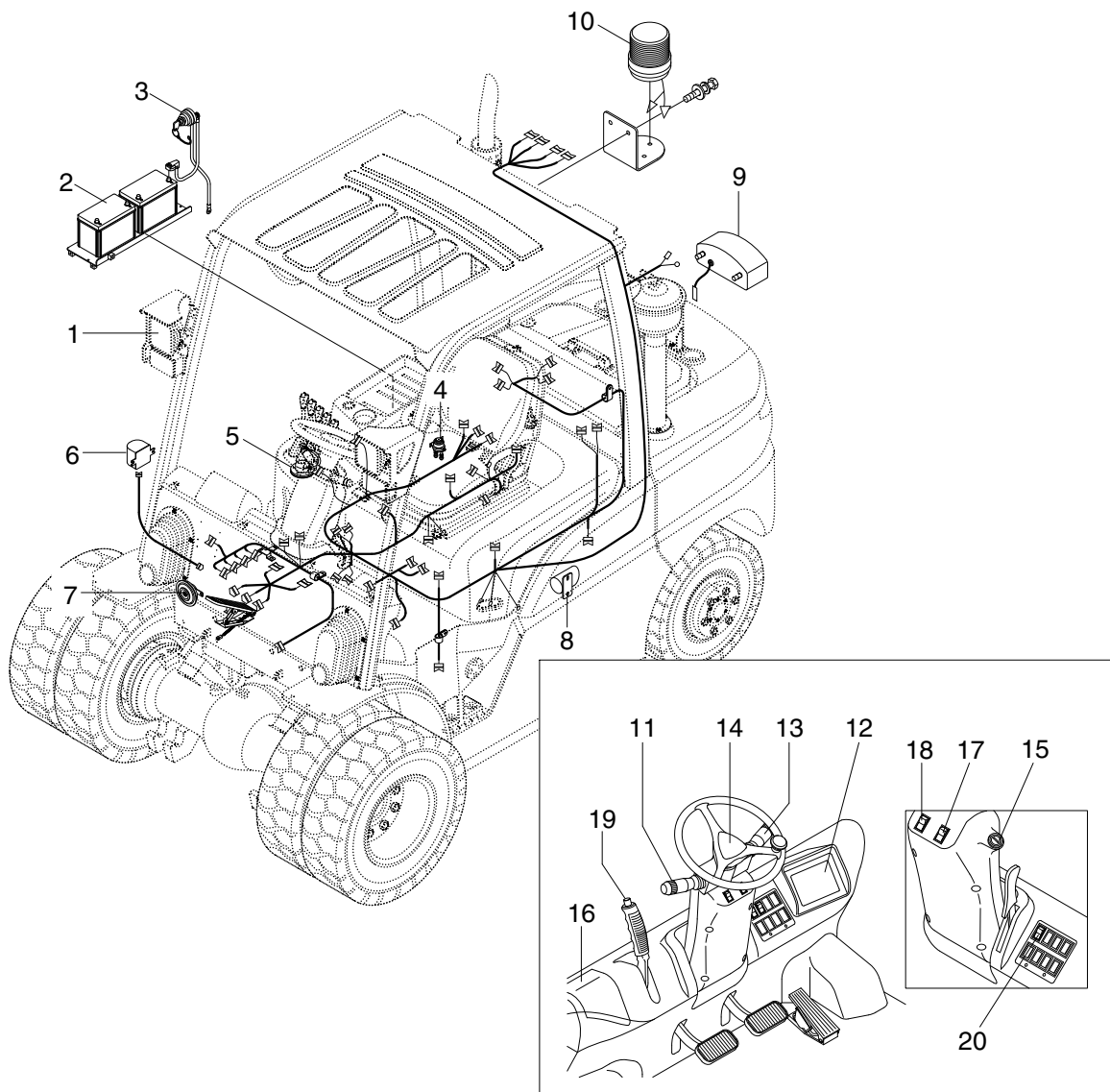


SECTION 7 ELECTRICAL SYSTEM

Group 1	Component location	7-1
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SECTION 7 ELECTRICAL SYSTEM

