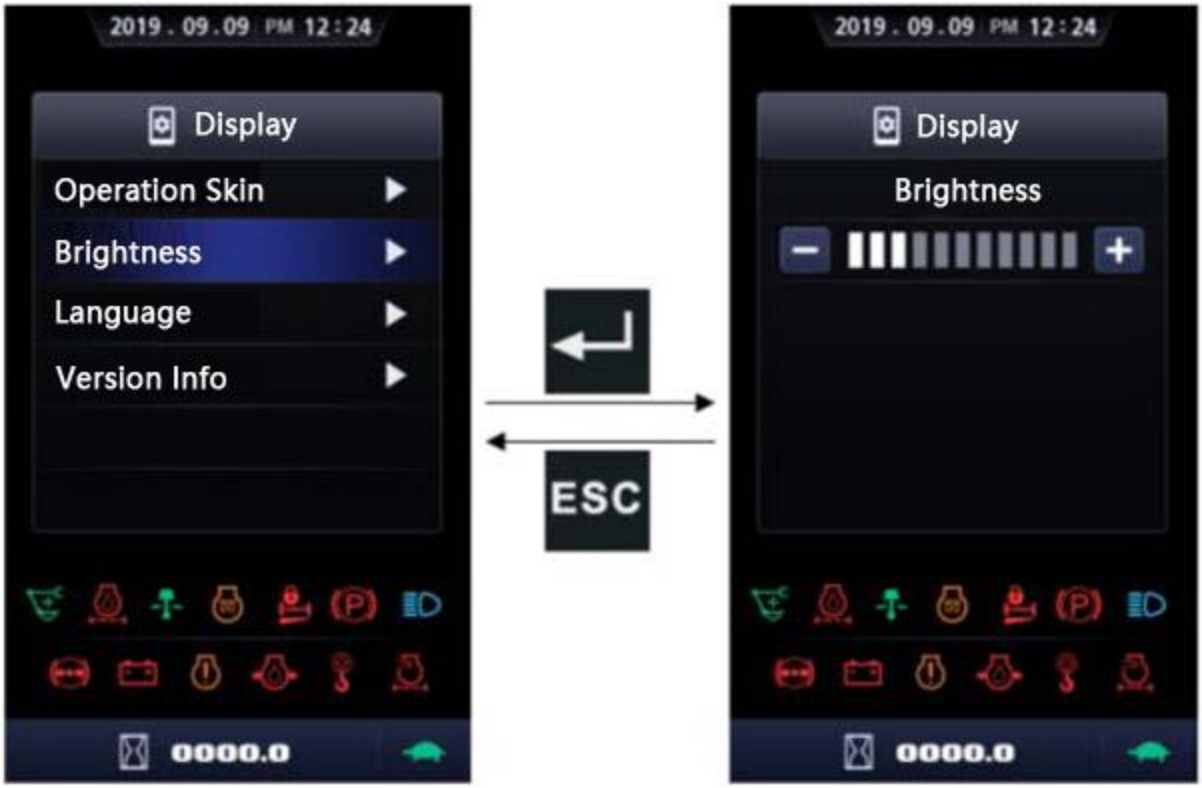
5) Screen setting

(1) Operation screen



① The type of the operation screen can be set: analog/digital.

(2) Screen brightness



① The screen brightness can be set.

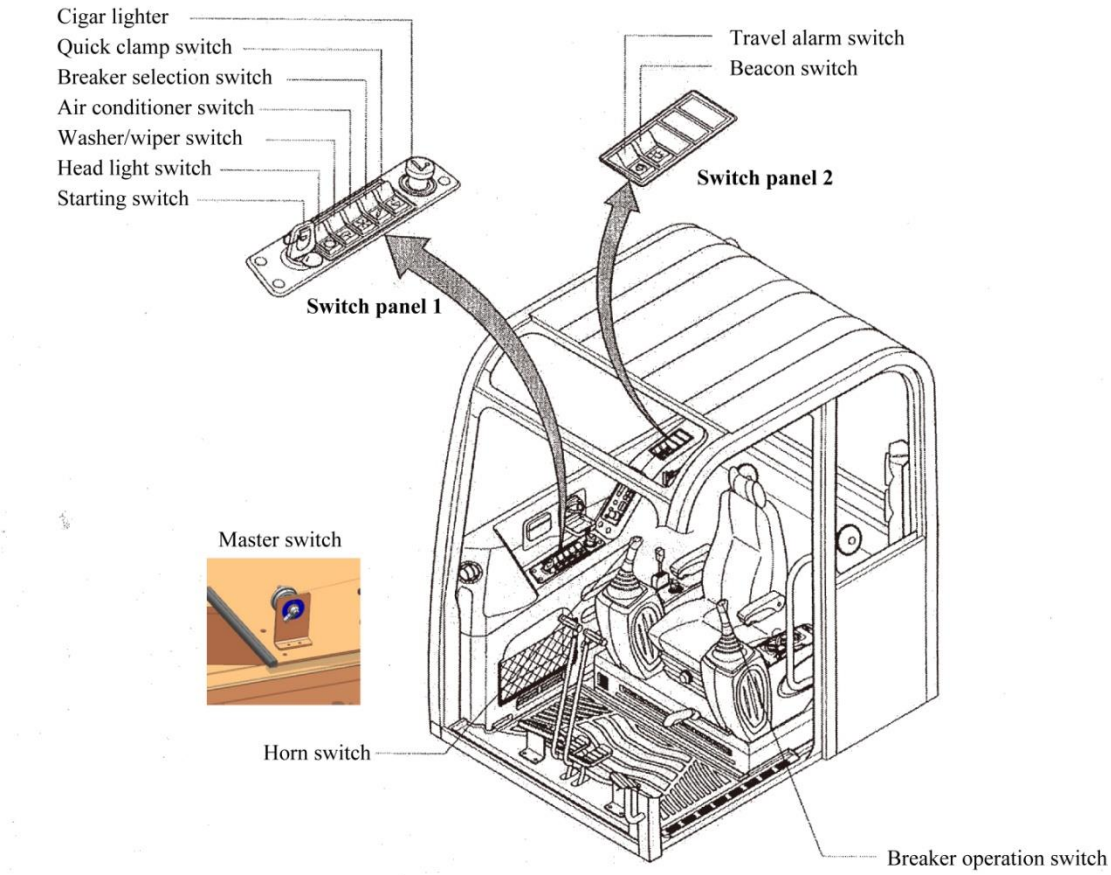
(3) Language

① The desired language can be selected. The screen will show the selected language.

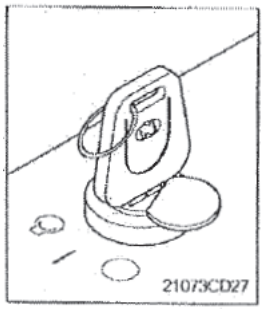
(4) Version information

① The F/W, Image, GPS version and model of the device can be confirmed.

2. Switches



1) Starting switch



(1) There are three positions: OFF, ON and START.

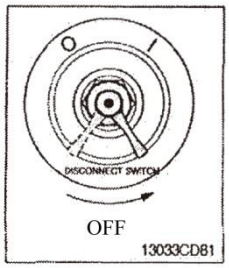
(2) ○ (OFF): None of electrical systems activate.

(3) | (ON): All the systems operate.

