

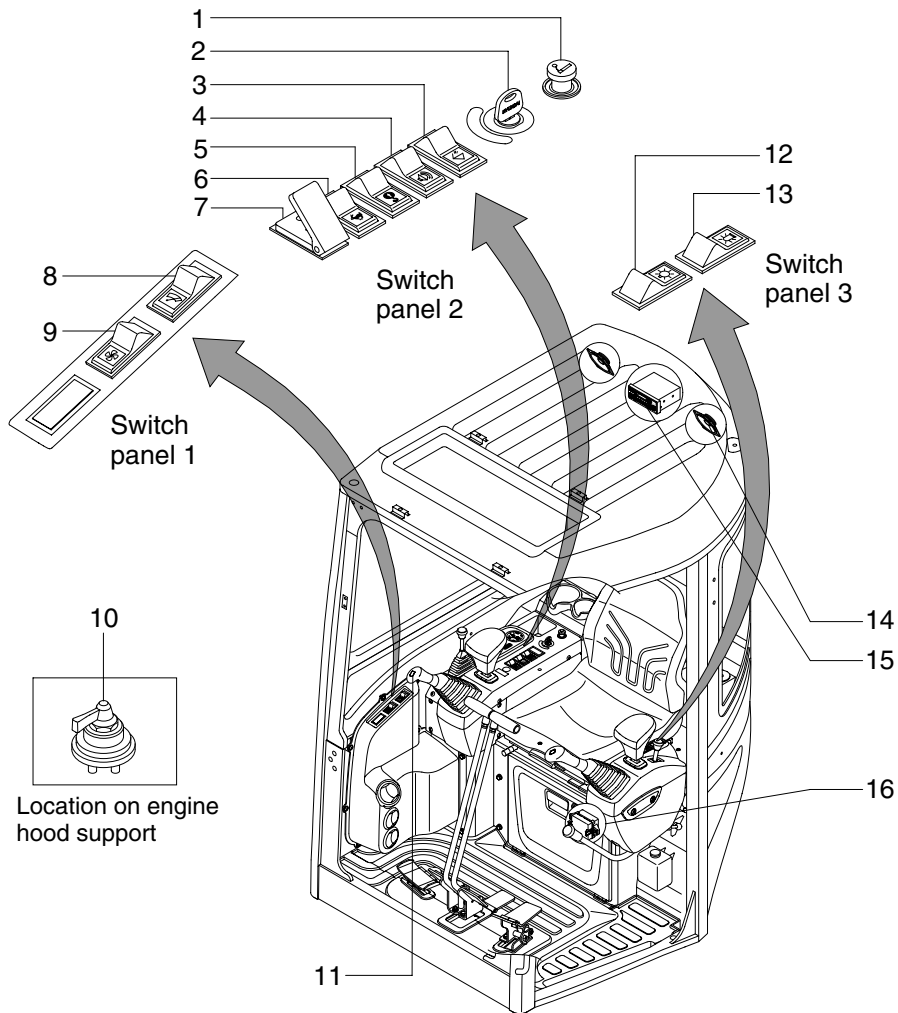
SECTION 4 ELECTRICAL SYSTEM

Group 1 Component Location	4-1
Group 2 Monitoring system	4-3
Group 3 Electrical Circuit	4-8
Group 4 Electrical Component Specification	4-24
Group 5 Connectors	4-30

SECTION 4 ELECTRICAL SYSTEM

GROUP 1 COMPONENT LOCATION

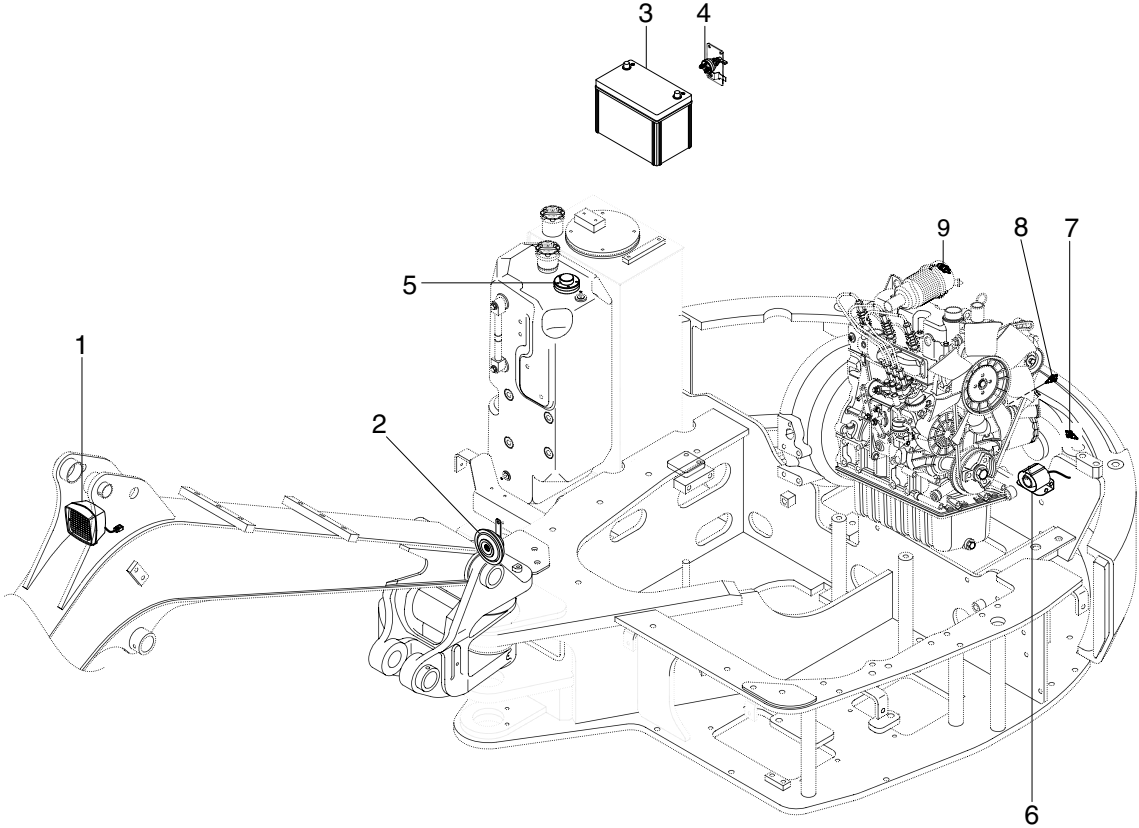
1. LOCATION 1



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- | | | | | | |
|---|-----------------------------|----|---------------------|----|--------------------|
| 1 | Cigar lighter | 7 | USB socket | 13 | Beacon switch |
| 2 | Start switch | 8 | Washer/wiper switch | 14 | Speaker |
| 3 | Quick clamp switch | 9 | Heater switch | 15 | Radio & USB player |
| 4 | Travel alarm switch | 10 | Master switch | 16 | Fuse box |
| 5 | Overload switch | 11 | Horn switch | | |
| 6 | Travel speed control switch | 12 | Main light switch | | |

2. LOCATION 2



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- | | | | | | |
|---|-----------|---|---------------------|---|-----------------------------|
| 1 | Work lamp | 4 | Master switch | 7 | Water temperature sender |
| 2 | Horn | 5 | Fuel sender | 8 | Engine oil pressure switch |
| 3 | Battery | 6 | Travel alarm buzzer | 9 | Air cleaner pressure switch |

GROUP 2 MONITORING SYSTEM

1. OUTLINE

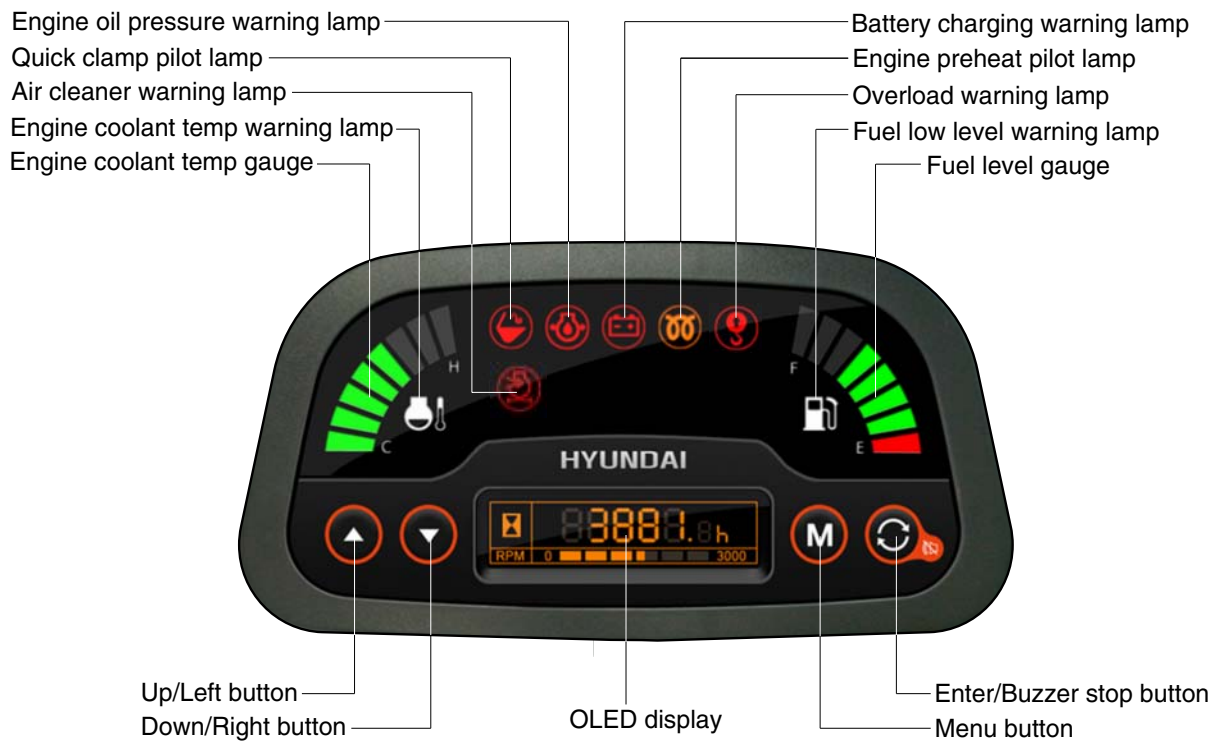
Monitoring system consists of the monitor part and switch part.