GROUP 1 COMPONENT LOCATION



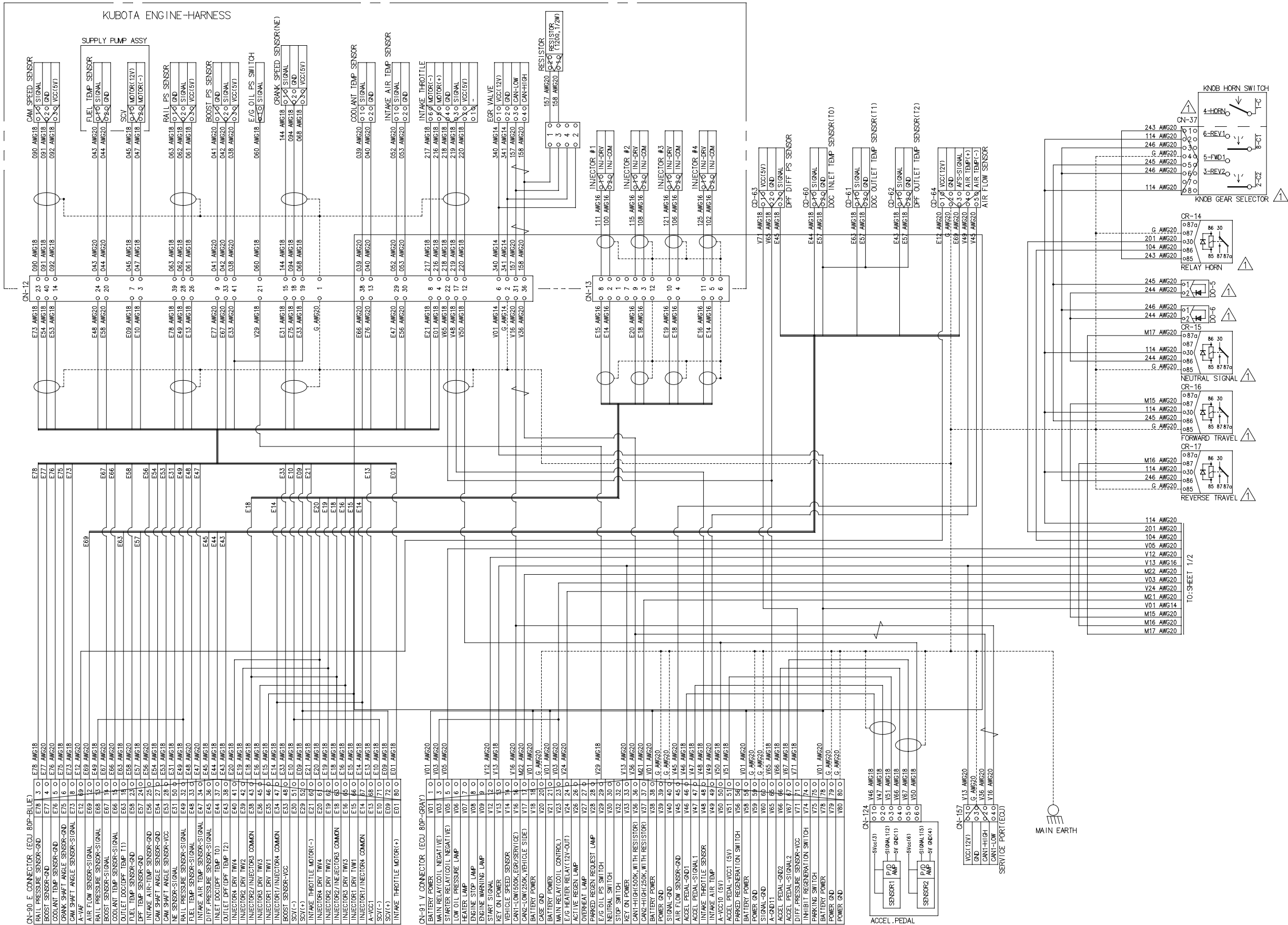
35D9AEL01

- | | | |
|--------------------|--------------------------|-----------------------------|
| 1 Work lamp | 9 Combination lamp | 15 Start switch |
| 2 Battery | 10 Beacon lamp | 16 Fuse box |
| 3 Master switch | 11 Forward-reverse lever | 17 Work lamp switch (opt) |
| 4 Start relay | 12 Cluster | 18 Hazard lamp switch (opt) |
| 5 Fuel sender | 13 Head lamp switch | 19 Parking lever |
| 6 Air heater relay | Illumination lamp | 20 Auto shift switch |
| 7 High horn | Turn signal switch | |
| 8 Back buzzer | 14 Horn button | |

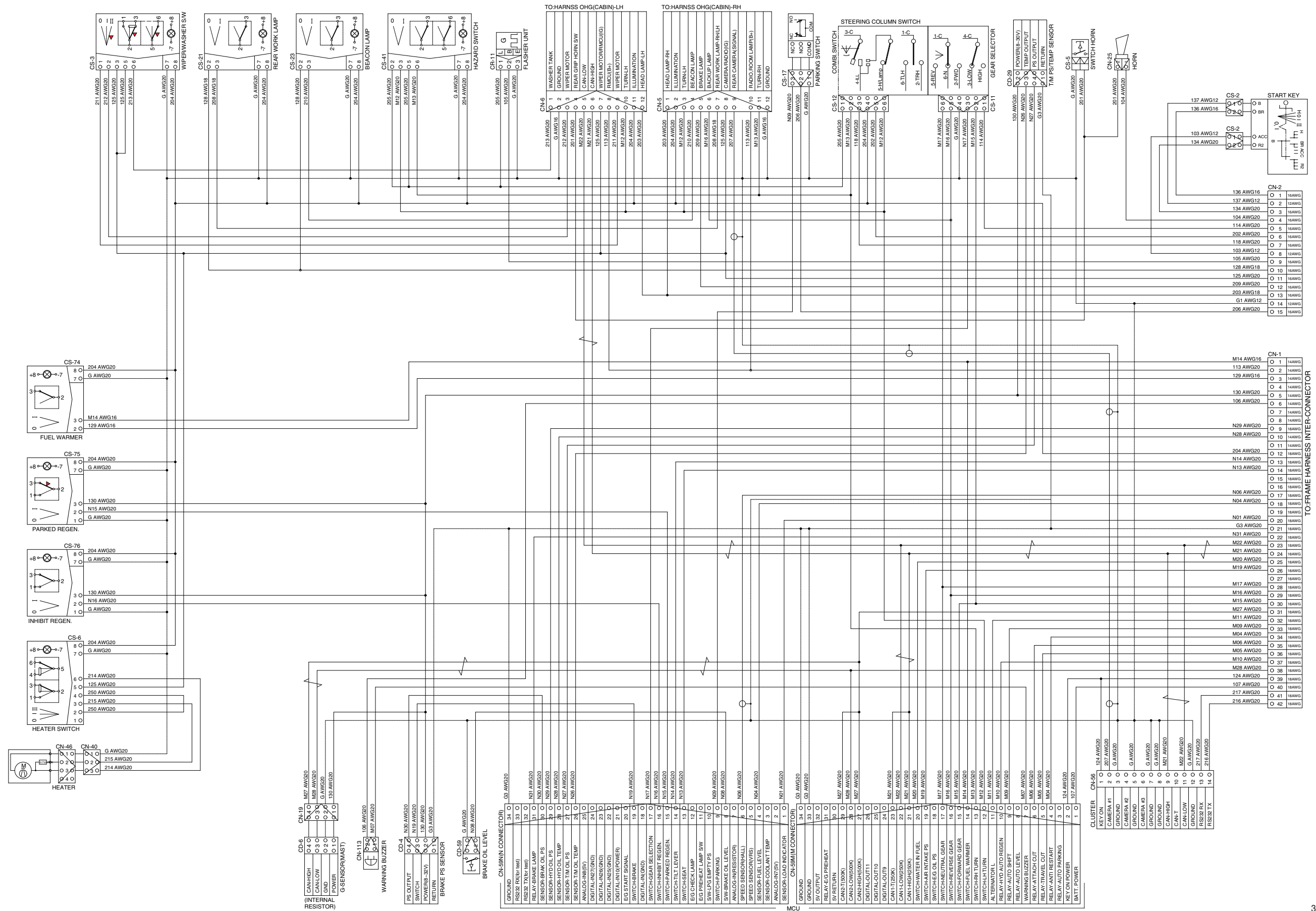
- ELECTRICAL CIRCUIT (1/4)