(4) (START): Use when starting the engine. Release the key immediately after starting.

※ The key must be in the ON position with engine running to maintain electrical and hydraulic functions and prevent serious machine damage.

2) Master switch



(1) This switch is used to shut off the entire electrical system.

(2) I: The battery remains connected to the electrical system.

O: The battery is disconnected to the electrical system.

※ Never turn the master switch to O (OFF) with the engine running. It could result in engine and electrical system damage.

3) Main light switch

(1) This switch has two modes for operation of the head light and work light.

● Mode 1: The beacons of the head light and instrument are ON.

● Mode 2: The work light and the beacon below it are ON.

4) Wiper and washer switch

(1) This switch has two modes for operation of the wiper and washer.

● Mode 1: the wiper can be operated.

● Mode 2: If this switch is turned to the mode 2, washing fluid will be sprayed and the wiper will work. If this switch is released, the mode 1 will be enabled.

5) Travel alarm switch (optional)

(1) This switch is used to alarm surroundings when the machine travels to forward and backward.

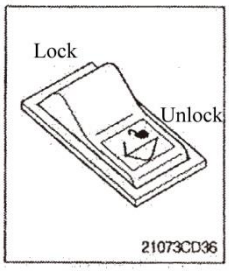
(2) On pressing this switch, the alarm operates only when the machine is traveling.

6) Air conditioner switch

(1) This switch is used to operate the air conditioner.

(2) See the air conditioner and heater instructions for details.

7) Quick clamp switch (optional)



(1) This switch is used to engage or disengage the hook on the quick clamp.

(2) See the "Quick Clamp" for details.

※ The quick clamp must be operated with the quick clamp switch in the lock position and the safety pin assembled.

8) Breaker selection switch (optional)

(1) This switch is used to control the breaker.

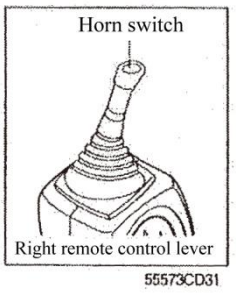
(2) On pressing this switch, the breaker will operate.

9) Swing beacon switch (optional)

(1) This switch is used to turn on the swing beacon in the cab.

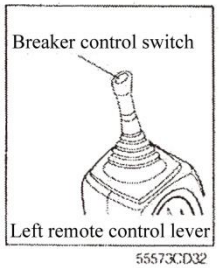
(2) On pressing this switch, the beacon below will be ON.

10) Horn switch



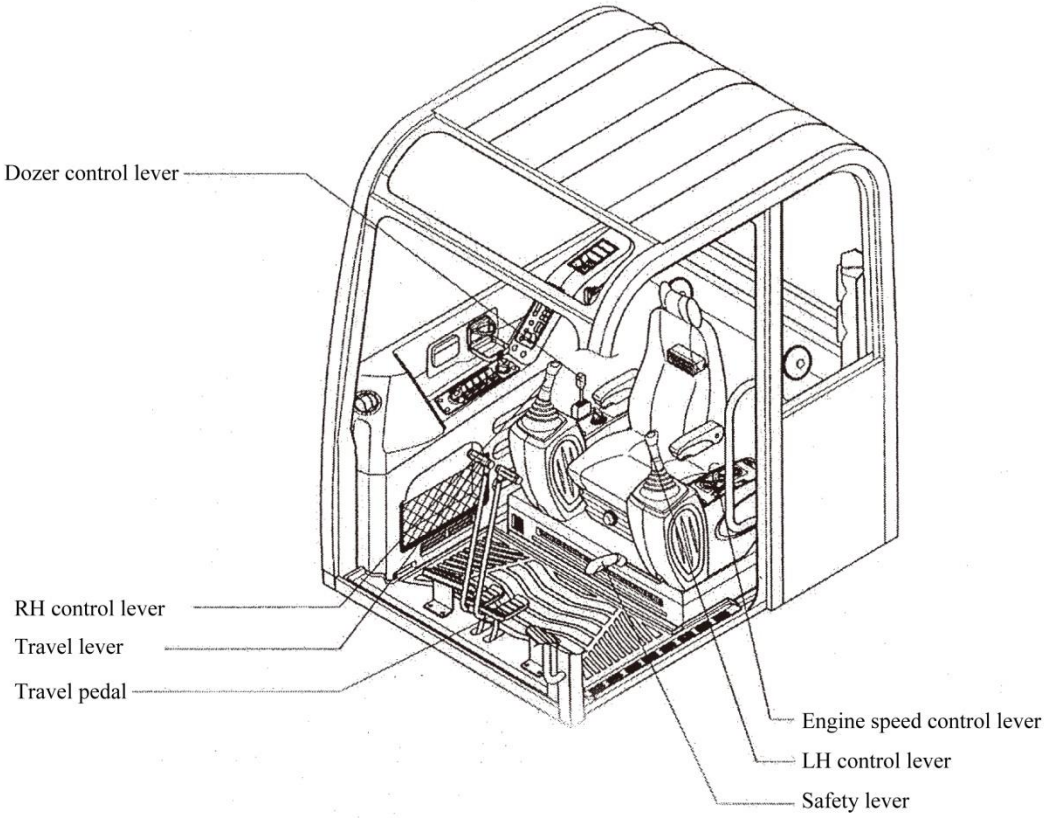
(1) This switch is at the top of left side control lever. On pressing, the horn sounds.

11) Breaker operation switch

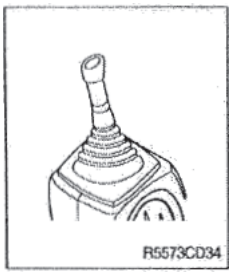


(1) On pressing this switch, the breaker operates only when the breaker selection switch on the switch panel is selected.

4. Levers and Pedals



1) LH control lever

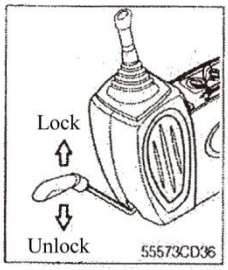


(1) This joystick is used to control the swing and arm.
(2) Refer to the operation of working devices in Chapter 4 for details.

2) RH control lever

(1) This joystick is used to control the boom and bucket.
(2) Refer to the operation of working devices in Chapter 4 for details.

3) Safety lever



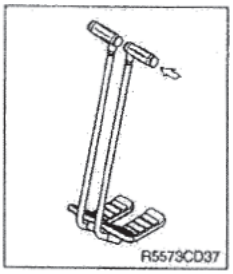
(1) When this lever is in the LOCK position, the console box will be raised, the pilot oil line will be cut off, and the working device and swing will not work.

※ Be sure to raise the lever to the LOCK position when leaving from operator's seat.

(2) By pushing the lever to UNLOCK position, the machine is operational.

※ Do not use the safety lever as a handle when getting on or off the machine.

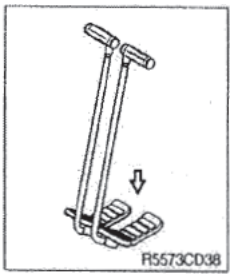
4) Travel lever



(1) This lever is mounted on the travel pedal and used for traveling by hand. The operation principle is same as that of the travel pedal.

(2) Refer to the "Traveling of Machine" for details.

