Body/equipment mounting directives

CANTER

for FE Gas gasoline-engined vehicle

FUSO

Model Year 2019

Body/equipment mounting directives

FE Gas
gasoline-engined vehicle

MITSUBISHI FUSO TRUCK & BUS CORPORATION
KAWASAKI, JAPAN

Contents

1 Introduction

MITSUBISHI FUSO TRUCK & BUS CORPORATION, as the manufacturer of MITSUBISHI FUSO vehicles, publishes this body/equipment mounting directive to provide body manufacturers with important technical information about the basic vehicle. This information must be observed by the body manufacturer in the production of bodies and equipment, fittings and modifications for MITSUBISHI FUSO vehicles.

Due to the large number of body manufacturers and body types, MITSUBISHI FUSO TRUCK & BUS CORPORATION cannot take into account all the possible modifications to the vehicle, e.g. performance, stability, load distribution, center of gravity and handling characteristics, that may result from the design of attachments, bodies, equipment or modifications. For this reason, MITSUBISHI FUSO TRUCK & BUS CORPORATION can accept no body manufacturer liability for accidents or injuries sustained as a result of such modifications to the vehicles if such modifications have a negative impact on the overall vehicle. Accordingly, MITSUBISHI FUSO TRUCK & BUS CORPORATION will only assume liability as vehicle manufacturer within the scope of the design, production and instruction services which it has performed itself.

The body manufacturer is bound to ensure that its bodies and equipment, fittings and modifications are themselves not defective, nor capable of causing defects or hazards to the overall vehicle. If this obligation is violated in any way, the body manufacturer shall assume full product liability. The body/equipment mounting directives enable MITSUBISHI FUSO TRUCK & BUS CORPORATION to instruct the body manufacturer about important aspects that must be observed when mounting its bodies and equipment, fittings and modifications.

These body/equipment mounting directives are primarily intended for the professional manufacturers of bodies, equipment, fittings and modifications for our vehicles. As a result, these body / equipment mounting directives assume that the body manufacturer has suitable background knowledge. If you intend to mount attachments, bodies and equipment on or carry out modifications to our vehicles, please be aware that certain types of work (e.g. welding work on load-bearing components) may only be carried out by qualified personnel. This will avoid the risk of injury while also ensuring that the degree of quality required for the attachments, bodies, equipment and modifications is given.

<For USA, Canada>

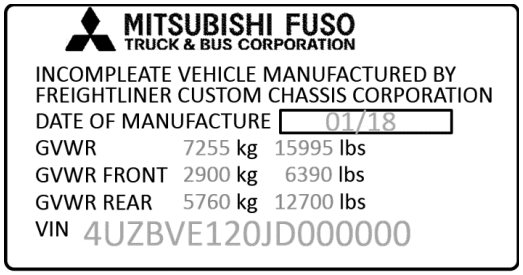
List of FMVSS and CMVSS applicable to MFTBC trucks with GVWR of more than 10,000 lbs. manufactured after Jan. 1, 2007 is shown below.

FMVSS/CMVSS NO.	Title
101	Controls and Displays
102	Transmission Shift Lever Sequence, Starter Interlock and Transmission Braking Effect
103	Windshield Defrosting and Defogging Systems
104	Windshield Wiping and Washing Systems
105	Hydraulic Brake Systems
106	Brake Hoses
108	Lamps, Reflective Devices and Associated Equipment
111	Rearview Mirrors
115	Vehicle Identification Number (CMVSS only)
116	Motor Vehicle Brake Fluids
119	New Pneumatic Tires for Vehicles other than Passenger Cars
120	Tire Selection and Rims for Motor Vehicles other than Passenger Cars
124	Accelerator Control Systems
205	Glazing Materials
206	Door Locks and Door Retention Components
207	Seating Systems
208	Occupant Crash Protection
209	Seat Belt Assemblies
210	Seat Belt Assembly Anchorages
302	Flammability of Interior Materials
1100	Vehicle Emissions (CMVSS only)
1106	Noise Emission (CMVSS only)

In addition to the Incomplete Vehicle Document, a Safety conformance Label as shown to the right is affixed to all vehicles when shipped from the factory. This label contains all the FMVSS numbers applicable not only to chassis-cabs but also to completed vehicles if they are completed in accordance with the Incomplete Vehicle Document.

This label is affixed to the door latch post of the left-hand side door.

DO NOT COVER OVER WITH ANY OTHER LABEL.



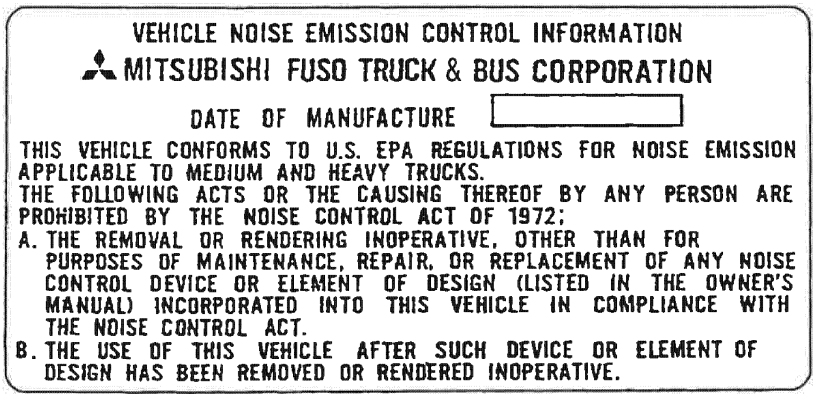
NOISE REGULATIONS

The U.S. Environmental Protection Agency (EPA) has established noise emission standards applicable to medium and heavy trucks in excess of 10,000 lbs. GVWR manufactured after January 1, 1988 (40 CFR §205.52), requiring that they must conform to an 80 dB (A) maximum noise level when tested pursuant to EPA's test procedures.

MFTBC trucks are built in conformance with EPA Noise Emission Standards. Modified or altered vehicles may increase in noise emissions; compliance with applicable noise standards are the responsibility of the subsequent stage manufacturer.

A sample of the Noise Emission Conformity Label is shown below. This label is affixed to all the vehicles when shipped from the factory.

DO NOT COVER OVER WITH ANY OTHER LABEL.



This label is affixed to the left-hand side door panel.

1.1 The aim of these directives

These directives serve as instructions for the manufacture of attachments, bodies, equipment and modification to other make bodies and major assemblies. These directives are divided into 10 interlinked chapters to help you find the information you require more quickly:

Additional information

The index, in PDF format, is linked to help you find the information you require quickly.

Make absolutely sure that you observe the technical threshold values selected in Section 4 as planning must be based on these values.

Section 6 "Modifications to the basic vehicle" and Section 7 "Construction of bodies" represent the main source of technical information contained in these body/equipment mounting directives.

1.1 The aim of these directives

⚠ Risk of accident

Before installing any attachments, special-purpose bodies, equipment or carrying out any modifications to the basic vehicle and/or its assemblies, you must read the relevant sections of the Owner's Handbook, as well as the operating and assembly instructions issued by the manufacturer of the accessories and items of optional equipment.

You could otherwise fail to recognize dangers, which could result in injury to yourself or others.

The instructions listed herein must be observed in full to maintain the operational reliability and road safety of the chassis and for observance of material defect claims.

Illustrations and schematic drawings are examples only and serve to explain the texts and tables.

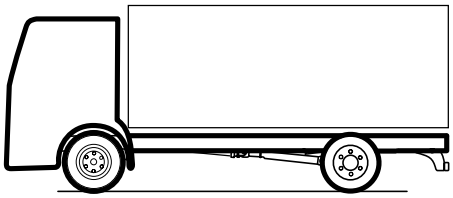
References to regulations, standards, directives etc. are given in keywords and serve for information only.

Additional information is available from any

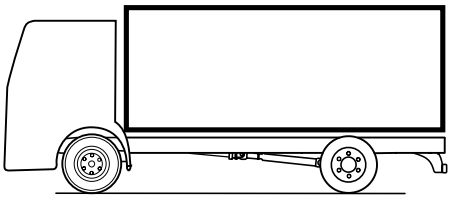
MITSUBISHI FUSO authorized Distributer

Your
MITSUBISHI FUSO TRUCK & BUS CORPORATION

The illustrations below explain the difference between "Basic vehicle" and "Body":



Basic vehicle



Body

1.2 Symbols

The following symbols are used in these directives:

Risk of accident

A warning draws your attention to possible risks of accident and injury to yourself and others.

Environmental note

An environmental note gives you tips on the protection of the environment.

Property damage

This note draws your attention to possible damage to your vehicle.

Additional information

This note points out any additional information.

▷ page

This symbol indicates the page on which you will find further information on the subject. These pages are cross-linked in the PDF file.

1.3 Vehicle safety

⚠ Risk of accident and injury

The use of parts, assemblies or conversion parts and accessories which have not been approved may jeopardize the safety of the vehicle.

Before installing any attachments, special-purpose bodies, equipment or carrying out any modifications to the basic vehicle and/or its assemblies, you must read the relevant sections of the Owner's Handbook, as well as the operating and assembly instructions issued by the manufacturer of the accessories and items of optional equipment.

You could otherwise fail to recognize dangers, which could result in injury to yourself or others.

Official acceptance by public testing bodies or official approval does not rule out safety hazards.

In many countries, parts that make extensive changes to the vehicle can invalidate the general operating permit. Specifically, this concerns parts which:

- change the vehicle type approved in the general operating permit
- could endanger road users
- could adversely affect safety exhaust emissions, or noise levels

Additional information

Make absolutely sure that you comply with federal, state, and local regulations and codes as attachments, bodies, equipment on or modifications to the vehicle will change the vehicle type approved and may invalidate the general operating permit.

Notes on vehicle safety

MITSUBISHI FUSO recommends

using appropriate parts only for each particular vehicle model.

1.4 Operational reliability

⚠ Risk of accident

Before installing any attachments, special-purpose bodies, equipment or carrying out any modifications to the basic vehicle and/or its assemblies, you must read the relevant sections of the Owner's Handbook, as well as the operating and assembly instructions issued by the manufacturer of the accessories and items of optional equipment.

You could otherwise fail to recognize dangers, which could result in injury to yourself or others.

Work incorrectly carried out on electronic components and their software could prevent this equipment from working correctly. Since the electronic systems are networked, this might also affect systems that have not been modified.

Malfunctions in the electronic systems could seriously jeopardize the operating safety of the vehicle.

1.5 Accident prevention

Observe the requirements and precautions set out in this manual when carrying out body-building work or modification work.

The body, the attached or installed equipment and any modifications must comply with the applicable laws and ordinances as well as work safety or accident prevention regulations, safety rules and accident insurer requirements.

All technical means shall be used to avoid operating conditions that may be unsafe or liable to cause an accident.

All federal, state, and local regulations and codes and registration requirements must be complied with.

The manufacturer of the attachment, body, equipment or conversion or the device manufacturer is responsible for compliance with these laws and regulations.

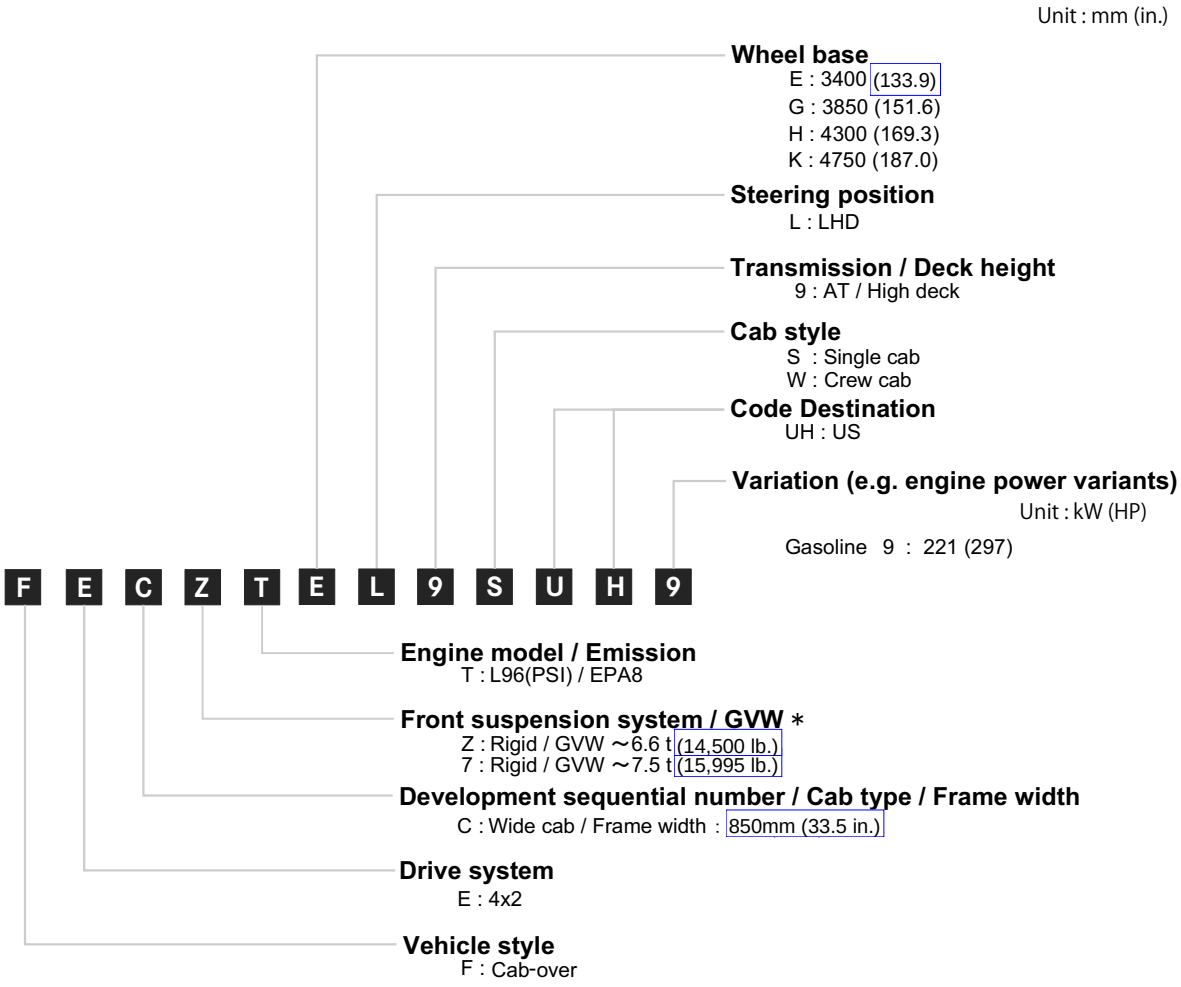
1.6 Note on copyright

All the text, illustrations and data contained in these body/equipment mounting directives are protected by copyright.

If you have any questions, please contact the department responsible ▷ page 14.

2.1 Vehicle and model designations

2.1.1 Model coding system



***The maximum GVW varies depending on vehicle types.**

Before mounting necessary body parts/equipment, check the model designation and specifications of your vehicle ▷ page 199.

model code / model name
FECZTS/FE140 Gas Single Cab
FEC7TS/FE160 Gas Single Cab
FEC7TW/FE160 Gas Crew (Double) Cab

2.2 Technical advice and contact department

The following department can provide support for technical and design engineering matters.

Contacts	MFTA Product Applications Department
Telephone:	856-467-3958
Telefax:	856-467-5553
Postal address:	Mitsubishi Fuso Truck of America, Inc. 2015 Center Square Road Logan Township, NJ 08085

2.3 Product safety

Both the vehicle manufacturer and the body manufacturer must always ensure that they introduce their scopes into the market in a safe condition and that third parties are not at risk of any safety hazard. If this is not adhered to they may be subject to civil, criminal and public law consequences. Every manufacturer is liable for the products it manufactures.

From this, it follows that the vehicle body/conversion manufacturer therefore also bears responsibility for the following:

- the operating and road safety of the body
- the operating and road safety of parts and modifications
- testing and maintaining the operating and handling safety of the vehicle after the body/equipment is mounted (the body and/or equipment must not have a negative effect on the driving, braking or steering characteristics of the vehicle)
- influences of parts on or modifications to the chassis
- consequential damage resulting from the body, attachment, equipment or modification
- consequential damage resulting from retrofitted electrical and electronic systems
- maintaining the operational reliability and freedom of movement of all moving parts of the chassis after the body/equipment is mounted (e.g. axles, springs, propeller shafts, steering, transmission linkage, etc.) even in the case of diagonal torsion between the chassis and the bodies

2.3 Product safety

Be careful of the following points when carrying out body-building or modification work.

Safety design

- Securing adequate safety and reliability, and preparing safety devices (design which is fail-safe and takes account of misoperation and misuse, safety evaluation)
- Storing technical material, drawings and documents during development

Manufacturing quality

- Manufacturing according to the drawings in order to prevent errors, missing parts and defective assembly, and secure high manufacturing quality
- Implementing a quality confirmation inspection, and storing the records of the inspection
  Use the post-body-building/modification inspection sheet.

Preparing an instruction manual and warning indications

- Instruction manual
  Concrete indication of the effect of incorrect operation on the human body, the vehicle, and other locations (elimination of indications that are likely to cause misunderstanding, and also ambiguous expressions)
- Warning indications
  To ensure that the vehicle is used as safely as possible, warning indications must use expressions that are easy to understand and letters that are large enough to read easily, include pictures, and be applied to locations that are readily visible to the driver.

2.4 Ensuring traceability

Hazards in your body/equipment which become known after delivery may necessitate supplementary measures in the market (customer notification, warnings, recalls). In order to make these measures as efficient as possible, your product must be traceable after delivery.

For this purpose and to enable federal or state vehicle registers to be used for determining which owners are affected, we advise you to promptly file the serial number/identification number of your equipment/ add-on part linked to the vehicle identification number for the truck in your databases. Similarly, it is also advisable to store the addresses of your customers for this purpose and to grant subsequent purchasers the opportunity to register.

2.5 Mitsubishi three diamonds and Fuso emblem

The Mitsubishi three diamonds and Fuso emblem are owned or controlled by MITSUBISHI FUSO.

They must not be removed or affixed in another position.

Mitsubishi three diamonds and Fuso emblems supplied separately must be attached at the points specified by MITSUBISHI FUSO.

Overall appearance of the overall vehicle

If the vehicle fails to comply with the appearance and quality standards as required by MITSUBISHI FUSO TRUCK & BUS CORPORATION, the trademarks such as the Mitsubishi three diamonds and Fuso emblem must be removed.

Third-party trademarks

- may not be affixed next to MITSUBISHI FUSO trademarks

Binding ruling

The MITSUBISHI FUSO Brand Trademark Directive governs the use of trademarks by body manufacturers on integrated bodies mounted on chassis. MITSUBISHI FUSO TRUCK & BUS CORPORATION reserves the right to prohibit the body manufacturer from using MITSUBISHI FUSO trademarks in the event of any violations to this body/equipment mounting directive, including the trademark directive.

- If you have any question, contact the department responsible ▷ page 14.

2.6 Trademarks

Labels and marks must be applied to the predetermined positions.

For details of the location and method of applying labels and marks, refer to "10.14 Other Equipment" ▷ page 341.

2.7 Recycling of components

Environmental note

When planning attachments, bodies, equipment and modifications, the following principles for environmentally-compatible design and material selection shall be taken into account.

Materials with risk potential, such as halogen additives, heavy metals, asbestos, CFCs and CHCs, are to be avoided.

- It is preferable to use materials which permit recycling and closed material cycles.
- Materials and production processes are to be selected such that only low quantities of waste are generated during production and that this waste can be easily recycled.
- Plastics are to be used only where they provide advantages in terms of cost, function or weight.
- In the case of plastics, and composite materials in particular, only compatible substances within one material family are to be used.
- For components which are relevant to recycling, the number of different types of plastics used must be kept to a minimum.
- It must be assessed whether a component can be made from recycled material or with recycled elements.
- It must be ensured that components can be dismantled easily for recycling, e.g. by snap connections or predetermined breaking points. These components should generally be easily accessible and should permit the use of standard tools.
- Service products must be capable of being removed simply and in an environmentally responsible manner by means of drain plugs, etc.
- Wherever possible, components should not be painted or coated; colored plastic parts are to be used instead.
- Components in areas at risk from accidents must be designed in such a way that they are damage-tolerant, repairable and easy to replace.

2.8 Quality system

World-wide competition, increased quality standards demanded by the customer from the product as a whole, national and international product liability laws, new organizational forms and rising cost pressures make efficient quality assurance systems a necessity in all sectors of the automotive industry.

For the reasons quoted above, MITSUBISHI FUSO TRUCK & BUS CORPORATION urgently advises body manufacturers to set up a quality management system with the following minimum requirements:

- Does the quality management system clearly define responsibility and authority?
- Is there a description of processes/workflows?
- Are the contracts checked/is the feasibility of construction checked?
- Are product checks on the basis of specified instructions carried out?
- What provisions are made for the handling of faulty products?
- Are the inspection results documented and archived?
- Do all employees concerned have currently valid proof of the qualification required?
- Is the test equipment systematically monitored?
- Is there a system for labelling materials/parts?
- Are quality assurance measures carried out at suppliers?

3.1 Selecting the chassis

Property damage

When planning attachments, bodies, equipment or modification work, the selected vehicle must be checked to verify whether it fulfills the necessary requirements.

In order to ensure safe operation of the vehicle, it is essential to choose the chassis and equipment carefully in accordance with the intended use.

Along with the selection of the correct vehicle version, the required series and special equipment such as

- Wheelbase
- Engine/Transmission
- Power take-offs
- Axle ratio
- Position of the center of gravity
- Legal registration requirements (e.g. underride guard)
- Permissible and technical gross vehicle and axle weights

should be taken into consideration and be appropriate for the intended use.

Property damage

Observe the Model. The axle weight designation or the load capacity of the tires has only limited relevance to the gross weight of the vehicle.

Additional information

The non-availability of a vehicle version may be an indication that the vehicle is not suitable for the intended application.

3.2 Vehicle modifications

⚠ Risk of accident

Do not carry out any modifications to major assemblies (steering, brake system etc.). Any modifications to the steering and the brake system may result in these systems malfunctioning and ultimately failing. The driver could lose control of the vehicle and cause an accident.

Alterations to the basic vehicle are permitted only within the framework of the procedures described in this body/equipment mounting directive.

The vehicles are shipped after adequate consideration has been given to safety, reliability and mantainability. Ensure that these functions remain intact after body-building or modification work.

The vehicles must still comply with the regulation of the country where the vehicles are used after modifications have been carried out.

Do not change critical safety parts or noise reduction parts because this may cause a serious accident and is also illegal.

When selecting body-building or modification parts, give consideration to strength, robustness and safety, and also strive to minimize weight.

Install body-building or modification parts in such a way that visibility in the forward direction is not impaired.

Take care not to damage or impair the function of parts on the chassis side.

Upon completion of the work, check to see if the manufacturing quality conforms to the design and also if the specified performance and functions have been secured.

Drive the vehicle and confirm that there is no unusual vibration or noise and also that the vehicle performance is stable.

If the method of handling or maintaining the vehicle changes as a result of carrying out body building or modification, prepare an instruction manual and keep a copy in the vehicle, and also apply warning labels to the vehicle.

The body or equipment manufacturer must apply an Intermediate or Final Stage Manufacturer's Label and inform the officially recognized approval authority or inspector of any modifications to the chassis when the vehicle is inspected.

Following all work on the brake system, i.e. even if merely disassembling parts, a complete check (operation, effectiveness and visibility) of the entire brake system must be performed.

3.3 Dimensions, weights, overall vehicle height

Risk of accident

The vehicle tire load capacity may not be exceeded by overloading the vehicle beyond its specified gross vehicle weight. The tires could overheat and suffer damage. This could cause an operator to lose control of the vehicle and cause an accident with possible injury or death.

Information on the permissible axle loads can be found in this manual and on the vehicle model plate.

All legal provisions governing the permissible vehicle length, height, and width must be taken into account when planning bodies.

Additional information

Information about changes in weight is available from the department responsible ▷ page 14.

Dimensions and weight details can be found in the drawings and technical data. They are based on a vehicle that is fitted with standard equipment. Weight tolerances of ±3% in production must be taken into consideration.

The permissible axle loads and the maximum permissible gross vehicle weight specified in the technical data may not be exceeded.

The technical data can be found in the vehicle documents, on the vehicle model plate.

3.4 About vehicle body incline

- When mounting the rear body onto the chassis, take care to evenly balance weight on the left and right sides. If there is a difference in weight between the left and right sides, adjust by adding counterweights or spacers on the sub-frame. Modification of axles suspension, including removal or replacement of individual spring leaves, is prohibited.
  Also, use the chassis height adjustment shims (4.5mm {0.18in.} thickness) set on the front and rear springs.

Shim

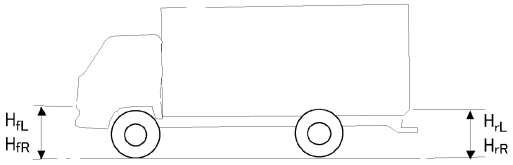
	MFTBC Part No.
Front	MC110153
Rear	MB161776

Spacer Specification

Material	Thickness (mm{in.})	Finish
SS400(JIS G3101)	4.5 {0.18}	Painting for rust prevention
E275A(ISO 630)		
S275JR/JO(EN10025)		
SUP9(JIS G4801)		
55Cr3(ISO683-14)		
or equivalent		

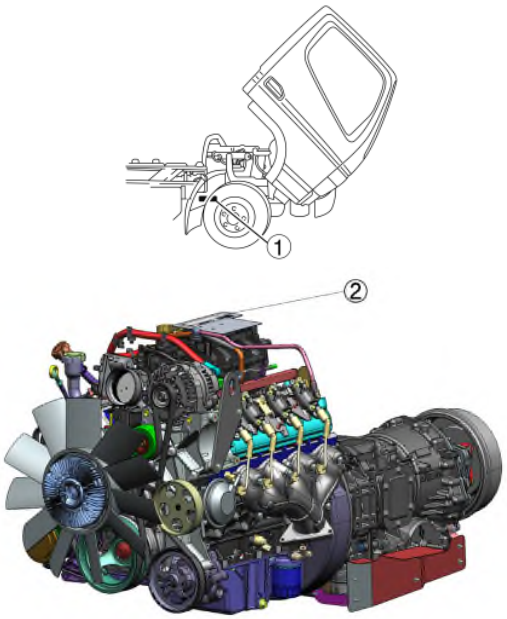
- The following are target reference values for tilting the body of an assembled vehicle.
  - Left-right weight difference
    $|HfL - HfR| \leq 10mm$ {0.39in.}
    $|HrL - HrR| \leq 10mm$ {0.39in.}
  - Front-back deviation
    $|(HfL - HfR) - (HrL - HrR)| \leq 10mm$ {0.39in.}

HfL: Center height of headlamp (left side)
HfR: Center height of headlamp (right side)
HrL: Lower height of rear end of body outer panel (left side)
HrR: Lower height of rear end of body outer panel (right side)



3.5 Vehicle type identification data

If presented at the time of repair or parts order, the chassis number ① and engine number ② will facilitate the quick and smooth processing of your requests.



3.5.1 Vehicle identification number (V.I.N.)

The vehicle identification number is indicated on the left frame, near the front wheel.

2019 VEHICLE IDENTIFICATION NUMBER FOR HEAVY DUTY TRUCK
(MITSUBISHI FUSO TRUCK AND BUS CORPORATION)

4 U Z B Y G 1 1 0 K G 1 2 3 4 5 6

1ST : WMI Code
4: USA

1ST, 2ND and 3RD : WMI Code
UZ: INCOMPLETE VEHICLE

4TH : GVW/BRAKE SYSTEM
A: 10,001 - 14,000 lbs / HYDRAULIC
B: 14,001 - 16,000 lbs / HYDRAULIC
C: 16,001 - 19,500 lbs / HYDRAULIC

5TH : LINE
V: FEC7TS FE160 SINGLE CAB
W: FEC7TW FE160 CREW CAB
X: FEC9TS FE160 SINGLE CAB
Y: FECZTS FE140 SINGLE CAB

6TH : SERIES (WHEELBASE)
E: 3.2 - 3.49 m
G: 3.8 - 4.09 m
H: 4.1 - 4.39 m
K: 4.7 - 4.99 m

7TH : CAB/CHASSIS TYPE and MAKE
1 : CHASSIS CAB for MITSUBISHI FUSO

8TH : ENGINE
1 : 6.0 L GASOLINE

9TH : CHECK DIGIT

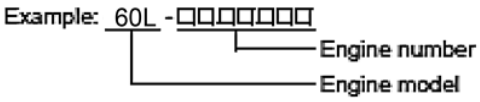
10TH : MODEL YEAR
K : 2019

11TH : PLANT
G : USA/ GAFFNEY

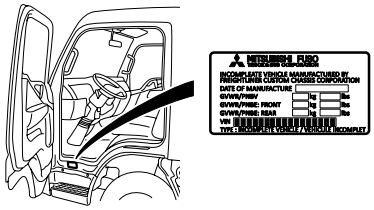
12TH – 17TH : PLANT SEQENTIAL NUMBER

3.5.2 Engine number

The engine number is indicated on the front side of the cylinder head.

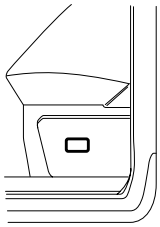


3.5.3 Nameplate



Y03304

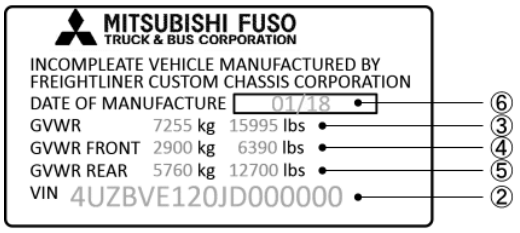
<Crew-cab model>



Z11769

The nameplate shows the following.

<for TF Eagle>



② Vehicle identification number
③ Maximum permitted laden mass of the vehicle
④ Maximum permitted load mass for front axle
⑤ Maximum permitted load mass for rear axle
⑥ Month and year of manufacture

3.6 Tires

The body manufacturer must ensure that:

- the largest permissible factory-authorized tires can be fitted.
- the distance between the tire and the mudguard or wheel housing is sufficient even when snow or anti-skid chains are fitted, with the suspension fully compressed (including any twist) (Adherence to valid regulations).
- that the relevant information in the drawings is observed.

If the option of fitting snow and anti-skid chains cannot be guaranteed, the operator should be informed by the body manufacturer (operating instructions).

⚠ Risk of accident

Exceeding the specified tire load-bearing capacity or the permissible maximum tire speed can lead to tire damage or failure. The operator could lose control of the vehicle, and cause an accident and injuries.

For this reason, only fit tires of a type and size approved for your vehicle and observe the tire load-bearing capacity required for your vehicle. Observe tire speed index.

Comply with federal, state, and local regulations and codes governing the approval of tires. These regulations may define a specific type of tire for your vehicle or may forbid the use of certain tire types which are approved in other countries. MFTA does not offer optional tire sizes for any model.

! Property damage

If you have other wheels fitted

- the brakes or components of the suspension system could be damaged
- wheel and tire clearance can no longer be guaranteed
- the brakes or components of the suspension system can no longer function correctly.

3.7 Bolted and welded connections

Risk of accident

Do not modify any bolted connections that are relevant to safety, e.g. that are required for wheel alignment, steering or braking functions.

When unfastening bolted connections make sure that, when work is complete, the connection again corresponds with the original condition.

Welding work on the chassis/body may only be carried out by trained and qualified personnel.

The body, the attached or installed equipment and any modifications must comply with the applicable laws and ordinances as well as work safety or accident prevention regulations, safety rules and accident insurer requirements.

Additional information

Further information on bolted and welded connections can be found in Section 5 "Damage prevention" ▷ page 54 and Section 6 "Modifications to the basic vehicle" ▷ page 78.

3.7.1 Nuts and Bolts for Use on Frame

Pay attention to the following when removing nuts and bolts used on a standard vehicle.

- Target Locations
  Nuts and bolts used for tightening frame cross-members and side members (including nuts and bolts used for tightening the fuel tank and battery together)

  How to distinguish nuts and bolts

  Bolt (8T) .... Identifying letter "8"

  Nut (6T) .... Identification at diagonal corner

- Handling of nuts and bolts
  (a) Bolts that have been removed cannot be used again. Tighten again using new bolts having the same strength.
  (b) Nuts and bolts must be tightened to the following torques:
  M10: 60 to 80 Nm {44 to 59 ft.lbs, 6.1 to 8.2 kgf.m}
  M12: 98 to 120 Nm {72 to 89 ft.lbs, 10.0 to 12.0 kgf.m}

- In particular, cross-members must be tightened when bolts used for tightening cross-members together are removed for moving the fuel tank and battery.

3.7.2 Welded connections

Welding work on the chassis/body may only be carried out by trained and qualified personnel.

Property damage

Parts which must not be welded:

- Assemblies such as the engine, transmission, axles, etc.
- The chassis frame (except frame modifications).

Additional information

Further information on bolted and welded connections can be found in Section 5 "Damage prevention" ▷ page 54 and
Section 6 "Modifications to the basic vehicle" ▷ page 78.

3.8 Soundproofing

The following modifications can lead to noise problems:

- Change of engine model
- Change of reduction gear
- Change of transmission gear
- Replacement of tires with non-registered ones
- Change of exhaust pipe diameter, clamping position or muffler size
- Change of radiator cooling fan size, pitch, number of blades or rotational speed
- Change of air intake duct diameter, shape or length
- Modifications of shielding cover around the engine which can lead to reduced shielding performance or increased ambient temperature inside the shielding cover

Do not modify the vehicle except for those indicated in the body/equipment mounting directives.
Shielding covers around the engine and transmission, muffler with combined exhaust emission control device, and exhaust pipe between exhaust manifold and muffler with combined exhaust emission control device are components to be noise-proofed.
Therefore, never attempt to modify them.
Take utmost care not to damage these components if they are to be removed once and then reinstalled for facilitating mounting works.

- Noise-insulating parts fitted as standard must not be removed or modified.
- The level of interior noise must not be adversely affected.

Additional information

Comply with all national regulations and directives.

3.9 Exhaust system

The exhaust system must not be modified.
If modification is unavoidable, consult with the department in charge of the measures ▷ page 14.

It is a violation of federal law to alter exhaust pipe, aftertreatment system, or other emission-related components, in any way that would bring the engine/ vehicle out of compliance with certification requirements.

Property damage

The original exhaust system mounting, by this we mean the bracket components including frame-mounted castings, may not be modified. Modifications can lead to damage to the exhaust system.

Additional information

Further information on exhaust system can be found in Section 6 "Exhaust system" ▷ page 107.

3.9.1 EPA8

Environmental note

Modifications carried out incorrectly to the routing of the exhaust system upstream of the catalytic converter can result in the leakage of untreated exhaust gas into the environment.

To satisfy the EPA8 emissions legislation, exhaust aftertreatment system is used, which is based on Selective Catalytic Converter.
This technology requires components for which installation space is needed in the vehicle.

3.9.2 The exhaust system

The exhaust system consists of:

- Oxygen Sensor
- Exhaust Catalyst
- Muffler

3.10 Maintenance and repairs

⚠ Risk of accident and injury

Always have maintenance work for installed body or equipment performed at a qualified specialist workshop possessing the required expertise and tools in order to perform the necessary work.

MITSUBISHI FUSO recommends a MITSUBISHI FUSO authorized Distributer for all chassis-related service work.

It is absolutely essential that all safety-relevant work and all work on safety-relevant systems is performed by a qualified specialist workshop.

Before performing any maintenance work, always read the technical documentation, such as the Instruction Manual and the workshop information. Always have all maintenance work performed at the correct time. If this is not done, malfunctions or failures may occur in systems that could be relevant to safety. This could make you cause an accident, which could result in injury to yourself or others.

Maintenance and repair of the vehicle should not be made unnecessarily difficult by the body or other installed equipment.

Maintenance points and major assemblies must be easily accessible.

- The Instruction Manual must be followed and supplemented as necessary.
- Stowage boxes must be fitted with maintenance flaps or removable rear panels.
- The battery compartment must be sufficiently ventilated, with provision for air to enter and exit.
- Check the condition and capacity of batteries and service them in accordance with the manufacturer's specifications ▷ page 35.

Any additional expenses arising from the body in connection with warranty, maintenance or repair will not be borne by MFTA or its authorized dealer.

3.10.1 Maintenance instructions

The following must be observed by the body manufacturer before delivery of the vehicle:

- Due date of inspection
- The load sensing valve (LSV) must be set.
- Check the condition and capacity of batteries and service them in accordance with the manufacturer's specifications.
- Check the headlamp setting or have this checked at a qualified specialist workshop.
- Retighten the wheel nuts to the specified torque.
- Instruction Manual and directives for maintenance of attachments, bodies, installations or conversions, which have been installed by the body manufacturer, must be provided with the vehicle in the language of the country of use.
- MITSUBISHI FUSO recommends adapting to each individual body the scope of maintenance work which has to be carried out on the body, co-ordinating it by means of the valid MITSUBISHI FUSO service systems. This applies both to the scope and type of service work, and for determining the service due dates for servicing intervals based on time elapsed and distance covered.

3.10.2 Preparation for storing the vehicle

Property damage

For vehicle deliveries in winter, to prevent paint, finish, and surface damage, please clean the vehicle at the earliest opportunity. Particular attention should be paid to the transmission housing and light-alloy wheels.

The battery may run down if the vehicle is stored for a long time with the key left in the key cylinder, so remove the key before storing the vehicle.

Storage in an enclosed space:

- Clean the overall vehicle.
- Check the oil and coolant levels.
- Inflate the tires to 50 kPa {7.3 psi, 0.5 kgf/cm^2} above the specified tire pressures.
- Release the handbrake and chock the wheels.
- Disconnect the battery and grease battery lugs and terminals.

Storing the vehicle in the open (< 1 month):

- Carry out the same procedure as for storing in an enclosed space.
- Close all air inlets and set the heating system to "Off".

Storing the vehicle in the open (> 1 month):

- Carry out the same procedure as for storing in an enclosed space.
- Fold the windscreen wipers away from the windscreen.
- Close all air inlets and set the heating system to "Off".
- Remove the battery and store it in accordance with the manufacturer's specifications.

Maintenance work on stored vehicles (in storage for > 1 month):

- Check the oil level once a month.
- Check the coolant once a month.
- Check the tire pressures once a month.
- Remove the battery.

Removing the vehicle from storage:

- Check the fluid levels in the vehicle.
- Correct the tire pressures to the manufacturer's specifications.
- Check the battery charge and install the battery.
- Clean the overall vehicle.

3.10.3 Battery maintenance and storage

To avoid damage to the battery, disconnect the battery if the vehicle is to be immobilized for a period of longer than 1 week.

If the vehicle is immobilized for periods of longer than 1 month, remove the battery and store it in a dry place at temperatures of between 0 °C {32 °F} to 30 °C {86 °F}.

Store the battery in an upright position.

The battery charge must be kept above 12.55 V at all times.

Property damage

If the battery voltage drops below 12.1 V, the battery may become damaged and have to be replaced.

Leaving the vehicle parked up for long periods of time can lead to battery damage. This can be avoided by disconnecting the battery and storing it appropriately.

3.10.4 Work before handing over the modified vehicle

The manufacturer must confirm the work and modifications carried out by making an entry in the vehicle or job file.

Checking the overall vehicle

Check the vehicle for perfect condition. All damage must be repaired.

If it is not known how long a vehicle equipped with a hydraulic clutch operating system has been in storage, the brake fluid must be renewed.

Checking the batteries:

Test the battery charge before handing over the vehicle.

Checking the tires

Before handing over the vehicle, check that the tires are inflated to the specified pressure and check the tires for damage. Damaged tires must be replaced.

Checking wheel alignment

When equipment, attachments and bodies have been mounted, it is recommended to have the toe setting checked by a qualified specialist workshop. MFTA recommends a MITSUBISHI FUSO authorized Distributer for this work.

It is absolutely essential that all safety-relevant work and all work on safety-relevant systems be performed by a qualified specialist workshop.

Additional information

Further details are available from any MITSUBISHI FUSO authorized Distributer.

3.11 Optional equipment

⚠ Risk of accident and injury

The use of parts, assemblies or conversion parts and accessories which have not been approved may jeopardize the safety of the vehicle.

Before installing any attachments, special-purpose bodies, equipment or carrying out any modifications to the basic vehicle and/or its assemblies, you must read the relevant sections of the vehicle Owner's Manual, as well as the operating and assembly instructions issued by the manufacturer of the accessories and items of optional equipment.

You could otherwise fail to recognize dangers, which could result in injury to yourself or others.

MITSUBISHI FUSO recommends using equipment available as option codes to adapt the vehicle to the body optimally.

All code-specific special equipment is available from your MITSUBISHI FUSO authorized dealer or from body manufacturer advisors ▷ page 14.

Optional equipment (e.g. , auxiliary tanks, toolboxes, etc.) or retrofitted equipment increases the unladen weight of the vehicle.

When chassis are fitted with bodies or accessory equipment, the frame height can change considerably in both the laden and unladen state.

The actual vehicle weight and axle loads must be determined by weighing before mounting.

Not all optional equipment can be installed in any vehicle without problems. This applies, in particular, for retrofitted equipment because the installation space may already be occupied by other components or the special equipment may require other components.

If the current value falls outside the specified range when body building and modification work are performed for electrical parts, a fault is detected, causing a warning lamp to go on and remain on or a function not to operate.

- If an electrical part is to be added or a lamp is to be replaced with an LED lamp, the current value of the electrical part should be ensured to fall within a specified range. This is, however, does not guarantee that the electrical part to be mounted will be fully operational when its current value falls within the specified range.
- For the specified current value, ask your MITSUBISHI FUSO authorized Distributer or body manufacturer advisors ▷ page 14.
- Some electrical parts to be mounted require that the SAM control unit parameters be changed. For the electrical parts to be mounted, see 8.1.1 Signal detection and actuation module-related parts ▷ page 159. Ask your MITSUBISHI FUSO authorized Distributer.
- When adding or replacing a lighting unit, be sure to mount one that complies with the applicable laws and regulations, and observe the regulations governing visibility.

4.1 Vehicle overhang and technical wheelbases

Risk of accident

The body must be designed in such a way that placement of excessive load weight at the rear is prevented. It is important to comply with the points listed below, otherwise the necessary steering and braking forces for safe vehicle operation cannot be transferred to the road.

- When calculating the length of the vehicle overhang, always take into account the permissible axle loads and the minimum front axle load.
- Comply with the minimum front axle load ▷ page 41.
- Take the weight of special equipment into consideration when making calculations.

4.1 Vehicle overhang and technical wheelbases

4.1.1 Maximum vehicle overhangs

Maximum vehicle overhang (U)
65% of wheelbase

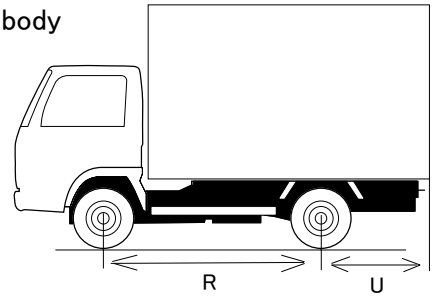
Van body: Body that does not accept load jutting out in the rear of vehicle

Example: Van body, Tank truck, etc.

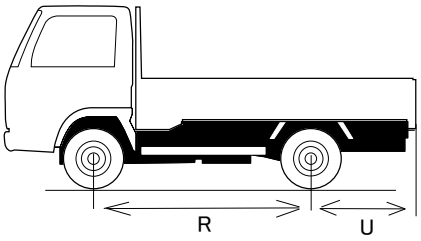
Additional information

All national laws, directives and registration requirements must be complied with.

Van body



Except Van body



R = Wheel base
U = Rear over hang

4.2 Weight distribution, CoG height, anti-roll bars

⚠ Risk of accident

The body must be designed in such a way that placement of excessive load weight at the rear is prevented. It is important to comply with the points listed below, otherwise the necessary steering and braking forces for safe vehicle operation cannot be transferred to the road.

4.2.1 Weight distribution

Avoid one-sided or laterally asymmetric weight distribution.

The wheel load (1/2 the axle load) may be exceeded by no more than 4%. Observe the tire load capacity.

Example:

- Permissible axle load 5,000 kg {11020 lb}
- Permissible wheel load distribution 2,600 kg to 2,400 kg {5730 lb to 5290 lb}

4.2.2 CoG height

Body/equipment manufacturer must calculate the vertical center of gravity, as measured from ground, for the completed and loaded vehicle. The provided maximum vertical center of gravity for the relevant chassis model cannot be exceeded under any operating condition.

MITSUBISHI FUSO cannot vouch for the handling, braking and steering characteristics of vehicles with attachments, installations or modifications for payloads with centers of gravity that violate prescribed limits (e.g. rear-mounted. overheight and side-mounted loads). The vehicle body/equipment manufacturer/converter is responsible for the safety of the vehicle in all cases.

Per the chassis-cab Incomplete Vehicle Document: The maximum vertical center of gravity of the completed vehicle specified below must not be exceeded at maximum GVWR and rated front & rear GAWR.

Single Cab, Crew Cab: 62.0 in. (1575mm)

4.2.3 Stabilizers roll control

Make sure that the vehicle you are building is correctly equipped. MFTA provides stabilizers as factory equipment for different model series, and does not offer optional stabilizers for any model.

4.3 Steerability

Risk of accident

The body must be designed in such a way that a placement of excessive load weight at the rear is prevented. The following points must be complied with otherwise the steering and braking forces necessary for safe driving cannot be transmitted.

To ensure sufficient vehicle steerability, the minimum front axle load (25% of gross vehicle weight) must be maintained under all load conditions. Consult the department responsible in the event of any deviations ▷ page 14.

Property damage

The permissible front axle load must not be exceeded.

Observe the notes on product liability ▷ page 15.

4.4 Clearance for the basic vehicle and bodies

Certain clearances must be maintained in order to ensure the function and operational safety of assemblies.

Dimensional data in the body/equipment mounting directives must be observed.

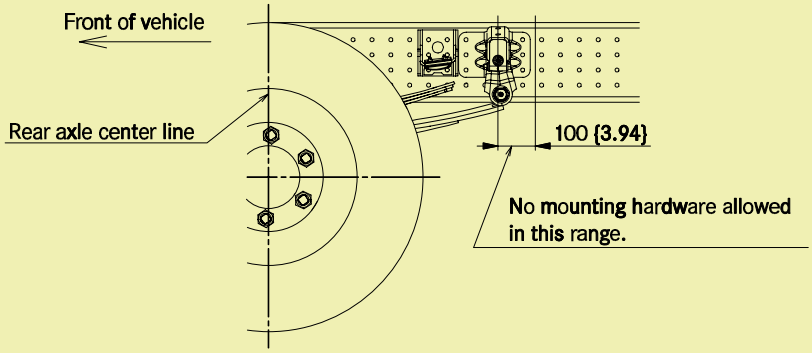
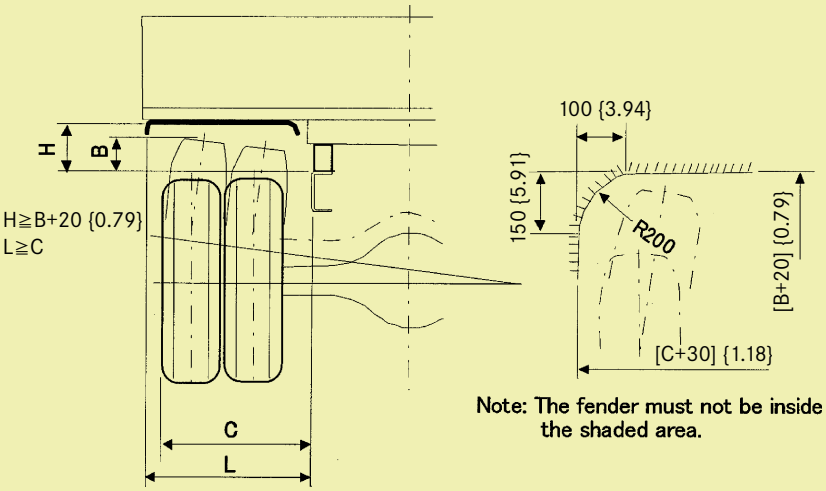
The minimum clearance between chassis parts and rear body parts must be kept according to the following table of minimum clearance standard.

Unit: mm {in.}

Part	Minimum Clearance and Notes
1. Section behind cab	In the section behind the cab, there are a cab tilt locking unit, power steering oil tank, coolant reservoir tank or expansion tank, etc. Ensure there is a clearance of at least 100 {3.94} between the cab and rear body to facilitate trouble-free operation, inspection and filling works. Provide a protector in order to prevent loads from falling from the rear body front window of the dump or other rear body.
2. Areas around engine	Vertical direction 40 {1.57} Lateral direction 30 {1.18} Longitudinal direction 25 {0.98}
3. Transmission Assembly	Do not install any rear body part in the area of 100 {3.94} of rear part, because transmission ass'y is moved backward in the same inclination line of engine, to pull out the clutch spline shaft, when transmission ass'y is removed from engine.
4. The Surrounding part of Transmission	25 {0.98} at surrounding part of transmission except rear part.
5. Upper part of Transmission	Keep more than 100 {3.94} of clearance between the upper surface of upper cover and the rear body part if possible, because this clearance is used when the transmission upper cover is removed.
6. The surrounding part of the Propeller shaft and the Rear axle	Min. 25 {0.98} of the surrounding part.
7. The brake hose (which connects to the front and rear wheel)	Keep min. 50 {1.97} of clearance at worst. This brake hose is considered to move when vehicle is driven.
8. Other hoses	40 {1.57}

4.4 Clearance for the basic vehicle and bodies

Unit: mm {in.}

Part	Minimum Clearance and Notes
9. Rear springs	The link at the rear end of the main spring may move during traveling. Do not fit any mounting hardware within the range indicated in the figure. 
10. Space above rear axle	Electrical lines such as the brake hose and wiring harness are laid on top of the rear axle. Provide enough space above the rear axle so that these lines will not come into contact with any of the mounting parts even when the axle is elevated to the highest position. Refer to "Differential and tire bound height" ▷ page 242.
11. Attaching the rear fender	The clearance between the rear fender and tire must be designed to be optimum assuming that the vehicle is traveling in bad conditions. Determine the standard clearance from the fender and top and side surfaces of the frame as follows from dimensions B and C listed in 10.7.2 "Differential and tire bound height" ▷ page 242.  Note: The fender must not be inside the shaded area.

4.4 Clearance for the basic vehicle and bodies

Unit: mm {in.}

<table>
<tr><th>Part</th><th>Minimum Clearance and Notes</th></tr>
<tr><td>12. The exhaust system</td><td>The heat affection and the interference of the exhaust system is a quite important factor in the safety of the vehicle. Keep the clearance between the rear body parts and these parts at least following figures on the table.
<table>
<tr><th>Parts name</th><th>Minimum Clearance (mm)</th></tr>
<tr><td>Fuel hose and pipe</td><td>200 {7.87}</td></tr>
<tr><td>Wiring harness</td><td>150 {5.91} (*100 {3.94})</td></tr>
<tr><td>Fuel tank</td><td rowspan="4">150 {5.91}</td></tr>
<tr><td>Battery cable</td></tr>
<tr><td>Rubber parts</td></tr>
<tr><td>Plastic parts</td></tr>
<tr><td>Rear body floor</td><td rowspan="6">100 {3.94}</td></tr>
<tr><td>Brake booster</td></tr>
<tr><td>Brake hose and pipe</td></tr>
<tr><td>Oil pan</td></tr>
<tr><td>Oil pipe</td></tr>
<tr><td>Tire</td></tr>
<tr><td>Vacuum tank</td><td>80 {3.15}</td></tr>
<tr><td>Propeller shaft</td><td rowspan="6">50 {1.97}</td></tr>
<tr><td>Rear axle, Differential</td></tr>
<tr><td>Parking brake cable</td></tr>
<tr><td>Shock absorber bush</td></tr>
<tr><td>Shackle bush</td></tr>
<tr><td>Rear mud guard</td></tr>
<tr><td>Shock absorber</td><td>30 {1.18}</td></tr>
<tr><td>Mounting frame, Additional member etc.</td><td rowspan="2">20 {0.79}</td></tr>
<tr><td>Spring, Axle</td></tr>
</table>
Note*:When wireharness is covered by heatproof conduit or protection

Do not install a tailpipe under the fuel pipe, hose connection and fuel filter drain tube.

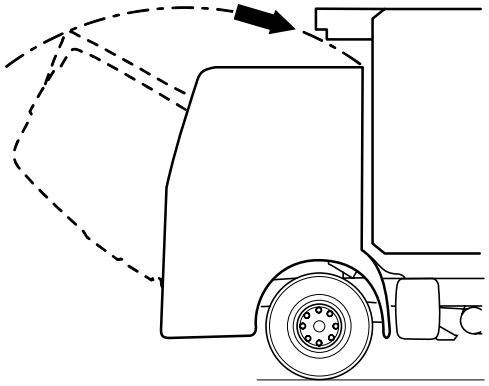
Keep body mounting such as wood and rubber parts away from the muffler built in the emission control system and exhaust pipe by at least 100 {3.94}. If this is impossible, install a heat shield plate to avoid a heat effect and check that there is no safety problem.</td></tr>
<tr><td>13. Fuel tank</td><td>The fuel tank must be mounted so that refilling operations such as opening/closing the filler cap and pouring fuel are not obstructed.</td></tr>
<tr><td>14. Battery</td><td>Mounting hardware must be located so that battery removal/installation and inspection as well as battery cover detaching/attaching can be done easily.</td></tr>
</table>

Additional information

Read and comply with the relevant sections of the body/equipment mounting directives.

4.4.1 Attachment above cab

- Observe the permissible center of gravity location and the front axle load.
- Make sure that there is sufficient space for tilting Refer to "10.5.3 Cab side view" ▷ page 228.



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Cab tilting range clearance

4.5 Permissible load on cab roof

When attaching externally mounted parts such as roof deck or ladder onto the roof, take care to prevent the weight of these parts from exceeding 50 kg {110 lb}.

4.6 Vehicle body incline

As far as possible, take steps to ensure that the weight of the body-building part is balanced in the left-right direction. If it is not possible to ensure left-right weight balance, carry out adjustment by adding a counterweight or adding a spacer to the mounting frame, for example.

When carrying out body-building work, be sure to observe the following items in order to ensure that the vehicle does not topple over or become twisted.

- Be sure to carry out the work on flat ground.
- As far as possible, carry out the work with both the front and rear tires on the ground.
- When installing the body, ensure that the chassis is horizontal.
- When installing the body, place it symmetrically on the chassis to prevent it from tilting.

4.6.1 Measuring the tilt of the body

When carrying out body-building work, measure the tilt of the body shown below. If the tilt of the body of the completed vehicle when empty exceeds the target value, correct it.

- Front tilt: ΔHf
  Left-right difference at the headlamp center height "Fig. 1 Front view"
  ΔHf = H1 – H2
  Target: | ΔHf | ≤ 10 mm {0.39 in.}
- Rear tilt: ΔHr
  Left-right difference at the stop lamp center height "Fig. 2 Rear view"
  ΔHr = h1 – h2
  Target: | ΔHr | ≤ 10 mm {0.39 in.}
- Twisting in the longitudinal direction of the vehicle: Tw
  Tw = ΔHf – ΔHr = (H1 – H2) – (h1 – h2)
  Target: | Tw | ≤ 10 mm {0.39 in.}

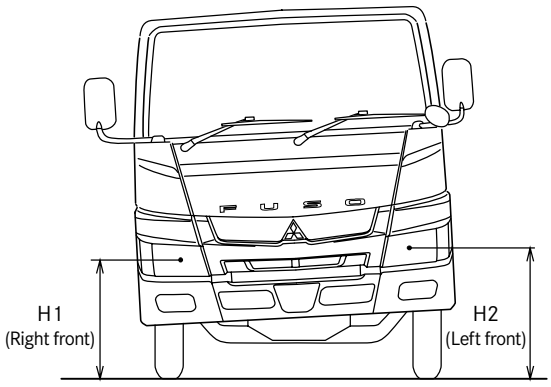


Fig. 1 Front view

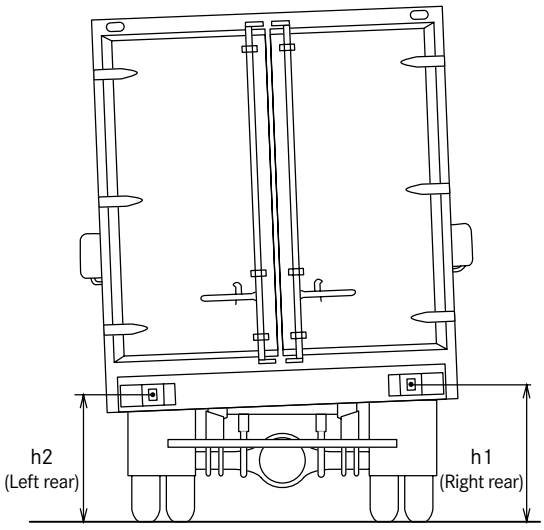


Fig. 2 Rear view

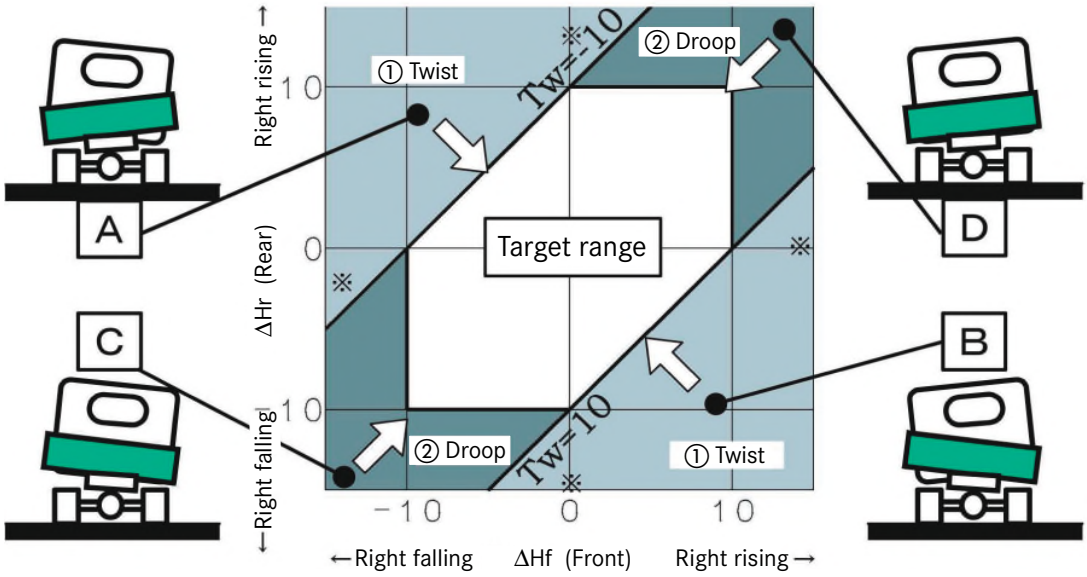
4.6.2 Correction method

The correction method differs depending upon the posture of the actual vehicle.

Check to see which condition of A to D shown in the graph below the measurement results correspond to, and then carry out correction as follows. (Note that if you carry out a different kind of correction, the results may actually become worse.)

Note: Measure the tilt of the body with the body-building part mounted.

Body posture and applicable correction method



Twist correction (In the case of A and B: | Tw | > 10 mm {0.39 in.})

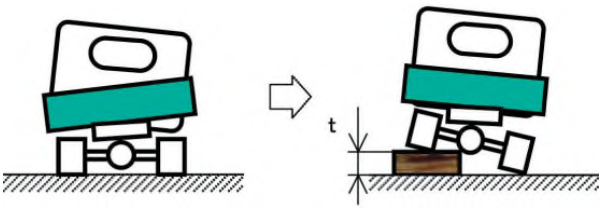
When clamping the body-building part, the twist can be corrected by applying a twist to the chassis in the opposite direction.

- Place chocks firmly beneath the front wheels.
- In the case of A (Tw < −10 mm {0.39 in.}), place the left rear wheel on a plate of thickness t corresponding to the amount of twist. In the case of B (Tw > 10 mm {0.39 in.}), place the right rear wheel on the plate.

Amount of lift-up of the wheel on one side for correcting twist **Unit: mm {in.}**

Twist "| Tw |"	Plate thickness (lift-up) "t"
10 to 15 {0.39 to 0.59}	100 {3.94}
15 to 20 {0.59 to 0.79}	150 {5.91}

(Lift-up on one side is also permissible.)