• ELECTRICAL CIRCUIT (2/4)

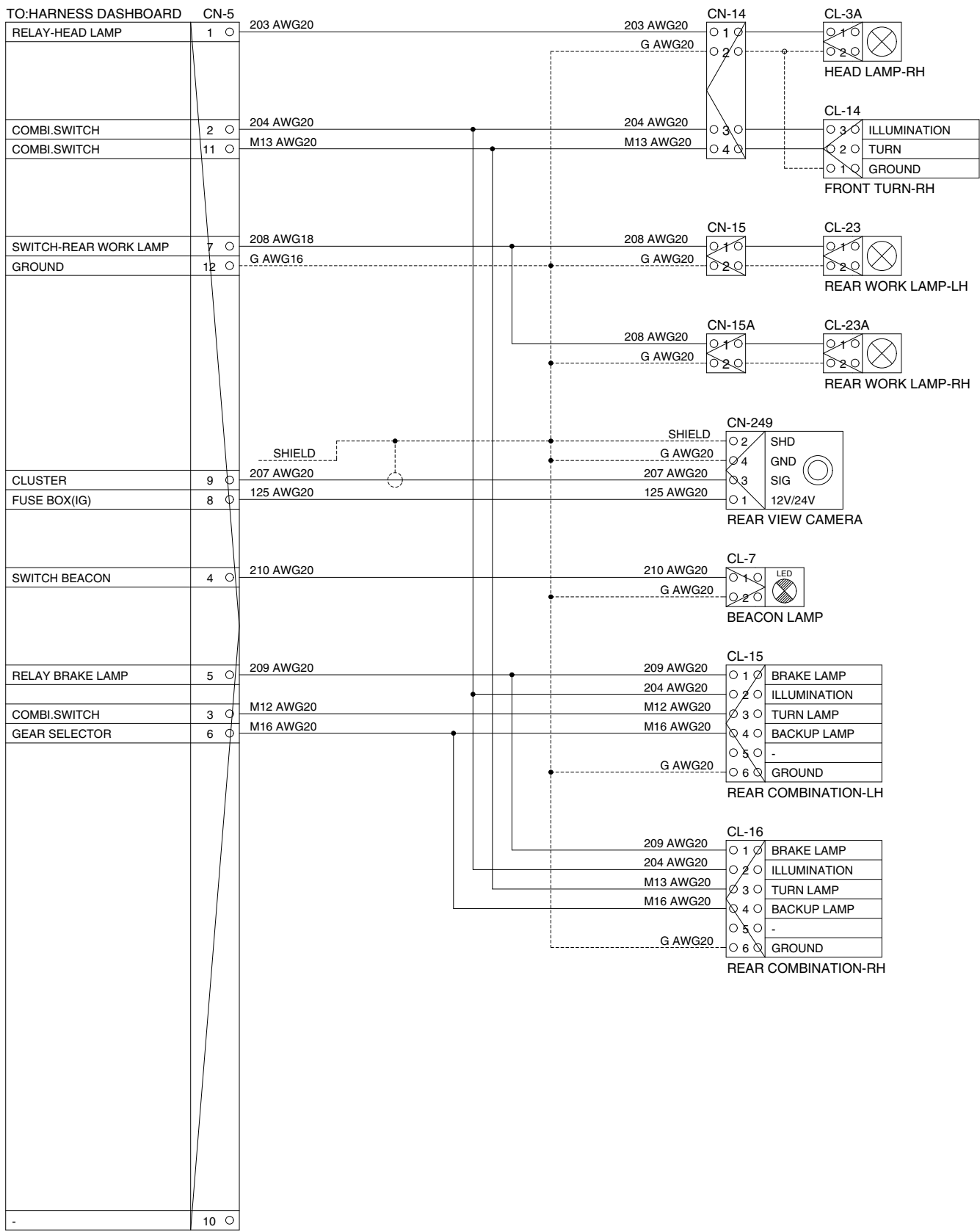


• ELECTRICAL CIRCUIT (3/4)

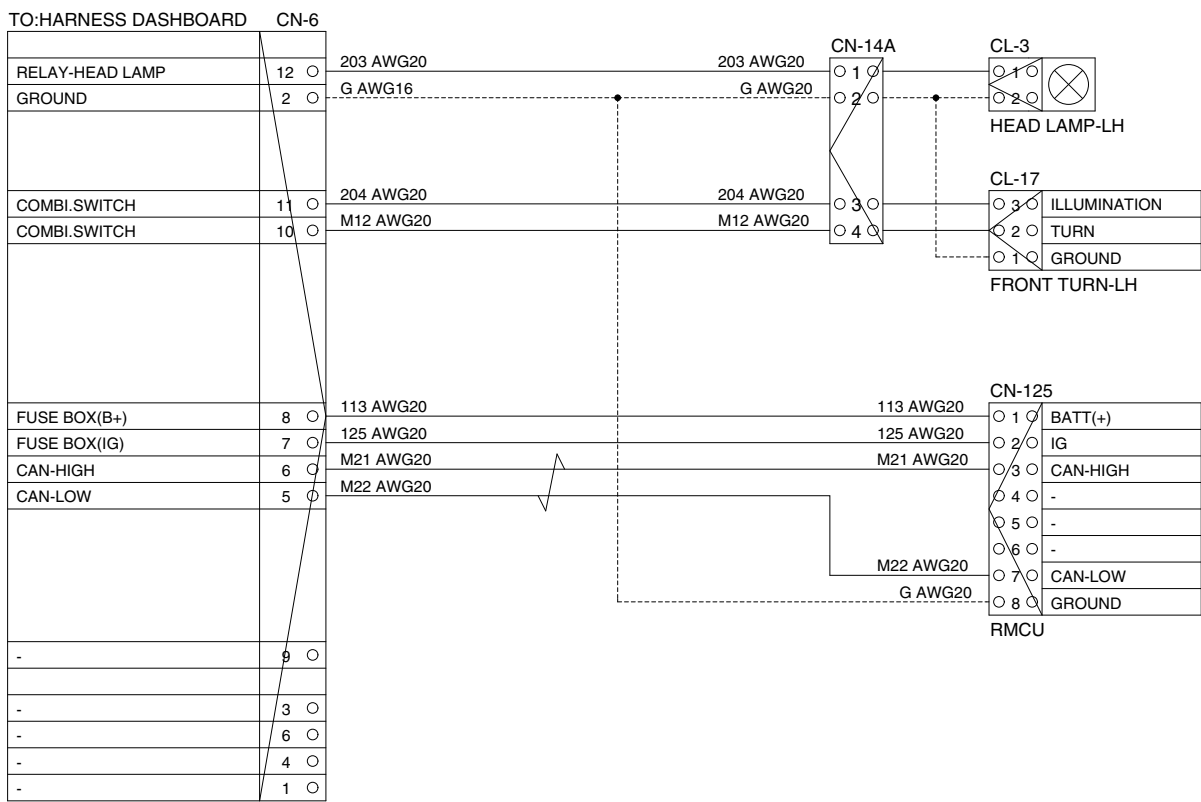


• ELECTRICAL CIRCUIT (4/4)