5) Travel pedal

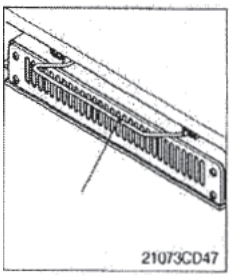


(1) This pedal is used to move the machine forward or backward.

(2) If the left side pedal is pressed, the left track will move. If the right side pedal is pressed, the right track will move.

(3) Refer to the "Traveling of Machine" for details.

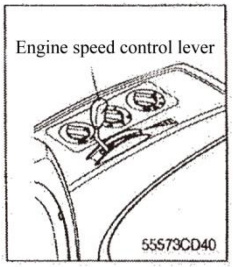
6) Seat and console box adjust lever



(1) This lever is used to move the seat and console box to fit the contours of the operator's body.

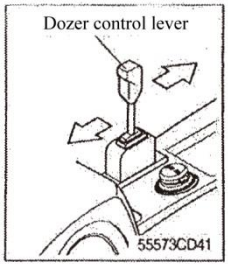
(2) Pull the lever to adjust forward or backward over 90 mm (3.5").

7) Engine speed control lever

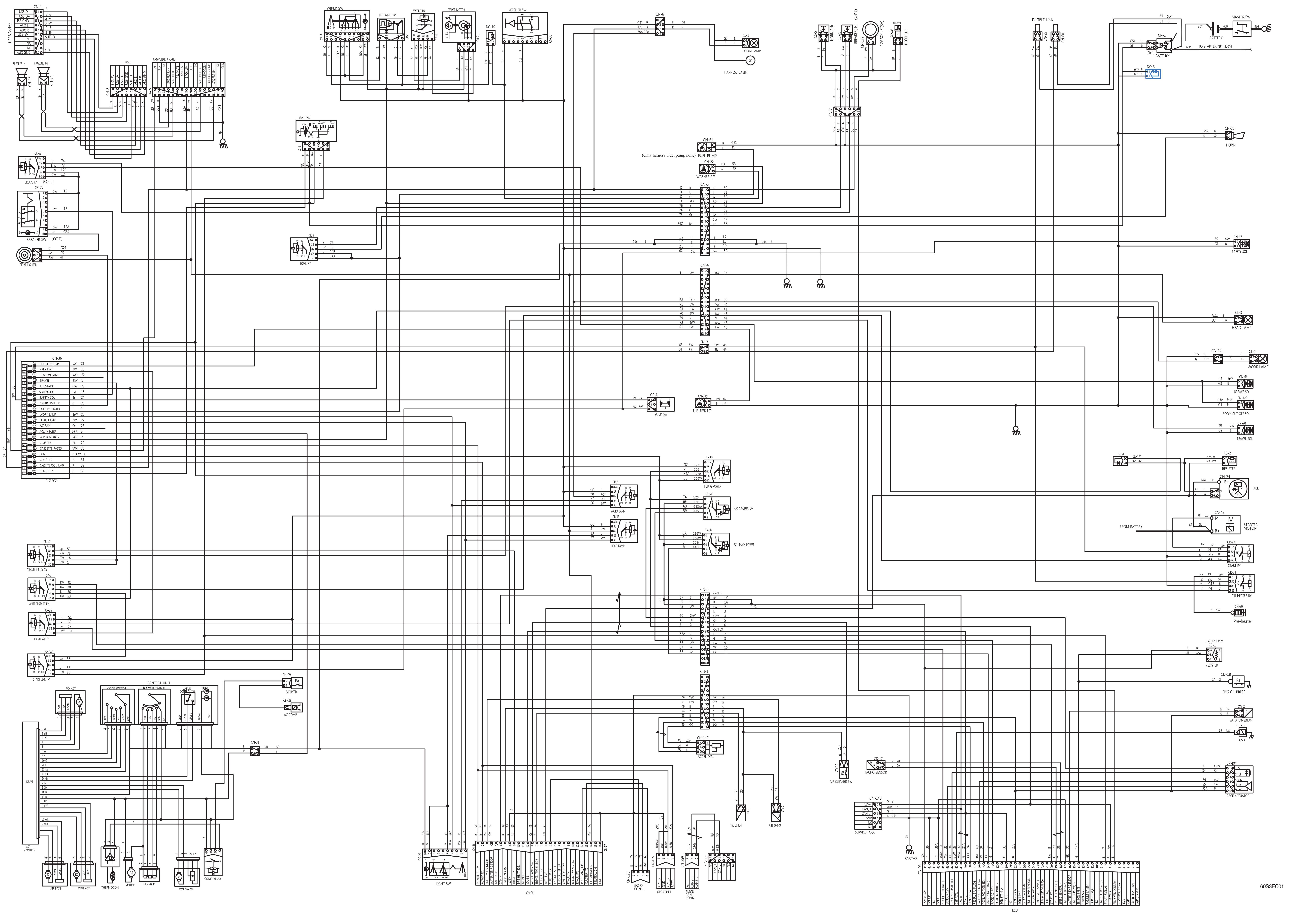


(1) This control lever is to increase or decrease the engine speed.
(2) Move this control lever backward to increase the engine speed and forward to decrease the engine speed.
(3) To stop the engine, move the engine speed control lever forward to the maximum, and turn the key to the OFF position.

8) Dozer control lever



(1) This lever is used to operate the dozer blade.
(2) If the lever is pushed forward, the dozer blade will be going down. If the lever is pulled back, the dozer blade will be going up.



60S3EC01

1. POWER CIRCUIT

The negative terminal of battery is grounded to the machine chassis.

When the start switch is in the OFF position, the current flows from the positive battery terminal as shown below.

1) OPERATING FLOW

Battery → Battery relay → Fusible link (CN-60) → I/conn [CN-3 (2)]

- → Fuse box [No.1] → Start switch [CS-2 (1)]
- → Fuse box [No.2] → MP3 & Radio player [CN-27 (8)]
  - → Room lamp [CL-1 (1)] / 12V socket [CN-139 (2)]
- → Fuse box [No.3] → Cluster [CN-56 (2)]
  - → GPS connector [CN-125 (1)]
- → Fuse box [No.4] → ECU main power relay [CR-68 (1,2)]
  - → ECU IG power relay [CR-45 (30)]

