

Chapter 7

ELECTRICAL SYSTEM

1. LAMPS, REFLECTIVE DEVICES AND ASSOCIATED EQUIPMENT
2. FUSE BLOCK, RELAY PANEL AND FUSIBLE LINK BLOCK
3. INSTALLATION OF ADDITIONAL SWITCHES
4. ALTERNATOR OUTPUT CHARACTERISTIC
5. INSTALLATION OF 180A OR 200A ALTERNATOR (OPT)
6. ELECTRICAL POWER SOURCES
7. BACK-UP ALARM (OPTIONAL EQUIPMENT)
8. HARNESS WIRING
9. INSTALLATION OF THE BATTERY DISCONNECT SWITCH
10. INSTALLATION OF FLASHER CUT HARNESS

1. LAMPS, REFLECTIVE DEVICES AND ASSOCIATED EQUIPMENT

Requirements of CMVSS 108

The following devices are provided, located and/or wired by Hino Motors, Ltd.

Requirements of CMVSS 108.

- Head lamps
- Daytime Running lamps
- Front side reflex reflectors
- Front side marker lamps
- Front turn signal lamps
- Front cab roof clearance & I.D. lamps
- Rear reflex reflectors (Temporary loc.)
- Tail lamps (Temporary loc.)
- Stop lamps (Temporary loc.)
- License plate lamps (Temporary loc.)
- Back up lamps (Temporary loc.)
- Rear turn signal lamps (Temporary loc.)

The following additional devices must be installed on the body and meet all the requirements of CMVSS 108.

- Rear side marker lamps
- Rear side reflex reflectors
- Rear clearance lamps
- Rear identification lamps

The following additional devices must be installed on the body and meet all the requirements of CMVSS 108 if the overall vehicle length is 30 feet or greater.

- Intermediate side marker lamps
- Intermediate side reflex reflector

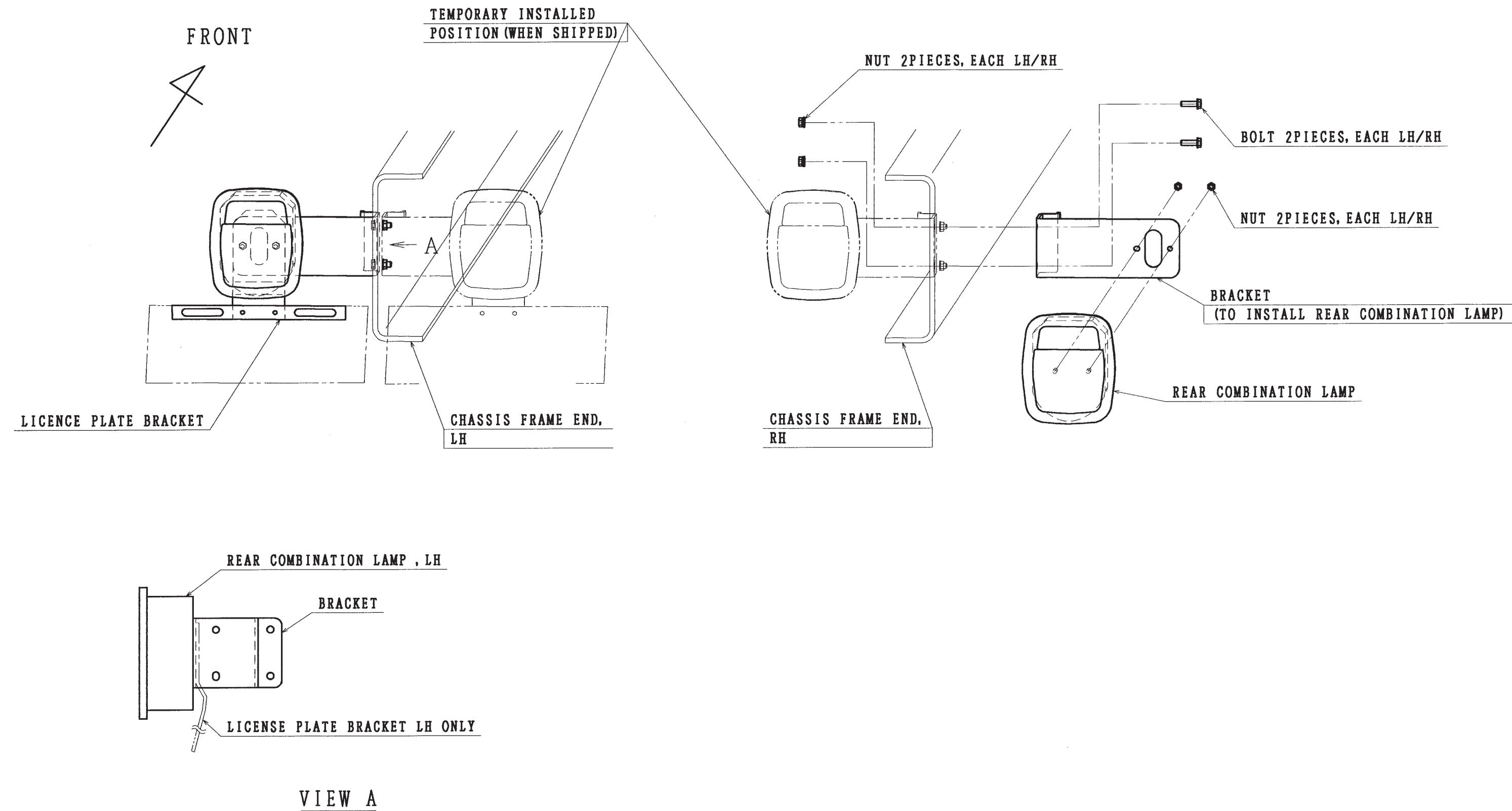
Installation of Rear Lamps

Rear combination lamps such as tail lamps, stop lamps, turn signal lamps, rear reflex reflectors, back up lamps and license plate lamps are temporary installed on the end of chassis frame at factory, they should be relocated by subsequent manufacturer to conform to CMVSS 108.

Notes for relocation of rear combination lamps:

- Tail lamps, stop lamps and turn signal lamps, back up lamps and license plate lamps are designed in one body as rear combination lamps. Do not install the rear combination lamps horizontally or up side down not to affect the performance of license plate lamps and water drain holes.
- Install the rear combination lamps to the outside of frame end at right and left using same holes, bolts and nuts of frame end as temporary fitted.
- When installing the rear combination lamps to the rear body, be sure to prevent breakage, deflection and vibration of rear combination lamp body.
- Tightening torque for rear combination lamp mounting nuts is 50 ± 20 kgf·cm (3.6 ± 1.4 lb·ft).
- Tightening torque for the stay mounting bolts is 210 ± 80 kgf·cm (15 ± 6 lb·ft).
- Do not apply rust-proofing clear lacquer to lamp lens or body.
- Bracket for rear license plate is fitted together with rear combination lamp, LH, to the chassis frame.

Installation of Rear Combination Lamps



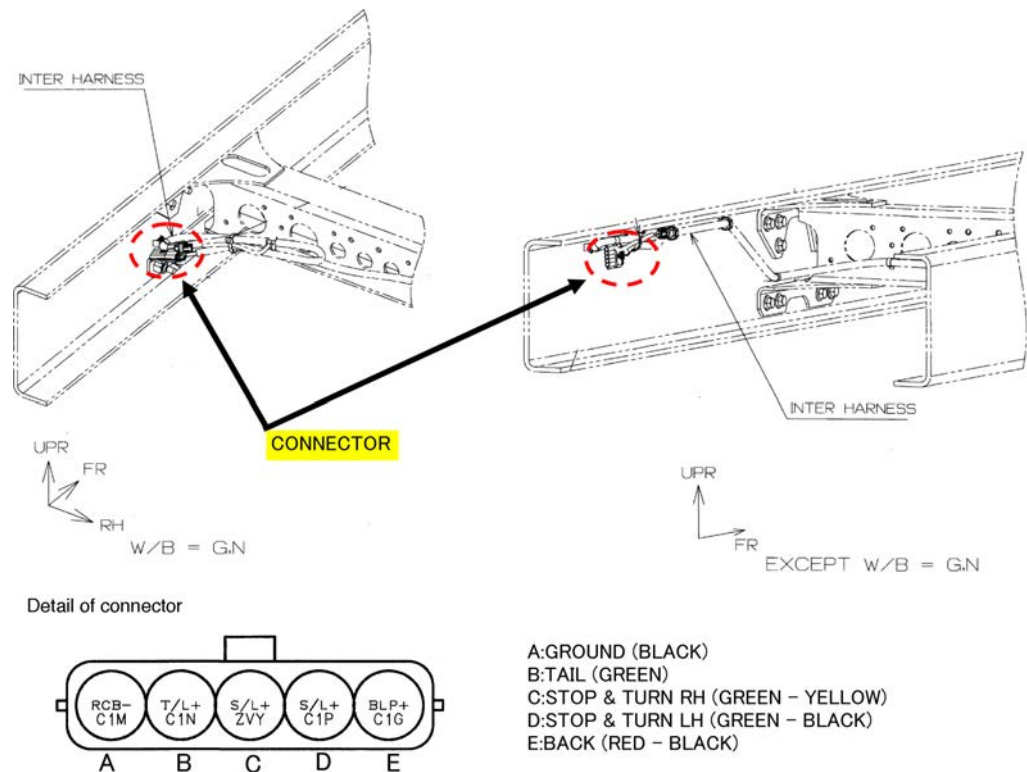
Case of rear combination lamp less option

The connector for rear combination lamp is provided at the end of LH side rail.

See the following figure.

Please prepare rear combination lamps which complied with CMVSS108 and the harness which links LH and RH side lamp.

Install them to comply with CMVSS108.



Cautions Regarding Additional Turn Signal Lamps

This is to avoid a possible failure of flasher unit arising from excessive electrical loading due to the mounting of additional turn signal lamps to the flasher unit of the vehicle.

The flasher unit on each vehicle is designed to accommodate the total wattage of the turn signal lamps.

Must consider the function of the turn signal including the hazard warning for proper working when changing design of the turn signal lamps.

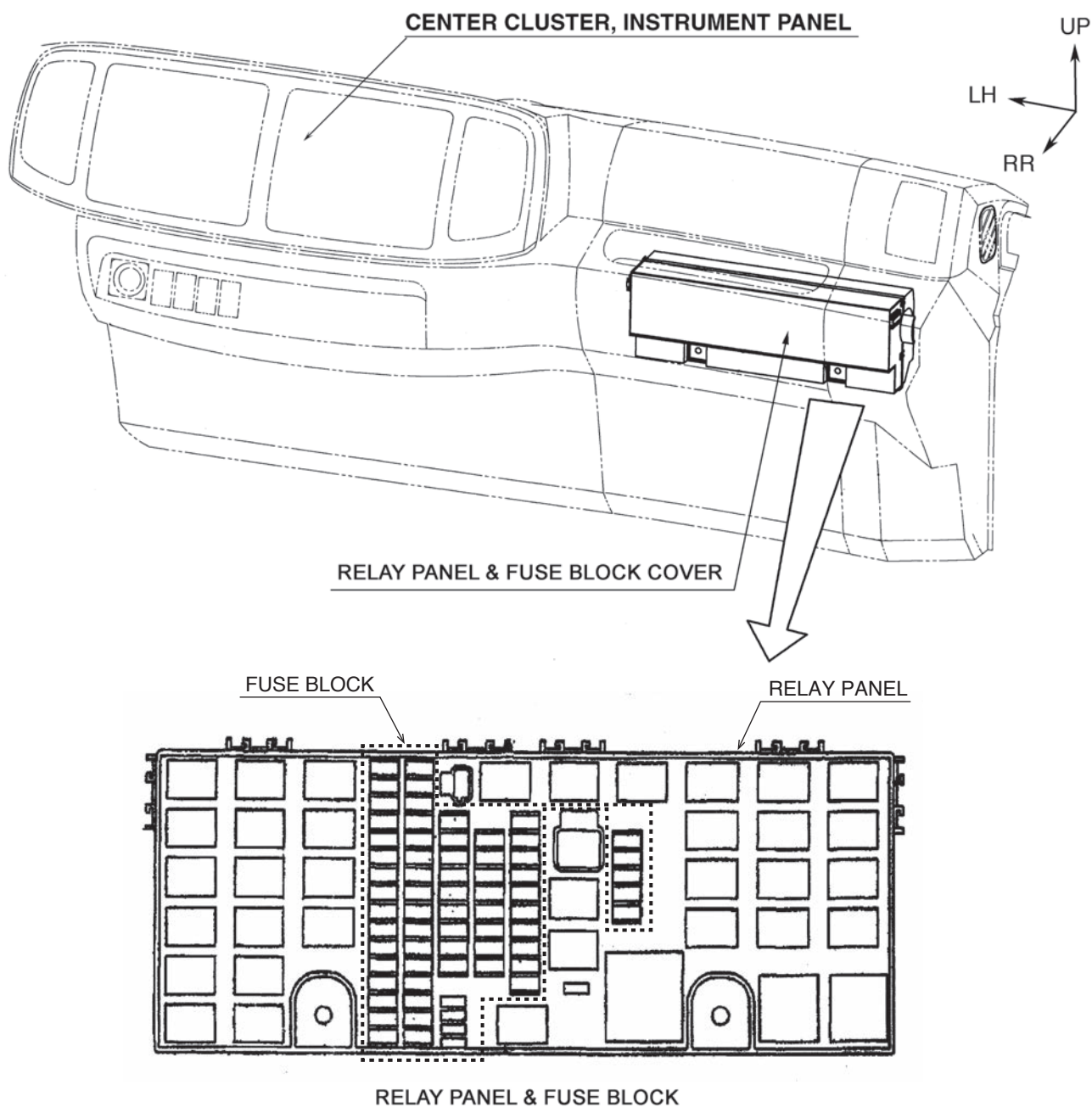
The turn signal lamps on each vehicle meet the CMVSS, and no additional lamp is needed in this regard so long as the vehicle is used as it was designed.

When you intend to add side turn signal lamps, install them according to the NOTE of paragraph ELECTRICAL POWER SOURCES.

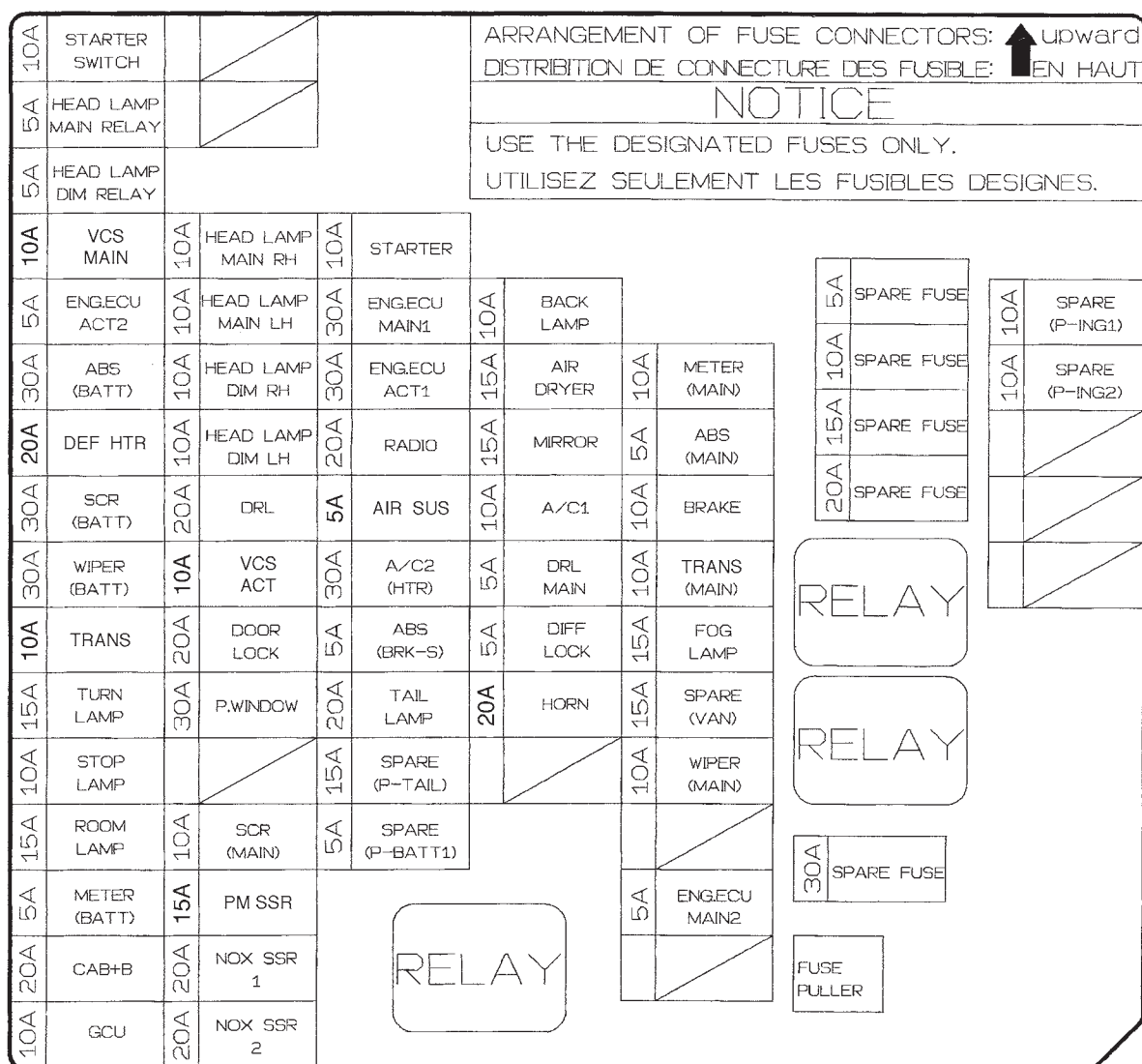
2. FUSE BLOCK, RELAY PANEL AND FUSIBLE LINK BLOCK

Location of the Cab Side

The fuse block and the relay panel are located inside the instrument panel as shown below.