*ELEC.DIAGRAM OF HARNESS CABIN-RH



*ELEC.DIAGRAM OF HARNESS CABIN-LH

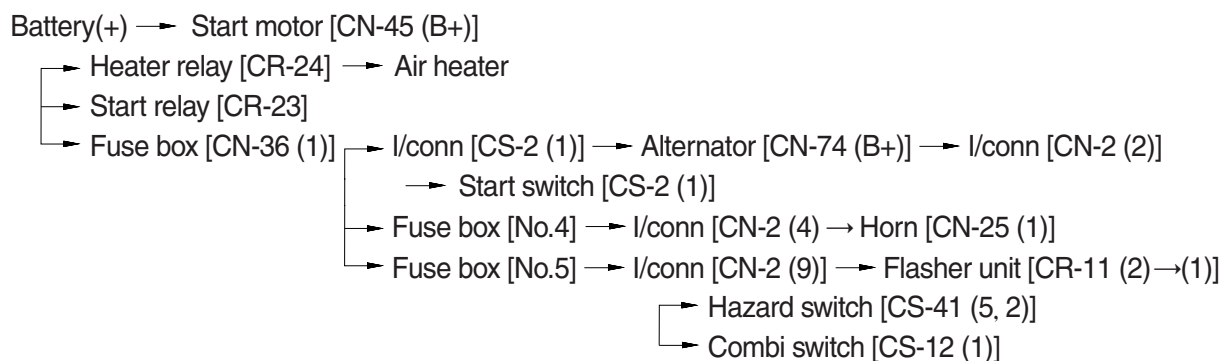


1. POWER CIRCUIT

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

When the start switch is in the off position, the current flows from the positive battery terminal.

1) OPERATING FLOW

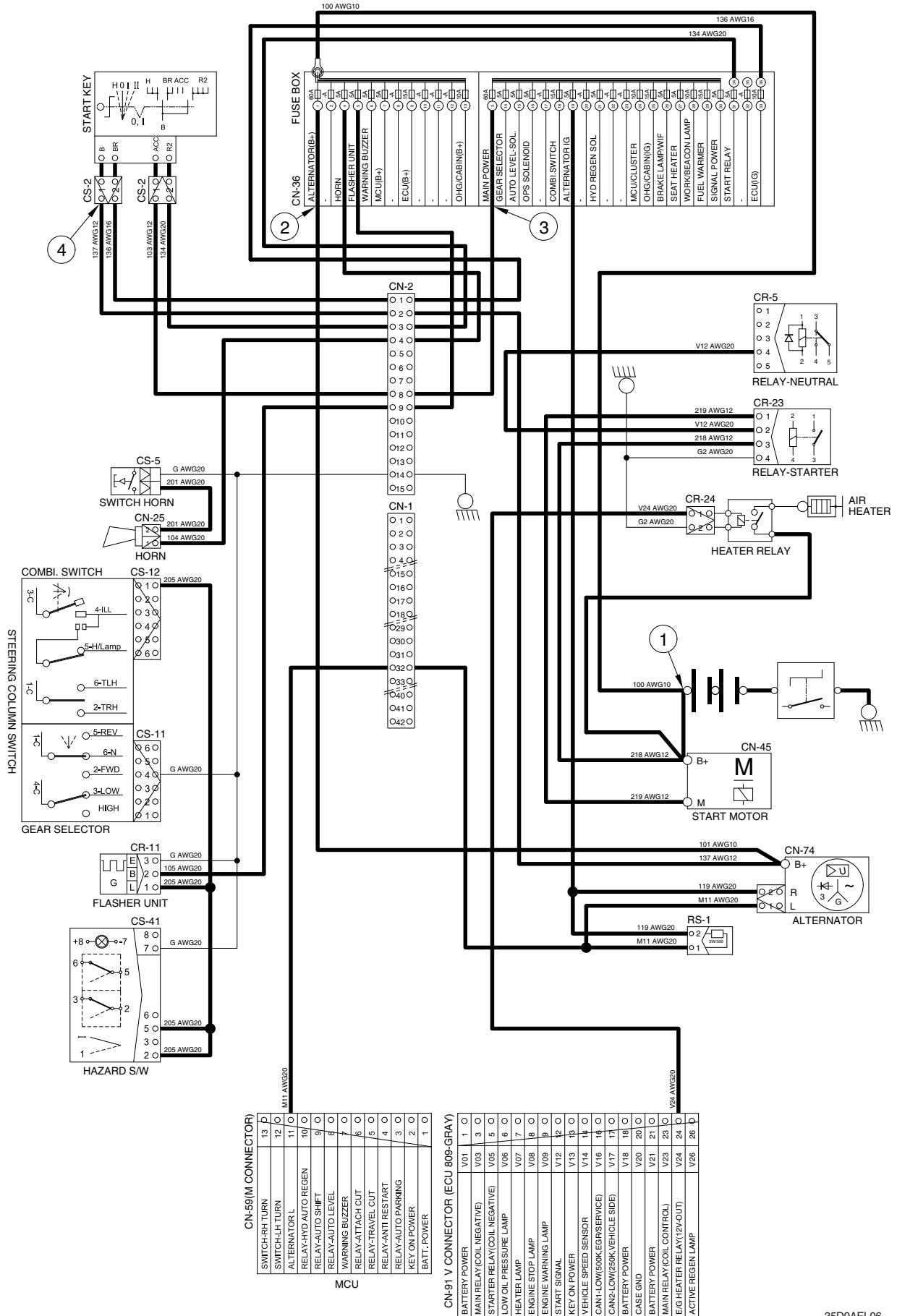


2) CHECK POINT

Engine	Key switch	Check point	Voltage
OFF	OFF	① - GND (Battery(+)) ② - GND (Fuse No.1) ③ - GND (Fuse No.3) ④ - GND (Start key)	24V

※ GND : Ground

POWER CIRCUIT



35D9AEL06

2. STARTING CIRCUIT

1) OPERATING FLOW

Battery (+) terminal → Fuse box [CN-36 (1)] → Alternator [CN-74 (B+)] → I/conn [CN-2 (2)]
→ Start switch [CS-2 (1)] → Start motor [CN-45 (B+)] → Start relay [CR-23]

※ The engine can be started only when the gearshift is in neutral position.