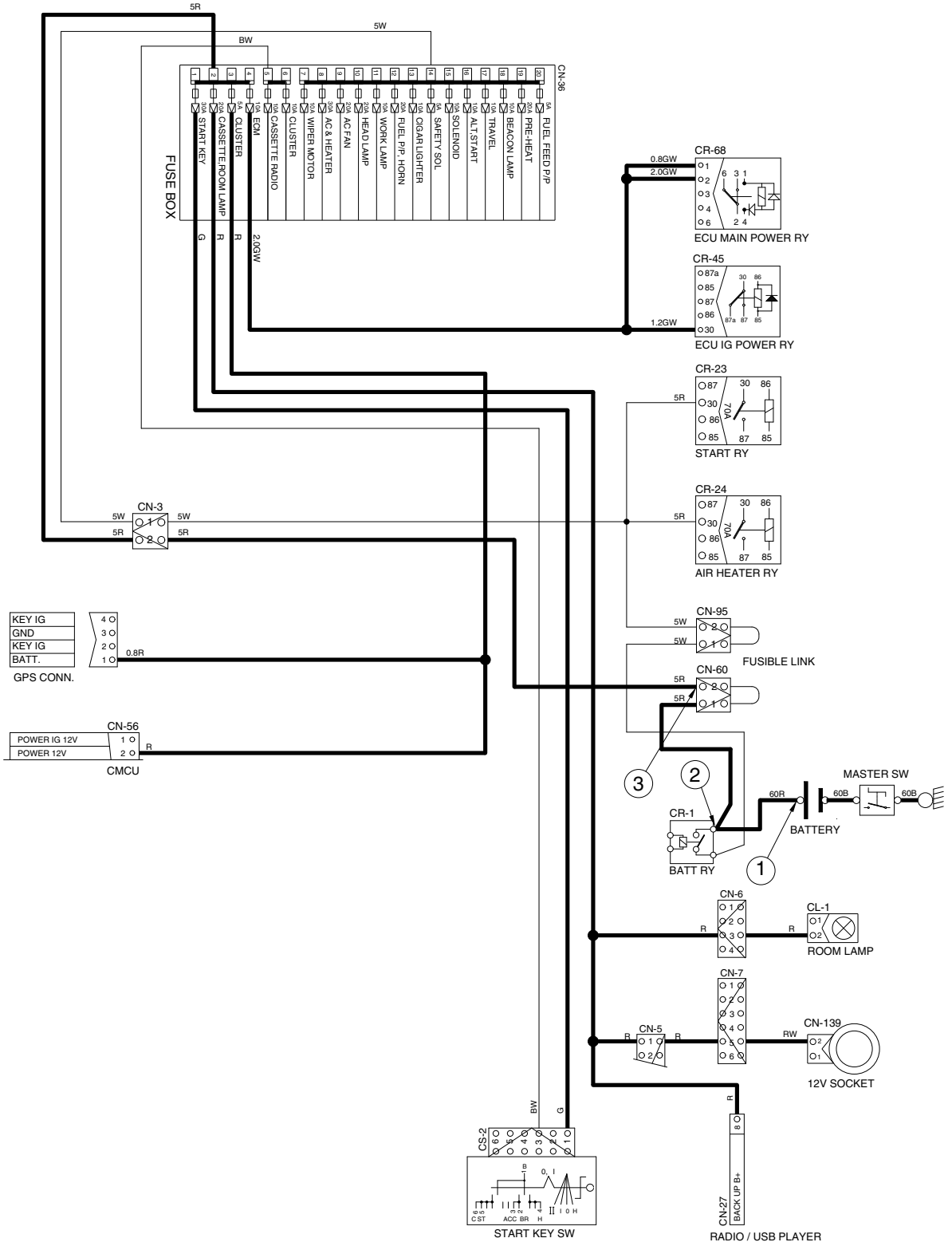
※ I/conn : Intermediate connector

2) CHECK POINT

Engine	Start switch	Check point	Voltage
OFF	OFF	① - GND (battery) ② - GND (battery relay) ③ - GND (fusible link)	10~12.5V

※ GND : Ground

POWER CIRCUIT



60S4EL04

2. STARTING CIRCUIT

1) OPERATING FLOW

Battery (+) terminal → Battery relay [CR-1] → Fusible link [CN-60]
→ I/conn [CN-3 (2)] → Fuse box No.1 → Start key [CS-2 (1)]

※ Start switch : ON

- Start switch ON [CS-2 (2)] → ECU IG power relay [CR-45 (86)]
  I/conn [CN-5 (9)] →
  Battery relay [CR-1]:Battery relay operating (all power is supplied with the electric component)
- Start switch ON [CS-2 (3)] → Fuse box (all power is supplied with electric component)

※ Start switch : START

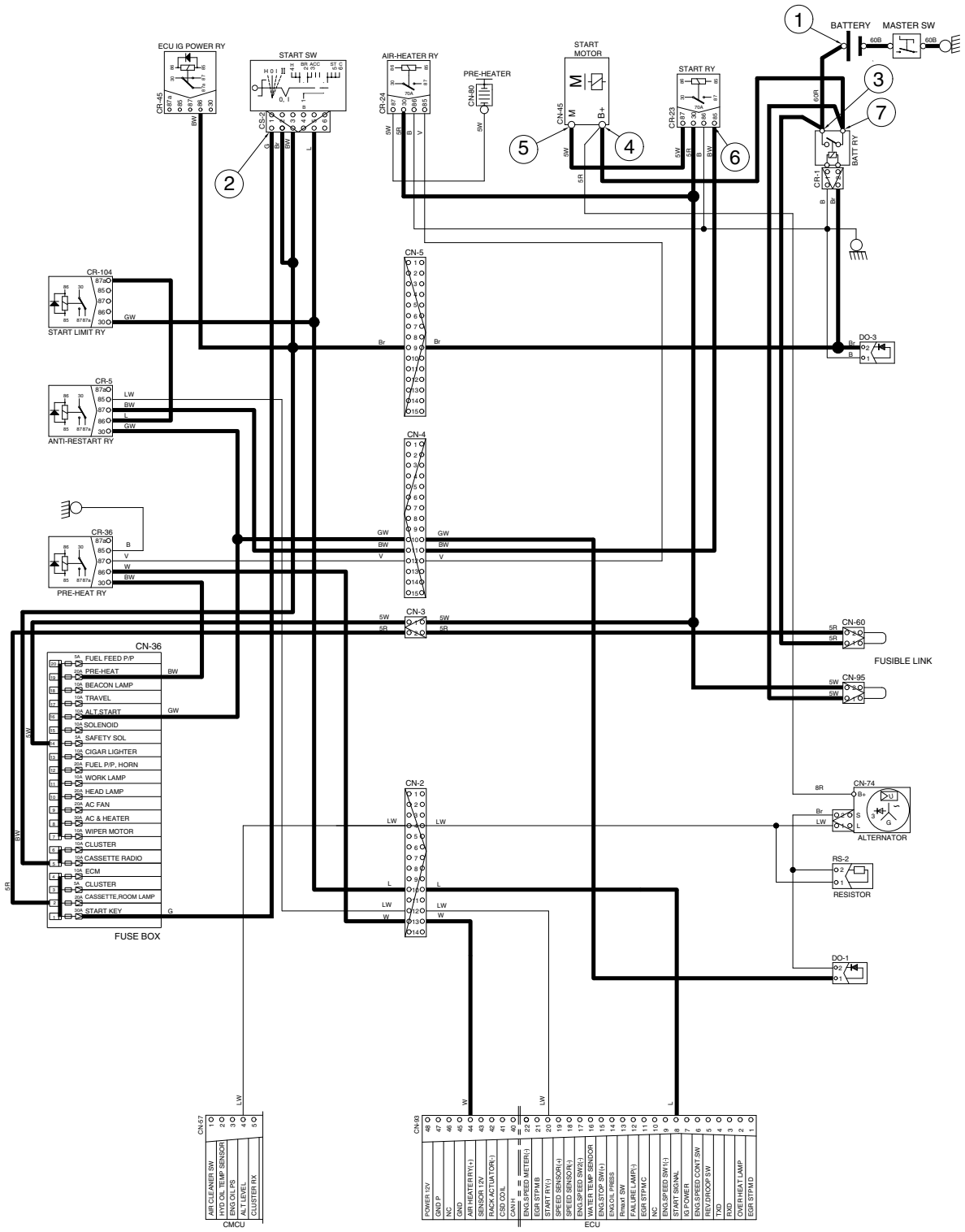
Start switch START [CS-2 (5)] → Anti-restart relay [CR-5 (86) → (87)] → I/conn [CN-4 (11)]
→ Start relay [CR-23 (C2) → (2)] → Starter motor operating
I/conn [CN-2 (10)] → ECU [CN-93 (8)]

2) CHECK POINT

Engine	Start switch	Check point	Voltage
Operating	Start	① – GND (battery) ② – GND (start key) ③ – GND (battery relay M4) ④ – GND (starter B^+) ⑤ – GND (starter M) ⑥ – GND (start relay) ⑦ – GND (battery relay M8)	10~12.5V

※ GND : Ground

STARTING CIRCUIT



60S4EL05

3. CHARGING CIRCUIT

When the starter is activated and the engine is started, the operator releases the key switch to the ON position.