The monitor part gives warnings when any abnormality occurs in the machine and informs the condition of the machine.

Various select switches are built into the monitor panel, which act as the control portion of the machine control system.

2. CLUSTER

1) MONITOR PANEL



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2) CLUSTER CHECK PROCEDURE

(1) Start key : ON

- ① Check monitor initial 6 seconds
 - a. All lamps light up.
- ② Check monitor after 2 seconds : Indicate machine condition
 - a. Tachometer : 0 rpm
 - b. Fuel gauge : Pointed at appropriate level
 - c. Engine coolant temperature gauge : Pointed at appropriate level
 - d. Warning lamp

※ **During start key ON the engine oil pressure lamp and battery charging lamp go on, but it is not abnormal.**

(2) Start of engine

- ① Check machine condition
 - a. Tachometer pointed at present rpm
 - b. Gauge and warning lamp : Indicate at present condition.

※ When normal condition : All warning lamp OFF
- ② When abnormal condition
 - a. The lamp lights up.
 - b. The lamp light up until normal condition.

3. CLUSTER FUNCTION

1) GAUGES AND DISPLAYS

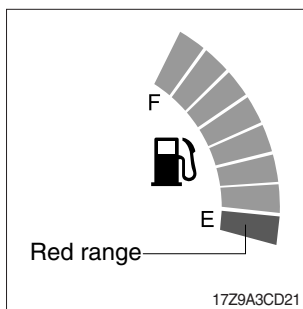
(1) Service meter





- ① This meter shows the total operation hours of the machine.
- ② Always ensure the operating condition of the meter during the machine operation.

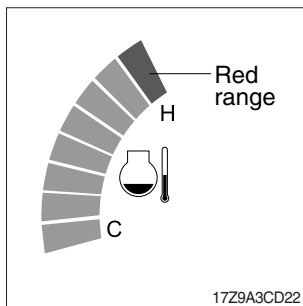
Inspect and service the machine based on hours as indicated in chapter 6, maintenance.


(2) Fuel gauge



- ① This gauge indicates the amount of fuel in the fuel tank.
 - ② Fill the fuel when the red range or warning lamp  ON.
- ※ If the gauge illuminates the red range or warning lamp  ON even though the machine is on the normal condition, check the electric device as that can be caused by the poor connection of electricity or sensor.

(3) Engine coolant temperature gauge



- ① This indicates the temperature of coolant.
 - Red range : Above 115°C (239°F)
 - ② When the red range pointed or warning lamp  ON, engine do not abruptly stop but run it at medium speed to allow it to cool gradually, then stop it.
Check the radiator and engine.
- ※ If the engine is stopped without cooled down running, the temperature of engine parts will rise suddenly, this could cause severe engine trouble.

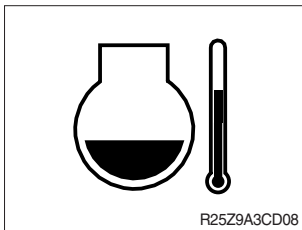
2) WARNING AND PILOT LAMPS

(1) Fuel low level warning lamp



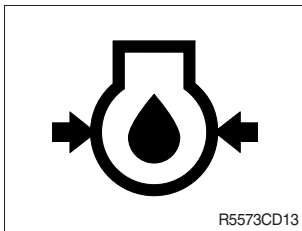
- ① This lamp ON and buzzer sounds when the level of fuel is below 5.5 l (1.5 U.S. gal).
- ② Fill the fuel immediately when the lamp ON.

(2) Engine coolant temperature warning lamp



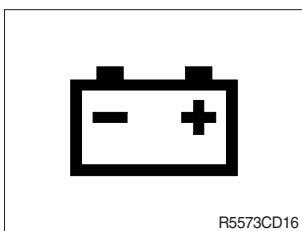
- ① This lamp ON and buzzer sounds when the temperature of coolant is over the normal temperature 115°C (239°F) .
- ② Check the cooling system when the lamp ON.

(3) Engine oil pressure warning lamp



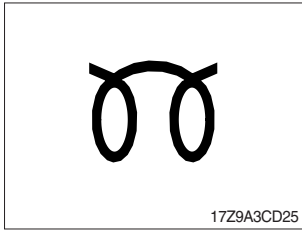
- ① This lamp ON and buzzer sounds after starting the engine because of the low oil pressure.
- ② If the lamp ON during engine operation, shut OFF engine immediately. Check oil level.

(4) Battery charging warning lamp



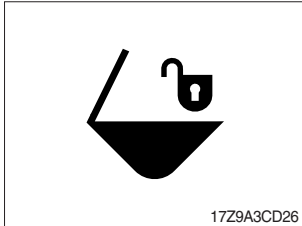
- ① This lamp ON and buzzer sounds when the starting switch is ON, it is turned OFF after starting the engine.
- ② Check the battery charging circuit when this lamp blinks during engine operation.

(5) Engine preheat pilot lamp



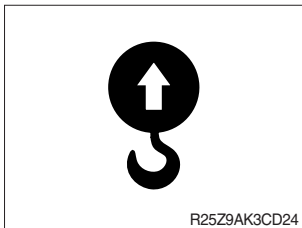
- ① When the start switch turn to HEAT position, pilot lamp comes ON.
- ② Refer to the page 4-4 for details in operator's manual.

(6) Quick clamp lock pilot lamp



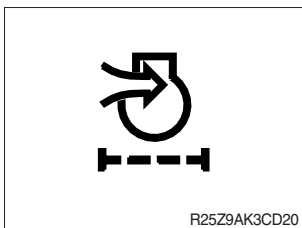
- ① When the quick clamp switch turned ON, this lamp turn ON and the buzzer sounds.
- ② This lamp turned OFF and the buzzer stop when the quick clamp switch turned OFF.