(1) When start key switch is in ON position

Start switch ON [CS-2 (2)] → I/conn [CN-2 (1)] → Fuse box [No.36 →33] → ECU (IG)

(2) When start key switch is START position

Start switch START [CS-2 (2)] → I/conn [CN-2 (3)] → Fuse box [No. 34 →31]

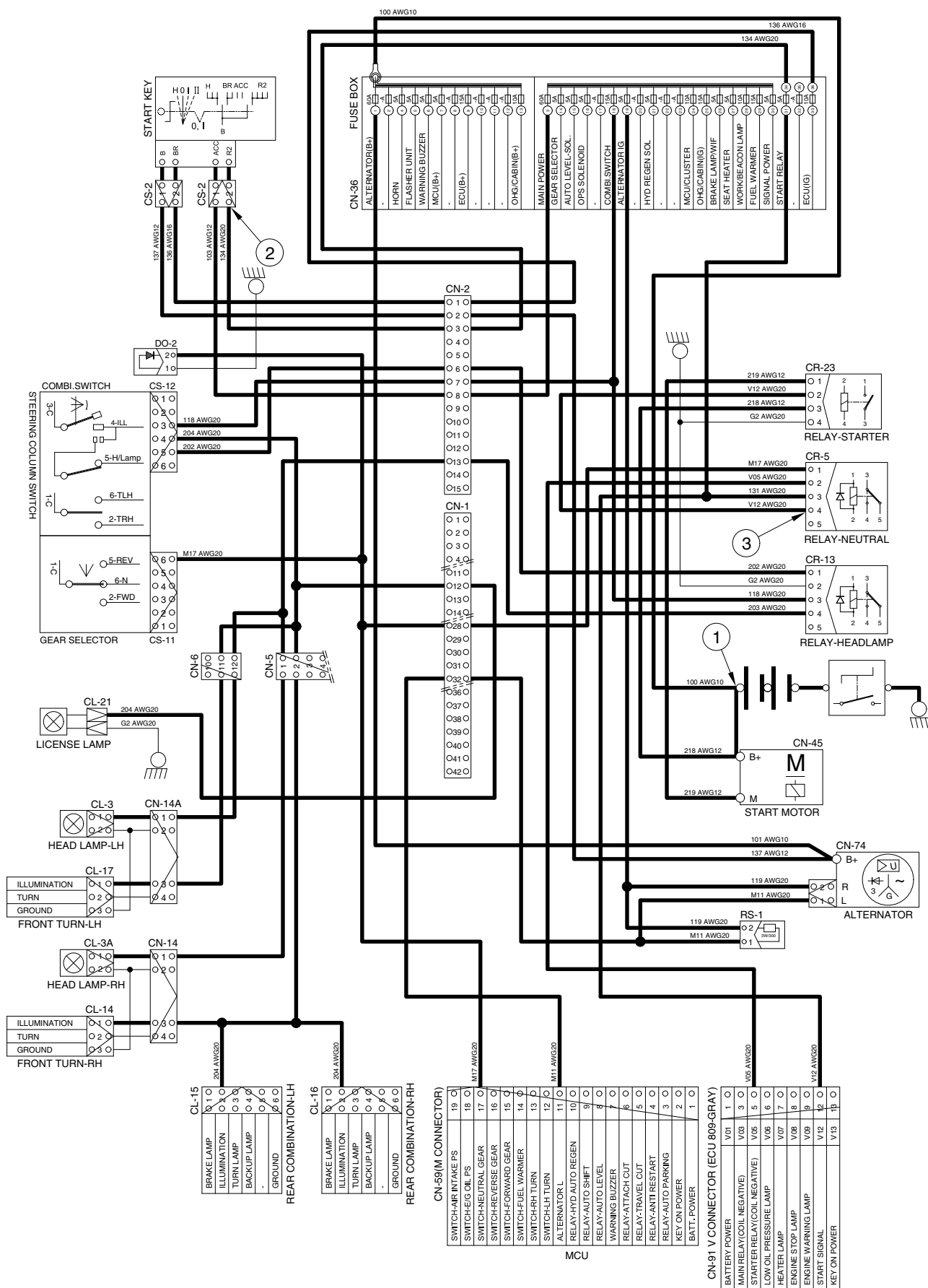
→ Neutral relay [CR-5(3) → (4)]
└→ Start relay [CR-23]
└→ ECU [CN-91 (12)]

2) CHECK POINT

Engine	Key switch	Check point	Voltage
Running	ON	① - GND (Battery B+) ② - GND (Start key) ③ - GND (Neutral relay)	24V

※ GND : Ground

STARTING CIRCUIT



3. CHARGING CIRCUIT

When the starter is activated and the engine is started, the operator release the start 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 through the fuse box.