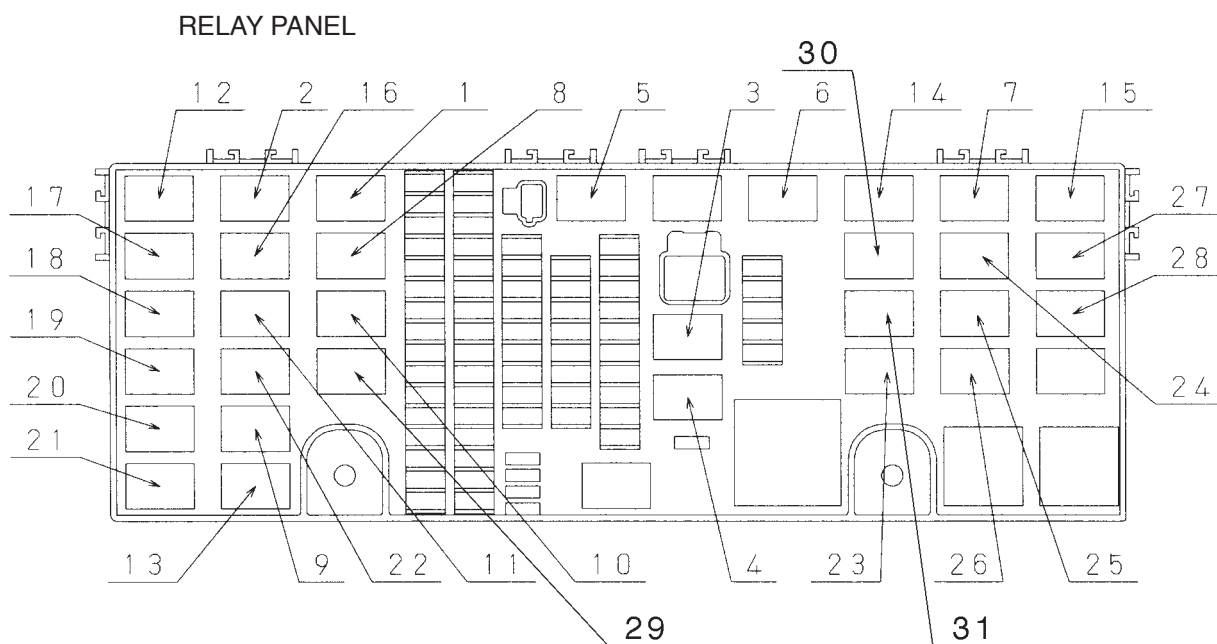
FUSE BLOCK



[NOTE]

Be sure to use each capacity fuse designated in the above table.

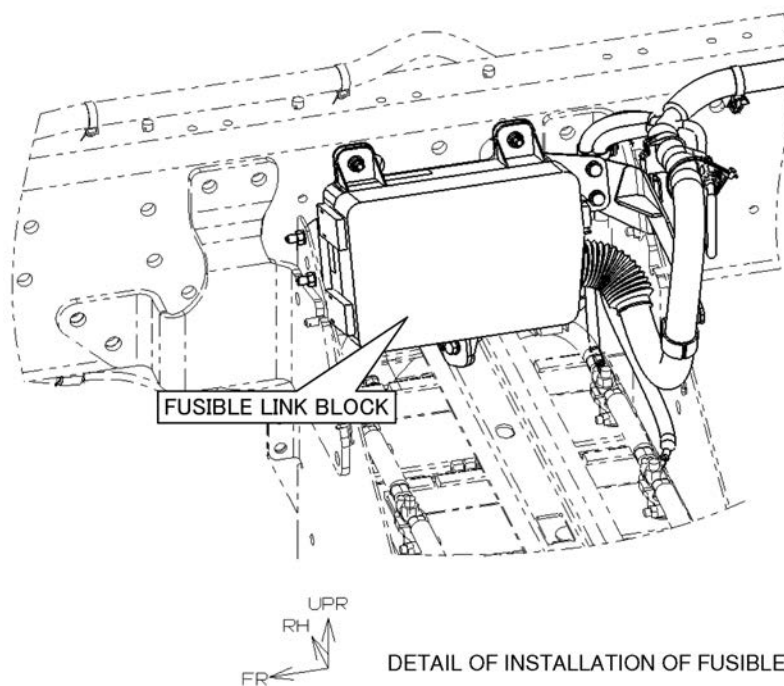
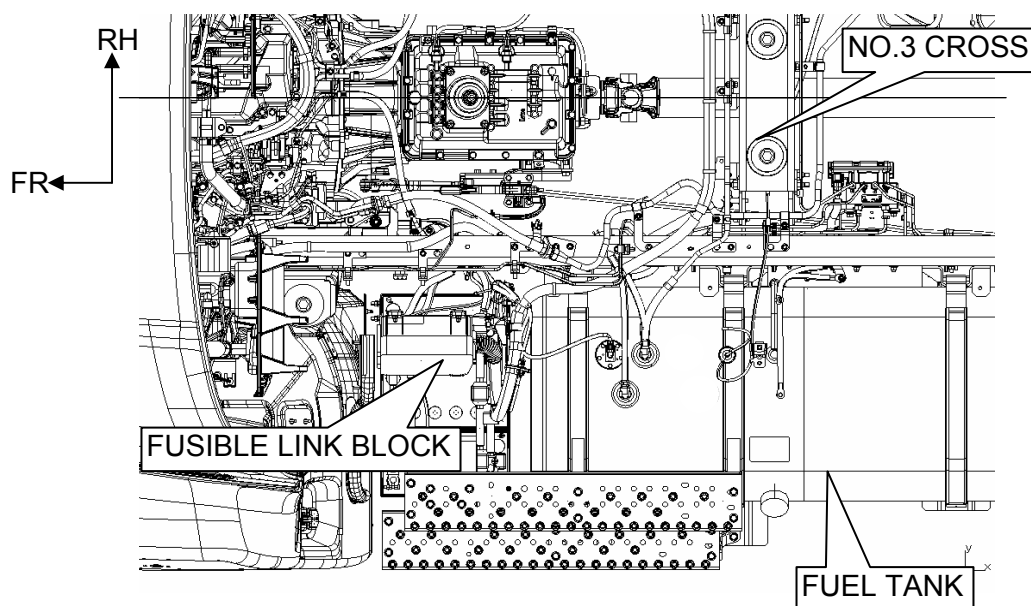
Never use the capacity fuse exceeding the designated one in the above, otherwise over current may damage the harness wires and fusible linkage wires.



No.	POLE NUMBER OF CONNECTOR	DESCRIPTION
1	4	HEAD LAMP RELAY (MAIN)
2	4	HEAD LAMP RELAY (DIMMER)
3	4	TAIL LAMP RELAY 1
4	4	TAIL LAMP RELAY 2
5	4	POWER RELAY No.1
6	4	POWER RELAY No.2
7	4	POWER ACC RELAY
8	4	HORN RELAY
9	4	HEATER RELAY (MIRROR)
10	4	HEATER RELAY
11	4	A/C RELAY
12	4	DAY TIME RUNNING LAMP RELAY
13	4	ALLISON AT STARTER RELAY
14	4	POWER RELAY No.3
15	4	POWER RELAY No.4
16	4	AIR HORN RELAY
17	5	AIR SUS DUMP RELAY No.3
18	5	AIR SUS DUMP RELAY No.4
19	5	ABS EXH RELAY
20		
21	5	DEF-P BZR OFF RELAY
22	5	ABS LAMP RELAY
23	4	U2 ECU MAIN RELAY
24		
25	5	STARTER CUT RELAY
26	4	U2 ACT POWER RELAY
27		
28	4	VCS ACT RELAY
29	4	DEF HEATER RELAY
30	4	TRANS STOP NC RELAY
31	4	TRANS STOP DMY RELAY

Location of the Chassis Side

The fusible link block is installed in left side rail as shown below.



DETAIL OF INSTALLATION OF FUSIBLE LINK BLOCK

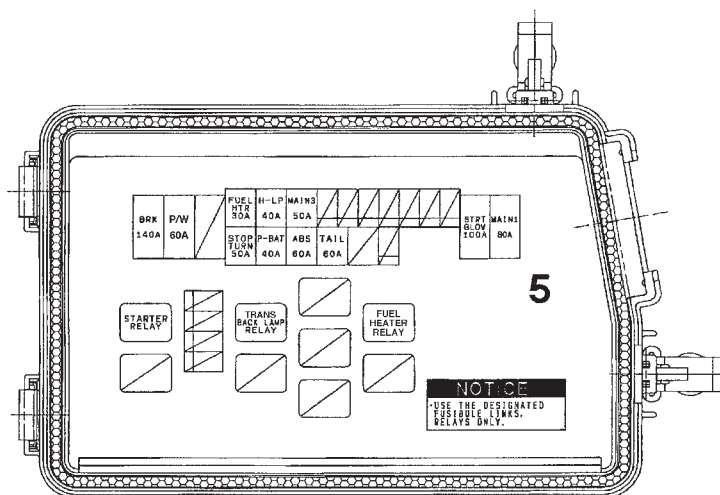
[NOTE]

Do not remove the harness connector, fusible link block, and cover except for repair and/or inspection.

If removal is necessary, pay attention that water and/or foreign matter do not attach or enter the connector, terminals, electric component box, and cover.

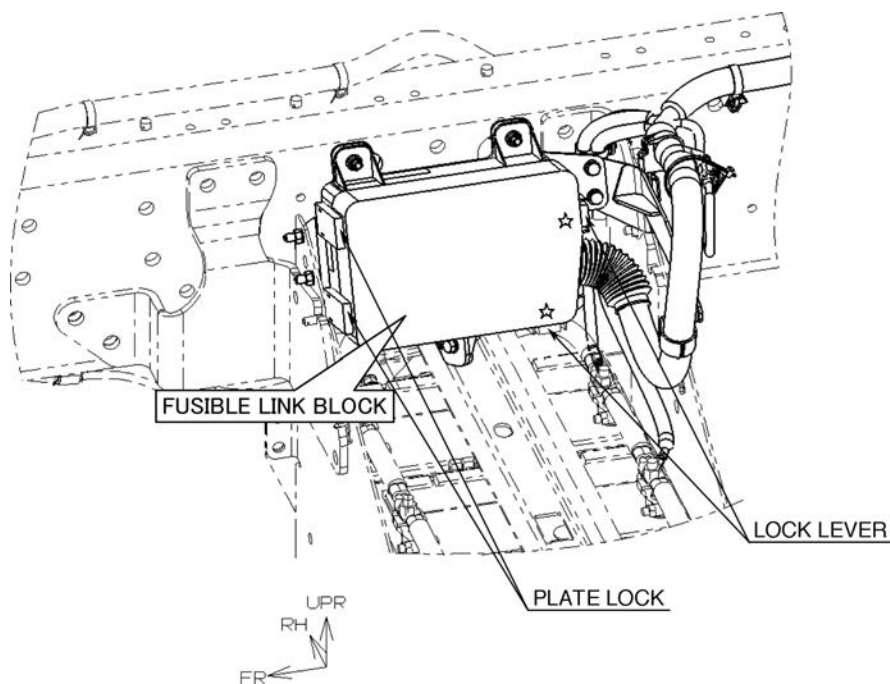
If repair or replacement is required, make sure there is no attachment or entry of water and/or foreign matter. Mount properly to ensure waterproof function is not compromised.

DETAIL OF FUSIBLE LINK AND RELAY POSITION



- How to remove fusible link box cover.

1. Push lock lever and remove lock. (2 position, marked ☆)
2. Pull-up 2 position of plate lock and remove cover.

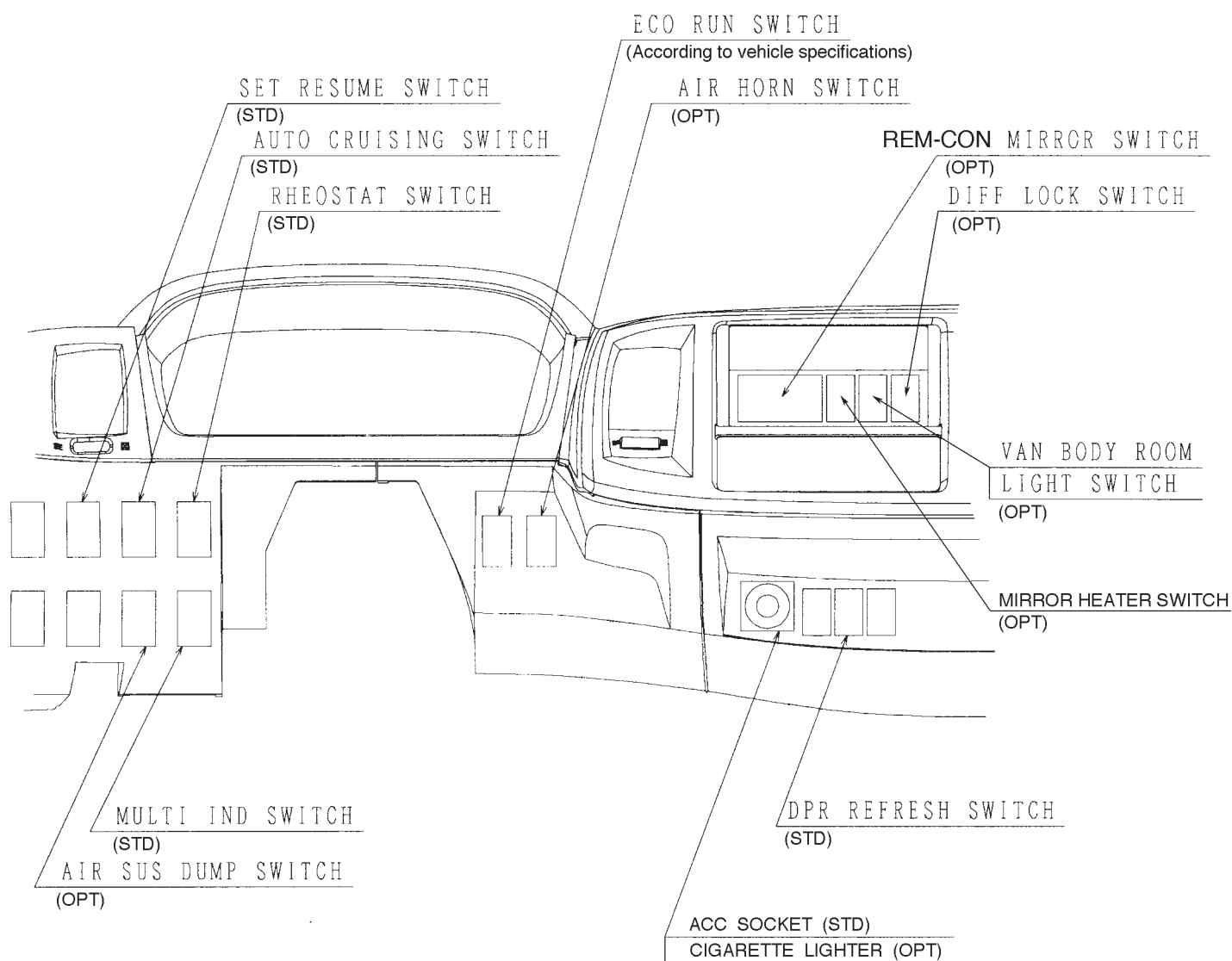


3. INSTALLATION OF ADDITIONAL SWITCHES

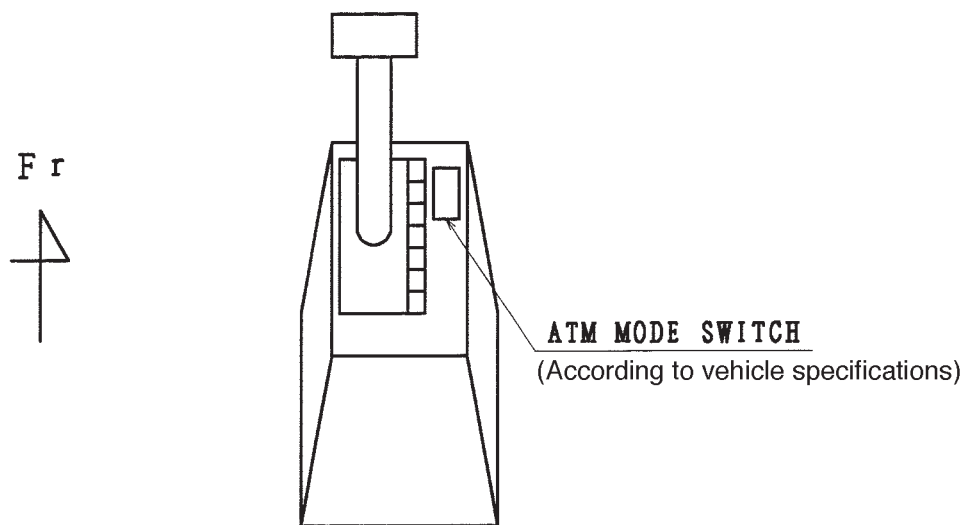
When install additional switches at instrument panel or floor console for body mounting, be sure to observe the following precautions.

- Install additional switches at available space after confirmation of original condition on the actual vehicle.
- See figure below which shows all switches layout included option.
- Do not connect an electrical circuit of the body to the existing switch, otherwise over current may damage harness and switch.
- Install labels indicating the purpose of each switches to prevent wrong operation.