(7) Overload warning lamp

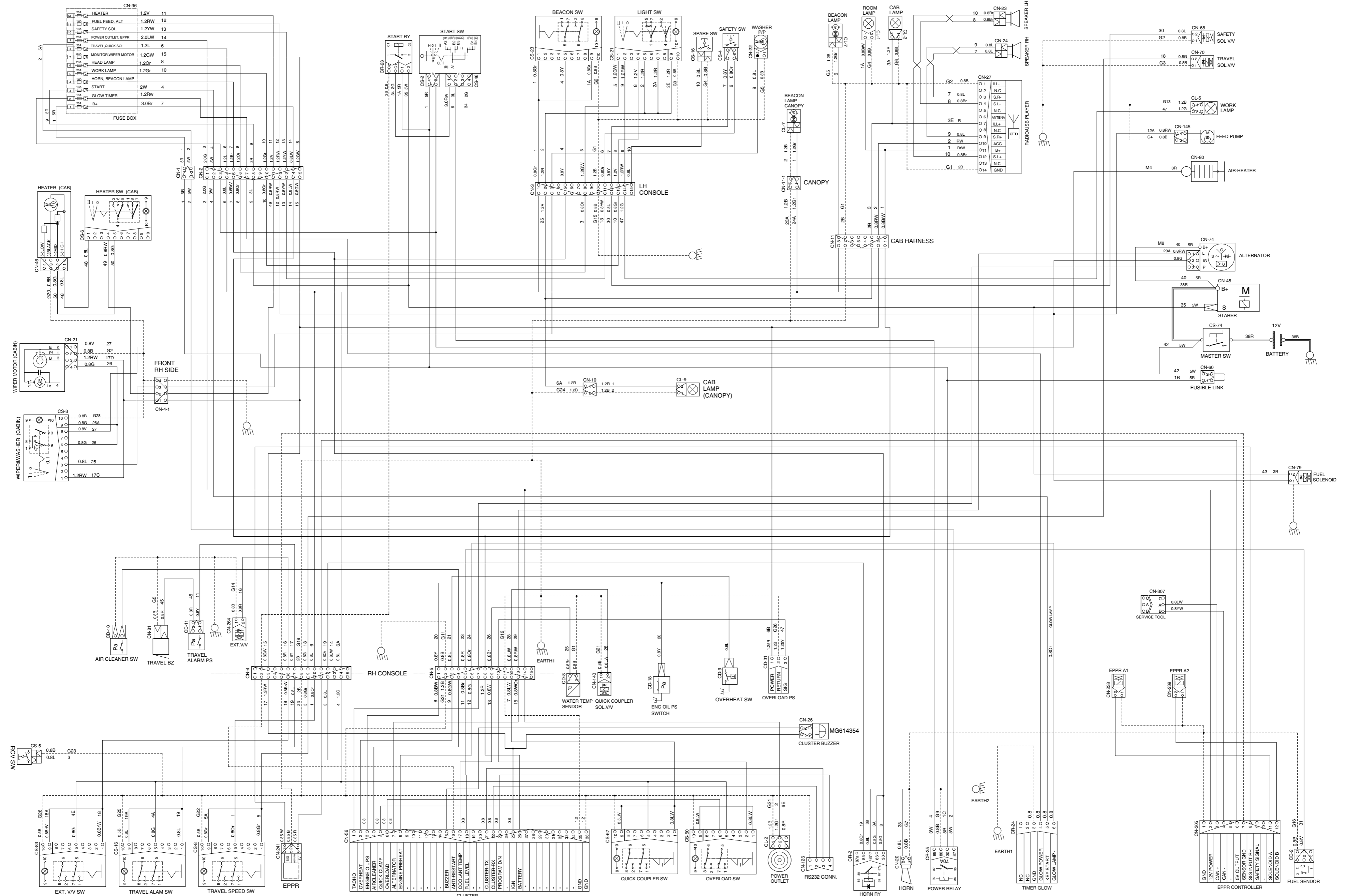


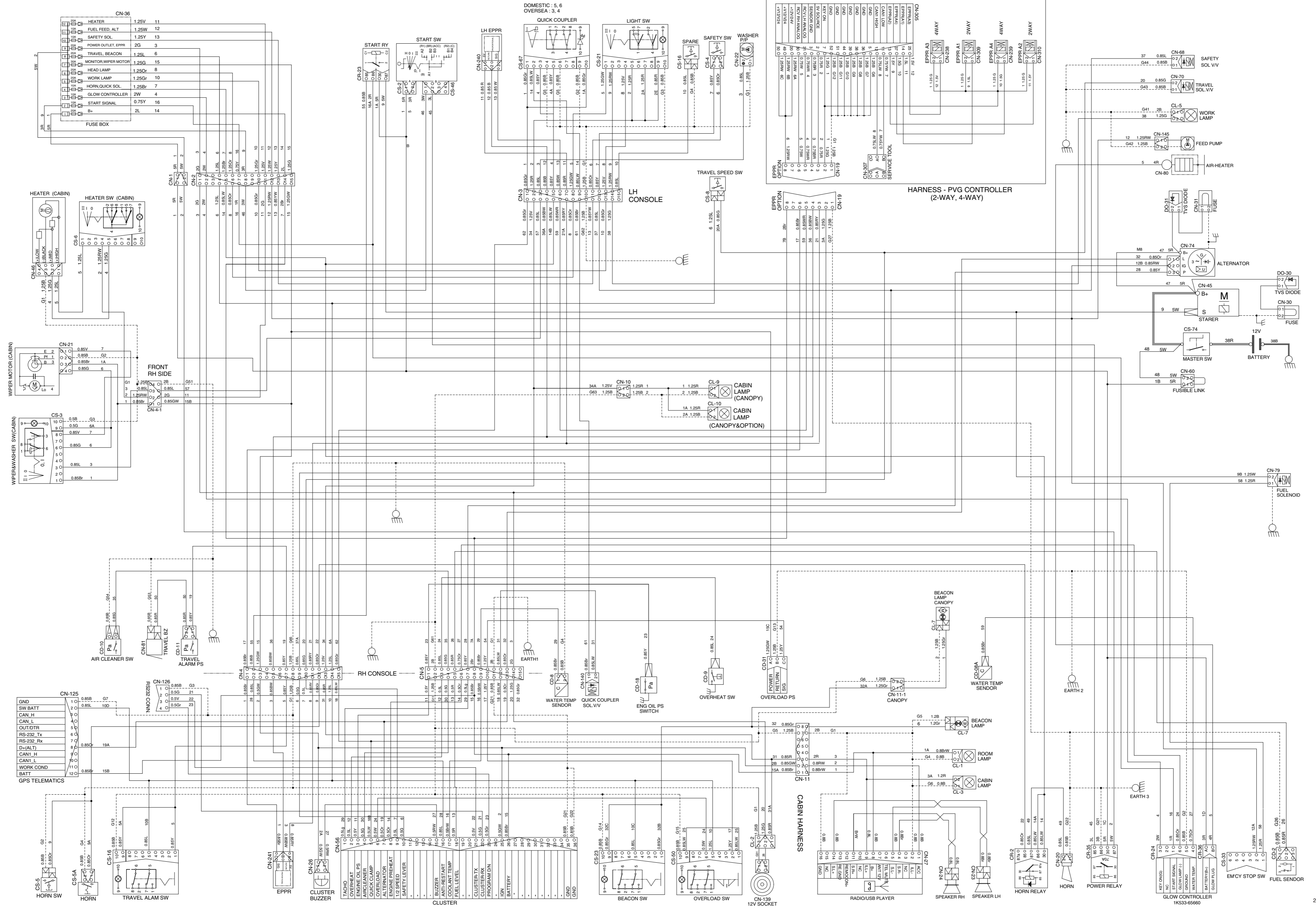
- ① When the machine is overload, this lamp ON during the overload switch is ON.
- ② Reduce the machine load.

(8) Air cleaner warning lamp



- ① This lamp ON when the filter of air cleaner is clogged.
- ② Check the filter and clean or replace it.





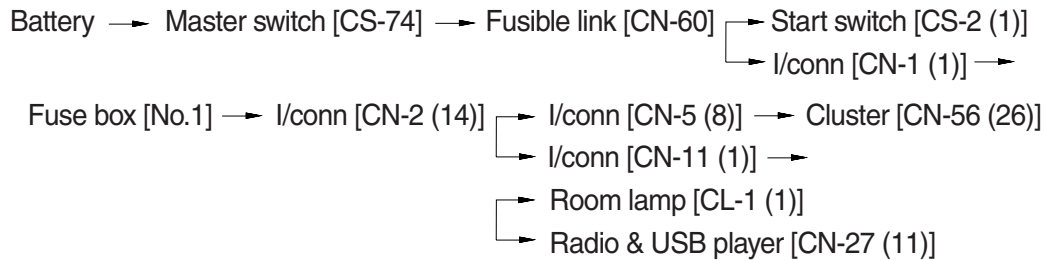


1. POWER CIRCUIT

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



※ I/conn : Intermediate connector

2) CHECK POINT

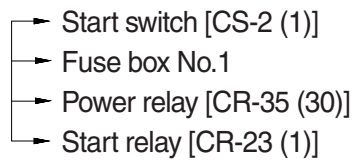
Engine	Start switch	Check point	Voltage
OFF	OFF	① - GND (Battery) ② - GND (Master switch) ③ - GND (Fusible link)	10~12.5 V

※ GND : Ground

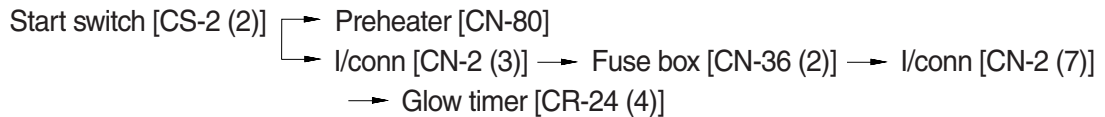
2. STARTING CIRCUIT

1) OPERATING FLOW

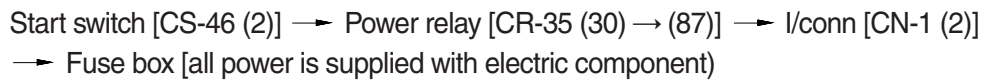
Battery(+) terminal → Master switch [CS-74] → Fusible link [CN-60]