Charging current generated by operating alternator flows into the battery through the Battery relay (CR-1).

The current also flows from alternator to each electrical component and controller through the fuse box.

1) OPERATING FLOW

(1) Warning flow

Alternator "L" terminal → I/conn [CN-2 (4)] → Cluster [CN-57 (4)] → Cluster warning lamp

(2) Charging flow

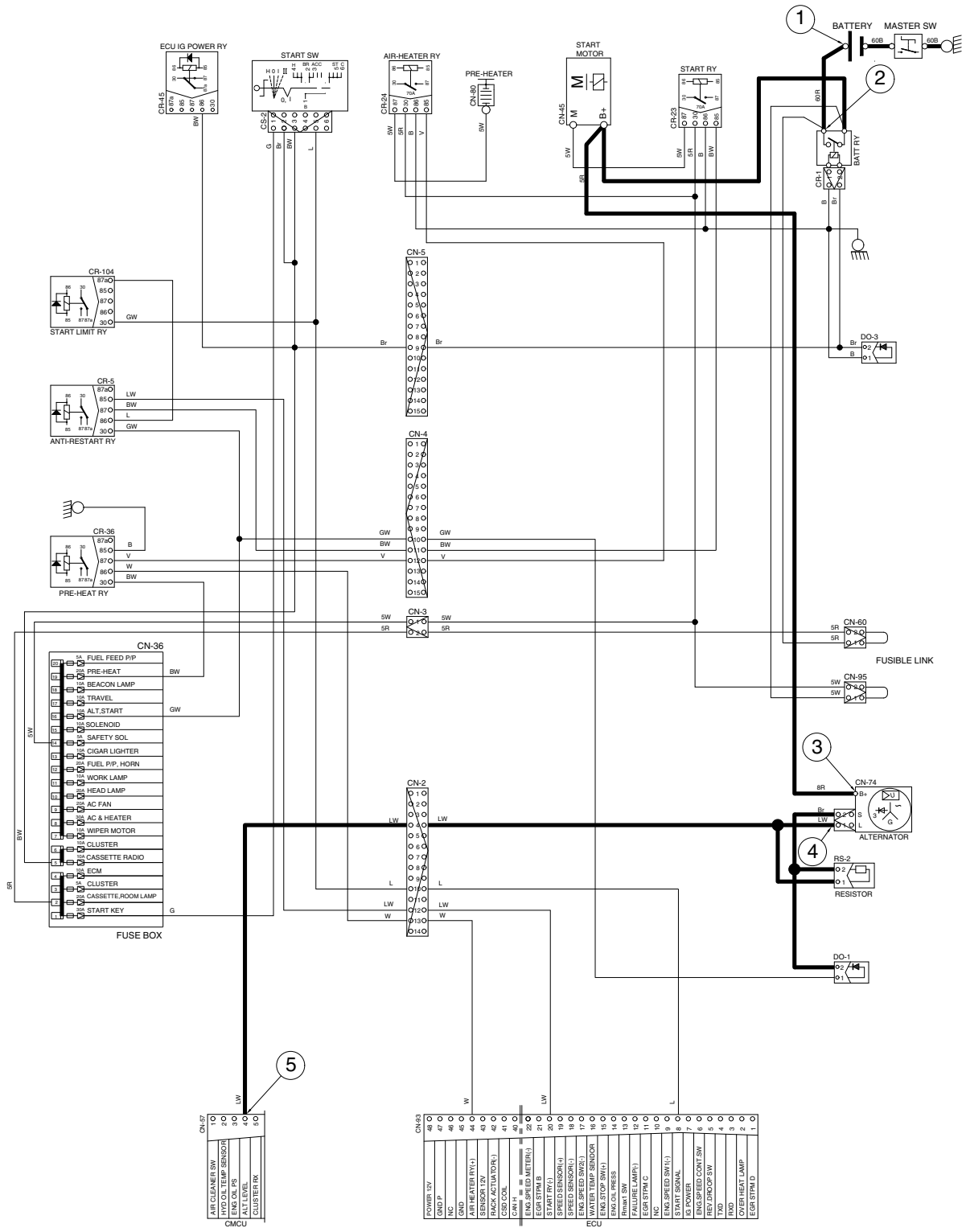
Alternator "B^+" terminal → Battery relay → Battery (+) terminal

2) CHECK POINT

Engine	Start switch	Check point	Voltage
Operating	Start	① – GND (battery voltage) ② – GND (battery relay) ③ – GND (alternator B^+ terminal) ④ – GND (alternator L terminal) ⑤ – GND (cluster)	10~12.5V

※ GND : Ground

CHARGING CIRCUIT



60S4EL06

4. HEAD AND WORK LAMP CIRCUIT

1) OPERATING FLOW

Fuse box (No.10) → Head lamp relay [CR-13 (30) → (86)] → Switch [CS-21 (5)]
Fuse box (No.11) → Work lamp relay [CR-3 (30) → (86)] → Switch [CS-21 (2)]