INSTRUMENT PANEL

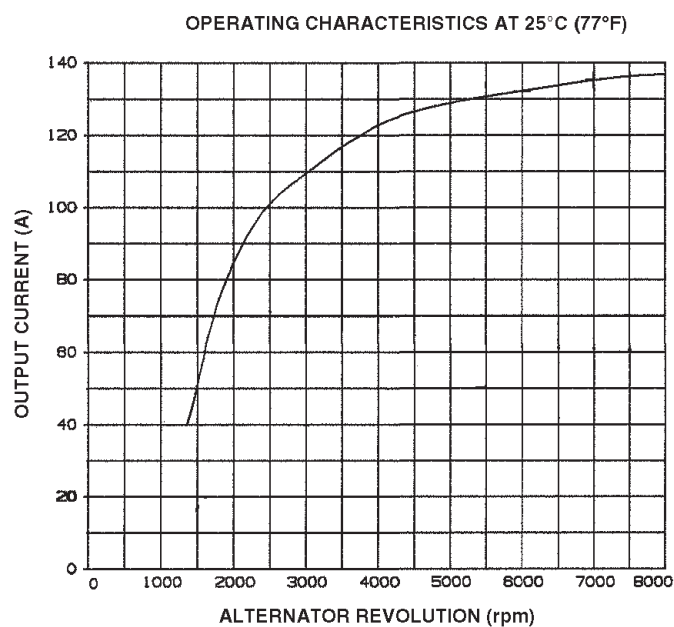


FLOOR CONSOLE (ATM VEHICLE ONLY)

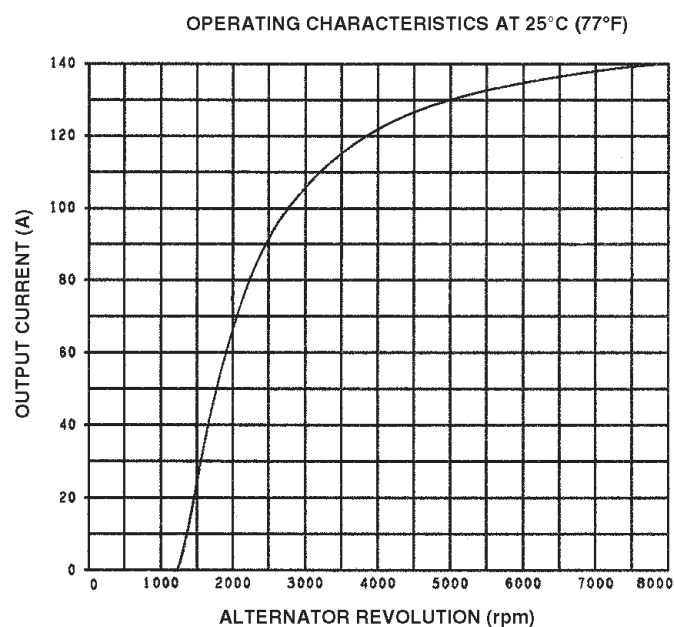
SELECTOR LEVER

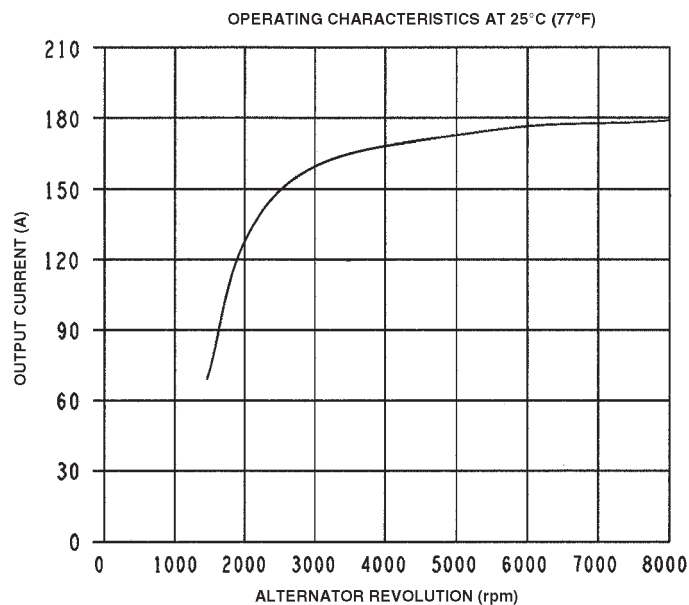
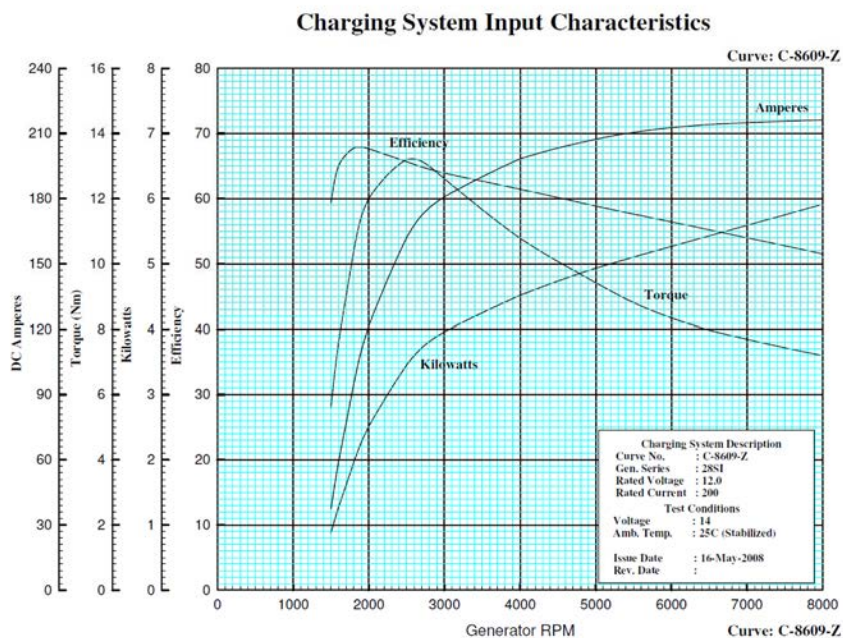
4. ALTERNATOR OUTPUT CHARACTERISTIC

STD : 12V-130A



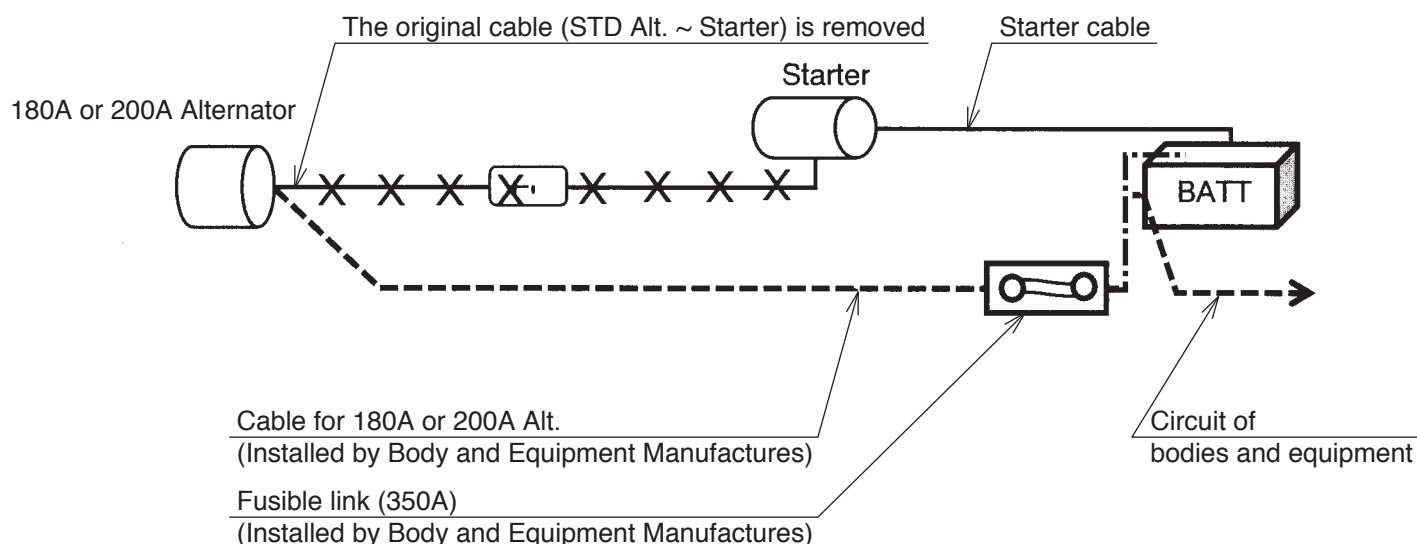
OPT : 12V-135A



OPT : 12V-180A**OPT : 12V-200A**

- The maximum power available for the whole vehicle is defined by the capacity of the alternator. Therefore, the electric power that is not consumed by electrical equipments such as head lamps etc. can be available for the body side.
- Pay attention not to exceed the capacity of the alternator equipped on the vehicle.
- In the event that you are obliged to carry out the body mounting exceeding the capacity of the alternator, select the one available as an option or consult HMC or Hino authorized dealer.

5. INSTALLATION OF 180A OR 200A ALTERNATOR (OPT)



General precaution

It forbids enlarging capacity of the fuse installed in vehicles.

Body and Equipment Manufactures has to guarantee about selection and attachment of the cable for 180A or 200A Alternator.

The maximum of the current which can be take out as an object for bodies and equipment is 50A (600A).

Install the exterior case for protection a cable (The quality of the material is entrusted with task of manufacturer.)

Make sure that the cable has sufficient slack to absorb relative movement.

Refer to "HARNESS WIRING" in Chapter 7 besides the above.

Select the cable

Choose the cable in consideration of the following item.

The rated current is 180A or 200A. (In case of cold start more than 200A current may flow.)

In order to install in the engine, use the electric wire about AVX-40sq or beyond it.

(Heat-resistant spec. over 80°C(176°F)/over 3000h is recommended.)

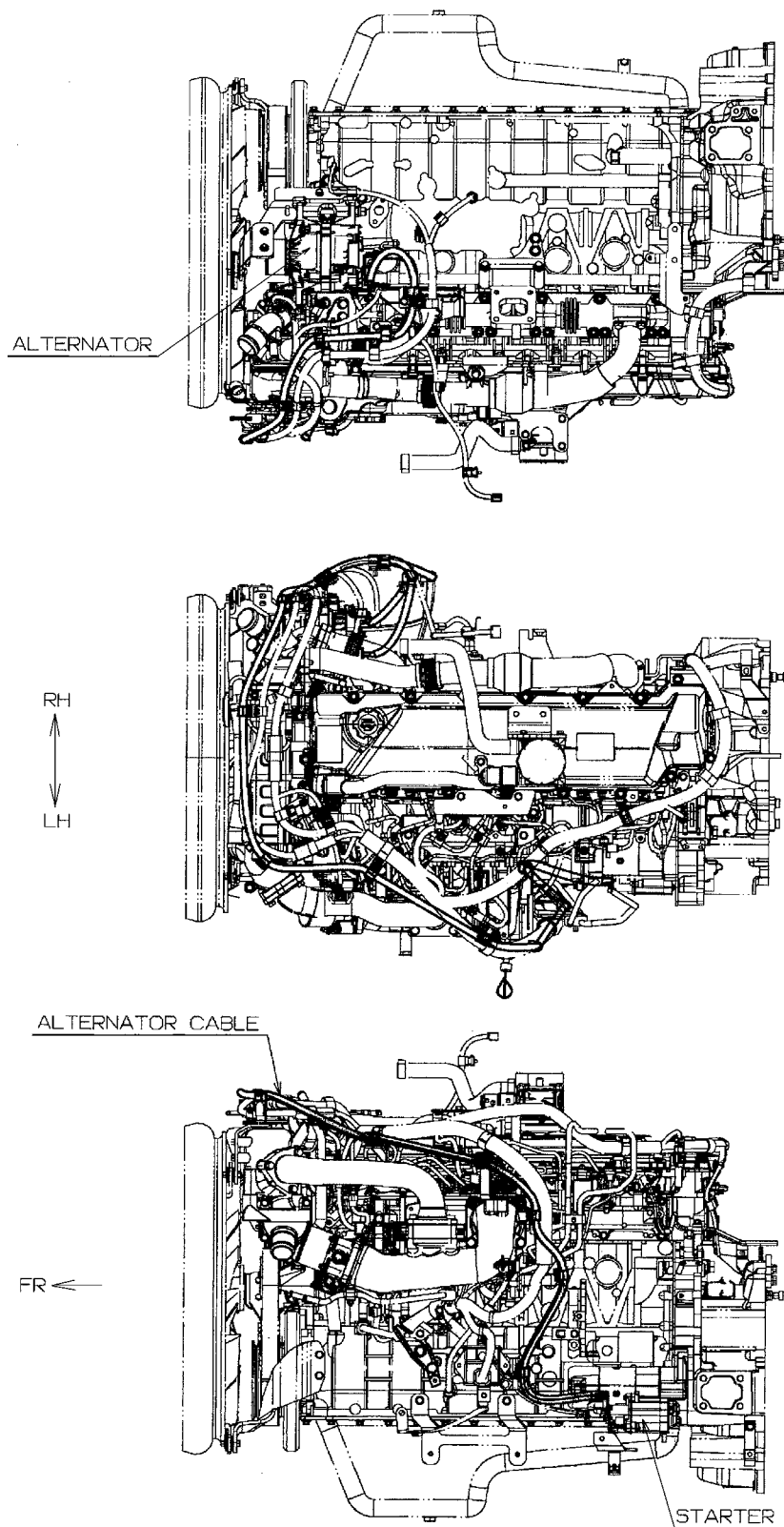
Fusible link

The capacity of fuse link is equivalent to 350A.

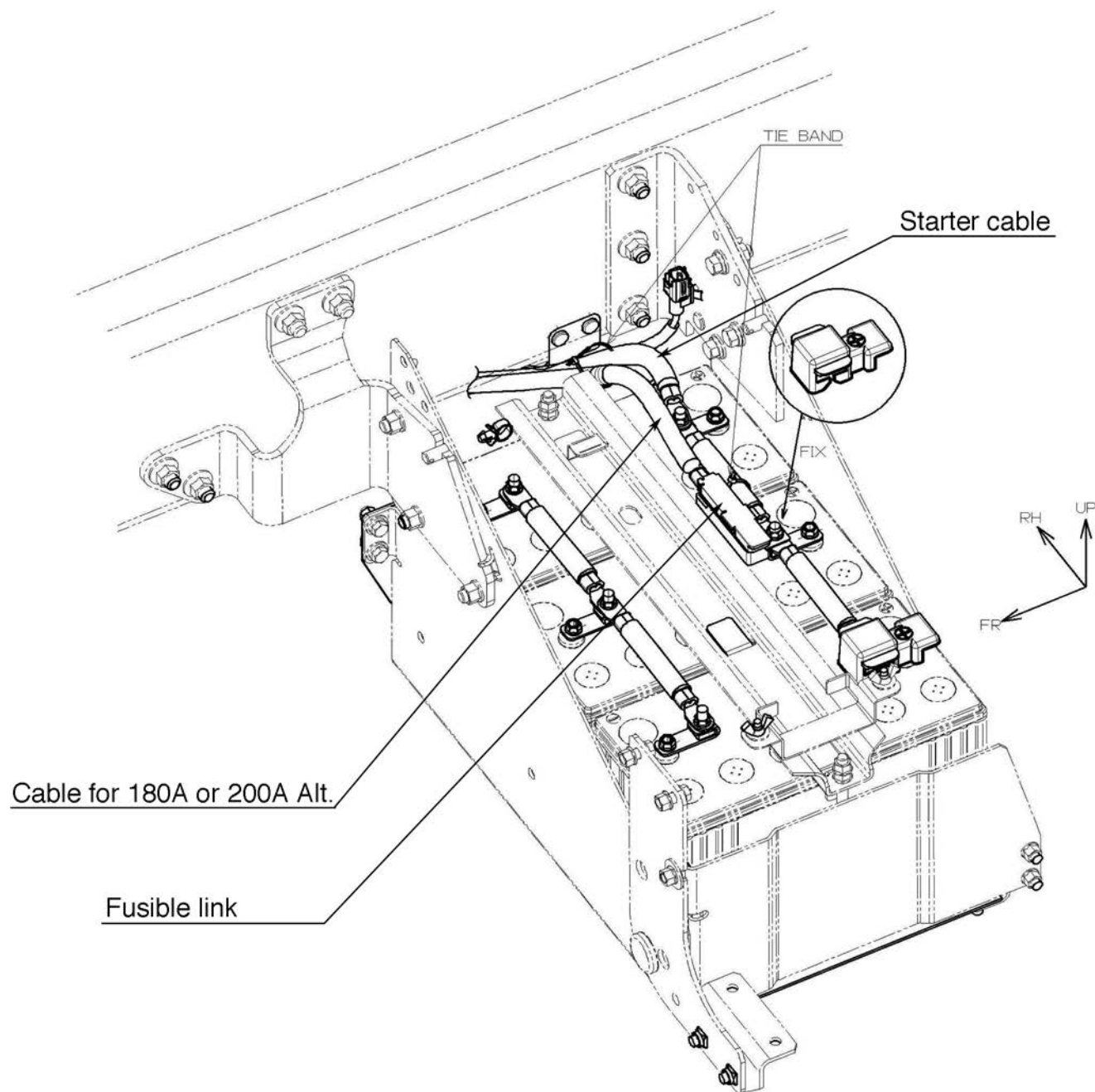
(For example: MEGA fuse part No. 0298350 made by Littelfuse)

Select and install a fuse box according to Body and Equipment Manufactures' responsibility.

It recommends installing in the position near the battery if possible.



DETAIL OF ALTERNATOR (STD) CABLE INSTALLATION



DETAIL OF 180A or 200A ALTERNATOR CABLE ON BATTERY

6. ELECTRICAL POWER SOURCES

If you must take an electrical power supply for the body or equipment from the Hino chassis, take it from the electrical power supply connector.

Power Supply Connectors and Positions

Detail of power supply connectors as shown in the table below.