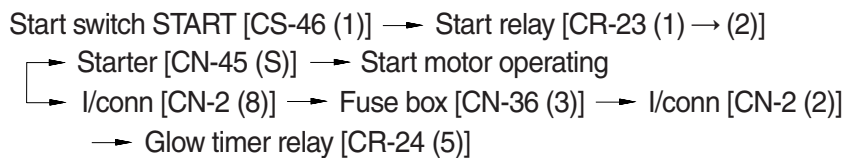
※ Start switch : HEAT



※ Start switch : ON



※ Start switch : START

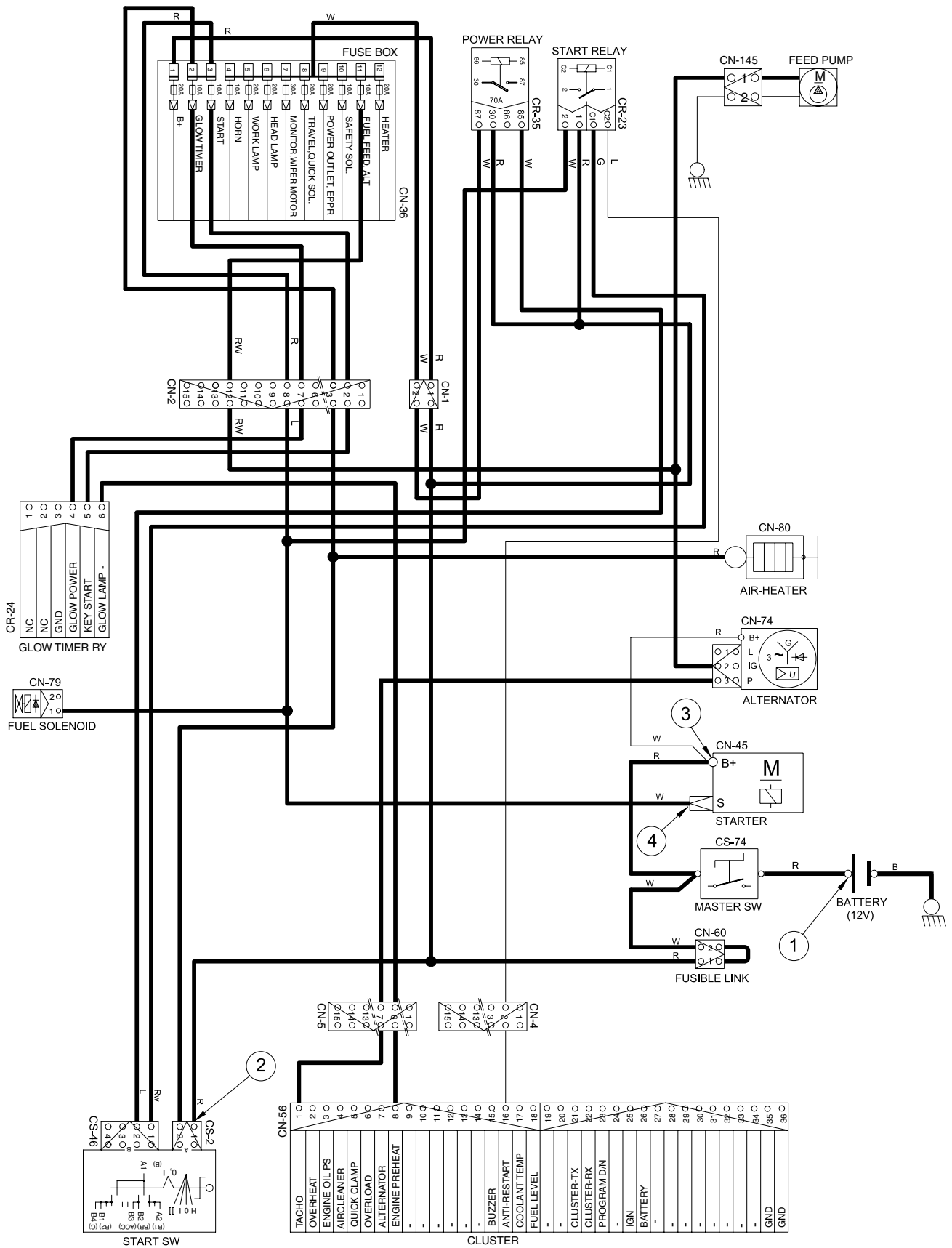


2) CHECK POINT

Engine	Start switch	Check point	Voltage
Operating	Start	① - GND (Battery) ② - GND (Start key) ③ - GND (Starter B ⁺) ④ - GND (Starter S)	10~12.5 V

※ GND : Ground

STARTING CIRCUIT



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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.

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-5 (13)] → Cluster [CN-56 (7)] → Cluster warning lamp ON

(2) Charging flow

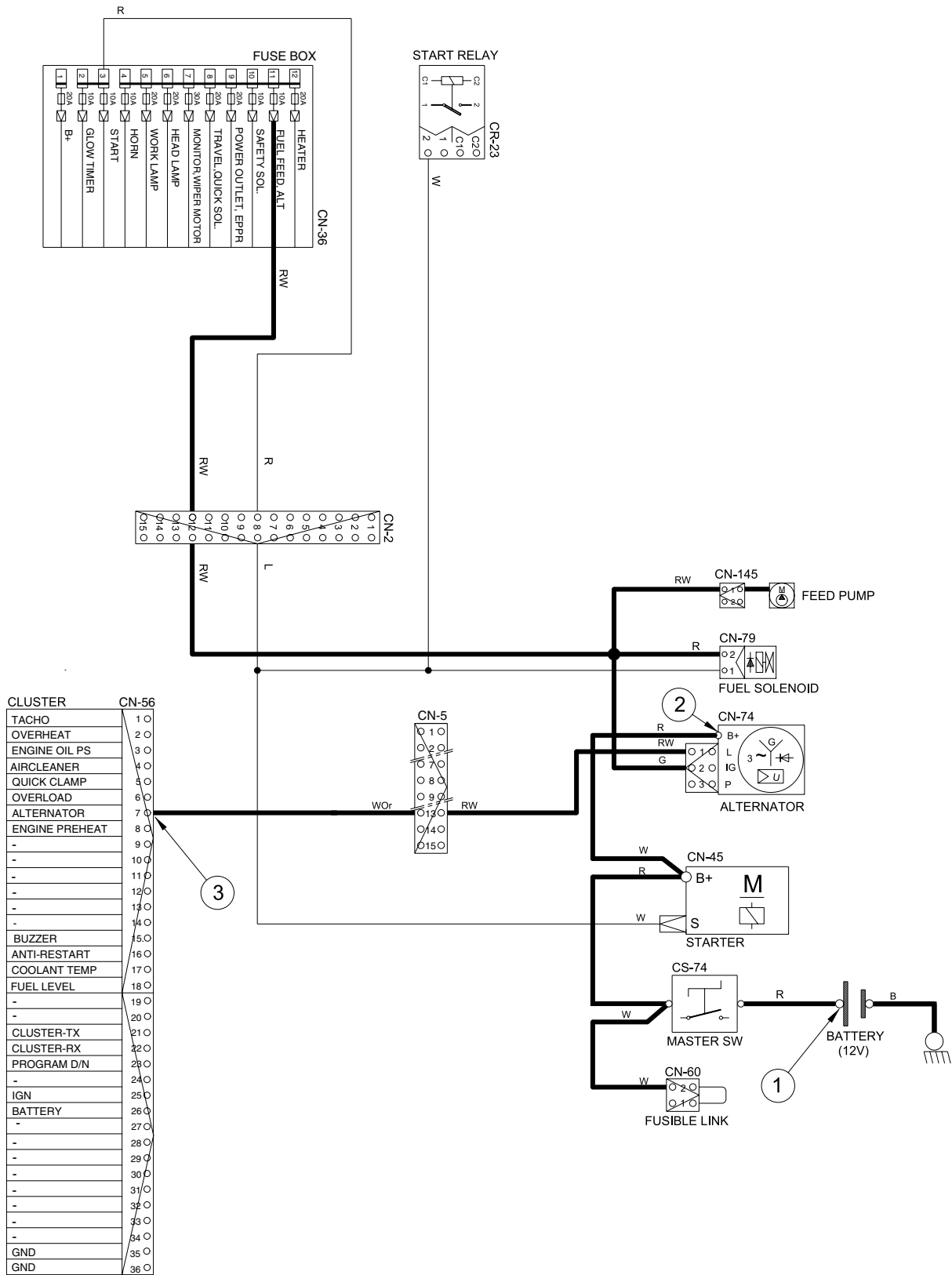
Alternator "B+" terminal → Battery(+) terminal

2) CHECK POINT

Engine	Start switch	Check point	Voltage
ON	ON	① - GND (Battery voltage) ② - GND (Alternator B ⁺ terminal) ③ - GND (Cluster)	10~12.5 V

※ GND : Ground

CHARGING CIRCUIT



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4. HEAD AND WORK LIGHT CIRCUIT

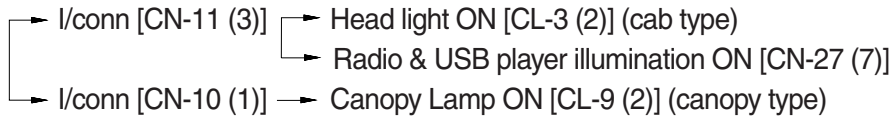
1) OPERATING FLOW

Fuse box (No.6) → I/conn [CN-2 (6)] → I/conn [CN-3 (8)] → Light switch [CS-21 (1)]

Fuse box (No.5) → I/conn [CN-2 (10)] → I/conn [CN-3 (13)] → Light switch [CS-21 (4)]