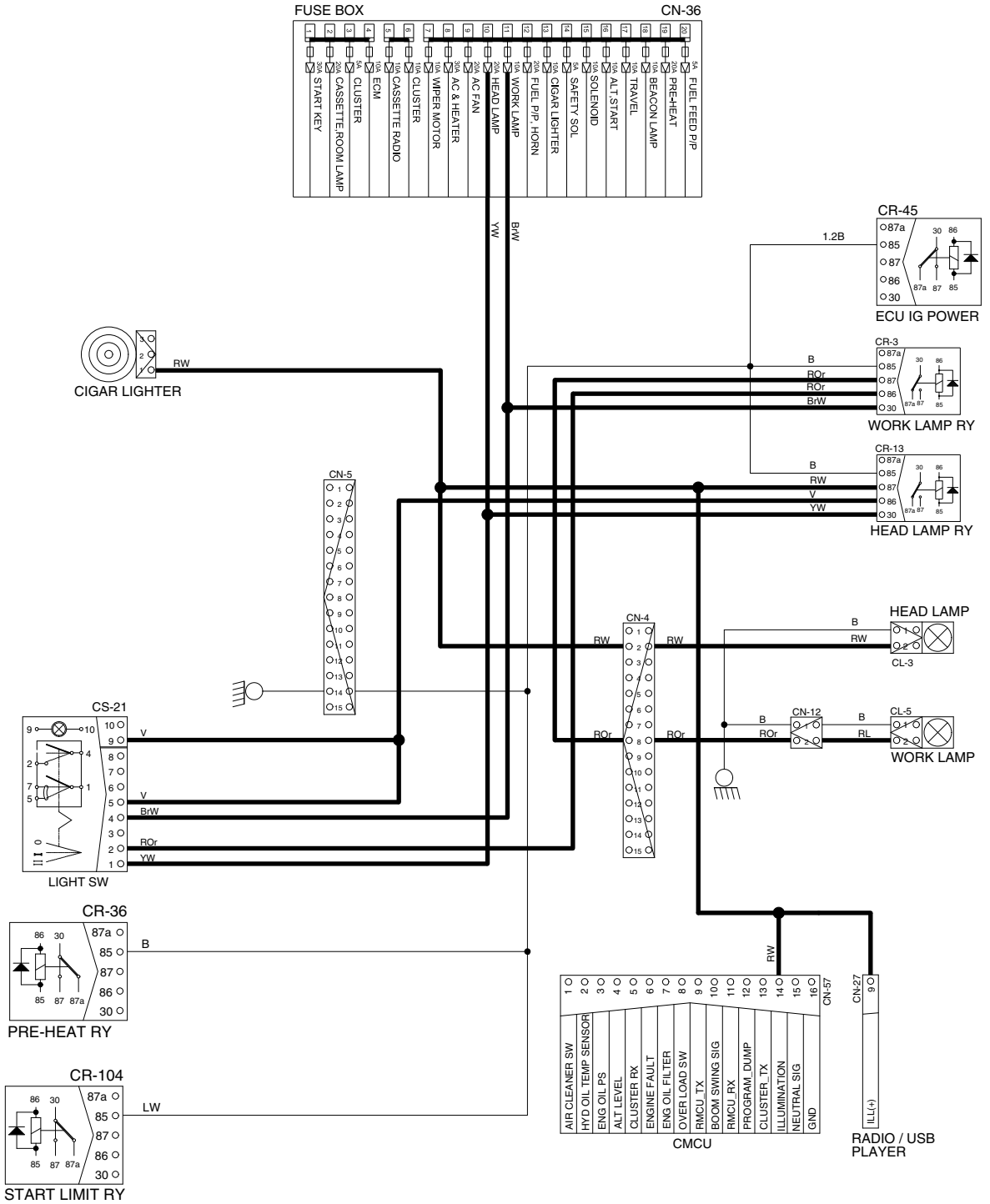
(1) Head lamp switch ON

Head lamp switch ON [CS-21 (5)] → Head lamp relay [CR-13 (86) → (87)]
- → I/conn [CN-4 (2)] → Head lamp ON [CL-3 (2)]
- → Cigar lighter [CL-2 (1)]
- → MP3 & Radio player illumination ON [CN-27 (9)]
- → Cluster illumination ON [CN-57 (14)]

(2) Work lamp switch ON

Work lamp switch ON [CS-21 (2)] → Work lamp [CR-3 (30) → (87)] → I/conn [CN-4 (8)]
I/conn [CN-12 (2)] → Work lamp ON [CL-5 (2)]

HEAD AND WORK LAMP CIRCUIT



60S4EL07

5. WIPER AND WASHER CIRCUIT

1) OPERATING FLOW

(1) Key switch ON

Fuse box (No.7) → Wiper relay [CR-4 (86)]
→ Int wiper relay [CR-6 (4)]
→ Wiper switch [CS-3 (10)]
→ Wiper motor [CN-21 (3)]
→ I/conn [CN-5 (4)] → Washer pump [CN-22 (2)]

(2) Wipe switch ON : 1st step (low speed)

Wiper switch ON [CS-3 (5)→(6)] → Int wiper relay [CR-6 (6)→(3)] → Wiper relay [CR-4 (85)→(30)]
→ Washer motor operating [CN-21 (4)]

(3) Wiper switch ON : 2nd step (washer)

Wiper switch ON [CS-3 (2)] → Int wiper relay [CR-6 (1)] → Washer switch [CS-30 (1)]
→ Wiper relay [CR-4 (85)→(30)]
→ Wiper motor operating[CN-21(1)]

Washer switch ON [CS-30 (1)] → I/conn [CN-5 (3)] → Washer pump operating [CN-22 (1)]

(4) Auto parking (when switch OFF)

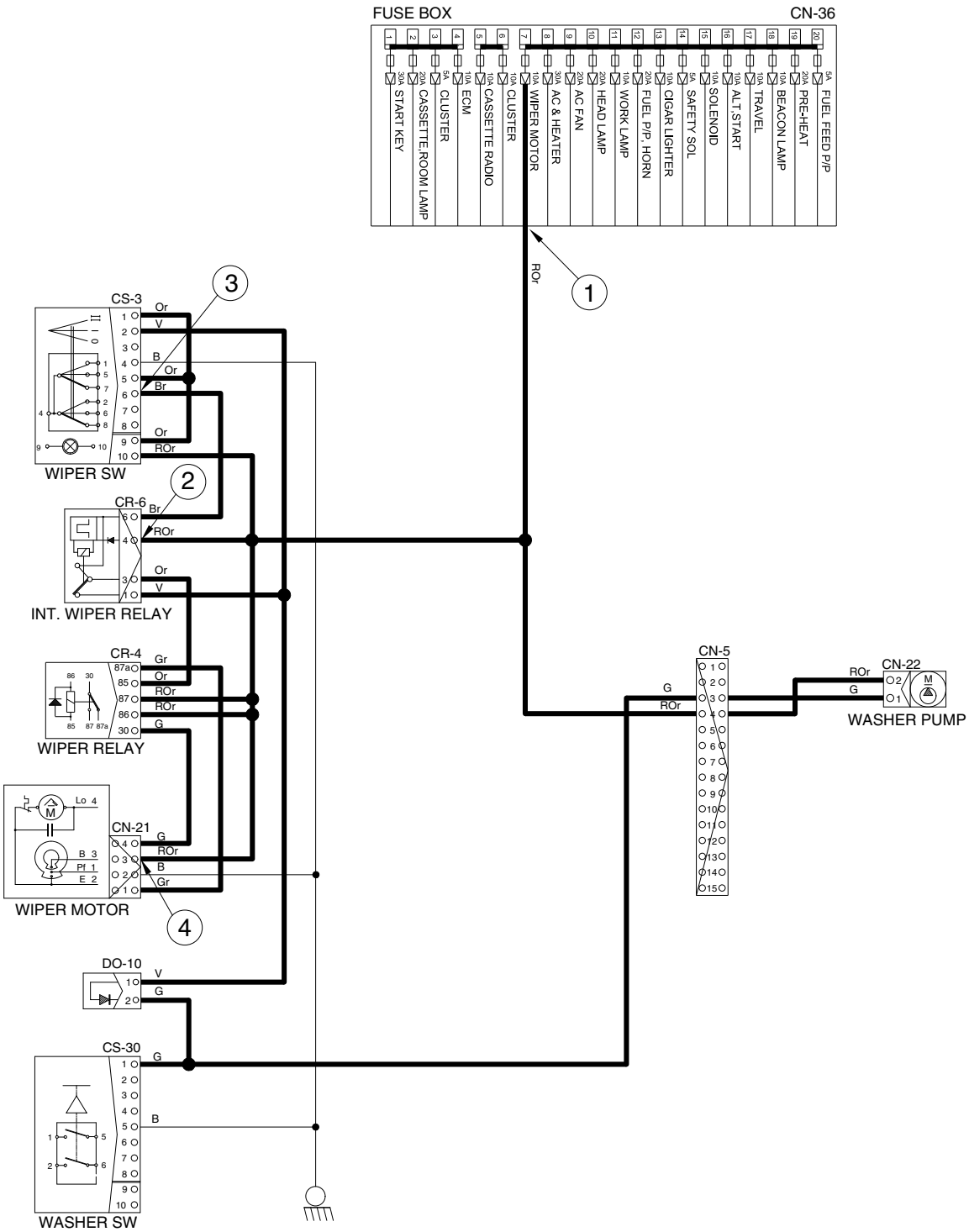
Switch OFF → Wiper motor [CN-21 (1)] → Wiper switch [CS-3 (5)→(6)] → Int wiper relay [CR-6 (6)→(3)]
→ Wiper relay [CR-4 (85)→(30)] → Wiper motor [CN-21 (4)]
→ Wiper motor parking position by wiper motor controller