CAB SIDE

Connector Mark	Pole Code	Circuit (Main Application)	Max. Capacity (A)	Wire Size & Color	Connector Part No.	Coupling Connector (Spare Parts) Part No.	Applicable Model	Description
A	AGK	12V output connected with battery	3	1.25 W-	SZ591-04002	SZ591-04001	All	Unfused 12V Power tap, fuse and switch are required
B	A6N	Activator for P.T.O. governor mode	-	0.5 Y-	SZ591-04002	SZ591-04001		Input 12V positive signal for governor activation to P.T.O. mode *2
C	AGM	Power supply	7 *1	1.2 L-	SZ591-04002	SZ591-04001		12V Power tap with key in "ON"
D	%17	T/M Neutral signal output	-	0.5 B-R	SZ591-04002	SZ591-04001		T/M Neutral signal for enable stater
E	AT6	Starter enable signal input	-	0.5 L-	SZ591-04002	SZ591-04001		Input 12V positive signal for activation of starter
F	%14	Head lamp output signal	-	0.5 R-G	SZ591-04002	SZ591-04001		Output 12V signal linked with Head lamp H/L change
G	%15	Engine stop	-	0.5 Y-B	SZ591-04002	SZ591-04001		Input 12V signal for Engine stop
H	%16	Power supply	9.4	1.25 G-	SZ591-04002	SZ591-04001		12V power tap for Fog lamp
I	A6P	P.T.O. preset idle up signal input	-	0.5 L-B	SZ591-04002	SZ591-04001		Input 12V positive signal for idle up (Activate when input 12V positive signal to Connector "B") *3
J	A6Q	P.T.O. enable signal	-	0.5 L-W	SZ591-04002	SZ591-04001		Output 12V signal for activation of Connector "B" *2 (Activation of P.T.O. mode = connected to ground Activation of running = Open circuit)

*2 : 1) P.T.O. Governor activation conditions
[Activation conditions : All AND conditions]

Engine status	ON
Starting of engine operation	OFF
System action	OFF
Vehicle speed	≤50km/h (31.25mph)
Engine speed	≤4000 r/min.
Engine Coolant temperature	≤110°C (230°F)
Transmission gear position	NEUTRAL
Throttle lever angle of body side	≤5%

[Deactivation conditions : All OR conditions]

Engine status	OFF
Starting of engine operation	ON
System action	ON
Engine speed	> 4000 r/min.
Engine Coolant temperature	> 110°C (230°F)
Transmission gear position	GEAR IN

2) It is possible to set idle up by customizing

*3 : 1) It need to customize for idle up.
2) Please contact to HMC for customizing.

Connector Mark	Pole Code	Circuit (Main Application)	Max. Capacity (A)	Wire Size & Color	Connector Part No.	Coupling Connector (Spare Parts) Part No.	Applicable Model	Description
K	#J1	Cab - Chassis Through Wire 1	10	1.25 G-	82824-E0K90	82824-E0K80	All	For Cab - Chassis Through Wire
	#J2	Cab - Chassis Through Wire 2		1.25 L-				
	#J3	Cab - Chassis Through Wire 3		1.25 P-				
	#J4	Cab - Chassis Through Wire 4		1.25 R-				
	#J5	Cab - Chassis Through Wire 5		1.25 V-				
	#J6	Cab - Chassis Through Wire 6		1.25 W-				
L	T21	Power Supply (BAT)	2	0.85 W-	S8281-E0M40 Color: Natural (Delphi Part No. 12064769)	Delphi Part No. 12064770		For Telematics
	T22	Power Supply (ACC)	2	0.85 GR-				
	T23	E/G Control Diag CAN (HI)	-	0.5 P-				
	T24	VCS CAN (HI)	-	0.5 Y-				
	T25	Ground	-	0.5 BR-				
	T26	Power Supply (Starter switch "On")	7 *1	0.85 L-				
	T2Y	E/G Control Diag CAN (Lo)	-	0.5 V-				
	T2Z	VCS CAN (Lo)	-	0.5 G-				
M	ANZ	Idle Up Signal	-	0.5 R-	SZ591-04002	SZ591-04001		Input 12V positive signal for engine idle up

*1 Total Max. current together with Pole code AGM (Connector Mark C) & T26 (Connector Mark L).

*4 Even if input signal for engine idle up, it does not raising of engine speed in the shipping chassis condition.
It need to customize for raising of engine speed.
Please contact to HMC for the detail.

• Activation conditions

Engine speed will raise when all of the following conditions are satisfied.

- Input engine idle up signal.
- Position of transmission gear is neutral.
- Releasing the clutch pedal (Vehicle with Manual Transmission only).

- Range of engine speed : 750 to 980 r/min.

(This range can be set optionally.)

CAUTION :

Should modify circuit on body side to avoid electrical surge voltage.

Inside circuit damage of ECU and electric noise may adversely affect the vehicle's equipment.

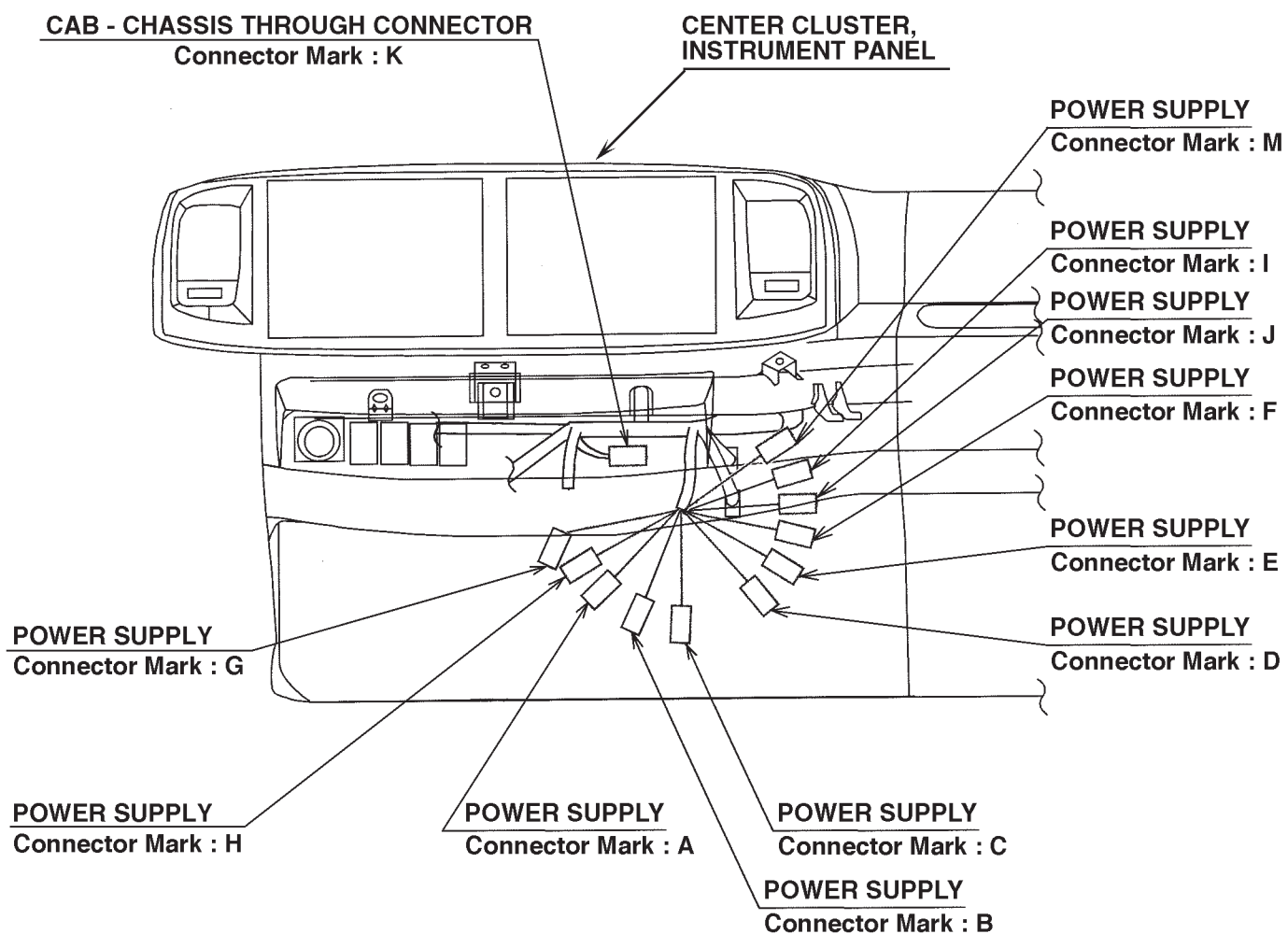
CHASSIS FRAME SIDE

Connector Mark	Pole Code	Circuit (Main Application)	Max. Capacity (A)	Wire Size & Color	Connector Part No.	Coupling Connector (Spare Parts) Part No.	Applicable Model	Description
N	K95	Power Supply	-	0.5 L-Y	S8256-01260	S8256-01250	All	External engine control device of Engine control for superstructure (Connect with HINO genuine parts only)
	K96	Accel sensor	-	0.5 G-Y				
	K97	Ground	-	0.5 G-				
O	AM6	Power Supply	7	1.25 W-	S8281-E0D80 Color: Black	S8281-E0D40		12V Power tap with starter switch "ON" and Van lamp switch "ON"
	AP9	Left turn signal	0.5	0.5 B-R				For Side turn lamp, LH
	APA	Right trun signal	0.5	0.5 B-W				For Side turn lamp, RH
	AGQ	Power Supply	10.5	1.25 G-				12V Power tap with Head light switch in"ON"
	APN	Power Supply	7	1.25 L-R				12V Power tap with starter switch "ON"
P	#JD	Cab - Chassis Through Wire 1	10	1.25 G-	S8281-E0D80	S8281-E0D40		For Cab - Chassis Through Wire
	#JE	Cab - Chassis Through Wire 2		1.25 L-				
	#JF	Cab - Chassis Through Wire 3		1.25 P-				
	#JG	Cab - Chassis Through Wire 4		1.25 R-				
	#JH	Cab - Chassis Through Wire 5		1.25 V-				
	#JJ	Cab - Chassis Through Wire 6		1.25 W-				

[NOTE]

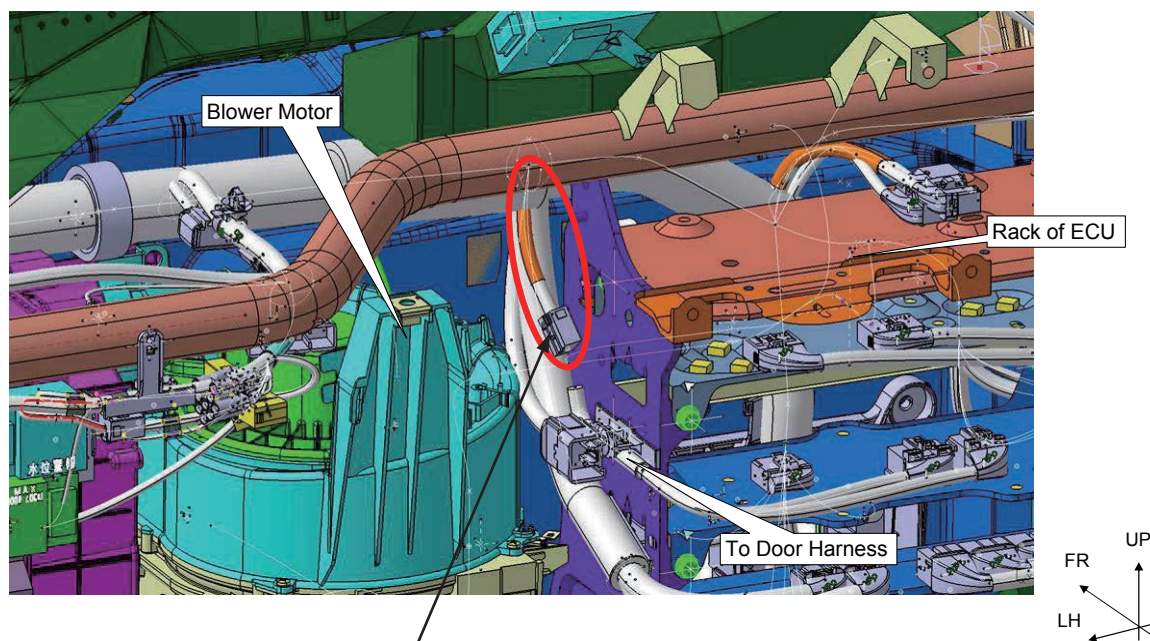
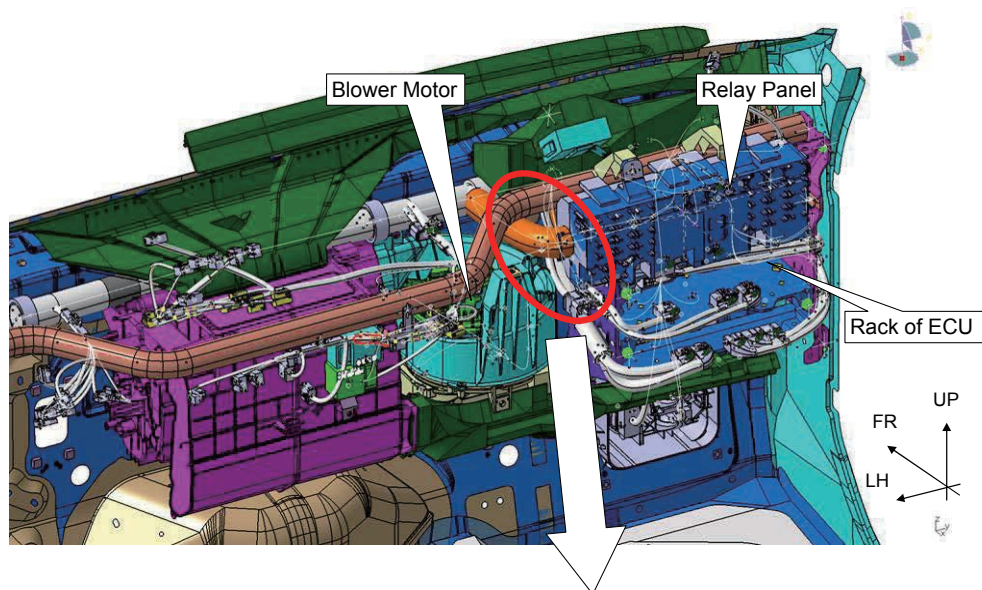
- The permissible current be taken from spare power connector is determined from the capacity of the fuse and wire size. Make sure that the maximum load (current) of the installed equipment must be kept lower current than the permissible capacity to be able to take from spare power connector.
- Be sure to keep the lower current value than the alternator generated capacity when switched on the original and additional equipment same time to avoid over discharging electricity of the battery.
- When use pole code "AP9" and "APA" (Connector Mark O), it should be on the following condition.
Turn and hazard lamp should be LED type.
If circuit current flow will exceed 0.5A, use them for operating circuit of the relay unit which to be operated turn and hazard lamp circuit.
- Refer to "8.HARNESS WIRING" in Chapter 7 for wire color code.

PROVIDED POSITION OF CAB SIDE



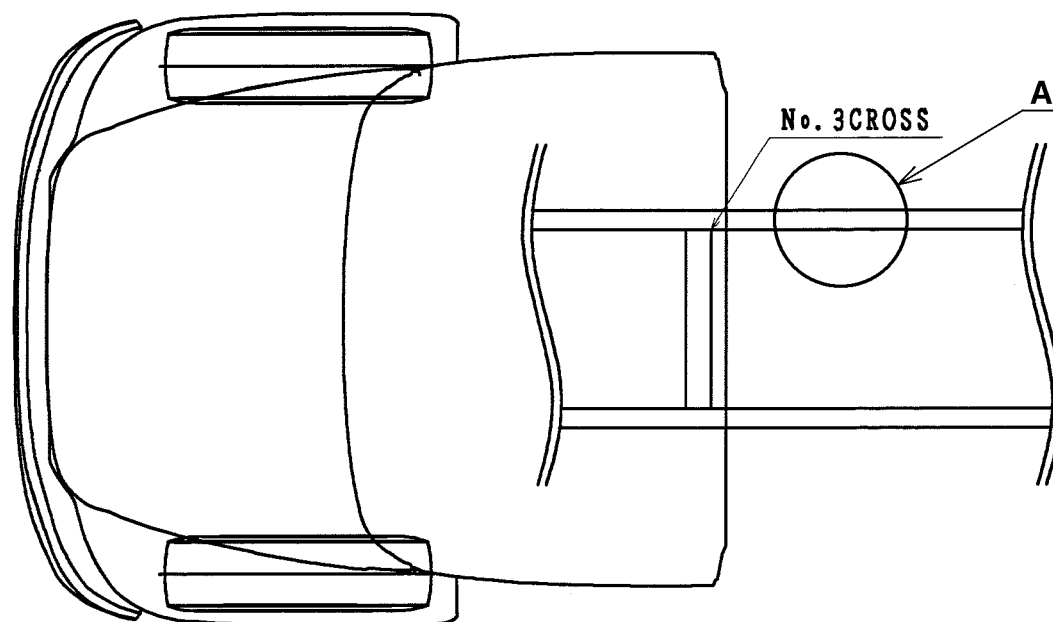
- See the previous page for wire color.