(1) Main light switch ON : 1st step

Main light switch ON [CS-21 (5,7)] → I/conn [CN-3 (2)]



(2) Main light switch ON : 2nd step

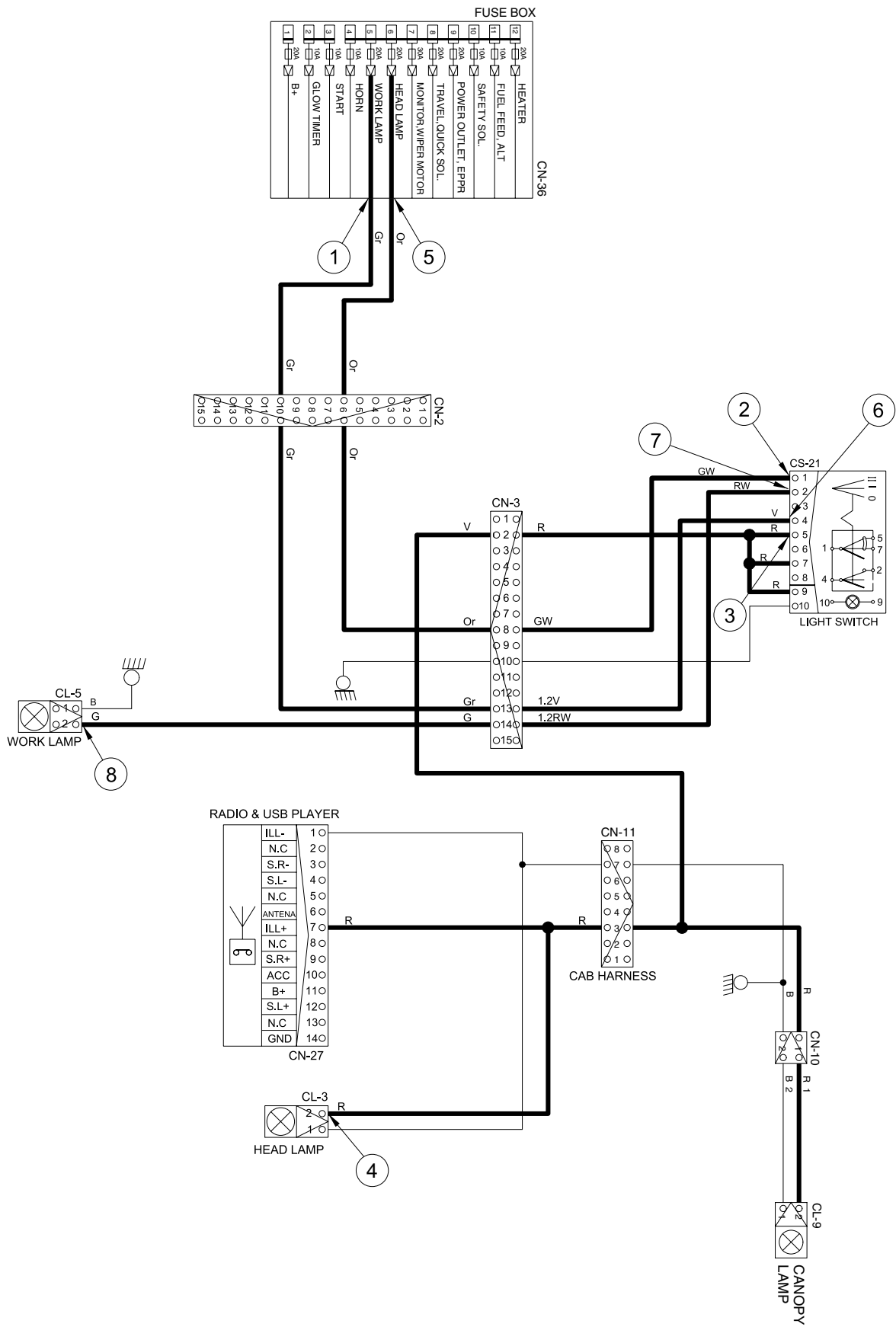
Main light switch ON [CS-21 (2)] → I/conn [CN-3 (14)] → Work light ON [CL-5 (2)]

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 (Head light) ⑤ - GND (Fuse box) ⑥ - GND (Switch power input) ⑦ - GND (Switch power output) ⑧ - GND (Work light)	10~12.5 V

※ GND : Ground

HEAD AND WORK LIGHT CIRCUIT



5. BEACON LAMP CIRCUIT

1) OPERATING FLOW

Fuse box (No.4) → I/conn [CN-2 (5)] → I/conn [CN-3 (5)] → Beacon lamp switch [CS-23 (5)]

(1) Beacon lamp switch ON

Beacon lamp switch ON [CS-23 (1)]

→ Switch Indicator lamp ON [CS-23 (9)]

→ I/conn [CN-3 (1)] → I/conn [CN-11 (8)] → Beacon lamp ON [CL-7] (cab type)

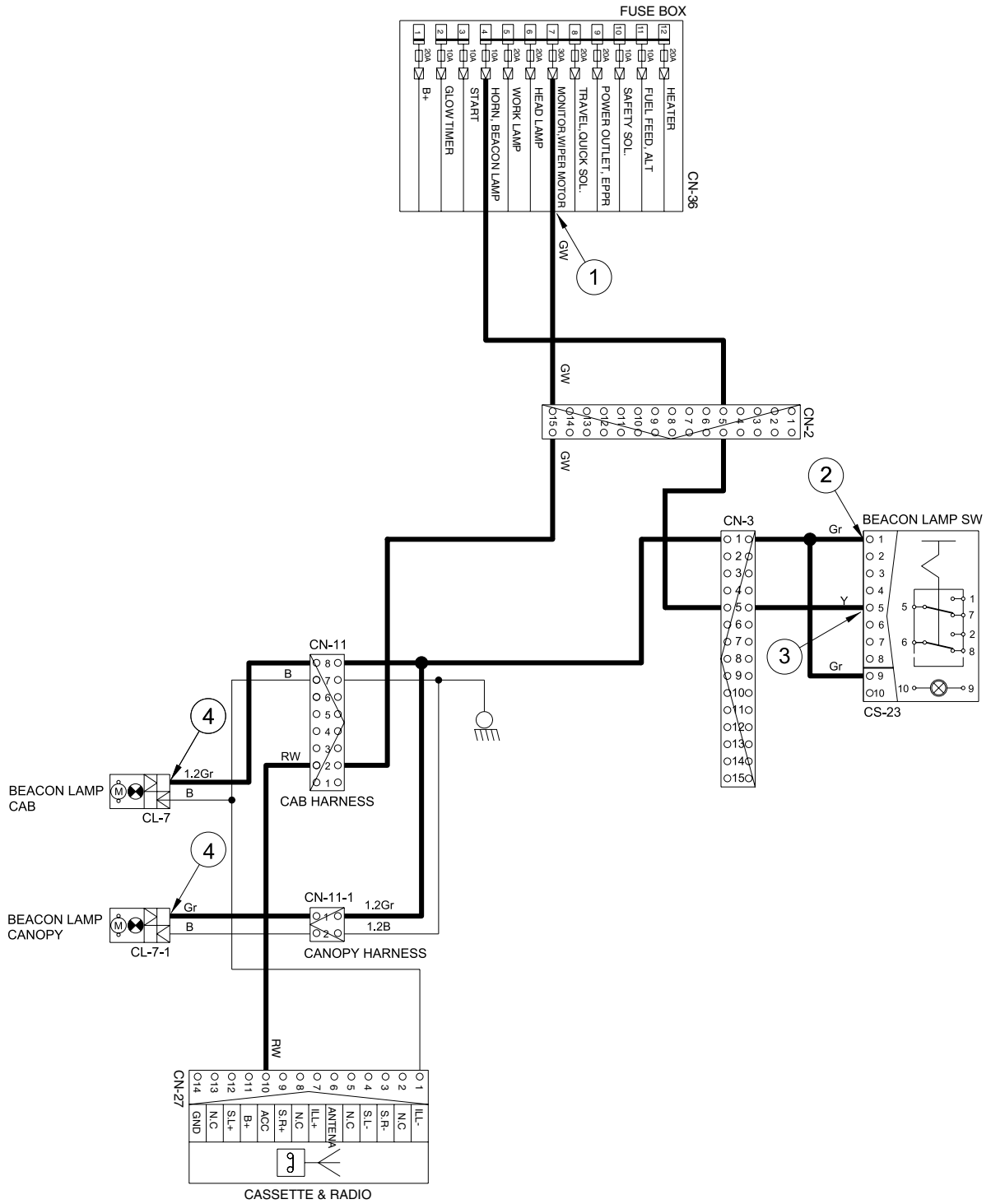
→ I/conn [CN-11-1 (1)] → Beacon lamp ON [CL-7-1] (canopy type)

2) CHECK POINT

Engine	Start switch	Check point	Voltage
STOP	ON	① - GND (Fuse box) ② - GND (Switch power output) ③ - GND (Switch power input) ④ - GND (Beacon lamp)	10~12.5 V