- After clamping the body-building part, first slacken all of the clamping bolts. (Take care to ensure that it is safe.)
- Lift the tire onto the plate, and then once again tighten the clamping bolts.
- Lower the tire from the plate, and confirm that there is no looseness in the clamped part or any other part.

Note: In the case of a vehicle whose initial posture corresponds to the vicinity of one of the ※ marks indicated in the diagram "Body posture and applicable correction method" on ▷ page 48 (body is both tilted and twisted), the posture after this correction has been carried out sometimes becomes condition C or D. In such a case, proceed with tilt correction.

Tilt correction (C and D: | ΔHf | > 10 mm {0.39 in.}, or | ΔHr | > 10 mm {0.39 in.})

With the body-building part clamped to the vehicle, insert a spacer between the axle spring washer and the spring.

By inserting a spacer at either the front wheel or the rear wheel, both the front and rear of the vehicle will be corrected. First, insert a spacer at the rear wheel, and only if correction is insufficient insert a spacer at the front wheel as well.

Note: Regarding the implementation of the following work, please consult with your local MITSUBISHI FUSO dealer.

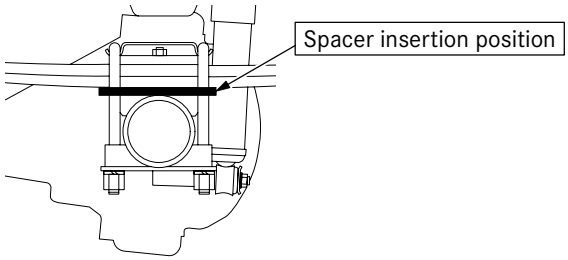
- Place chocks beneath the front wheels, then jack up the rear axle in order to firmly support the frame or the body-building part.
- Remove the center bolt of the spring, then while referring to the table below select a suitable number of spacers, insert them, and retighten the center bolt to the specified torque.

Note: If the length of the center bolt is insufficient, replace the bolt with one that is between one and two orders longer.

4.6 Vehicle body incline

Number of spacers to be inserted in order to correct tilt **Unit: mm {in.}**

Tilt | Hf | or | Hr |	Number of spacers
10 to 14 {0.39 to 0.55}	1
14 to 18 {0.55 to 0.71}	2

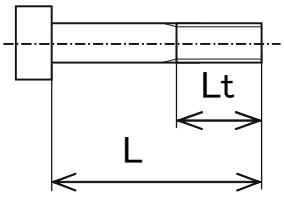


Spacer part number and insertion position

Vehicle model	Spacer part number (All t = 4.5)	Insertion position of rear wheel spacer	
		In the case of C (Right falling)	In the case of D (Right rising)
FEC	MB161776	Below right spring	Below left spring

Center bolt

Model	Part No.	Size	Bolt Length L	Thread length Lt
FECZ	MK613560	M12X1.25	94	23
FEC7 (Single cab)	MK613561	M12X1.25	130	22
FEC7 (Crew cab)	MK613562	M12X1.25	181	23



- Clamp the spring to the axle by tightening the U-bolt to the specified torque.

Note: If the length of the U-bolt is insufficient, replace the bolt with one that is between one and two orders longer.

- Re-check the tilt, and if the amount of correction is insufficient, insert a spacer at the front wheel as well.
  - Place chocks beneath the rear wheels, then jack up the rear axle in order to firmly support the frame.
  - Insert a spacer (MC110153) between the front axle and the left or right front wheel, whichever is lower (the tilt will be corrected by approximately 5 mm {0.2 in.}).

  Note:
  - It is unnecessary to loosen the center bolt for the spring.
  - If the length of the center bolt is insufficient, replace the bolt with one that is between one and two orders longer.

If it is still necessary to correct the vehicle tilt even after performing the above corrective procedure, please contact the department responsible.

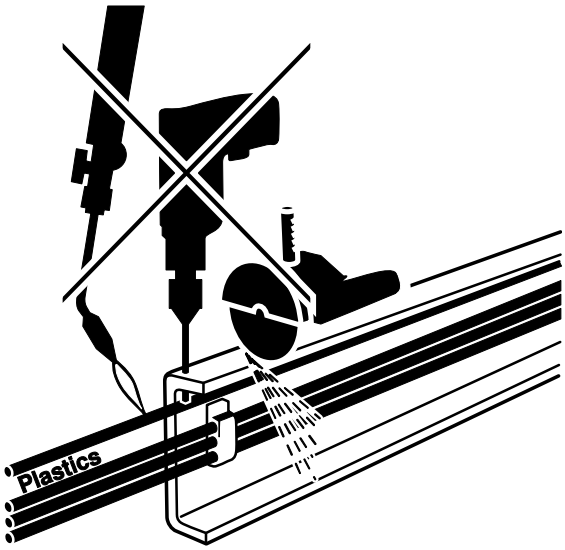
"2.2 Technical advice and contact persons"
▷ page 14

See PTO addendum.

5.1 Brake hoses/cables and lines

Risk of accident

Work carried out incorrectly on the brake hoses, cables and lines may impair their function. This may lead to the failure of components or parts relevant to safety.



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- Fuel and hydraulic lines and brake hoses must be covered or removed if necessary before carrying out any welding, drilling and grinding work and before working with cutting disks.
- After installing, fuel lines, hydraulic lines and brake hoses, the system must be tested for pressure loss and leaks.
- No other lines may be attached to brake hoses.
- Lines must be protected from heat by means of appropriate insulation.
- Line routing must be designed to prevent any increase in pressure loss.

Comply with all national regulations and laws.

Additional information

Further information on brake hoses can be found in 6.13 "Brake systems" ▷ page 102.

5.1 Brake hoses/cables and lines

Precautions for carrying out body building and modification work

Before carrying out work near the parts indicated below, secure a place to stand on other than the vehicle itself. During the work, take care not to pull on the fuel hose or place it where it is likely to be pulled, otherwise fuel will leak from those parts.
In the event that you inadvertently place your foot on, or pull, any of the parts indicated below, start the engine of the vehicle before shipping it from the factory, and then confirm that there is no leakage.

Examples of fuel leakage and parts where leakage occurred

Part	Precaution
Fuel connector at left rear of the engine	• Do not place your foot on the top of the engine. • Do not pull the fuel hose.
Top of the fuel tank	• Do not place your foot on the fuel tank.
Vicinity of the fuel tank	• Do not place your foot on the fuel hose
Intermediate connector of the fuel system on the left side face of the transmission	• Do not place your foot on the fuel hose. • Do not pull the fuel hose.

When body-building a single cab vehicle, do not pull on the exhaust brake harness, or place your foot on or stand on the connection part of a connector. This may damage the exhaust brake harness connector or cause the connector to drop out.

5.2 Welding work

The legal stipulations regarding the transport and storage of airbag units must be observed.

All laws governing explosive substances must be complied with.

The following safety measures must be observed to prevent damage to components caused by overvoltage during welding work:

- Disconnect the positive and negative terminals from the battery and cover them.
- Connect the welding-unit ground terminal directly to the part to be welded.
- Do not touch electronic component housings (e.g. control modules) and electric lines with the welding electrode or the ground contact clamp of the welding unit.
- Before welding, cover spring to protect them from welding spatter. Do not touch springs with welding electrodes or welding tongs.
- Cover the fuel tank and fuel system (lines, etc.) before carrying out welding work.
- Avoid welding work on inaccessible cavities in the cab.
- Welds must be ground down and reinforced with angular profiles to prevent notching from welding penetration.
- Avoid welds in bends.
- The distance from a weld to the outer edge should always be at least 15 mm {0.59 in.}.

Property damage

Do not connect the arc welder ground clamp to assemblies such as the engine, transmission or axles.

Welding work is not permitted on assemblies such as the engine, transmission, axles, etc.

- Avoid defects such as deposited metal cracking, toe crack, blow holes, slag inclusion, under cut, poor penetration, etc.

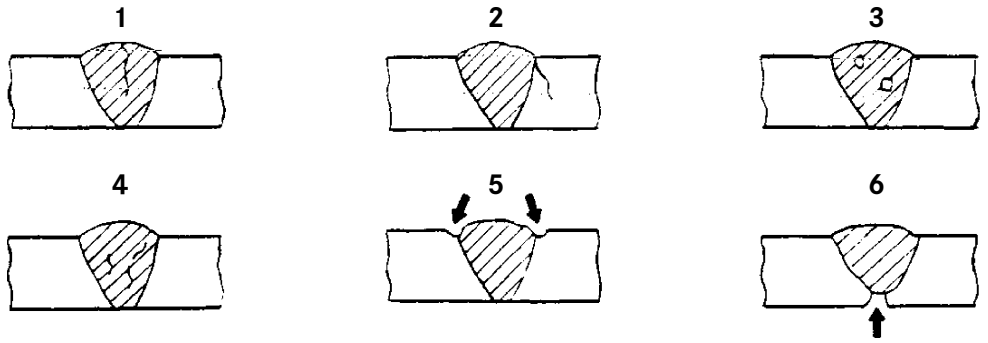


Fig. 1

1 Deposited metal cracking
2 Toe crack
3 Blow hole
4 Slag inclusion
5 Under cut
6 Poor penetration

Additional information

Additional information on welded connections can be found in Section 6 "Modifications to the basic vehicles" ▷ page 78 and Section 8 "Electrics/electronics" ▷ page 158.

The following safety measures must be observed to prevent damage to welding parts;

- Do not weld any item to the frame to hold it temporarily.
- Clean parts thoroughly with a wire brush and dry them off before welding.
- Make sure the paint is completely removed, before welding a painted part.
- Use a low hydrogen type welding electrode. The welding electrode absorbs moisture when it is used, so it is necessary to dry it thoroughly before use.
- When welding, maintain the optimum welding speed and conditions for the preservation of the welding electrode.
- Maintain the welding current at the optimum value for safety.
- Make several short welding beads rather than one long bead.
- Make symmetrical beads to limit shrinkage.
- Avoid more than 3 welds at any one point.
- Avoid welding in strain hardened zones.
- When connecting the ground cable of the arc welder, make sure to disconnect the negative terminal from the battery. The ground of the welder should be connected to the side rail near the welded part. Never connect around the engine, transmission, propeller shaft, front and rear axles, etc.
- When performing welding work on the chassis, take proper measure to prevent the tubes, harnesses, rubber parts, springs, etc. from heat or spatter.
- Do not cool parts off with water after welding.

Risk of accident and injury

Before performing electric of arc welding as part of vehicle repair operation, disconnect the negative (-) cable from the battery. The ground cable of the welding machine should be connected to a point as close to the welding area as possible.

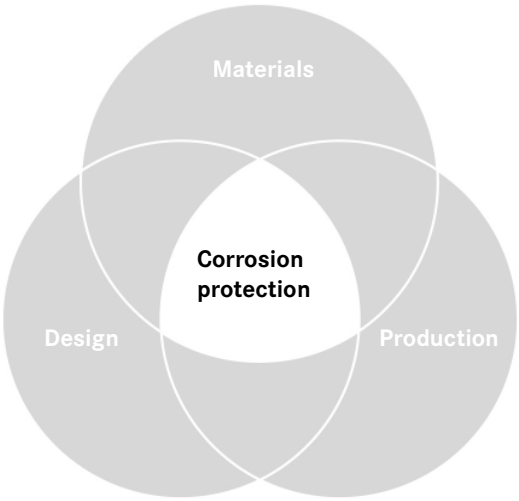
5.3 Corrosion protection measures

General

In order to preserve the durability and quality standard of the vehicle, measures must be taken to protect it against corrosion when the vehicle is modified and after installing bodies and fittings.

Information on the design, execution of work and the requirements of the materials and components to be used with regard to corrosion protection is listed below.

To achieve good corrosion protection, the areas of design (1), production (2) and materials (3) must be perfectly matched.



Optimum corrosion protection

5.3 Corrosion protection measures

Disassembly of components

If the body manufacturer makes structural modifications to the chassis, the corrosion protection in the affected areas must be restored to match the production standards of MITSUBISHI FUSO. The areas must also be finished with appropriate paintwork. Information on approved MITSUBISHI FUSO refinishing paint suppliers is available on request from the responsible department ▷ page 14.

Damage to components

If components are damaged during disassembly (scratches, scuff marks), they must be professionally repaired. This applies especially for drilled holes and openings. Two-component epoxy primers are particularly suitable for repair work.

Cutting of components

When cutting and grinding work is carried out, the adjacent painted components must be protected against flying sparks and shavings. Grinding dust and shavings must be carefully removed because these contaminants can spread corrosion. Edges and drilled holes must be cleanly deburred in order to guarantee optimum corrosion protection.

Corrosion protection on reinforcements and fittings

Reinforcements and fittings must receive adequate anti-corrosion priming prior to installation. In addition to galvanizing, cataphoretic dip-priming and zinc-rich paint in sufficient coatings have proved satisfactory for this purpose.

5.3 Corrosion protection measures

Corrosion prevention in welding work

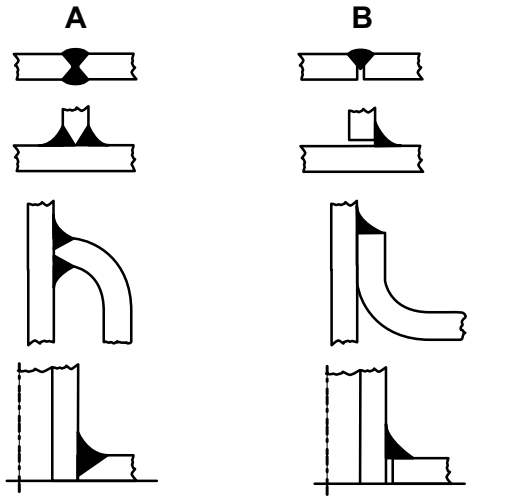
In order to avoid crevice corrosion at weld seams, the welds should be made in accordance with the examples shown.

Preparation

The welding area must be free from corrosion, grease, dirt or similar contamination. If painted surfaces are to be welded, the paint coat must first be removed by grinding or chemical stripping. If this is not done, the paint will burn and the residues can impair corrosion resistance.

After welding work

- Remove drilling shavings.
- Deburr sharp edges.
- Remove any burned paint and thoroughly prepare surfaces for painting.
- Prime and paint all unprotected parts.
- Preserve cavities with wax preservative.
- Carry out corrosion protection measures on the underbody and frame parts.



Example: Weld seams

A – Suitable
B – Unsuitable

Additional information

Plug and slot welds, particularly on horizontal surfaces, should be avoided due to the risk of corrosion. If they are unavoidable, these welds must receive additional preservation. Furthermore, avoid designs which allow moisture to accumulate. These must be fitted with additional drainage holes or gaps in the weld seam.

5.4 Bolted connections

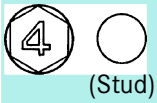
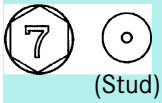
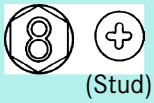
Use the specified bolts and nuts. Unless otherwise specified, tighten to the torques shown in the table below.

Make sure that the thread and washer are dry when tightening.

If strength categories differ between a nut and bolt (or stud bolt), tighten the nut to the torque specified for the bolt.

- Hex bolt and stud bolt

Unit: N·m {kgf·m}

Strength category	4T		7T		8T	
Indication / Nominal diameter mm	 (Stud)		 (Stud)		 (Stud)	
M5	2 to 3 {0.2 to 0.3}	–	4 to 6 {0.4 to 0.6}	–	5 to 7 {0.5 to 0.7}	–
M6	4 to 6 {0.4 to 0.6}	–	7 to 10 {0.7 to 1.0}	–	8 to 12 {0.8 to 1.2}	–
M8	9 to 13 {0.9 to 1.3}	–	16 to 24 {1.7 to 2.5}	–	19 to 28 {2.0 to 2.9}	–
M10	18 to 27 {1.8 to 2.7}	17 to 25 {1.8 to 2.6}	34 to 50 {3.5 to 5.1}	32 to 48 {3.3 to 4.9}	45 to 60 {4.5 to 6.0}	37 to 55 {3.8 to 5.7}
M12	34 to 50 {3.4 to 5.1}	31 to 45 {3.1 to 4.6}	70 to 90 {7.0 to 9.5}	65 to 85 {6.5 to 8.5}	80 to 105 {8.5 to 11}	75 to 95 {7.5 to 10}
M14	60 to 80 {6.0 to 8.0}	55 to 75 {5.5 to 7.5}	110 to 150 {11 to 15}	100 to 140 {11 to 14}	130 to 170 {13 to 17}	120 to 160 {12 to 16}
M16	90 to 120 {9.0 to 12}	90 to 110 {9 to 11}	170 to 220 {17 to 23}	160 to 210 {16 to 21}	200 to 260 {20 to 27}	190 to 240 {19 to 25}
M18	130 to 170 {14 to 18}	120 to 150 {12 to 16}	250 to 330 {25 to 33}	220 to 290 {22 to 30}	290 to 380 {30 to 39}	250 to 340 {26 to 35}
M20	180 to 240 {19 to 25}	170 to 220 {17 to 22}	340 to 460 {35 to 47}	310 to 410 {32 to 42}	400 to 530 {41 to 55}	360 to 480 {37 to 49}
M22	250 to 330 {25 to 33}	230 to 300 {23 to 30}	460 to 620 {47 to 63}	420 to 560 {43 to 57}	540 to 720 {55 to 73}	490 to 650 {50 to 67}
M24	320 to 430 {33 to 44}	290 to 380 {29 to 39}	600 to 810 {62 to 83}	540 to 720 {55 to 73}	700 to 940 {72 to 96}	620 to 830 {63 to 85}

5.4 Bolted connections

- Hex flange bolt

Unit: N·m {kgf·m}

Strength category	4T		7T		8T	
Indication / Nominal diameter mm						
M6	4 to 6 {0.4 to 0.6}	–	8 to 12 {0.8 to 1.2}	–	10 to 14 {1.0 to 1.4}	–
M8	10 to 15 {1.0 to 1.5}	–	19 to 28 {2.0 to 2.9}	–	22 to 33 {2.3 to 3.3}	–
M10	21 to 30 {2.1 to 3.1}	20 to 29 {2.0 to 3.0}	45 to 55 {4.5 to 5.5}	37 to 54 {3.8 to 5.6}	50 to 65 {5.0 to 6.5}	50 to 60 {5.0 to 6.5}
M12	38 to 56 {3.8 to 5.5}	35 to 51 {3.5 to 5.2}	80 to 105 {8.0 to 10.5}	70 to 95 {7.0 to 9.5}	90 to 120 {9 to 12}	85 to 110 {8.5 to 11}

- Hex nut

Unit: N·m {kgf·m}

Strength category	4T		6T	
Indication / Nominal diameter mm				
	Standard thread	Coarse thread	Standard thread	Coarse thread
M5	2 to 3 {0.2 to 0.3}	–	4 to 6 {0.4 to 0.6}	–
M6	4 to 6 {0.4 to 0.6}	–	7 to 10 {0.7 to 1.0}	–
M8	9 to 13 {0.9 to 1.3}	–	17 to 24 {1.7 to 2.5}	–
M10	18 to 27 {1.8 to 2.7}	17 to 25 {1.8 to 2.6}	34 to 50 {3.5 to 5.1}	32 to 48 {3.3 to 4.9}
M12	34 to 50 {3.4 to 5.1}	31 to 45 {3.1 to 4.6}	70 to 90 {7.0 to 9.5}	65 to 85 {6.5 to 8.5}
M14	60 to 80 {6.0 to 8.0}	55 to 75 {5.5 to 7.5}	110 to 150 {11 to 15}	100 to 140 {11 to 14}
M16	90 to 120 {9.5 to 12}	90 to 110 {9 to 11}	170 to 220 {17 to 23}	160 to 210 {16 to 21}
M18	130 to 170 {14 to 18}	120 to 150 {12 to 16}	250 to 330 {25 to 33}	220 to 290 {22 to 30}
M20	180 to 240 {19 to 25}	170 to 220 {17 to 22}	340 to 460 {35 to 47}	320 to 410 {32 to 42}
M22	250 to 330 {25 to 33}	230 to 300 {23 to 30}	460 to 620 {47 to 63}	420 to 560 {43 to 57}
M24	320 to 430 {33 to 44}	290 to 380 {29 to 39}	600 to 810 {62 to 83}	540 to 720 {55 to 73}

- Hex flange nut

Unit: N·m {kgf·m}

Strength category	4T	
Indication / Nominal diameter mm		
	Standard thread	Coarse thread
M6	4 to 6 {0.4 to 0.6}	–
M8	10 to 15 {1.0 to 1.5}	–
M10	21 to 31 {2.1 to 3.1}	20 to 29 {2.0 to 3.0}
M12	38 to 56 {3.8 to 5.5}	35 to 51 {3.5 to 5.2}

5.4 Bolted connections

Preventing contact corrosion

Direct contact between materials with different electrode potentials can lead to corrosion of the less noble material when exposed to moisture and salt ions.

When selecting materials, avoid the following combinations:

- Chrome/nickel-steel with aluminium
- Chrome/nickel-steel with zinc-coated steel

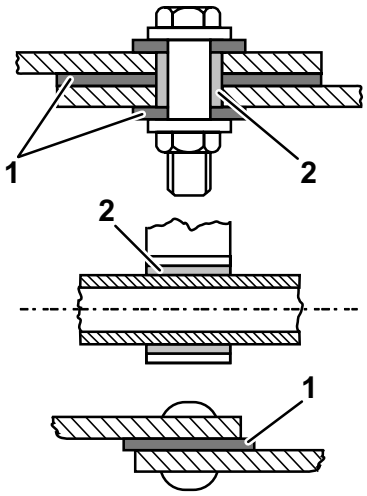
Insulation by coating

Contact corrosion can be prevented by using insulation such as washers, sleeves or bushings. Even in this case, however, the connecting points must not be persistently exposed to moisture.

Vehicle cleaning and care

When the vehicle is handed over to the body manufacturer, it must immediately be cleaned of salt and dirt. If it is to be stored for some time, the vehicle must be preserved.

During modification it must be ensured that load-bearing components are additionally protected against aggressive chemicals and environmental influences. If the vehicle comes into contact with chemicals or salts (e.g. snow-clearing operations), it must be cleaned thoroughly at regular intervals.



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1 Insulating washer
2 Insulating sleeve

! Property damage

A conductive connection occurs if two different metals are brought into contact with each other through an electrolyte (e.g. air humidity). This causes electrochemical corrosion and the less base of the two metals is damaged. The further apart the two metals are in the electrochemical potential series, the more intense electrochemical corrosion becomes.

For this reason, electrochemical corrosion must be prevented by insulation or by treating the components accordingly, or it can be minimised by selecting suitable materials.

5.5 Painting work

Environmental note

Paints and lacquers are harmful to health and to the environment if they are not handled correctly.

Dispose of paints and lacquers in an environmentally responsible manner.

General precautions

- If you removed parts, be sure to re-install them in their original positions.
- If you removed any labels, obtain new labels and apply them to the same positions from which you removed the old labels.
- Paint compatibility should be checked when repainting. In order to avoid color variations on painted bodies, MITSUBISHI FUSO recommends that paints be used only if they have been tested and approved for the vehicle model in question. There may be paint colors and parts not available for some vehicle types. Contact the MITSUBISHI FUSO authorized Distributer to confirm which colors or parts are available for the vehicle.

5.5.1 Areas which must not be repainted

If you repaint the following parts and areas, trouble may occur. For this reason, before repainting the body areas, apply masking tape or other protective material to these areas to prevent them from being exposed to paint.

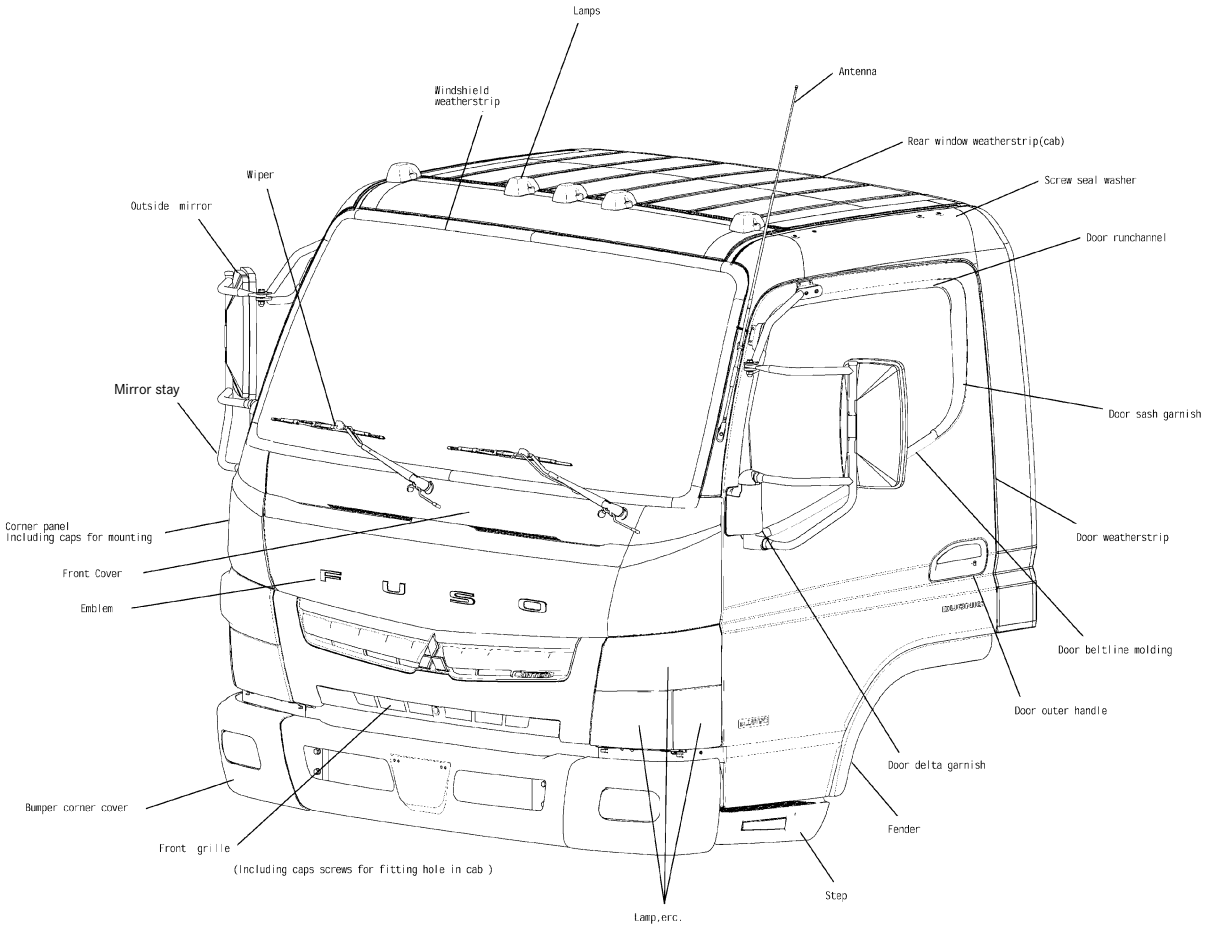
If you removed parts, be sure to re-install them in their original positions. Also, if you removed any labels, obtain new labels and apply them to the same positions from which you removed the old labels.

- Sealing surfaces
- Windows
- Cotact areas between the wheels and wheel hubs, contact areas between the disk wheels of the double tires
- Contact areas for wheel nuts
- Brake hose and brake associated parts
- Various vinyl tubes and identification tape
- Breathers on transmission, axles, etc.
- Disk brakes and disk rotors
- Fuel pump are on top of the tank to not be repainted.
- Door locks
- Door retainers in the rear door hinges
- Spring mounting area
- Rubber hoses
- Cab suspension, engine, chassis suspension and steering system rubber or plastic parts
- Electric control unit
  TCU (Transmission Control Unit)
  SAM (Body electronics control unit with integrated relay and fuse)
- Electrical wiring and connectors
- Lamps, switches, batteries and other electrical parts
- Drive shaft connecting flange (propeller shaft, PTO output shaft)
- Piston rods for the hydraulic and pneumatic cylinders
- Control valves for the air lines
- Various caution plates and nameplates
- Rubber or polypropylene parts for cab
  - Weatherstrips
  - Rear view mirror bodies
  - Mud guard aprons
  - Washer nozzles
  - Splash aprons
  - Mud guards
  - Steps
  - Fenders
  - Runchannels
  - Bumper corner covers
  - Packing rubbers (mirror fitting, antenna fitting, and grip fitting bases)
  - Antenna
- The following parts should not be repainted for appearance reasons.
  - Emblems (such as FUSO)
  - Rear view mirror stays
  - Fenders
  - Wiper arms and blades
  - Antenna and its bracket

5.5.2 Precautions to be observed when drying the paint

- Forced drying
  In order to protect resin and rubber parts, ensure that the temperature of the painted surface does not exceed 80°C {176°F}.
  If the temperature is likely to exceed 80°C {176°F}, either remove the following parts or take steps to protect them from heat.

Parts to be removed or shielded from heat when repainting at temperatures exceeding 80°C {176°F}



- Natural drying
  There is no need to remove resin or rubber parts from the vehicle.

Note 1. Acrylic lacquer type paint may be prone to blistering. For details, ask the paint manufacturer/supplier.

2. Be sure to sand the surfaces before repainting, otherwise the paint film may not adhere well.

5.5.3 Painting vehicles prior to shipment

- Cab

Part name	Painting specifications		
	Body color (color name)	Color code	Paint manufacturer
Outside of cab (body color)	Natural white	AC17031	Kansai Paint
	Sonic blue	CTB10000	Nippon Paint
	Forest green	CTG10058	Nippon Paint
	Arcadia silver	CTH10090	Dai Nippon Toryo
	Light blue	AC17120	Dai Nippon Toryo
	Shannon blue	AC17089	Nippon Paint
	Jupiter green	AC17010	Kansai Paint
	Fiji green	AC17088	Kansai Paint
	Bright orange	AC17024	Kansai Paint
	Mars red	AC17023	Kansai Paint
	Warm silver	AC17130	Dai Nippon Toryo
	Active yellow	CFY10013	Kansai Paint
	Ice blue-silver	CFH10002	Dai Nippon Toryo

- Chassis

Part name	Paint specifications	
Frame	RN chassis black or Emaron MS chassis black	Dai Nippon Toryo
Axles [front and rear]	Chassis Super MZ or chassis black M	Dai Nippon Toryo
Propeller shaft	RM chassis super black	Dai Nippon Toryo
Spring	Spring black No. 1000	Dai Nippon Toryo
Fuel tank	TBK-9011	Ameri Coats

5.5.4 Repainting of the cab

- When a standard-color-coated cab is repainted, plastic and rubber parts on it should be removed where possible to protect them from adverse effects.

Removable parts	Parts to be masked
• Emblems • Front grille *1 • Corner panels *1 • Front cover • Steps • Fenders • Wipers • Antenna • Lamps • Outside mirrors, mirror stays • Bumper corner covers • Heat protector (at back of cab) • Sealing washers for screws	• Door outer handles • Weatherstrips *2 • Caution labels • Door delta garnish • Door runchannels • Door sash garnish • Door beltline moldings

*1 The caps covering the holes in the cab for mounting the radiator grille and corner panels cannot be reused once removed. Replace them with new ones.

Part name	Part No.
Clip	MK676916 (MITSUBISHI FUSO part number)

*2 Before reinstalling removed door weatherstrips, check their plastic clips for deformation in claws and defects preventing smooth insertion. Any defective clips must be replaced with new ones.

Part name	Part No.
Clip	MK402586 (MITSUBISHI FUSO part number)

- Before the cab is shipped from the factory, it is coated with a non-sanding type high-adhesion natural white paint only. However, in order to completely remove oil, grease and other contaminants from the surfaces to be painted, it is recommended that you sand these surfaces.
  Paint other than natural white is not high-adhesion paint. When using paint of a different color, be sure to sand the surfaces to be painted before applying the paint.
  (Sanding procedure: Sand the surfaces uniformly with #400 sandpaper until the gloss disappears from the surface.)

5.5 Painting work

- Repainting the cab
  Paint
  When repainting the cab with lacquer or urethane paint, it is recommended that you use one of the following kinds of paint because it has been confirmed that they form a high-adhesion film even when applied without sanding the surfaces to be painted.

Manufacturer	Name of paint
Kansai Paint	Retan PG80 Retan PG60 Acric #1000
Rock Paint Co., Ltd.	38 Line Co-Rock 79 Line Rock Ace 73 Line Hi Rock 35 Line Rock Lacquer
Isamu Paint Co., Ltd.	AU21 Hi-Art #3000

Manufacturer	Name of paint
Dai Nippon Toryo Co., Ltd.	Auto V Top Monarch Auto Squall Auto Acrose Super Auto Swift Acrytan 1000 T-300LINE
Nippon Paint Co., Ltd.	Nax Mighty Lac Nax Sperio Nax Besta Nippe Acrylic

For brands other than the above, you must confirm whether or not it is necessary to sand the surfaces to be painted, by asking the paint manufacturer, for example.

- Outline of repair-painting using arcadia silver or warm silver paint
  Carry out repair-painting using arcadia silver (CTH10090) or warm silver (AC17130) paint, by means of the following procedure.

Process	Description of work
1. Preparing faulty areas for repainting	Remove graining and runs by wet-rubbing with #400 sandpaper, and after the surface is smooth, finish by wet-rubbing with #600 – 800 sandpaper. If there are areas where the paint film is insufficiently thick, wet-rub them with #800 sandpaper. If there are areas on the outside of the above which are to be coated with clear paint, wet-rub them with #1500 sandpaper.
2. Degreasing and masking	Air-blow areas to be repair-painted and also the vicinity thereof, carry out degreasing with a silicone remover, and then carry out masking as necessary.

Process	Description of work
3. Applying an intermediate coat	If the substrate (ED) is visible through the baked paint film, apply an intermediate coat. • Apply the intermediate coat to a thickness which is sufficient to adequately hide exposed ED areas. The film thickness should be 15 – 20 µm {49 – 66 µft}. • Wipe away misted areas using thinner. • Wait 3 to 5 minutes to allow the paint film to set, then force-dry it at 80°C {176°F} for 15 minutes. • After force-drying, allow the paint film to cool down, then wet-rub the intermediate coat with #600 waterproof sandpaper. • Using #800 waterproof sandpaper, finish the base painting area (the outer side of the intermediate coat) by wet-sanding. * If the substrate (ED) is not exposed, there is no need to apply an intermediate coat. Paint used: Primer surfacer STX-2K-HS 2-liquid type paint hardener 25 % 2-liquid type paint thinner 10 % (STX-2K-TH-0D)
4. Applying the base coat	First determine the color of the base repair-painting areas, and then shade the peripheral areas. Do not apply a thick coat to the base. (12 – 15 µm {39 – 49 µft}) Lightly apply one coat of paint to the areas which the mist of the base coat (17130 colors) reach (shaded areas). Promptly proceed to the next process within 2 to 3 minutes (before the paint becomes touch-dry). In some cases this process can be omitted. [Paint blending] Use the undiluted paint after filtering it. Return the unused paint to its original container and store it. If the area to be repair-painted is small, you can carry out shading more easily by adding a further 10 to 20 % of thinner to reduce the viscosity and also spraying at a lower air pressure. Wait for about 7 minutes to allow the paint to set, and then apply clear paint. [Mixing ratio of paint] Base coat AC-17130 (quick-drying) 100 (VOLUME) (When the room temperature is between 10 and 20°C {50 and 68°F}) Base coat thinner 11070 approx. 70 (16 – 18 seconds by the use of Iwata cup*3) (When the room temperature is between 20 and 25°C {68 and 77°F}) Base coat thinner 11050 (Standard 20°C) (When the room temperature is between 25 and 35°C {77 and 95°F}) Base coat thinner 11040

5.5 Painting work

Process	Description of work
5. Clear painting	Lightly mist-coat all of the areas to be repair-painted, finish continuously with one wet coat of paint, and then immediately shade the mist area. [Mixing ratio of paint] 2-liquid type paint Clear 20 – 60 100 2-liquid type paint MS hardner 50 2-liquid type paint Thinner quick-drying Approx. 10 (18 – 20 seconds by the use of Iwata cup*3) [Mixing ratio for ombre painting] Clear paint blended according to the above 10 2-liquid type paint Thinner For shading 11031 50 * The blended clear paint can be used for up to about 4 hours at normal temperature.
6. Drying	After applying clear paint, wait for 2 to 3 minutes to allow it to set, then force-dry it at 80°C {176°F} for 15 minutes.

*3: The Iwata cup:
is a simple paint viscometer, viscocity cup, NK-2 produced by ANEST IWATA Corporation.

For details, please address inquiries to MITSUBISHI FUSO's authorized Distributer.

5.5.5 Procedure for painting plastic parts

- Do not paint, bake or dry plastic parts of the cab while they are installed. Remove plastic parts and paint them as described below. It is recommended that you use the paint and painting method indicated in the table below.

Paint manufacturer	Dai Nippon Toryo Co., Ltd.
Paint type	Acrylic and urethane type
Name of paint	Planitto #3000
Curing agent	Planitto #721 curing agent
Blending ratio	Main ingredient : Curing agent = 100 : 15
Diluting thinner	Planitto #30 thinner
Paint viscosity	12 – 14 seconds/by the use of Iwata cup *1
Dry film thickness	20 – 35 µ
Setting	Normal temperature × 5 – 10 minutes
Drying the paint film	60 – 70° × 30 – 40 minutes Touch-drying ≈ 15 – 20 minutes
Pre-treating the surface to be painted	1. Sanding white painted surfaces 2. IPA degreasing 3. Air blow
Painting method	Hand spraying with gun

Note 1. Acrylic lacquer type paint may be prone to blistering. For details, ask the paint manufacturer/supplier.

2. Be sure to sand the surfaces before repainting, otherwise the paint film may not adhere well.

*1: The Iwata cup:
is a simple paint viscometer, viscocity cup, NK-2 produced by ANEST IWATA Corporation.

- Custom vehicles and optional plated parts cannot be repainted.

- Solvent for removing contamination
  Synthetic resin used for the grille, and so on, do not readily withstand organic solvents. For this reason, if you select the wrong kind of solvent for wiping such a part, cracks may occur and also marks may remain on the surface of the part.

- Organic solvents which can be used
  - Kerosene
  - Light oil
  - Anti-freeze
  - Wax spray can (Nihon Parkerizing Co., Ltd.) Neo lider
  - Industrial soap
  - Unigold
  - Car Spray 99

- Solvents which must not be used
  - Paint thinner
  - Turpentine
  - Gasoline
  - Escort
  - Origin veil
  - Torepika
  - Emulsion wax
  - Commercially available wax
  - Acetone
  - Reagent alcohol (The Japanese Pharmacopoeia Grade 1)
  - Ketones
  - Esters
  - Chlorinated hydrocarbon

5.5.6 Laminated glass

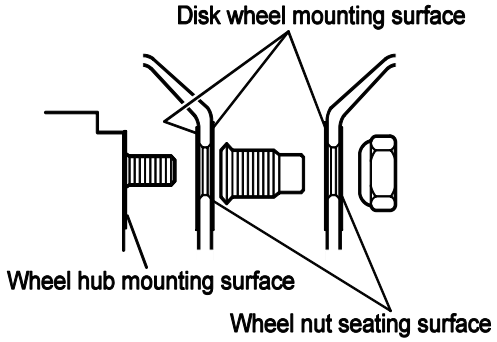
- When a repainted cab body is forced-dried, the temperature should not exceed 100 °C {180 °F} and the process must be completed within 60 minutes. When using a temperature above 100 °C {180 °F}, cover the glass surfaces with shields to prevent them from being heated beyond 100 °C {180 °F} or remove the glass.
- Laminated glass is marked by a double slash (//) in the lower left corner.

5.5.7 Painting the disk wheels

Disk wheels are sometimes painted in the specified color in addition to the original paint on the wheels as shipped by the wheel manufacturer. However, this could lead to loose wheel nuts depending on the thickness of the paint coating.

Prohibition of additional painting

- Do not apply additional painting to disk wheel mounting surfaces, wheel nut seating surfaces and wheel hub mounting surfaces. This makes the paint coating thicker, which could lead to loose wheel nuts. If additional painting has been applied, remove it and clean the surface with a wire brush.



- If you removed parts, securely re-install them in their original positions. If you peeled off labels, obtain new labels and stick them in their original locations.

Tire rotation

- If additional paint on a disk wheel mounting surface becomes the mounting surface for the mating part (wheel hub or wheel) as a result of tire rotation, remove the paint on the wheel mounting surface and wheel nut seating surface and clean the surfaces with a wire brush before installing the disk wheel. If it is installed without removing the paint, the thick paint coating could lead to loose wheel nuts.

5.6 Chassis springs

5.6.1 Leaf springs

- Only use original equipment spring leaves which have been tested and approved for the vehicle model in question. Reinforcement by installing heavier, stiffer, additional spring leaves is not permitted.
- Do not damage the surface or the corrosion protection of the spring leaves when carrying out installation work.
- Before carrying out welding work, cover the spring leaves to protect them against welding spatter. Do not touch springs with welding electrodes or welding tongs.

5.7 Tilting the cab

Risk of injury

Before tilting the cab, please make sure that you read the "Tilting the cab" section in the detailed Owner's Manual.

You could otherwise fail to recognize dangers, which could result in injury to yourself or others.

5.8 Towing and tow-starting

Risk of accident and injury

Before towing or tow-starting, please make sure that you read the "Towing" section in the detailed Owner's Manual. You could otherwise fail to recognize dangers and cause an accident, which could result in injury or death.

Property damage

Failure to observe the instructions in the Owner's Manual can result in damage to the vehicle.

5.9 Risk of fire

⚠ Risk of fire

Work on live electrical lines carries a risk of short circuit.

Before starting work on the electrical system, disconnect the on-board electrical system from the power source, e.g. battery.

With all bodies make sure that neither flammable objects nor flammable liquids can come into contact with hot assemblies (including through leakages in the hydraulic system) such as the engine, transmission, exhaust system, turbocharger, etc.

Appropriate caps, seals and covers must be installed on the body in order to avoid the risk of fire.

5.10 Electromagnetic compatibility (EMC)

The different electrical devices on board the vehicle cause electrical interference in the vehicle's electrical circuit. At MITSUBISHI FUSO, electronic components installed at the factory are checked for their electromagnetic compatibility in the vehicle.

When retrofitting electric or electronic systems, they must be tested for electromagnetic compatibility and this must be documented.

The equipment must have been granted type approval in accordance with FCC regulations.

The following standards provide information on this:

Additional information

The notes on operating safety and vehicle safety in Section 1 "Introduction" ▷ page 9 and ▷ page 10 must be complied with.

5.11 Storing and handing over the vehicle

Storage

To prevent any damage while vehicles are in storage, MITSUBISHI FUSO recommends that they be serviced and stored in accordance with the manufacturer's specifications ▷ page 35.

Handover

To prevent damage to the vehicle or to repair any existing damage, MITSUBISHI FUSO recommends that the vehicle be subjected to a full function check and a complete visual inspection before it is handed over ▷ page 36.

6.1 General

Risk of injury

Do not modify any bolted connections that are relevant to safety, e.g. that are required for wheel alignment, steering or braking functions.

When unfastening bolted connections make sure that, when work is complete, the connection again corresponds with the original condition.

Welding work on the chassis/body may only be carried out by trained and qualified personnel.

The body, the attached or installed equipment and any modifications must comply with the applicable laws and directives as well as work safety or accident prevention regulations, safety rules and accident insurer requirements.

Additional information

Further information on bolted and welded connections can be found in Section 3 "Planning of bodies" ▷ page 22 and Section 5 "Damage prevention" ▷ page 52.

- Never modify (weld, padding, additional work, etc.) or heat critical safety parts such as the axle, steering, brake, suspension related components, propeller shaft. If you study the movement of critical safety parts owing to unavoidable circumstances, be sure to consult the department responsible.
▷ page 14

Main critical safety parts
- Knuckle arm
- Knuckle arm bolt
- Tie rod assembly
- Tie rod arm
- Tie rod arm bolt
- Axle
- Steering shaft assembly
- Power steering booster
- Power steering booster bracket
- Pitman arm ball stud
- Steering drag link
- Steering ball stud
- Steering universal yoke
- Steering slip joint
- Steering spider
- Brake hose, brake pipe
- Brake booster
- Air tank, vacuum tank
- Wheel bolt
- Wheel nut
- Spring bracket
- Spring U-bolt
- Propeller shaft

Observe the following precautions during body building work.

Failure to observe any of them could damage an engine or intake system part.

- Do not run the engine with the air cleaner removed.
- Do not allow paint or organic solvent (including evaporated gas) to be drawn into the engine intake system.
- Do not heat the engine intake system from the outside.

6.2 Chassis frame material

If the frame is extended, the material of the extension element and reinforcing bracket must have the same quality and dimensions as the standard chassis frame.

See the respective body/equipment mounting directives for the longitudinal frame member dimensions.

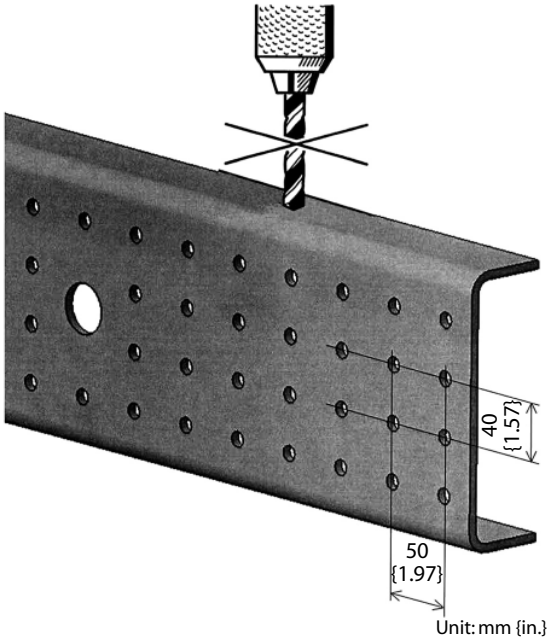
Material: FEC HTP540

6.3 Drilling work on the vehicle frame

Drilling work on side rails

All factory holes in side rails are regularly spaced {50 mm (1.97 in.) in longitudinal pitch and 40 mm (1.57 in.) in vertical pitch}. Use existing holes instead of drilling new holes. Never drill holes in any top flange areas. Also avoid enlarging existing holes in principle. If it is unavoidable to enlarge a hole, limit the hole diameter to 13 mm (0.51 in.).

No load may be applied to the center of the web of the longitudinal member (diaphragm effect). If this is unavoidable, make sure that there is a large area of support on both sides of the web.



6.3 Drilling work on the vehicle frame

Drilling work on the crossmembers

- The holes and distances between the holes should conform to the values specified in the chart below.

Crossmember type	Hole diameter	Center-to-center distance of holes
• Alligator type (see Fig. 1) • Channel type (see Fig. 2)	9 mm {0.35 in.} max.	30 mm {1.18 in.}* min.

Note*: Maintain the dimensions of previously drilled holes.

- Holes should be more than 100 mm {3.94 in.} away from the end of the side rail flange or the end of the gusset.
- Holes in the web of the channel type crossmember should be 50 mm {1.97 in.} min. from the end of the crossmember. (Refer to Fig. 2)
- Holes in the flange should be more than 25 mm {0.98 in.} from the end.
- Holes should be drilled more than 20 mm {0.79 in.} from the curved part of the flange.

Alligator type

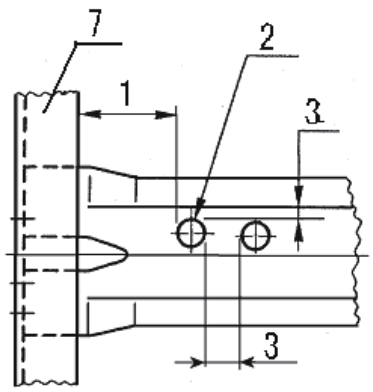


Fig. 1

Channel type

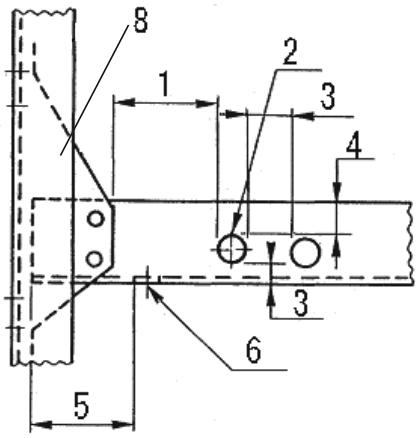


Fig. 2

1 100 mm {3.94 in.} min
2 DIA 9mm {0.35 in.} max
3 25 mm {0.98 in.} min
4 20 mm {0.79 in.} min
5 50 mm {1.97 in.} min (Web surface)
6 DIA 13 mm {0.51 in.} max (Web surface)
7 Side rail
8 Gusset

6.4 Welding work on the vehicle frame

Welding anything onto chassis frame is prohibited in principle, as doing so increases the risk of cracks in the member. For detailed instructions about rear body mounting, see 7.2 “Mounting frame” ▷ page 120.

Additional information

Further information on welded connections can be found in Section 5 "Damage prevention" ▷ page 54.

6.5 Reinforcements

Reinforcement for a cab-back-mounted crane

Adding a stiffener to the outside of a side rail generally has no reinforcing effect, as the stiffener (or a local reinforcement) will create a sudden change in rigidity in the frame, which is likely to cause cracks to develop in the frame. However, frame reinforcement is indispensable around the crane mounting area where stress concentrates during crane operation; follow the instructions below when performing such frame reinforcement work:

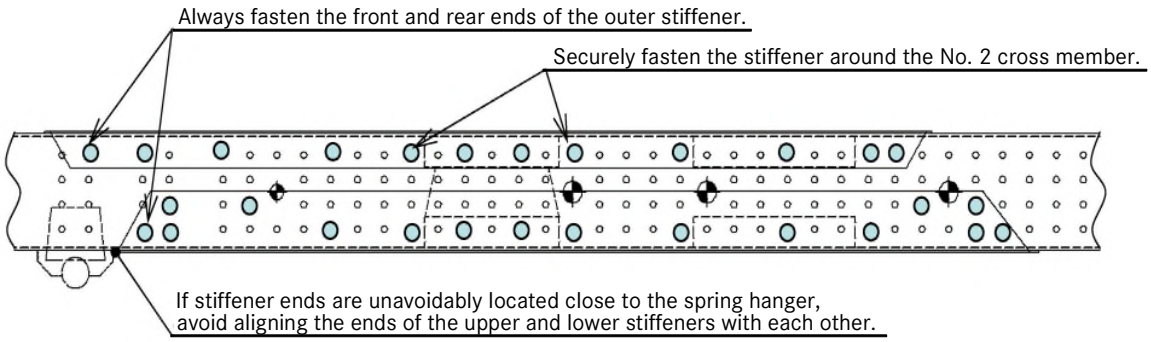
- Any of the ends of outer stiffeners should not be aligned with any of the ends of a sub side rail inside the side rail.
- Any of the ends of outer stiffeners should not be aligned with any stress concentration point such as the back of the cab, an area neighboring a spring hanger, and cross member ends. If it is unavoidable to locate a stiffener end close to a spring hanger, avoid aligning the ends of upper and lower stiffeners.
- Cut any end of an outer stiffener at an angle of more than 45 degrees, not squarely.
- Fasten outer stiffeners to side rails by riveting or bolting on the web surface.
- Use 10 mm {0.39 in.}-diameter rivets and M10 bolts for fastening. Use a riveting machine for riveting.

  Tightening torque

  Unit: N·m {ft.lbs, kgf·m}

Name	Tightening torque
Bolt M10 Flange bolt 10T	88 to 105 {65 to 80, 9 to 11}
Nut M10 Flange nut 6T	

  Do not use ground bolts for fastening outer stiffeners. Mount the DEF tank bracket (plastic) with bolts tightened to a torque of 21 to 31 N·m {15 to 23 ft.lbs, 1 to 3.2 kgf·m}.
- When re-riveting, do not use a rivet of the same diameter as the removed rivet in the same place. It is permitted to re-rivet with an 11 mm (0.43 in.) diameter rivet in place of a removed 10 mm (0.39 in.) diameter rivet after enlarging the hole correspondingly, provided the distance from the end of the outer stiffener is at least 25 mm (0.98 in.) from the edge of the rivet hole.
- Always fasten the front and rear ends of any outer stiffener.
- Stiffeners must be fastened especially securely around the No.2 cross member.
- The spacing between rivets or bolts should be no more than 200 mm (7.87 in.). The spacing must be closer near the ends of an outer stiffener.
- A channel-section stiffener, if inferior in dimensional accuracy, will create a gap at its flanges when installed on a side rail and may cause problems. Instead, use two L-section stiffeners on the top and bottom sides of the side rail.
- To ensure that the seating surfaces of bolts and nuts function properly, do not make outer stiffener mounting holes any larger than 11 mm {0.43 in.} in diameter. Slotting holes must not be used.
- If any chassis part has to be mounted astride an outer stiffener, create a gap in height with spacers {approx. 25 x 160 mm {0.98 x 6.3 in.}} equal to the outer stiffener added between them. Do not use existing plain washers for this purpose.
- Do not use bolts at the four corners outside the cross member/transmission mount to fasten outer stiffeners.



6.6 Modifications to the wheelbase

The wheelbase should not be extended or shortened because considerations for the propeller shaft length, balance, position of center bearings, brake piping and harness length are required.

If this is unavoidable, contact the department responsible ▷ page 14.

6.6.1 Prohibition on modifying the propeller shaft

⚠ Risk of accident

It is strictly prohibited to modify the propeller shaft by welding or other means to change its length.

An improperly modified propeller shaft may cause vibration during operation, which in turn may cause damage to the transmission, separation of the propeller shaft, and other dangerous conditions, possibly resulting in a serious accident.

6.7 Frame modifications

- The maximum permissible axle loads must not be exceeded, while the minimum front axle load must be exceeded.
- Rear underride guard: fastened in the same way as on a standard vehicle.
- Extend the mounting frame to the end of the frame.

6.7.1 Precautions for modification

In the case that a rear body of special design is mounted or the vehicle is to be used in special conditions, use utmost care that neither the structure nor the strength of the frame is impaired during mounting or modification work.
When mounting a rear body of special design, pay full attention to even weight distribution on the frame.
Refer to "10.6.2 Frame section modulus" ▷ page 233.
Attaching stiffeners, drilling holes or welding objects to the frame can affect the strength of the frame greatly, possibly resulting in a deformed or cracked frame. Avoid performing any unnecessary reinforcement, drilling or welding work on the frame.

6.7.2 Extending and shortening

- Frame rear overhang extending procedure
  Perform the following steps to extend the frame rear overhang.

- Extension members

Unit: mm {in.}

Extension member		Reinforcement		Electrode	
Material	Thickness	Material	Thickness	Shielded metal arc welding	CO_2 gas shielded arc welding
MJSH440W (S355J2C+N), HTP540 (S500MC)	Same as the side rail	MJSH440W (S355J2C+N)	3.2 - 4.5 {0.13 to 0.18}	Illuminite base, for 540 MPa, D4301 or equivalent as per JIS Z3211	YGW11 or equivalent as per JIS Z3312

As high tensile strength steel (540 MPa class) hardens more easily at welds than automotive structural steel (MJSH440W), follow the instructions below.

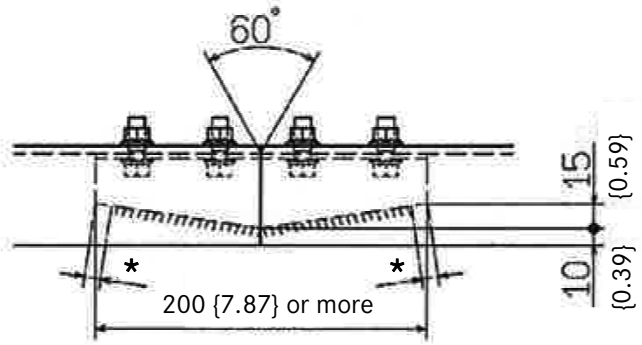
(a) Be sure to use a low-hydrogen type electrode. Especially, where the weld must have the same strength level as the base metal, use a low hydrogen, high tensile strength type electrode.
(b) Short weld beads are more likely to crack due to low hardening rate, so in areas requiring many short weld beads, perform continuous welding instead.

6.7 Frame modifications

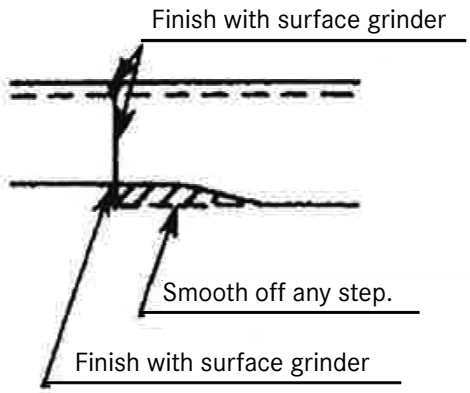
- Extending and shortening procedure
  Follow the reinforcement method described below.

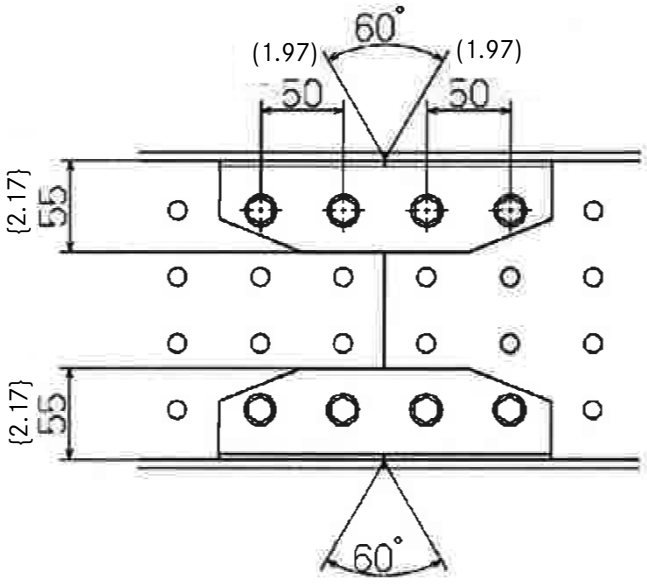
  When bolts are used for fastening the reinforcement, fasten it at two or more points to each of the frame and extension member. Use M10 bolts (8T) and nuts (6T) and tighten them to a torque of 60 to 80 N-m {44 to 59 ft-lbs., 6.1 to 8.2 kgf-m}.

  Finish flange ends at butt welds of the side rail with particular care using a grinder so that there is no undercut or build-up of weld metal. Also make sure that there is no difference in level between the side rail and extension member. If there is a step between them, finish the area for a smooth surface.



Note: Do not weld 10mm {0.39 in.} at *.





unit: mm {in.}

- Cautions for finishing the side rails.
  Be especially careful when finishing the flange end of the butt-welded side rails. Ensure a clean finish by grinding the weld so it is free of undercut, pileup or convex bead.

Under cut

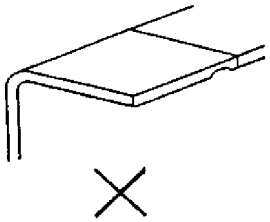


Fig. 3

Pile up

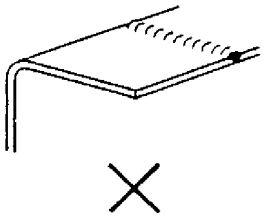


Fig. 4

6.7.3 Others

Never drill or grind any notches in the side rail, crossmember flange, or crossmember gusset.

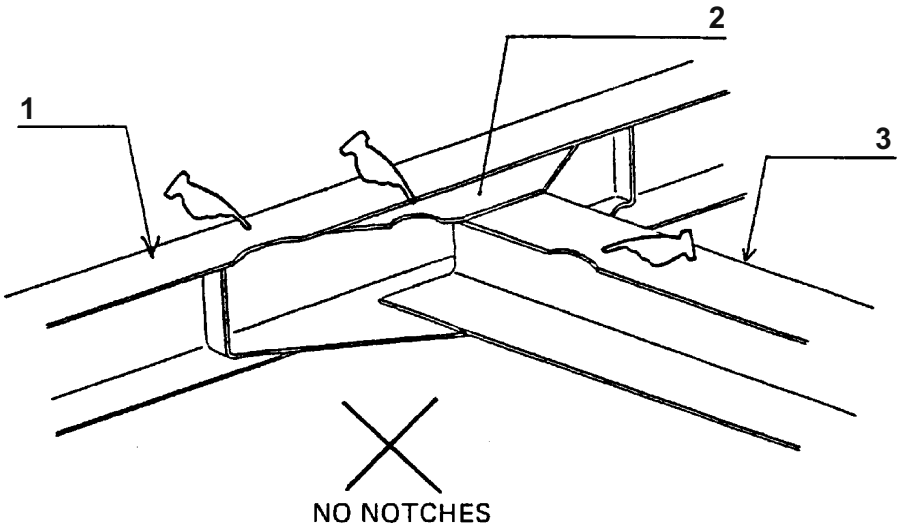


Fig. 1

1 Side rail
2 Crossmember gusset
3 Crossmember

6.8 Mounting of implements and auxiliary components

6.8 Mounting of implements and auxiliary components

⚠ Risk of accident

The use of parts, assemblies or conversion parts and accessories which have not been approved may jeopardize the safety of the vehicle.