POSITION OF TELEMATICS CONNECTOR

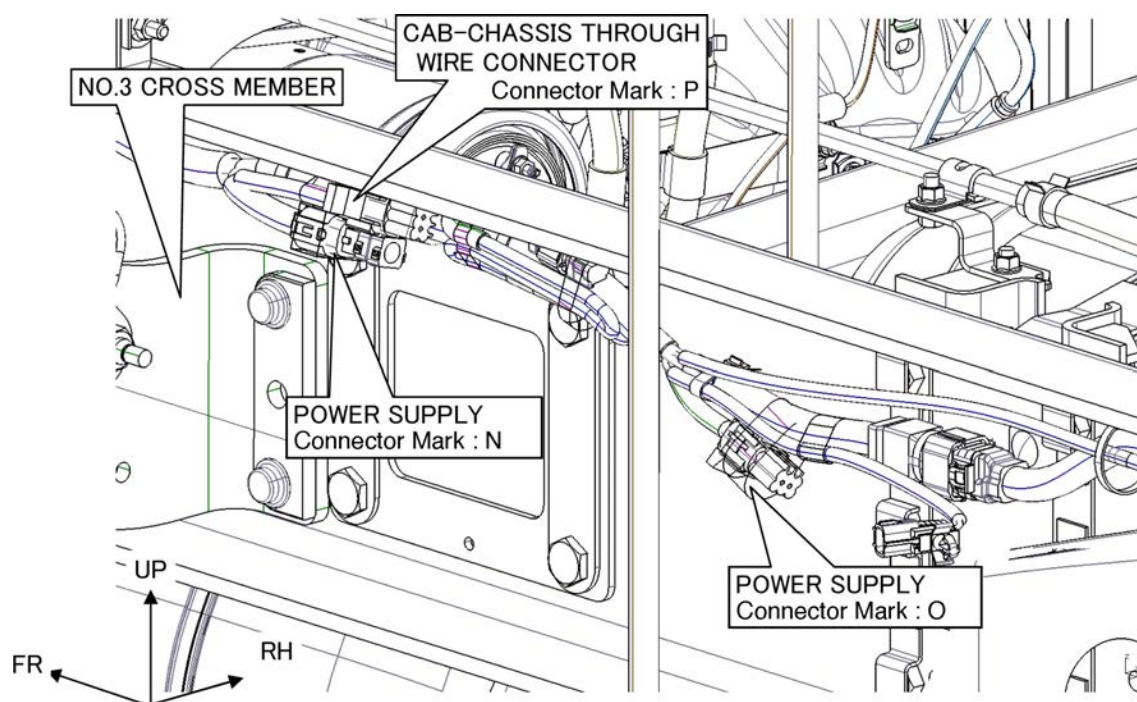
TELEMATICS CONNECTOR

Connector Mark : L

PROVIDED POSITION OF CHASSIS SIDE


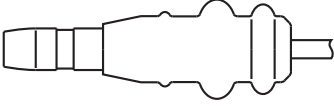
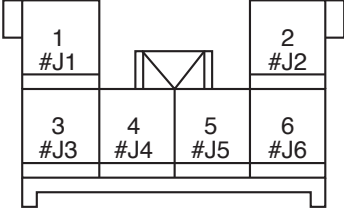
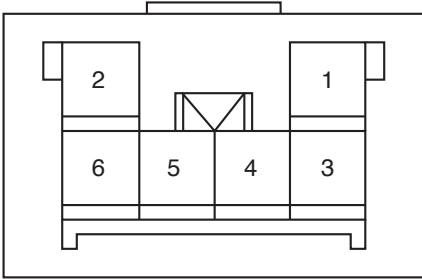
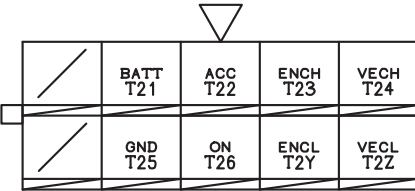
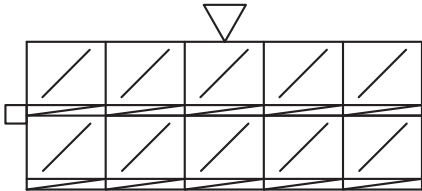


• Detail of A

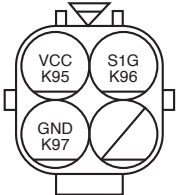
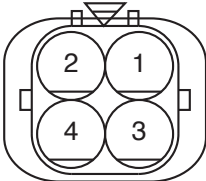
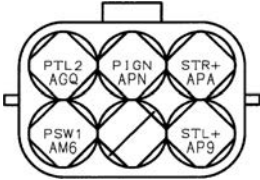
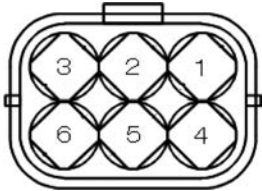
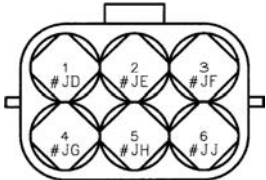
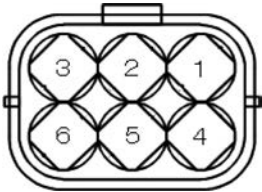


DETAIL OF POWER SUPPLY CONNECTORS

• CAB SIDE

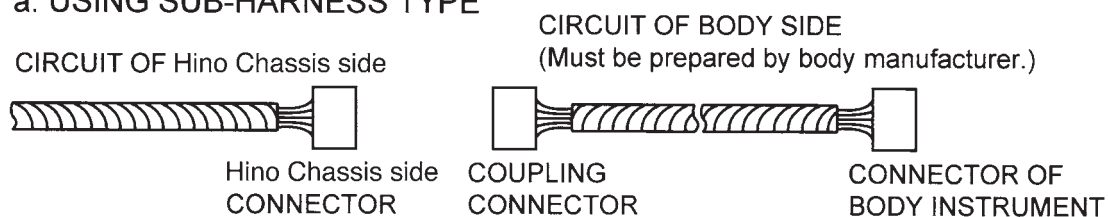
MARK	CONNECTOR	
	VEHICLE SIDE	COMPANION SIDE
A B C D E F G H I J M	 <p> A : AGK B : A6N C : AGM D : %17 E : AT6 F : %14 G : %15 H : %16 I : A6P J : A6Q M : ANZ </p>	
	PART No. SZ591 - 04002	PART No. SZ591 - 04001
K		
	PART No. 82824 - E0K90	PART No. 82824 - E0K80
L		
	PART No. S8281 - E0M40 (Delphi PART No. 12064769)	Delphi PART No. 12064770

• CHASSIS FRAME SIDE

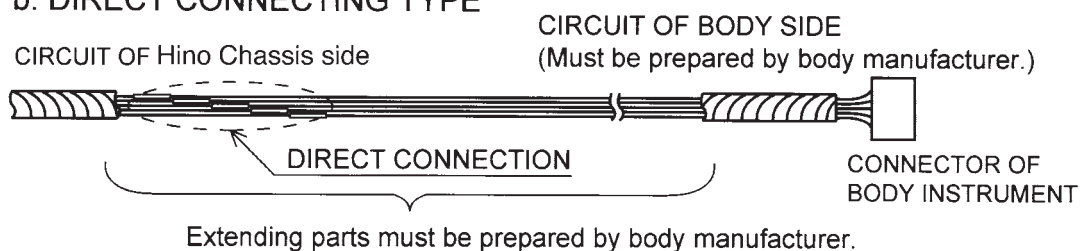
MARK	CONNECTOR	
	VEHICLE SIDE	COMPANION SIDE
N		
	PART No. S8256 - 01260	PART No. S8256 - 01250
O		
	PART No. S8281 - E0D80 (Delphi PART No. 12052848)	PART No. S8281 - E0D40 (Delphi PART No. 12124107)
P		
	PART No. S8281 - E0D80 (Delphi PART No. 12052848)	PART No. S8281 - E0D40 (Delphi PART No. 12124107)

HOW TO TAKE ELECTRICITY FROM POWER SUPPLY CONNECTOR

a. USING SUB-HARNESS TYPE



b. DIRECT CONNECTING TYPE



[NOTE]

- We recommend sub-harness type.
- If you must take power using direct connecting type, be sure to observe the precautions described here in after section "HARNESS WIRING".

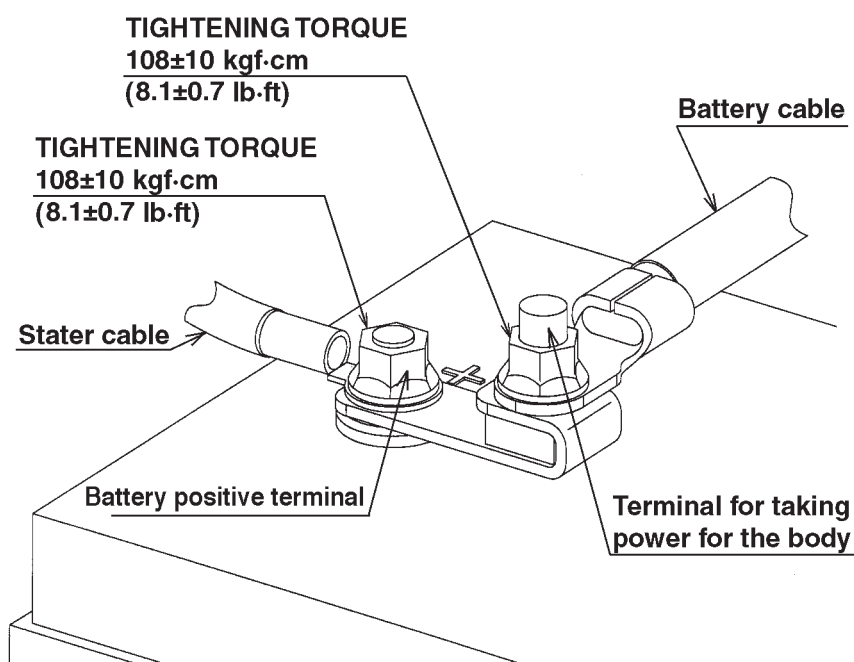
Taking Power Directly from the Battery

If you intend to take power for the body directly from the battery, secure the battery cable and the body power supply terminal together with the same nut.
For details, see the following figure.

In this case, you must install a fuse at a suitable point in the circuit and take precautions to prevent short circuits as these may lead vehicle fires.

When securing the cable and power terminal, make sure you tighten the nut properly.

- Battery model : GR31



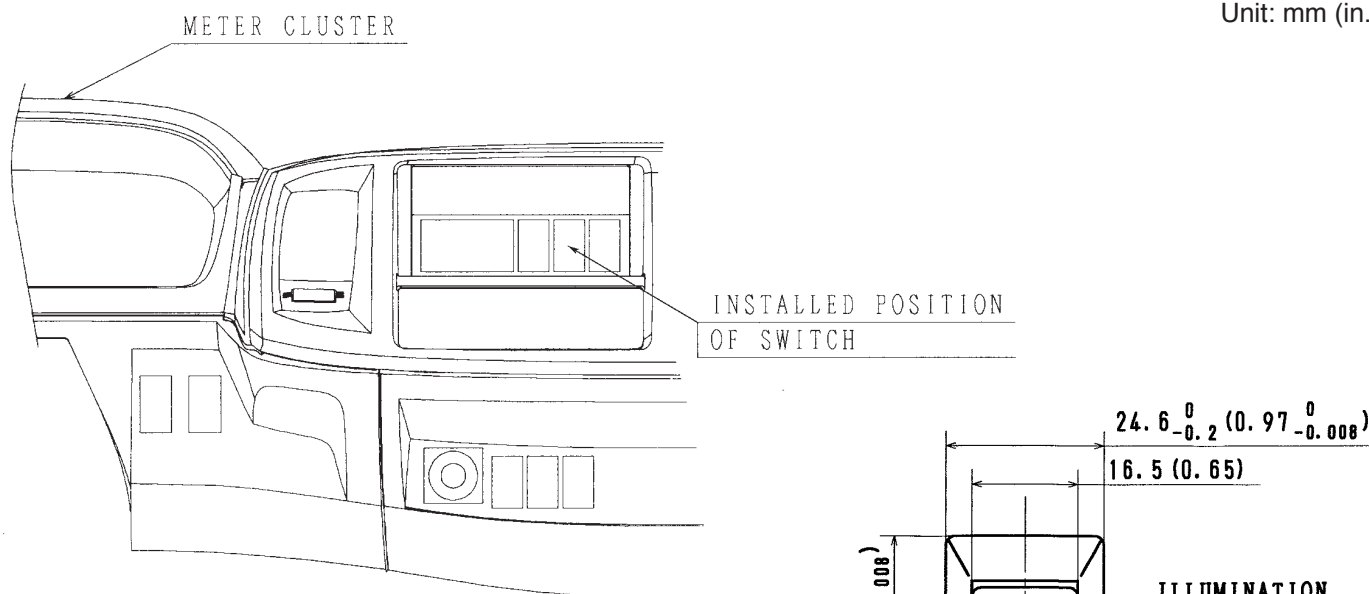
Room Lamp Switch for Van Body

Room lamp switch is provided as an optional equipment.

Be sure to follow the manner described in following figures when install the switch.

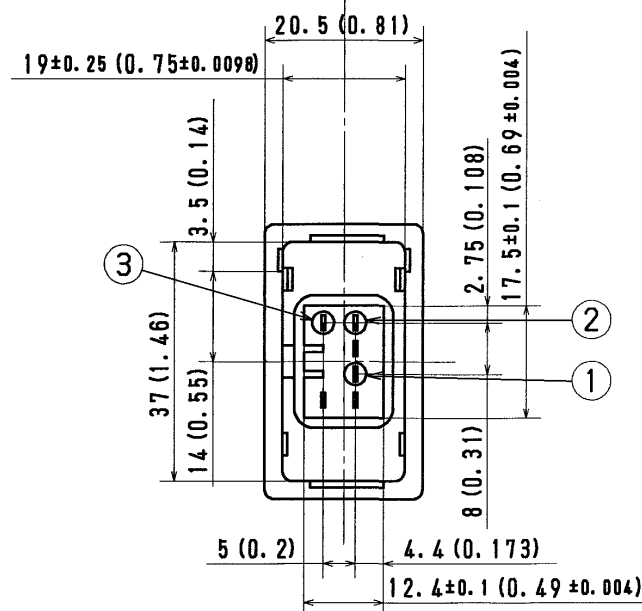
INSTALLATION POSITION OF SWITCH

Unit: mm (in.)



[NOTE]

- Install the switch after removed cover plate.



[NOTE]

- VIEW FROM SWITCH SIDE
- POLE POSITION

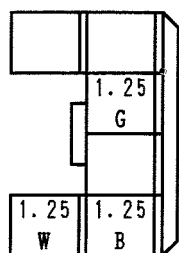
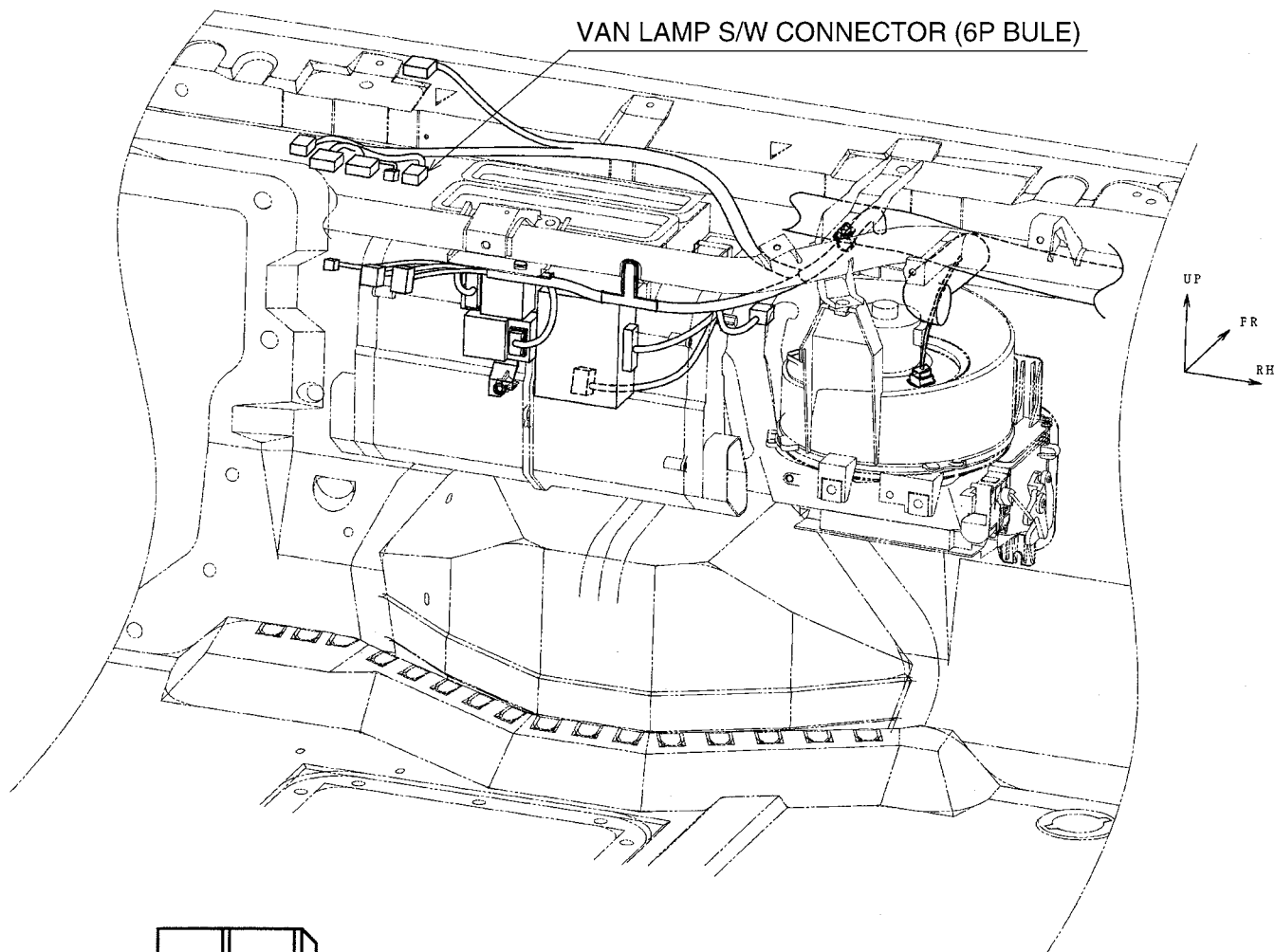
- ① BATTERY CIRCUIT
- ② GROUND CIRCUIT
- ③ CONNECTED TO THE ROOM LAMP CONNECTOR FOR VAN BODY TO BE PROVIDED BEHIND CAB.