※ GND : Ground

BEACON LAMP CIRCUIT



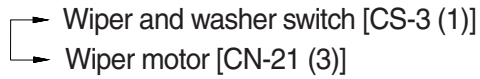
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6. WIPER AND WASHER CIRCUIT

1) OPERATING FLOW

(1) Start switch ON

Fuse box (No.7) → I/conn [CN-2 (15)] → I/conn [CN-4 (1)]



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

Wiper switch ON [CS-3 (6)] → Wiper motor operating [CN-21 (4)]
 → Wiper & washer switch lamp ON [CS-3 (9)]

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

Wiper switch ON [CS-3 (6)] → Wiper motor operating [CN-21 (4)]

Wiper switch ON [CS-3 (3)] → I/conn [CN-4 (3)] → I/conn [CN-3 (3)]

→ Washer pump operating [CN-22 (2)]

(4) Auto parking (when switch OFF)

Switch OFF → Wiper motor [CN-21 (1)] → Wiper switch [CS-3 (8) → (6)]

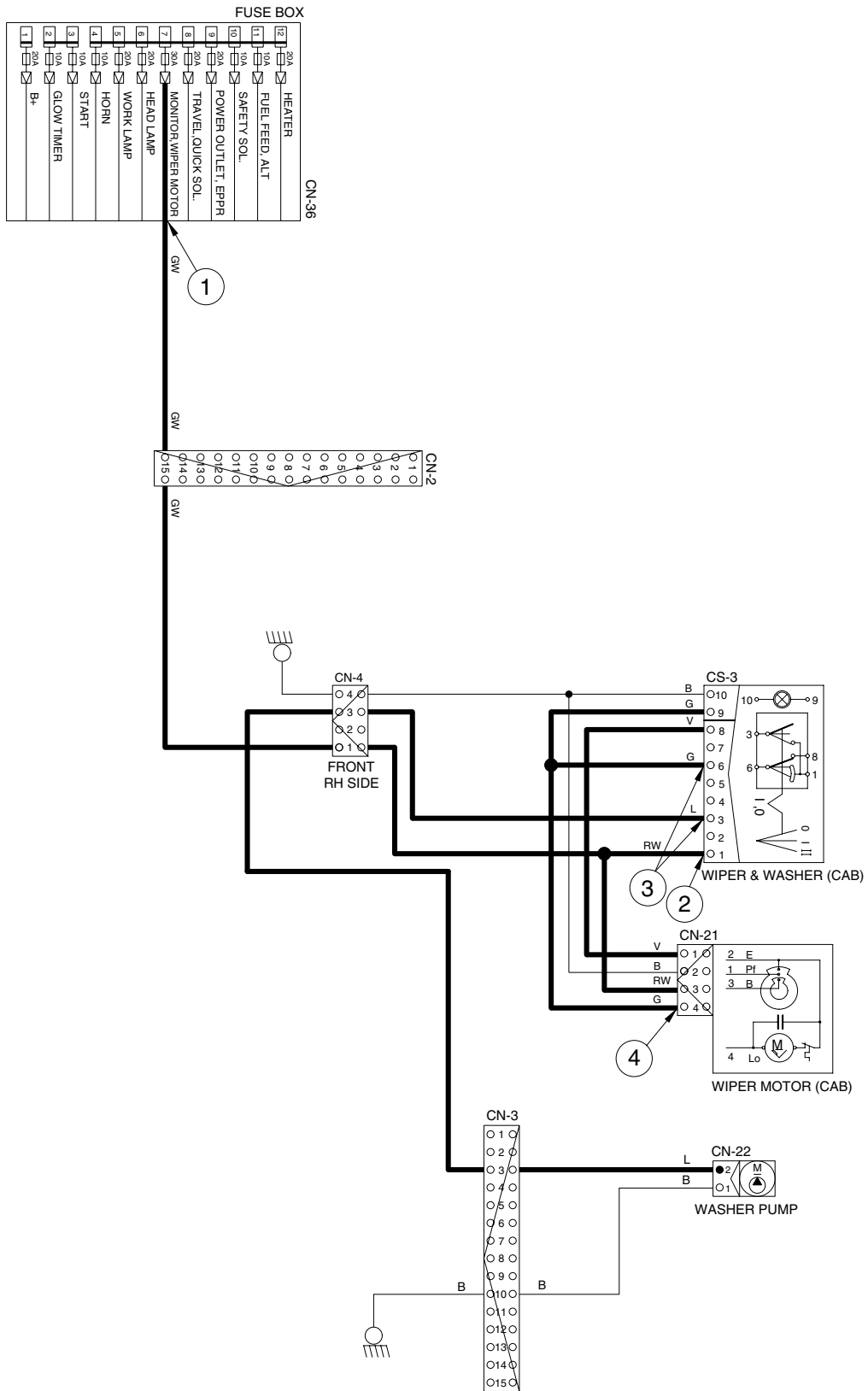
→ Wiper motor [CN-21 (4)] → Wiper motor parking position by wiper motor controller

2) CHECK POINT

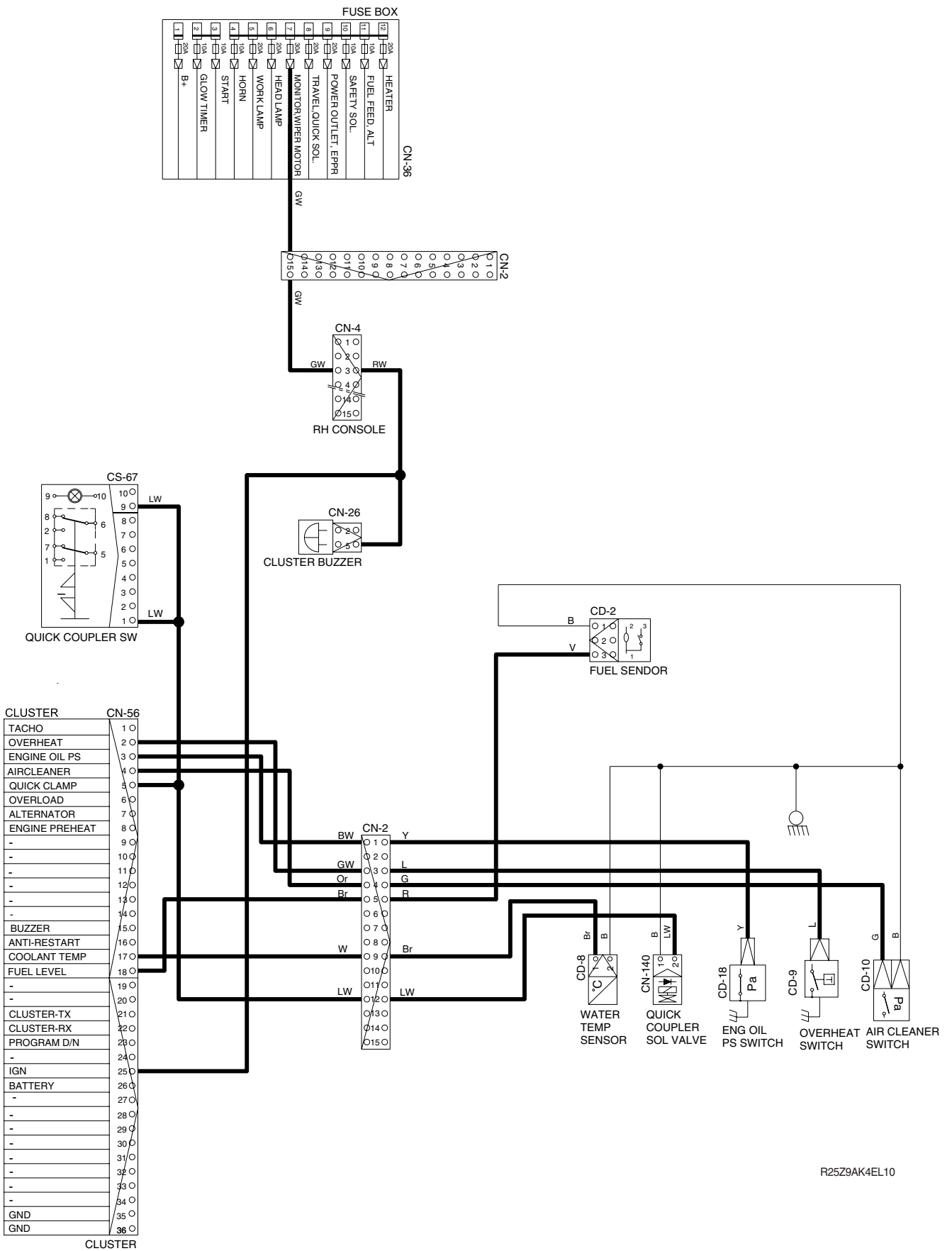
Engine	Start switch	Check point	Voltage
STOP	ON	① - GND (Fuse box) ② - GND (Switch power input) ③ - GND (Switch power output) ④ - GND (Wiper motor)	10~12.5 V