1) OPERATING FLOW

(1) Warning flow

Alternator [CN-74 (L)] → I/conn [CN-1 (32)] → MCU [CN-59 (11)]

(2) Charging flow

Alternator [CN-74 (B+)] → Fuse box [CN-36 (1)] → Starter [CN-45 (B+)] → Battery (+) terminal
→ Charging

2) CHECK POINT

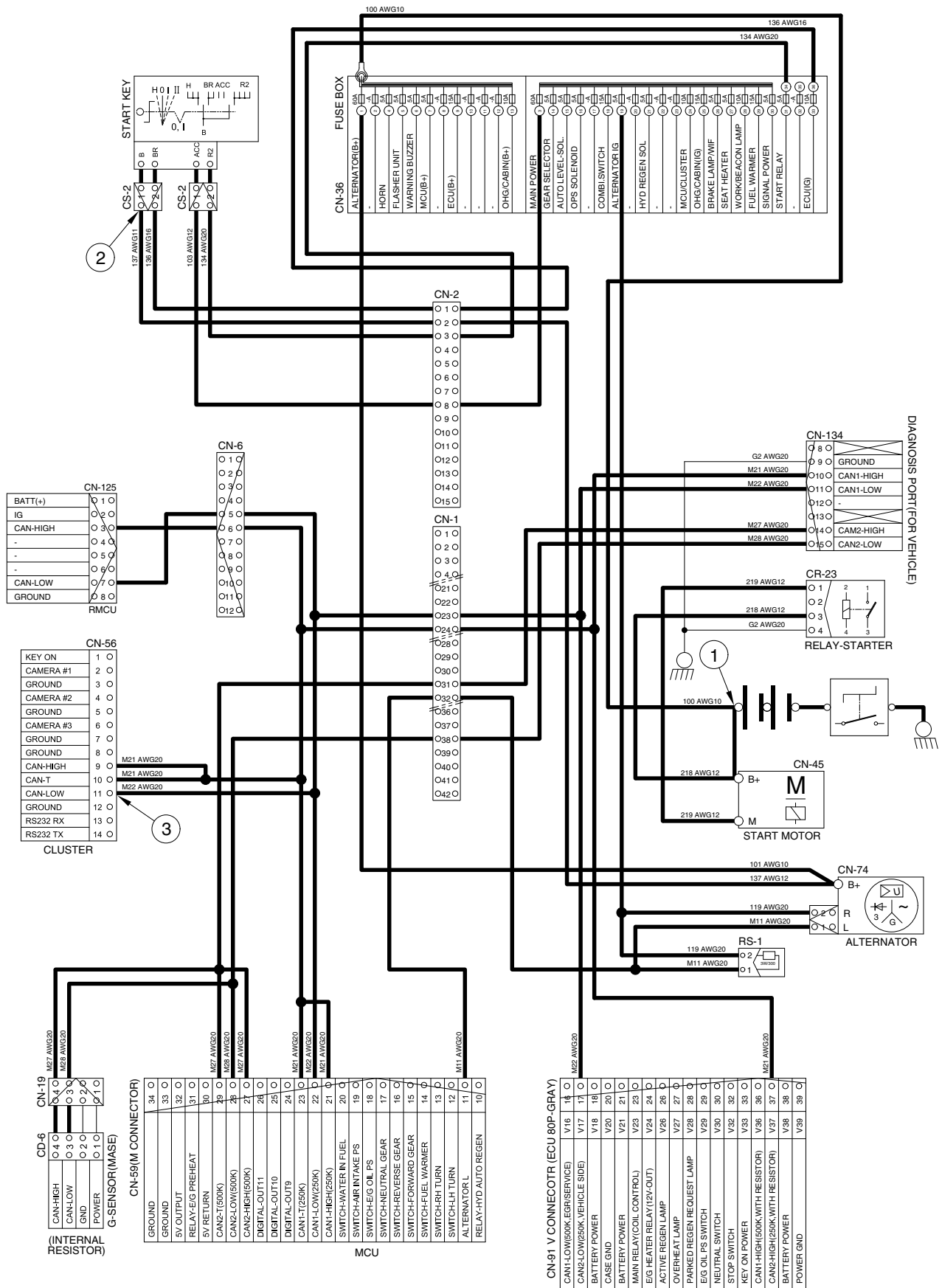
Engine	Key switch	Check point	Voltage
ON	ON	① - GND (Alternator B+) ② - GND (Start switch) ③ - GND (Cluster)	24V

※ GND : Ground

※ Cautions

1. When using an arc welder, always disconnect the ground lead from the battery to prevent alternator or battery damage.
2. Attach the welding ground clamp as close to the weld area as possible to prevent welding current from damaging the bearings of the alternator.
3. Do not disconnect the battery when the engine is running. The voltage surge can damage the diode and resistors in the electrical system.
4. Do not disconnect an electric wire before the engine is stopped and the switches are OFF.

CHARGING CIRCUIT



35D9AEL08

4. PREHEATING CIRCUIT

Combustion chamber air heater are used in order to give satisfactory starting of low ambient temperatures.

1) OPERATING FLOW

Battery (+) terminal → Fuse box [CN-36 (1)] → I/conn [CN-74A (1)] → Alternator [CN-74 (B+)]
→ I/conn [CN-2 (2)] → I/conn [CS-2(1)] → Start switch
→ Heater relay [CR-24] → Air heater

※ When you turn the start switch to the ON position, the air heater relay makes the air heater operated and the air heater of the cluster turned ON.

Start switch ON [CS-2 (1)] → I/conn [CN-2 (8)] → Fuse box [CN-36 (3)] → I/conn [CN-1 (39)]
→ Cluster [CN-56 (1)] → Key ON
→ MCU [CN-59 (2)] → Key ON power

2) CHECK POINT

Engine	Key switch	Check point	Voltage
Stop	HEAT	① - GND (Battery B+) ② - GND (Air heater) ③ - GND (Air heater relay) ④ - GND (Start switch) ⑤ - GND (Cluster)	24V

※ GND : Ground

Wiring Diagram for MCU (Microcontroller Unit)

MCU Pinout:

Pin	Signal
1	KEY ON
2	CAMERA #1
3	GROUND
4	CAMERA #2
5	GROUND
6	CAMERA #3
7	GROUND
8	GROUND
9	CAN-HIGH
10	CAN-T
11	CAN-LOW
12	GROUND
13	RS232 RX
14	RS232 TX

START KEY:

The START KEY is a 4-position switch with the following contacts: H, O, I, II, H, BR, ACC, R2. The wiring is as follows:

- H: 157 AWG12 to CS-2 (1)
- O: 136 AWG16 to CS-2 (2)
- I: 103 AWG12 to CS-2 (3)
- II: 134 AWG20 to CS-2 (4)
- H: 103 AWG12 to CS-2 (5)
- BR: 103 AWG12 to CS-2 (6)
- ACC: 103 AWG12 to CS-2 (7)
- R2: 103 AWG12 to CS-2 (8)

FUSE BOX:

The FUSE BOX contains the following fuses:

- ALTERNATOR (B+)
- HORN
- FLASHER UNIT
- WARNING BUZZER
- MCU (B+)
- ECU (B+)
- OHG CABIN (B+)
- MAIN POWER
- GEAR SELECTOR
- AUTO LEVEL SOL
- OPS SOLENOID
- COMBI SWITCH
- ALTERNATOR IG
- HYD REGEN SOL
- MCU CLUSTER
- OHG CABIN (IG)
- BRAKE LAMP WIF
- SEAT HEATER
- WORK/BEACON LAMP
- FUEL WARMER
- SIGNAL POWER
- START RELAY
- ECU (IG)

Other Components:

- CN-36:** 100 AWG16, 134 AWG20
- CN-2:** 100 AWG16, 134 AWG20
- CN-1:** 100 AWG16, 134 AWG20
- CN-56:** 124 AWG20
- CN-45:** 100 AWG10, 101 AWG10, 137 AWG12
- CN-74:** 101 AWG10, 137 AWG12
- ALTERNATOR:** 101 AWG10, 137 AWG12
- START MOTOR:** 100 AWG10, 101 AWG10, 137 AWG12
- HEATER RELAY:** 100 AWG10, 101 AWG10, 137 AWG12
- AIR HEATER:** 100 AWG10, 101 AWG10, 137 AWG12

GROUP 3 COMPONENT SPECIFICATION

No	Part name	Qty	Specification														
1	Battery	2	12V×96 AH×2 EA RC : 130 min CCA : 630A														
2	Working lamp	1	24V, 70W														
3	License lamp	1	24V, 3W×2														
4	Rear Combination lamp (LED)	2	24V, 1.2/0.7W (Stop/Tail) 24V, 2.4W (Turn) 24V, 1.2W (Back Up)														
5	Head lamp	2	24V, 70W														
6	Flasher lamp	2	24V, 0.7/3.4W (posi/turn signal)														
7	Beacon lamp (opt)	1	24V, max. 0.560A														
8	Beacon lamp (LED)	1	12~30V, max. 0.800A														
9	Camera (opt)	1	24V, 2.5W														
10	Start relay	1	24V, 300A														
11	Glow relay	1	24V, 300A														
12	Relay (4P)	3	24V, 20A														
13	Relay (5P)	3	24V, 6A														
14	Flasher Unit	1	24V, 85±10 CM, (21W + 21W) × 2 + 3W × 2														
15	Back buzzer	1	24V, 90±5 dB, 60±10 C/M														
16	Horn	1	24V, MAX 1.5A, 100 ~ 115 dB														
17	Cluster	1	24V, 15W														
18	G-sensor (Mast angle) (opt)	1	24V, 5W														
19	Fuel level sender	1	<table border="1"> <tr> <td>Float indicator</td><td>E</td><td>4/8</td><td>F</td></tr> <tr> <td>Resistance (Ω)</td><td>700</td><td>350</td><td>50</td></tr> <tr> <td rowspan="2">Tolerance (Δ)</td><td>+0%</td><td rowspan="2">+5%</td><td>-0%</td></tr> <tr> <td>+5%</td><td>-5%</td></tr> </table>	Float indicator	E	4/8	F	Resistance (Ω)	700	350	50	Tolerance (Δ)	+0%	+5%	-0%	+5%	-5%
Float indicator	E	4/8	F														
Resistance (Ω)	700	350	50														
Tolerance (Δ)	+0%	+5%	-0%														
	+5%		-5%														
20	Master switch	1	24V, 180A														
21	Gear selector switch	1	24V, 3.5A														
22	Combination switch	1	Direction : 24V, 3.5A Multi-function switch : 24V, 2A														
23	Brake switch	1	24V, 50W														
24	Working lamp switch	1	24V, 15A														
25	Hazard switch	1	24V, 15A														
26	Start switch	1	24V, 30A														
27	Parked regeneration switch	1	24V, 15A														
28	Inhibit regeneration switch	1	24V, 15A														
29	Fuel warmer switch	1	24V, 15A														
30	Beacon lamp switch (opt)	1	24V, 15A														
31	Wiper/washer switch (opt)	1	24V, 15A														

GROUP 4 CONNECTOR DESTINATION

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-1	AMP	42	I/conn (Frame harness-dashboard harness)	936421	936429
CN-2	AMP	15	I/conn (Dashboard harness-frame harness)	2-85262-1	368301-1
CN-5	KET	12	I/conn (Cabin harness-dashboard harness)	MG610346	MG640348
CN-6	KET	12	I/conn (Cabin harness-dashboard harness)	MG610346	MG640348
CN-12	AMP	42	Engine harness	936421	-
CN-13	MOLEX	12	Injection harness	33472-1206	-
CN-14	DAEDONG	4	Head/Turn lamp harness	110-4PR	110-4PT
CN-14A	DAEDONG	2	Head lamp (LH)	110-2PR	-
CN-15	DAEDONG	2	Work lamp harness (LH)	110-2PR	-
CN-15A	DAEDONG	2	Work lamp harness (RH)	110-2PR	-
CN-16	AMP	3	I/conn (Load sensor-frame harness)	174357-2	-
CN-17	KET	2	I/conn (Frame harness-tilt lever switch)	MG610320	-
CN-18	AMP	2	Socket harness	174352-2	174354-2
CN-19	AMP	4	I/conn (G-sensor-dashboard harness)	174257-2	174259-2
CN-25	MOLEX	2	Horn	35825-0211	-
CN-36	QPL	-	Fuse box	21HN-55010	-
CN-45	KET	2	Start motor (B+)	S820-208000	-
			Start motor (M)	171809-2	-
CN-56	AMP	14	Cluster	776273-2	-
CN-59N	AMP	34	MCU (Machine control unit)	4-1437290-1	-
CN-59M	AMP	34	MCU (Machine control unit)	4-1437290-0	-
CN-65	KET	1	Back buzzer	ST730018-3	ST750036-3
CN-66	DEUTSCH	2	Pressure auto regen valve	DT06-2S	-
CN-74	KET	2	Alternator	MG640188-4	-
CN-74	KET	-	Alternator (B+)	S820-308000	-
CN-90E	MOLEX	80	Engine control unit	34566-1903	-
CN-91V	MOLEX	80	Engine control unit	34566-0803	-
CN-96	AMP	4	Fuel warmer	2-967325-3	-
CN-97	KET	2	Fuel feed pump	MG610043	-
CN-113	KET	2	OPSS buzzer	MG610320	-
CN-122	DEUTSCH	2	Forward solenoid 1	DT06-2S	-
CN-123	DEUTSCH	2	Reverse solenoid 1	DT06-2S	-
CN-124	AMP	6	Accelerator pedal	174262-2	-
CN-125	AMP	6	RMCU	-	174262-2
CN-130	AMP	2	Cut-off solenoid 1 (Tilt)	174352-2	174354-2
CN-131	AMP	2	Cut-off solenoid 2 (Lift)	174352-2	174354-2