DETAIL OF SWITCH

Part Number : S8428-03780

Detail of Provision of Connector

- Connector which is connected with room lamp switch for van body is provided center of dash board panel described in following figure.
- Make sure to connect the power supply connector with switch.



82824 - E0U10

[NOTE]

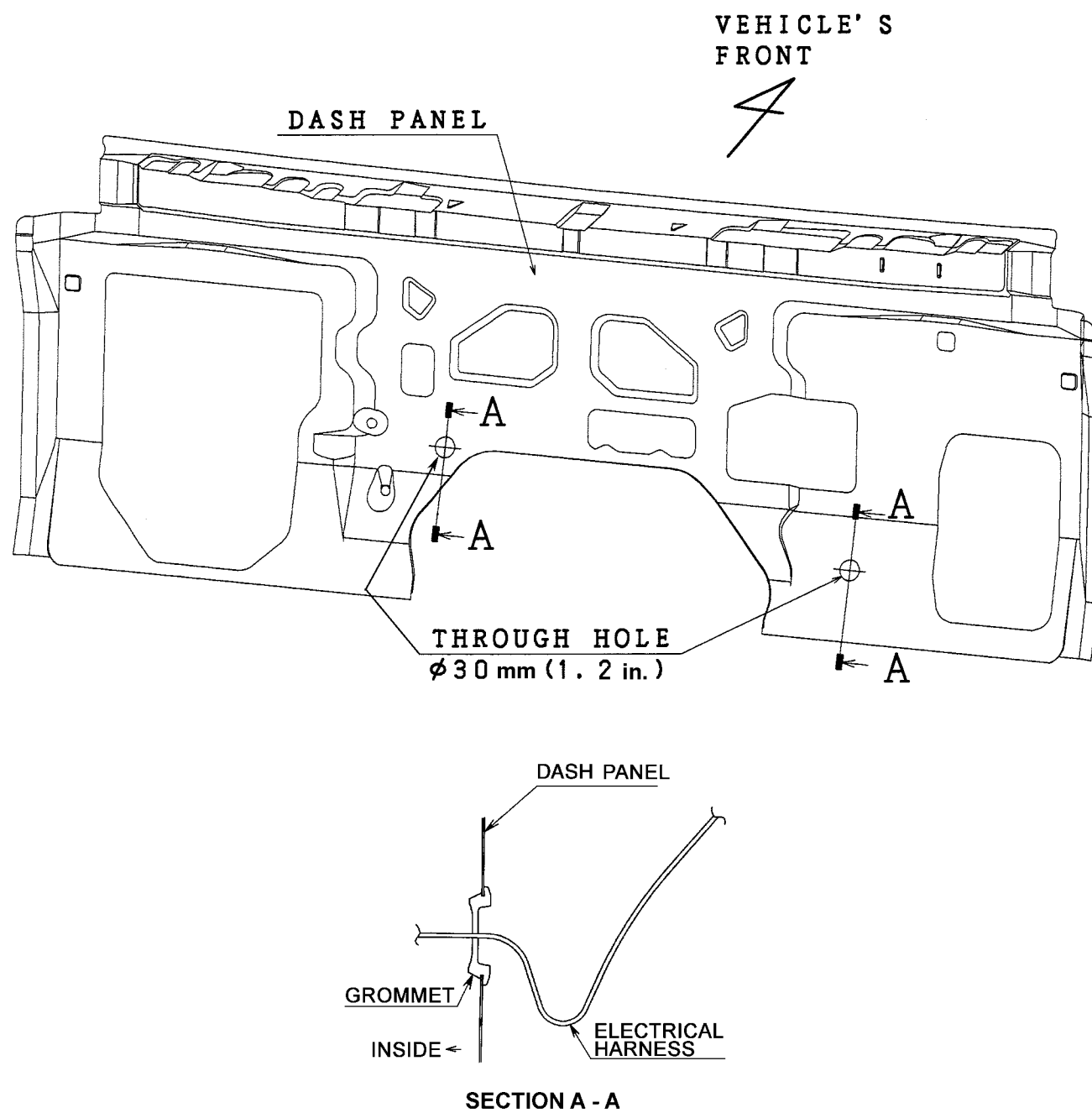
*COLOR OF HARNESS

- G: GREEN (BATTERY CIRCUIT, MAX. 7A)
- B: BLACK (GROUND CIRCUIT)
- W: WHITE (CONNECTED TO THE POWER SUPPLY CONNETOR "E" FOR ROOM LAMP OF VAN BODY TO BE PROVIDED BEHIND CAB.)

Precaution for Installing Wires, etc., to Cab

When installing a harness etc. through the hole of front dash panel, to secure the rust prevention and water proof before the said taken-in, carry out fitting and wiring according to the following instructions.

- Through hole $\phi 30$ mm (1.2 in.) is provided on the front dash panel but it is closed with a grommet. Make a slit on this grommet and, after the wiring, sufficiently seal its periphery with a sealing agent.
- In order to inhibit water intrusion, lower the wiring as shown on "Section A - A" to drain the water and after that bring the wiring into the cab.
- It is prohibited to fix the wiring with a tapping screw etc., because this can be a cause of penetration of dust.



7. BACK-UP ALARM (OPTIONAL EQUIPMENT)

Back-up alarm is optional equipment.

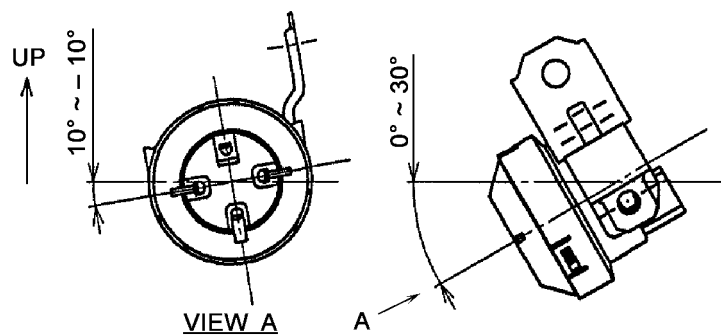
At chassis delivery, back-up alarm is temporary installed onto the rear combination lamp bracket (LH side).

Install the back-up alarm in proper position when mounting body.

Observe precautions as followings.

Installation angle

- Must be kept the permissible range of installing angles shown in the figure below.
- If the installing angle is not within range, water will accumulate inside the alarm and may lead to failure.



Position

Install the back-up alarm in a position where it is not exposed to splashing with muddy water, stone or water.

Precaution for painting

Make sure that the alarm is covered during painting to protect the paint coming into alarm from sound emitting hole for avoiding failure of no sound.

Sound Pressure Level	85±15dB (A) at 1m (3.28ft)
----------------------	----------------------------

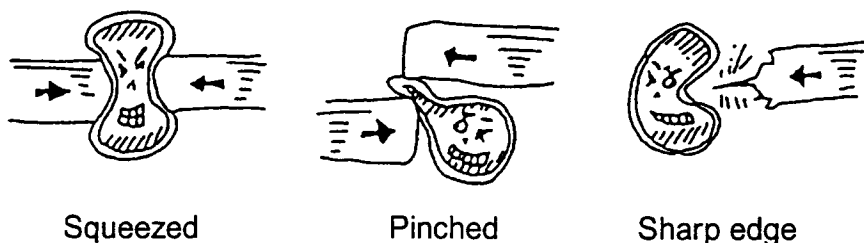
8. HARNESS WIRING

- If a mistake is made in the harness wiring while mounting a body or equipment, the harness wire may be damaged by vehicle vibration while the vehicle is driving, or water, dust, or mud entering into the harness wire. If these occur, a short-circuit or fire may result causing a serious accident.
- Accordingly, be sure to observe the procedures given below for modifications or alterations of the harness wire involved with the body mounting or other actions.

Important Points in Installing Electrical Equipment and Harness Wire

Cautions needed when mounting the body or equipment

When installing U-bolts or related parts of body to chassis frame, be careful that the harness wires are not squeezed, pinched or forced into contact with sharp edges.



Harness wires, battery cables, terminals and electrical equipments (switches, joints) must be easily inspected and serviced after mounting a body.



Junction block

Modifying of the junction block is prohibited because it may be cause of problem such as entering water into the junction block.

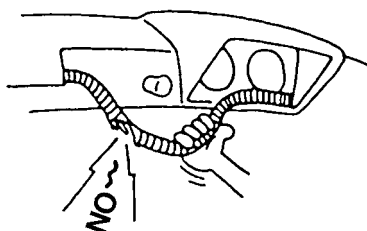
Therefore, please consult HMC if need to handle it.

When installing to fit a alarm for the body, make sure that its sound is clearly different from that of the existing alarm around the driver's seat.

[SPECIFICATION OF EXISTING ALARM AROUND DRIVER'S SEAT]

ALARM TYPE	SPECIFICATIONS
• Low brake pressure warning alarm	<ul style="list-style-type: none"> • Sound pressure : 90 to 105 dB (A) {At a distance of 1m (3.28ft)} • Frequency : 400 to 600 Hz
• HYDRAULIC brake motor emergency warning alarm	<ul style="list-style-type: none"> • Sound pressure : 90 to 105 dB (A) • Frequency : 2 KHz

Do not pull forcibly the harness wiring when handling it.



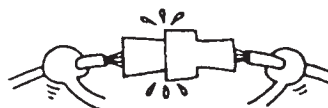
When removing the connector, be sure to hold the male and female parts of the connector by housing.

Do not remove the connector by holding harness wire.

CORRECT

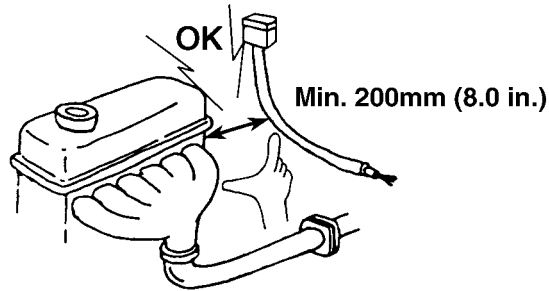


INCORRECT



Secure sufficient clearance with the high-temperature parts.
Measure the temperature whenever required to prevent the problem of heat.

- Don't install a harness wire in the vicinity of the exhaust pipe or muffler or where the harness wire is exposed directly to the exhaust gas.
- Clearance against heat-generating parts; Minimum 200mm (8.0 in.).



- When the clearance is less than 200mm (8.0 in.) with heat-generating parts, provide an insulator to protect harness wire from heat.

NOTE: The allowable temperature of vinyl coating harness wire is 20°C (48°F) to 60°C (140°F).

Addition or Modification of harness wire

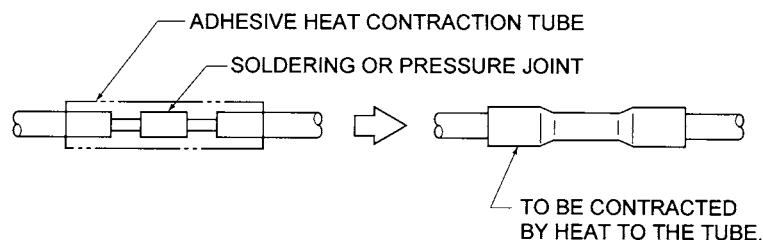
If you intend to extend harness wire, make sure that you use the same size and color of wire as the original.

Make all joint secure by soldering or pressure joints. After connecting, remove burrs and cover completely with insulation material.

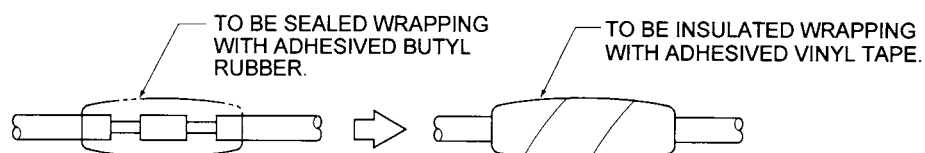
When making joint parts in chassis side wiring, cover joint parts with waterproof sealant, then cover fully with insulating material.

[EXAMPLE FOR WATERPROOFING AND INSULATION]

- Cover joint parts with adhesive heat contraction tube.



- Cover joint parts with butyl rubber.



When soldering, do not use chlorine.

If you intend to move the battery or modify the battery cable layout, do not extend or shorten the battery cable.

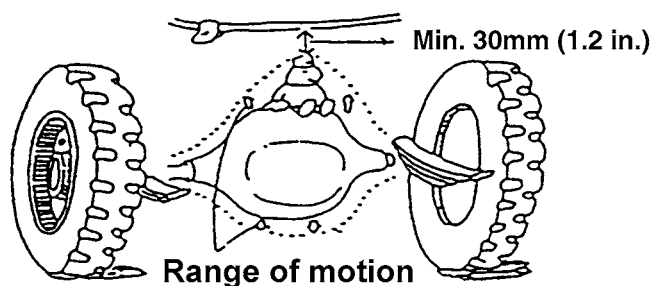
If you move the battery, resistance of the extended harness wire should be below 45milli-Ohms. Otherwise critical burner failure can be brought.

In areas where the battery cables are subject to movement due to relative motion of the starter and the side rail, do not modify the clamping method, positions of clamps, or the amount of slack in the cables.

Clamp harness wire firmly to prevent it from contacting the moving or vibrating parts of the chassis or rear body, and any sharp edges or corners.

[CLEARANCES FOR WIRE]

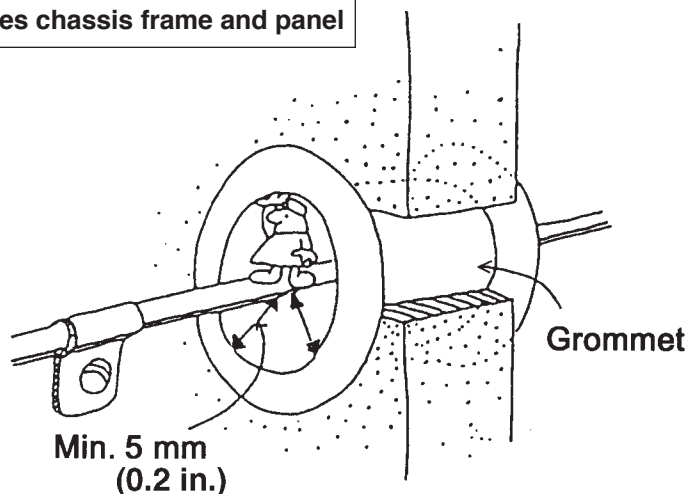
POSITION	CLEARANCES
• Between moving parts and wiring.	At the close point : min. 30mm (1.2 in.)
• Between sharp edges or comers and wiring.	Minimum clearance : min. 10mm (0.4 in.)



Where harness wire passes through the chassis frame or a panel, always use a grommet to prevent damage to the harness wire and potential short circuits.

EXAMPLE OF USING GROMMET

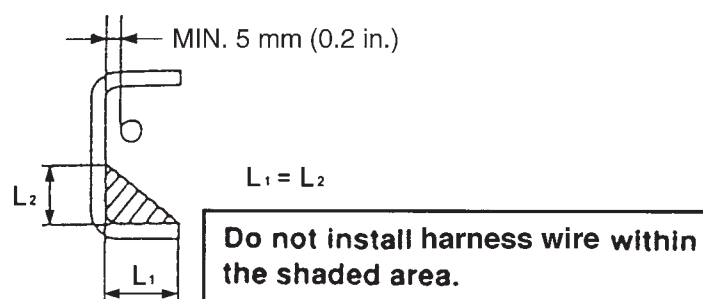
Protection of harness wire which penetrates chassis frame and panel



Do not install harness wire where it may be damaged by accumulation of mud or snow, by freezing, or by road debris.

If you must install harness wire in such positions, protect it with metal plates.

Harness wires should be installed where there is no danger of damage from accumulation of mud, sand, or snow.



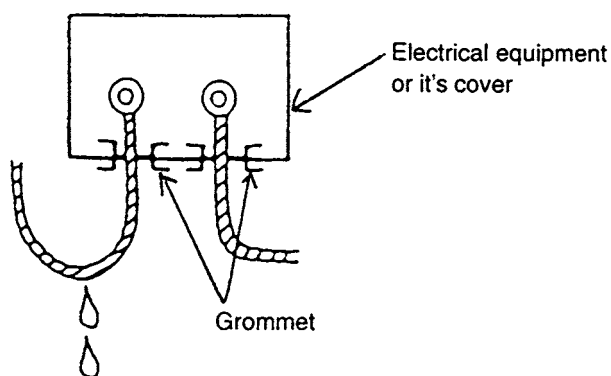
When installing a harness wire inside the side rail, place the harness wire along already installed harness wire and do not wire independently along empty spaces.

Also, when wiring under the floor of the body or inside the roof construction, be sure to place the harness wire along the structure frame, use a clip following the indicated interval, carry out water proofing measures and observe the harness wiring rules.

Do not make connections by cutting open the coating of a wire and pulling out the bare wire. This procedure is very dangerous and may damage to other wires.

Plug up the passage hole of a harness wire with a grommet so that water dose not pour in electrical equipment along with a harness wire.

Make a terminal parts higher than the entrance of a harness wire.



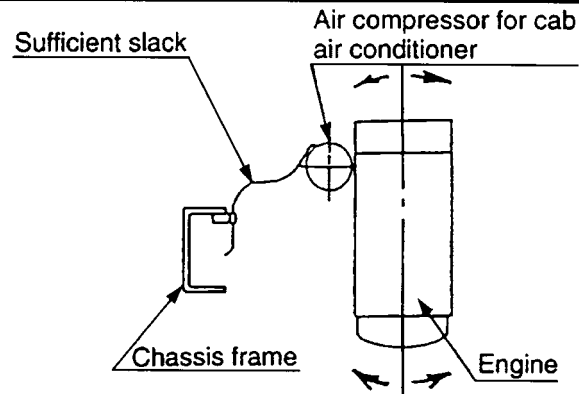
Install harness wire where they are not exposed to dust or water.

Do not install the harness wire on the top or outer side of the chassis frame. In such positions, they may be damaged by being stepped on during body mounting, or by road debris during vehicle operation.