2) CHECK POINT

Engine	Start switch	Check point	Voltage
STOP	ON	① - GND (fuse box) ② - GND (switch power input) ③ - GND (switch power output) ④ - GND (wiper motor)	10~12.5V

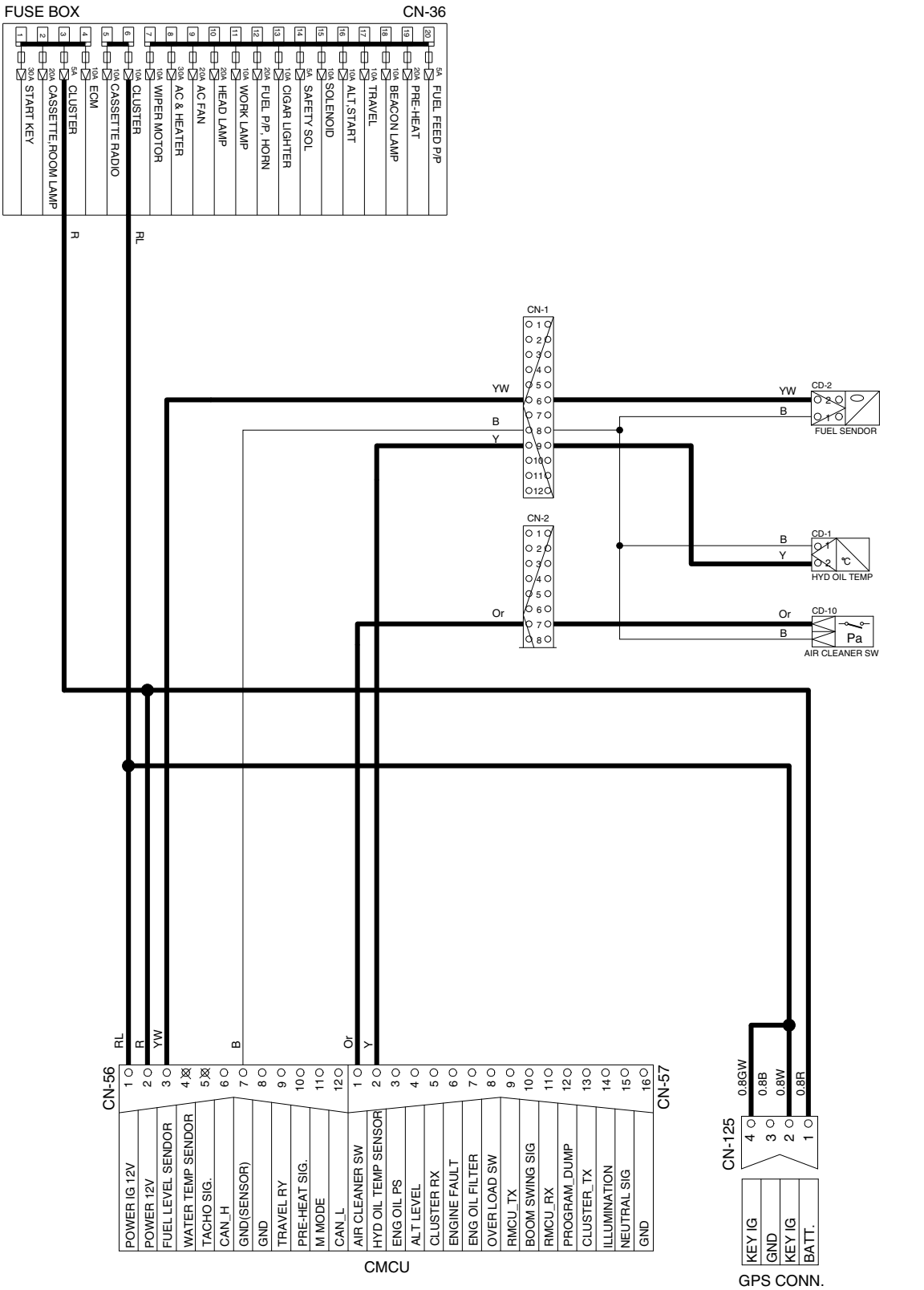
※ GND : Ground

WIPER AND WASHER CIRCUIT

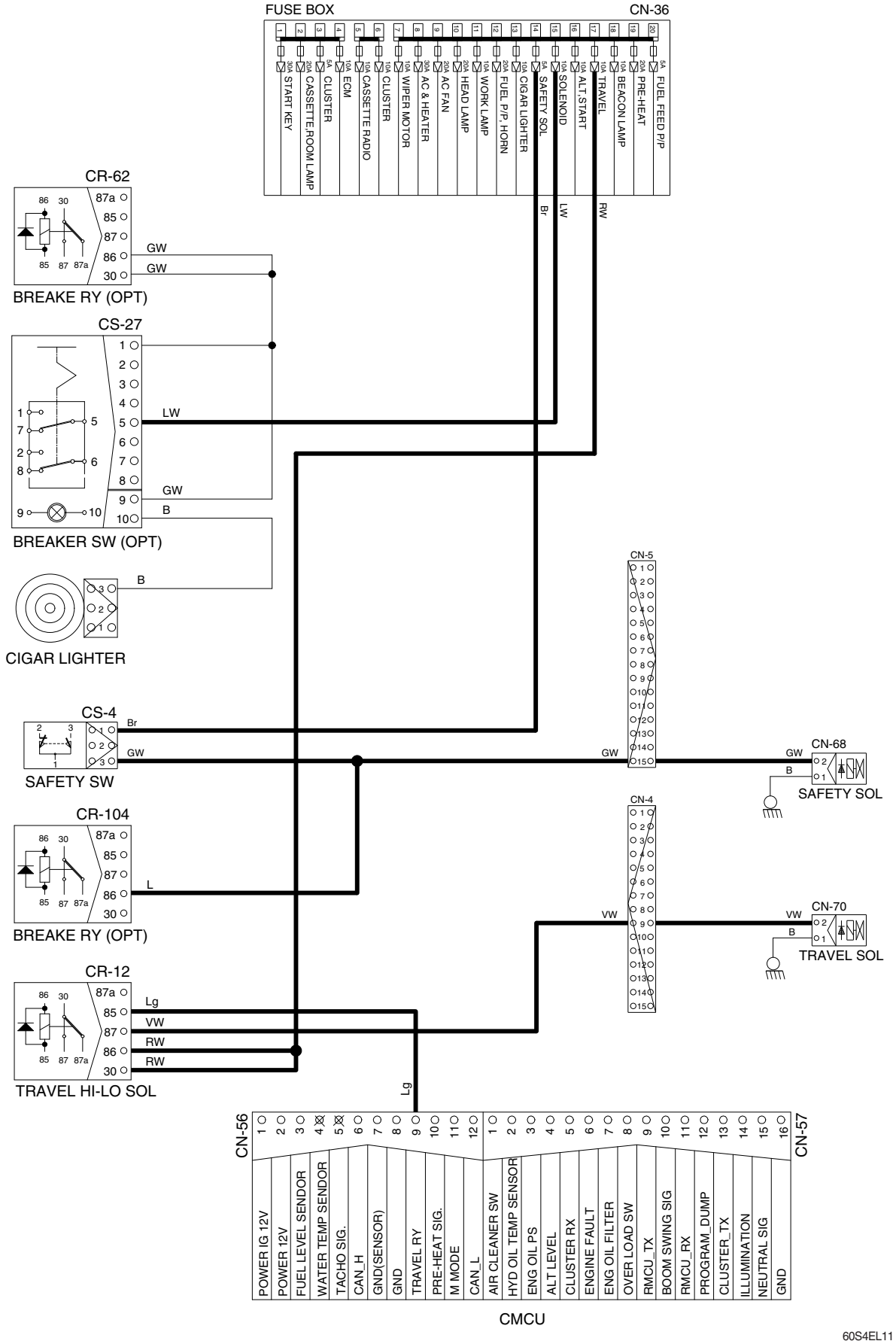


60S4EL09

MONITORING CIRCUIT



ELECTRIC CIRCUIT FOR HYDRAULIC



60S4EL11

GROUP 5 FAULT CODES

ENGINE ERROR CODE

NO	CODE	SPN	FMI	Description
1	P0117	110	4	Failure with Cooling water temperature sensor (voltage low)
2	P0118	110	3	Failure with Cooling water temperature sensor (high low)
3	P0119	110	2	Intermittent failure with cooling water temperature sensor
4	P0122	91	4	Failure with accelerator sensor (Voltage low)
5	P0123	91	3	Failure with accelerator sensor (Voltage high)
6	P0124	91	2	Intermittent failure with accelerator sensor
7	P0217	110	0	Cooling Water Temperature Rise Alarm
8	P0219	190	0	Overspeed Error
9	P0222	29	4	Failure with Spare accelerator sensor (Voltage low)
10	P0223	29	3	Failure with Spare accelerator sensor (Voltage high)
11	P0224	29	2	Intermittent failure with Spare accelerator sensor
12	P0340	1078	4	Failure with Speed Sensor
13	P0562	158	1	Failure with Power supply Voltage (low voltage)
14	P0563	158	0	Failure with Power supply Voltage (high voltage)
15	P0601	630	12	Failure with ECU internal EEPROM (read/writing error)
16	P0605	628	12	Failure with ECU internal FlashROM fault(Checksum A)
17	P0634	1136	0	ECU Temperature Rise Alarm
18	P0642	1079	4	Failure with Sensor 5V (Low Voltage)
19	P0643	1079	3	Failure with Sensor 6V (High Voltage)
20	P0668	1136	4	Failure with ECU Temperature Sensor (Low Voltage)
21	P0669	1136	3	Failure with ECU Temperature Sensor (High Voltage)
22	P0666	1485	4	Failure with Main relay
23	P1101	522323	0	Air cleaner Clogging Alarm
24	P1125	91	1	Failure with Accelerator sensor (foot pedal-close position)
25	P1126	91	0	Failure with Accelerator sensor (foot pedal-open position)
26	P0628	91	15	Failure with Accelerator sensor (foot pedal is ineffective)
27	P1151	522329	0	Oil-water separator Alarm
28	P1192	100	4	Failure with Oil pressure switch
29	P1198	100	1	Failure with Oil Pressure Descend
30	P1202	1210	4	Failure with Rack position sensor(Low Voltage)
31	P1203	1210	3	Failure with Rack position sensor(High Voltage)
32	P1211	638	7	Rack Actuator - Mechanical failure
33	P1212	638	4	Failure with Rack actuator (low current)
34	P1213	638	3	Failure with Rack actuator (High current)
35	P1214	638	2	Failure with Engine
36	P1217	522314	0	Abnormal Water Temperature