Before installing any attachments, special-purpose bodies, equipment or carrying out any modifications to the basic vehicle and/or its assemblies, you must read the relevant sections of the vehicle Owner's Manual, as well as the operating and assembly instructions issued by the manufacturer of the accessories and items of optional equipment.

You could otherwise fail to recognize dangers, which could result in injury or death.

Official acceptance by public testing bodies or official approval does not rule out safety hazards.

All federal, state, and local regulations and codes and registration requirements must be complied with.

6.8.1 Mounting equipment on the side rail

- Attach a stiffener to the inside of the side rail as shown in Fig. 1 when installing bolts to support heavy components on the side rail overhang. This will prevent cracks in the frame due to resonance of the component if the static load caused by the weight of the component exceeds 100 kg {220 lb} of force for each bolt.

Example:

- As a rule, avoid attaching additional equipment together with components (Spare tire carrier, battery, etc.) which are already installed to the frame side. When this is absolutely necessary, increase the size of the bolts, or the number of bolt locations, to decrease the stress on each bolt.

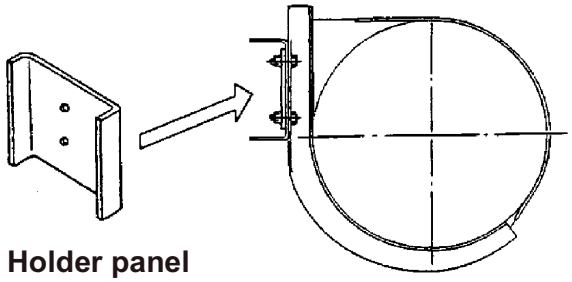


Fig. 1

6.8 Mounting of implements and auxiliary components

6.8.2 Wheel chocks

Mounting

- In a suitable bracket so that they cannot rattle.
- Secured to prevent loss.
- Ensure good accessibility.

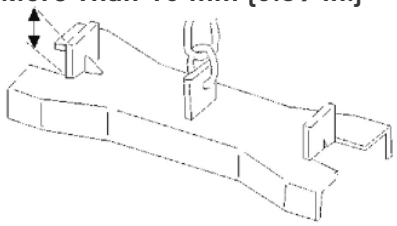
6.8.3 Spare tire carrier

- Install under the frame, on the side of the frame or on the body in accordance with the chassis drawing.
- It must be easily accessible and easy to handle.
- The Spare tire - carrier
  When remodelling the tire carrier, followings must be paid attention:
  (a) A single worker can easily remove or attach the tire.
  (b) Interference is not caused with parts other than the intended stopper when tightening the tire on the tire carrier.
  (c) The worker can attach even burst tires.
  (d) The tightening section is prevented from becoming loose.
  Example 1: Clamped tire-carrier
  - The tightening bolt must be 30 mm {1.18 in.} or longer.
  - Double nuts must be used for tightening.
  - The structure having a height difference for preventing falling on the bracket.
  - The structure having a stopper for preventing tightening nuts and bolts from falling.

  Example 2: Hoisted tire-carrier
  - The structure must have a spring inserted below the hoisting plate.
  - The structure must prevent reverse rotation of the hoisting shaft.
  - The structure must have a lock for preventing the tire from falling

  (e) The tightening bolt must be M10, 7 T strength or an equivalent product. (clamped tire-carriers)
  (f) The tire shape must limit movement in the forward, backward, left and right directions. (clamped tire-carriers)
  (g) Take care to prevent injury when hoisting tires. (hoisted tire-carriers)
  (h) Tightening bolts must be tightened to a torque of at least 49 Nm and by a force at least 290 N at handles. The tire-carrier must be designed to have enough contact area to support the tire securely. (hoisted tire-carriers)
  (i) The height difference on the lifter must be at least 10 mm {0.39 in.}, or the lifter must be of a shape that enables the same effect. (hoisted tire-carriers)

More Than 10 mm {0.39 in.}



  (j) When manufacturing the carrier, apply a tensile load of 4900 N or more on the lifter. (hoisted tire-carriers)
  (k) Affix a Caution Plate indicating the recommended tightening torque 49 Nm at a position that can be easily seen during operation.

6.8 Mounting of implements and auxiliary components

- Carry out the following tests with the carrier attached to the body or in a similar state.
  (a) Tensile strength test
  (clamped tire-carrier)
  Apply the following load face down at the center of the disk wheel with a tire attached to the carrier.

$P = W \times \alpha \times \beta$

P	:	Test load
W	:	tire of maximum set weight
α	:	Load multiple of 2.5
β	:	Required safety ratio of 1.3

(hoisted tire-carrier)
Apply the following load face down via the hoisting plate.

$P = (Po \times \gamma \pm W \times \alpha) \times \beta$

P	:	Test load
Po	:	Load applied on chain by tightening torque during standard tightening
W	:	tire of maximum set weight
α	:	Load multiple of 2.5
β	:	Required safety ratio of 1.3
γ	:	Load multiple of 1.5

As a result of this test, carrier components must be free from detrimental deformation.

(b) Hoisting strength test
(hoisted tire carrier)
Fix the hoisting plate, and apply the following torques on the carrier.

$T = To \times \gamma \times \beta$

T	:	Test torque
To	:	Standard tightening torque
β	:	Required safety ratio of 1.3
γ	:	Load multiple of 1.5

As a result of this test, carrier components must be free from detrimental deformation.

(c) Operating durability
Hoist a tire of maximum allowable weight, tighten to a torque of 49 Nm, and then winch down. Repeat this series of operations 200 times. (This test needs be carried out continuously.) As a result of this test, operation must remain uninterrupted and carrier components must be free from detrimental deformation.

(d) Looseness resistance
Increase and decrease vibrations of 1 g (9.8 m {32 ft}/sec2) (need not be 1 g during resonance vibrations) and 8.3 Hz to 50 Hz (500 to 3,000 times per minute) on the supporting device in the vertical direction of the carrier mount continuously for one hour taking at least 5 minutes for each reciprocal movement.
As a result of this test, the carrier device must be free from detrimental looseness.

6.8 Mounting of implements and auxiliary components

Crank handle (reference)

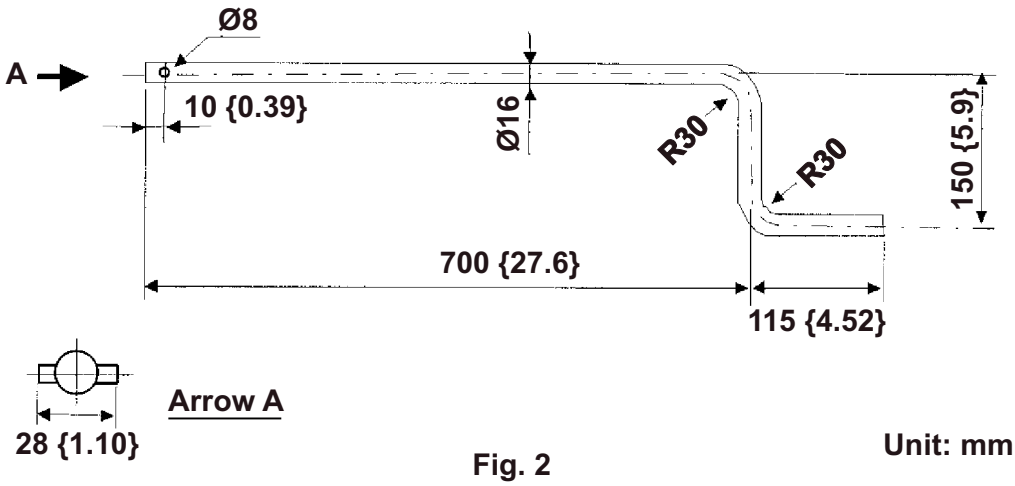


Fig. 2

Unit: mm {in.}

6.8.4 Mudguards and wheel arches

- The distance from the tire to the mudguard or wheel arch must be sufficient, even when snow chains or anti-skid chains are fitted and at full spring compression (including under torsion). The dimensional data in the tender drawings must be observed.
- On chassis with standard bore holes for mudguard brackets, use these bore holes to secure the brackets.

6.8 Mounting of implements and auxiliary components

6.8.5 Side underrun protections

Mount components in accordance with local regulations.

6.8.6 Rear underrun protection <Vehicle with rear underrun protection>

Rear underrun protection should be installed in compliance with UN regulation R58 and in accordance with the drilling work instructions.

- the distance between the rear of the vehicle and the final rear axle is more than 1,000 mm
- the ground clearance of the chassis as well as the main body parts exceeds 700 mm for the unladen vehicle across the entire width.

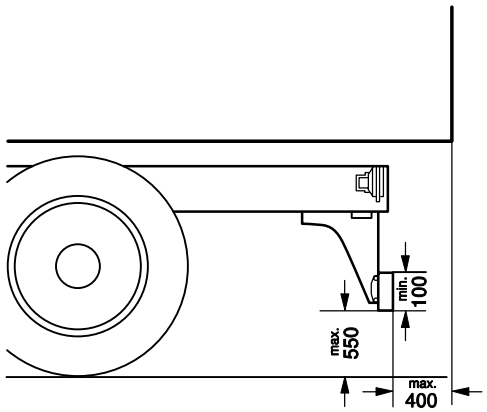
Exceptions to this regulation are semitrailer tractor vehicles, machines and vehicles whose purpose cannot be fulfilled if an underrun protection is fitted.

If an underrun protection is required, it must comply with UN Regulation R58.

The underrun protection must be mounted as far back as possible.

Installation dimensions:

- maximum height of underrun protection (unladen vehicle) above road surface: 550 mm.
- maximum width = width of rear axle (outer tire edge).
- minimum width: = Width of rear axle – 100 mm on each side (widest axle is authoritative)
- crossmember section height at least 100 mm.
- edge radius at least 2.5 mm.



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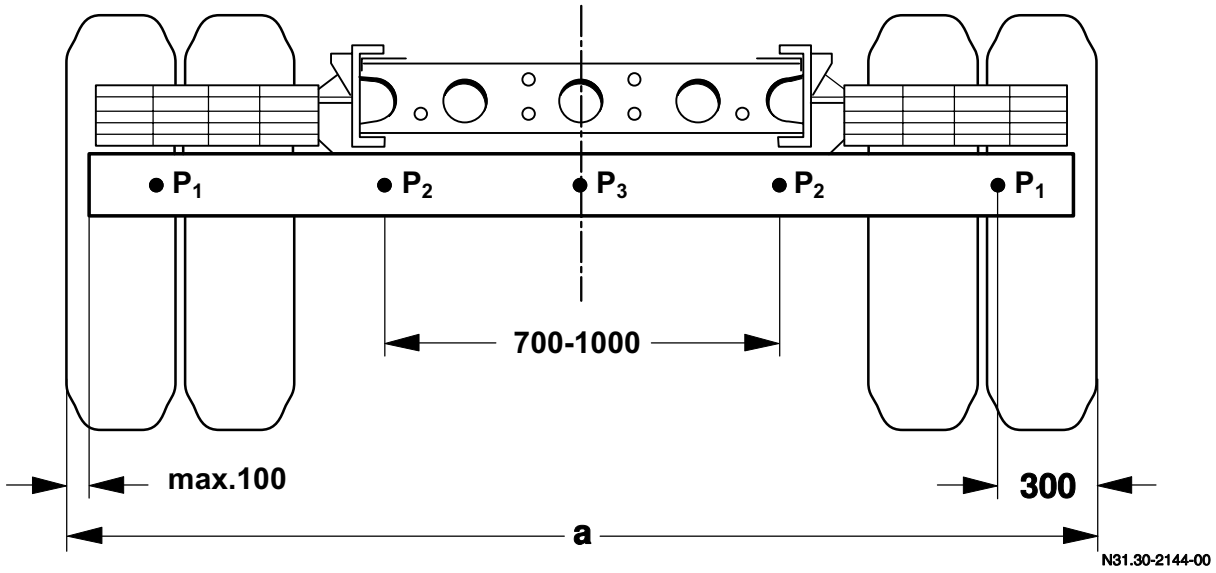
The rear underrun protection fitted at the factory complies with UN Regulation R58. No modifications may be made. If modifications are unavoidable, they must be clarified in advance with the vehicle licensing agency responsible.

6.8 Mounting of implements and auxiliary components

D

Check strength of underrun protection and its mounting in accordance with UN Regulation R58.

At maximum deformation, the distance from the end of the body to the end of the underrun protection at the load points may not exceed 400 mm.



a = Rear axle width
P_1, P_2, P_3 = Load application points

6.9 Cab

Modifications to the cab must not have a negative effect on the operation or strength of assemblies or control elements or on the strength of load-bearing parts.

The tilting cab must not be fixed rigidly to the bodywork. If any interventions to the cab are planned they must be co-ordinated with the department responsible ▷ page 14.

- The content relating to in Section 2.5 Mitsubishi three diamonds and Fuso emblem must be complied with ▷ page 18.

Attaching the roof deck

Roof

- When attaching externally mounted parts such as roof deck or drag foiler onto the roof, use the exclusive mounting holes provided on the roof. (See Figs. 1 and 2.)
- Prevent the weight of externally mounted parts attached to the roof from exceeding 50 kg {110 lb}. (See Figs. 1, 2 and 4.)
- Use nickel-chrome plated stainless steel bolts and washers.
- Take special care to prevent the body from becoming scratched when attaching externally mounted parts.
- Insert packing between externally mounted parts and the body to prevent rusting. Use RC710CP (EPDM) rubber or equivalent with a thickness of 2 mm {0.079 in.} or less and a hole diameter of 8 mm {0.31 in.} (for ozone crack prevention).
- After attaching externally mounted parts, coat the entire periphery of the mounting bolts with sealer.
- The top coat of paint must be applied to externally mounted parts before attaching to the roof. (See Fig. 3.)

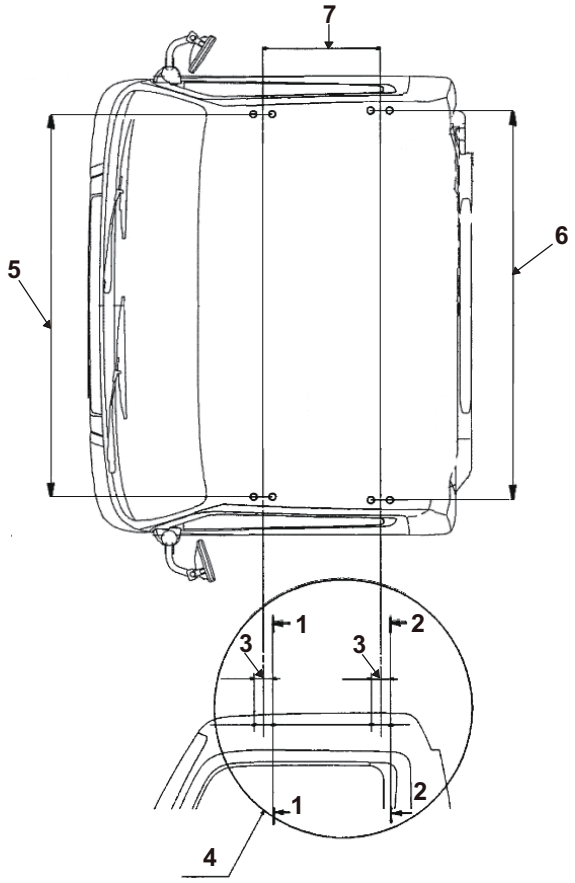
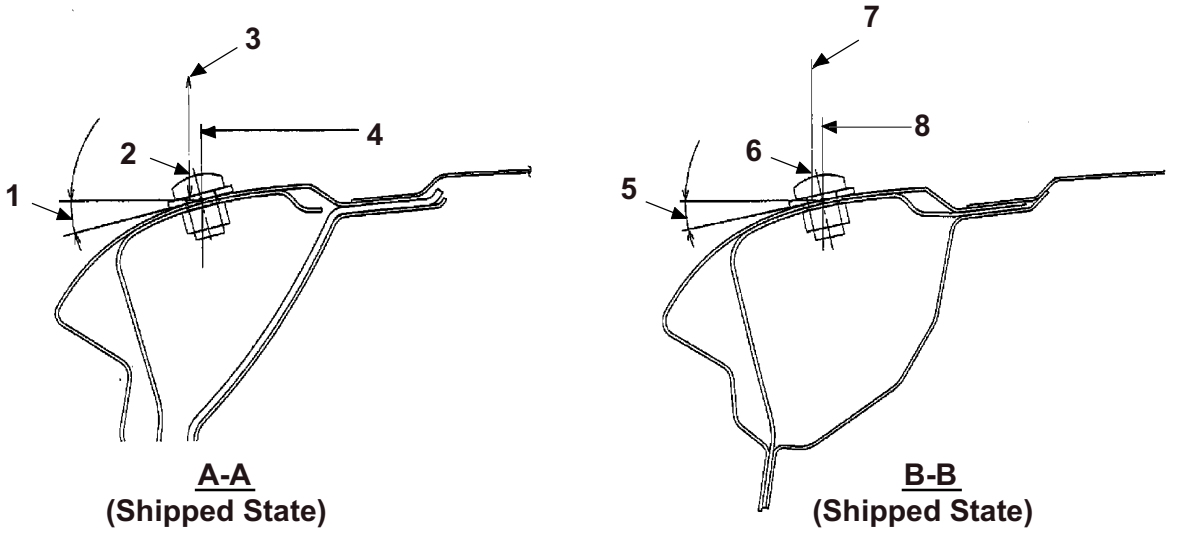


Fig. 1

1 Section A-A
2 Section B-B
3 80 mm {3.15 in.}
4 Detail C
5 1664 mm {65.5 in.} (Wide cab)
1364 mm {53.7 in.} (Standard cab)
6 1694 mm {66.7 in.} (Wide cab)
1394 mm {54.9 in.} (Standard cab)
7 500 mm {19.7 in.}



DETAIL C (1)

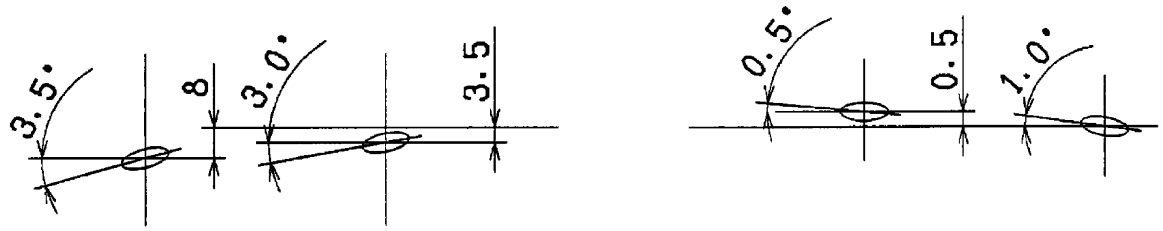


Fig. 2

1 16.5° (Wide cab, Standard cab)
2 31.0 mm {1.22 in.} (Wide cab)
29.0 mm {1.14 in.} (Standard cab)
3 roof top
4 1664 mm {66 in.} (Wide cab)
1364 mm {53.7 in.} (Standard cab)
5 14.5° (Wide cab, Standard cab)
6 34.5 mm {1.36 in.} (Wide cab)
32.5 mm {1.28 in.} (Standard cab)
7 roof top
8 1694 mm {66.7 in.} (Wide cab)
1394 mm {54.9 in.} (Standard cab)

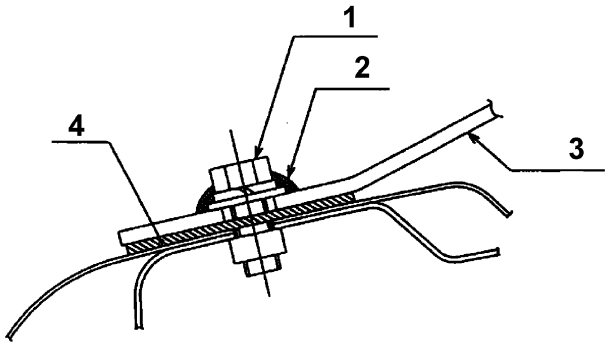


Fig. 3

1 Use washer and bolt with plain washer
2 Coat periphery with sealer
3 Roof deck or drag foiler
4 Rubber packing

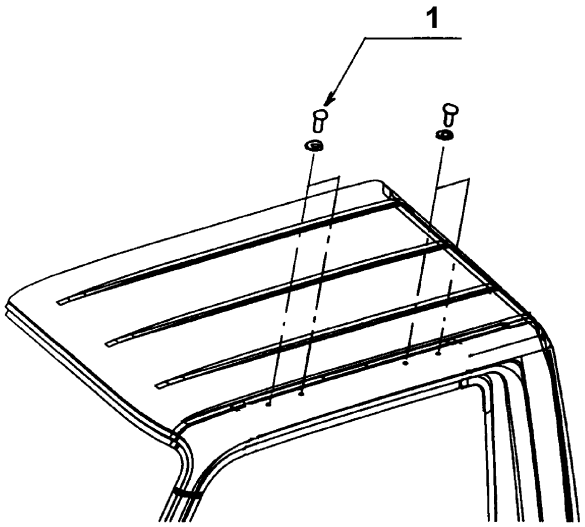


Fig. 4

1 Bolt and washer: Left/right total 8 places
(For roof deck or drag foiler)

6.10 Seats and bench seat

⚠ Risk of injury

Modifications to or work incorrectly carried out on a restraint system (seat belt and seat belt anchorages), could cause the restraint systems to stop functioning correctly. For this reason, never carry out modifications to the restraint systems.

Comply with all federal, state, and local regulations and codes.

The retrofitting of original seats and/or bench seats is only permitted and possible if the necessary preinstallations exist in the vehicle, such as suitable floor assembly, reinforced cab/cab suspension. For all other seat retrofittings, corresponding evidence (belt checks, tensile tests) is required as part of an endorsement check carried out by the seat or equipment installer.

B

6.11 Power take-offs (PTO)

C

6.11.1 Transmission driven power take-off

See PTO addendum.

6.12 Installation of propeller shafts

The modification of extending or shortening the wheelbase or additional installation of a transmission to the drive line requires the modification of the propeller shaft. If the propeller shaft is improperly modified such as a change in the pipe length by welding to the main unit of the propeller shaft, vibration caused by the propeller shaft can lead to a serious trouble or accident such as cracks and rupture of the clutch housing and falling-off of the propeller shaft. Therefore, the modification of the propeller shaft is strictly prohibited.

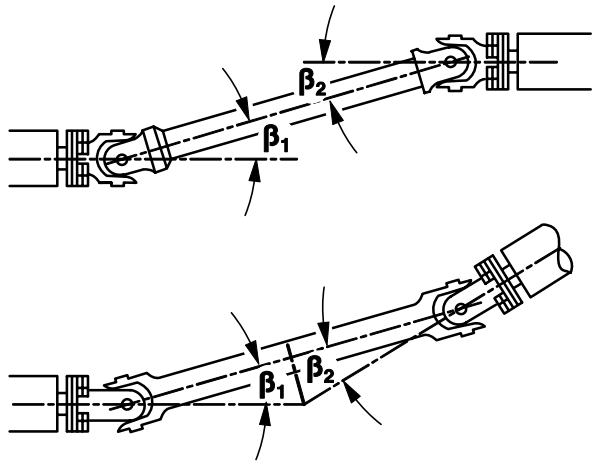
If the modification of the propeller shaft is necessary due to a customer's request or body mounting layout, be sure to consult with contact personnel for body mounting and modification. (▷ page 14)

Observe the following when installing propeller shafts:

- Installation guidelines of the propeller shaft manufacturer.
- If necessary, fit several propeller shafts with intermediate bearings.
- The flanging surfaces must be completely flat.
- The angular offsets must be identical at both universal joints ($ß_1 = ß_2$). They must not be greater than 6° or less than 1°.
- Balancing plates must not be removed.
- Make sure that the marks are aligned on the propeller shafts during installation.
- Eliminate any vibrations, e.g. by optimising the propeller shaft angles.

6.12 Installation of propeller shafts

6.12.1 Types of angular offset



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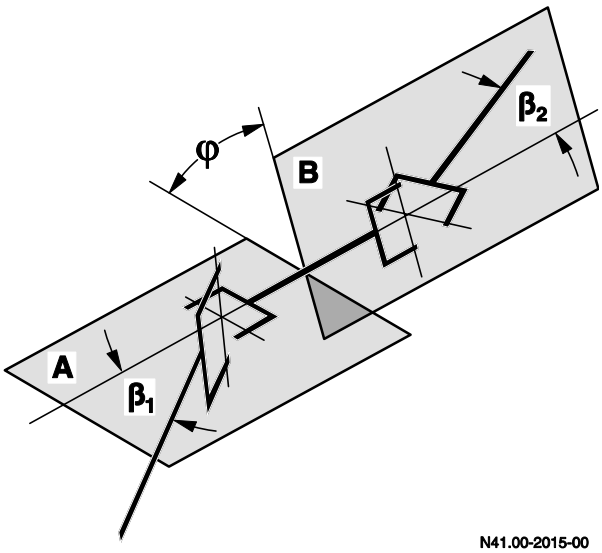
Angle in one plane (two-dimensional offset)

$ß_1 = ß_2$
Upper = Z-type offset
Lower = W-type offset



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Angles in two planes (three-dimensional offset)

$ß_1 = ß_2$

With three-dimensional offset, the input and output shafts intersect in different planes (combined W- and Z-offset).

In order to compensate for any irregularities, the inner joint fork must be offset.

Property damage

Failure to observe these instructions could result in damage to the major assemblies.

6.13 Brake systems

Risk of accident

Work carried out incorrectly on the brake system may impair its function. This may lead to the failure of components or parts relevant to safety. This could cause an operator to lose control of the vehicle and cause an accident with possible injury or death.

All accident prevention regulations must be complied with when working on the vehicle.

Comply with all federal, state, and local regulations and codes.

Additional information

After any modifications the brake system must be tested for proper operation and approved by a technical inspection authority otherwise the operating permit will be invalidated.

Further information can be found in Section 5 "Damage prevention" ▷ page 52.

Disk brake

Property damage

Do not impede cooling by attaching spoilers below the bumper, additional hub caps or brake disk covers, etc.

6.13.1 Chassis tubing form and dimension specifications

The chassis uses steel brake lines which conform to the following specifications.

(Double Flare type) Unit: mm {in.}

Nominal diameter	A	B	t	C	S min.	Material
4.75 4.76 {0.19}	6.6-7.1 {0.26-0.28}	3.0-3.7 {0.12-0.15}	0.7 {0.03}	1.4 {0.06}	1.0 {0.04}	SPCC (JIS) (ASTM A109 or A366) Double walled steel tubes
6.35 {0.25}	8.6-9.1 {0.34-0.36}	4.5-5.2 {0.18-0.20}	0.7 {0.03}	1.4 {0.06}	1.0 {0.04}	

(ISO flare type) Material is the same as Double Flare types. Unit: mm {in.}

Nominal diameter	D1	D2	D3	D4 min.	T	L
4.75 4.76 {0.19}	4.83-4.69 {0.190-0.185}	7.28-6.92 {0.286-0.273}	3.5-3.0 {0.137-0.119}	4.7 {0.19}	0.77-0.63 {0.030-0.025}	2.8-2.2 {0.110-0.087}
6.35 {0.25}	6.42-6.28 {0.252-0.248}	8.98-8.62 {0.353-0.340}	5.1-4.6 {0.201-0.182}	6.3 {0.25}		

D4 is an outside diameter on the sealing surface. The surface-roughness is $\sqrt[3.2]{\lambda\tau 0.8}$

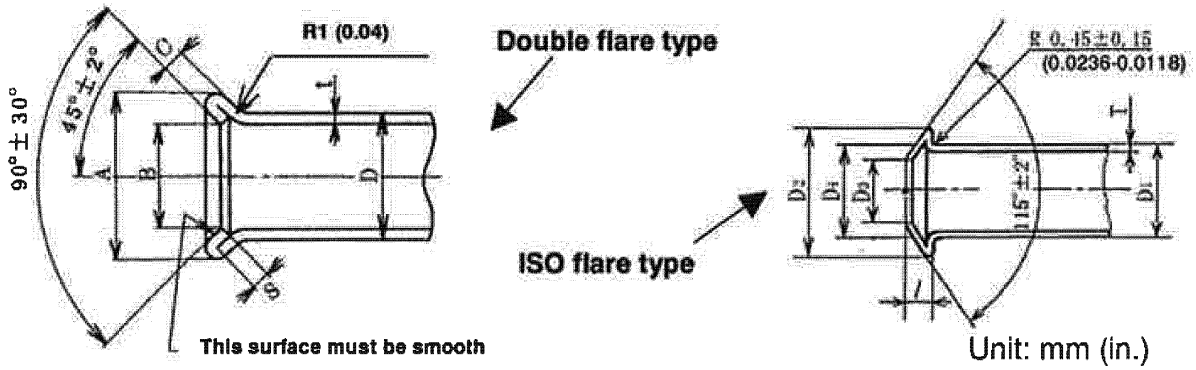


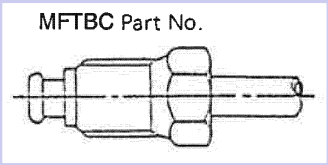
Fig. 1

The tightening torques for the flare nuts which connect the brake lines are shown below.

Nominal Diameter mm {in.}	Tightening torque N·m {ft.lbs, kgf.cm}
4.75 4.76 {0.19}	13 to 17 {9.4 to 12.3, 130 to 170}
6.35 {0.25}	19 to 26 {13.7 to 18.8, 190 to 260}

6.13.2 Making additional tubes

- Only use brake tubes of the same material as the tubes connected to the chassis when extending the brake tubes.
- Only use steel tubes to extend the brake fluid tubes. Never use copper tubes.
- Only use metric pipe tools to form the flared end of brake lines as shown in the "Flared end shape figure" in Fig. 1. Be careful to not scratch the tubes, or damage the mating surfaces when flaring the ends.
- A brass nut used with steel tubes could cause uneven fitting between the flared surface of the tubes and the connecting surface joint, resulting in fluid leakage.
- Use the flare nuts specified in the table below.

Nominal diameter of tube mm {in.}	 Fig. 2
4.75 4.76 {0.19}	MF651001 (Double flare type) MK678335 (ISO flare type)
6.35 {0.25}	MF651002 (Double flare type) MK678336 (ISO flare type)

- Use a tubing bending tool to bend the brake lines correctly. Do not use heat to bend the brake lines.
- The bend curvature R should strictly conform to the minimum allowable bend radius R shown in the table below.

Nominal diameter mm {in.}	Bend radius mm {in.}
4.75 4.76 {0.19}	25 {0.98}
6.35 {0.25}	30 {1.18}

- The required length of the straight portion of the line end and the bent portion must conform to the dimensions specified in Fig. 3.

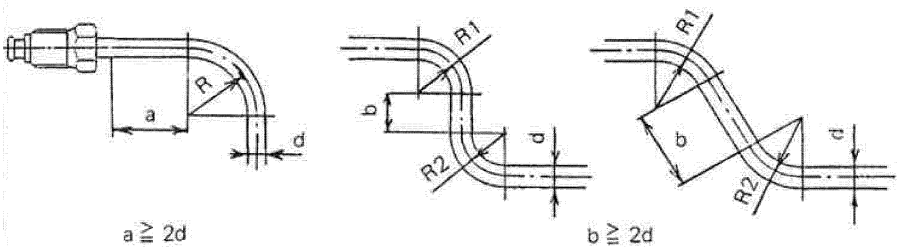


Fig. 3

- Use high pressure air nozzle to clean and remove foreign matter from inside the brake lines before use. Use compressed air for cleaning. Cleaning oil is not recommended, but completely remove any residue if it is used.

6.13.3 Running additional lines

- Avoid crossing brake lines. If this is unavoidable, position each line so it clears the other by more than 15 mm {0.59 in.}. (Fig. 4)

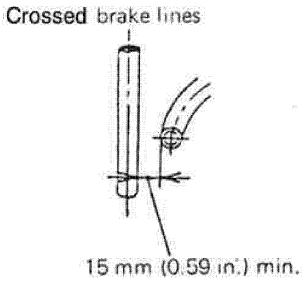


Fig. 4

- Position the brake lines so that they are not closer than 15 mm {0.59 in.} to sharp edges of the frame or other parts. (Fig. 5)

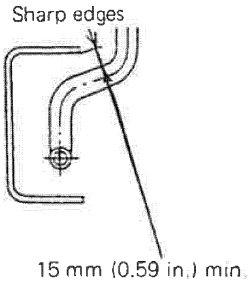


Fig. 5

- Securely clamp brake lines with PVC coated clamps or grommets to prevent vibrations when the vehicle is running.
- The standard brake line clearances are shown in the table below.

Unit: mm {in.}

	Tube dia	Clamp intervals
Straight tube	4.75-8 {0.19-0.315}	550 {21.65} max.
Curved tube	↑	400 {15.75} max.

- Brake lines should be laid along the inside web of the side rail whenever possible. When they cross over to the opposite side rail, they should be positioned along the crossmembers.
  Install the lines more than 10 mm {0.39 in.} away from bolts and rivets.
- Make sure the brake fluid lines can be bled easily.
- Never clamp or tape electrical wires to the brake lines, as this can cause corrosion of the line.
  Maintain the clearances described in Section 4 "Clearance for the basic vehicle and bodies" ▷ page 42.
- The clearance between the brake lines and exhaust system components should conform to the specifications in Section 4 "Clearance for the basic vehicle and bodies" ▷ page 42.
- Position the connection nut in a location where it can be completely tightened without difficulty.
- Tighten the flare nuts to torque specified in ▷ page 104. Do not tighten the flare nut any further if oil leaks. Loosen the flare nut completely, adjust the mating surfaces, re-thread the nut and then tighten it completely.
- Never force or tighten any part with a wrench or other tool if problems occur while installing brake lines. Realign the brake lines so the mating surfaces are correctly positioned, and then tighten the flare nut. If possible, first gently thread the nuts by hand, and then tighten them with the designated flare nut wrench.
- Never install brake lines near the drive shaft or other moving parts.
- Never change the installation location of the brake hoses.
- When replacing the brake lines, do not use the fluid which was drained.
  Drain the fluid completely and replace with new fluid.
- Install the brake lines so that they are protected from damages caused by flying objects thrown up by the tires.
- When it is necessary to protect brake lines against possible damage as described above, install a protective panel as shown below.
  (a) Fabricate a protective panel which will not be deformed by flying objects and come in contact with the brake lines.
  (b) Position and shape the protective panel properly (for drain holes, etc.) so water will drain freely.

Example

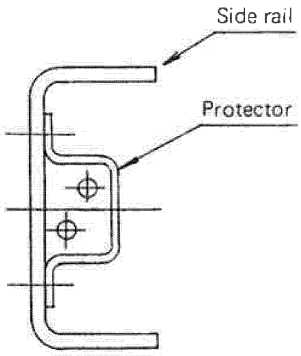


Fig. 6

6.14 Exhaust system

The modification of the exhaust system is prohibited because it has an adverse effect on the noise regulation, fire prevention, emission control system and engine.

<Vehicles with 3-way catalyst systems>

6.14.1 Exhaust gas purification devices and sensors

- Exhaust gas purification devices may be damaged by heavy impact against their body or fall. When mounting, handle them with sufficient care.
- To prevent the exhaust gas purification devices and engine proper from being adversely affected, do not relocate the exhaust gas, exhaust oxygen sensors.
  If temporary removal of these parts becomes inevitable during mounting, be sure to reinstall these parts in the original places. Connect the oxygen sensors properly, not in reverse, too loose nor too tense. Also, install exhaust gaskets and clamps and make sure of gas-tightness.
- Exhaust gas purification devices and sensors are periodically inspection for maintenance. Install them so that removal and inspection work can be carried out without any problems.

6.14.2 Exhaust System

Catalytic exhaust gas aftertreatment

Catalytic exhaust gas aftertreatment removes NOx in the exhaust gas.
Do not modify and transfer the following parts because the performance of the system is deteriorated.

- Exhaust Gaskets
- Oxygen Sensors
- Exhaust Piping
- Catalysts
- Muffler

Precautions for electric welding

If electric welding is performed while the electric wiring for the pump module of the BlueTec system is still connected, the internal electric circuits on the module could be damaged. Be sure to disconnect the module's electric wiring connector as follows before starting electric welding:

- Turn the starter switch to "OFF".
- Leave the starter switch in the "OFF" position for at least 1 minute. (This is necessary for after-run processing.)
- Disconnect the wiring connector on the pump module side.
- Be sure to ground the welder close to the welding area.

When reconnecting the connector after completing the electric welding, confirm that the starter switch is in the "OFF" position.

! Property damage

Do not divide any power supply from an existing fuse.

Especially the BlueTec system will not work if its fuse has blown. In winter and cold areas, the system consumes more electric power for its heater to prevent freezing. Never branch power for another electric device from the fuse.

6.14.3 Clearance between exhaust system parts and other parts

- The exhaust pipe and exhaust gas purification devices (catalyst) become so hot that if they are too close to or in-terfere with other chassis parts, a serious accident like fire or damage by melting could occur. Malfunction is also a possible consequence. Secure sufficient clearance in accordance with the standards ▷ page 44. If this is impracticable, provide a shield plate against heat to ensure safety.
- Do not install the tail pipe under fuel pipe, fuel hose joint or fuel filter drain tube.
  Wooden and rubber body parts should be more than 100 mm {3.94 in.} apart from the muffler and exhaust pipe. If this is impracticable, provide a shielding plate against heat to ensure safety.

6.14.4 Exhaust gas purification devices (catalysts) and sensors

- The exhaust catalyst may be damaged by heavy impact against its body or fall. When mounting, handle it with sufficient care.
- To prevent the exhaust gas purification devices (catalyst) and engine proper from being adversely affected, no modification of the exhaust system is permitted.
  If temporary removal of these parts becomes inevitable during mounting, be sure to reinstall these parts in the original places. Connect the pressure sensor hose properly, not in reverse, too loose nor too tense. Also, securely clip hose joints and make sure of gas-tightness.

6.15 Fuel system

Under no circumstances should any part of the gasoline fuel system be modified or moved.
This includes the fuel tank, fuel pump assembly, fuel lines, vapor lines, fuel filter hoses and pipes, evap canister, and vent solenoid.
The gasoline fuel system has been designed and validated to meet the evaporative emission regulations in CFR title 40 part 86.

6.16 Other

6.16.1 Allison Transmission

Cautions for vehicles with transmission (automatic transmission)

Consult the Allison transmission owners manual provided with the vehicle.
When removing the transmission components and associated parts (piping and wiring included) or performing other works for body mounting, pay particular attention to the following.

Oil cooler piping

- When reinstalling removed oil cooler piping, etc., make sure that the pipe and the transmission system components do not contain any foreign matter. The presence of dirt or the like may cause the system, etc. to malfunction.
- After reinstalling, be sure to adjust the automatic transmission fluid level and initialize thetransmission system.

Clearance

- Make sure that the piping and harness are at least 25 mm {0.98 in.} apart from other parts. If this is impractical with parts installed on the same plane, clamp them at proper point(s) to hold them securely.

Automatic transmission fluid level adjustment

Consult the Allison transmission initial oil fill and start up procedure and other referenced documents.
After reinstalling removed oil cooler piping, adjust the automatic transmission fluid level as follows.

Automatic transmission fluid level adjustment procedure

Perform the adjustment in the following sequence.
The position of the automatic transmission fluid level plug is the normal fluid level. If the automatic transmission fluid is up to the normal level after the hydraulic circuit is filled up, the adjustment has been properly made.

6.16.2 BEFORE START

<1000/2000 PRODUCT FAMILY>

Propaty damage

Several steps in this document dictate that the transmission be shifted to DRIVE. Where so specified, DRIVE MUST be selected.
DO NOT select REVERSE. Stalling the transmission in REVERSE may damage the transmission, driveline, axle or other vehicle components.

Additional information

Several steps in this document dictate that the transmission be shifted to NEUTRAL. For transmissions with the park provision, it is preferable to select PARK instead of NEUTRAL in each of these circumstances.

6.16.3 INITIAL FILL AND START-UP PROCEDURE

The following steps outline the initial fill and start-up procedure for all models.

1 Add the appropriate volume of transmission fluid prior to initial start-up. For oil volumes, refer to Transmission Data for the 1000/2000, the 3000 or the 4000 Product Family.
Restrictions apply if a non-gravity, or pressurized, delivery system is used to fill the transmission with fluid. See paragraph 5.0, Pressurized Fluid Fill, for additional information.
2 Idle the unit in Neutral for at least 15 seconds to allow the converter to fill with oil.
3 WARNING: When operating a transmission as instructed below, the vehicle must be pre-vented from moving. Both the park and service brakes must be applied and the vehicle should be blocked to prevent movement. Warn personnel to keep clear of the vehicle and its travel path. Failure to do so may cause serious injury.
With the vehicle brakes applied and the operator in the driver's station, operate the engine for one minute at 1000-1500 rpm with the transmission in Drive range to purge air from the cooling sys-tem.
4 Return the engine to idle (500-800 rpm) and the transmission to Neutral. Check the fluid level with vehicle on level ground.

Additional information

Always check fluid level with the dipstick in the "unscrewed"or loose position.

5 Now that the system is purged of air and the hydraulic circuits are filled, it is unlikely that fluid will be measurable on the dipstick. Add transmission fluid until the fluid level is at the COLD FULL mark on the dipstick. See the appropriate Fill Tube and Dipstick Installation Drawing for dipstick calibration markings.

Risk of accident

When operating a transmission at stall conditions as instructed below, the vehicle must be prevented from moving. Both the park and servise brakes must be applied and the vehicle should be blocked to prevent movement. Warn personnel to keep clear of the vehicle and its travel path. Failure to do so may cause serious injury.

6 Operate the transmission at part throttle stall, brakes locked, engine at approximately half power, in Drive for 15 seconds. Return engine to idle and shift to Neutral. After 15 seconds, shift to Drive and repeat sequence. Continue the Drive-stall/ Neutral-idle sequence until oil sump temperature reaches a range of 71 °C to 93 °C (160 °F - 200 °F).
7 Return the engine to idle (500-800 rpm) and the transmission to Neutral. Recheck the fluid level.

8 With the transmission fluid in the sump temperature range shown in step 5, add oil to raise the fluid level near the HOT FULL mark. DO NOT OVER FILL. Overheating or oil foaming out of the breather may occur with overfill conditions.

Property damage

The transmission must not be operated for extended periods of time until the hot full level has been verified on the dipstick. Transmission damage can result from extended operation at low fluid level conditions.

Additional information

The fluid between the HOT ADD and HOT FULL calibration marks on the dipstick represent the operating band for the transmission at normal sump temperatures, The width of this band differs for the various types of transmission sumps and various transmission models. The band is designed to represent the following oil volume:

- approximately 1.0 liters (1.1 quarts) of fluid for the 1000/2000 Product Family
- approximately 2.0 liters (2.1 quarts) of fluid for the 3000 and 4000 Product Families

6.16.4 PRESSURIZED FLUID FILL

Due to the risk of damaging seals in the transmission, the use of a non-gravity or a pressurized de-vice to fill the transmission with fluid is permitted only in certain circumstances as defined below. Ingeneral, the practice is not recommended.

The requirements for the use of pressurized fluid fill are as follows.

- The induced pressure inside the transmission during the fill process must be limited to a maximum of 35.0 kPa (5.1 psi).
- The compliance to the pressure limit must be confirmed by test.
- Verifiable process controls are required to assure compliance to the pressure limit.

The verification test for a given vehicle installation is conducted by installation of a pressure gage in one of the following locations:

- In a modified PTO cover on the transmission (if so equipped)
- in a modified fill tube at the altemate fill tube mounting location on the transmission (not available with 4000 Product Family models)
- At the drain plug location in the oil sump.

The standard transmission breather must remain intact and unmodified during tests, sisce the breather is the conventional mechanism for pressure relief in the transmission during the oil fill process.

6.16.5 PRESSURIZED FLUID LEVEL CHECK

It is advisable to perform periodic transmission fluid level checks each time the vehicle is to be placed in service or at the end of the service cycle when the fluid is warm. DO NOT OVER FILL. Overheating or oil foaming out of the breather may occur with overfill conditions.

6.16.6 LIST OF REFERENCED DOCUMENTS

- Transmission Data for the:
  - 1000/2000 Product Families
  - 3000 Product Family
  - 4000 Product Family

- Allison Controls Manual Section B: System Operation for the 3000 and 4000 Product Families

1000/2000 Product Family Installation Drawings

- Fill Tube, Dipstick, and Deep Oil Pan Requirements
- Fill Tube, Dipstick, and Shallow Oil Pan Requirements

3000 Product Family Installation Drawings

- Oil Fill Tube and Dipstick Requirements

4000 Product Family Installation Drawings

- Oil Fill Tube and Dipstick Requirements

6.16 Other

⚠ Risk of accident

For safety, keep the foot brake applied after the engine is started.

Operator action	Vehicle action
With the vehicle in the initialization standby mode, set the change lever to "-".	"6" flashes on the gear shift indicator, meaning that the reset process has been completed.

7.1 General

⚠ Risk of accident and injury

Do not modify any bolted connections that are relevant to safety, e.g. that are required for wheel alignment, steering or braking functions.

When unfastening bolted connections make sure that, when work is complete, the connection again corresponds with the original condition.

Welding work on the chassis/body may only be carried out by trained personnel.

The body, attached or installed equipment and any modifications must comply with the applicable laws and directives as well as workplace safety or accident prevention regulations, safety rules and accident insurer requirements.

⚠ Risk of fire

With all bodies make sure that neither flammable objects nor flammable liquids can come into contact with hot assemblies (including through leakages in the hydraulic system) such as the engine, transmission, exhaust system, turbocharger, etc.

Appropriate caps, seals and covers must be installed on the body in order to avoid the risk of fire.

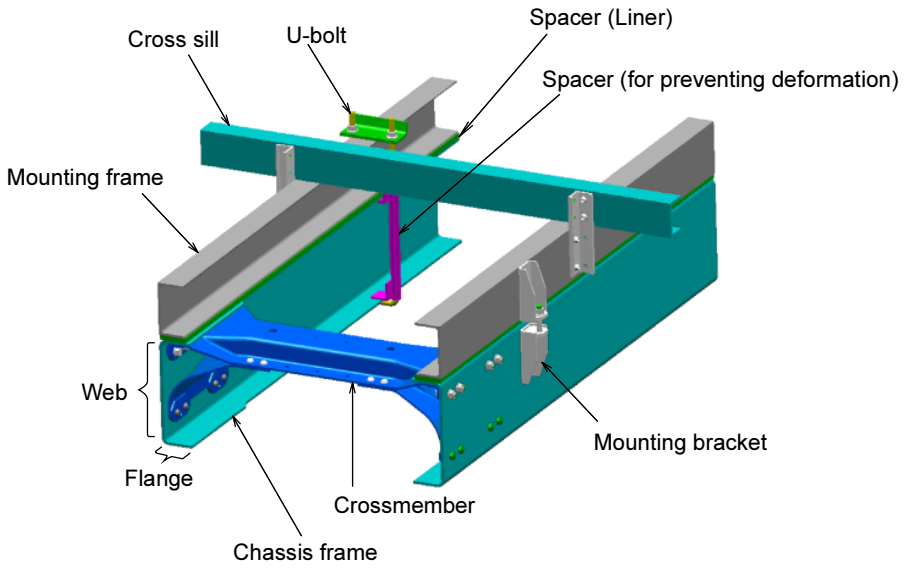
❗ Property damage

Bodies on which the transmission can be expected to be exposed to high levels of water, e.g. cleaning water (flushing, overflowing or similar), require an effective cover over the transmission (transmission guard) which will prevent abrupt cooling as well as water ingestion via the transmission breather.

ⓘ Additional information

Further information on bolted and welded connections can be found in Section 3 "Planning of bodies" ▷ page 29 and Section 5 "Damage prevention" ▷ page 52.

7.1.1 Body mounting methods



Correct calculation of load on the chassis frame

- If a mounting frame is used, the stress calculation of the chassis frame must be conducted for beams combined with the body to be mounted.
- The mounting frame must be fastened to the chassis frame so firmly that the rear body weight may be borne evenly by the combined chassis frame and mounting frame.

Additional information

- For the strength calculation of the chassis frame and mounting frame, refer to "10.4 Weight distribution table" ▷ page 207 and "10.6.2 Frame section modulus" ▷ page 233.
- The frame stress should be less than the values shown in the table below.

Table of frame stresses (when loaded to rating) Unit: MPa [psi] {kgf/mm^2}

Material / Condition	High tensile steel plate with tensile strength	
	SAPH440 (S355MC) 440 [64] {45}	HTP540 (S500MC) 540 [78] {55}
Vehicles mainly driven on paved roads	74 [11] {7.5} or less	88 [12.5] {9.0} or less
Vehicles mainly driven on rough roads	54 [7.8] {5.5} or less	64 [9.3] {6.5} or less

7.1.2 Mounting frame

All bodies require a mounting frame or a substructure that assumes the function of a mounting frame to ensure a reliable connection between the chassis and the body.

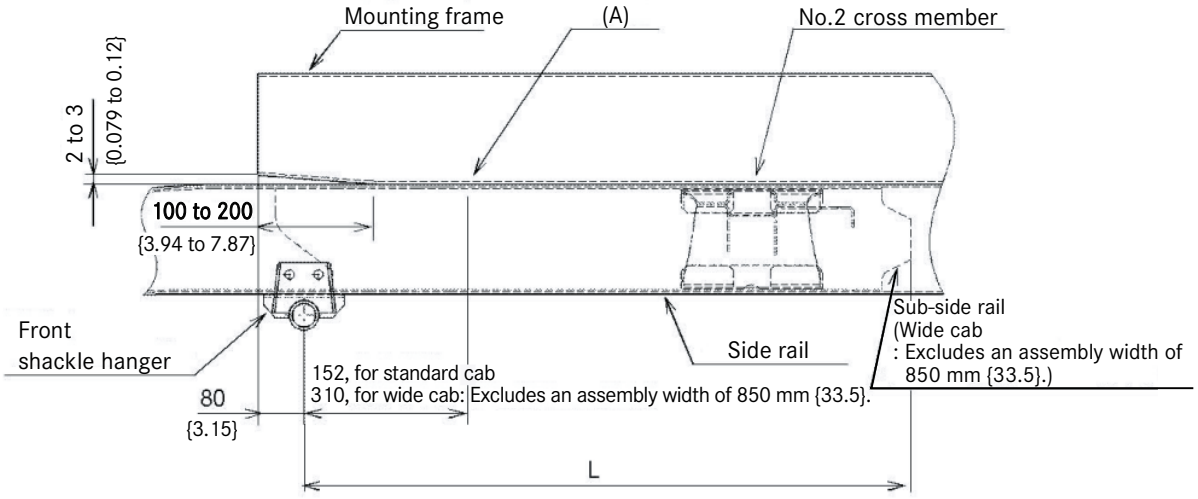
Property damage

If more than one body is mounted on the same chassis (e.g. platform and loading tailgate), the larger of the specified moments of resistance must be taken to determine the mounting frame.

7.2 Fastening mounting frame to chassis frame

7.2.1 Cargo trucks

- Be sure to install a mounting frame to ensure that a concentrated load is not applied to the chassis frame.



Unit: mm {in.}

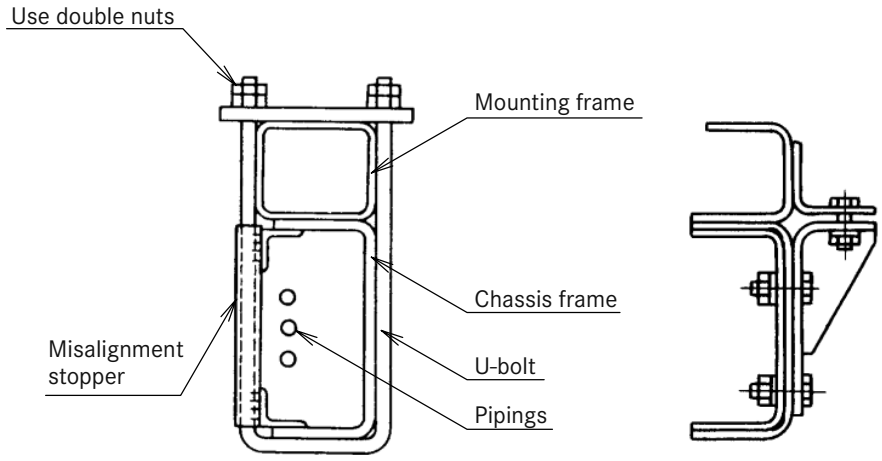
Vehicle model	L
Wide cab	1100 {43.3}

Note: (A) indicates the part of the frame assembly that has been enlarged assembly width; wide cab: 750 mm {29.5 in.} assembly width).

7.2 Fastening mounting frame to chassis frame

Cargo

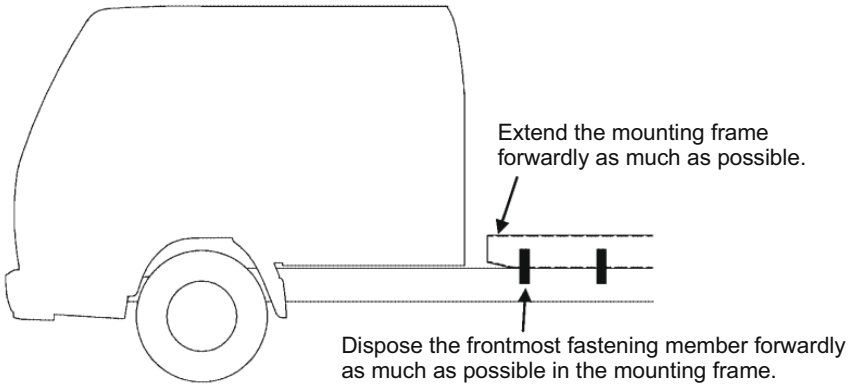
- Carry out the following in order to prevent stress concentrating at the front end of the mounting frame. Make the length of the tapered part of the bottom end of the mounting frame between 100 and 200 mm, and end the taper at a point that is not past (A). If a taper cannot be secured, form the end to a radius of at least 10, and extend the end part to the front (vicinity of the shackle).
- To connect the mounting frame to the chassis frame, either use U-bolts, or in the case of a heavy body building part fix the mounting frame with opposing brackets and ensure that the load imposed by the body building part plus the freight is borne by both the mounting frame and the chassis frame.
  Ensure that the front end connecting part is frontward of the No.2 cross member (transmission suspension part). A large number of holes and wires pass through this area, so take care not to damage them when installing the U-bolts.



7.2 Fastening mounting frame to chassis frame

Cargo

<Crew cab>



7.2 Fastening mounting frame to chassis frame

Cargo

(1) Position of mounting frame

- Install the mounting frame as shown in Fig. 1 to gradually reduce the stress concentrations in the front end. The front end of the mounting frame should be installed as close to the rear of the cab as possible. Extend the mounting frame as far toward the cab as possible when the rear body is installed far from the cab.

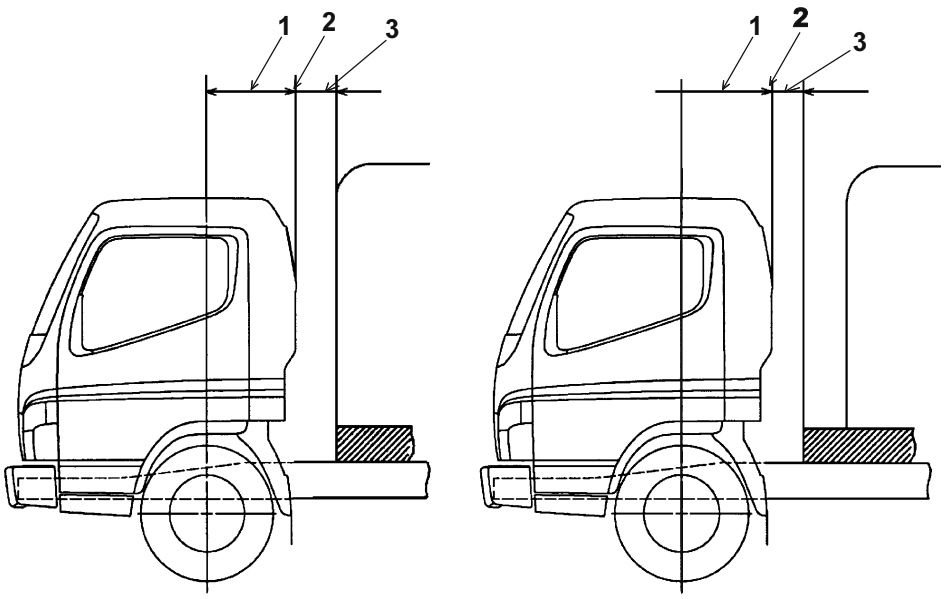


Fig. 1

1 525 mm {20.7 in.}
2 CAB BACK
3 Extend the front end of the mounting frame as far forward as possible; less than 300 mm {11.8 in.}

7.2 Fastening mounting frame to chassis frame

Cargo

- Examples of front-end shape of mounting frames
  (a) Install the mounting frame having the shape as shown in Fig. 2 to gradually reduce the stress concentrations in the front end.

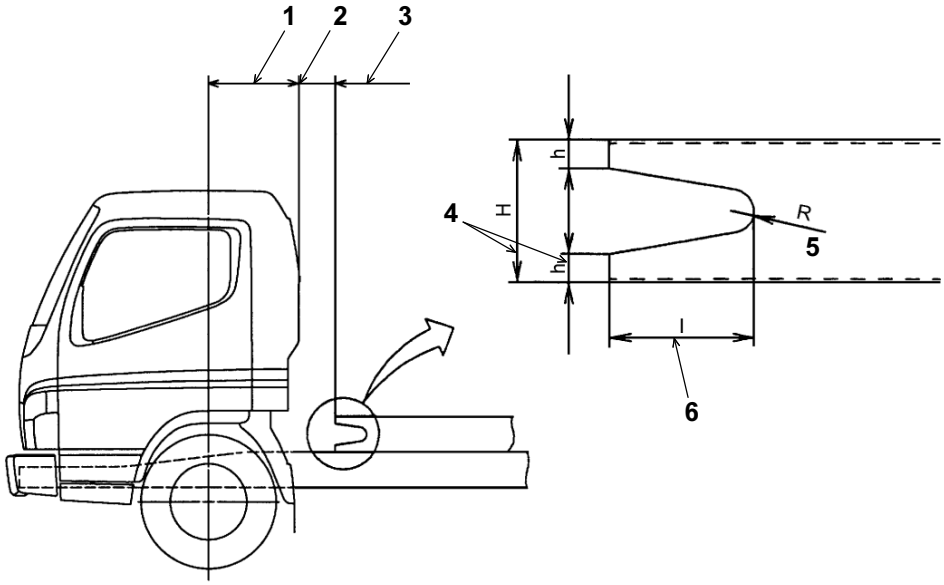


Fig. 3

1 525 mm {20.7 in.}
2 CAB BACK
3 Extend the front end of the mounting frame as far forward as possible; less than 115 mm {4.53 in.}
4 "h" should be between a fourth and a fifth of "H"
5 DRILLING
6 "l" must not be less than 2/3H(two thirds of "H")

7.2 Fastening mounting frame to chassis frame

Cargo

(b) The shape of the mounting frame front end as shown in Fig. 2 is highly desirable. However, if there is enough room behind the cab, the shape as shown in Fig. 3 is also acceptable.