If there is a harness for the chassis already installed close to the wiring area when wiring is done inside the chassis frame, the wiring and taping should be done along this harness.

When installing harness wire for parts of the engine, transmission, etc., install the harness wire in parallel to existing harness wire, and be sure to allow sufficient slack to adsorb any relative movement. Make sure that the harness wire does not touch any other parts.

When installing the harness wire to connect to the power unit, make sure that harness wire has sufficient slack to absorb relative movement.

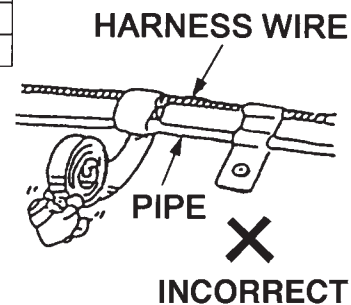
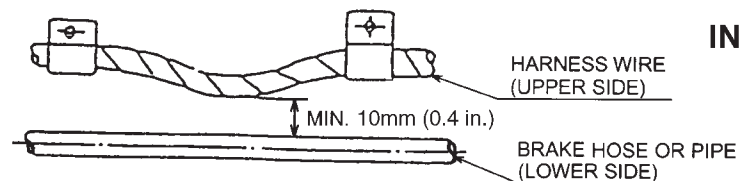


Where harness wire runs parallel to pipes (including rubber hoses, vinyl hoses, and steel pipes) or brake system pipes (including brake hoses and brake pipes), never clamp the harness wire together with these pipes.

[CLEARANCES BETWEEN HARNESS WIRES AND PIPES]

WIRING METHOD	CLEARANCE
Pipe and parallel wire	min. 10mm (0.4 in.)
Crossing point of wire and pipe	min. 20mm (0.8 in.)

Never secure harness wires together with pipes or link rods.



If you move the battery, you may have to temporarily remove the battery cables from the terminals of the battery.

When reinstalling the battery cables, observe the specified torque to avoid damaging the battery terminal.

Unit: kgf-cm (lb-ft)

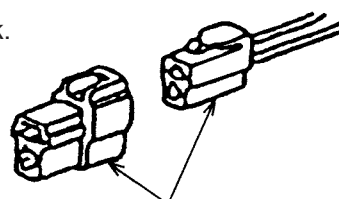
SIZE OF BOLT & NUT	TIGHTENING TORQUE
M8	77±19 (5.8±1.4)
M10	108±10 (8.1±0.7)

If a terminal is damaged, replace it with a new parts.

If you move the battery, make sure it is positioned at least 200 mm (8.0 in.) away from the exhaust system such as muffler and tail pipe.

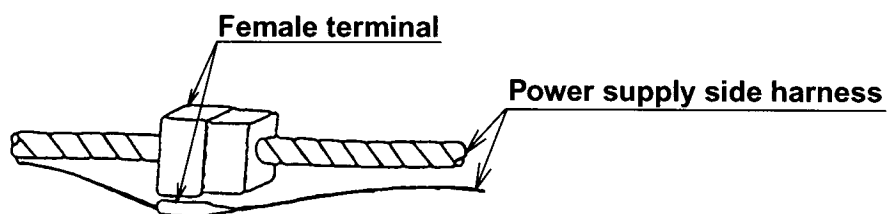
If you must install the battery within 200 mm (8.0 in.) of the exhaust system, protect it with insulating panels.

Always use a connector with lock.



Connector with lock

If you use a plug-type connecting terminal, fit the female terminal into the power supply side. This is due to the connecting terminal detaching which does not allow a short-circuit to occur even if the chassis frame or body construction make contact.

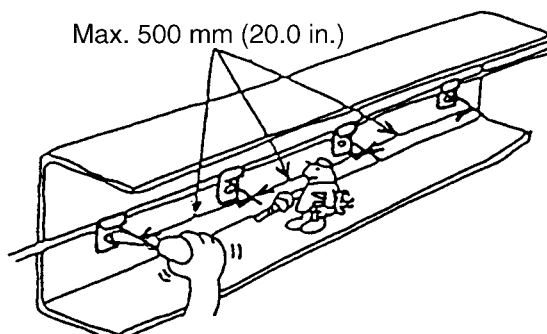


To prevent sagging, contact with other parts or contact with sharp edges or corners, secure all harness wire with clips.

The clips should be spaced at a standard interval of 300~500 mm (12.0~20.0 in.). This interval should be shorter where conditions dictate.

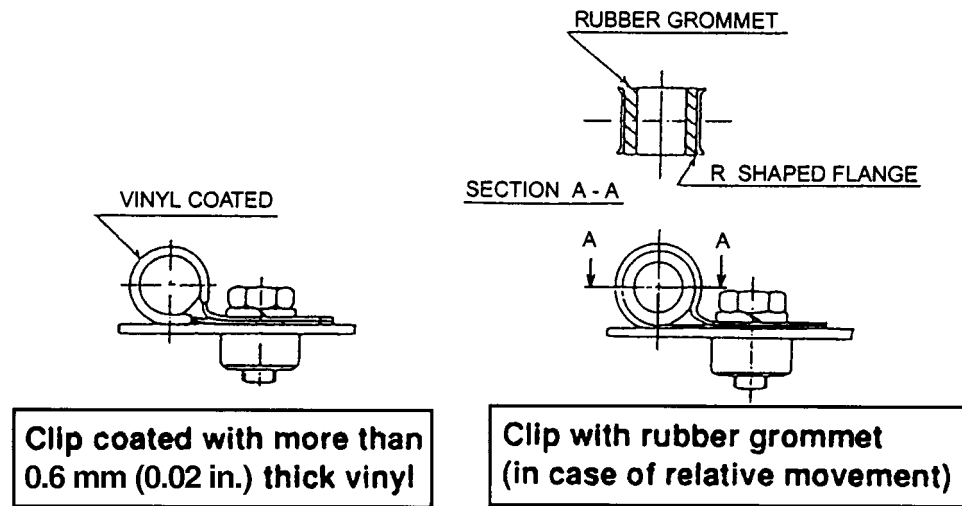
Clipping interval

Max. 500 mm (20.0 in.)



All clips should use resin coating or attached grommets.

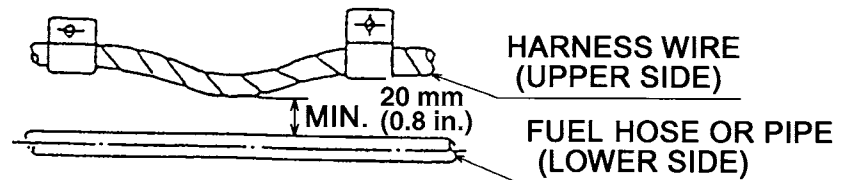
[RECOMMENDED CLIP TYPES]



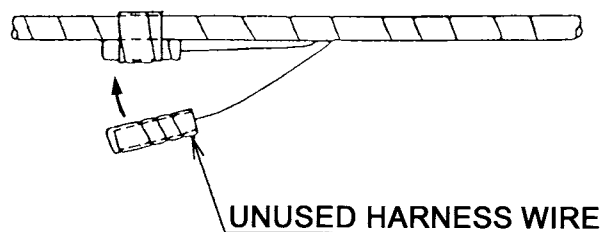
Crocodile clips and adhesive clips should only be used for temporary installation.

Harness wires should be installed above fuel hoses or pipes to avoid fuel dripping onto the harness wire in the event that a fuel leak occurs.

Keep a clearance at least 20 mm (0.8 in.) between the harness wire and fuel hose.

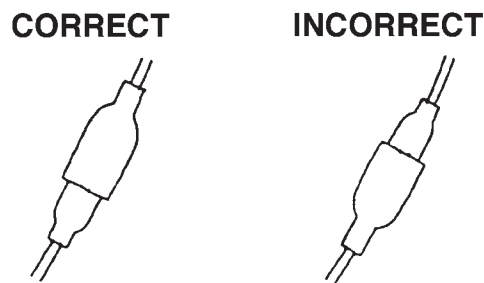


Bundle unused harness wires and their terminals should be bundled with other harness wires and covered with vinyl tape to prevent water from penetrating the terminal.



Mount a cover or a protector to prevent water entry along the harness wire.

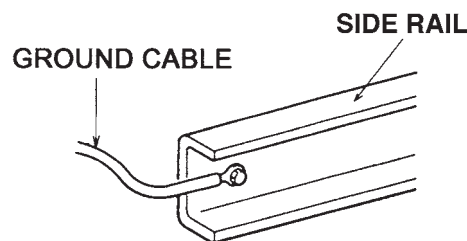
- A water-proof boot should be installed facing down.



A connector, if used at a position exposed to water, should always use water-proof type.

The circuit must be designed that the ground cable of the additional power supply is connected to the negative terminal of the battery.

Install the ground for an additional power supply always on the engine or side rail.



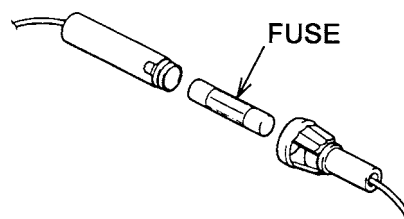
Mount the ground terminal securely in the front of a circular plate terminal.

Fuses of optimum capacity must be used for vehicles considering the operating load and the operating frequency.

Don't add any load from accessories to the existing fuses.

Be sure to insert a fuse in an added harness wire all the time.

Use a vinyl-coated clamp, taking adequate care against short circuit.



- The fuse capacity should be about 1.4 times the load current.

Ex : For the load current of 3A,
 $3 \times 1.4 = 4.2 \text{ A}$

Therefore, the standard fuse capacity of 5A is the best choice.

FUSE RATED CURRENT AGAINST LOAD (Automobile Standard JASO D610-75)

LOAD CURRENT, A	BELOW 7	7 MIN. AND BELOW 11	11 MIN. AND BELOW 14	14 MIN. AND BELOW 21
Fuse rated current, A	10	15	20	30

Ex : 5A fuse can be used for the load current of 3.5A maximum.

When installing additional electronic machine, the circuit must be wired through the fusible link and to be grounded direct to the side rail.

- Be sure to not flow the dormant current in the circuit.

Make sure that the clamp of the harness wire should be added to install as occasion demands to prevent the resonance oscillation of the harness wire due to engine vibration and vehicle's running.

- Take special attention for the clamping that the case to be used harness wire with fusible link.

When installing electric motor consumed bigger load, be sure to use the appropriate size of harness wire.

- If over capacity of spare power circuit, take the power direct from the battery.

Electric Wire Size and Permissible Currents

Wire Size and Currents

When wiring the harness wire together with the body mounting operations, select an appropriate type of harness wire taking into consideration the power consumption capacity (A) of the electrical equipment such will be mounted and the condition of the installation location referring as following table.

CONNECTING FUSE CAPACITY (A)	WIRE TYPE		WIRE SIZE AND LENGTH						
		AMBIENT TEMPERATURE	0.5mm ² (0.0008 in. ²)	0.85mm ² (0.0013 in. ²)	1.25mm ² (0.002 in. ²)	2mm ² (0.0031 in. ²)	3mm ² (0.005 in. ²)	5mm ² (0.008 in. ²)	8mm ² (0.012 in. ²)
5	AV	80°C (176°F)	MAX. 30m (MAX. 98 ft)	—	—	—	—	—	—
	AVX	100°C (212°F)							
	AEX	120°C (248°F)							
10	AV	80°C (176°F)	MAX. 15m (MAX. 49 ft)	MAX. 20m (MAX. 66 ft)	MAX. 30m (MAX. 98 ft)	—	—	—	—
	AVX	100°C (212°F)							
	AEX	120°C (248°F)							
15	AV	80°C (176°F)	X	MAX. 15m (MAX. 49 ft)	MAX. 20m (MAX. 66 ft)	MAX. 35m (MAX. 115 ft)	—	—	—
	AVX	100°C (212°F)							
	AEX	120°C (248°F)							
20	AV	80°C (176°F)	X	X	MAX. 15m (MAX. 49 ft)	MAX. 25m (MAX. 82 ft)	MAX. 40m (MAX. 131 ft)	—	—
	AVX	100°C (212°F)							
	AEX	120°C (248°F)							
30	AV	80°C (176°F)	X	X	X	MAX. 5m (MAX. 16 ft)	MAX. 10m (MAX. 33 ft)	MAX. 15m (MAX. 49 ft)	MAX. 25m (MAX. 82 ft)
	AVX	100°C (212°F)							
	AEX	120°C (248°F)							
40	AV	80°C (176°F)	X	X	X	MAX. 5m (MAX. 16 ft)	MAX. 9m (MAX. 30 ft)	MAX. 20m (MAX. 66 ft)	MAX. 20m (MAX. 66 ft)
	AVX	100°C (212°F)							
	AEX	120°C (248°F)							
50	AV	80°C (176°F)	X	X	X	X	MAX. 7m (MAX. 23 ft)	MAX. 10m (MAX. 33 ft)	MAX. 15m (MAX. 49 ft)
	AVX	100°C (212°F)							
	AEX	120°C (248°F)							
60	AV	80°C (176°F)	X	X	X	X	X	MAX. 5m (MAX. 16 ft)	MAX. 10m (MAX. 33 ft)
	AVX	100°C (212°F)							
	AEX	120°C (248°F)							
80	AV	80°C (176°F)	X	X	X	X	X	X	MAX. 10m (MAX. 33 ft)
	AVX	100°C (212°F)							
	AEX	120°C (248°F)							
	WIRE TYPE		WIRE SIZE AND PERMISSIBLE CURRENT						
		AMBIENT TEMPERATURE	0.5mm ² (0.0008 in. ²)	0.85mm ² (0.0013 in. ²)	1.25mm ² (0.002 in. ²)	2mm ² (0.0031 in. ²)	3mm ² (0.005 in. ²)	5mm ² (0.008 in. ²)	8mm ² (0.012 in. ²)
	AV	80°C (176°F)	9A	11A	14A	20A	27A	36A	47A
	AVX	100°C (212°F)	8A	10A	13A	17A	24A	33A	43A
	AEX	120°C (248°F)	7A	9A	12A	17A	23A	32A	42A

[NOTE]

- Marked “X” can not be used.
- Marked “—” shows the wire length maximum 50 m (164 ft).

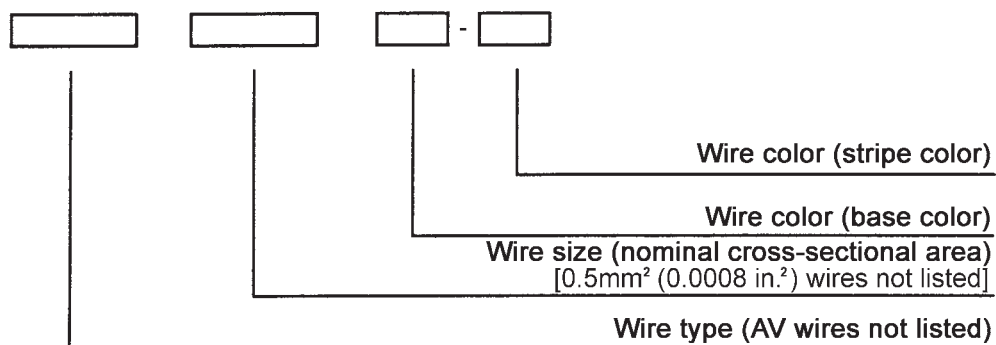
[NOTE]

- Select wires size to suit the power consumption current.
- If you intend to use AEX wire, make sure that you also use heat resistant protective tubing, tape, and clips.
- Where the wire is subject to movement caused by relative motion, use wire of 0.85 mm² (0.0013 in.²) cross section or larger.
- Characteristic of wire.