37	P1221	522251	7	【Reserved】
38	P1222	522241	4	Failure A with Rack actuator Relay
39	P1223	522241	3	Failure B with Rack actuator Relay
40	P1224	522241	2	Intermittent failure with Rack actuator relay

NO	CODE	SPN	FMI	Description
41	P1225	522253	1	Failure with Spare Accelerator sensor (foot pedal-close position)
42	P1226	522253	0	Failure with Spare Accelerator sensor (foot pedal-open position)
43	P1227	522254	8	Failure with Spare accelerator sensor (Pulse communication)
44	P1228	522254	15	Failure with Spare accelerator sensor (foot pedal is ineffective)
45	P1232	167	4	Failure A with Start Assist Relay
46	P1233	522243	3	Failure B with Start Assist Relay
47	P1234	522243	2	Intermittent failure with start assist relay
48	P1242	522242	4	Failure A with CSD Solenoid Valve
49	P1243	522242	3	Failure B with CSD Solenoid Valve
50	P1244	522242	2	Intermittent failure with CSD Solenoid Valve
51	P1340	522402	4	Failure with Spare speed sensor
52	P1402	522251	4	Failure A with EGR valve (Step motor A -phase)
53	P1403	522251	3	Failure B with EGR valve (Step motor A -phase)
54	P1412	522252	4	Failure A with EGR valve (Step motor B- phase)
55	P1413	522252	3	Failure B with EGR valve (Step motor B- phase)
56	P1422	522253	4	Failure A with EGR valve(Step motor C- phase)
57	P1423	522253	3	Failure B with EGR valve(Step motor C-phase)
58	P1432	522254	4	Failure A with EGR valve(Step motor D- phase)
59	P1433	522254	3	Failure B with EGR valve(Step motor D- phase)
60	P1562	167	4	Failure with Charge switch
61	P1568	522730	1	Charge alarm
62	P1601	522243	2	Failure with ECU internal EEPROM (Checksum)
63	P1605	628	2	Failure with ECU internal FlashROM (Checksum B)
64	P1606	628	2	Failure with ECU internal FlashROM fault(Checksum C)
65	P1610	522727	12	Failure A with Sub-CPU
66	P1611	522727	12	Failure B with Sub-CPU
67	P1612	522727	12	Failure C with Sub-CPU
68	P1620	522728	12	Failure with ECU internal MAP format
69	P1644	1079	2	Intermittent failure with Sensor 5V
70	P1664	1136	2	Intermittent failure with ECU temperature sensor
71	P2228	108	4	Failure with Atmospheric pressure sensor (voltage low)
72	P2229	108	3	Failure with Atmospheric pressure senso (voltage high)
73	P2230	108	2	Intermittent failure with Atmospheric pressure sensor
74	u0001	639	12	CAN communication error
75	U0167	522730	12	Failure with Immobilizer (CAN communication)
76	U0426	1202	2	Failure with Immobilizer (system)
77	U1167	639	8	Failure with Immobilizer (pulse communication)

For detail, please refer to the YAMMAR troubleshooting manual on the relevant website.