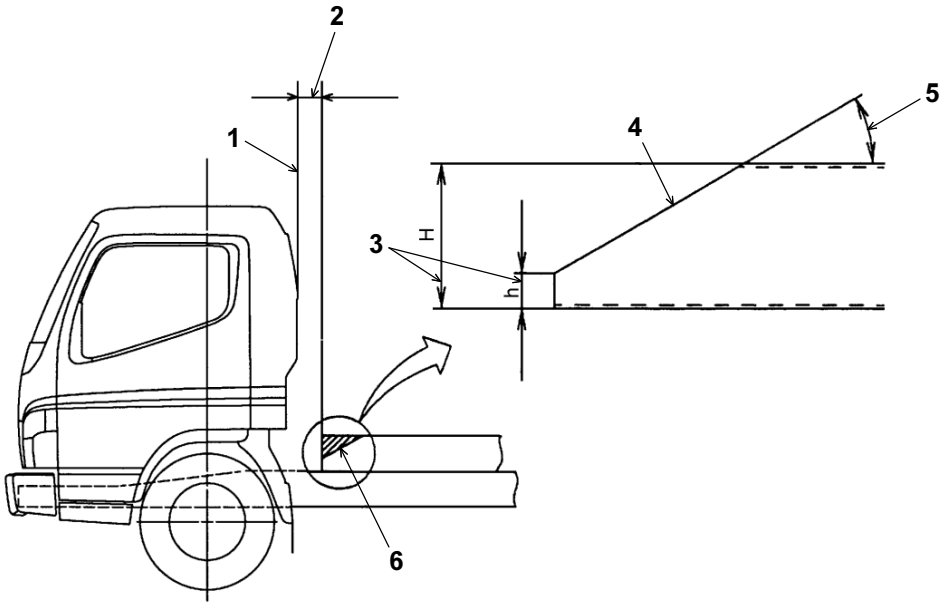


Fig. 3

1 CAB BACK
2 Less than 300 mm {11.8 in.}
3 "h" should be between a fourth and a fifth of "H"
4 Left open
5 Less than 30°
6 Cut off Obliquely

7.2 Fastening mounting frame to chassis frame

Cargo

(c) If it is difficult to shape the front end of the mounting frame as described in Fig. 2 and Fig. 3, cut it to the shape as shown in Fig. 4 before installation.

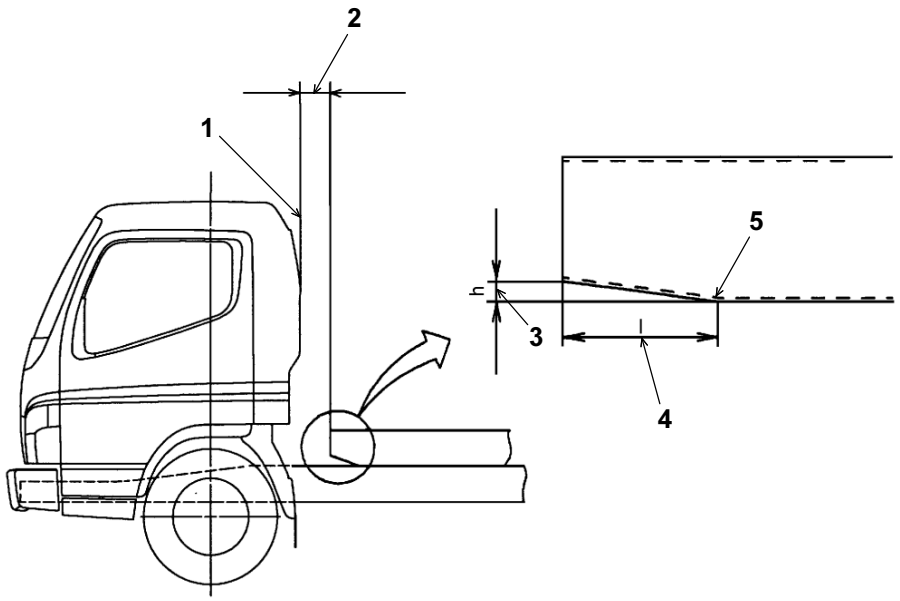


Fig. 4

1 CAB BACK
2 Less than 300 mm {11.8 in.}
3 "h" should be 2 to 3 mm {0.079 to 0.12 in.}
4 "l" should be 50 to 70 mm {1.97 to 2.76 in.}
5 This corner should be ground smoothly

7.2 Fastening mounting frame to chassis frame

Cargo

- If the chassis frame changes its width behind the cab back as shown in Fig. 7 and the mounting frame should extend forward beyond the width-changed portion, the mounting frame must also change its width along the chassis frame. The portion of the mounting frame where the width changed must have the internal surface reinforced with stiffeners as shown in the figure.

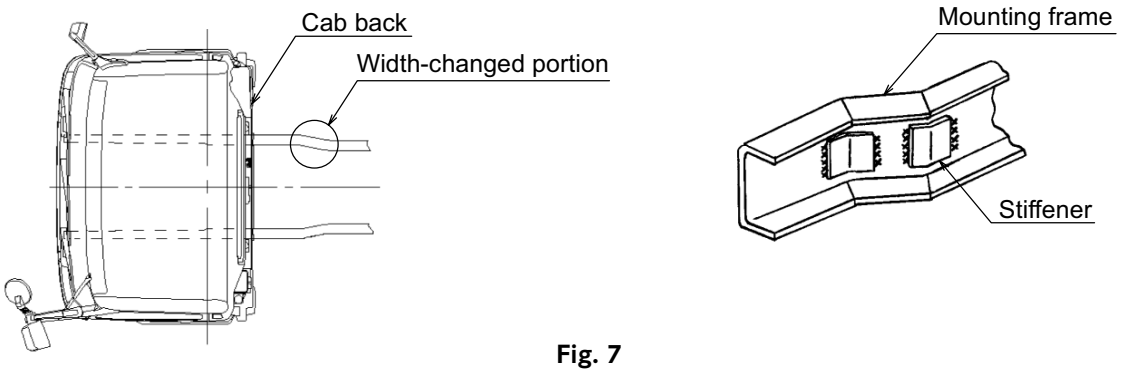
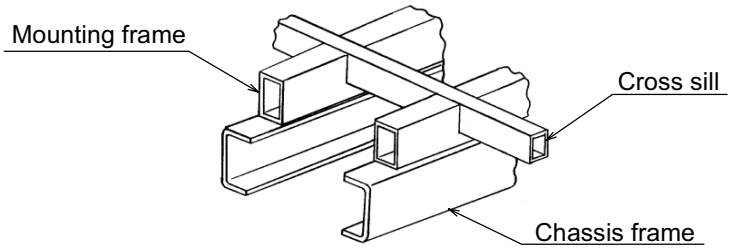


Fig. 7

Other notes

- If, for the sake of a low deck design, the mounting frame and the cross sill must be arranged on the same plane, pass the cross sill member through the mounting frame.

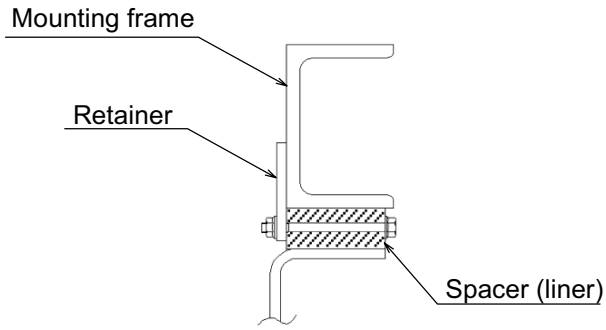


7.2 Fastening mounting frame to chassis frame

Cargo

(2) Spacer (Liner)

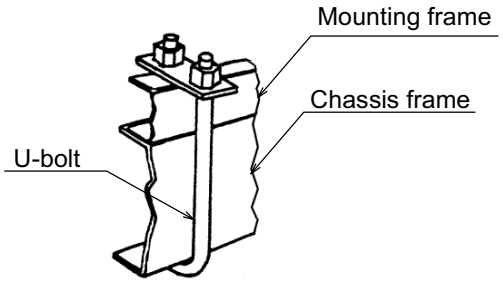
- Placing a spacer (liner) between the chassis frame and the mounting frame is not recommended because the combining force between both frames may be lowered.
- In an unavoidable case, hold the spacer (liner) in position with an additional retainer.



Installation of out-of-position preventive retainer

(3) Frame fasteners and their features

- U-bolt
  The U-bolt is a fastener widely used for combining two or more members. This offers a considerable fastening force and is effective for preventing lateral movement of members. However, it is not so effective for suppressing the longitudinal movement. Therefore, it is required that a retainer be used together for that purpose.



7.2 Fastening mounting frame to chassis frame

Cargo

- **Mounting Bracket**

When U-bolts cannot be used with a particular body, use mounting brackets in those positions to attach it to the mounting frame. Use the following bracket locations and installation procedures.

- Attach the mounting brackets to the chassis frame with bolts whenever possible. Be especially careful not to damage any pipes, hoses, and wiring harnesses attached to or around the frame.
- Do not attach brackets close to the ends of crossmembers, gussets or stiffeners. Brackets should be installed at least 200 mm {7.87 in.} away from the end of these parts.

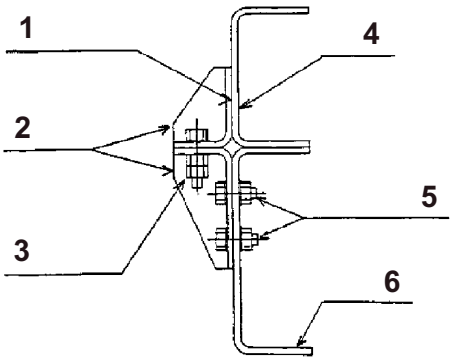


Fig. 8

1 Attached by welding
2 Mounting bracket
3 Use double nuts
4 Mounting frame
5 Tighten the bolts and nuts in more than two locations.
6 Chassis frame

- As a maker option, the genuine rear body brackets are available as shown below.

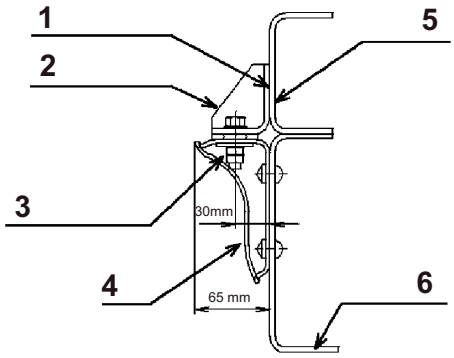


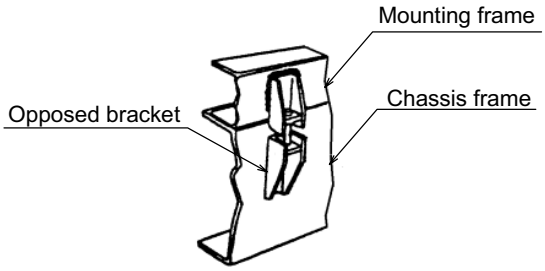
Fig. 9

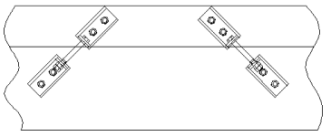
1 Attached by welding
2 Mounting bracket
3 Use double nuts With washer (more than Ø32 mm {Ø1.26 in.})
4 Genuine mounting bracket
5 Mounting frame
6 Chassis frame

7.2 Fastening mounting frame to chassis frame

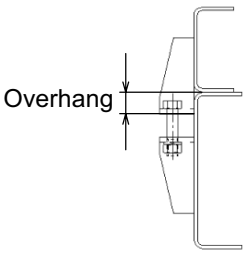
Cargo

- Opposed bracket
  This is a fastener composed of two brackets opposed to each other (one on chassis frame, one on mounting frame) and one bolt connecting these brackets. This offers a larger fastening force in a vertical direction as compared to a U-bolt. However, it is inferior in the longitudinal and lateral holding forces. To increase the longitudinal holding force of this fastener, arrange two pairs of brackets diagonally as shown below. To increase the lateral holding force, overhang the bracket on the mounting frame side toward the chassis frame side.



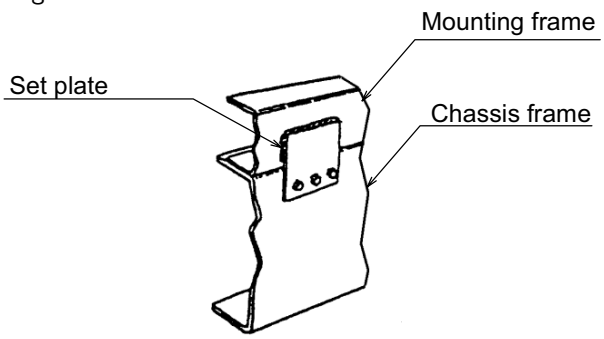


For increasing longitudinal holding force



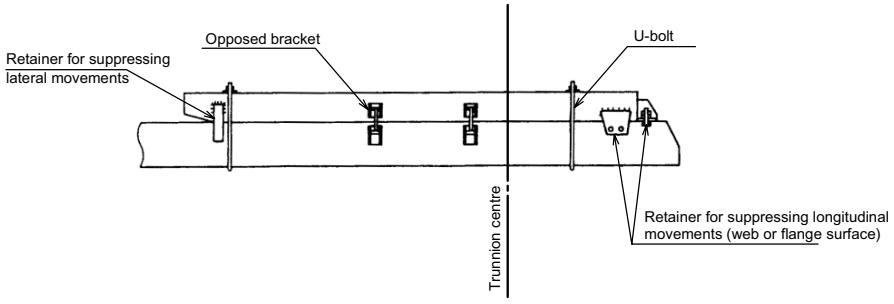
For increasing lateral holding force

- Mounting flange
  This is a retainer composed of a set plate fastening the chassis frame and mounting frame to each other. This offers a strong holding force in the longitudinal direction but is inferior to a U-bolt or opposed bracket in vertical and lateral holding forces.



Precautions for fastening frames

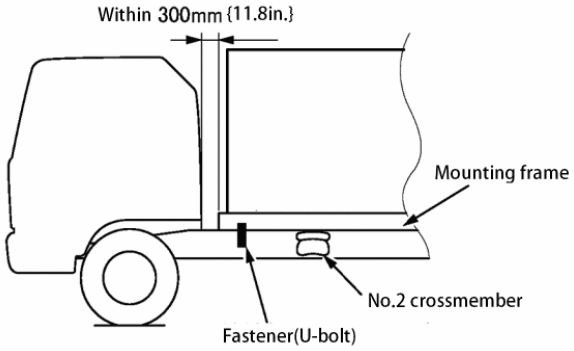
- When fastening the mounting frame to the chassis frame using U-bolts and opposed brackets, use retainers for preventing longitudinal and lateral movements together.



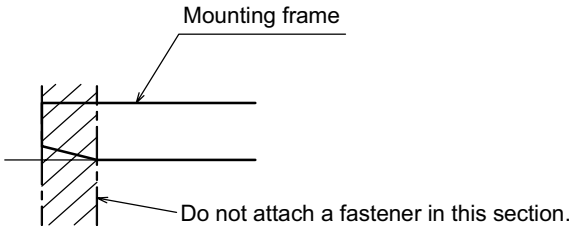
7.2 Fastening mounting frame to chassis frame

Cargo

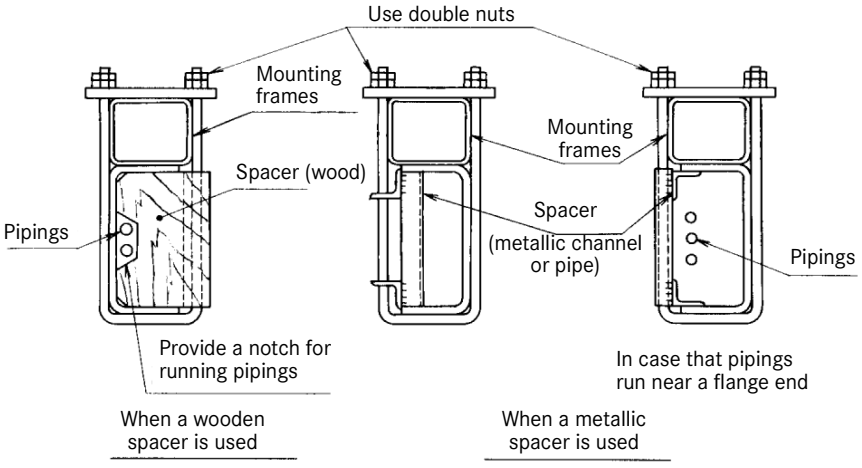
- Even if the distance between the cab back and body front end is larger, extend the mounting frame to near the cab back and secure it at a position before a No.2 crossmember with a fastener.



- When fastening with a U-bolt, ensure that ample spaces are left for running pipes, hoses, wires and harnesses.
- Do not attach any fastener in the mounting frame front end section where the sectional shape is different from the remaining part.



- When the mounting frame and chassis frame are combined with a U-bolt, insert a spacer in the chassis frame at the combined position to prevent the side rail flanges from deforming. When attaching the U-bolt near a hot component such as a muffler, use a metallic spacer, not a wooden spacer which can catch fire. Avoid welding a metallic spacer to the chassis frame to hold it in position.

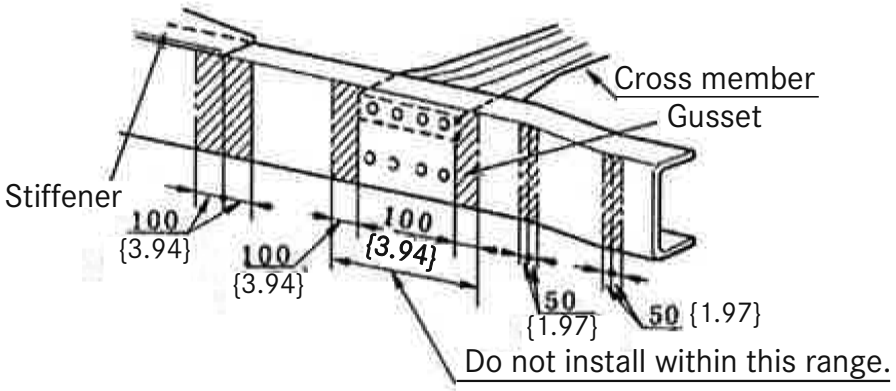


- Attaching opposed brackets to a chassis frame should be done with bolts. For the procedure, refer to "6. Modifications to the basic vehicle" ▷ page 78.

7.2 Fastening mounting frame to chassis frame

Cargo

- Do not use U-bolts or opposed brackets for crossmember, stiffener and gusset attaching sections or near the curved section of the chassis frame because these sections are likely to be subjected to stress concentration.

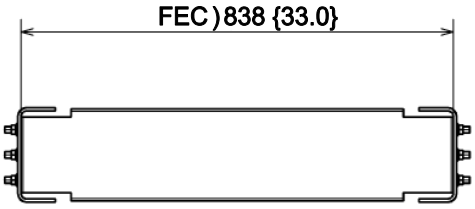


Unit: mm {in.}

B

(4) Rear end of chassis frame

As a result of Product Tolerance for vehicles without RUP, the width dimension of the assembly at the Rear End of the Chassis Frame, may sometimes differ greatly from the dimension indicated in "10.5 Chassis cab drawings". Refer to ▷ page 218.
If this constitutes an obstacle to body building, devise countermeasures to facilitate body building, such as the installation of a cross member at the rear end of the chassis frame.
An example of a cross member is shown in the figure below.

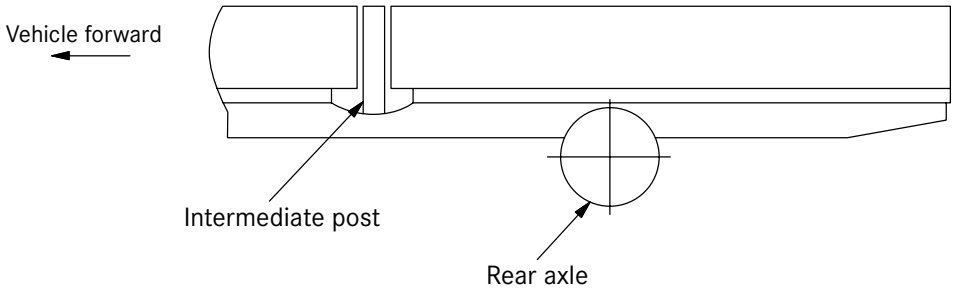


View seen from the rear of the vehicle

Unit: mm {in.}

(5) Intermediate post

- On chassis mounted with a 5-way openable rear body, heavy object container or low rigidity body, install an intermediate post at a position just before the rear front axle to prevent the body from drooping rearward or to facilitate sideway swinging of a gate to open or close it during loading.



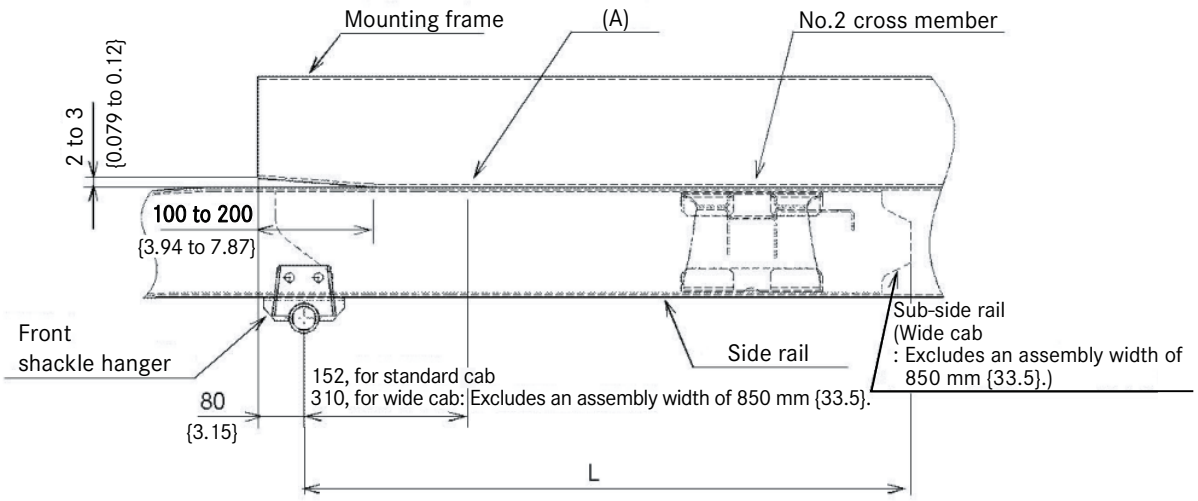
- When installing an intermediate post on a truck with a long wheelbase, taking the chassis frame deflection during loading into consideration, provide an ample space between the post and the side gate so that trouble-free side gate opening/closing operations may be assured.

7.2 Fastening mounting frame to chassis frame

Tank truck

7.2.2 Tank truck, Powder carrying vehicle

- Be sure to install a mounting frame to ensure that a concentrated load is not applied to the chassis frame.



Unit: mm {in.}

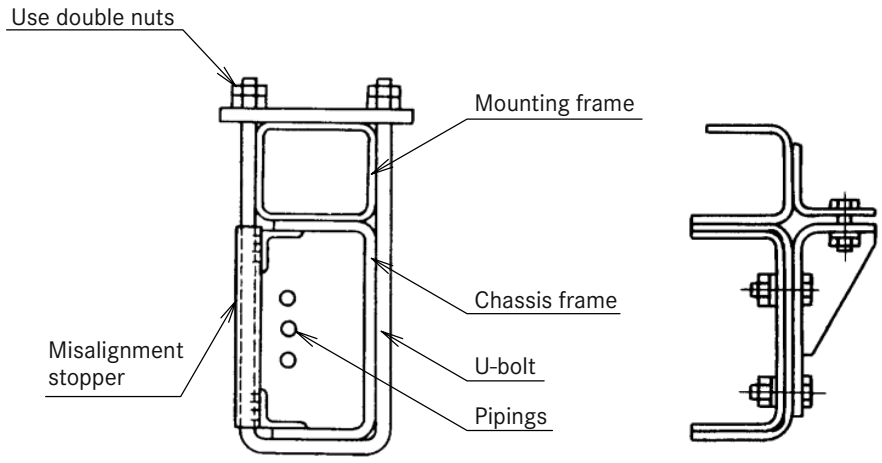
Vehicle model	L
Wide cab	1100 {43.3}

Note: (A) indicates the part of the frame assembly that has been enlarged assembly width; wide cab: 750 mm {29.5 in.} assembly width).

7.2 Fastening mounting frame to chassis frame

Tank truck

- Carry out the following in order to prevent stress concentrating at the front end of the mounting frame. Make the length of the tapered part of the bottom end of the mounting frame between 100 and 200 mm {3.94 and 7.87 in.}, and end the taper at a point that is not past (A). If a taper cannot be secured, form the end to a radius of at least 10, and extend the end part to the front (vicinity of the shackle).
- To connect the mounting frame to the chassis frame, either use U-bolts, or in the case of a heavy body building part fix the mounting frame with opposing brackets and ensure that the load imposed by the body building part plus the freight is borne by both the mounting frame and the chassis frame.
  Ensure that the front end connecting part is frontward of the No.2 cross member (transmission suspension part). A large number of holes and wires pass through this area, so take care not to damage them when installing the U-bolts.



7.2 Fastening mounting frame to chassis frame

Tank truck

(1) Position of mounting frame

- Install the mounting frame as shown in Fig. 1 to gradually reduce the stress concentrations in the front end. The front end of the mounting frame should be installed as close to the rear of the cab as possible. Extend the mounting frame as far toward the cab as possible when the rear body is installed far from the cab.

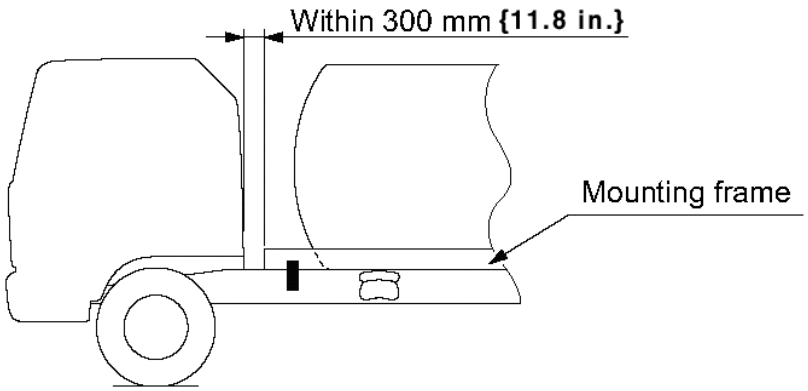


Fig. 1

1 CAB BACK
2 Extend the front end of the mounting frame as far forward as possible; less than 300 mm {11.8 in.}

- Examples of front-end shape of mounting frames
  (a) Install the mounting frame having the shape as shown in Fig. 2 to gradually reduce the stress concentrations in the front end.

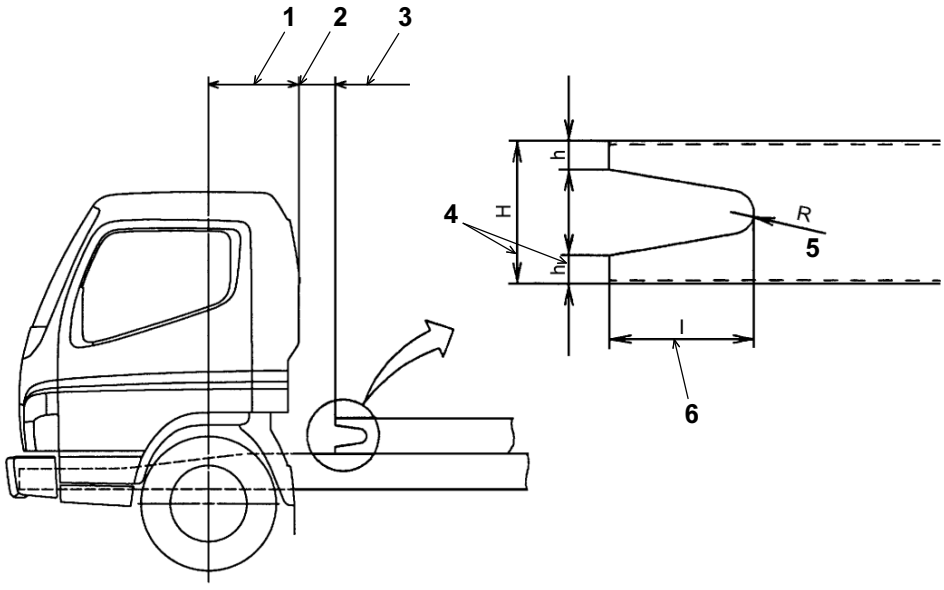


Fig. 3

1 525 mm {20.7 in.}
2 CAB BACK
3 Extend the front end of the mounting frame as far forward as possible; less than 115 mm {4.53 in.}
4 "h" should be between a fourth and a fifth of "H"
5 DRILLING
6 "l" must not be less than 2/3H(two thirds of "H")

7.2 Fastening mounting frame to chassis frame

Tank truck

(b) The shape of the mounting frame front end as shown in Fig. 2 is highly desirable. However, if there is enough room behind the cab, the shape as shown in Fig. 3 is also acceptable.

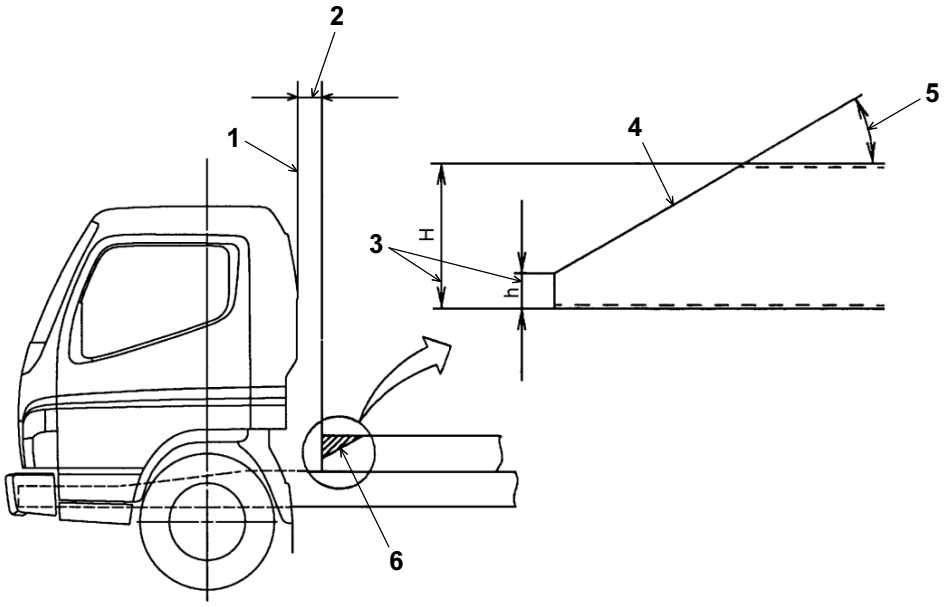


Fig. 3

1 CAB BACK
2 Less than 300 mm {11.8 in.}
3 "h" should be between a third to a forth of "H"
4 Left open
5 Less than 30°
6 Cut off Obliquely

7.2 Fastening mounting frame to chassis frame

Tank truck

(c) If it is difficult to shape the front end of the mounting frame as described in Fig. 2 and Fig. 3, cut it to the shape as shown in Fig. 4 before installation.

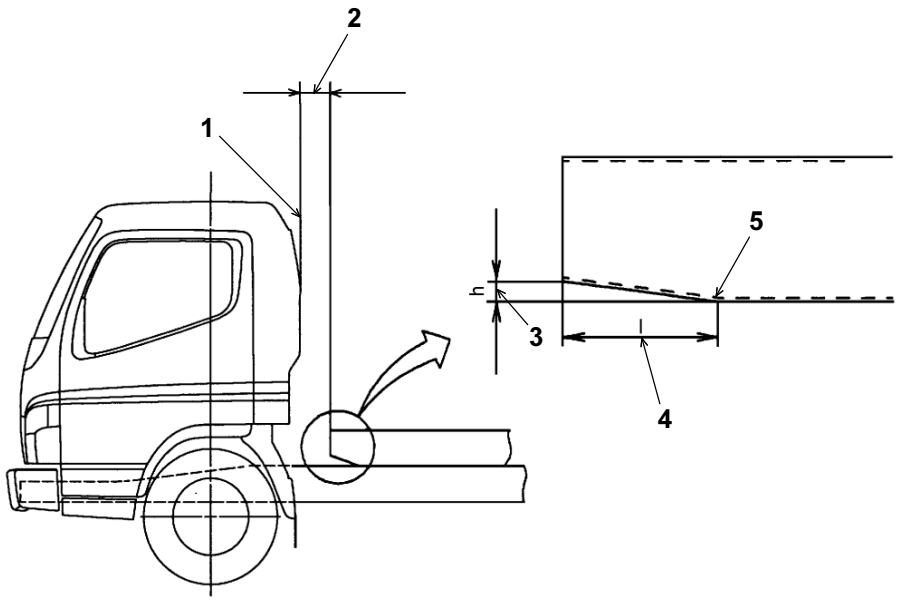


Fig. 4

1 CAB BACK
2 Less than 300 mm {11.8 in.}
3 "h" should be 2 to 3 mm {0.079 to 0.12 in.}
4 "l" should be 200 mm {7.87 in.}
5 This corner should be ground smoothly

7.2 Fastening mounting frame to chassis frame

Tank truck

- If the chassis frame changes its width behind the cab back as shown in Fig. 7 and the mounting frame should extend forward beyond the width-changed portion, the mounting frame must also change its width along the chassis frame. The portion of the mounting frame where the width changed must have the internal surface reinforced with stiffeners as shown in the figure.

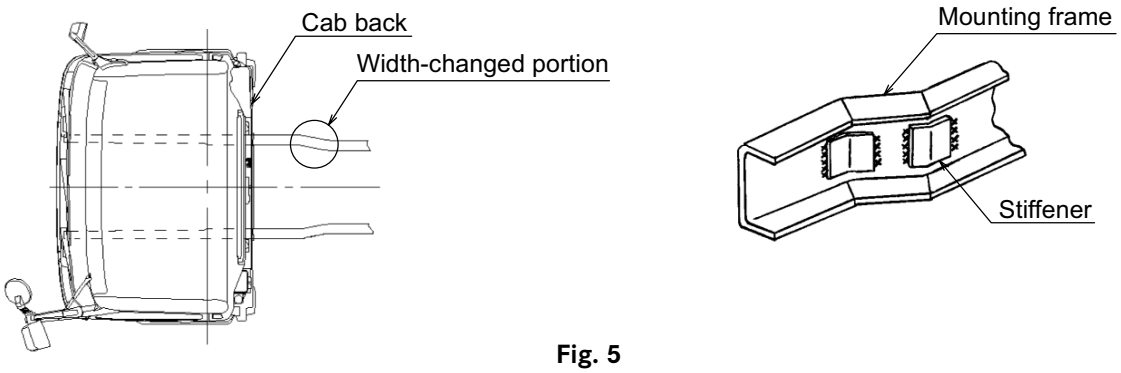
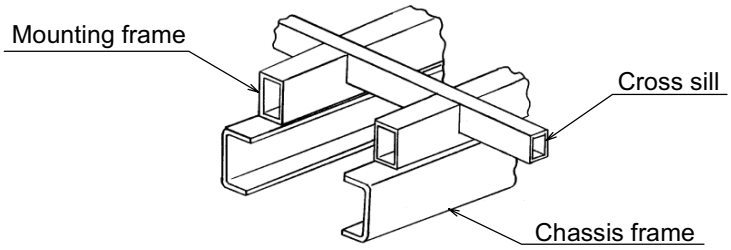


Fig. 5

Other notes

- If, for the sake of a low deck design, the mounting frame and the cross sill must be arranged on the same plane, pass the cross sill member through the mounting frame.



7.2 Fastening mounting frame to chassis frame

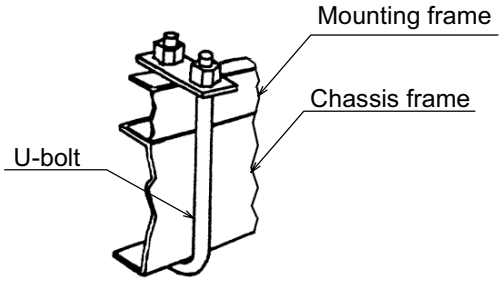
Tank truck

(2) Spacer (liner)

The spacer (liner) reduces the fastening force between the chassis frame and the mounting frame.

(3) Frame fasteners and their features

- U-bolt
  The U-bolt is a fastener widely used for combining two or more members. This offers a considerable fastening force and is effective for preventing lateral movement of members. However, it is not so effective for suppressing the longitudinal movement. Therefore, it is required that a retainer be used together for that purpose.



7.2 Fastening mounting frame to chassis frame

Tank truck

- **Mounting Bracket**

When U-bolts cannot be used with a particular body, use mounting brackets in those positions to attach it to the mounting frame. Use the following bracket locations and installation procedures.

- Attach the mounting brackets to the chassis frame with bolts whenever possible. Be especially careful not to damage any pipes, hoses, and wiring harnesses attached to or around the frame.
- Do not attach brackets close to the ends of crossmembers, gussets or stiffeners. Brackets should be installed at least 200 mm away from the end of these parts.

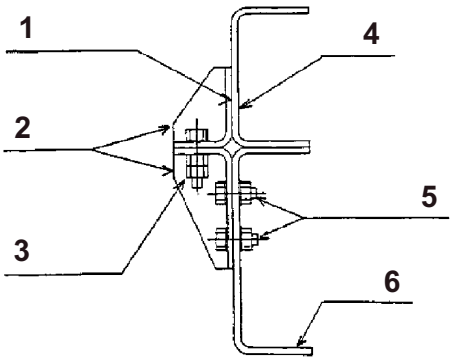


Fig. 6

1 Attached by welding
2 Mounting bracket
3 Use double nuts
4 Mounting frame
5 Tighten the bolts and nuts in more than two locations.
6 Chassis frame

- As a maker option, the genuine rear body brackets are available as shown below.

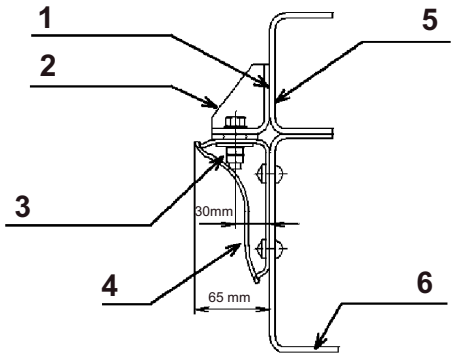


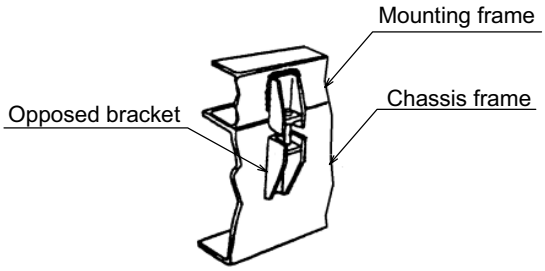
Fig. 7

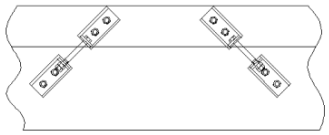
1 Attached by welding
2 Mounting bracket
3 Use double nuts With washer (more than Ø32 mm {Ø1.26 in.})
4 Genuine mounting bracket
5 Mounting frame
6 Chassis frame

7.2 Fastening mounting frame to chassis frame

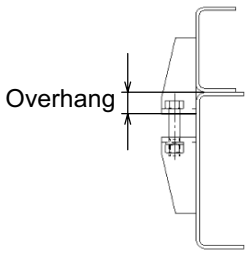
Tank truck

- Opposed bracket
  This is a fastener composed of two brackets opposed to each other (one on chassis frame, one on mounting frame) and one bolt connecting these brackets. This offers a larger fastening force in a vertical direction as compared to a U-bolt. However, it is inferior in the longitudinal and lateral holding forces. To increase the longitudinal holding force of this fastener, arrange two pairs of brackets diagonally as shown below. To increase the lateral holding force, overhang the bracket on the mounting frame side toward the chassis frame side.



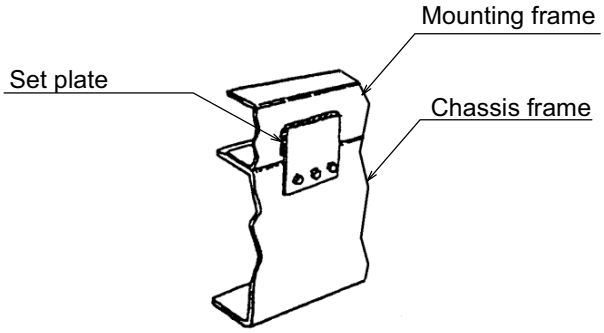


For increasing longitudinal holding force



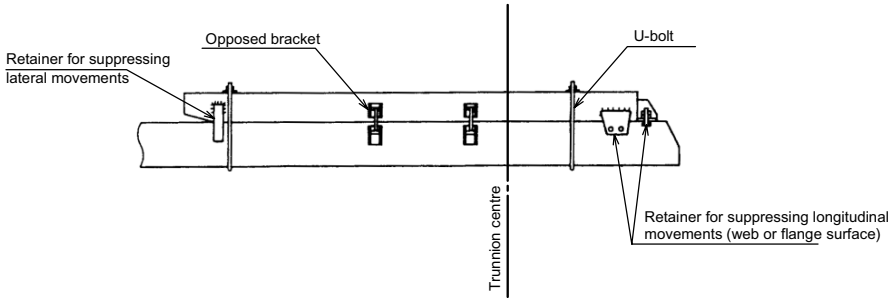
For increasing lateral holding force

- Mounting flange
  This is a retainer composed of a set plate fastening the chassis frame and mounting frame to each other. This offers a strong holding force in the longitudinal direction but is inferior to a U-bolt or opposed bracket in vertical and lateral holding forces.



Precautions for fastening frames

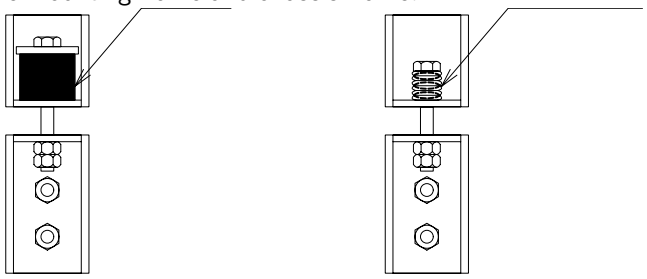
- When fastening the mounting frame to the chassis frame using U-bolts and opposed brackets, use retainers for preventing longitudinal and lateral movements together.



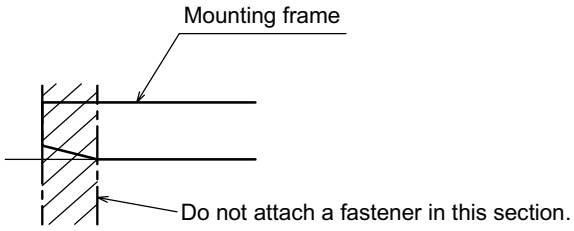
7.2 Fastening mounting frame to chassis frame

Tank truck

- For fastening at the forefront, use a flexible joint such as shown in the figure below to absorb the relative displacement between the mounting frame and chassis frame.



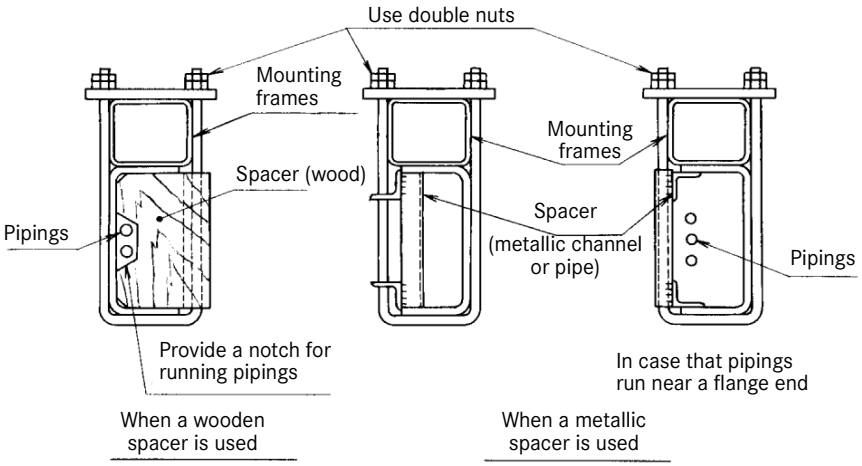
- When fastening with a U-bolt, ensure that ample spaces are left for running pipes, hoses, wires and harnesses.
- Do not attach any fastener in the mounting frame front end section where the sectional shape is different from the remaining part.



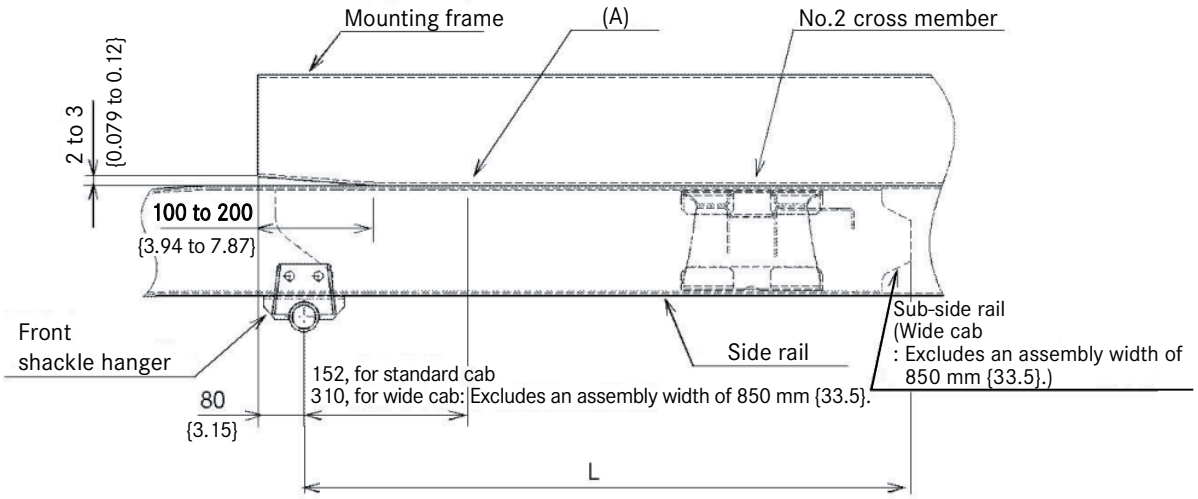
7.2 Fastening mounting frame to chassis frame

Tank truck

- When the mounting frame and chassis frame are combined with a U-bolt, insert a spacer in the chassis frame at the combined position to prevent the side rail flanges from deforming. When attaching the U-bolt near a hot component such as a muffler, use a metallic spacer, not a wooden spacer which can catch fire. Avoid welding a metallic spacer to the chassis frame to hold it in position.



- Attaching opposed brackets to a chassis frame should be done with bolts. For the procedure, refer to "6. Modifications to the basic vehicle" ▷ page 78.
- Do not use U-bolts or opposed brackets for crossmember, stiffener and gusset attaching sections or near the curved section of the chassis frame because these sections are likely to be subjected to stress concentration.



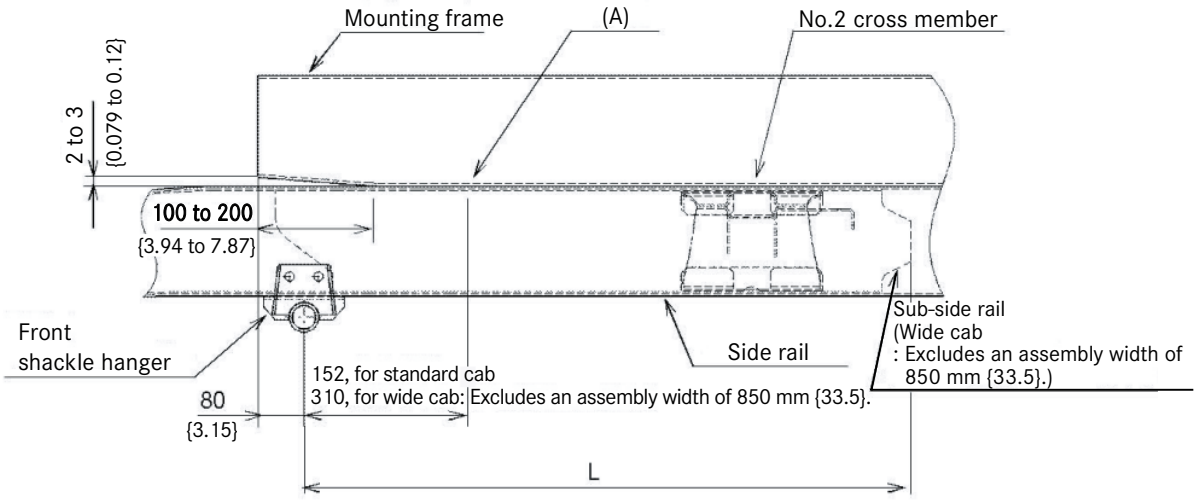
Unit: mm {in.}

Vehicle model	L
Wide cab	1100 {43.3}

Note: (A) indicates the part of the frame assembly that has been enlarged assembly width; wide cab: 750 mm {29.5 in.} assembly width).

7.2.3 Loading crane

- Be sure to install a mounting frame to ensure that a concentrated load is not applied to the chassis frame.



Unit: mm {in.}

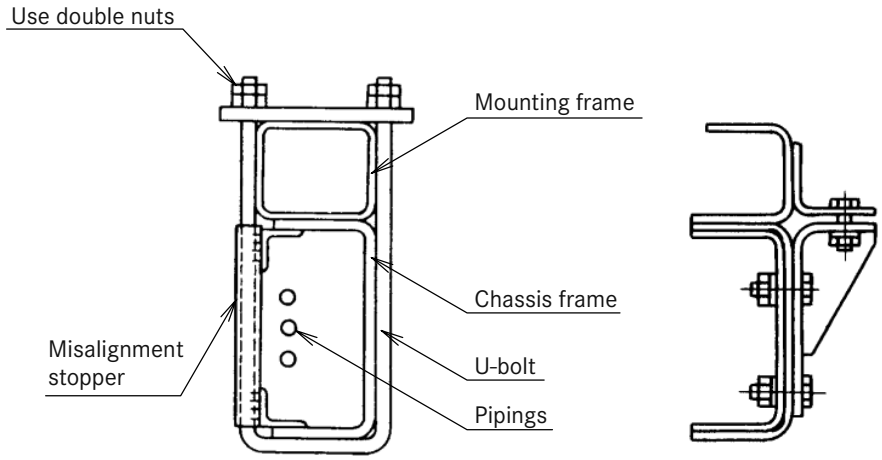
Vehicle model	L
Wide cab	1100 {43.3}

Note: (A) indicates the part of the frame assembly that has been enlarged assembly width; wide cab: 750 mm {29.5 in.} assembly width).

7.2 Fastening mounting frame to chassis frame

Loading crane

- Carry out the following in order to prevent stress concentrating at the front end of the mounting frame. Make the length of the tapered part of the bottom end of the mounting frame between 100 and 200 mm {3.94 and 7.87 in.}, and end the taper at a point that is not past (A). If a taper cannot be secured, form the end to a radius of at least 10, and extend the end part to the front (vicinity of the shackle).
- To connect the mounting frame to the chassis frame, either use U-bolts, or in the case of a heavy body building part fix the mounting frame with opposing brackets and ensure that the load imposed by the body building part plus the freight is borne by both the mounting frame and the chassis frame.
  Ensure that the front end connecting part is frontward of the No.2 cross member (transmission suspension part). A large number of holes and wires pass through this area, so take care not to damage them when installing the U-bolts.



7.2 Fastening mounting frame to chassis frame

Loading crane

(1) Position of mounting frame

- Be sure to use a mounting frame of box construction for ensuring higher rigidity.
- For reducing cab vibrations and protecting a chassis frame, mount the crane at a position as close to the cab back as possible.

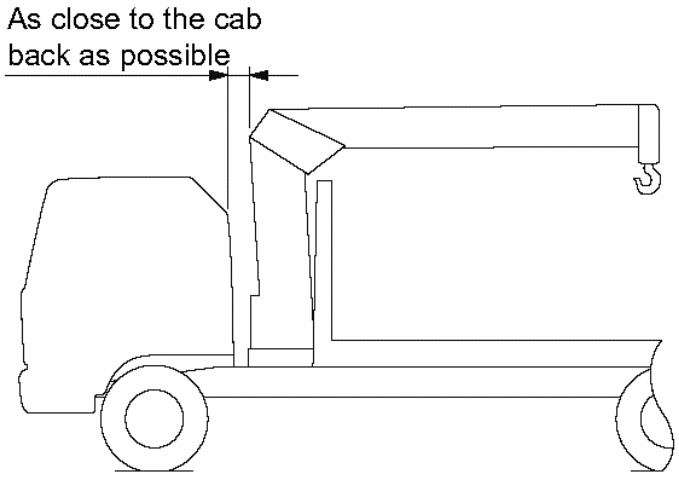


Fig. 1

- Examples of front-end shape of mounting frames
  (a) Install the mounting frame having the shape as shown in Fig. 2 to gradually reduce the stress concentrations in the front end.

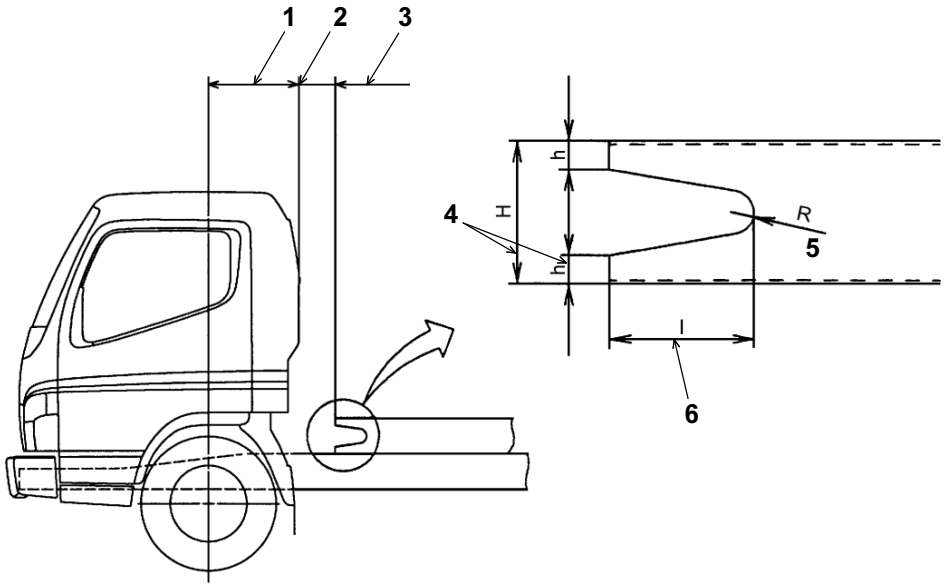


Fig. 3

1 525 mm {20.7 in.}
2 CAB BACK
3 Extend the front end of the mounting frame as far forward as possible; less than 115 mm {4.53 in.}
4 "h" should be between a fourth and a fifth of "H"
5 DRILLING
6 "l" must not be less than 2/3H(two thirds of "H")

(b) The shape of the mounting frame front end as shown in Fig. 2 is highly desirable. However, if there is enough room behind the cab, the shape as shown in Fig. 3 is also acceptable.

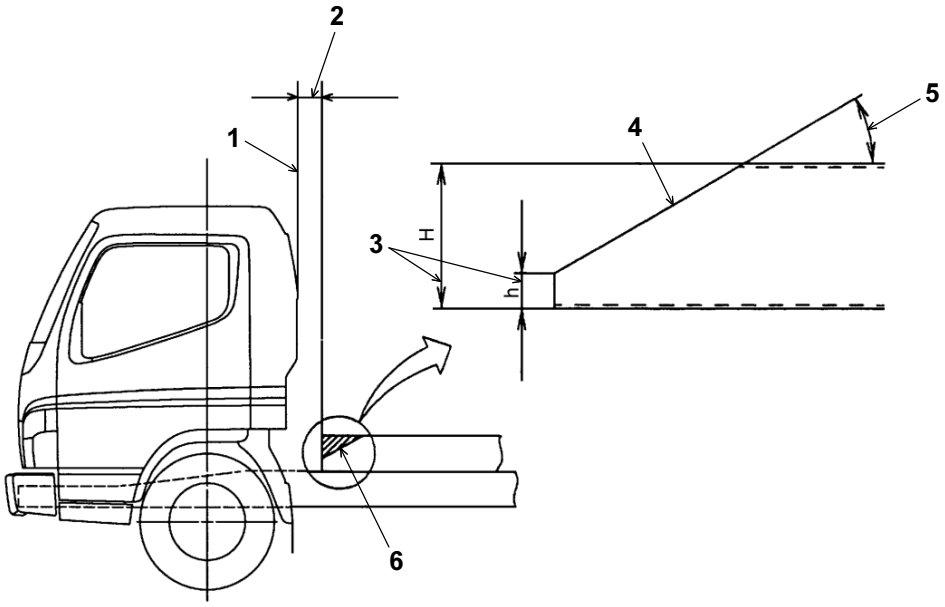


Fig. 3

1 CAB BACK
2 Less than 300 mm {11.8 in.}
3 "h" should be between a third to a forth of "H"
4 Left open
5 Less than 30°
6 Cut off Obliquely

7.2 Fastening mounting frame to chassis frame

Loading crane

(c) If it is difficult to shape the front end of the mounting frame as described in Fig. 2 and Fig. 3, cut it to the shape as shown in Fig. 4 before installation.

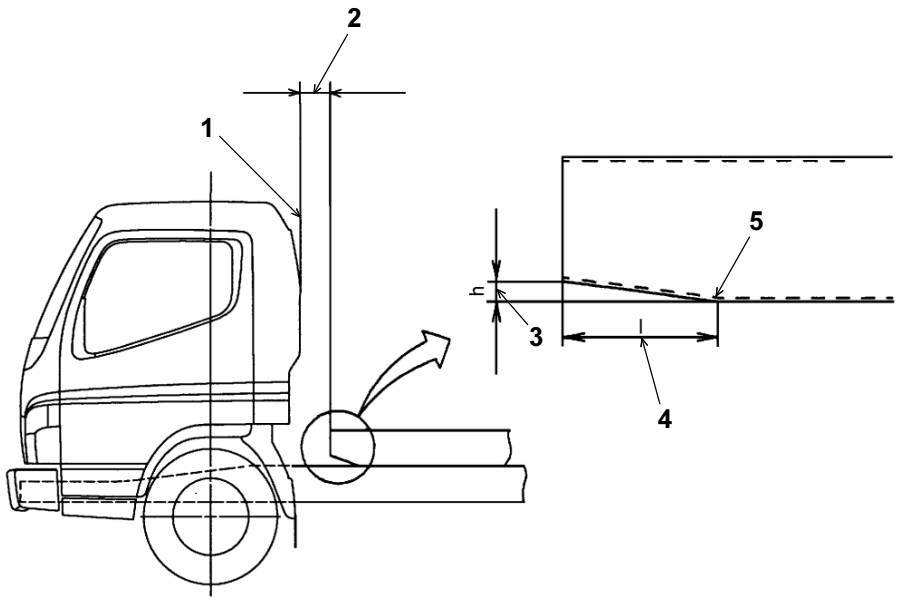


Fig. 4

1 CAB BACK
2 Less than 300 mm {11.8 in.}
3 "h" should be 2 to 3 mm {0.079 to 0.12 in.}
4 "l" should be 50 to 70 mm {1.97 to 2.76 in.}
5 This corner should be ground smoothly

7.2 Fastening mounting frame to chassis frame

Loading crane

- If the chassis frame changes its width behind the cab back as shown in Fig. 7 and the mounting frame should extend forward beyond the width-changed portion, the mounting frame must also change its width along the chassis frame. The portion of the mounting frame where the width changed must have the internal surface reinforced with stiffeners as shown in the figure.

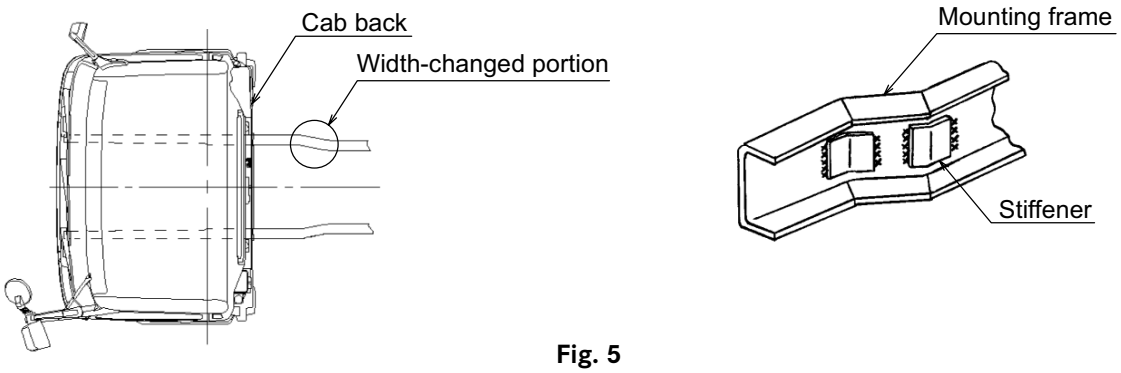
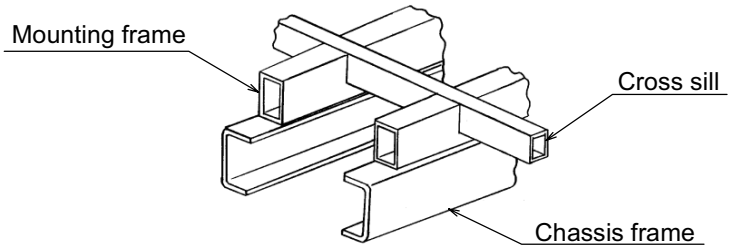


Fig. 5

Other notes

- If, for the sake of a low deck design, the mounting frame and the cross sill must be arranged on the same plane, pass the cross sill member through the mounting frame.