Wire type	Permissible ambient temperature	Notes
AV wire (low-voltage wire for vehicles.)	max. 80°C (176°F)	Use for normal wiring.
AVX wire (cross-lined vinyl) (heat-resistant low-voltage wire for vehicles.)	max. 100°C (212°F)	Use for wiring in engine room and other areas with high ambient temperature.
AEX wire (cross-lined polyethylene) (heat-resistant low-voltage wire for vehicles.)	max. 120°C (248°F)	

Coding for Electrical Wires

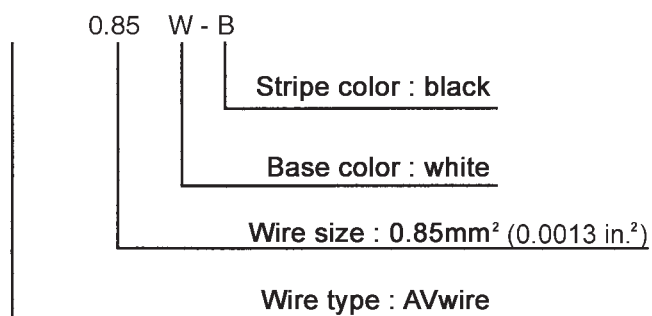
Wire codes represent size and color



Code

Wire color code	Wire color
B	BLACK
BR	BROWN
DG	DARK GRAY
G	GREEN
GR	GRAY
L	BLUE
LG	LIGHT GREEN
O	ORANGE
P	PINK
R	RED
V	VIOLET
W	WHITE
Y	YELLOW

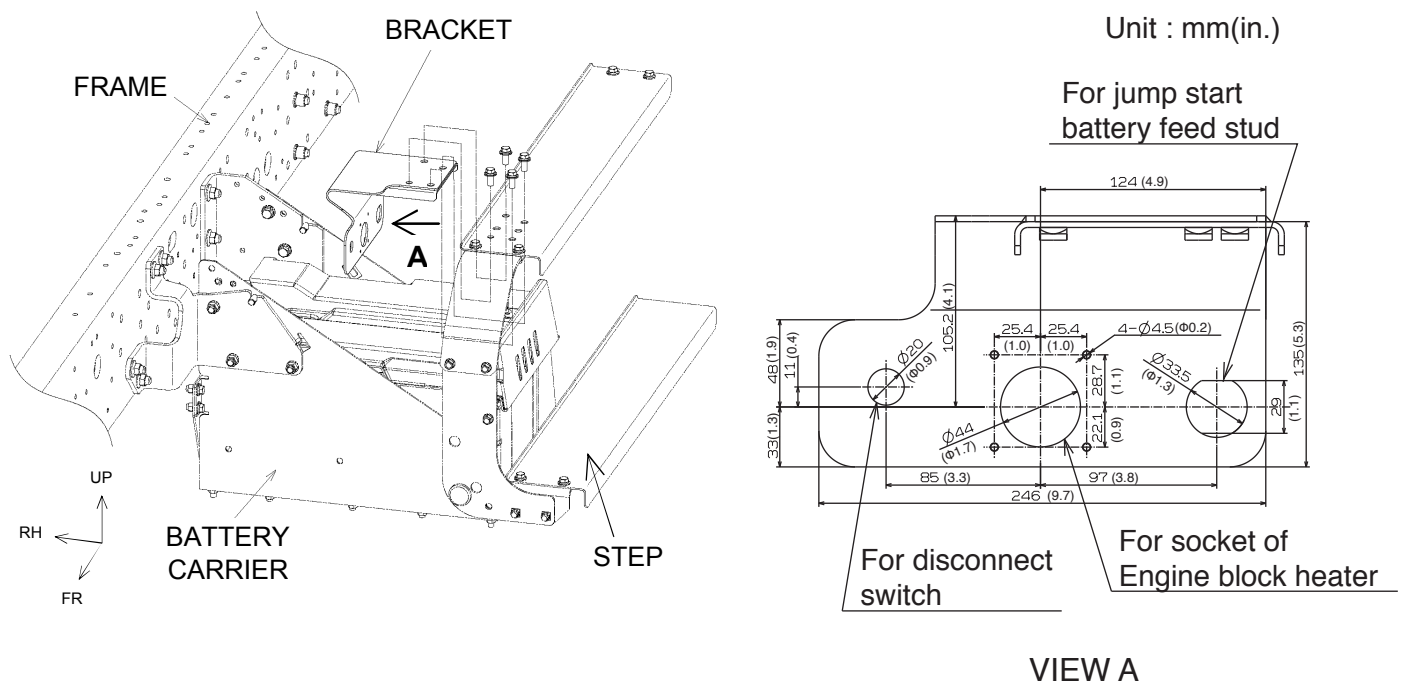
For example



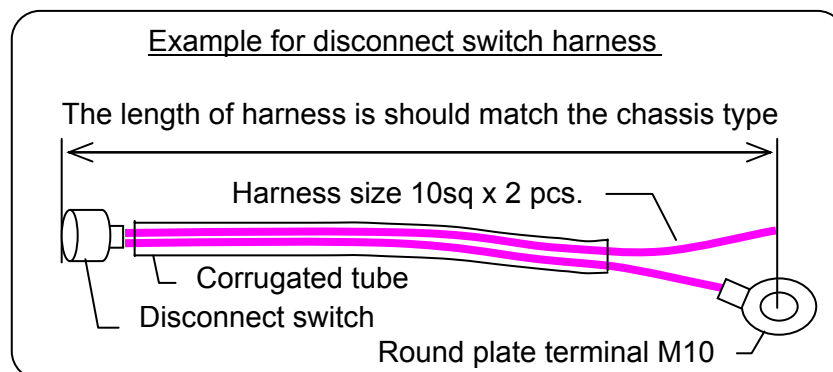
9. INSTALLATION OF THE BATTERY DISCONNECT SWITCH

When installing the battery disconnect switch, be sure to observe the following procedures by own responsibility of Body and Equipment manufacturers.

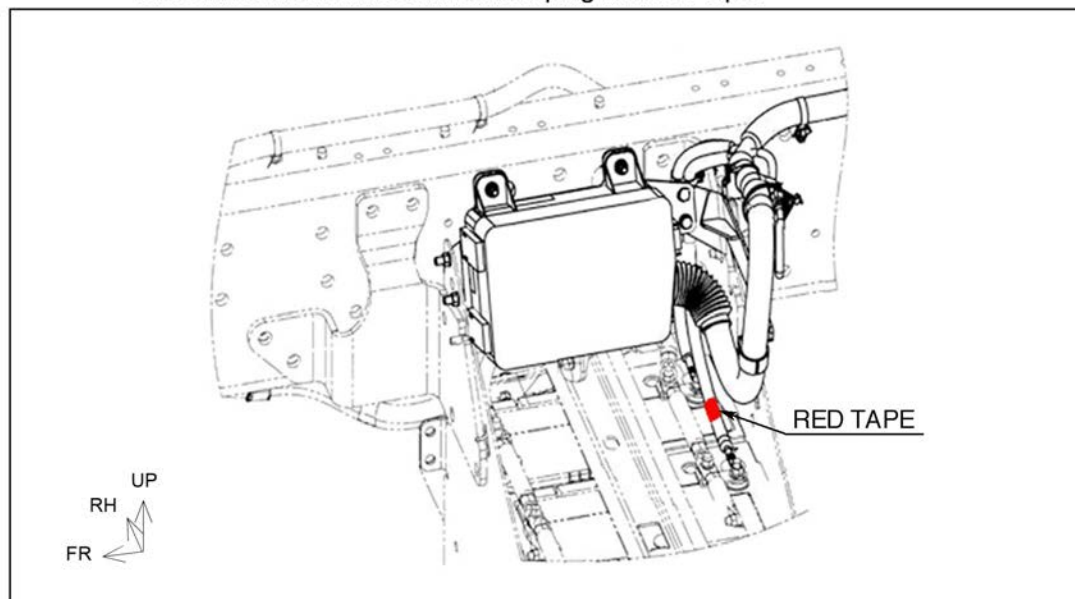
- Body and Equipment Manufacturers should prepare the battery disconnect switch, harness and other necessary parts for installing battery disconnect switch.
- The bracket for installing disconnect switch is installed on chassis. See the figure below for detail of installation position.



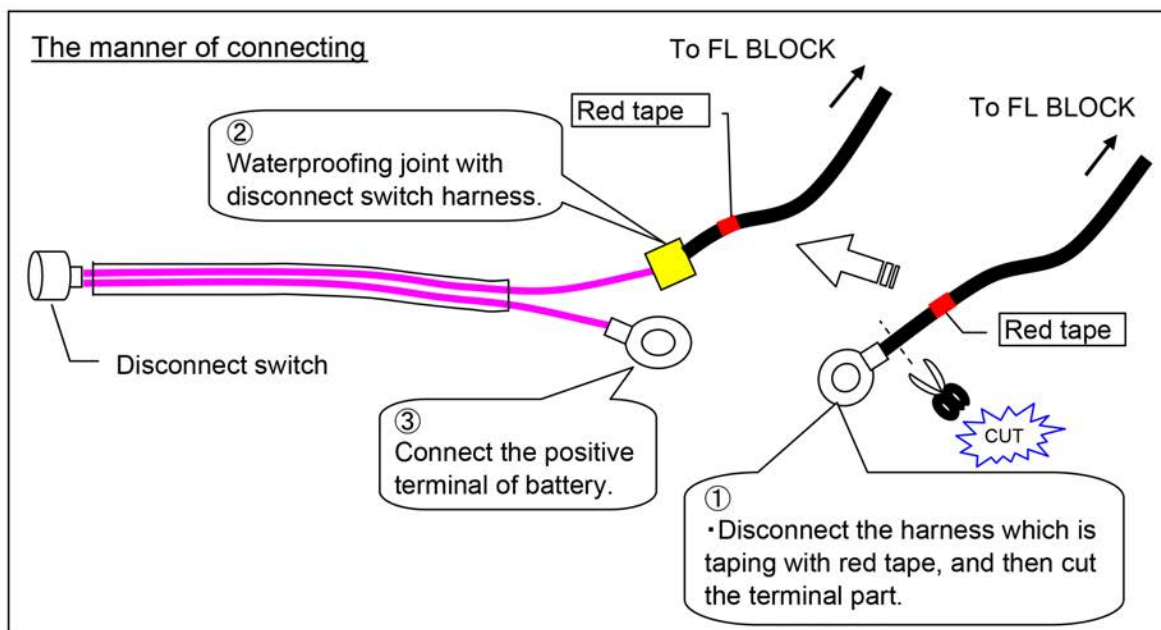
- Should make a harness as figure below.



- Turn the starter switch to "LOCK" position, and should wait at least 10 minutes, then disconnect the negative terminal of battery.
- Disconnect the harness which is taping with red tape.



- Install the disconnect switch harness between the positive terminal of battery and harness which is taping with red tape. See below the manner of connecting.
Tightening torque of terminal nut : $108 \pm 10 \text{ kgf} \cdot \text{cm}$ ($8.1 \pm 0.7 \text{ lb} \cdot \text{ft}$)
Should use 10 sq or more for harness.
The joint parts needs waterproofing.



- Should tighten the earth cable with negative terminal of battery.

[Note]

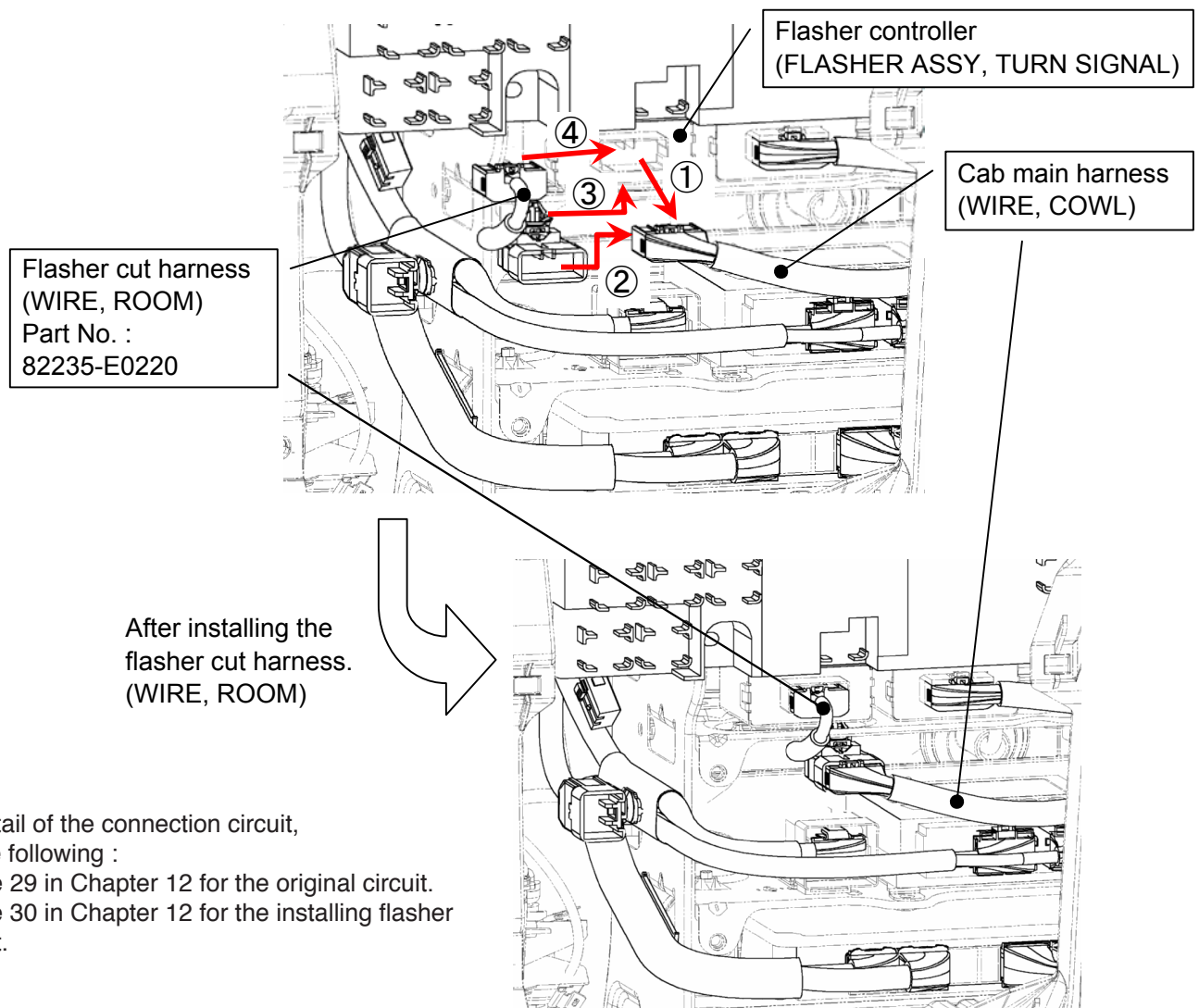
- The power circuit is cut off by this alteration but after-run circuit of DCU is worked for keeping function of DCU.
- Refer to "WELDING WORK" and "DEF- SCR SYSTEM" in Chapter 4 when welding operation, etc.

10. INSTALLATION OF FLASHER CUT HARNESS

Be sure to observe the following instructions when separating rear stop lamp and turn signal lamp.

Procedure for installing flasher cut harness

- Prepare the flasher cut harness below which is available as a spare parts.
Part No. : 82235-E0220
- Disconnect the cab main harness from flasher controller.
*Flasher controller is installed in ECU lack of instrument panel light side.
- Connect the flasher cut harness to cab main harness.
- Install the connector clamp of flasher cut harness to under the tray.
- Connect the flasher cut harness to flasher controller.



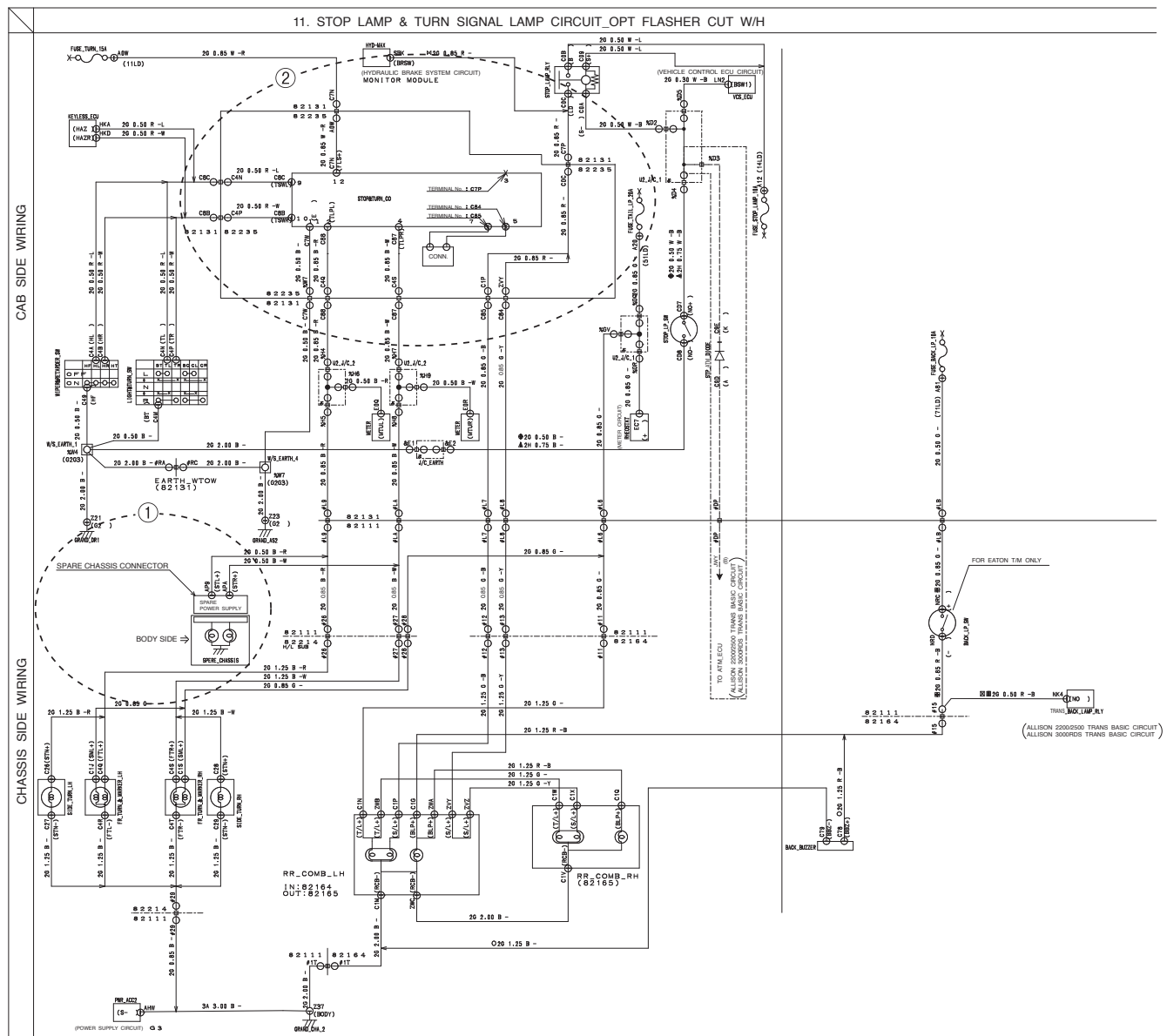
[CAUTION]

The rear turn lamp connection will be cut out after this modifying, therefore, the following additional modifying is required.

Method of Taking Out The Rear Turn Lamp Circuit.

- When usage electric current value of each terminal of right and left is 0.5A/12V or less, connect to the turn signal switch circuit of spare chassis connector. ①
See "Connector Mark O", page 18 and page 23 in Chapter 7 for details connector.
(In this case, it can be connected directly to the circuit.)
- When usage electric current value of each terminal of right and left is more than 0.5A/12V, take out the rear side turn lamp circuit from the terminal C84 and C85 of the stop & turn controller. ②
See "Connector Mark K", page 17 and page 22 in Chapter 7 for details connector, and the next page is showing connecting details.
(Since the output of the controller is disconnected by changing the output method of the stop lamp.)

<Summary Circuit>



Connecting Details