※ GND : Ground

WIPER AND WASHER CIRCUIT

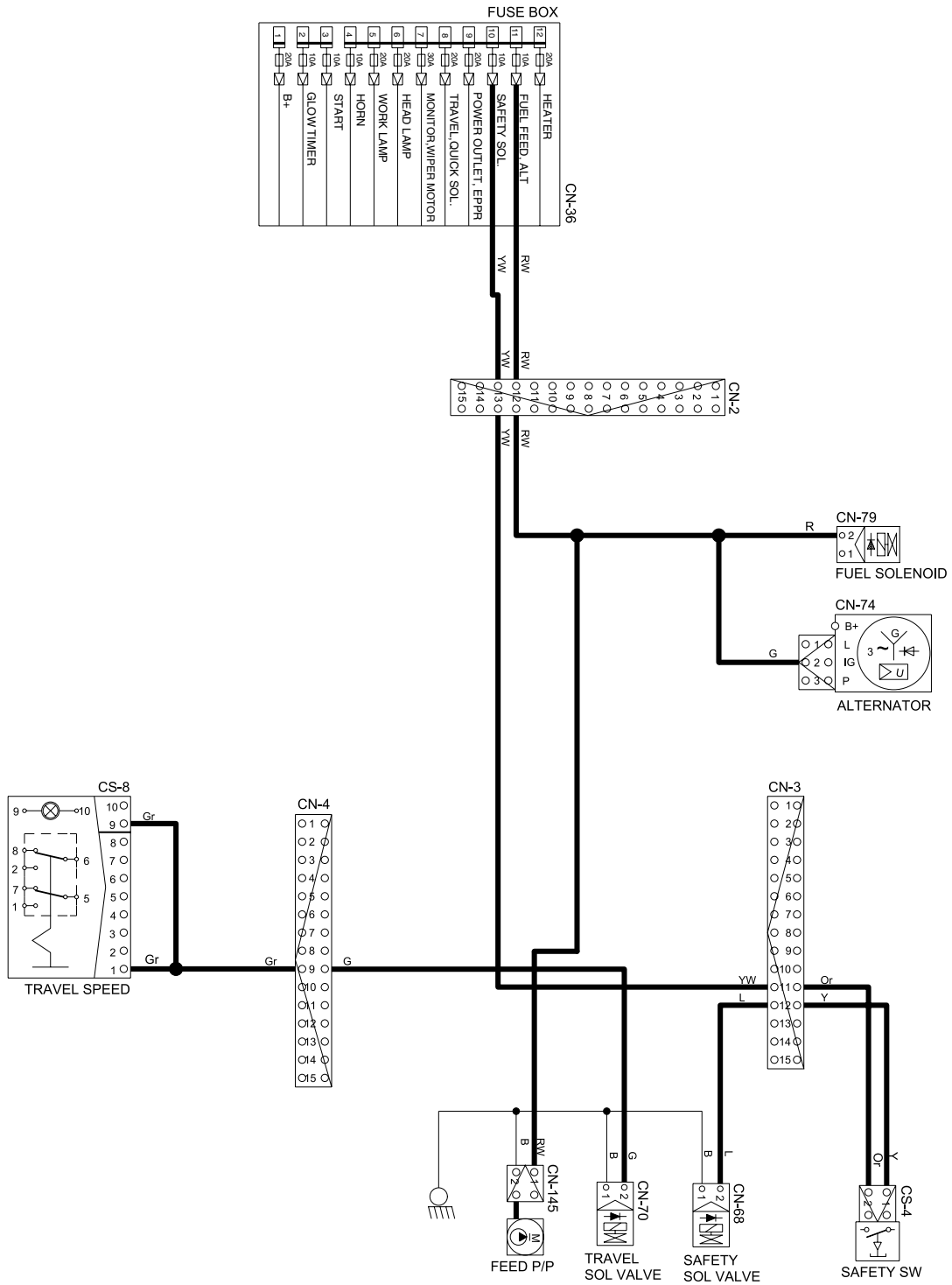


MONITORING CIRCUIT



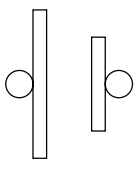
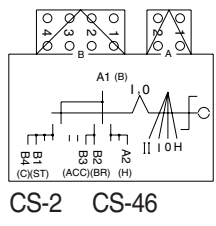
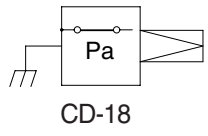
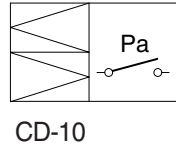
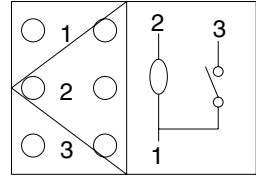
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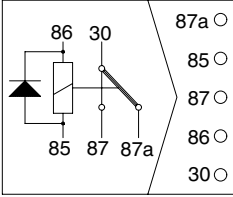
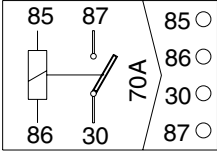
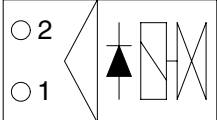
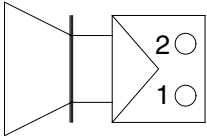
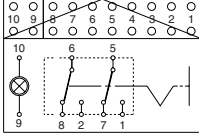
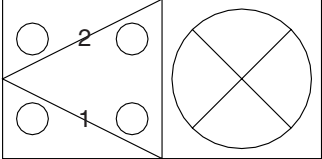
ELECTRIC CIRCUIT FOR HYDRAULIC

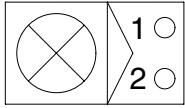
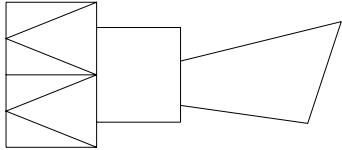
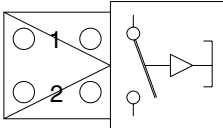
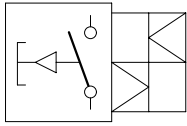
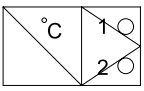
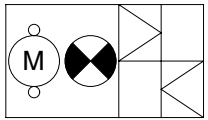


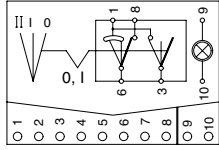
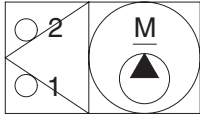
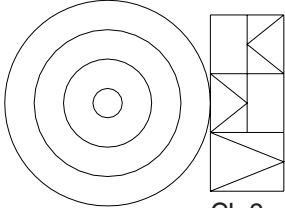
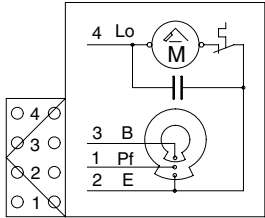
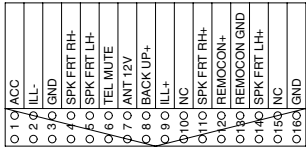
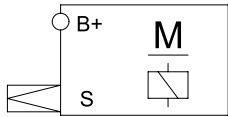
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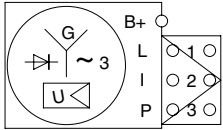
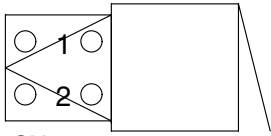
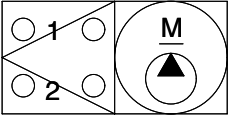
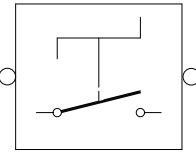
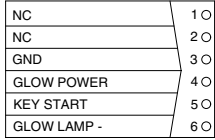
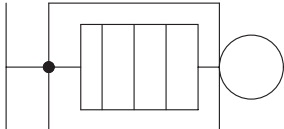
GROUP 4 ELECTRICAL COMPONENT SPECIFICATION

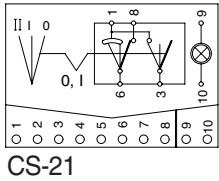
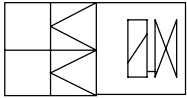
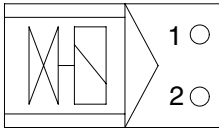
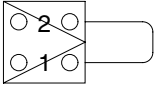
Part name	Symbol	Specification	Check
Battery		12V × 58Ah (5h rating)	※ Check specific gravity 1.280 over : Over charged 1.280 ~ 1.250 : Normal 1.250 below : Recharging
Start key	 <p style="text-align: center;">CS-2 CS-46</p>	12V	※ Check contact OFF : ∞ Ω (for each terminal) ON : 0 Ω (for terminal 1-3 and 1-2) START : 0 Ω (for terminal 1-5)
Pressure switch (for engine oil)	 <p style="text-align: center;">CD-18</p>	0.5 kgf/cm ² (N.C TYPE)	※ Check resistance Normal : 0 Ω (CLOSE)
Air cleaner pressure switch	 <p style="text-align: center;">CD-10</p>	Pressure: 635 mmH ₂ O (N.O TYPE)	※ Check contact Normal : ∞ Ω
Fuel sender	 <p style="text-align: center;">CD-2</p>	-	※ Check resistance Full : 30 Ω Low : 100 Ω Empty warning : 200 Ω