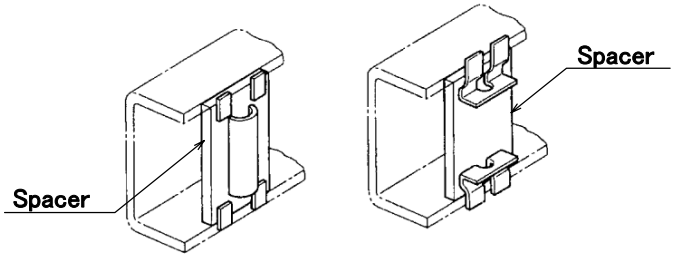


(2) Spacer (liner)

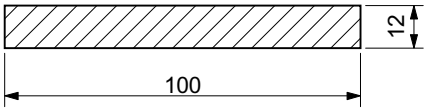
The spacer (liner) reduces the fastening force between the chassis frame and the mounting frame.

(3) Frame reinforcement

- In order to prevent the chassis frame flanges from deforming, provide the chassis frame with spacers for supporting the flanges. Avoid welding a metallic spacer to the chassis frame to hold it in position.



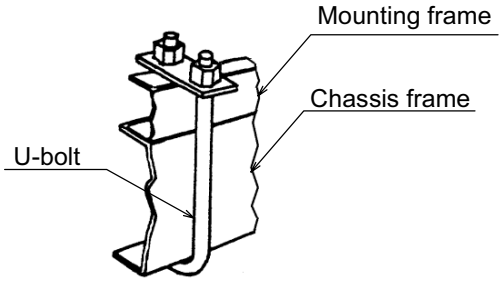
- Spacers for preventing deformation of the chassis frame must be fabricated from a steel plate having a sectional area of minimum 1200 mm^2.



- The frame section near the crane mounting position can be locally subjected to stress concentration during crane operation. Do not forget to reinforce this section with stiffeners. For the frame reinforcement procedure, refer to "6.5 Reinforcement" ▷ page 84.

(4) Frame fasteners and their features

- U-bolt
  The U-bolt is a fastener widely used for combining two or more members. This offers a considerable fastening force and is effective for preventing lateral movement of members. However, it is not so effective for suppressing the longitudinal movement. Therefore, it is required that a retainer be used together for that purpose.



7.2 Fastening mounting frame to chassis frame

Loading crane

- **Mounting Bracket**

When U-bolts cannot be used with a particular body, use mounting brackets in those positions to attach it to the mounting frame. Use the following bracket locations and installation procedures.

- Attach the mounting brackets to the chassis frame with bolts whenever possible. Be especially careful not to damage any pipes, hoses, and wiring harnesses attached to or around the frame.
- Do not attach brackets close to the ends of crossmembers, gussets or stiffeners. Brackets should be installed at least 200 mm away from the end of these parts.

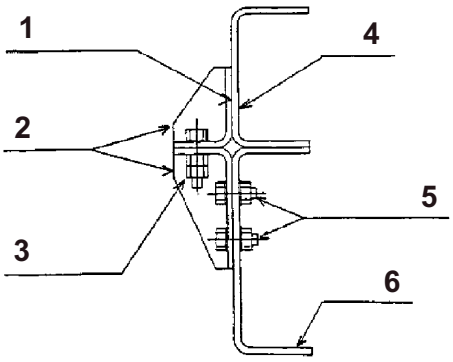


Fig. 6

1 Attached by welding
2 Mounting bracket
3 Use double nuts
4 Mounting frame
5 Tighten the bolts and nuts in more than two locations.
6 Chassis frame

- As a maker option, the genuine rear body brackets are available as shown below.

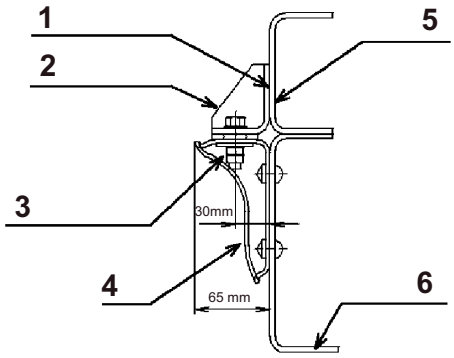


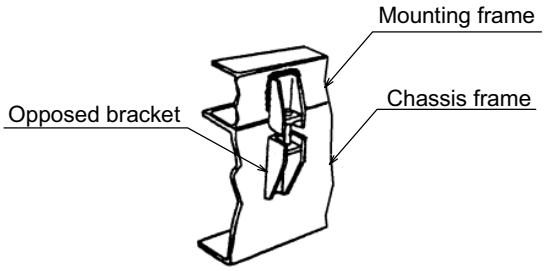
Fig. 7

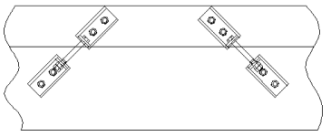
1 Attached by welding
2 Mounting bracket
3 Use double nuts With washer (more than Ø32 mm {Ø1.26 in.})
4 Genuine mounting bracket
5 Mounting frame
6 Chassis frame

7.2 Fastening mounting frame to chassis frame

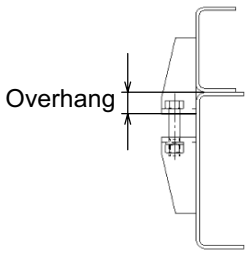
Loading crane

- Opposed bracket
  This is a fastener composed of two brackets opposed to each other (one on chassis frame, one on mounting frame) and one bolt connecting these brackets. This offers a larger fastening force in a vertical direction as compared to a U-bolt. However, it is inferior in the longitudinal and lateral holding forces. To increase the longitudinal holding force of this fastener, arrange two pairs of brackets diagonally as shown below. To increase the lateral holding force, overhang the bracket on the mounting frame side toward the chassis frame side.



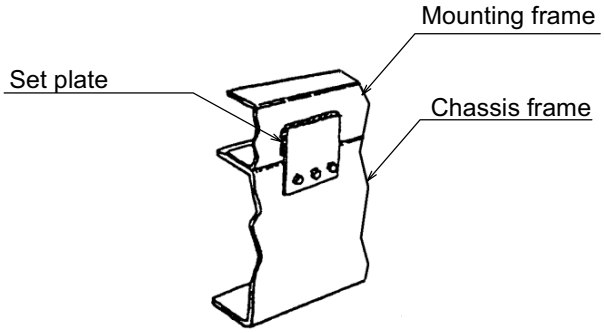


For increasing longitudinal holding force



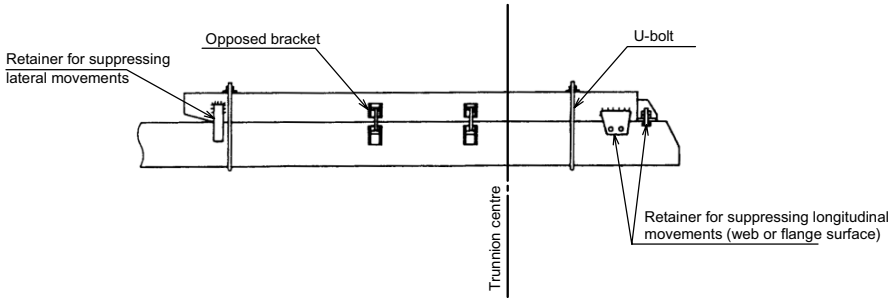
For increasing lateral holding force

- Mounting flange
  This is a retainer composed of a set plate fastening the chassis frame and mounting frame to each other. This offers a strong holding force in the longitudinal direction but is inferior to a U-bolt or opposed bracket in vertical and lateral holding forces.



Precautions for fastening frames

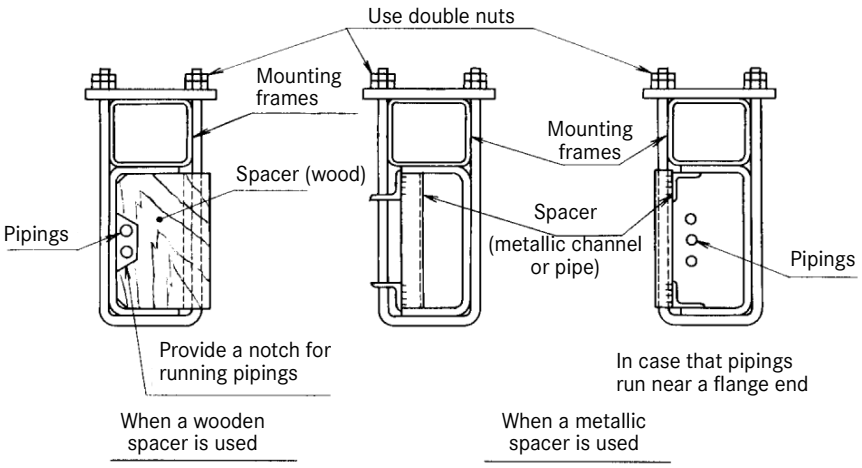
- When fastening the mounting frame to the chassis frame using U-bolts and opposed brackets, use retainers for preventing longitudinal and lateral movements together.



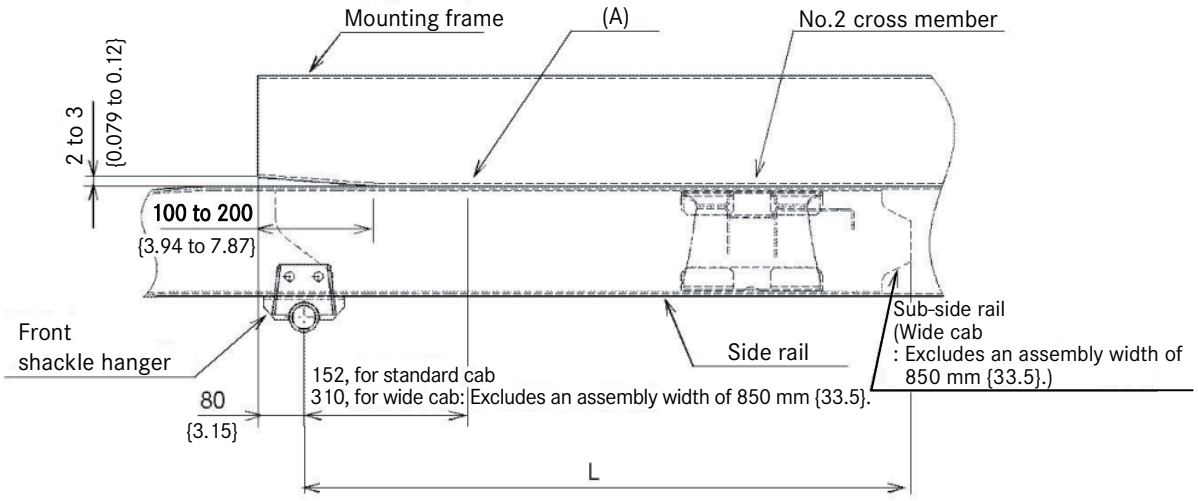
7.2 Fastening mounting frame to chassis frame

Loading crane

- When the mounting frame and chassis frame are combined with a U-bolt, insert a spacer in the chassis frame at the combined position to prevent the side rail flanges from deforming. When attaching the U-bolt near a hot component such as a muffler, use a metallic spacer, not a wooden spacer which can catch fire. Avoid welding a metallic spacer to the chassis frame to hold it in position.



- Attaching opposed brackets to a chassis frame should be done with bolts. For the procedure, refer to "6. Modifications to the basic vehicle" ▷ page 78.
- Do not use U-bolts or opposed brackets for crossmember, stiffener and gusset attaching sections or near the curved section of the chassis frame because these sections are likely to be subjected to stress concentration.



Unit: mm {in.}

Vehicle model	L
Wide cab	1100 {43.3}

Note: (A) indicates the part of the frame assembly that has been enlarged assembly width; wide cab: 750 mm {29.5 in.} assembly width)

7.2.4 Fuel Tank

Under no circumstances should any part of the gasoline fuel system be modified or moved.
This includes the fuel tank, fuel pump assembly, fuel lines, vapor lines, fuel filter hoses and pipes, evap canister, and vent solenoid.
The gasoline fuel system has been designed and validated to meet the evaporative emission regulations in CFR title 40 part 86.

Overhang mount type

Cautions relating to fuel tank

- Auxiliary ports are not allowed on the MFTBC supplied gasoline fuel tanks.
- The temporary rubber cap on the fuel tank must be removed.
- Do not allow foreign materials to enter the fuel tank and related parts,
- Use of the MFTBC supplied fuel fill kit (A03-427 10-000) is required to meet the evaporative emissions regulations.
- The fuel filler end of (A03-4289 1-000) must be attached to the rear body structure. The rear body structure must be strong enough to support the weight of all components. The filler pipe must not be allowed to project beyond the side of the body.
- Position of upper most mounting hole on fuel fill end to be 187mm above the height of the upper truck frame flange. See Fig.1
- Shorter end of elbow hose (03-42708-000) to fit over fill neck on tank. Ensure that elbow is seated as far as possible onto fill neck of tank. Position clamp as indicated in Fig 2.
- Elbow hose and vent tube to pass through cutout in rail. Ensure that neither hose nor vent tube contacts metal rail. Apply edge guard if needed.
- Insert straight pipe end of (A03-4289 1-000) into elbow hose and attach with clamp as shown in Fig.2.
- For body widths shorter than 102 in., longer end of elbow hose may be trimmed as necessary.
- Clamps to be torqued to 60±5 lbs.-in. (6.8 ±1 Nm)
- Vent tube must be connected to filler neck assembly. DO NOT VENT TO ATMOSPHERE. Ensure vent tube is free of kinks.
- Attach small ground strap to body.
- "UNLEADED GASOLINE FUEL ONLY" label is provided with fuel fill kit. This label must be attached at the fill location in view of operator when filling.

7.2 Fastening mounting frame to chassis frame

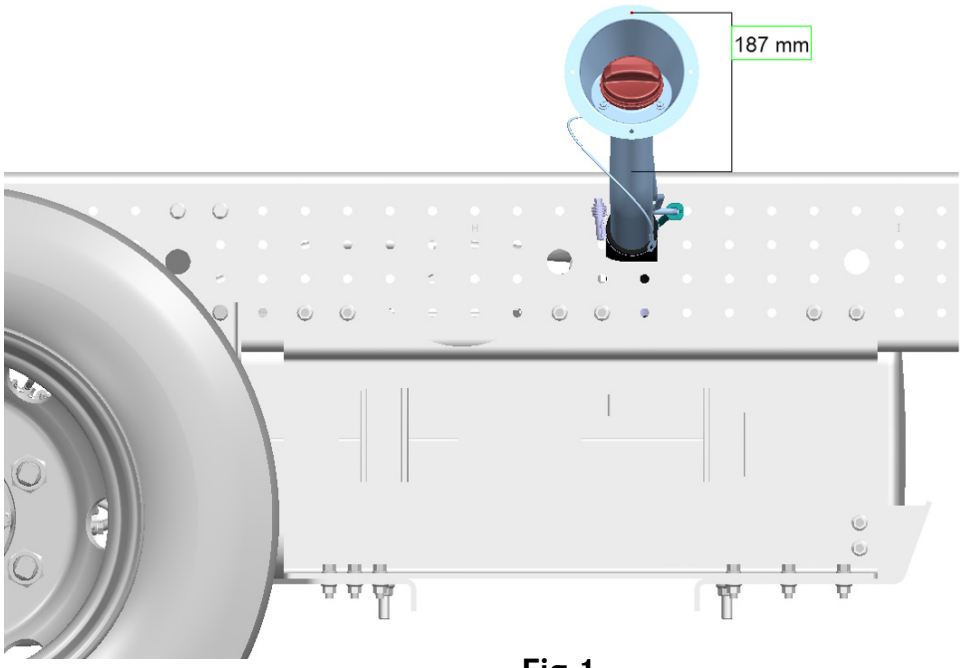


Fig.1

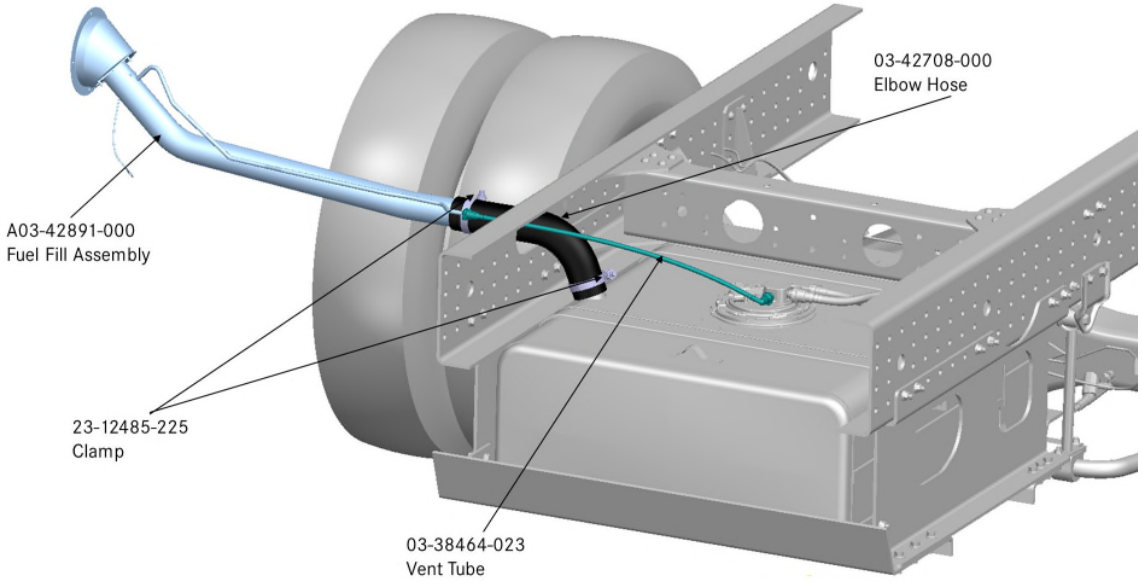


Fig.2

Unit: N·m {ft.lbs, kgf·m}

Part	Tightening torque	Remarks
Clamp	6.8 ± 1.0 {5.0 ± 0.7, 0.7 ± 0.1}	-
Filler end	8 to 12 {5.9 to 8.8, 0.8 to 1.2}	With tether of filler cap

8.1 Electrical system

Risk of accident

Work carried out incorrectly on the electrical system may impair its function. This may lead to the failure of components or parts relevant to safety.

Work on live electrical lines carries a risk of short circuit.

Before starting work on the electrical system, disconnect the on-board electrical system from the power source, e.g. battery.

All accident prevention regulations must be complied with when working on the vehicle.

Comply with all national regulations and laws.

Additional information

Observe the notes on operating safety and vehicle safety in Section 1 "Introduction" ▷ page 9 and ▷ page 10.

8.1.1 Signal detection and actuation module-related parts

Cautions on Signal detection and Actuation Module (SAM) (relay and fuse-integrated control unit for body equipment)

The signal detection and actuation module is an integrated unit with the control and power distribution functions for electric parts of the cab and body equipment.

(a) Before disconnecting the connected cables of the signal detection and actuation module control unit, set the starter switch of the vehicle to OFF.

(b) Before performing welding to the chassis and body, be sure to disconnect the signal detection and actuation module control unit cables and connectors. Use exteme care of spattering (sparks, etc.) thrown on the harnesses during the welding work.
Ground the welder near the weld.

(c) When cleaning inside the cab, take utmost care not to splash the signal detection and actuation module control unit (including relays, fuses and connectors) with water.

(d) When removing the signal detection and actuation module control unit from the vehicle, set the starter switch of the vehicle to OFF, then disconnect the harness from the battery terminals and remove the connectors/nuts in the following order. (To reinstall, reverse the sequence of removal.)

- Disconnect the power line (connector No. 9C, nut No. 10C) first.
- Disconnect the control unit connectors.
- Disconnect the ground line (connector No. 8C) last.
- Bracket nuts (back of signal detection and actuation module, M6 x 4)]

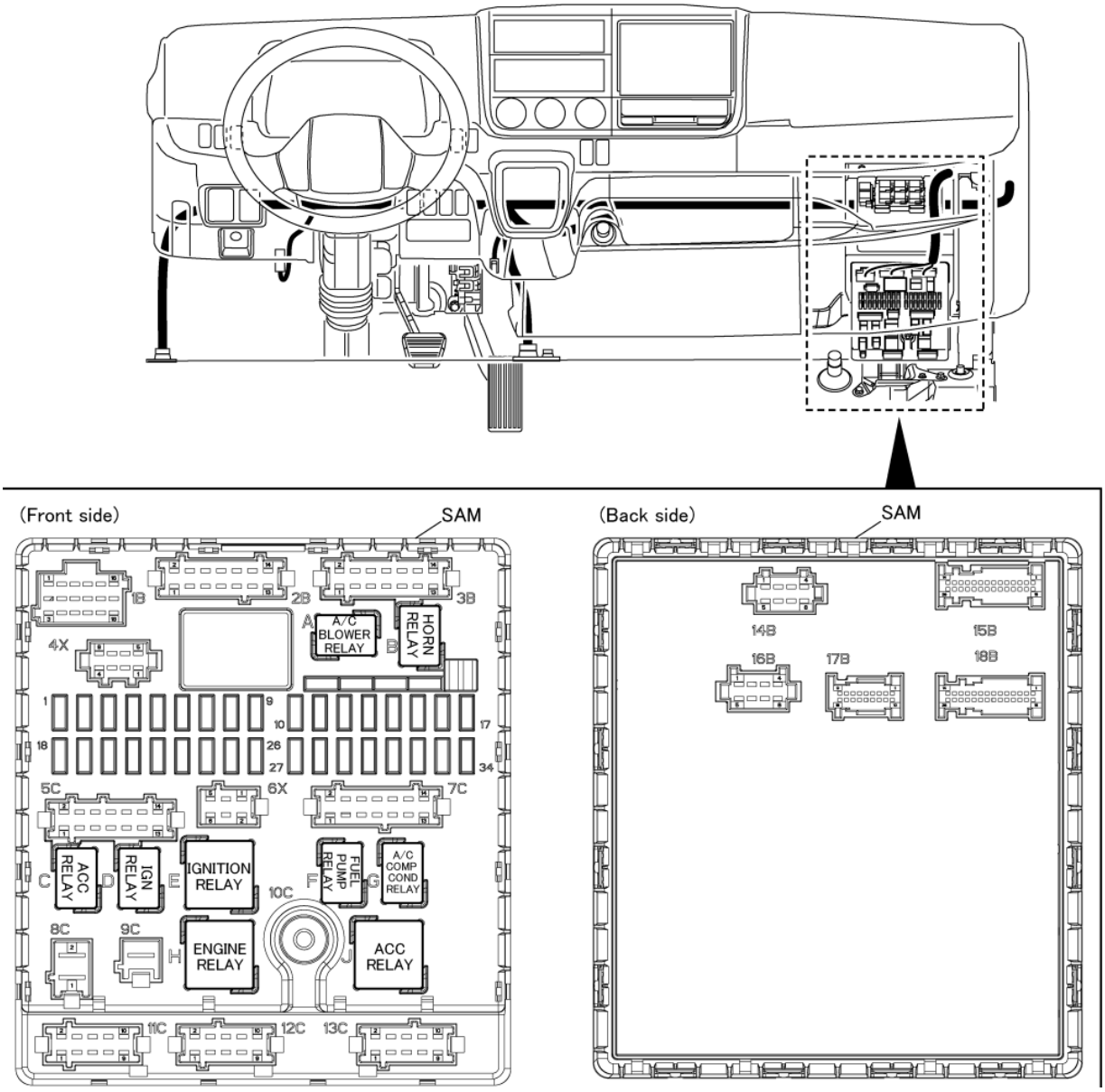
When installing the signal detection and actuation module control unit to the vehicle, tighten its nuts to the torques specified below.

Unit: N·m {ft.lbs, kgf·m}

Nut type	Torque	Use
M6	4 to 6 {3 to 4.4, 0.4 to 0.6} nominal value: 5.4 {4, 0.55}	To mount the control unit to be bracket
M8	10 to 15 {7.2 to 11.0, 1 to 1.5} (nominal value: 12.7 {9.3, 1.3})	To mount the power line 10C

(e) Relays and fuses should be carefully installed or removed in/from the signal detection and actuation module control unit one by one.

8.1 Electrical system



Cautions to be taken when handling signal detection and actuation module related parts

To protect the functions of the SAM, be sure NOT to:

(a) Alter electrical routing by extending or cutting a power cable or connector to/from other parts than the connector used for body equipment or other similar methods.
(b) Alter the SAM control unit in any way.
(c) Remove or paint the cover of the SAM control unit.

Output terminals for additional wiring

The SAM control unit has circuit output terminals for additional wiring as listed below. Connect power or signal cables to the connectors used for body equipment to add the wiring as required.

Circuit name	Allowable current
Power supply (Batt)	7 A
Power supply (ACC)	7 A
Power supply (key-on)	7 A
ILL power supply*	2.5 A (chassis harness side) 2.5 A (body harness side)
Neutral signal*	0.2 A
Power take-off signal*	0.2 A
Parking brake signal*	0.2 A
Back alarm signal*	0.2 A

(a) Cautions when using output terminals for additional wiring
- Allowable current values are specified for the output terminals. Make sure that the rated current for any additional electric part to be used is lower than the specified allowable current.
- When any diagnostic function of the output terminals marked * is used, it is necessary to change data for the SAM. For details, ask the contact person.
- When a signal output terminal is used to operate any body equipment-side apparatus, use it as the activating side for operation relay. The relay used must be a noise-absorbing element-incorporated type.
- For necessary output lead-out connectors, see "Mounting Location of Optional Terminal Inside Cab" ▷ page 178.

(b) Precautions for body building and modifying electrical parts

Adding or replacing any electrical part without any good reason causes the SAM control unit to detect a fault. A warning lamp then goes on and remains on or the power is shut down, resulting in vehicle failure.
- If an electrical part is to be added or a lamp is to be replaced with an LED lamp, the current value of the electrical part should be ensured to fall within a specified range. This is, however, does not guarantee that the electrical part to be mounted will be fully operational when its current value falls within the specified range.
- For the specified current value, consult a MITSUBISHI FUSO authorized Distributer or your contact person ▷ page 14.
- Body building or modification of any of the following electrical parts requires that the SAM control unit parameters be changed. Consult a MITSUBISHI FUSO authorized Distributer. Some parts to be mounted may not be fully operational depending on their specifications or the vehicle specifications. Major body building and modification examples:
  - Mounting a transmission PTO
  - Mounting a dump control lever [PTO ON/OFF]
  - Mounting a centralized door lock and keyless entry system
  - Mounting a heated mirror
  - Mounting fog lamps
  - Mounting the step lamp
  - Modifying the rear combination lamp [incorporating LED]
  - Adding a turn signal
  - Modifying the license plate lamp

8.1.2 Starter switch

- The starter switch uses weak current contacts. Do not add any wiring to the line connected to the starter switch.
- In case the use of a power source linked to the starter switch is unavoidable, be sure to connect to the appropriate output terminal for additional wiring provided on the signal detection and actuation module control unit via the connector for body equipment.
  Regarding the output terminals for additional wiring provided on the signal detection and actuation module control unit, see "8.1.1 Signal detection and actuation module-related parts" ▷ page 159.

8.2 Electric wiring

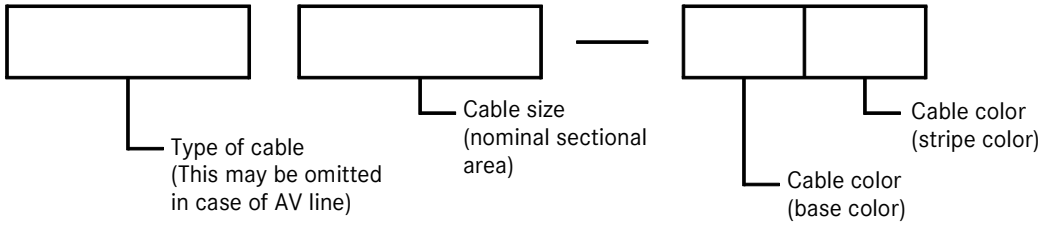
8.2.1 General precautions

The vehicle is delivered after electric wiring and fuses on the chassis side are checked with respect to load capacity, frequency of use, etc. to make sure of fire prevention and running safety. Do not alter the wiring unless it is absolutely necessary. Should it become unavoidable to extend or modify the wiring, be sure to follow the instructions given in "8.2 Electric Wiring".

8.2.2 Cable Identification

Cable size and cable color

Coding system

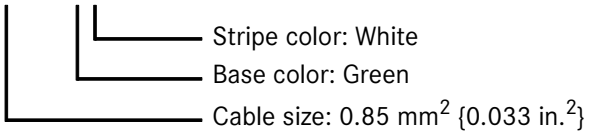


Alphabetical symbols of cable colors

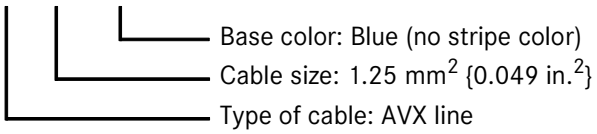
Symbol	Color	Symbol	Color
W	WHITE	L	BLUE
B	BLACK	Br	BROWN
R	RED	Lg	LIGHT GREEN
Y	YELLOW	O	ORANGE
G	GREEN		

Typical examples of cable identification codes

- 0.85 – GW



- AVX1.25 – L



Select types of cables

Related standards
(JIS C 3406: Low voltage cables for automotive use)
(JASO D 608: Heat-resistive low voltage cables for automotive use)
(JASO D 609: Current capacity of low voltage cables for automotive use)

Type of cable

Select necessary types of cables from the list below.

Type of cable	Location of use
AV line Vinyl-insulated low voltage cable for automotive use	Used for ordinary wiring
AVX line Cross-linked vinyl heat-resistive low voltage cable for automotive use	Used for wiring in areas where ambient temperature is high, such as around engine
AEX line Cross-linked polyethylene heat-resistive low voltage cable for automotive use	

Cable size

Select necessary cable sizes from the list below.

Nominal sectional area	Number of strands /Strand diameter Unit: mm {in.}	Allowable current (A)		
		AV line	AVX line	AEX line
0.5f	20/0.18 {0.0071}	8	7	7
0.5	7/0.32 {0.013}	9	8	8
0.75f	30/0.18 {0.0071}	10	9	9
0.85	11/0.32 {0.013}	11	10	10
1.25f	50/0.18 {0.0071}	14	13	13
1.25	16/0.32 {0.013}	14	14	13
2	26/0.32 {0.013}	20	18	18
3	41/0.32 {0.013}	27	25	25
5	65/0.32 {0.013}	36	34	33
8	50/0.45 {0.018}	47	44	43

"f" suffixed to nominal sectional area stands for "flexible."

Use flexible cables in vibrating and crooked areas, such as at the cab to chassis, engine, transmission and dump hinge.

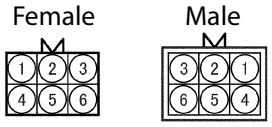
8.2.3 Connector code

Connector pin numbers

Numbering of terminals

Female terminals: Numbering started from upper left

Male terminal: Numbering started from upper right



8.2.4 Existing wiring and custom-built truck body on chassis side

- Make sure that wiring is not caught in by custom-built truck body.
- Make sure that wiring clear of sharp edges.
- When handling, do not pull wiring with excessive force.
- Remove harness connector by the connector body. Do not pull the harness.
- Make sure that wiring has a sufficient distance from heating parts.
- After installing custom-built truck body, make sure that associated wiring and parts can be inspected and serviced without hindrance.
- When a buzzer is provided for custom-built truck body, avoid shared use of chassis-side buzzer or use of a buzzer that is the same in tone as the chassis-side one.

8.2.5 Change and extension of wiring

Cables to be used

- Use cables conforming to JIS C 3406 (low voltage cables for automotive use), JASO D 608 (heat-resistive low voltage cables for automotive use) or equivalent. As to vinyl tape, use products conforming to JIS C 2336 (vinyl adhesive tapes for electric insulation) or equivalent. See "Type of cable" in "8.2.2 Cable Identification" ▷ page 163.
- When selecting a cable size, make sure that its allowable current conforms to the system rating. Especially in a system where a motor, etc. is used as a load, allow for the current in case the motor locks (restricted). See "Cable size" in "8.2.2 Cable Identification" ▷ page 163.

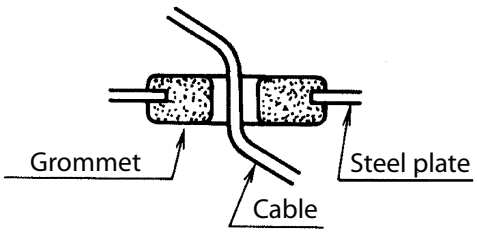
Wiring procedure

- When custom-built truck body-side wiring is extended, do not relocate existing cables and wires installed at the time of delivery from the manufacturer. If relocation is unavoidable, make sure that there is sufficient space from neighbouring parts and there is no interference with them.
- For wiring, install cables along rear body members, frame, etc. Do not stretch them in the air.
- Install cables clear of chassis and custom-built truck body rotary parts, vibrating parts and sharp edged parts. Firmly clamp cables.
  Secure the following clearances.

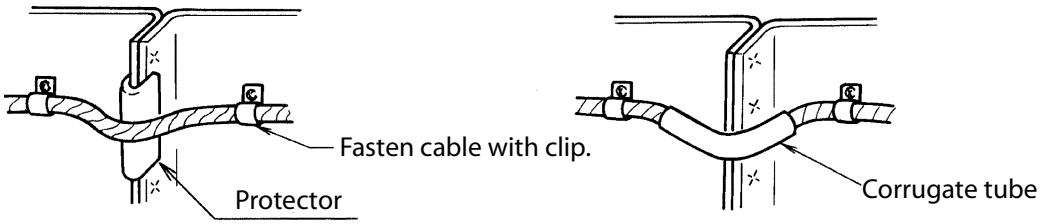
Unit: mm {in.}

Location	Minimum clearance
Between moving part and wiring	10 {0.39}
Between sharp edge and wiring	10 {0.39}

- Be sure to use a grommet in every cable through hole in the steel plate to prevent the cable from being damaged in the sheathing and short-circuited.



- Use additional clips as required where the cable may contact the edges of metal parts to prevent damage to sheathing due to vibration-induced contact. Alternatively, cover the metal edges with a protector or wrap corrugate tube around the part of the cable that contacts the metal edges.



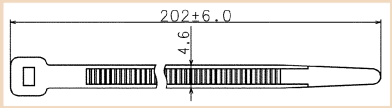
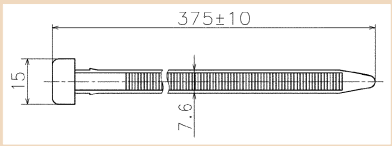
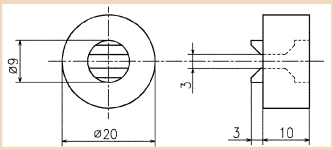
- If a harness exists nearby, tape the cable along to the harness. It is positively prohibitive to lay cables along the brake piping (including brake hose and brake pipe), fuel piping (including all metal and rubber hoses) and grease piping. Maintain clearances between cable and existing harness.

Unit: mm {in.}

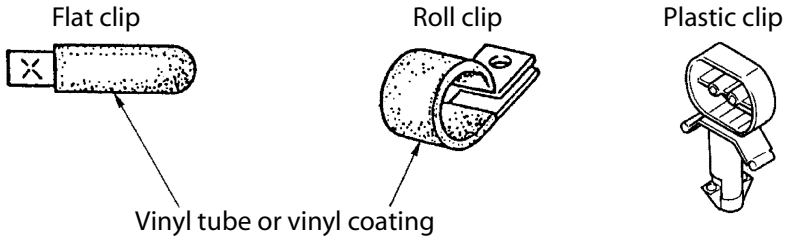
Wiring method	Minimum clearance
Parallel	10 {0.39}
Crossover	20 {0.79}

- For clearance between cable and exhaust system part, see "4.4 Clearance for the basic vehicle and bodies" ▷ page 42.
- Install harnesses or battery cables where they will not be covered with accumulated dirt, snow, etc., iced nor damaged by flying stones. In an unavoidable case, provide a metal shield to protect the harness or cable.
- Do not connect cables with sheathing broken and wires drawn out.
- When equipment is wired, water may run down the cable into the equipment. Seal the through hole firmly with a grommet or the like and install the cable with its terminal upward.
- Route cables through places where they are not splashed with water or covered with dust.
- Do not install cables onto the top and outer sides of the frame. They may be damaged by feet put on the frame or stones flying to the frame during running.
- Install cables in the engine compartment apart enough from heat sources and along existing harness. Bind cables extensively with heat-resistive vinyl tape or fasten with metal sheet clamps (rubber- or vinyl-coated). Do not use non-heat-resistive vinyl tape because it is degraded to separate by heat.
- Install cables to engine- and transmission-mounted parts routing along existing harnesses so that their relative movements can be absorbed. Also, give cables a proper amount of slack so that they do not contact with other parts.
- When the routing of battery cables is changed for relocation of battery or other reason, do not extend or shorten battery cables and/or charging circuits of alternator, etc. Especially, do not change clamping method, clamping position, slack, etc. in areas of relative movement between starter and frame.
- When battery is relocated, locate it at least 200 mm {7.87 in.} apart from the exhaust system (muffler with emission gas purifier and tail pipe). If less than 200 mm {7.87 in.} apart, provide a heat insulator.
- When cables are shortened, do not cut them short but bind excess length of cable to existing harness or the like bundled with vinyl type.
- Hold MWP water-proof connectors for rear combination lamp, license lamp, side turn lamp, etc. in place by fastening the connector body with hook type plastic clips (MH056347 to MH056350) or band clips.

- When cable bands are cut off for convenience of work, obtain necessary parts in accordance with the list below and restore the cable bands to their original state.

Part name	Part No.	Geometry	Remarks
BAND, CABLE	MK663741		Cable tie: Hellermann Tyton, T50R-HSW or equivalent
BAND, CABLE	MK663652		Cable tie: Hellermann Tyton, CT375 or equivalent
SPACER, BAND	MK663653		For MK663652

- For clipping, use coating tape, protective rubber or plastic clip. Limit sticking and clasping clips to auxiliary use.



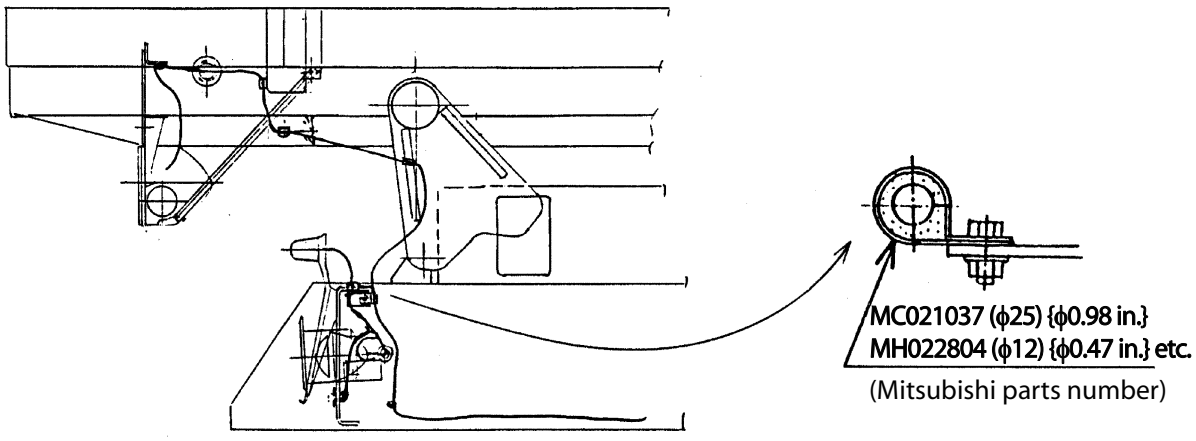
Given below are the standard limits of spacing for cable clamps.

Unit: mm {in.}

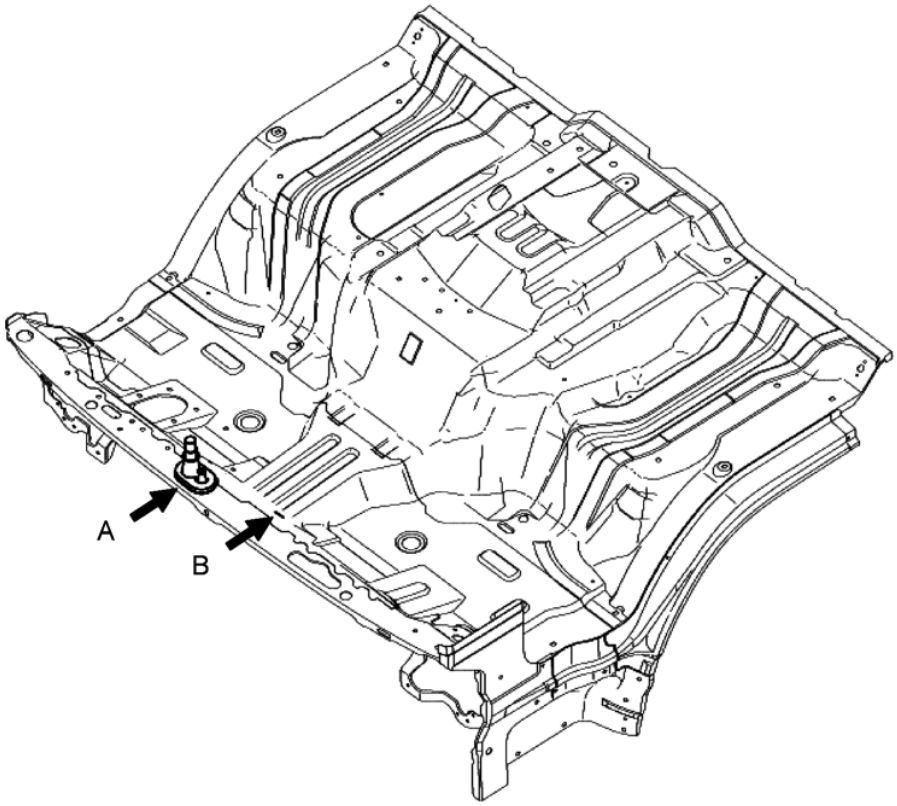
Harness diameter	Limit of spacing
5 {0.2} max	300 {11.81} max
5 – 10 {0.2 – 0.39}	Approx. 400 {15.75}
10 – 20 {0.39 – 0.79}	Approx. 500 {19.69}

8.2 Electric wiring

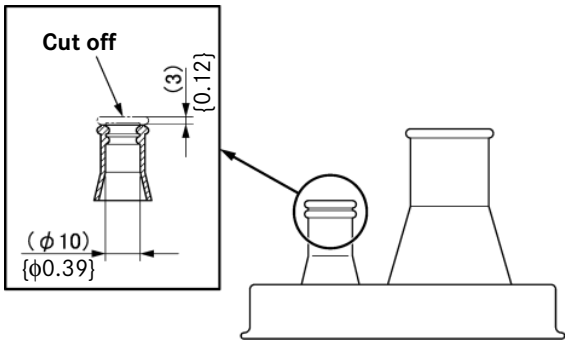
For cables to rotary portions of dump hinge and other custom-built truck body parts and vibrating bodies of engine, transmission, etc., use solid rubber clips.



- When passing electrical wiring through the cab floor, use the grommets in the area A and B shown below.



Let harness pass through the grommet cut as shown below and then tape them.



Unit: mm {in.}

Procedure for wire connection

- In the case of wire connection using plug and plug receptacle, use the plug receptacle on the power supply side, so that if the plug and plug receptacle should be separated, the disconnected wire is not short-circuited even if it touches the vehicle body.
- When cable is extended, the extension cable should be identical in sectional area and hue. Connect the cable ends firmly by soldering or using crimp type terminal and provide the joint with solid insulating covering. Be sure not to connect cables by twisting together. When soldering, do not use hydrochloric acid.
  Especially, when wires of chassis harnesses (all harnesses outside of the cab) are extended, properly protect joints against water and insulate them.

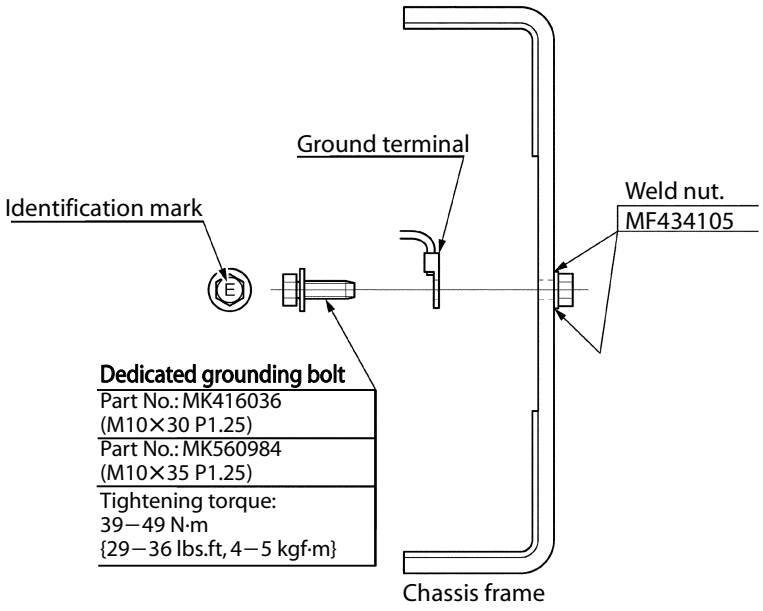
8.2.6 Grounding

Ground extended power cable to the circuit connecting to the minus (–) terminal of battery. In the case of grounding to the frame, establish the grounding point on unmasked or uncoated surface.

Use eyelet terminal for grounding.

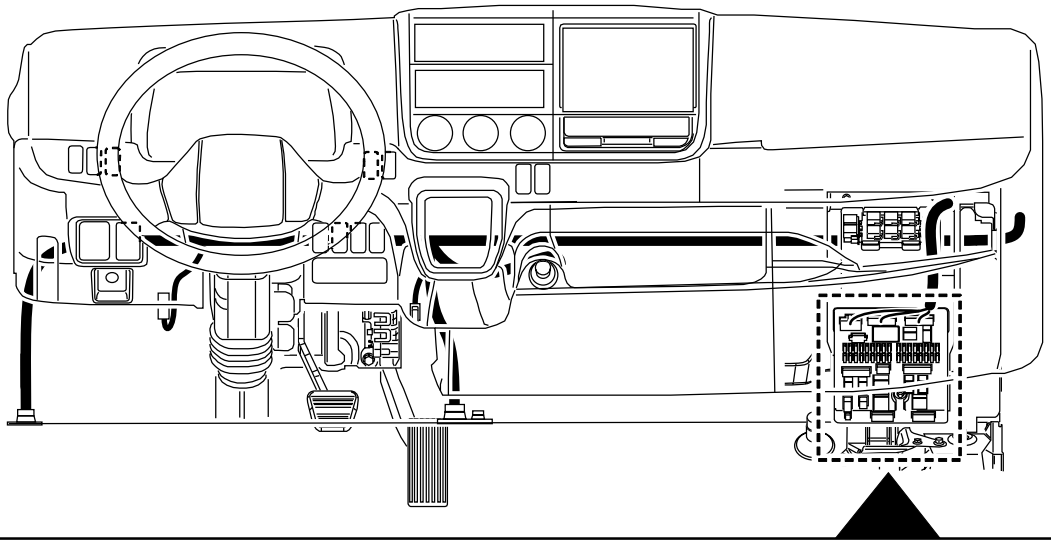
Dedicated bolt for grounding is used for tightening ground terminal. In the case where dedicated grounding bolt is removed during custom-built truck body installation, do the following.

- If grounding point is not relocated
  Reinstall the removed dedicated grounding bolt by tightening to the specified torque.
- If grounding point is relocated
  Use designated dedicated grounding bolt shown below. Spot weld nut to the frame and tighten bolt to the specified torque. Provide the weld with touch-up coating.

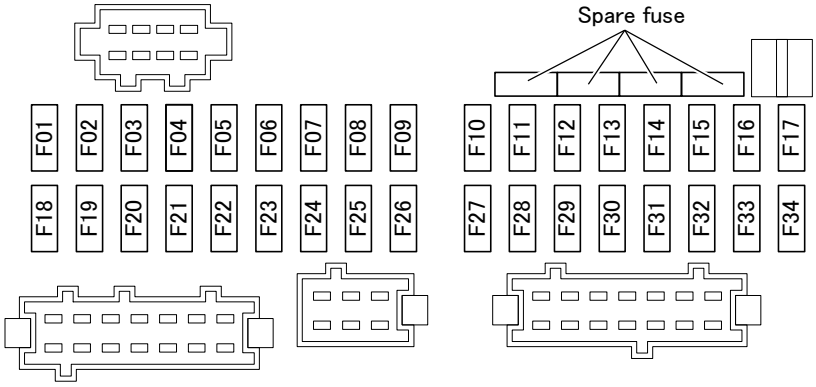


When wiring from the custom-built truck body side is grounded to the frame, do the same as described in [If grounding point is relocated] above.

FUSE BOX

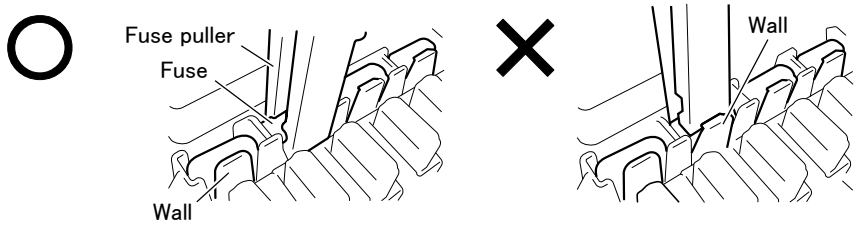


<Inside of SAM>



SAM : Signal detect and actuation modules

Removal of spare fuse



WARNING ⚠

- **To prevent possible injury, be sure to disconnect the negative (-) cable of the battery and insulate it with tape before removing fuses. (See Gr00.)**

CAUTION ⚠

- **If a fuse blows out, identify and remedy the cause, then replace the fuse.**
- **Be sure to use the fuse with the specified ampere.**
- **Insert the fuse puller into the gap on the outer side of the fuse holder wall to remove the spare fuse. Do not force the puller into the gap on the inner side of the fuse holder wall. Doing so will break the SAM and cause malfunctions or a fire.**

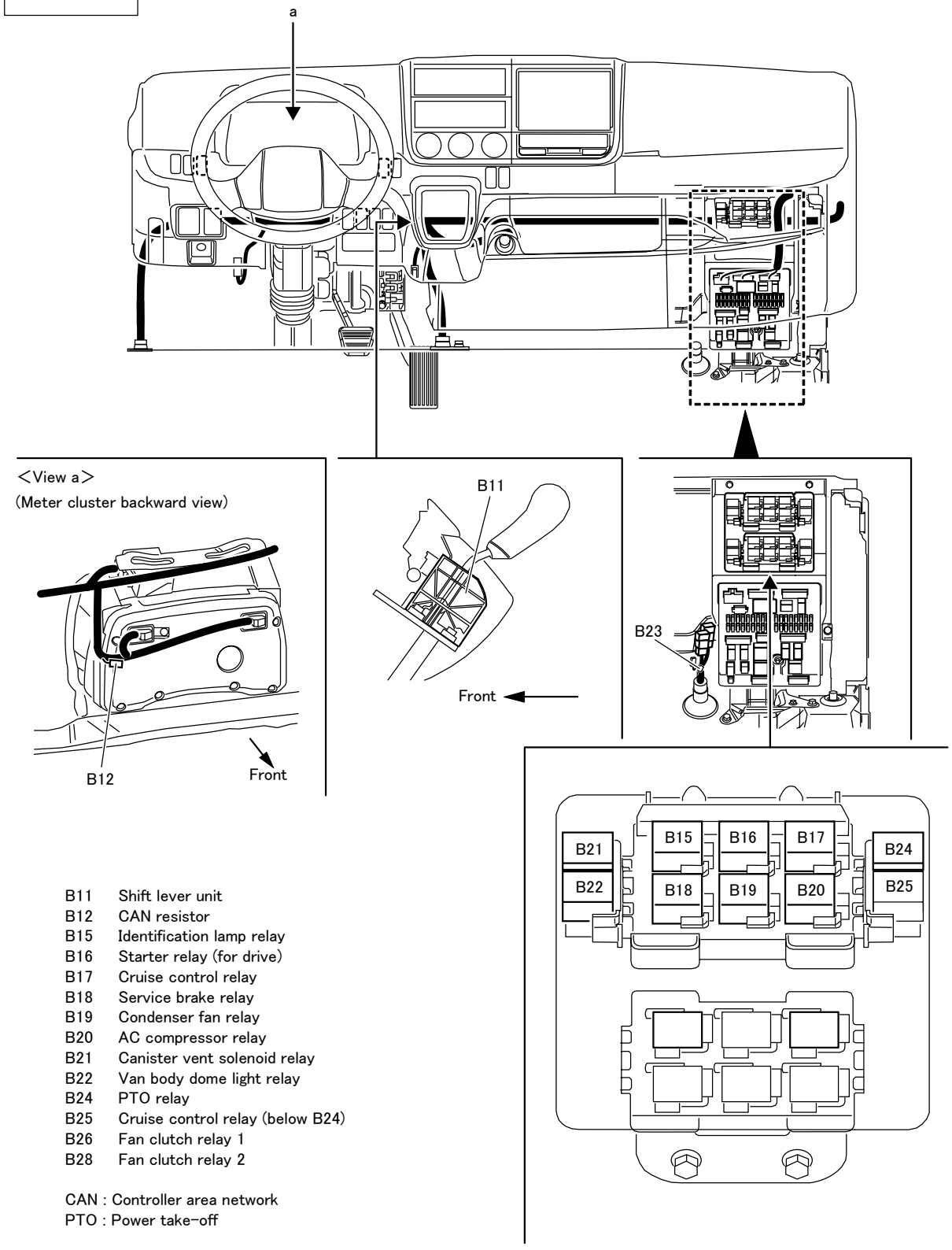
54-L10238FUSE-1

Fuse box

Fuse No.	Main load	Capacity
F01	Starter	10A
F02	—	—
F03	—	—
F04	Opt (IGN)	10A
F05	Power window (driver's seat side)	30A
F06	Canister ventilation relay	10A
F07	Power window (assistant driver's seat side)	30A
F08	Identification lamp	20A
F09	Meter cluster, diagnosis connector, combination switch	10A
F10	Stop lamp relay	10A
F11	Blower fan	30A
F12	Audio, keyless entry ECU	15A
F13	Starter switch, range selector lever	10A
F14	Horn	10A
F15	Audio	10A
F16	Cigarette lighter	20A
F17	—	—
F18	ABS ECU	10A
F19	Engine ECU	10A
F20	Van body dome light	10A
F21	CGW (CAN)	10A
F22	Meter cluster	15A
F23	CGW (CAN)	10A
F24	Automatic transmission ECU	10A
F25	Opt (ACC)	10A
F26	Opt (B)	10A
F27	Van body dome light	20A
F28	Injector	10A
F29	Injector	10A
F30	O^2 sensor	15A
F31	Engine ECU	20A
F32	Engine ECU, Air conditioner	10A
F33	—	—
F34	—	—

ABS : Anti-lock brake system
ECU : Electronic control unit
CAN : Controller area network

B11 to 28



B11 Shift lever unit
B12 CAN resistor
B15 Identification lamp relay
B16 Starter relay (for drive)
B17 Cruise control relay
B18 Service brake relay
B19 Condenser fan relay
B20 AC compressor relay
B21 Canister vent solenoid relay
B22 Van body dome light relay
B24 PTO relay
B25 Cruise control relay (below B24)
B26 Fan clutch relay 1
B28 Fan clutch relay 2

CAN : Controller area network
PTO : Power take-off

54-L10146B-2

8.3 Handling of electric/electronic equipment

8.3.1 Available types of electronic control systems (typical examples)

- Engine electronic control unit
- Transmission electronic control unit (TCU)
- Anti-lock brake system (ABS)
- Idling stop & start system (ISS)
- SRS air bag
- Signal detection and Actuation Module (SAM)
- Emergency locking retractor (ELR)
- Keyless entry
- Immobilizer

8.3.2 Handling of electronic parts

In the electronic control systems-equipped vehicle, multi-way connectors suited for weak current of such electronic parts and circuits as sensors, control units and actuators are used. When handling these connectors, use particular care in the following respects.

- Do not disjoin and rejoin connectors unless necessary. Connector pins could be deformed or damaged, resulting in poor contact.
- Disjoin connectors holding their housings. Pulling by cable or by force may deform connector pins.
- When disjoining connectors, do not let water, oil or dust adhere to their pin, or poor contact or unsteady continuity could result.
- Join connectors firmly after completion of work. When a harness is removed for servicing, restore it firmly to the original place after work.
- Use of electronic equipment, such as relays, solenoid valves and motors, for installation on the vehicle body is limited to those incorporating diode or varister noise absorbing elements.

8.3.3 Handling of battery

To prevent damage or fire of battery-related parts, observe the following precautions when handling the battery.

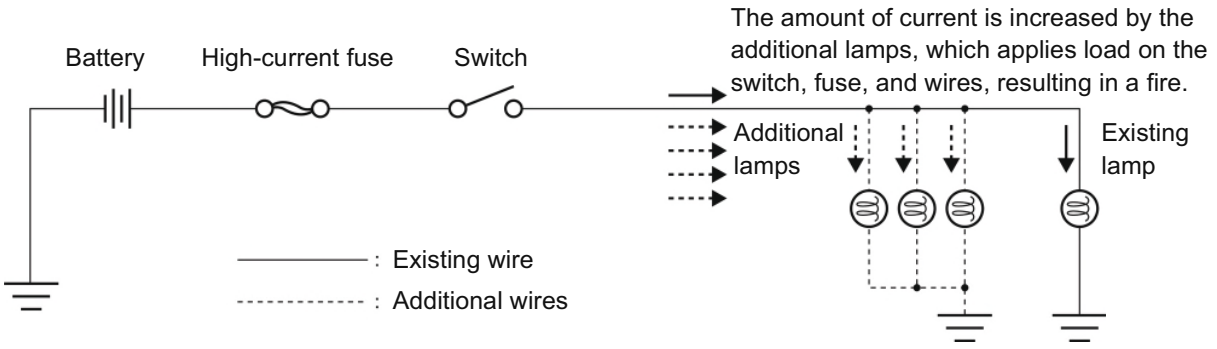
- Do not loosen or disconnect the battery cable while the engine is running.
- Be sure to connect the battery when starting the engine through towing.
- When performing a quick charge of the battery, be sure first to disconnect the battery cables from (+) and (–) terminals.
- Protect the cable to be routed near the exhaust system with a heat-resistant outer jacket.
- Route cables so that none rub together.

8.4 Power supply

8.4.1 Taking power from the existing wiring

(a) Source the power for the lamps and devices of the built body from the specified connector.
If an electrical device related to the built body is to be added, do not install a part or route a harness that can give a false signal to the power line and ground line of the electrical devices on the vehicle side.
Adding a wire to a midway point of the existing wire or increasing capacity by changing the fuse causes an excessive current to flow through the power supply and fuse box, leading to a fire.
Never change or add electrical wires except for those contained in this manual.
Increase the number of lamps according to the table given below (load, power source, etc.).

(b) Typical faulty wiring



8.4.2 Taking power via the onboard battery terminal

Take power by way of the onboard battery terminal only when doing that is absolutely necessary to achieve body building. If it is done unavoidably, observe the following precautions.

(a) Add a fuse of a correct type to any additional wire to thereby protect the circuit.

(b) Use a wire of 5.0 mm^2 {0.2 $in.^2$} or more for the additional wire ("between battery terminal and fuse" of the next figure (▷ page 176). Set the wire as short as possible and make sure that its jacket is not damaged to result in a short.