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CN-132	DEUTSCH	2	Forward solenoid 2	DT06-2S	-
CN-133	DEUTSCH	2	Reverse solenoid 2	DT06-2S	-
CN-134	KET	20	Diagnosis port	MG652863	-
CN-138	KET	3	DC/DC converter	MG610045	MG620044
CN-139	DEUTSCH	3	Load sensor harness	DTM06-3S	-
CN-140	KET	3	MCU update	MG610327	-
CN-157	AMP	4	CAN (service port)	174257-2	174259-2
CN-249	AMP	4	Rear view camera	174257-2	174259-2
Switch					
CS-2	KET	2	Start switch	MG610281	MG620282
CS-3	CARLING	10	Wiper/Washer	21HN-56300	-
CS-5	RING TERM	-	Horn switch	S810-105000	-
CS-11	DEUTSCH	6	Gear selector switch	DT06-6S	-
CS-12	DEUTSCH	6	Combination switch	DT06-6S-P012	-
CS-13	KET	2	Tilt lever switch	MG610320	MG642552
CS-17	KET	3	Parking switch	MG610045	-
CS-21	CARLING	10	Rear work lamp	21HN-56300	-
CS-23	CARLING	10	Wiper/Washer	21HN-56300	-
CS-41	CARLING	10	Hazard switch	21HN-56300	-
CS-73	DEUTSCH	6	Seat switch	DT06-6S	-
CS-74	CARLING	10	Fuel warmer switch	21HN-56300	-
CS-75	CARLING	10	Parked regeneration switch	21HN-56300	-
CS-76	CARLING	10	Inhibit regeneration switch	21HN-56300	-
Lamp					
CL-3	KET	2	Head lamp	MG652520	-
CL-7	DEUTSCH	2	Beacon lamp	DT06-2S	DT04-2P
CL-14	AMP	3	Front turn lamp-RH	936187-3	-
CL-15	DAEDONG	6	R/Combination lamp-LH	110-6PR	-
CL-16	DAEDONG	6	R/Combination lamp-RH	110-6PR	-
CL-17	AMP	1	Front turn lamp-LH	936187-3	-
Relay					
CR-5	OMRON	5	Neutral relay	21FV-55510	-
CR-11	KET	3	Flasher unit relay	S810-003702	-
CR-12	OMRON	5	Auto level relay	21FV-55510	-
CR-13	OMRON	5	Head lamp relay	21FV-55510	-
CR-23	KET	4	Start relay	MG610047	-
CR-24	KET	2	Heater relay	MG610043	-
CR-43	OMRON	5	ECU (B+) relay	21FV-55510	-

Connector number	Type	No. of pin	Destination	Connector part No.	
				Female	Male
CR-45	OMRON	5	ECU (IG) relay	21FV-55510	-
CR-50	OMRON	5	Travel cut relay	21FV-55510	-
CR-51	OMRON	5	Attach cut relay	21FV-55510	-
CR-52	OMRON	5	Brake lamp relay	21FV-55510	-
CR-57	OMRON	5	Auto shift relay	21FV-55510	-
Sensor and pressure switch					
CD-2	KET	3	Fuel sendor	MG610327	-
CD-4	DEUTSCH	4	Oil pressure sensor	DT06-4S	-
CD-5	DEUTSCH	4	Hyd temperature sensor	DT06-4S	-
CD-6	DEUTSCH	4	G sensor	DT06-4S	-
CD-10	KET	1	Air cleaner switch	ST730057-2	-
CD-29	DEUTSCH	4	T/M temperature sensor	DT06-4S	-
CD-35	DEUTSCH	2	Water in fuel switch	DT06-2S	-
CD-50	DEUTSCH	3	Load sensor	DTM06-3S	-
CD-59	KET	2	Brake oil level	MG610320	-
CD-60	YAZAKI	2	DOC inlet temp sensor	7283-7026-30	-
CD-61	YAZAKI	2	DOC outlet temp sensor	7283-7028-10(-30)	-
CD-62	YAZAKI	2	DOC outlet temp sensor	7283-7023(-10)	-
CD-63	AMP	3	DPF Diff. pressure sensor	1813271-1	-
CD-64	SUMITOMO	5	Air-flow sensor	6189-1046	-
CD-73	KET	3	Speed sensor	MG610327	-
DO-01	-	-	Diode	F15890030	-
DO-02	-	-	Diode	F15890030	-
DO-03	-	-	Diode	21EA-50550	-
DO-04	-	-	Diode	21EA-50550	-

GROUP 5 TROUBLESHOOTING

Trouble symptom	Probable cause	Remedy
Lamps dimming even at maximum engine speed.	Faulty wiring.	Check for loose terminal and disconnected wire.
Lamps flicker during engine operation.	Improper belt tension.	Adjust belt tension.
Charge lamp does not light during normal engine operation.	- Charge lamp defective. - Faulty wiring.	- Replace. - Check and repair.
Alternator makes abnormal sounds.	Alternator defective.	Replace.
Starting motor fails to run.	- Faulty wiring. - Insufficient battery voltage.	- Check and repair. - Recharge battery.
Starting motor pinion repeats going in and out.	Insufficient battery voltage.	Recharge battery.
Excessively low starting motor speed.	- Insufficient battery voltage. - Starting motor defective.	- Recharge battery. - Replace
Starting motor comes to a stop before engine starts up.	- Faulty wiring. - Insufficient battery voltage.	- Recharge battery. - Replace
Heater signal does not become red.	- Faulty wiring. - Glow plug damaged.	- Check and repair. - Replace
Engine oil pressure caution lamp does not light when engine is stopped (with starting switch left in "ON" position).	- Caution lamp defective. - Caution lamp switch defective.	- Replace - Replace