Part name	Symbol	Specification	Check
Horn relay	 <p>CR-2</p>	12V 20A	※ Check resistance Normal : About 200 Ω (for terminal 1-3) : 0 Ω (for terminal 2-4)
Power relay	 <p>CR-35</p>	12V 70A	※ Rated coil current 1.2±0.3 A
Solenoid valve	 <p>CN-68 CN-70 CN-140</p>	12V 1A	※ Check resistance Normal : 15~25 Ω (for terminal 1-2)
Speaker	 <p>CN-23 (LH) CN-24 (RH)</p>	4 Ω 20W	※ Check resistance Normal : 4 Ω
Switch (Locking type)	 <p>CS-8 CS-16 CS-83</p>	12V 16A	※ Check contact Normal OFF - ∞ Ω (for terminal 1-5,2-6) - 0 Ω (for terminal 5-7,6-8)
Lamp	 <p>CL-3 CL-5</p>	12V 55W (H3 TYPE)	※ Check disconnection Normal : 1.2 Ω

Part name	Symbol	Specification	Check
Room lamp	 <p>CL-1</p>	12V 10W	※ Check disconnection Normal : A few Ω
Horn	 <p>CN-20</p>	12V 6A	132±5 dB
Safety switch	 <p>CS-4</p>	Micro 12V 15A	※ Check contact Normal : 0 Ω Operating : ∞ Ω
Horn switch	 <p>CS-5 CS-16</p>	12V 10A	※ Check contact Normal : 0 Ω
Water temp sender	 <p>CD-8</p>	-	※ Check contact 50°C : 0.748~0.904 Ω 67°C : 0.538~0.650 Ω 102°C : 0.185~0.167 Ω 110°C : 0.143~0.130 Ω 135°C : 0.076~0.100 Ω
Beacon lamp	 <p>CL-7</p>	12V (strobe type)	※ Check disconnection Normal : A few Ω

Part name	Symbol	Specification	Check
Wiper & washer switch	 <p>CS-3</p>	12V 16A	※ Check contact Normal : $\infty \Omega$
Washer pump	 <p>CN-22</p>	12V 3.8A	※ Check contact Normal : 3Ω (for terminal 1-2)
Cigar lighter	 <p>CL-2</p>	12V 10A 1.4W	※ Check coil resistance Normal : About $1M \Omega$ ※ Check contact Normal : $\infty \Omega$ Operating time : 5~15sec
Wiper motor	 <p>CN-21</p>	12V 3A	※ Check contact Normal : 6Ω (for terminal 2-6)
Radio & USB player	 <p>CN-27</p>	12V 20W	※ Check resistance Power ON : $4 \Omega \pm 4 \Omega$ (for pin 1-6, 4-8)
Starter	 <p>CN-45</p>	12V 1.7kW	※ Check contact Normal : 0.1Ω

Part name	Symbol	Specification	Check
Alternator	 <p>CN-74</p>	12V 40A	※ Check contact Normal : 0 Ω (For terminal B ⁺ -1) Normal : 10 ~ 12.5V
Travel alarm	 <p>CN-81</p>	12V	-
Fuel feed pump	 <p>CN-145</p>	12V	-
Master switch	 <p>CN-74</p>	12V 1000A	-
Glow timer	 <p>CR-24</p>	12V	-
Air-heater	 <p>CN-80</p>	12V 42A 500W	-

Part name	Symbol	Specification	Check
Light switch	 <p>CS-21</p>	12V 16A	※ Check contact Normal : $\infty \Omega$
Solenoid valve (engine stop)	 <p>CN-79</p>	12V	※ Coil resistance : 1.8Ω
EPPR valve	 <p>CN-238 CN-239</p>	700mA	※ Check resistance Normal : $15\sim 25 \Omega$ (for terminal 1-2)
Fusible link	 <p>CN-60</p>	27A	※ Check coil resistance Normal : $3.26m \Omega / m$

GROUP 5 CONNECTORS

1. CONNECTOR DESTINATION

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-1	AMP	2	I/conn (Main harness-fuse box)	S813-130200	S813-030201
CN-2	AMP	15	I/conn (Main harness-fuse box)	2-85262-1	368301-1
CN-3	AMP	15	I/conn (Main harness-LH console harness)	2-85262-1	368301-1
CN-4	AMP	15	I/conn (Main harness-heater & wiper harness)	2-85262-1	368301-1
CN-5	AMP	15	I/conn (Main harness-RH console harness)	2-85262-1	368301-1
CN-10	AMP	2	I/conn (Main harness-cab lamp harness)	S816-002002	S816-102002
CN-11	KET	8	I/conn (Main harness-cab harness)	MG610051	S816-108202
CN-11-1	AMP	4	I/conn (Main harness-front RH side harness)	S810-004202	S810-104202
CN-20	DEUTSCH	2	Horn	DT06-2S-E012	-
CN-21	AMP	4	Wiper motor	180900-0	-
CN-22	KET	2	Washer tank	MG640605	-
CN-23	KET	1	Speaker LH	S822-014002	S822-114002
CN-24	KET	1	Speaker RH	S822-014002	S822-114002
CN-26	KET	5	Cluster buzzer	MG614354	-
CN-27	-	16	Radio & USB player	PK145-16017	-
CN-31	DEUTSCH	3	Air-con	DT06-3S	-
CN-36	-	-	Fuse box body	F12890010	-
CN-45	RING TERM	1	Starter	ST710258-2	-
	YAZAKI	1	Starter	7123-2115	-
CN-46	AMP	4	Heater	180900-0	-
CN-56	AMP	16	Cluster	-	145966-2
	AMP	20	Cluster	-	145967-2
CN-60	AMP	2	Fusible link	-	S813-130200
CN-68	DEUTSCH	2	Safety solenoid	DT06-2S-P012	-
CN-70	DEUTSCH	2	Travel HI-LO solenoid	DT06-2S-E012	-
CN-74	RING TERM	1	Alternator B+	GP110021	-
CN-74A	YAZAKI	2	Alternator	7122-2820	-
CN-79	SUMITOMO	2	Fuel cut-off solenoid	6195-0003	-
CN-80	RING TERM	1	Pre heater	GP110021	-
CN-81	SWP	1	Travel buzzer	S822-014000	S822-114000
CN-126	DEUTSCH	4	RS232 connection	DT06-4S-EP06	DT04-4P-E004
CN-139	AMP	2	Socket 12V	172434-2	-
CN-140	DEUTSCH	2	Quick clamp	DT06-2S-P012	-
CN-145	YAZAKI	2	Fuel feed pump	7122-2820	-
CN-238	DEUTSCH	2	EPPR rotate L	DT06-2S-P012	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-239	DEUTSCH	2	EPPR rotate R	DT06-2S-P012	-
CN-240	DEUTSCH	3	RH EPPR	DT06-3P	-
CN-246	DEUTSCH	2	EXT valve	DT06-2S-P012	-
CN-305	DEUTSCH	12	EPPR controller	DTM06-12SA	-
LAMP					
CL-1	KET	2	Room lamp	MG610070	-
CL-2	AMP	3	Cigar lighter	S810-003202	-
CL-5	DEUTSCH	2	Work lamp	DT06-2S-P012	-
CL-7	KET	1	Beacon lamp	S822-014002	S822-114000
CL-9	KET	2	Head lamp (cab type)	S822-014002	-
CL-10	KET	2	Head lamp (canopy type)	S822-014002	-
RELAY					
CR-2	KET	4	Horn relay	MG612017-5	-
CR-23	KET	5	Start relay	MG640927	-
CR-24	SUMITOMO	6	Glow timer relay	174204-1	-
CR-35	KET	5	Power relay	MG640927	-
SENSOR					
CD-2	AMP	3	Fuel sender	S816-003002	S816-102002
CD-8	AMP	2	Water temp sender	174374-3	-
CD-9	AMP	1	Water temp switch	172320-2	-
CD-10	-	1	Air cleaner pressure switch	ST730135-3	-
CD-11	KET	2	Travel pressure switch	MG640795	-
CD-18	RING TERM	1	Engine oil pressure	GP110021	-
SWITCH					
CS-2	AMP	2	Start key switch	S813-030201	-
CS-3	SWF	10	Wiper & washer switch	593757	-
CS-4	AMP	2	Safety switch	S814-102001	-
CS-5	DEUTSCH	1	Horn-RH switch	-	DT04-3P-CE03
CS-6	SWF	10	Heater switch	593757	-
CS-8	SWF	10	Travel speed switch	593757	-
CS-16	SWF	10	Travel alarm switch	593757	-
CS-21	SWF	10	Light switch	593757	-
CS-23	SWF	10	Beacon lamp switch	593757	-
CS-46	KET	4	Start switch	MG651926	-
CS-50	SWF	10	Overload switch	593757	-
CS-67	SWF	10	Quick coupler switch	593757	-
CS-83	SWF	10	EXT valve switch	593757	-