(c) For the combination of the capacity of the additional fuse and the wire size between the fuse and the additional load, study those marked with ○ in "List of recommended combinations of fuse capacity and wire size" (▷ page 176).

(d) Install the additional fuse in a waterproof cover (e.g. electric cover) or take an equivalent waterproofing measure for the additional fuse. Do not add wires or fuses to the existing high-current fuse box.

(e) Use of a directly connected power supply causes the onboard battery to tend to run down quickly. Make sure that the customer understands and observes the following handling precautions:

- It is prohibited to use the onboard battery for a long time with the engine stationary.
  Do not use the onboard battery as a service power supply (for the clock, memory, etc.).

Between battery terminal and fuse

(f) Use a round flat terminal for the power supply terminal and jointly fasten it by using the fixing nut for attaching the battery cable terminal.
Only one power supply terminal may be used.
Two or more additional terminals can be loosened, resulting in heat being generated or a short.

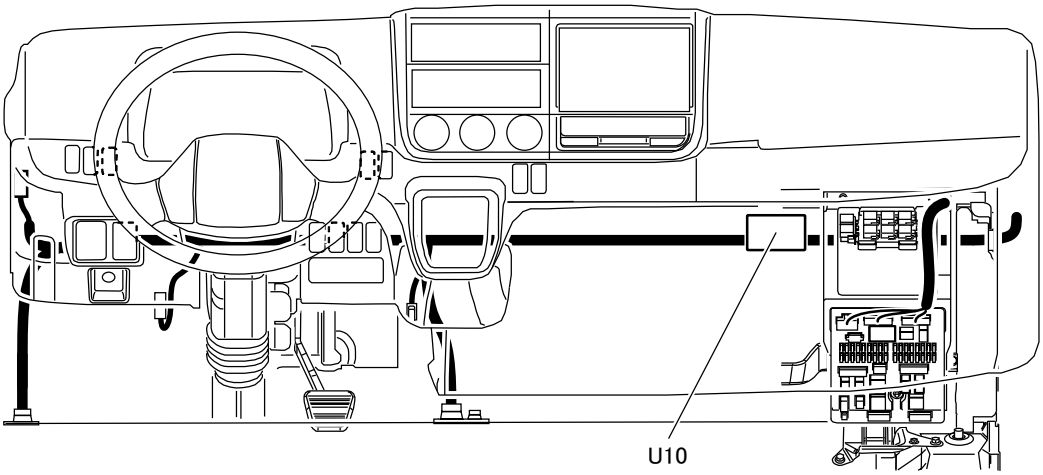
List of recommended combinations of fuse capacity and wire size

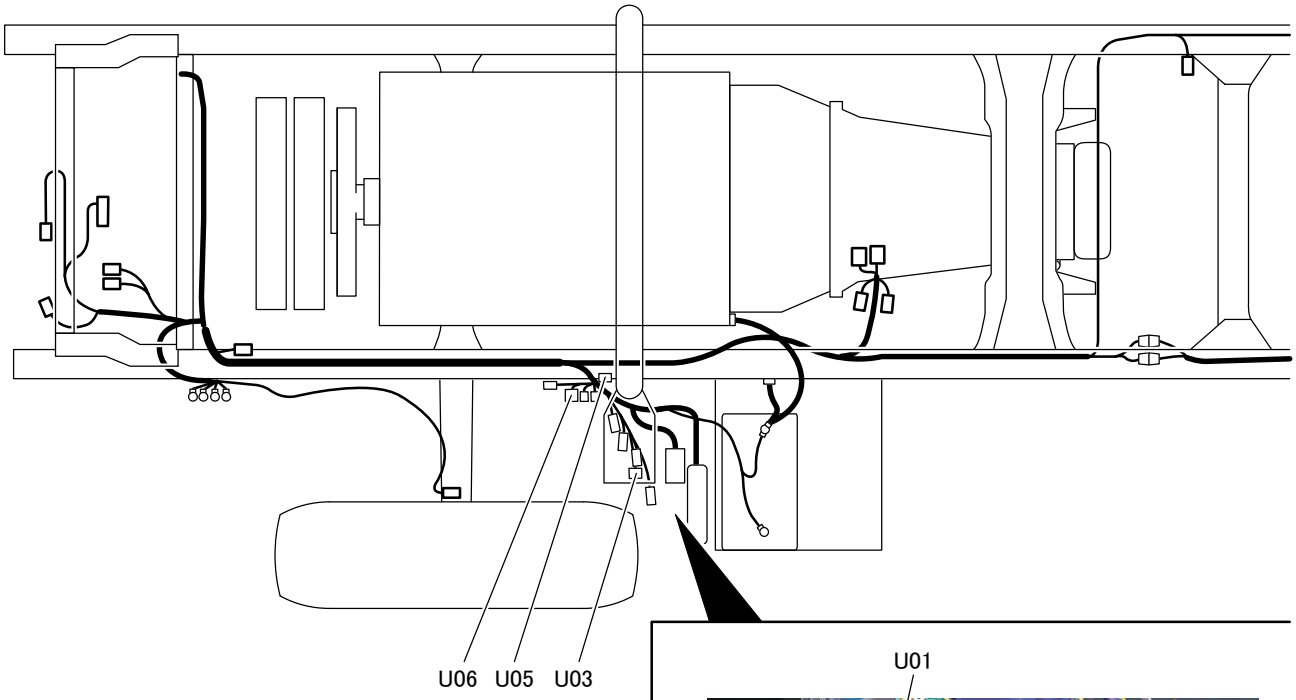
○ : Usable × : Not usable

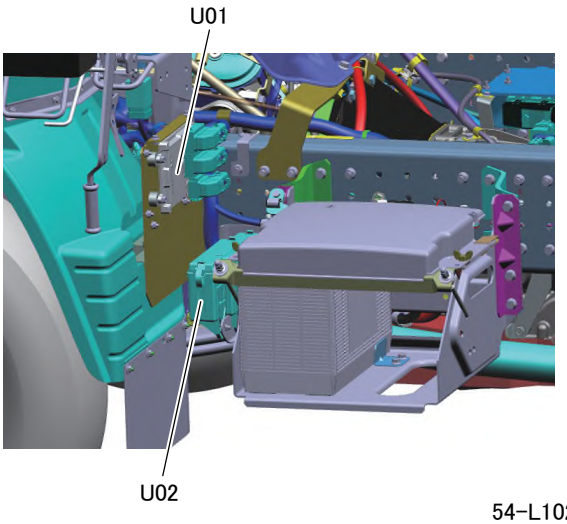
Fuse	Wire size (mm^2) [upper] and wire permissible current (A) [lower]								
Type	Specifications	0.3 0.012	0.5 0.020	0.85 0.033	1.25 0.049	2.0 0.079	3.0 0.120	5.0 0.200	(mm^2) ($in.^2$)
		11	14	18	23	31	42	57	(A)
Blade and glass tube	5 A	○	○	○	○	○	○	○	
	7.5 A	○	○	○	○	○	○	○	
	10 A	×	○	○	○	○	○	○	
	15 A	×	×	○	○	○	○	○	

Note: 1. Keep the continuous permissible current within 70 % of the fuse specifications value.
(E.g.) If the fuse used is 10 A:
$10 \times 0.7 = 7$ (A)
→ A load of up to 7 A can be used.
2. u: Not usable; – : 50 m (165 ft) max
3. AV/AVS wires: general wires; AVX wires: heat-resistant wires

U01 to 10







U01 Engine ECU
U02 High-current fuse box
U03 Fuel pump relay
U05 Diode (for starter relay)
U06 Starter relay
U10 CGW (CAN)

ECU : Electronic control unit

54-L10238U

8.4.3 Batteries

- Never place any metal objects or tools on the batteries.
- There is a risk of short circuit if the positive terminal clamp on the connected battery comes into contact with vehicle parts. This could cause the highly explosive gas mixture to ignite. You and others could be seriously injured as a result.
- When disconnecting the batteries, always disconnect the negative terminal clamp first and then the positive terminal.
- When connecting the batteries, always connect the positive terminal clamp first and then the negative terminal.
- Incorrect polarity of the supply voltage can cause irreparable damage to the control units.
- Never start the engine without a connected battery (battery terminals tightened).
- Do not disconnect or remove the battery terminals while the engine is running.
- If the batteries are flat, the engine can be jump-started using jump leads connected to the batteries of another vehicle. Observe the Instruction Manual. Do not use a quick charger for jump-starting.
- Only tow-start the vehicle with the batteries connected.
- Quick-charge the batteries only after disconnecting them from the vehicle's electrical system. Both the positive and negative terminals must be disconnected.

Additional information

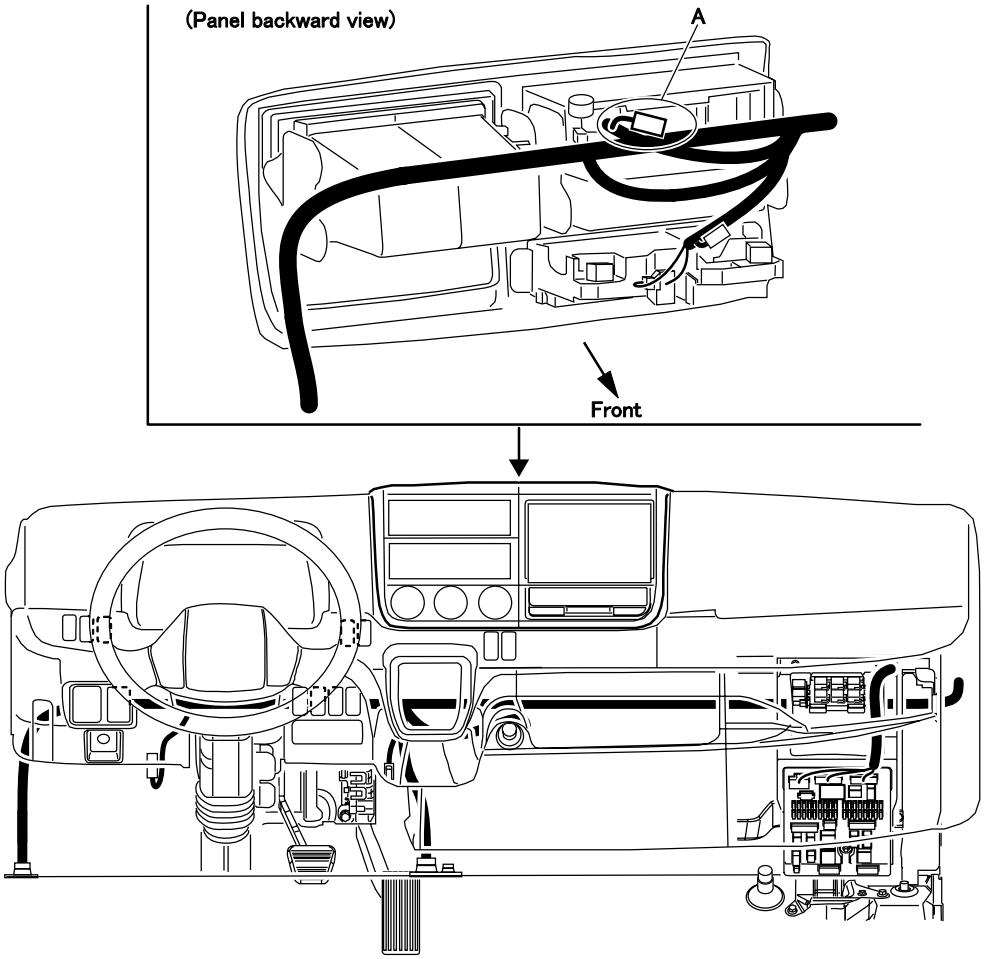
Installing additional electrical consumers
▷ page 165.

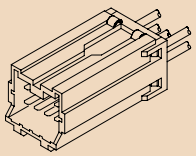
8.4.4 Lines, plug connections and control units

- A plug connection must not be unplugged from or plugged into the control unit(s) while the ignition is on.
- Lines must be protected from heat by means of insulation.
- Route cables in such a way that chafing cannot occur, particularly at crossover points and sharp edges. If necessary, use cable ducts, insulating loom, or guide pipes.
- Do not carry out tests at connector terminals using unsuitable tools (test probes, wire ends, etc.). This may lead to contact damage and subsequent problems. Use suitable test leads.
- The contact persons must be consulted if a battery isolating switch is to be retrofitted ▷ page 14.

8.4.5 Mounting location of optional terminal

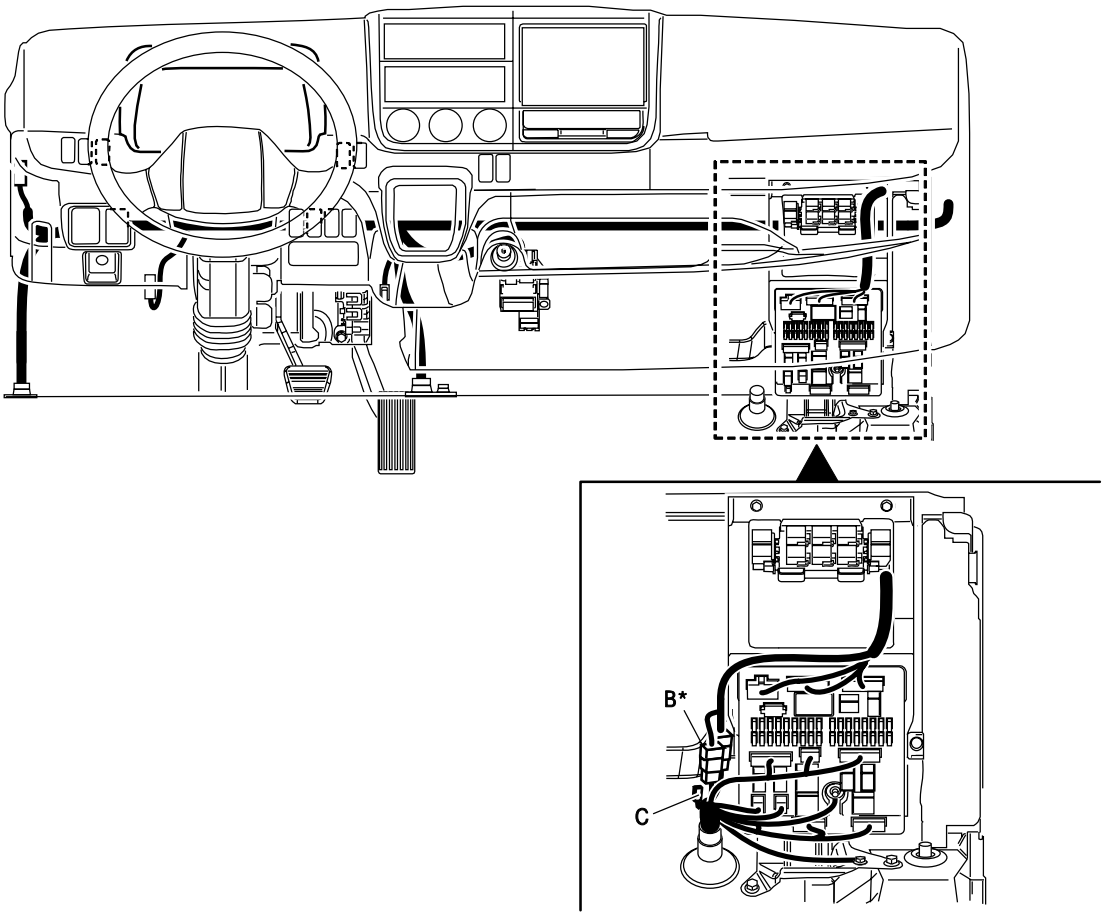
- Inside Cab



No.	Part Name	Connector No.	Circuit Description				Mating Connector
			No.	Circuit	Line color	Load	
A	OPTION CONNECTOR (Tachograph navigation)	MH056874 1 2 3 4 5 6	01 02 03 04 05 06	MAIN (12V) SPEEDSIG(25P) SPEEDSIG(8P)	Y-G Lg O-L	- - -	MH056807 

-: The connector marked with - is used for signal cabling only, not used to connect the loads.

8.4 Power supply



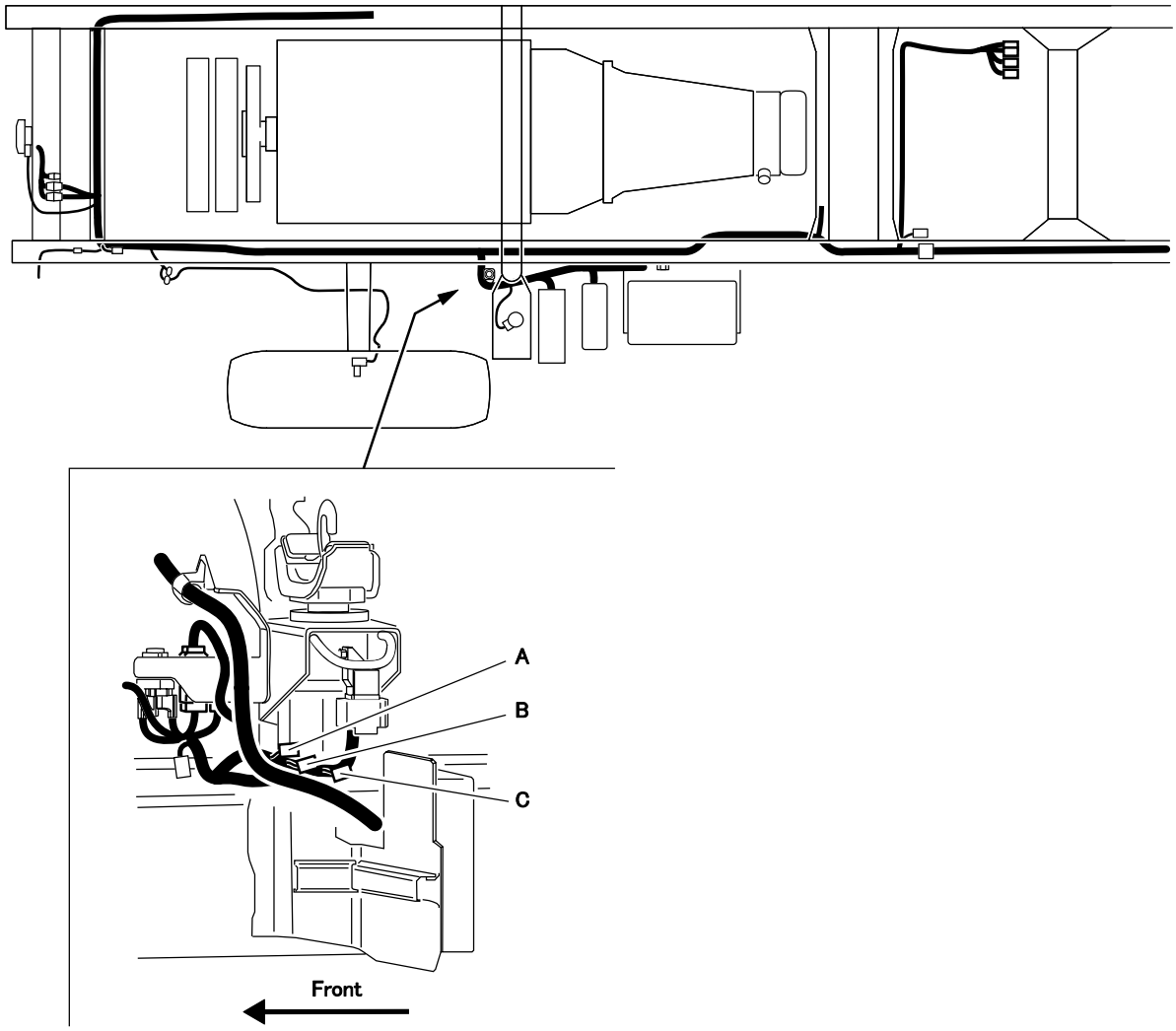
No.	Part Name	Connector No.	Circuit Description				Mating Connector
			No.	Circuit	Line color	Load	
B	OPTION CONNECTOR (Only When sub harness (MK649751) is arranged)	MH052847 1 2 3 4 5 6 7 8	01 02 03 04 05 06 07 08	PARKING ON NEUTRAL PTO ILL MAIN GND BATT ACC	Br R-G Lg-R O-B L-R B G-R W-R	*1 *1 *1 *1 *1 10A *1 *1	MH052805
C	OPTION CONNECTOR	MH056867 1 2	01 02	IDLE UP (SWtoGND)	R-B	-	MH056800

-: The connector marked with - is used for signal cabling only, not used to connect the loads.

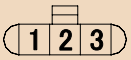
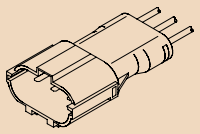
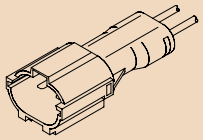
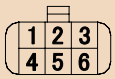
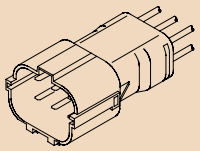
*: Note that, some of the circuit capacities are for SIGNAL-LEVEL amperage only, please refer ▷ page 159.

*1: Loads to be connected to the connector marked with *1 should be arranged so that the total value of the connector output in each of the cab and chassis side shall not exceed the permissible current.

- Mounting Location of Optional Terminal Outside Cab



8.4 Power supply

No.	Part Name	Connector No.	Circuit Description				Mating Connector
			No.	Circuit	Line color	Load	
A	OPTION CONNECTOR (van roomlanp & ID lamp)	MH056453 	01 02 03	VAN ID RAMP GND VAN ROOM LAMP	G-W B R	*8A 9A 5A	MH056403 
B	OPTION CONNECTOR (side turn) REQUIRES CIRCUIT ACTIVATION BY FUSO DIAGNOSTIC LAPTOP	MH056451 	01 02	TURN LH TURN RH	Gr-L Gr-R	*1 *1	MH056401 
C	OPTION CONNECTOR (chassis)	MH056457 	01 02 03 04 05 06	BATT ACC MAIN IDEL UP ILL GND	G-R W-R L-R R-B O-B B	*2 *2 *2 - - -	MH050090 

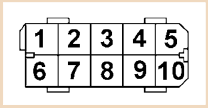
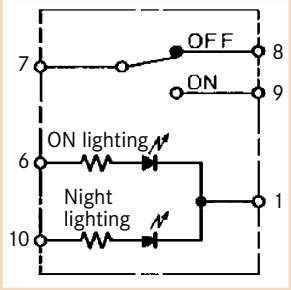
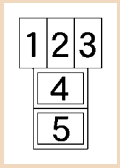
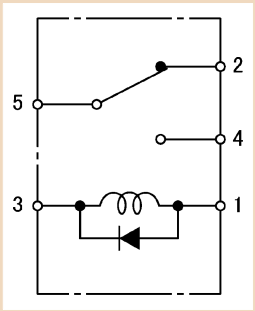
-: The connector marked with - is used for signal cabling only, not used to connect the loads.

*8A: Including marker lamps and ID lamps pre-mounted to the vehicle. (As an output terminal connector, approx. 5A as before.)

*1: In a vehicle with a connector marked with *1, one lamp as shown in the following can be additionally mounted for one side of the vehicle at manufacturer's option: voltage:12 V, lamp type: 21 W.

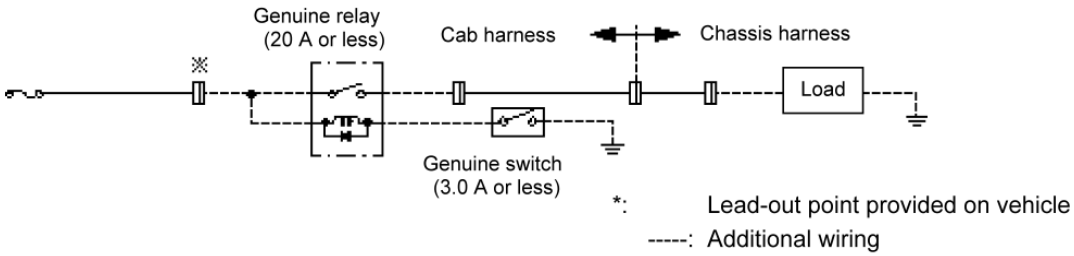
*2: Loads to be connected to the connector marked with *2 should be arranged so that the total value of the connector output in each of the cab and chassis side shall not exceed the permissible current.

8.4.6 Installation of switches and relays for equipment

Part Name	Mitsubishi Part No.	Allowable Current	Connector (Harness side)	Circuit
Rocker switch	MK645424	3.0 A or less	 MCP2.8 type connector Housing: A0145450026 Terminal: A0145451126KZ (wire diameter: 0.3 mm^2 {0.012 in.^{2}}) A0135457626KZ (wire diameter: 0.5 to 0.85 mm^2 {0.020 to 0.033 in.^{2}})	
Relay	MK420480 For 12 V	Between (5) and (4) (normal open side): 20 A or less Between (5) and (2) (normal close side): 10 A or less	 Connector type EQ5A (MH059820)	 3: Power supply side 1: Ground side

Notes:

1. If the total load current to the equipment connected to the switch for equipment exceeds 3.0 A, a relay must be added to prevent the flow of any load current exceeding 3.0 A through the switch.
   Night lighting and ON lighting are available for the switch for equipment. Use them as required.
2. The allowable current for the output line for equipment is specified separately from that for the relay above. Select the connected load that will not exceed either allowable current.
3. Typical example of use



8.5 Charging/discharging balance

The charging/discharging balance may become worse in the following operating conditions. For this reason, reduce the electrical load during work referring to the Engine Alternator Performance Curves.

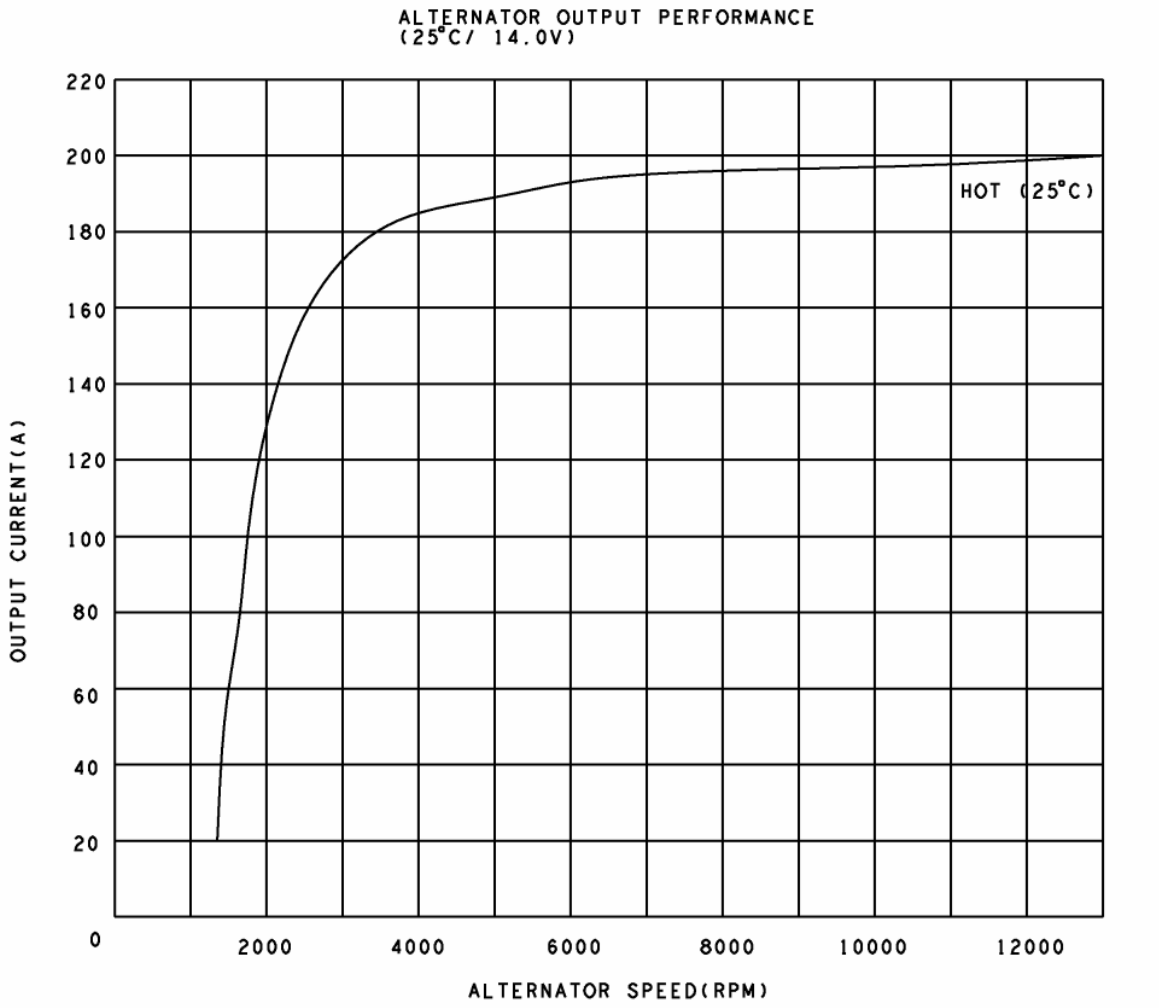
- When there is a lot of night work
- When working for a long time with the engine idling
- When many large load electrical auxiliary equipments are connected

In particular, when mainly idling the engine during night work, make sure that the electrical load is lower than the output current of the alternator.

8.5 Charging/discharging balance

- Engine Alternator Performance Curves

Nominal output 12V-180A



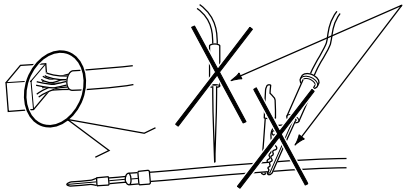
Alternator and engine speed ratio
3.3 : 1
Alternator: Engine

8.6 Electric circuit continuity check

Needling check is prohibitive.

Damage to cable insulation by test bar or electric circuit check lamp needle can result in premature corrosion of chassis harness.

Sticking of test bar or electric circuit check lamp needle into cable insulation is prohibitive.

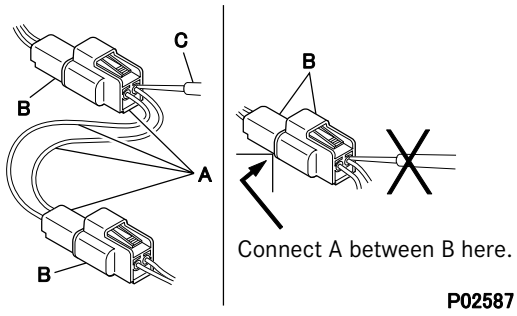


8.6.1 Check procedures

Continuity check with mating connectors joined (with continuity established in circuit)

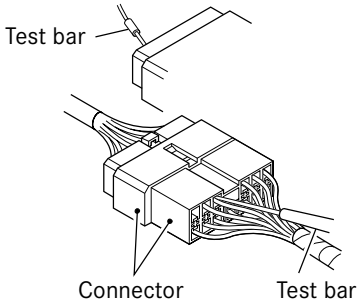
Waterproof connector

- Connect check harness A between joined circuit connectors B.
- Perform the check with the test bar applied to the check harness A connector
- Do not put in the test bar from connector B-side harness. The connector would lose waterproofing performance to result in harness corrosion.



Non-waterproof connector

- Insert the test bar from the harness side.
- If joined connectors are so small that test bar cannot be inserted, such as control unit connectors, do not push in the test bar by force but use a superfine pointed test bar.

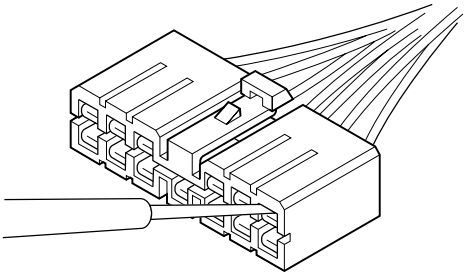


8.6 Electric circuit continuity check

Continuity check with connectors disjoined

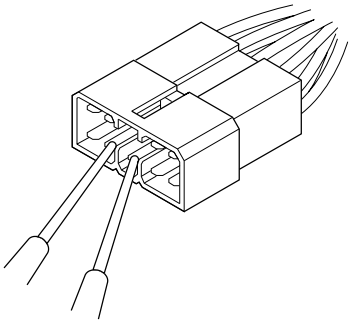
Check with female connector pins

- Perform the check with the test bar inserted in the pins.
- Forced bar insertion could result in poor contact.



Check with male connector pins

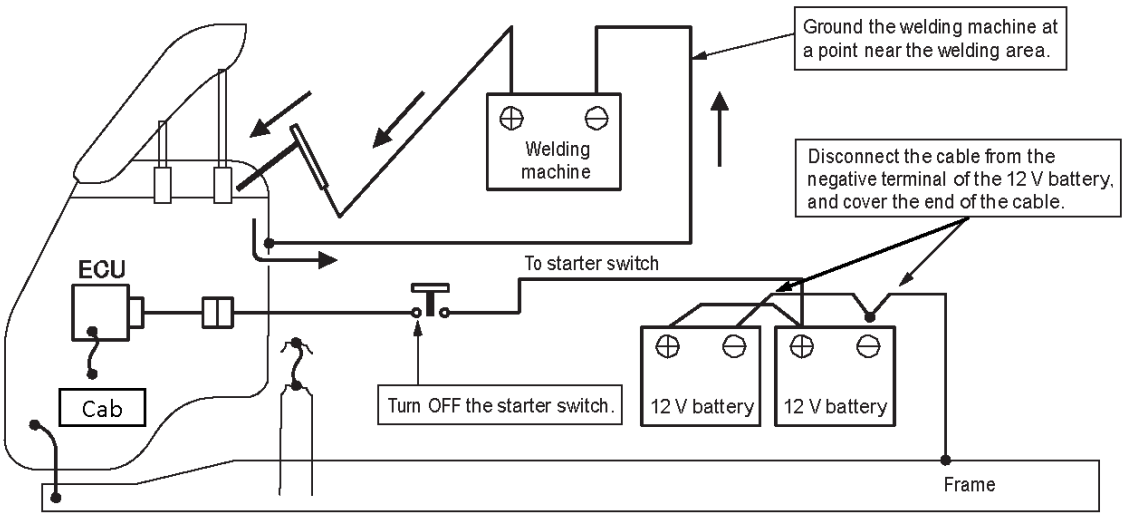
- Perform the check applying the test bar directly to connector pins.
- Take care that the test bar does not short-circuit between connector pins. In the case of electronic control units, short-circuiting could break down their internal circuit.



8.7 Precautions for electric welding

When a worker carries out arc welding, the electrical harness of the vehicle and also the electronic devices sometimes become damaged. To prevent this, observe the following precautions.

- Preparations for arc welding
  On the vehicle are mounted electronic devices and an electronic control unit (ECU) which are connected directly to the battery. If you carry out arc welding with these devices connected, current from the welding machine may flow in the reverse direction through the ground circuit and damage the devices.
  If you do not observe the precautions for welding, welding current will flow through the following circuit: ▷ page 188
  Before carrying out welding, carry out the following work.
  (a) Turn OFF the starter switch
  (b) Wait for at least one minute. (because SRS airbags are installed)
  (c) Be sure to ground the welding machine at a point near the welding area.
- When welding to the cabin
  Ground the cabin using a nearby plated bolt or a metallic part of the cabin.
  When grounding the cabin itself, remove the paint from the grounding point.
- When welding to the frame
  Ground the frame using a nearby plated bolt or the frame.
  When grounding the frame itself, remove the paint from the grounding point.
  Do not obtain a ground using a chassis spring because this may result in damage to the spring.



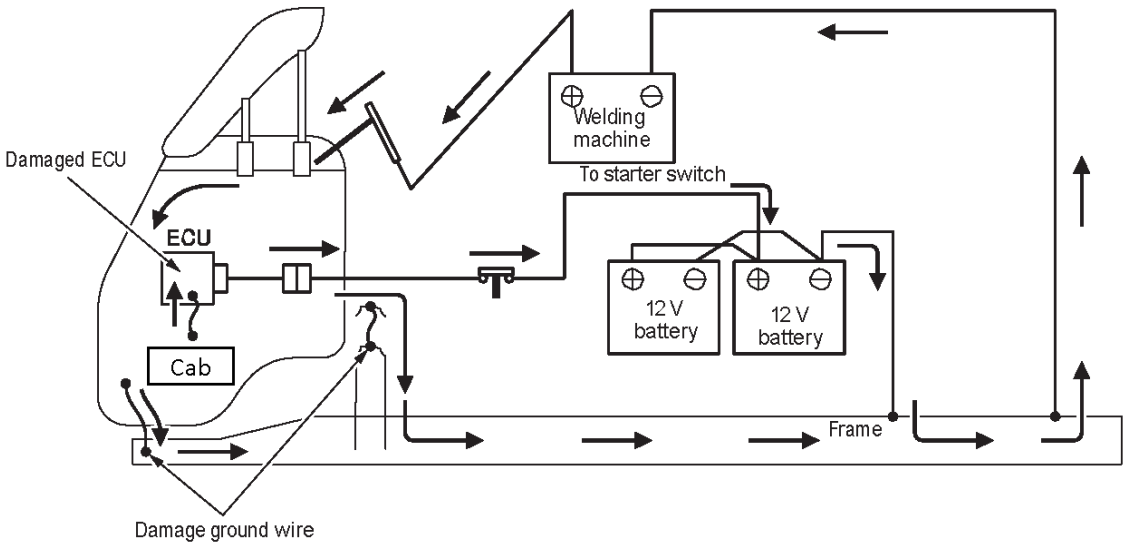
8.7 Precautions for electric welding

- Other precautions
  (a) Before carrying out welding, place a cover over electronic devices, rubber hoses, wire harnesses, pipes, tubes, chassis spring, tires and other items in the vicinity of the welding area in order to protect them from sparks (spatter) generated during welding.
  Please note that you cannot protect the ECU from damage caused by a short circuit if you accidentally touch the ECU case with the welding rod.
  (b) Carry out welding under appropriate conditions, take steps to minimize the effect of heat on the vicinity, and also strive to secure high welding quality.
- Checks to be performed after the end of welding work
  (a) Reconnect the battery cables that you disconnected from the positive and negative terminals, so as to restore the power.
  If you removed the paint from the frame or the cabin, apply rustproofing paint of the same color.
  (b) Confirm that the starter switch is OFF.
  (c) If you wait for at least 30 seconds before reconnecting the battery cables that you disconnected from the positive and negative terminals in step (a), the needle of each meter in the meter cluster will move. Note, however, that this is due to the operation the self-diagnostic function, and is not indicative of a fault.
  (d) After restoring the power, check the electronic devices to see if they function correctly.
  For the checking method, consult with your local MITSUBISHI FUSO dealer.
  (e) For the precautions to observe concerning the BlueTec exhaust gas aftertreatment when carrying out welding work, refer to ▷ page 108.

- If you do not observe the precautions for welding, welding current will flow through the following circuit:

Welding rod→Cabin meta→ECU→ECU wiring→Battery→Battery ground→Welding machine ground
Ground wire

As a result, other wiring including the ECU and the ground wire will be damaged.



8.8 Lighting

8.8.1 Installation of Additional lamps and equipment

- Turn signal lamps
  One lamp (*1) may be added on one side (*1: voltage 12 V, lamp specifications 21 W).
  The addition of the lamp may result in the open circuit detection function being inoperative. Use the specified additional lamp.
  After modification, be sure to perform the functional check.
  When you install additional turn lamp, ask an authorized MITSUBISHI FUSO dealer to change the parameters of the SAM control unit.
  Failure to change the parameters will result in the turn signal not operating properly.

- Installing rear lamps
  (1) The vehicle is shipped with the rear combination lamp, backup lamp, and license plate lamp temporarily mounted on the chassis. Use those parts.
  (2) Be sure to install the lamps on each side of the vehicle symmetrically. Fix lamp wires aesthetically nicely along the rear surfaces of the frame, cross member, and rear body by using adequate clamps.

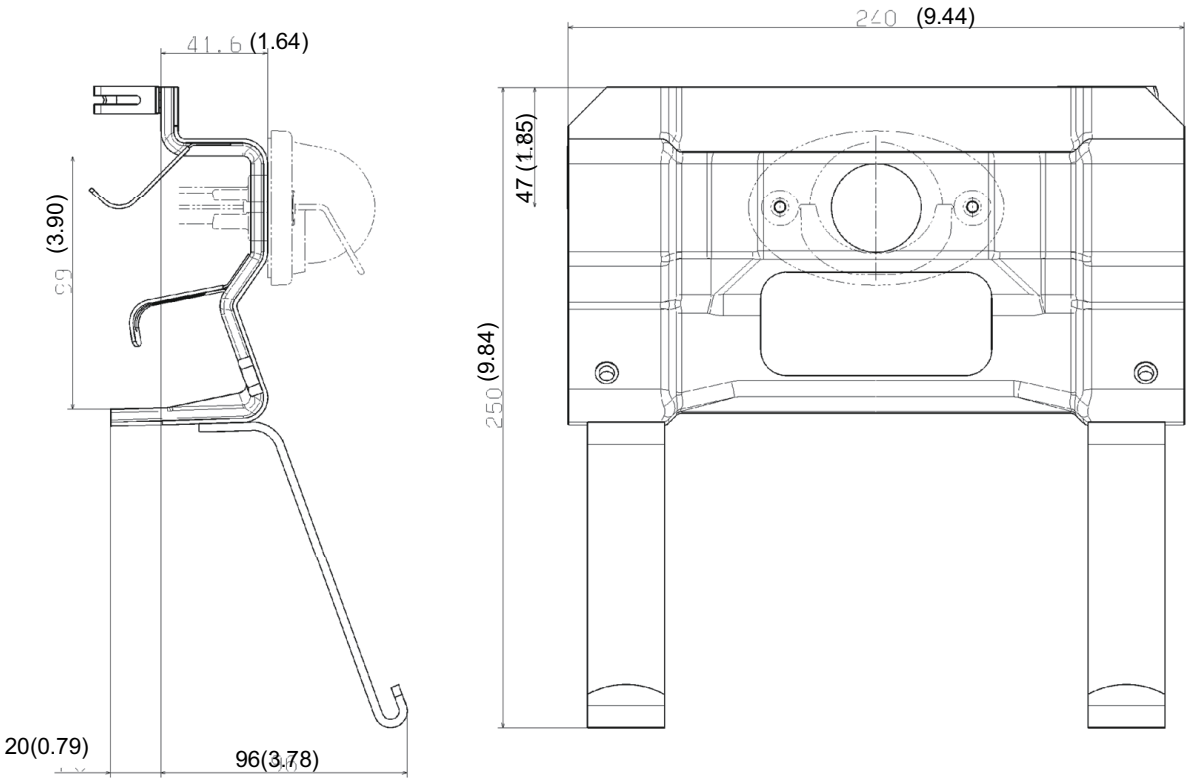
- Rear combination lamp
  (1) Installation
  On the chassis with a cab, the rear combination lamp has been temporarily mounted upside down and the water drain hole in the lamp has been taped. Be sure to peel off the tape after the lamp is installed in the correct position.
  Do not array the lamp vertically.
  (2) Harness extension
  The extension harness for the rear combination lamp is available now. please use it.

Unit: mm {in.}

Application	Length	Part No.
Extension harness for rear combination lamp	400 {15.7}	MC115366
	900 {35.4}	MC115367

8.8 Lighting

- License plate holder
  The license plate holder mounted to the chassis is a temporary holder.
  The body manufacturer shall fabricate a proper license plate holder which ensures the positional relation between the license plate lamp and the license plate shown in the drawing.
  Take the following into consideration when installing the license plate.
  (1) Pay sufficient attention to the legal requirements and safety.
  (2) The license plate shall be positioned so that it is not hidden behind the rear bumper or rear lights, etc.



Unit : mm{in.}

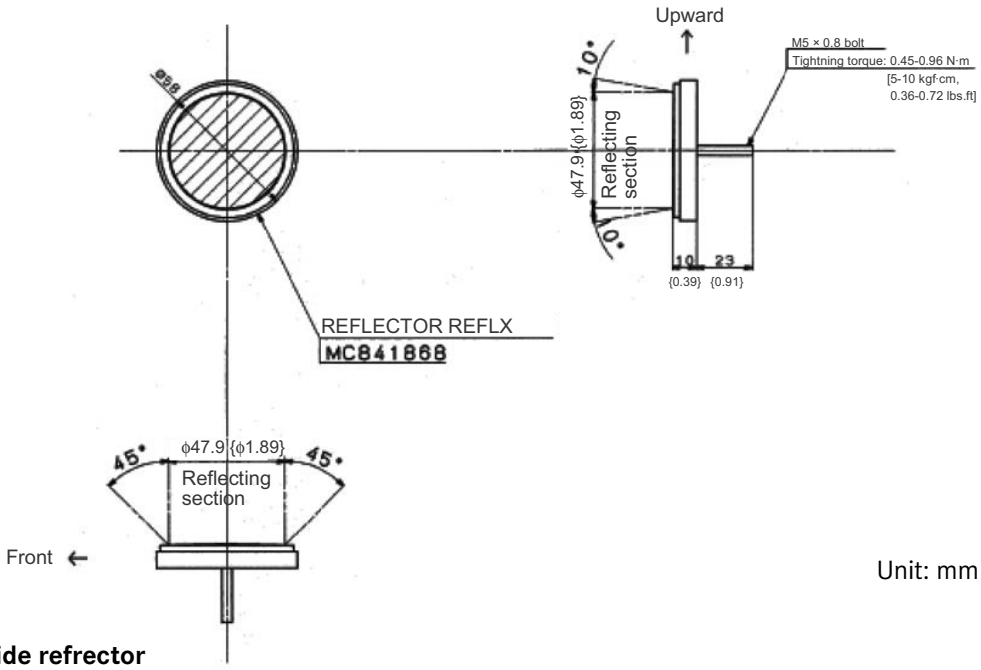
- Installation of side reflectors
  Remove side reflectors from the frame during body building for later use. For additional requirements, use MITSUBISHI FUSO genuine parts.
  The front side reflector, removed from the frame, can no longer be reused. Use a new part if replacement is necessary for a damage one.

8.8.2 Side reflector

The side reflectors must be removed before starting the body mounting work.

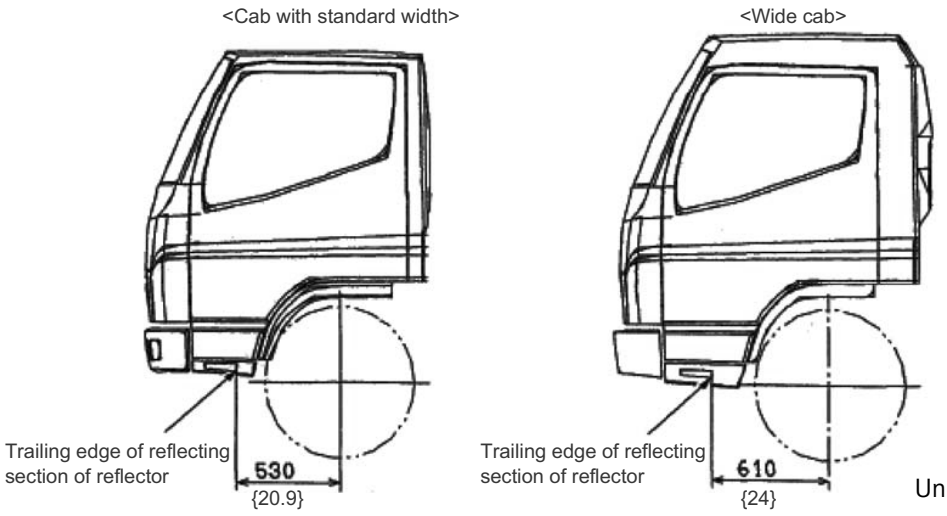
If any additional side reflectors are to be installed, be sure to use MITSUBISHI FUSO genuine reflectors.

Side refrector



Unit: mm {in.}

Front side refrector

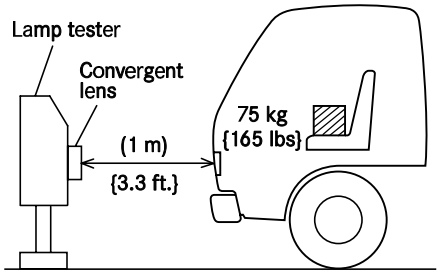


Unit: mm {in.}

8.8.3 Headlamp aiming

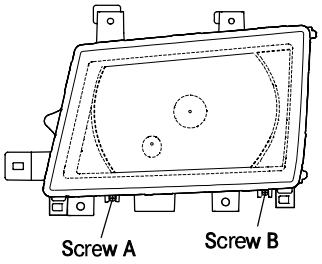
Preparation before Adjustment

- Park the vehicle on a level place.
- Be sure to put tire chocks securely in place.
- Unload the vehicle and make sure no one is in it.
- Inflate the tires to the specified pressure.
- Seat one person of an equivalent mass (75 kg {165 lbs}) in the vehicle.
- Start the engine and check that the battery is being charged.
- Place convergent lamp tester and the vehicle facing each other as shown in the drawing.
- Align the center of headlamp bulb and the center of convergent lens of convergent lamp tester. (The drawing shows the left-hand headlamp.)
- When adjusting one headlamp, mask the other to avoid light leakage.



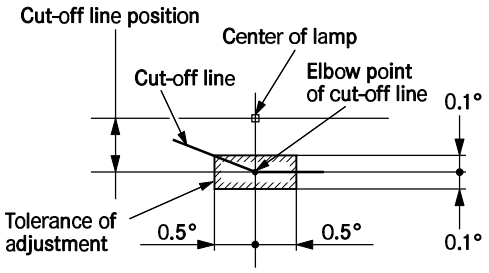
Adjustment

- Do not mask a lit headlamp for more than 2 minutes or the heat generated might cause a fire.



Adjustment of dipped beam

- Turn on dipped beam.
- Make adjustment by the following procedure so that the elbow point of dipped beam cut-off line is in the illustrated position.
- Vertical adjustment: Adjust by turning screws A and B in this order by the same amount.
- Horizontal adjustment: Turn screw B.
- Adjust the optical axes of the dipped beams so that the cut-off line position can conform to the standard value.



P105380E

Initial optical axis label	Optical axis adjustment angle
1.0%	0.57°
1.5%	0.86°

Vertical adjustment: Turn screws A and B in that sequence by equal amounts at a time.

Horizontal adjustment: Perform adjustment by turning screw B.

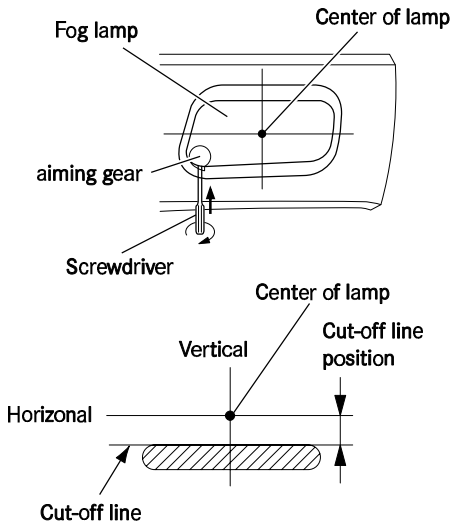
	Optical axis adjustment direction							
	Right headlamp				Left headlamp			
	Up	Down	Left	Right	Up	Down	Left	Right
Screw A	Counter-clockwise	Clock-wise			Counter-clockwise	Clock-wise		
Screw B	Counter-clockwise	Clock-wise	Counter-clockwise	Clock-wise	Counter-clockwise	Clock-wise	Clock-wise	Counter-clockwise

8.8.4 Fog lamp

After carrying out body-building, perform re-adjustment of aiming.

Using the aiming adjustment gear, adjust the left and right fog lamps to the correct optical axis.

Adjust the angle of the optical axis of the fog lamp so that the light-dark boundary line is in the location shown in the figure below.



Location of light-dark boundary line	Adjustment value
	1.5% max

	Optical axis adjustment direction	
	Up	Down
Driver rotation direction	Clockwise	Counter-clockwise

8.8.5 Lighting Guidelines

Before performing the following work, a body manufacturer shall confirm the legal compliance.

The following work would not assure the operation of the related system.

If the completed truck will use only LED lighting (discarding the factory incandescent combination lamps), the SAM (Signal Actuation Module) must be programmed to control LED-type lamps via a Fuso diagnostic laptop at a port-of-entry or dealer. If this programming is not performed, a SAM code and rapid "bulb-out" flash rate of the TURN LAMPS will result due to low amperage draw of LEDs.

Each left & right STOP/TURN/TAIL and the LICENSE PLATE lamp circuit must be utilized since they are monitored by SAM.

If additional amperage is connected and SAM detect it as the overload, the SAM will protect the circuit by shutting it down.

Power to the circuit will be restored once the excessive load is removed from the circuit.

Exterior Connections

TURN LAMPS

The two-wire "side turn" option connector shown in the chart in 8.4.3 must also be turned on via the Fuso diagnostic laptop.

Logistically, and due to narrow amperage range requirements, this is not a viable connection at this time.

BODY MARKER/ID LAMPS

As shown in the chart in 8.4.3, the load on the harness (green/white tracer line) for the 3-pin connector is up to 8 A including the marker lamps and ID lamps already installed to the chassis. (As an output terminal connector, it is approx. 5A as before. ▷ page 181.)

VAN BODY DOME LIGHT

As shown in the chart in 8.4.3, a connection to this wire at the three-pin harness (Red wire) may be made with a load up to 5A.

Van body dome light switch is standard equipment on the instrument panel.

TRAILER LIGHTING

If using chassis STOP/TURN/TAIL circuits to power trailer lamps, Generally, unless the trailer lights are LED type, the circuits on the chassis-cab must be used only for relay signal wires with dedicated fuse-protected load wires for the trailer lighting.

A 3-2 wire converter must be employed if a trailer or body will use a combined STOP/TURN lamp per side (generally the case for lighting systems which do not use a dedicated amber turn lamp per side).

Do not cut or joint the harness. If it is unavoidable, consult the contact person. ▷ page 14.

Note also that available wire length is short, so we recommend removal of the fender mud flap for improved access to exterior option connectors.

The MH056403, MH056401, MH050090 mating connectors for exterior lighting connections are available from your preferred MFTA dealer. (MFTA cannot sell any parts directly to an independent third party or end user.)

Interior Connections

Please reference the attached for cab wire pass-through locations as well as optionalconnectors/positions. ▷ page 178, ▷ page 179.

The MH056874 6-pin/3-wire ("A" in the diagram) connector is taped to the radio harness with MAIN switched power at its Yellow/Green wire.

Our chassis-cabs do not have the 8-pin MH052847 "B" connector, but the MH056867 2-pin/1-wire "C" connector at the lower right side of the dash offers BATT power at its Red/Black wire.

Note that, some of the circuit capacities are for SIGNAL-LEVEL amperage only, 0.2 A maximum for controlling a relay, please refer ▷ page 159, ▷ page 178.

The mating connectors MH056807, MH052805, MH056800 shown for interior connections are NOT available.

8.9 Mobile communications systems

The ADR/GGVS regulations (Hazardous Materials Road Transport Regulations and European Agreement concerning the International Carriage of Dangerous Goods by Road) and the manufacturer's information and installation specification must be observed.

If mobile communication systems (e.g. telephone, CB radio) are retrofitted, the following requirements must be fulfilled in order to avoid malfunctions developing on the vehicle at a later stage.

Equipment

- The equipment must have official approval and correspond to DIN 50498.
- The equipment must be permanently installed.
- Operation of portable or mobile equipment inside the cab is only permitted if this equipment is connected to a permanently installed external aerial.
- The transmitter must be installed separately from all other vehicle electronics.
- Protect equipment from moisture.
- Observe the permissible operating temperature.
- Protect the equipment against severe mechanical vibrations.

Aerial (for two-way radio sets)

- The aerial must be officially licensed.

Connection and wiring

- The connection should be made directly to teriminal inside cab ▷ page 178.
- Disconnect the unit from the electrical system before jump-starting.
- Cables should be wired via the shortest possible route (not looped) and twisted.
- Ensure that the system has a good ground connection to the body (aerial and equipment).
- The aerial and connecting cables between the transmitter, receiver and control panel must be routed separately from the vehicle wiring harness in the vicinity of the body ground.
- Make sure that the aerial cable is not kinked or crushed.

Additional information

The notes on operating safety and vehicle safety in Section 1 "Introduction" ▷ page 9 and ▷ page 10 must be complied with.

9.1 Axle load calculation

An axle load calculation is required to optimize the overall vehicle (vehicle and body). It is only possible to match the body to the truck if the vehicle is weighed before any work on the body is carried out. The weights measured by weighing form the basis of the axle load calculation.

The moment theorem is used to distribute the weight of the equipment on the front and rear axles. All distances relate to the center front axle (theoretical center). Mark the weight with mathematically correct signs and enter them in the table. The result will assist you in choosing the optimum positioning of the body.

It has proved useful to make the following calculations:

Weight

+ (plus) is everything when the vehicle is laden
– (minus) is everything that the vehicle can unload (weights)

Axle distance

+ (plus) is everything behind the center of the front axle
– (minus) is everything in front of the center of the front axle

Calculate the weight distribution on the front and rear axle using the formula:

$$\triangle G_{HA} = \frac{G_{component} \cdot a}{R} \text{ (kg {lb})}$$

$\triangle G_{HA}$ = Change in weight on rear axle in (kg {lb})

$G_{component}$ = Component weight in (kg {lb})

a = Axle distance to theoretical center of front axle in (mm {in.})

R = Theoretical wheelbase (mm {in.})

$$\triangle G_{VA} = G_{component} - G_{HA} \text{ (kg {lb})}$$

$\triangle G_{VA}$ = Change in weight on front axle in (kg {lb})

$G_{component}$ = Component weight in (kg {lb})

$\triangle G_{HA}$ = Change in weight on rear axle in (kg {lb})

Revision record <Common section (Chapter 1-9)>

–	27. Apr. 2018	Newly issued
Rev. code	Date issued	Remarks

NOTE:

1, Chapter 1-9 is Common Section for all markets and to be revised without any special notification. Therefore, please note that this version is not necessarily the latest one.

2, Chapter 10 is for specific market(s). MFTBC will distribute the latest version whenever it will be revised.

Body/equipment mounting directives

<Common section>

CANTER

for FE Gas gasoline-engined vehicle

MITSUBISHI FUSO TRUCK & BUS CORPORATION

April 2018 TL205

10.1 Model line-up

Model name	Model	Type	Drive system	Crew	Engine			G.V.W. {kg (lbs)}	G.C.W. {kg (lbs)}	Tire
					Model	Output {kw(HP)/rpm}	Torque {Nm(lbs-ft)/rpm}			
FE140 Gas	FECZTEL9SUH9	Forward control, tilt cab	4×2	3	L96 PSI 6.0L V8	221(297) /4400	489(3540) /4000	6575 (14500)	10755 (23710)	215/75R17.5
	FECZTGL9SUH9									
	FECZTHL9SUH9									
	FECZTKL9SUH9									
FE160 Gas	FEC7TEL9SUH9							7255 (15995)		
	FEC7TGL9SUH9									
	FEC7THL9SUH9									
	FEC7TKL9SUH9									
FE160 Gas Crew Cab	FEC7THL9WUH9	Forward control, fixed cab		7 (3+4)						
	FEC7TKL9WUH9									

10.2 Specifications

10.2.1 Specifications

Model		FECZTEL9SUH9	FECZTGL9SUH9	FECZTHL9SUH9
Emission		EAP 08 / OBD 16 / GHG17	EAP 08 / OBD 16 / GHG17	EAP 08 / OBD 16 / GHG17
Wheelbase {mm (inch)}		3400 (133.9)	3850 (151.6)	4300 (169.3)
Tread {mm (inch)}	Front	1675 (65.9)	1675 (65.9)	1675 (65.9)
	Rear	1670 (65.7)	1670 (65.7)	1670 (65.7)
Cab&Chassis weight {kg (lb)}		2585 (5699)	2600 (5732)	2630 (5798)
	Front	1585 (3494)	1600 (3527)	1620 (3571)
	Rear	1000 (2205)	1000 (2205)	1010 (2227)
Max. G.V.W. {kg (lb)}		6575 (14500)	6575 (14500)	6575 (14500)
Max. G.C.W. {kg (lb)}		10075 (22210)	10075 (22210)	10075 (22210)
Model		PSI L96	PSI L96	PSI L96
Max. Output (EEC)		221 kw / 4400 rpm	221 kw / 4400 rpm	221 kw / 4400 rpm
Max. Torque (EEC)		489 Nm / 4000 rpm	489 Nm / 4000 rpm	489 Nm / 4000 rpm
Transmission		Allison 1000 HS, 1000RDS(Option)	Allison 1000 HS, 1000RDS(Option)	Allison 1000 HS, 1000RDS(Option)
Gear ratio		3.10 - 1.81 - 1.41 - 1.00 - 0.71 - 0.61 Rev. 4.49	3.10 - 1.81 - 1.41 - 1.00 - 0.71 - 0.61 Rev. 4.49	3.10 - 1.81 - 1.41 - 1.00 - 0.71 - 0.61 Rev. 4.49
Propeller shaft		P3	P3	P3
Rear axle		R035T	R035T	R035T
Final reduction gear		D035H	D035H	D035H
Ratio		5.285	5.285	5.285
Front axle		F350T	F350T	F350T
Tires		215/75R17.5	215/75R17.5	215/75R17.5
Wheels		17.5X6.00-127-9t, 6 studs	17.5X6.00-127-9t, 6 studs	17.5X6.00-127-9t, 6 studs
Steering angle (in/out)		45°/34°	45°/34°	45°/34°
SRS air bag		-	-	-
Servic brake		Hydraulic with vacuum servo assistance, Dual circuit with ABS+EBD	Hydraulic with vacuum servo assistance, Dual circuit with ABS+EBD	Hydraulic with vacuum servo assistance, Dual circuit with ABS+EBD
Parking brake		Internal expanding type on propeller shaft	Internal expanding type on propeller shaft	Internal expanding type on propeller shaft
Front suspension		Semi-elliptic laminated leaf spring with shock absobers and stabilizer	Semi-elliptic laminated leaf spring with shock absobers and stabilizer	Semi-elliptic laminated leaf spring with shock absobers and stabilizer
Rear suspension		Semi-elliptic laminated leaf spring with shock absobers and stabilizer	Semi-elliptic laminated leaf spring with shock absobers and stabilizer	Semi-elliptic laminated leaf spring with shock absobers and stabilizer
P.T.O.		Torque converter turbine-driven squr gear (Option)	Torque converter turbine-driven squr gear (Option)	Torque converter turbine-driven squr gear (Option)
Fuel tank		151 L	151 L	151 L
Exhaust system		PSI provided 3-way catalyst	PSI provided 3-way catalyst	PSI provided 3-way catalyst
Electrical	Voltage	12 V	12 V	12 V
	Alternator	12 V-180 A	12 V-180 A	12 V-180 A
	Batteries	12 Volts (1231MF)	12 Volts (1231MF)	12 Volts (1231MF)
Cab		Wide, Single	Wide, Single	Wide, Single
Crew		3	3	3

Model		FECZTKL9SUH9	FEC7TEL9SUH9	FEC7TGL9SUH9
Emission		EAP 08 / OBD 16 / GHG17	EAP 08 / OBD 16 / GHG17	EAP 08 / OBD 16 / GHG17
Wheelbase {mm (inch)}		4750 (187.0)	3400 (133.9)	3850 (151.6)
Tread {mm (inch)}	Front	1675 (65.9)	1675 (65.9)	1675 (65.9)
	Rear	1670 (65.7)	1670 (65.7)	1670 (65.7)
Cab&Chassis weight {kg (lb)}		2650 (5842)	2585 (5699)	2600 (5732)
	Front	1630 (3594)	1585 (3494)	1600 (3527)
	Rear	1015 (2238)	1000 (2205)	1000 (2205)
Max. G.V.W. {kg (lb)}		6575 (14500)	7255 (15995)	7255 (15995)
Max. G.C.W. {kg (lb)}		10075 (22210)	10755 (23710)	10755 (23710)
Model		PSI L96	PSI L96	PSI L96
Max. Output (EEC)		221 kw / 4400 rpm	221 kw / 4400 rpm	221 kw / 4400 rpm
Max. Torque (EEC)		489 Nm / 4000 rpm	489 Nm / 4000 rpm	489 Nm / 4000 rpm
Transmission		Allison 1000 HS, 1000RDS(Option)	Allison 1000 HS, 1000RDS(Option)	Allison 1000 HS, 1000RDS(Option)
Gear ratio		3.10 - 1.81 - 1.41 - 1.00 - 0.71 - 0.61 Rev. 4.49	3.10 - 1.81 - 1.41 - 1.00 - 0.71 - 0.61 Rev. 4.49	3.10 - 1.81 - 1.41 - 1.00 - 0.71 - 0.61 Rev. 4.49
Propeller shaft		P3	P3	P3
Rear axle		R035T	R035T	R035T
Final reduction gear		D035H	D035H	D035H
Ratio		5.285	5.285	5.285
Front axle		F350T	F350T	F350T
Tires		215/75R17.5	215/75R17.5	215/75R17.5
Wheels		17.5X6.00-127-9t, 6 studs	17.5X6.00-127-9t, 6 studs	17.5X6.00-127-9t, 6 studs
Steering angle (in/out)		45°/34°	45°/34°	45°/34°
SRS air bag		-	-	-
Servic brake		Hydraulic with vacuum servo assistance, Dual circuit with ABS+EBD	Hydraulic with vacuum servo assistance, Dual circuit with ABS+EBD	Hydraulic with vacuum servo assistance, Dual circuit with ABS+EBD
Parking brake		Internal expanding type on propeller shaft	Internal expanding type on propeller shaft	Internal expanding type on propeller shaft
Front suspension		Semi-elliptic laminated leaf spring with shock absobers and stabilizer	Semi-elliptic laminated leaf spring with shock absobers and stabilizer	Semi-elliptic laminated leaf spring with shock absobers and stabilizer
Rear suspension		Semi-elliptic laminated leaf spring with shock absobers and stabilizer	Semi-elliptic laminated leaf spring with shock absobers and stabilizer	Semi-elliptic laminated leaf spring with shock absobers and stabilizer
P.T.O.		Torque converter turbine-driven squr gear (Option)	Torque converter turbine-driven squr gear (Option)	Torque converter turbine-driven squr gear (Option)
Fuel tank		151 L	151 L	151 L
Exhaust system		PSI provided 3-way catalyst	PSI provided 3-way catalyst	PSI provided 3-way catalyst
Electrical	Voltage	12 V	12 V	12 V
	Alternator	12 V-180 A	12 V-180 A	12 V-180 A
	Batteries	12 Volts (1231MF)	12 Volts (1231MF)	12 Volts (1231MF)
Cab		Wide, Single	Wide, Single	Wide, Single
Crew		3	3	3

Model		FEC7THL9SUH9	FEC7TKL9SUH9	FEC7THL9WUH9
Emission		EAP 08 / OBD 16 / GHG17	EAP 08 / OBD 16 / GHG17	EAP 08 / OBD 16 / GHG17
Wheelbase {mm (inch)}		4300 (169.3)	4750 (187.0)	4300 (169.3)
Tread {mm (inch)}	Front	1675 (65.9)	1675 (65.9)	1675 (65.9)
	Rear	1670 (65.7)	1670 (65.7)	1670 (65.7)
Cab&Chassis weight {kg (lb)}		2630 (5798)	2650 (5842)	2850(6283)
	Front	1620 (3571)	1630 (3594)	1775(3913)
	Rear	1010 (2227)	1015 (2238)	1075(2370)
Max. G.V.W. {kg (lb)}		7255 (15995)	7255 (15995)	7255 (15995)
Max. G.C.W. {kg (lb)}		10755t (23710)	10755 (23710)	10755 (23710)
Model		PSI L96	PSI L96	PSI L96
Max. Output (EEC)		221 kw / 4400 rpm	221 kw / 4400 rpm	221 kw / 4400 rpm
Max. Torque (EEC)		489 Nm / 4000 rpm	489 Nm / 4000 rpm	489 Nm / 4000 rpm
Transmission		Allison 1000 HS, 1000RDS(Option)	Allison 1000 HS, 1000RDS(Option)	Allison 1000 HS, 1000RDS(Option)
Gear ratio		3.10 - 1.81 - 1.41 - 1.00 - 0.71 - 0.61 Rev. 4.49	3.10 - 1.81 - 1.41 - 1.00 - 0.71 - 0.61 Rev. 4.49	3.10 - 1.81 - 1.41 - 1.00 - 0.71 - 0.61 Rev. 4.49
Propeller shaft		P3	P3	P3
Rear axle		R035T	R035T	R035T
Final reduction gear		D035H	D035H	D035H
Ratio		5.285	5.285	5.285
Front axle		F350T	F350T	F350T
Tires		215/75R17.5	215/75R17.5	215/75R17.5
Wheels		17.5X6.00-127-9t, 6 studs	17.5X6.00-127-9t, 6 studs	17.5X6.00-127-9t, 6 studs
Steering angle (in/out)		45°/34°	45°/34°	45°/34°
SRS air bag		-	-	-
Servic brake		Hydraulic with vacuum servo assistance, Dual circuit with ABS+EBD	Hydraulic with vacuum servo assistance, Dual circuit with ABS+EBD	Hydraulic with vacuum servo assistance, Dual circuit with ABS+EBD
Parking brake		Internal expanding type on propeller shaft	Internal expanding type on propeller shaft	Internal expanding type on propeller shaft
Front suspension		Semi-elliptic laminated leaf spring with shock absobers and stabilizer	Semi-elliptic laminated leaf spring with shock absobers and stabilizer	Semi-elliptic laminated leaf spring with shock absobers and stabilizer
Rear suspension		Semi-elliptic laminated leaf spring with shock absobers and stabilizer	Semi-elliptic laminated leaf spring with shock absobers and stabilizer	Semi-elliptic laminated leaf spring with shock absobers and stabilizer
P.T.O.		Torque converter turbine-driven squr gear (Option)	Torque converter turbine-driven squr gear (Option)	Torque converter turbine-driven squr gear (Option)
Fuel tank		151 L	151 L	151 L
Exhaust system		PSI provided 3-way catalyst	PSI provided 3-way catalyst	PSI provided 3-way catalyst
Electrical	Voltage	12 V	12 V	12 V
	Alternator	12 V-180 A	12 V-180 A	12 V-180 A
	Batteries	12 Volts (1231MF)	12 Volts (1231MF)	12 Volts (1231MF)
Cab		Wide, Single	Wide, Single	Wide, Crew
Crew		3	3	7

Model		FEC7TKL9WUH9
Emission		EAP 08 / OBD 16 / GHG17
Wheelbase {mm (inch)}		4750 (187.0)
Tread {mm (inch)}	Front	1675 (65.9)
	Rear	1670 (65.7)
Cab&Chassis weight {kg (lb)}		2870(6327)
	Front	1795(3957)
	Rear	1075(2370)
Max. G.V.W. {kg (lb)}		7255 (15995)
Max. G.C.W. {kg (lb)}		10755t (23710)
Model		PSI L96
Max. Output (EEC)		221 kw / 4400 rpm
Max. Torque (EEC)		489 Nm / 4000 rpm
Transmission		Allison 1000 HS, 1000RDS(Option)
Gear ratio		3.10 - 1.81 - 1.41 - 1.00 - 0.71 - 0.61 Rev. 4.49
Propeller shaft		P3
Rear axle		R035T
Final reduction gear		D035H
Ratio		5.285
Front axle		F350T
Tires		215/75R17.5
Wheels		17.5X6.00-127-9t, 6 studs
Steering angle (in/out)		45°/34°
SRS air bag		-
Servic brake		Hydraulic with vacuum servo assistance, Dual circuit with ABS+EBD
Parking brake		Internal expanding type on propeller shaft
Front suspension		Semi-elliptic laminated leaf spring with shock absobers and stabilizer
Rear suspension		Semi-elliptic laminated leaf spring with shock absobers and stabilizer
P.T.O.		Torque converter turbine-driven squr gear (Option)
Fuel tank		151 L
Exhaust system		PSI provided 3-way catalyst
Electrical	Voltage	12 V
	Alternator	12 V-180 A
	Batteries	12 Volts (1231MF)
Cab		Wide, Crew
Crew		7

10.2.2 Axle and tire load carrying capacity

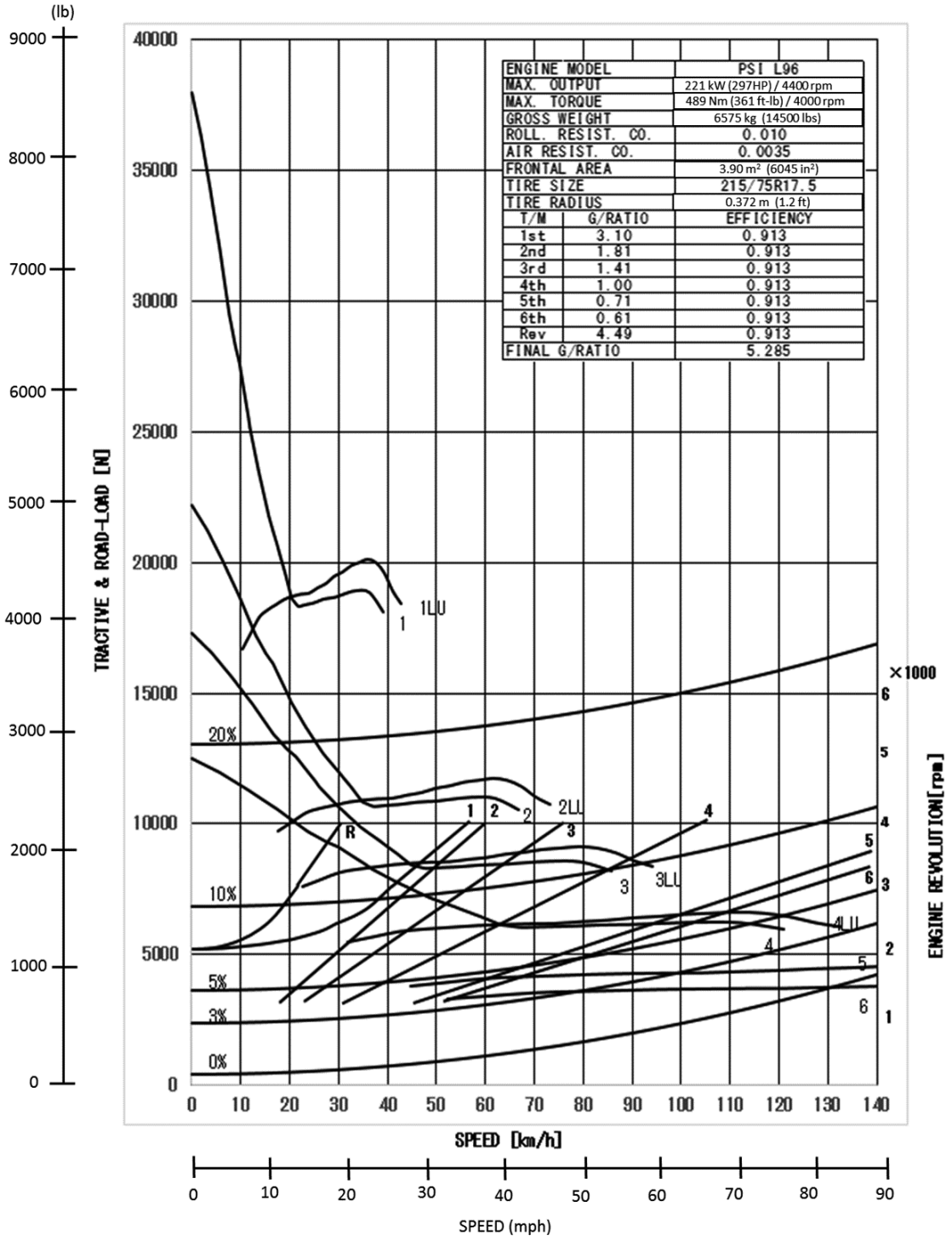
G.V.W. kg (lbs)	Model	Engine	Tire Size (×: Standard, 0: Optional)	Axle Capacity kg (lb)	
	Vehicle Model	Output kW(HP)	215/75R17.5	Front	Rear
6.575 (14500)	FECZTEL9SUH9	221 (297)	×	2900 (6390)	5760 (12700)
	FECZTGL9SUH9		×		
	FECZTHL9SUH9		×		
	FECZTKL9SUH9		×		
7.255 (15995)	FEC7TEL9SUH9		×		
	FEC7TGL9SUH9		×		
	FEC7THL9SUH9		×		
	FEC7TKL9SUH9		×		
	FEC7THL9WUH9		×		
	FEC7TKL9WUH9		×		
Tire Capacity kg(lbs)*1		Front	1700 × 2 = 3400 (7500)		
		Rear	1600 × 4 = 6400 (14110)		

*1 At Maximum information pressure (cold: Fr/Re)
215/75R17.5 690/690 (kPa), 100/100 (PSI)

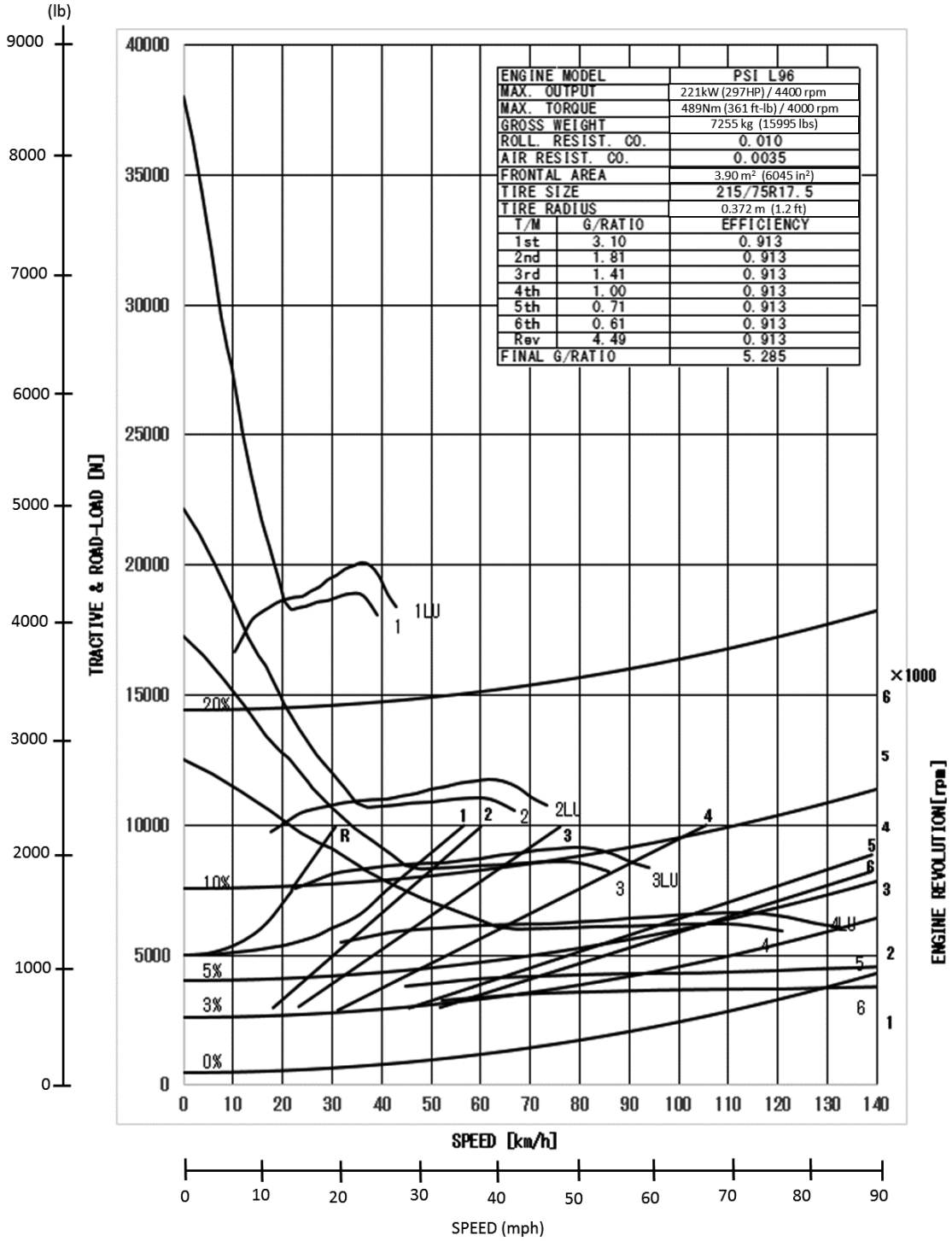
10.3 Performance curve

10.3.1 Vehicle performance curve

FECZT PSI L96



FEC7T PSI L96



10.3.2 Engine performance curve

Output

Torque

10.4 Weight distribution table

Model: FECZTEL9SUH9 229(297) {kW(HP)}

Wheelbase {m (ft)} : 3.400 (11)

Parts name	Weight {kg (lb)}	Distance *1 to center of gravity {m (ft)}	Front axle load {kg (lb)}	Rear axle load {kg (lb)}
Front bumper	11 (24)	-1.012 (-3)	14.3 (32)	-3.3 (-7)
Steering system	41 (90)	-0.719 (-2)	49.7 (110)	-8.7 (-19)
Engine control system	1 (2)	-1.000 (–3)	1.4 (3)	-0.3 (-1)
Brake, clutch control system	22 (49)	-1.000 (3)	28.5 (63)	-6.5 (-14)
Air intake system	19 (43)	0.524 (2)	16.3 (36)	3.0 (7)
Parking brake system	5 (11)	0.085 (0)	4.9 (11)	0.1 (0)
Remote control system	9 (209)	0.196 (1)	8.5 (19)	0.5 (1)
Cab assembly, Front cab mounting	355 (783)	-0.300 (-1)	386.3 (852)	-31.3 (-69)
Cooling system	28 (63)	-0.320 (-1)	31.0 (68)	-2.6 (-6)
Engine, Transmission assembly	429 (945)	0.401 (1)	378.2 (834)	50.6 (111)
HEV system	0 (0)	0.000 (0)	0.0 (0)	0.0 (0)
Rear cab mounting	44 (97)	-0.223 (-1)	46.9 (103)	-2.9 (-6)
Battery	49 (107)	0.889 (3)	36.0 (79)	12.7 (28)
Fuel system	200 (440)	3.830 (13)	-25.2 (-56)	224.8 (496)
Exhaust system	62 (138)	1.420 (5)	36.3 (80)	26.1 (57)
Propeller shaft assembly	22 (49)	2.204 (7)	7.7 (17)	14.3 (32)
Electric system	11 (25)	1.700 (6)	5.7 (13)	5.7 (13)
Frame and others	330 (728)	1.756 (6)	159.5 (352)	170.5 (376)
Engine and T/M cover	3 (6)	0.401 (1)	2.4 (5)	0.3 (1)
A/C unit	27 (60)	-0.780 (-3)	33.2 (73)	-6.2 (-14)
Electric others	39 (85)	-0.800 (-3)	47.8 (105)	-9.1 (-20)
ECU	4 (9)	-0.896 (-3)	5.1 (11)	-1.1 (-2)
SCR tank	4 (9)	1.975 (6)	1.7 (4)	2.4 (5)
Sprung weight	1715 (3781)		1276.2 (2814) 1276 (2813)	438.9 (968) 439 (968)
Unsprung weight	872 (1920)		310 (685)	562 (1240)
Chassis Cab weight *2	2587 (5701) 2585 (5699)		1586 (3499) 1585 (3494)	1001 (2208) 1000 (2205)

*1: From front axle center

*2: Chassis cab weight oil, fuel and coolant but exclude tire & disc, tools and persons.

10.4 Weight distribution table

Model: FECZTGL9SUH9 229(297) {kW(HP)}

Wheelbase {m (ft)} : 3.850 (13)

Parts name	Weight {kg (lb)}	Distance *1 to center of gravity {m (ft)}	Front axle load {kg (lb)}	Rear axle load {kg (lb)}
Front bumper	11 (24)	-1.012 (-3)	13.9 (31)	-2.9 (-6)
Steering system	41 (90)	-0.719 (-2)	48.7 (107)	-7.7 (-17)
Engine control system	1 (2)	-1.000 (-3)	1.4 (3)	-0.3 (-1)
Brake, clutch control system	22 (49)	-1.000 (-3)	27.7 (61)	-5.7 (-13)
Air intake system	19 (43)	0.524 (2)	16.7 (37)	2.6 (6)
Parking brake system	5 (11)	0.085 (0)	4.9 (11)	0.1 (0)
Remote control system	9 (20)	0.196 (1)	8.5 (19)	0.5 (1)
Cab assembly, Front cab mounting	355 (783)	-0.300 (-1)	382.7 (844)	-27.7 (-61)
Cooling system	28 (63)	-0.320 (-1)	30.7 (68)	-2.3 (-5)
Engine, Transmission assembly	429 (945)	0.401 (1)	384.0 (847)	44.7 (98)
HEV system	0 (0)	0.000 (0)	0.0 (0)	0.0 (0)
Rear cab mounting	44 (97)	-0.223 (-1)	46.5 (103)	-2.5 (-6)
Battery	49 (107)	0.889 (3)	37.5 (83)	11.2 (25)
Fuel system	200 (440)	4.280 (14)	-22.3 (-49)	221.8 (489)
Exhaust system	62 (138)	1.420 (5)	39.4 (87)	23.0 (51)
Propeller shaft assembly	23 (51)	2.430 (8)	8.5 (19)	14.5 (32)
Electric system	11 (25)	1.950 (6)	5.6 (12)	5.8 (13)
Frame and others	343 (757)	1.990 (7)	165.8 (366)	177.4 (391)
Engine and T/M cover	3 (6)	0.401 (1)	2.4 (5)	0.3 (1)
A/C unit	27 (60)	-0.780 (-3)	32.5 (72)	-5.5 (-12)
Electric others	39 (85)	-0.800 (-3)	46.7 (103)	-8.0 (-18)
ECU	4 (9)	-0.896 (-3)	4.9 (11)	-0.9 (-2)
SCR tank	4 (9)	1.975 (6)	2.0 (4)	2.2 (5)
Sprung weight	1729 (3813)		1288.7 (2841) 1289 (2842)	440.6 (971) 441 (972)
Unsprung weight	872 (1920)		310 (684)	562 (1240)
Chassis Cab weight *2	2601 (5733) 2600 (5732)		1599 (3525) 1600 (3527)	1003 (2211) 1000 (2205)

*1: From front axle center

*2: Chassis cab weight oil, fuel and coolant but exclude tire & disk, tools and persons.

10.4 Weight distribution table

Model: FECZTHL9SUH9 229(297) {kW(HP)}

Wheelbase {m (ft)} : 4.300 (14)

Parts name	Weight {kg (lb)}	Distance *1 to center of gravity {m (ft)}	Front axle load {kg (lb)}	Rear axle load {kg (lb)}
Front bumper	11 (24)	-1.012 (-3)	13.6 (30)	-2.6 (-6)
Steering system	41 (90)	-0.719 (-2)	47.9 (106)	-6.9 (-15)
Engine control system	1 (2)	-1.000 (-3)	1.4 (3)	-0.3 (-1)
Brake, clutch control system	22 (49)	-1.000 (-3)	27.1 (609	-5.1 (-11)
Air intake system	19 (43)	0.52482)	16.9 (37)	2.4 (5)
Parking brake system	5 (11)	0.085 (0)	4.9 (11)	0.1 (0)
Remote control system	9 (20)	0.196 (1)	8.6 (19)	0.4 (1)
Cab assembly, Front cab mounting	355 (783)	-0.300 (-1)	379.8 (837)	-24.8 (-55)
Cooling system	28 (63)	-0.320 (-1)	30.5 (67)	-2.1 (-5)
Engine, Transmission assembly	429 (945)	0.401 (1)	388.7 (857)	40.0 (88)
HEV system	0 (0)	0.000 (0)	0.0 (0)	0.0 (0)
Rear cab mounting	44 (97)	-0.223 (-1)	46.3 (102)	-2.3 (-5)
Battery	49 (107)	0.889 (3)	38.7 (85)	10.1 (22)
Fuel system	200 (440)	4.730 (16)	-19.9 (-44)	219.5 (484)
Exhaust system	62 (138)	1.420 (5)	41.7 (92)	20.6 (46)
Propeller shaft assembly	30 (66)	2.653 (9)	11.5 (25)	18.5 (41)
Electric system	11 (25)	2.020 (7)	6.0 (13)	5.3 (12)
Frame and others	366 (807)	2.205 (7)	178.3 (393)	187.7 (414)
Engine and T/M cover	3 (6)	0.401 (1)	2.4 (5)	0.3 (1)
A/C unit	27 (60)	-0.780 (-3)	31.9 (70)	-4.9 (-11)
Electric others	39 (85)	-0.800 (-3)	45.9 (101)	-7.2 (-16)
ECU	4 (9)	-0.896 (-3)	4.8 (11)	-0.8 (-2)
SCR tank	4 (9)	1.975 (6)	2.3 (5)	1.9 (4)
Sprung weight	1759 (3878)		1309.3 (2886) 1309 (2886)	449.8 (992) 450 (992)
Unsprung weight	872 (1920)		310 (684)	562 (1240)
Chassis Cab weight *2	2631 (5798) 2630 (5798)		1619 (3570) 1620 (3571)	1012 (2232) 1010 (2227)

*1: From front axle center

*2: Chassis cab weight oil, fuel and coolant but exclude tire & disk, tools and persons.

10.4 Weight distribution table

Model: FECZTKL9SUH9 229(297) {kW(HP)}

Wheelbase {m (ft)} : 4.750 (16)

Parts name	Weight {kg (lb)}	Distance *1 to center of gravity {m (ft)}	Front axle load {kg (lb)}	Rear axle load {kg (lb)}
Front bumper	11 (24)	-1.012 (-3)	13.3 (29)	-2.3 (-5)
Steering system	41 (90)	-0.719 (-2)	47.2 (104)	-6.2 (-14)
Engine control system	1 (2)	-1.000 (-3)	1.3 (3)	-0.2 (-1)
Brake, clutch control system	22 (49)	-1.000 (-3)	26.6 (59)	-4.6 (-10)
Air intake system	19 (43)	0.524 (2)	17.2 (38)	2.1 (5)
Parking brake system	5 (11)	0.085 (0)	4.9 (11)	0.1 (0)
Remote control system	9 (20)	0.196 (1)	8.6 (19)	0.4 (1)
Cab assembly, Front cab mounting	355 (783)	-0.300 (-1)	377.5 (832)	-22.4 (-49)
Cooling system	28 (63)	-0.320 (-1)	30.3 (67)	-1.9 (-4)
Engine, Transmission assembly	429 (945)	0.401 (1)	392.5 (867)	36.2 (80)
HEV system	0 (0)	0.000 (0)	0.0 (0)	0.0 (0)
Rear cab mounting	44 (97)	-0.223 (-1)	46.1 (102)	-2.1 (-5)
Battery	49 (107)	0.889 (3)	39.6 (87)	9.1 (20)
Fuel system	200 (440)	5.180 (17)	-18 (-40)	217.6 (480)
Exhaust system	62 (138)	1.420 (5)	43.7 (96)	18.7 (41)
Propeller shaft assembly	35 (77)	2.877 (9)	13.8 (30)	21.2 (47)
Electric system	11 (25)	2.000 (7)	6.6 (15)	4.8 (11)
Frame and others	379 (836)	2.435 (8)	184.9 (408)	194.5 (429)
Engine and T/M cover	3 (6)	0.401 (1)	2.5 (6)	0.2 (0)
A/C unit	27 (60)	-0.780 (-3)	31.5 (69)	-4.4 (-10)
Electric others	39 (86)	-0.800 (-3)	45.3 (100)	-6.5 (-14)
ECU	4 (9)	-0.896 (-3)	4.8 (11)	-0.8 (-2)
SCR tank	4 (9)	1.975 (6)	2.4 (5)	1.8 (4)
Sprung weight	1778 (3919)		1322.6 (2916) 1323 (2917)	455.1 (1003) 455 (1003)
Unsprung weight	872 (1920)		310 (684)	562 (1240)
Chassis Cab weight *2	2650 (5839) 2650 (5842)		1633 (3600) 1630 (3594)	1017 (2243) 1015 (2238)

*1: From front axle center

*2: Chassis cab weight oil, fuel and coolant but exclude tire & disc, tools and persons.

10.4 Weight distribution table

Model: FEC7TEL9SUH9 229(297) {kW(HP)}

Wheelbase {m (ft)} : 3.400 (11)

Parts name	Weight {kg (lb)}	Distance *1 to center of gravity {m (ft)}	Front axle load {kg (lb)}	Rear axle load {kg (lb)}
Front bumper	11 (24)	-1.012 (-3)	14.3 (32)	-3.3 (-7)
Steering system	41 (90)	-0.719 (-2)	49.7 (110)	-8.7 (-19)
Engine control system	1 (2)	-1.000 (–3)	1.4 (3)	-0.3 (-1)
Brake, clutch control system	22 (49)	-1.000 (3)	28.5 (63)	-6.5 (-14)
Air intake system	19 (43)	0.524 (2)	16.3 (36)	3.0 (7)
Parking brake system	5 (11)	0.085 (0)	4.9 (11)	0.1 (0)
Remote control system	9 (209	0.196 (1)	8.5 (19)	0.5 (1)
Cab assembly, Front cab mounting	355 (783)	-0.300 (-1)	386.3 (852)	-31.3 (-69)
Cooling system	28 (63)	-0.320 (-1)	31.0 (68)	-2.6 (-6)
Engine, Transmission assembly	429 (945)	0.401 (1)	378.2 (834)	50.6 (111)
HEV system	0 (0)	0.000 (0)	0.0 (0)	0.0 (0)
Rear cab mounting	44 (97)	-0.223 (-1)	46.9 (103)	-2.9 (-6)
Battery	49 (107)	0.889 (3)	36.0 (79)	12.7 (28)
Fuel system	200 (440)	3.830 (13)	-25.2 (-56)	224.8 (496)
Exhaust system	62 (138)	1.420 (5)	36.3 (80)	26.1 (57)
Propeller shaft assembly	22 (49)	2.204 (7)	7.7 (17)	14.3 (32)
Electric system	11 (25)	1.700 (6)	5.7 (13)	5.7 (13)
Frame and others	330 (728)	1.756 (6)	159.5 (352)	170.5 (376)
Engine and T/M cover	3 (6)	0.401 (1)	2.4 (5)	0.3 (1)
A/C unit	27 (60)	-0.780 (-3)	33.2 (73)	-6.2 (-14)
Electric others	39 (85)	-0.800 (-3)	47.8 (105)	-9.1 (-20)
ECU	4 (9)	-0.896 (-3)	5.1 (11)	-1.1 (-2)
SCR tank	4 (9)	1.975 (6)	1.7 (4)	2.4 (5)
Sprung weight	1715 (3781)		1276.2 (2814) 1276 (2813)	438.9 (968) 439 (968)
Unsprung weight	872 (1920)		310 (685)	562 (1240)
*2 Chassis Cab weight	2587 (5701) 2585 (5699)		1586 (3499) 1585 (3494)	1001 (2208) 1000 (2205)

*1: From front axle center

*2: Chassis cab weight oil, fuel and coolant but exclude tire & disk, tools and persons.

10.4 Weight distribution table

Model: FEC7TGL9SUH9 229(297) {kW(HP)}

Wheelbase {m (ft)} : 3.850 (13)

Parts name	Weight {kg (lb)}	Distance *1 to center of gravity {m (ft)}	Front axle load {kg (lb)}	Rear axle load {kg (lb)}
Front bumper	11 (24)	-1.012 (-3)	13.9 (31)	-2.9 (-6)
Steering system	41 (90)	-0.719 (-2)	48.7 (107)	-7.7 (-17)
Engine control system	1 (2)	-1.000 (-3)	1.4 (3)	-0.3 (-1)
Brake, clutch control system	22 (49)	-1.000 (-3)	27.7 (61)	-5.7 (-13)
Air intake system	19 (43)	0.524 (2)	16.7 (37)	2.6 (6)
Parking brake system	5 (11)	0.085 (0)	4.9 (11)	0.1 (0)
Remote control system	9 (20)	0.196 (1)	8.5 (19)	0.5 (1)
Cab assembly, Front cab mounting	355 (783)	-0.300 (-1)	382.7 (844)	-27.7 (-61)
Cooling system	28 (63)	-0.320 (-1)	30.7 (68)	-2.3 (-5)
Engine, Transmission assembly	429 (945)	0.401 (1)	384.0 (847)	44.7 (98)
HEV system	0 (0)	0.000 (0)	0.0 (0)	0.0 (0)
Rear cab mounting	44 (97)	-0.223 (-1)	46.5 (103)	-2.5 (-6)
Battery	49 (107)	0.889 (3)	37.5 (83)	11.2 (25)
Fuel system	200 (440)	4.280 (14)	-22.3 (-49)	221.8 (489)
Exhaust system	62 (138)	1.420 (5)	39.4 (87)	23.0 (51)
Propeller shaft assembly	23 (51)	2.430 (8)	8.5 (19)	14.5 (32)
Electric system	11 (25)	1.950 (6)	5.6 (12)	5.8 (13)
Frame and others	343 (757)	1.990 (7)	165.8 (366)	177.4 (391)
Engine and T/M cover	3 (6)	0.401 (1)	2.4 (5)	0.3 (1)
A/C unit	27 (60)	-0.780 (-3)	32.5 (72)	-5.5 (-12)
Electric others	39 (85)	-0.800 (-3)	46.7 (103)	-8.0 (-18)
ECU	4 (9)	-0.896 (-3)	4.9 (11)	-0.9 (-2)
SCR tank	4 (9)	1.975 (6)	2.0 (4)	2.2 (5)
Sprung weight	1729 (3813)		1288.7 (2841) 1289 (2842)	440.6 (971) 441 (972)
Unsprung weight	872 (1920)		310 (684)	562 (1240)
Chassis Cab weight *2	2601 (5733) 2600 (5732)		1599 (3525) 1600 (3527)	1003 (2211) 1000 (2205)

*1: From front axle center

*2: Chassis cab weight oil, fuel and coolant but exclude tire & disk, tools and persons.

10.4 Weight distribution table

Model: FEC7THL9SUH9 229(297) {kW(HP)}

Wheelbase {m (ft)} : 4.300 (14)

Parts name	Weight {kg (lb)}	Distance *1 to center of gravity {m (ft)}	Front axle load {kg (lb)}	Rear axle load {kg (lb)}
Front bumper	11 (24)	-1.012 (-3)	13.6 (30)	-2.6 (-6)
Steering system	41 (90)	-0.719 (-2)	47.9 (106)	-6.9 (-15)
Engine control system	1 (2)	-1.000 (-3)	1.4 (3)	-0.3 (-1)
Brake, clutch control system	22 (49)	-1.000 (-3)	27.1 (609	-5.1 (-11)
Air intake system	19 (43)	0.52482)	16.9 (37)	2.4 (5)
Parking brake system	5 (11)	0.085 (0)	4.9 (11)	0.1 (0)
Remote control system	9 (20)	0.196 (1)	8.6 (19)	0.4 (1)
Cab assembly, Front cab mounting	355 (783)	-0.300 (-1)	379.8 (837)	-24.8 (-55)
Cooling system	28 (63)	-0.320 (-1)	30.5 (67)	-2.1 (-5)
Engine, Transmission assembly	429 (945)	0.401 (1)	388.7 (857)	40.0 (88)
HEV system	0 (0)	0.000 (0)	0.0 (0)	0.0 (0)
Rear cab mounting	44 (97)	-0.223 (-1)	46.3 (102)	-2.3 (-5)
Battery	49 (107)	0.889 (3)	38.7 (85)	10.1 (22)
Fuel system	200 (440)	4.730 (16)	-19.9 (-44)	219.5 (484)
Exhaust system	62 (138)	1.420 (5)	41.7 (92)	20.6 (46)
Propeller shaft assembly	30 (66)	2.653 (9)	11.5 (25)	18.5 (41)
Electric system	11 (25)	2.020 (7)	6.0 (13)	5.3 (12)
Frame and others	366 (807)	2.205 (7)	178.3 (393)	187.7 (414)
Engine and T/M cover	3 (6)	0.401 (1)	2.4 (5)	0.3 (1)
A/C unit	27 (60)	-0.780 (-3)	31.9 (70)	-4.9 (-11)
Electric others	39 (85)	-0.800 (-3)	45.9 (101)	-7.2 (-16)
ECU	4 (9)	-0.896 (-3)	4.8 (11)	-0.8 (-2)
SCR tank	4 (9)	1.975 (6)	2.3 (5)	1.9 (4)
Sprung weight	1759 (3878)		1309.3 (2886) 1309 (2886)	449.8 (992) 450 (992)
Unsprung weight	872 (1920)		310 (684)	562 (1240)
*2 Chassis Cab weight	2631 (5798) 2630 (5798)		1619 (3570) 1620 (3571)	1012 (2232) 1010 (2227)

*1: From front axle center

*2: Chassis cab weight oil, fuel and coolant but exclude tire & disk, tools and persons.

10.4 Weight distribution table

Model: FEC7TKL9SUH9 229(297) {kW(HP)}

Wheelbase {m (ft)} : 4.750 (16)

Parts name	Weight {kg (lb)}	Distance *1 to center of gravity {m (ft)}	Front axle load {kg (lb)}	Rear axle load {kg (lb)}
Front bumper	11 (24)	-1.012 (-3)	13.3 (29)	-2.3 (-5)
Steering system	41 (90)	-0.719 (-2)	47.2 (104)	-6.2 (-14)
Engine control system	1 (2)	-1.000 (-3)	1.3 (3)	-0.2 (-1)
Brake, clutch control system	22 (49)	-1.000 (-3)	26.6 (59)	-4.6 (-10)
Air intake system	19 (43)	0.524 (2)	17.2 (38)	2.1 (5)
Parking brake system	5 (11)	0.085 (0)	4.9 (11)	0.1 (0)
Remote control system	9 (20)	0.196 (1)	8.6 (19)	0.4 (1)
Cab assembly, Front cab mounting	355 (783)	-0.300 (-1)	377.5 (832)	-22.4 (-49)
Cooling system	28 (63)	-0.320 (-1)	30.3 (67)	-1.9 (-4)
Engine, Transmission assembly	429 (945)	0.401 (1)	392.5 (867)	36.2 (80)
HEV system	0 (0)	0.000 (0)	0.0 (0)	0.0 (0)
Rear cab mounting	44 (97)	-0.223 (-1)	46.1 (102)	-2.1 (-5)
Battery	49 (107)	0.889 (3)	39.6 (87)	9.1 (20)
Fuel system	200 (440)	5.180 (17)	-18 (-40)	217.6 (480)
Exhaust system	62 (138)	1.420 (5)	43.7 (96)	18.7 (41)
Propeller shaft assembly	35 (77)	2.877 (9)	13.8 (30)	21.2 (47)
Electric system	11 (25)	2.000 (7)	6.6 (15)	4.8 (11)
Frame and others	379 (836)	2.435 (8)	184.9 (408)	194.5 (429)
Engine and T/M cover	3 (6)	0.401 (1)	2.5 (6)	0.2 (0)
A/C unit	27 (60)	-0.780 (-3)	31.5 (69)	-4.4 (-10)
Electric others	39 (86)	-0.800 (-3)	45.3 (100)	-6.5 (-14)
ECU	4 (9)	-0.896 (-3)	4.8 (11)	-0.8 (-2)
SCR tank	4 (9)	1.975 (6)	2.4 (5)	1.8 (4)
Sprung weight	1778 (3919)		1322.6 (2916) 1323 (2917)	455.1 (1003) 455 (1003)
Unsprung weight	872 (1920)		310 (684)	562 (1240)
Chassis Cab weight *2	2650 (5839) 2650 (5842)		1633 (3600) 1630 (3594)	1017 (2243) 1015 (2238)

*1: From front axle center

*2: Chassis cab weight oil, fuel and coolant but exclude tire & disk, tools and persons.

10.4 Weight distribution table

Model: FEC7THL9WUH9 229(297) {kW(HP)}

Wheelbase {m (ft)} : 4.300 (14)

Parts name	Weight {kg (lb)}	Distance *1 to center of gravity {m (ft)}	Front axle load {kg (lb)}	Rear axle load {kg (lb)}
Front bumper	11 (24)	-1.012 (-3)	13.6 (30)	-2.6 (-6)
Steering system	41 (90)	-0.719 (-2)	47.9 (106)	-6.9 (-15)
Engine control system	1 (2)	-1.000 (-3)	1.4 (3)	-0.3 (-1)
Brake, clutch control system	22 (49)	-1.000 (-3)	27.1 (60)	-5.1 (-11)
Air intake system	22 (49)	0.524 (2)	19.6 (43)	2.7 (6)
Parking brake system	5 (11)	0.085 (0)	4.9 (11)	0.1 (0)
Remote control system	9 (20)	0.196 (1)	8.6 (19)	0.4 (1)
Cab assembly, Front cab mounting	565 (1246)	0.240 (1)	533.5 (1176)	31.5 (69)
Cooling system	28 (63)	-0.320 (-1)	30.5 (67)	-2.1 (-5)
Engine, Transmission assembly	429 (945)	0.401 (1)	388.7 (857)	40.0 (88)
HEV system	0 (0)	0.000 (0)	0.0 (0)	0.0 (0)
Rear cab mounting	42 (93)	0.230 (1)	39.8 (88)	2.2 (5)
Battery	49 (107)	0.889 (3)	38.7 (85)	10.1 (22)
Fuel system	200 (440)	4.730 (16)	-19.9 (-44)	219.5 (484)
Exhaust system	61 (135)	1.420 (5)	40.9 (90)	20.1 (44)
Propeller shaft assembly	30 (66)	2.653 (9)	11.5 (25)	18.5 (41)
Electric system	11 (25)	2.020 (7)	6.0 (13)	5.3 (12)
Frame and others	366 (807)	2.205 (7)	178.3 (393)	187.7 (414)
Engine and T/M cover	3 (6)	0.401 (1)	2.5 (6)	0.3 (1)
A/C unit	36 (79)	-0.300 (-1)	38.5 (85)	-2.5 (-6)
Electric others	39 (85)	-0.800 (-3)	45.9 (101)	-7.2 (-16)
ECU	4 (9)	-0.896 (-3)	4.8 (11)	-0.8 (-2)
SCR tank	4 (9)	2.225 (7)	2.0 (4)	2.2 (5)
Sprung weight	1978 (4360)		1464.7 (3229) 1465 (3230)	513.1 (1131) 513 (1131)
Unsprung weight	872 (1920)		310 (684)	562 (1240)
Chassis Cab weight *2	2850 (6280) 2850 (6283)		1775 (3913) 1775 (3913)	1075 (2371) 1075 (2370)

*1: From front axle center

*2: Chassis cab weight oil, fuel and coolant but exclude tire & diskdisk, tools and persons.

10.4 Weight distribution table

Model: FEC7TKL9WUH9 229(297) {kW(HP)}

Wheelbase {m (ft)} : 4.750 (16)

Parts name	Weight {kg (lb)}	Distance *1 to center of gravity {m (ft)}	Front axle load {kg (lb)}	Rear axle load {kg (lb)}
Front bumper	11 (24)	-1.012 (-3)	13.3 (29)	-2.3 (-5)
Steering system	41 (90)	-0.719 (-2)	47.2 (14)	-6.2 (-14)
Engine control system	1 (2)	-1.000 (-3)	1.3 (3)	-0.2 (-1)
Brake, clutch control system	22 (49)	-1.000 (-3)	26.6 (59)	-4.6 (-10)
Air intake system	22 (49)	0.524 (2)	19.9 (44)	2.4 (5)
Parking brake system	5 (11)	0.085 (0)	4.9 (11)	0.1 (0)
Remote control system	9 (20)	0.196 (1)	8.6 (19)	0.4 (1)
Cab assembly, Front cab mounting	565 (1246)	0.240 (1)	536.5 (1183)	28.5 (63)
Cooling system	28 (63)	-0.320 (-1)	30.3 (67)	-1.9 (-4)
Engine, Transmission assembly	429 (945)	0.401 (1)	392.5 (865)	36.2 (80)
HEV system	0 (0)	0.000 (0)	0.0 (0)	0.0 (0)
Rear cab mounting	42 (93)	0.230 (1)	40.0 (88)	2.0 (4)
Battery	49 (107)	0.889 (3)	39.6 (87)	9.1 (20)
Fuel system	200 (440)	5.180 (17)	-18.0 (-40)	217.6 (480)
Exhaust system	61 (135)	1.420 (5)	42.8 (94)	18.3 (40)
Propeller shaft assembly	35 (77)	2.877 (9)	13.8 (30)	21.2 (47)
Electric system	11 (25)	2.000 (7)	6.6 (15)	4.8 (11)
Frame and others	379 (836)	2.435 (8)	184.9 (408)	194.4 (429)
Engine and T/M cover	3 (6)	0.401 (1)	2.5 (6)	0.2 (0)
A/C unit	36 (79)	-0.300 (-1)	38.3 (84)	-2.3 (-5)
Electric others	39 (85)	-0.800 (-3)	45.2 (100)	-6.5 (-14)
ECU	4 (9)	-0.896 (-3)	4.8 (5.2)	-0.8 (-2)
SCR tank	4 (9)	2.225 (7)	2.2 (5)	2.0 (4)
Sprung weight	1996 (4401)		1483.8 (3271) 1484 (3272)	512.2 (1129) 512 (1129)
Unsprung weight	872 (1920)		310 (685)	562 (1240)
*2 Chassis Cab weight	2868 (6321) 2870 (6327)		1794 (3956) 1795 (3957)	1074 (2369) 1075 (2370)

*1: From front axle center

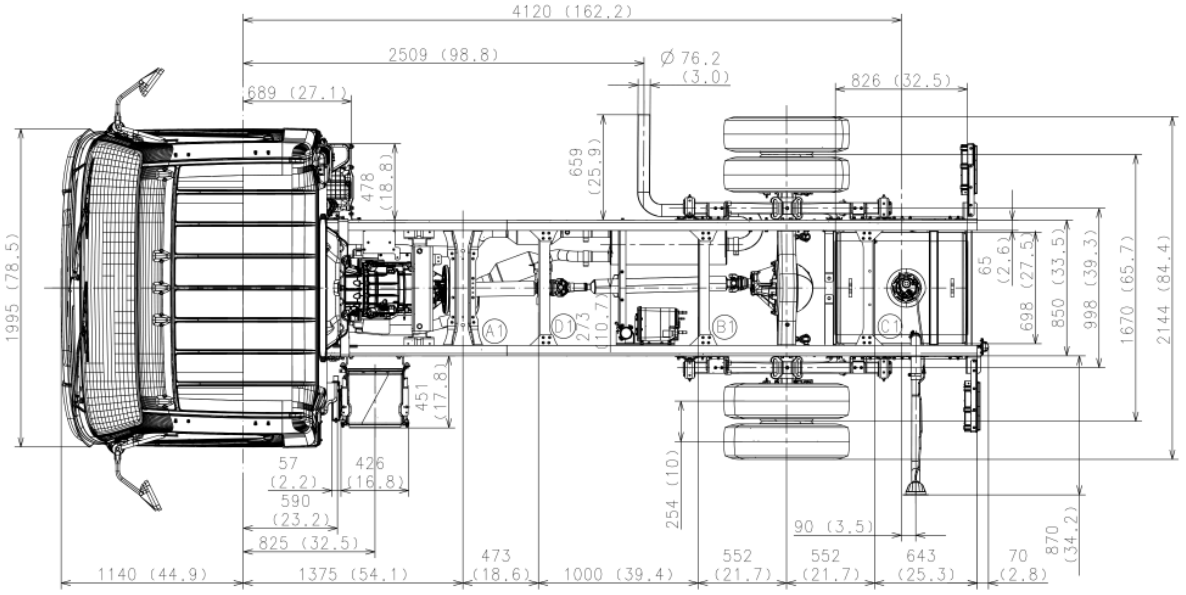
*2: Chassis cab weight oil, fuel and coolant but exclude tire & disk, tools and persons.

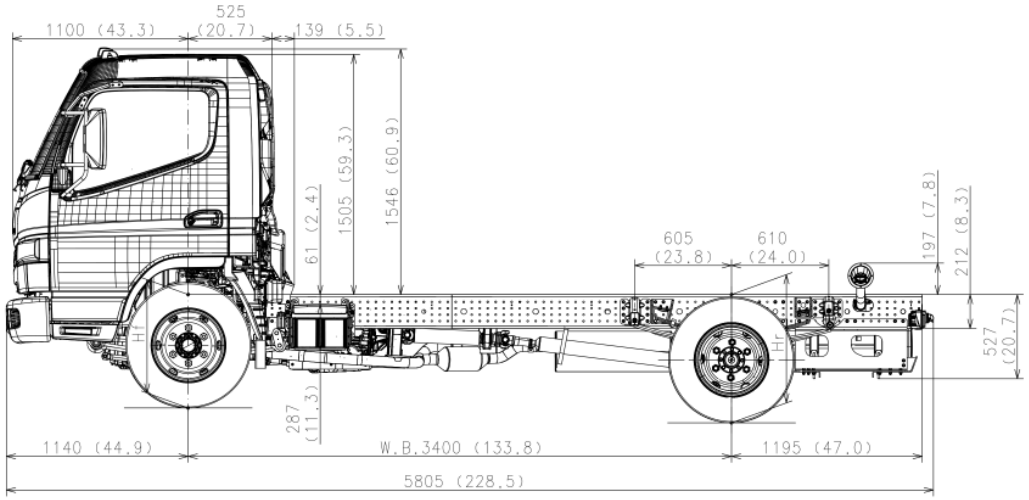
10.5 Chassis cab drawings

10.5.1 Chassis cab drawings

Model		Page	
Main model	Applicable model		
FEC7TEL9SUH9	FECZTEL9SUH9	219	FE160 / FE140 133.9" E WB
FEC7TGL9SUH9	FECZTGL9SUH9	220	FE160 / FE140 151.6" G WB
FEC7THL9SUH9	FECZTHL9SUH9	221	FE160 / FE140 169.3" H WB
FEC7TKL9SUH9	FECZTKL9SUH9	222	FE160 / FE140 187.0" K WB
FEC7THL9WUH9		223	FE160 CREW 169.3" H WB
FEC7TKL9WUH9		224	FE160 CREW 187.0" K WB

10.5 Chassis cab drawings

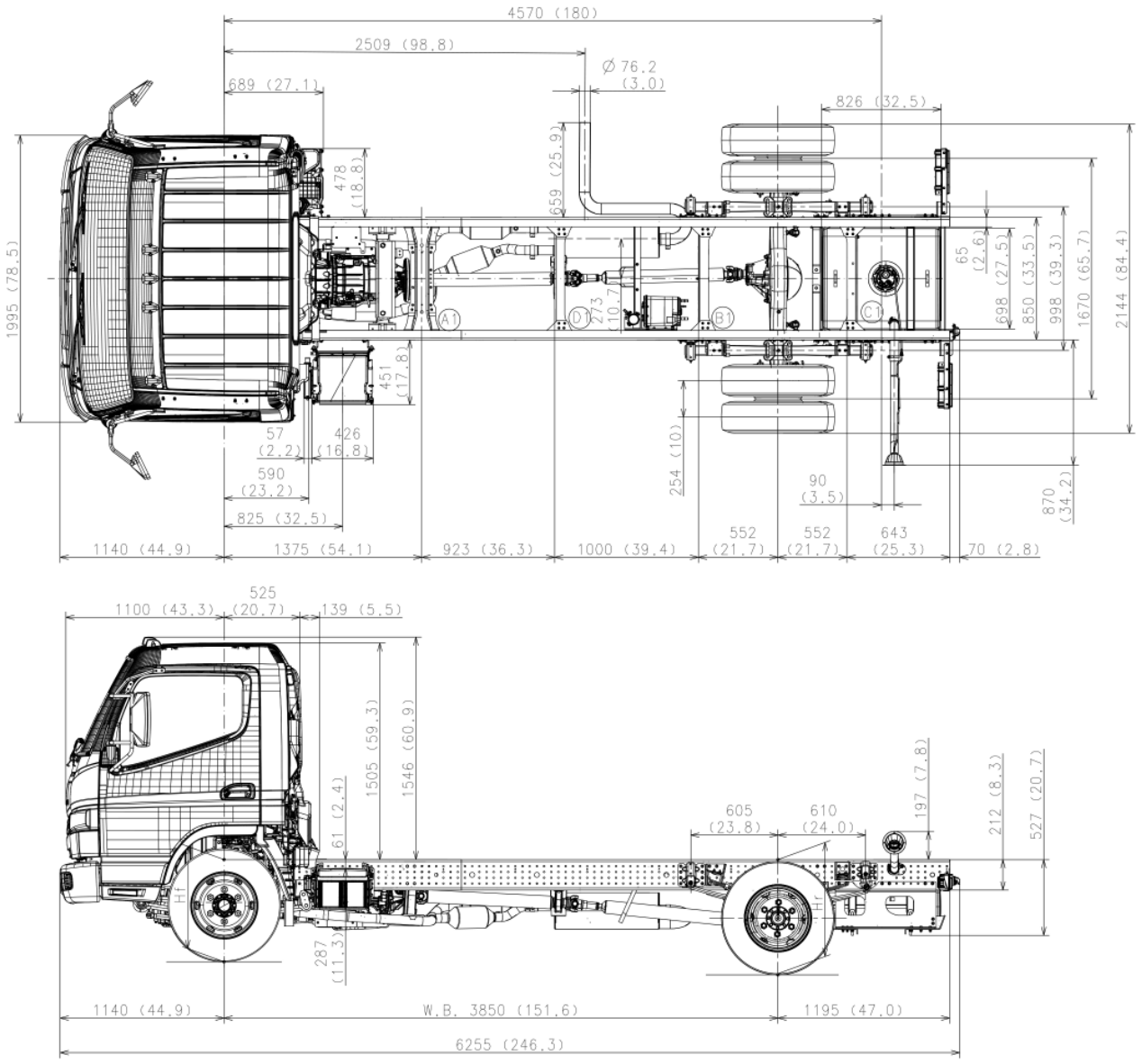




CHASSIS CAB
DRAWINGS

FECZTEL9SUH9 FEC7TEL9SUH9
UNIT :mm SCALE :1/30

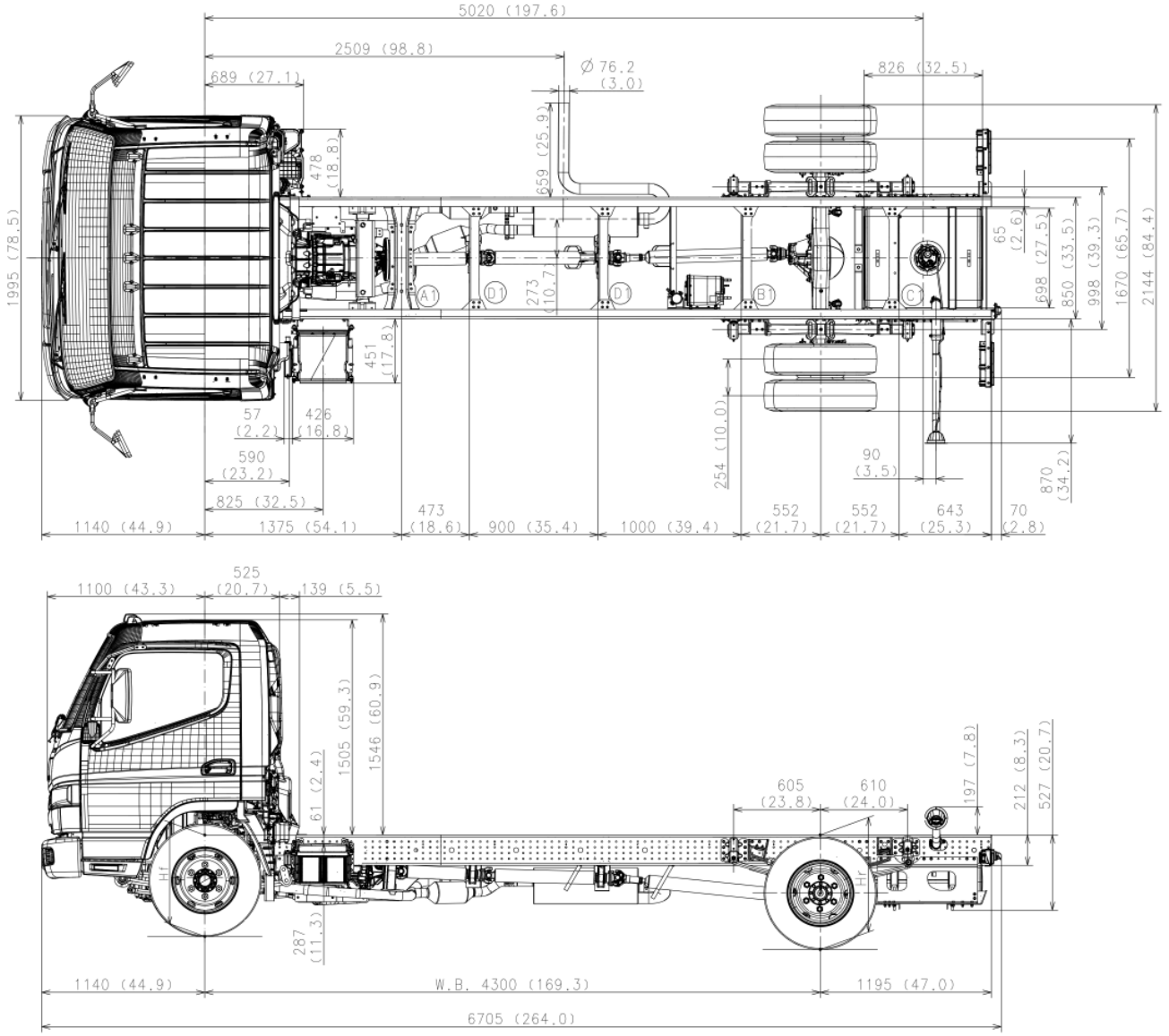
10.5 Chassis cab drawings



CHASSIS CAB
DRAWINGS

FECZTGL9SUH9 FEC7TGL9SUH9
UNIT : mm SCALE : 1/30

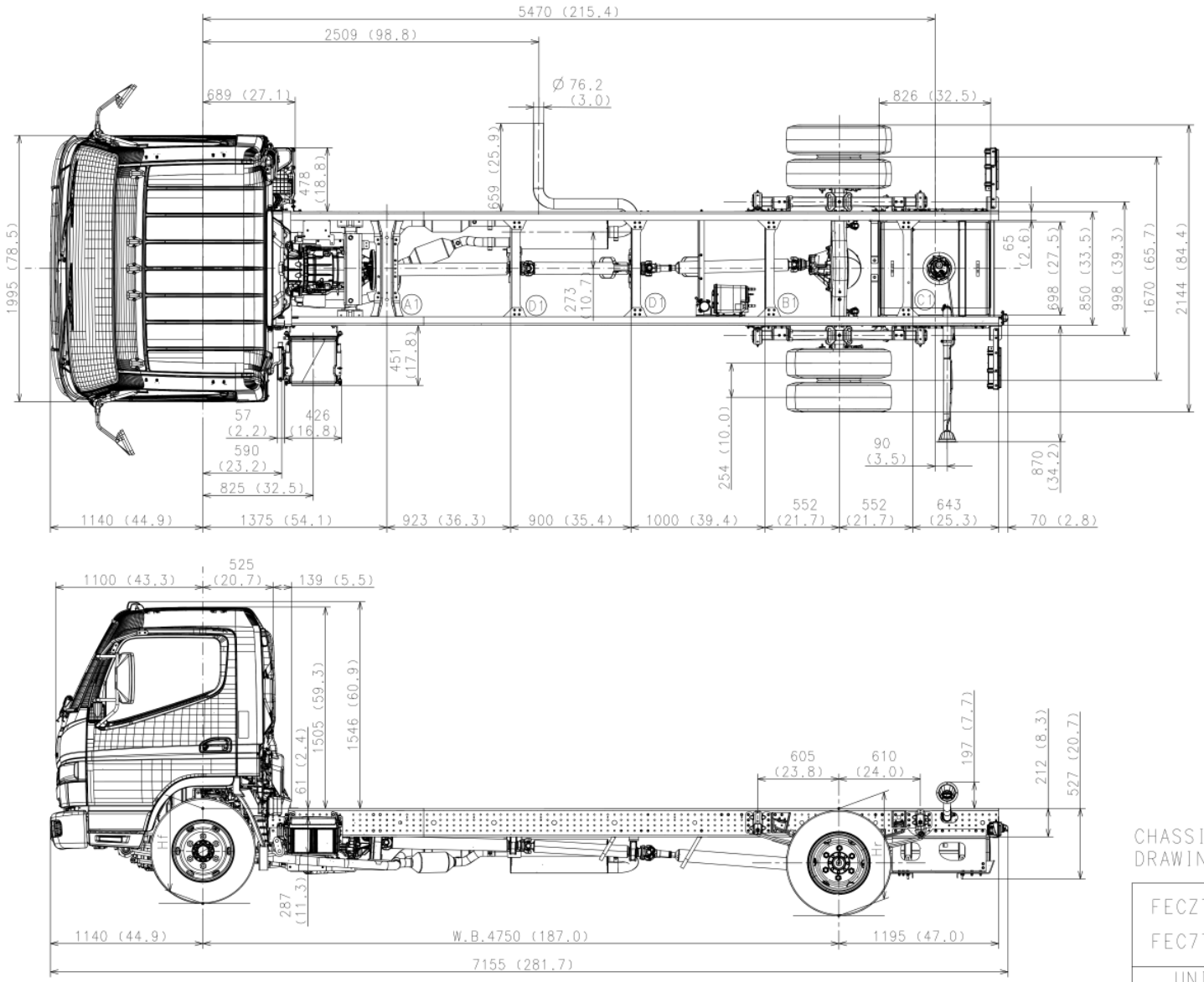
10.5 Chassis cab drawings



CHASSIS CAB DRAWINGS

FECZTHL9SUH9 FEC7THL9SUH9
UNIT : mm SCALE : 1/30

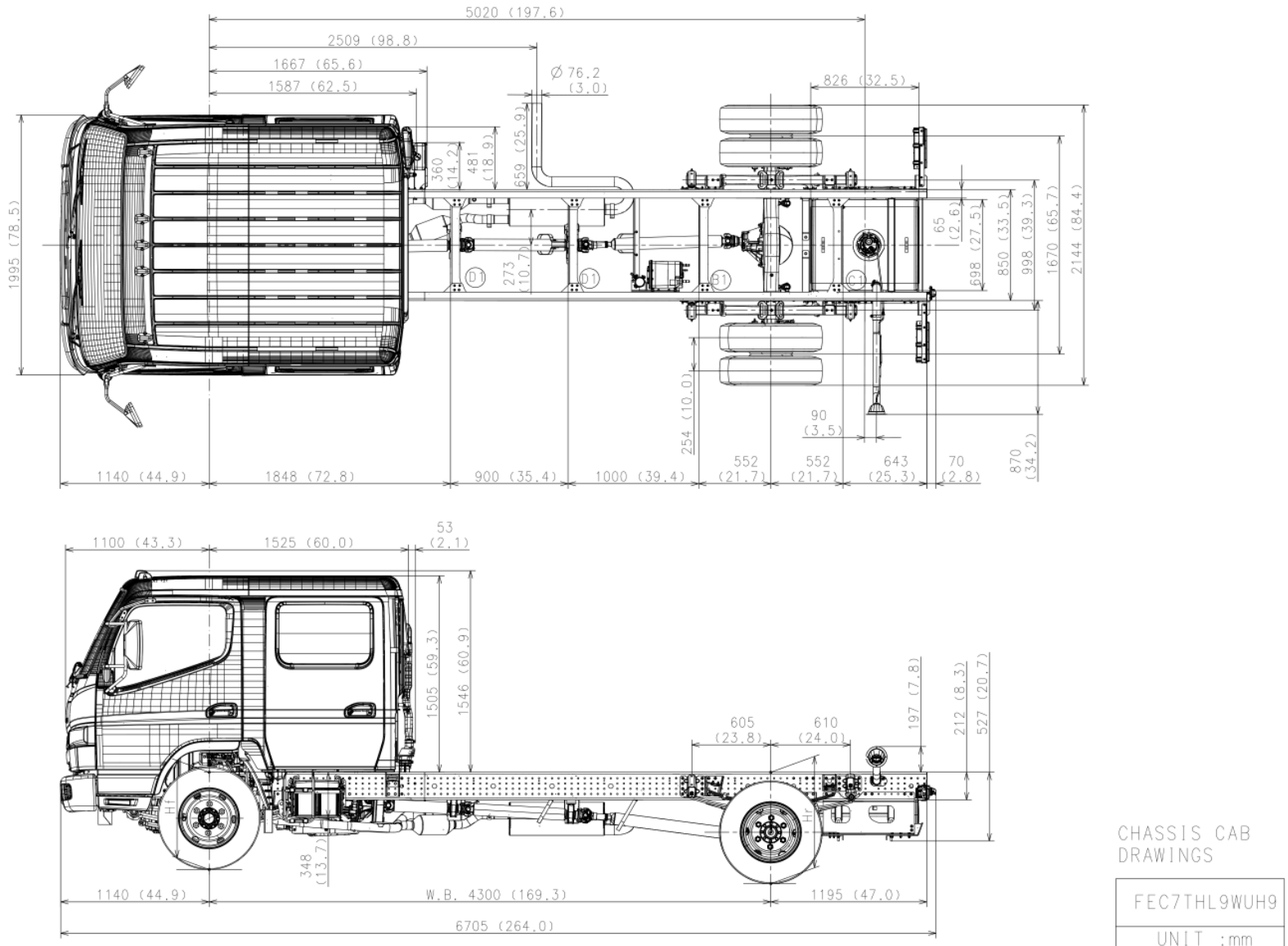
10.5 Chassis cab drawings



CHASSIS CAB DRAWINGS

FECZTKL9SUH9 FEC7TKL9SUH9
UNIT : mm SCALE : 1/30

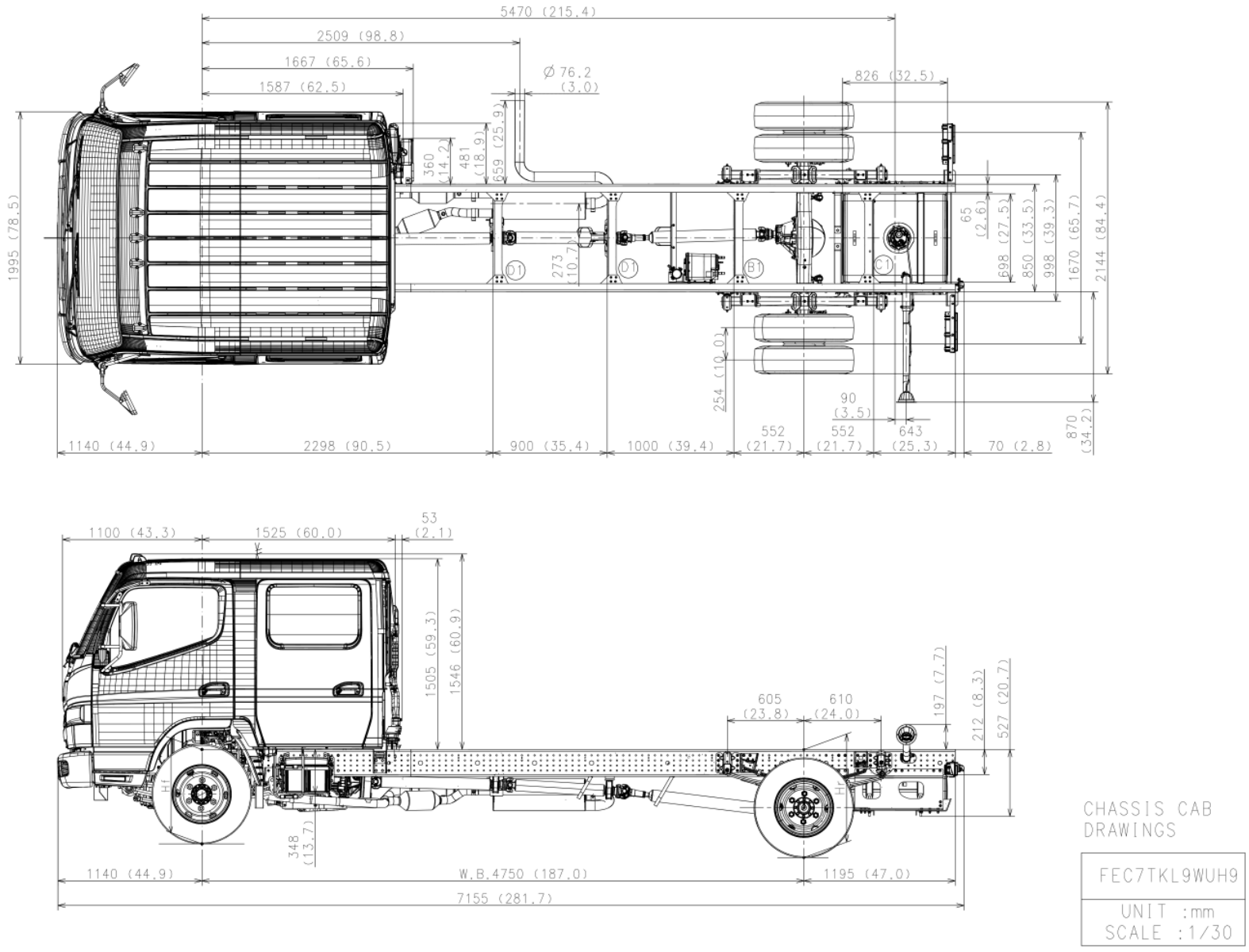
10.5 Chassis cab drawings



CHASSIS CAB
DRAWINGS

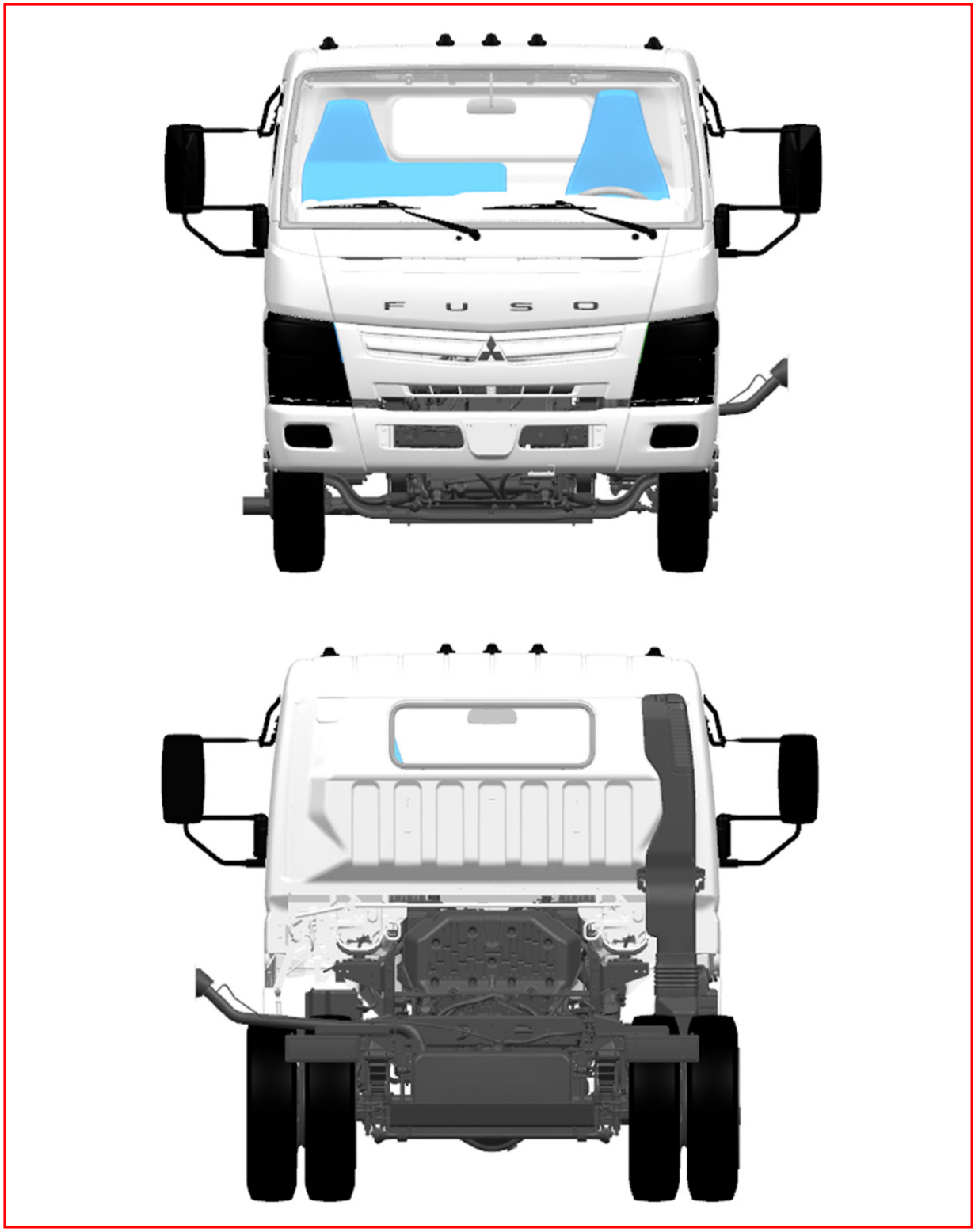
FEC7THL9WUH9
UNIT : mm SCALE : 1/30

10.5 Chassis cab drawings

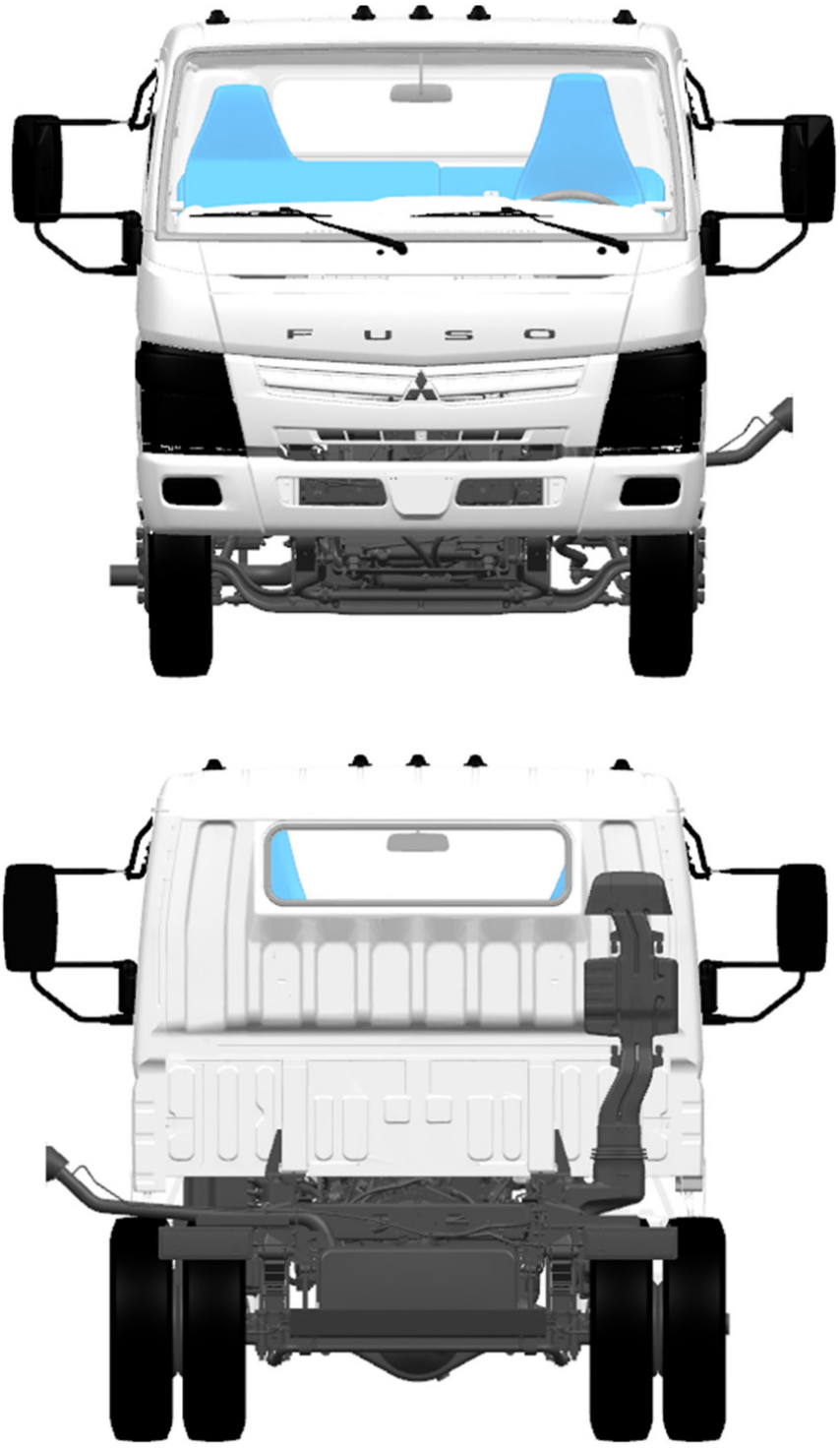


10.5.2 Cab drawings

Model	Page
FECZTEL9SUH9 FECZTGL9SUH9 FECZTHL9SUH9 FECZTKL9SUH9 FEC7TEL9SUH9 FEC7TGL9SUH9 FEC7THL9SUH9 FEC7TKL9SUH9	226
FEC7THL9WUH9 FEC7TKL9WUH9	227



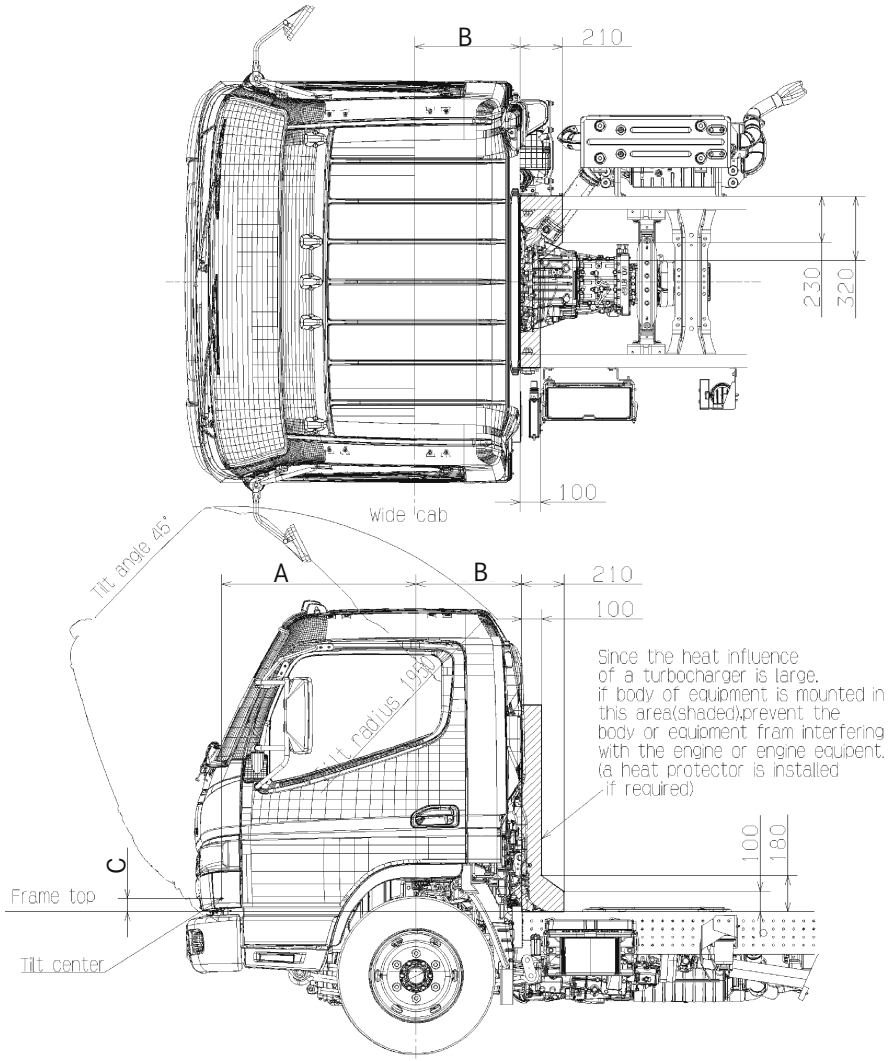
Single cab



Crew cab

10.5.3 Cab side view

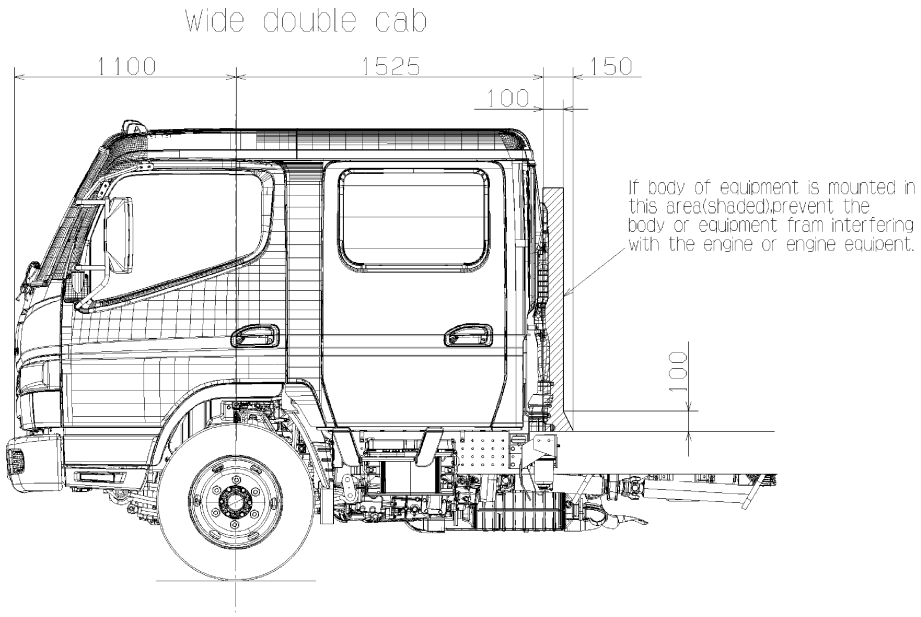
<Single cab>



unit: mm (in)

	A : Front axle center to cab tilt center	B : Front axle center to cab end	C : Top surface of frame to cab tilt center
FEC	965 (37.99)	525 (20.67)	55 (2.17)

<Crew cab>

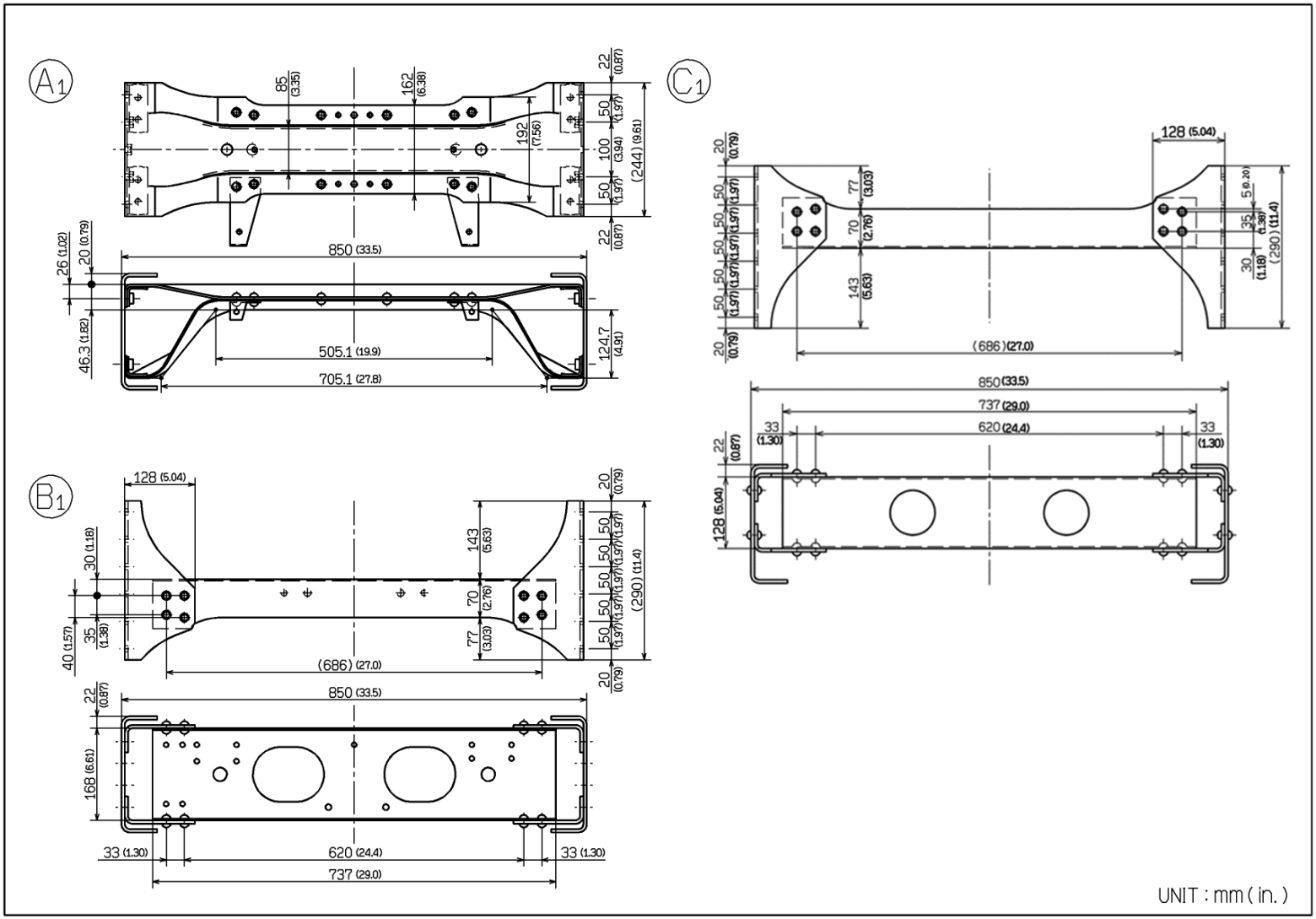

Wide double cab
1100
1525
150
100
If body of equipment is mounted in this area(shaded),prevent the body or equipment fram interfering with the engine or engine equipent.
100

10.6 Frame structure

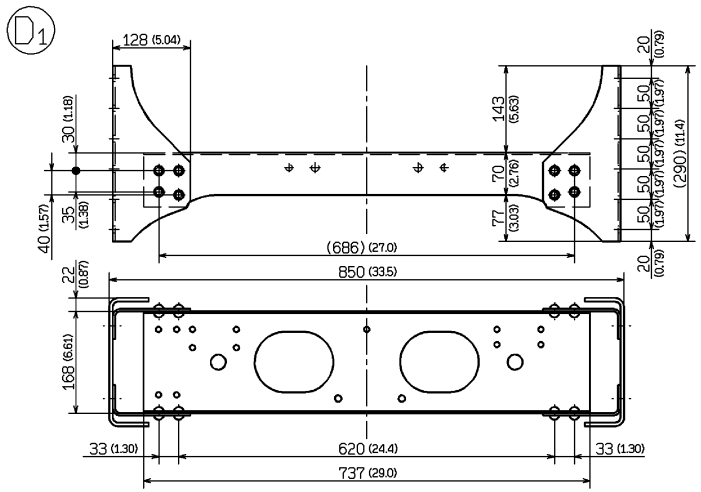
10.6.1 Detail of crossmembers

Model	Section	Page
FE	A-A, B-B, C-C	231
	D-D	232

10.6 Frame structure



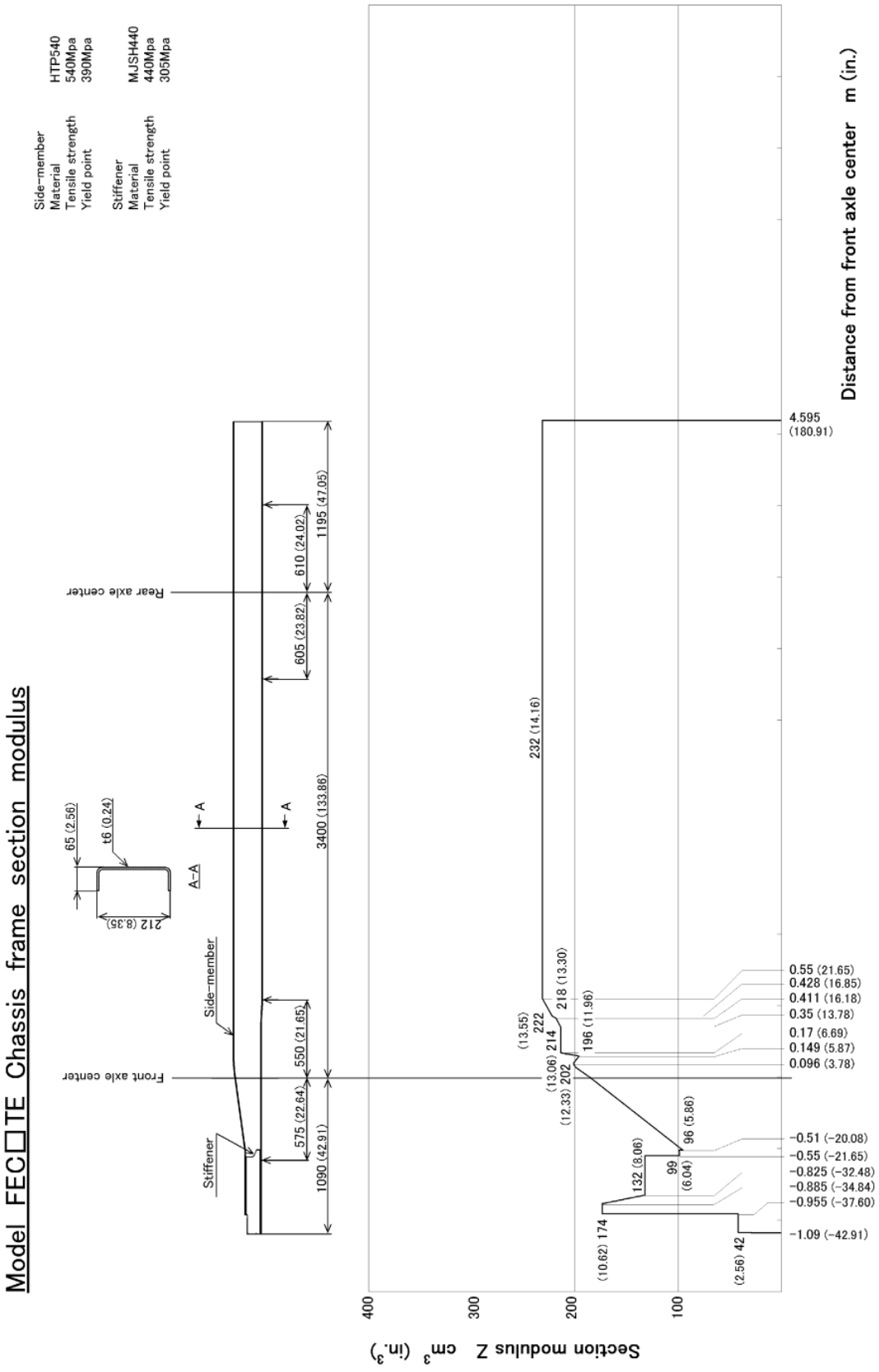
10.6 Frame structure

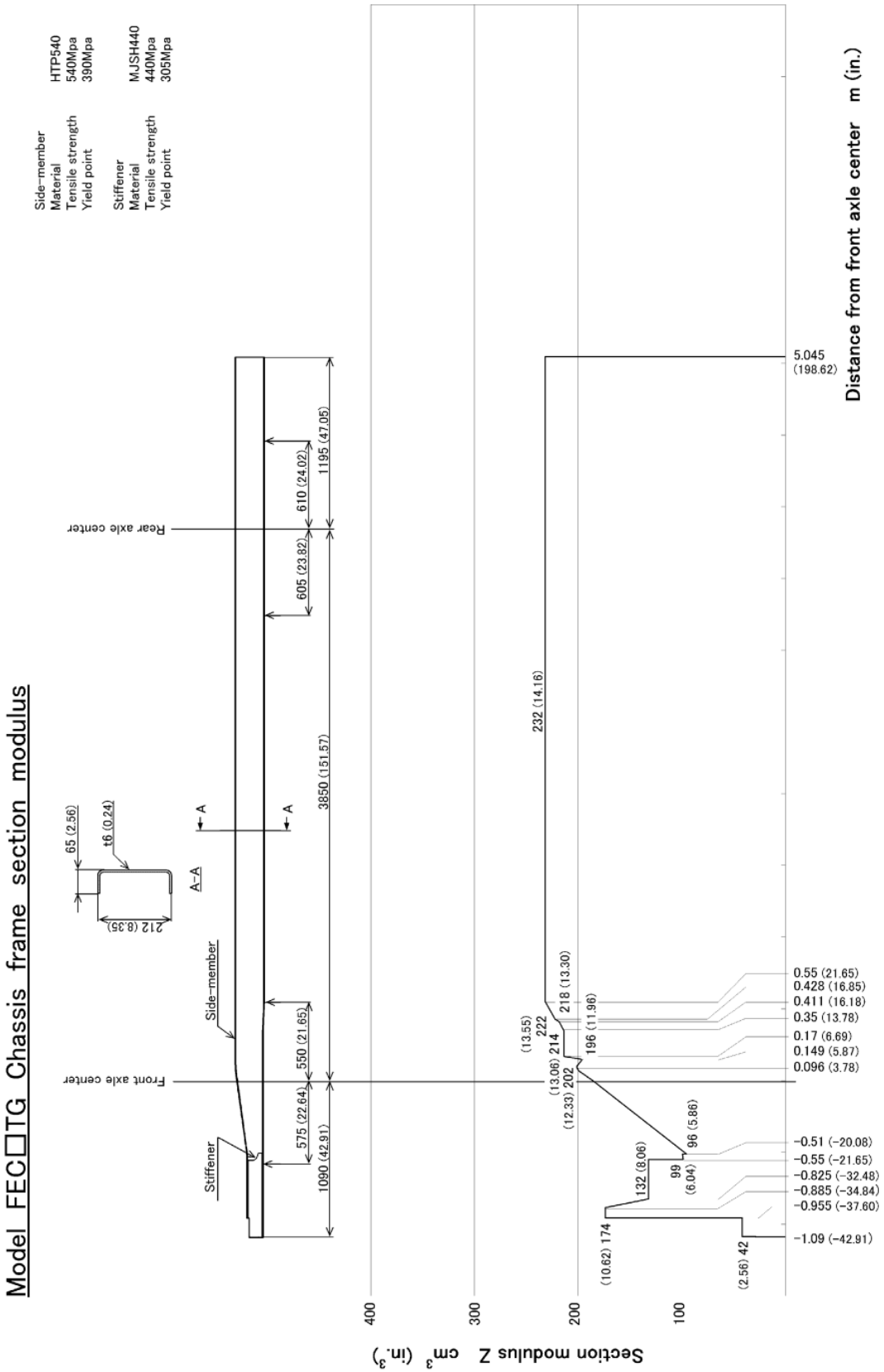


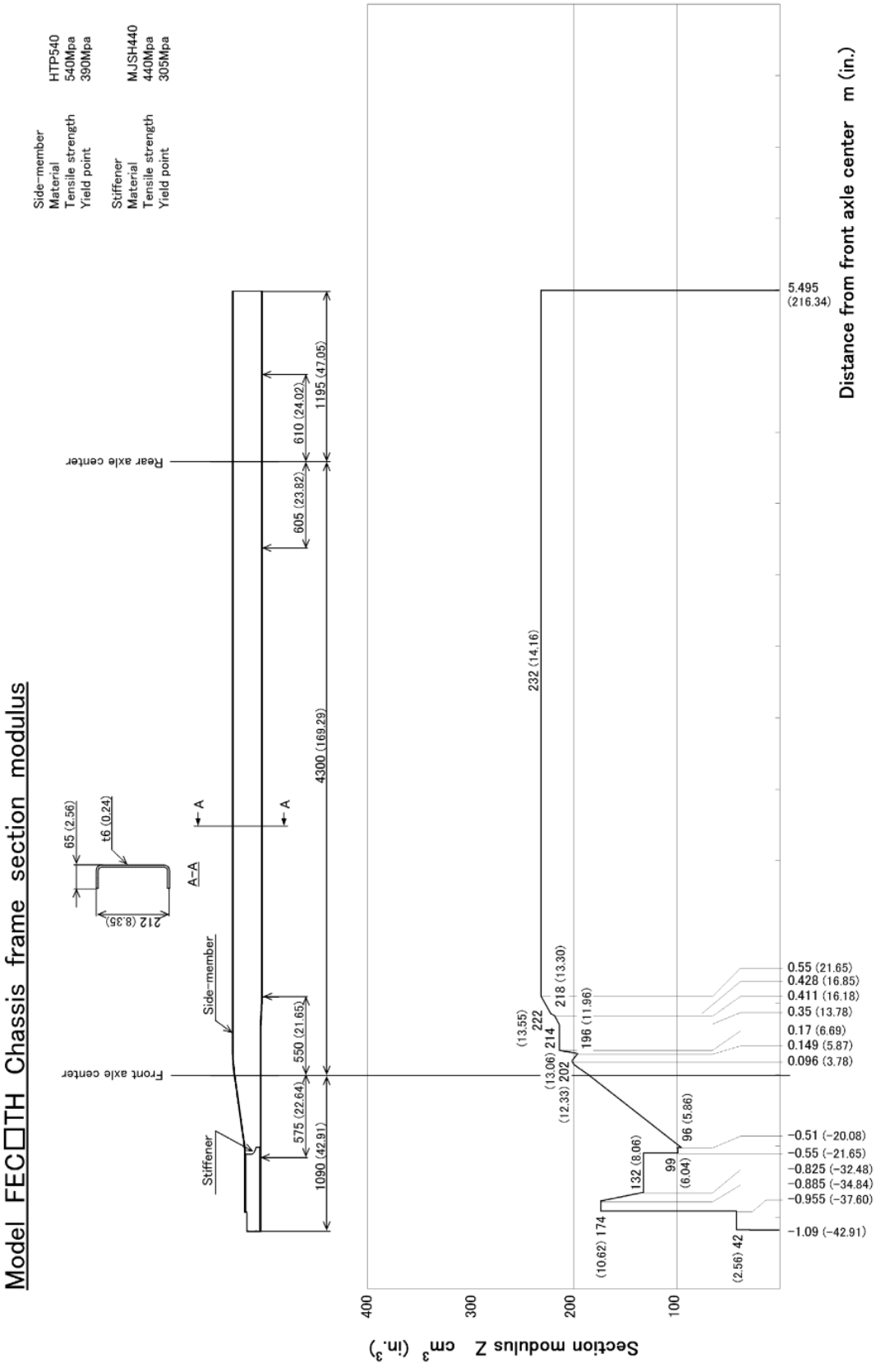
UNIT : mm (in.)

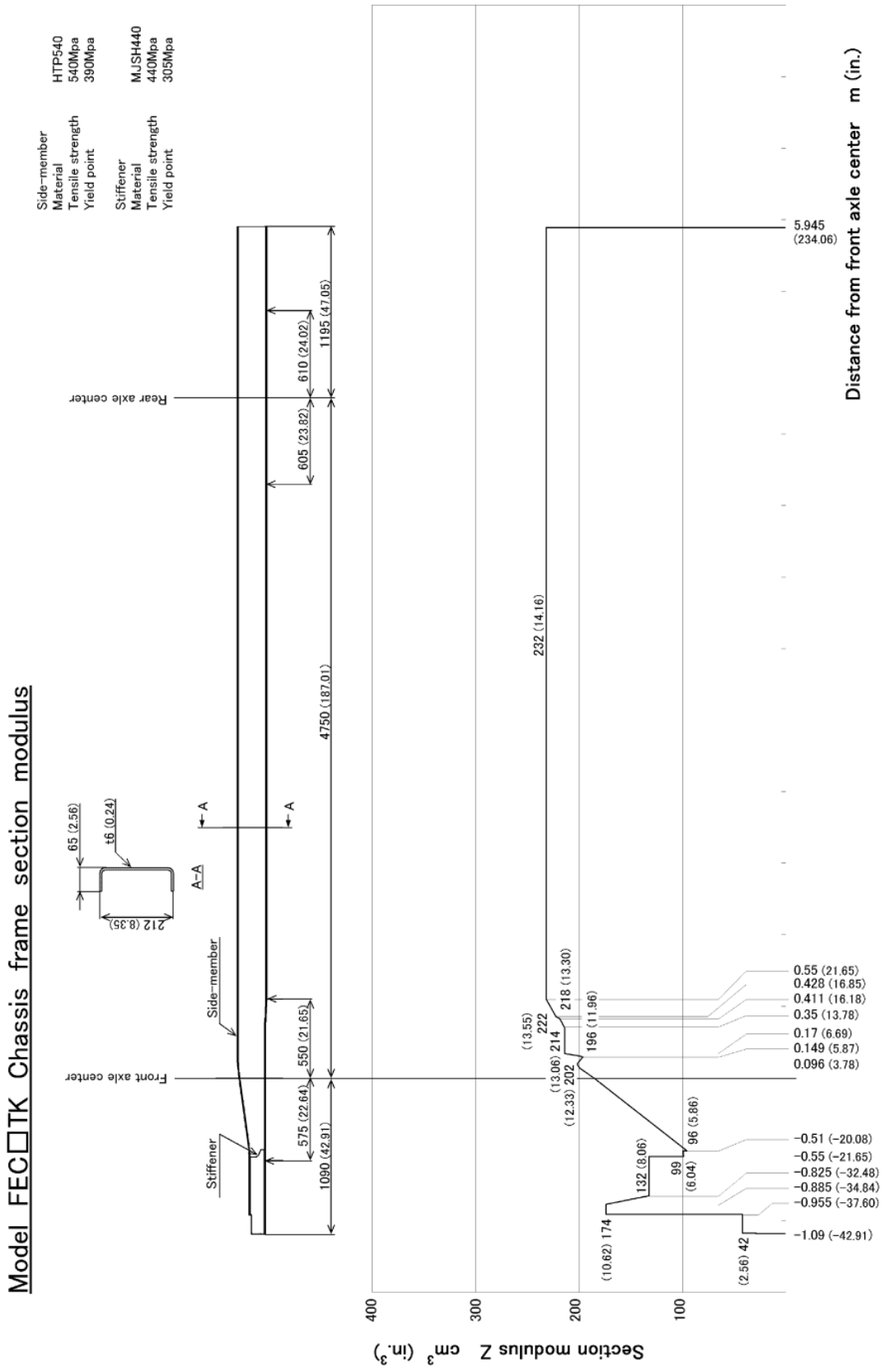
10.6.2 Frame section module

Model	Page
FEC□TE	234
FEC□TG	235
FEC□TH	236
FEC□TK	237


Model FEC□TE Chassis frame section modulus
Side-member
Material HTP540
Tensile strength 540Mpa
Yield point 390Mpa
Stiffener
Material MJSH440
Tensile strength 440Mpa
Yield point 305Mpa
Rear axle center
Front axle center
Side-member
Stiffener
A
A
A–A
65 (2.56)
t6 (0.24)
212 (8.35)
3400 (133.86)
1195 (47.05)
610 (24.02)
605 (23.82)
550 (21.65)
575 (22.64)
1090 (42.91)
232 (14.16)
218 (13.30)
222 (13.55)
214 (13.06)
202 (12.33)
196 (11.96)
96 (5.86)
99 (6.04)
132 (8.06)
174 (10.62)
42 (2.56)
4.595 (180.91)
0.55 (21.65)
0.428 (16.85)
0.411 (16.18)
0.35 (13.78)
0.17 (6.69)
0.149 (5.87)
0.096 (3.78)
−0.51 (−20.08)
−0.55 (−21.65)
−0.825 (−32.48)
−0.885 (−34.84)
−0.955 (−37.60)
−1.09 (−42.91)
400
300
200
100
Section modulus Z cm³ (in.³)
Distance from front axle center m (in.)

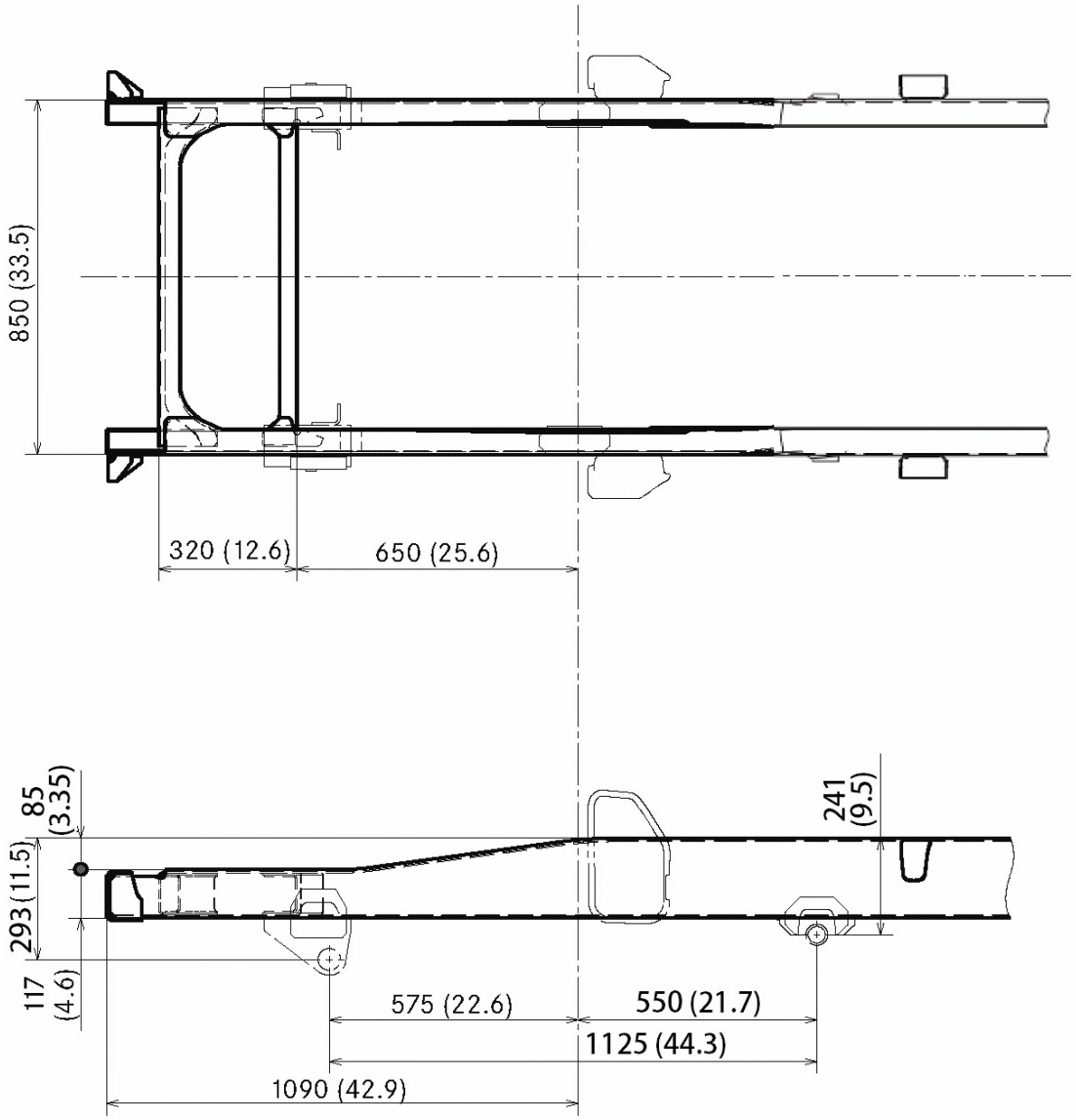

Model FEC□TG Chassis frame section modulus
Side-member
Material HTP540
Tensile strength 540Mpa
Yield point 390Mpa
Stiffener
Material MJSH440
Tensile strength 440Mpa
Yield point 305Mpa
Rear axle center
Front axle center
Side-member
Stiffener
A–A
65 (2.56)
t6 (0.24)
212 (8.35)
610 (24.02)
1195 (47.05)
605 (23.82)
3850 (151.57)
550 (21.65)
575 (22.64)
1090 (42.91)
5.045 (198.62)
Distance from front axle center m (in.)
232 (14.16)
218 (13.30)
196 (11.96)
(13.55) 222
(13.06) 214
(12.33) 202
96 (5.86)
99 (6.04)
132 (8.06)
(10.62) 174
(2.56) 42
0.55 (21.65)
0.428 (16.85)
0.411 (16.18)
0.35 (13.78)
0.17 (6.69)
0.149 (5.87)
0.096 (3.78)
−0.51 (−20.08)
−0.55 (−21.65)
−0.825 (−32.48)
−0.885 (−34.84)
−0.955 (−37.60)
−1.09 (−42.91)
400
300
200
100
Section modulus Z cm³ (in.³)


Model FEC□TH Chassis frame section modulus
Side-member
Material HTP540
Tensile strength 540Mpa
Yield point 390Mpa
Stiffener
Material MJSH440
Tensile strength 440Mpa
Yield point 305Mpa
Rear axle center
Front axle center
Side-member
Stiffener
A–A
65 (2.56)
t6 (0.24)
212 (8.35)
610 (24.02)
1195 (47.05)
605 (23.82)
4300 (169.29)
550 (21.65)
575 (22.64)
1090 (42.91)
232 (14.16)
(13.55) 222
(13.06) 214
(12.33) 202
218 (13.30)
196 (11.96)
96 (5.86)
132 (8.06)
99 (6.04)
(10.62) 174
(2.56) 42
5.495 (216.34)
0.55 (21.65)
0.428 (16.85)
0.411 (16.18)
0.35 (13.78)
0.17 (6.69)
0.149 (5.87)
0.096 (3.78)
−0.51 (−20.08)
−0.55 (−21.65)
−0.825 (−32.48)
−0.885 (−34.84)
−0.955 (−37.60)
−1.09 (−42.91)
Distance from front axle center m (in.)
Section modulus Z cm³ (in.³)
400
300
200
100

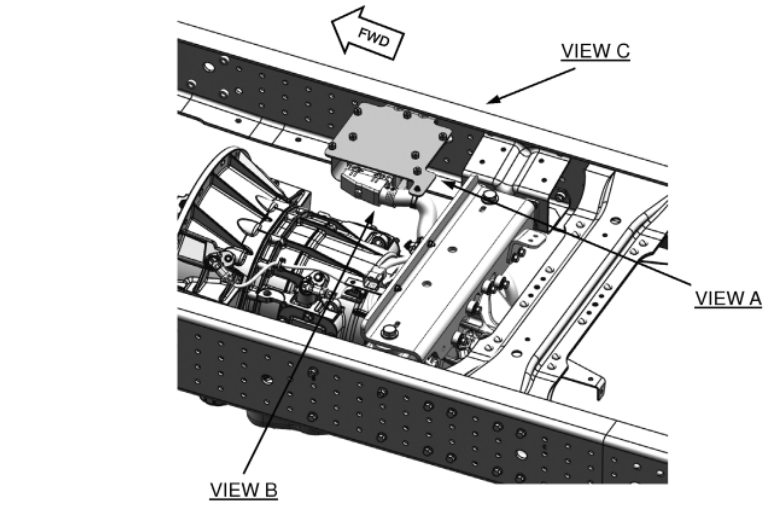

Model FEC□TK Chassis frame section modulus
Side-member
Material HTP540
Tensile strength 540Mpa
Yield point 390Mpa
Stiffener
Material MJSH440
Tensile strength 440Mpa
Yield point 305Mpa
Rear axle center
Front axle center
Side-member
Stiffener
A
A
A–A
65 (2.56)
t6 (0.24)
212 (8.35)
610 (24.02)
1195 (47.05)
605 (23.82)
4750 (187.01)
550 (21.65)
575 (22.64)
1090 (42.91)
232 (14.16)
5.945 (234.06)
Distance from front axle center m (in.)
Section modulus Z cm³ (in.³)
400
300
200
100
(13.55) 222
(13.06) 214
(12.33) 202
218 (13.30)
196 (11.96)
0.55 (21.65)
0.428 (16.85)
0.411 (16.18)
0.35 (13.78)
0.17 (6.69)
0.149 (5.87)
0.096 (3.78)
96 (5.86)
99 (6.04)
132 (8.06)
(10.62) 174
(2.56) 42
−0.51 (−20.08)
−0.55 (−21.65)
−0.825 (−32.48)
−0.885 (−34.84)
−0.955 (−37.60)
−1.09 (−42.91)

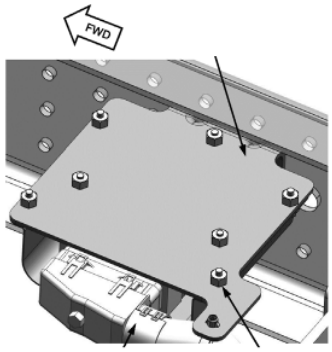
10.6.3 Frame front drawings

Front suspension type	Model	Frame width	Page
Rigid	FEC	850	239

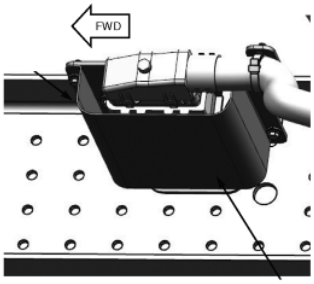

850 (33.5)
320 (12.6)
650 (25.6)
85 (3.35)
293 (11.5)
117 (4.6)
241 (9.5)
575 (22.6)
550 (21.7)
1125 (44.3)
1090 (42.9)

10.6.4 TCU installation drawing

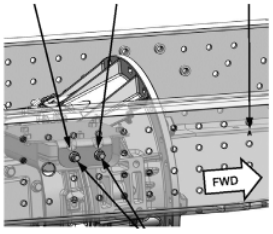




VIEW: A



VIEW: B



VIEW: C

TCU : Transmission control unit

10.7 Spring characteristic

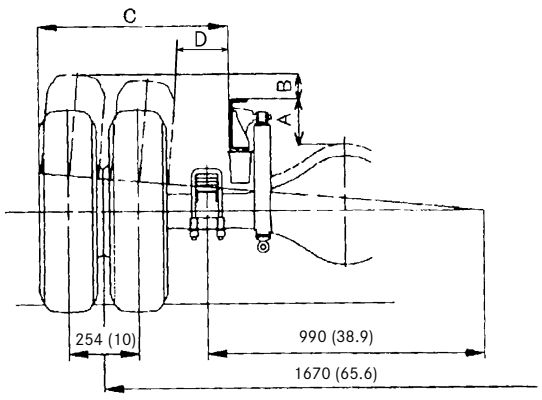
10.7.1 Distance from frame top surface to ground

MODEL	OBJECT ENGINE kW (HP)	CAB CHASSIS WEIGHT kg (lbs)			UNDER-SPRING WEIGHT kg (lbs)		DISTANCE FROM FRAME TOP SURFACE TO GROUND mm (inch)		CoG. HEIGHT mm (inch)
		Front Wf	Rear Wr	Total W	Front	Rear	Front ±10 Hf	Rear ±25 Hr	
FECZTEL9SUH9	221 (297)	1585 (3495)	1000 (2205)	2585 (5700)	310 (685)	562 (1240)	715 (28.1)	796 (31.3)	610 (24.0)
FECZTGL9SUH9	221 (297)	1600 (3530)	1000 (2205)	2600 (5735)	310 (685)	562 (1240)	714 (28.1)	796 (31.3)	610 (24.0)
FECZTHL9SUH9	221 (297)	1620 (3570)	1010 (2225)	2630 (5795)	310 (685)	562 (1240)	714 (28.1)	796 (31.3)	610 (24.0)
FECZTKL9SUH9	221 (297)	1630 (3595)	1015 (2240)	2645 (5835)	310 (685)	562 (1240)	713 (28.1)	796 (31.3)	610 (24.0)
FEC7TEL9SUH9	221 (297)	1585 (3495)	1000 (2205)	2585 (5700)	310 (685)	562 (1240)	715 (28.1)	796 (31.3)	610 (24.0)
FEC7TGL9SUH9	221 (297)	1600 (3530)	1000 (2205)	2600 (5735)	310 (685)	562 (1240)	714 (28.1)	796 (31.3)	610 (24.0)
FEC7THL9SUH9	221 (297)	1620 (3570)	1010 (2225)	2630 (5795)	310 (685)	562 (1240)	714 (28.1)	796 (31.3)	610 (24.0)
FEC7TKL9SUH9	221 (297)	1630 (3595)	1015 (2240)	2645 (5835)	310 (685)	562 (1240)	713 (28.1)	796 (31.3)	610 (24.0)
FEC7THL9WUH9	221 (297)	1775 (3915)	1075 (2370)	2850 (6285)	310 (685)	562 (1240)	777 (30.6)	844 (33.2)	715 (28.1)
FEC7TKL9WUH9	221 (297)	1795 (3960)	1075 (2370)	2870 (6330)	310 (685)	562 (1240)	777 (30.6)	844 (33.2)	715 (28.1)

Method of calculating Hf, Hr
Hr=hr+Rr : Frame height, Rear
hf : Distance from frame top to front wheel center (See drawings or following page 243.)
hr : Distance from frame top to rear wheel center (See drawings or following page 245.)
Rf, Rr : Tire radius (See drawings or following page 247.)

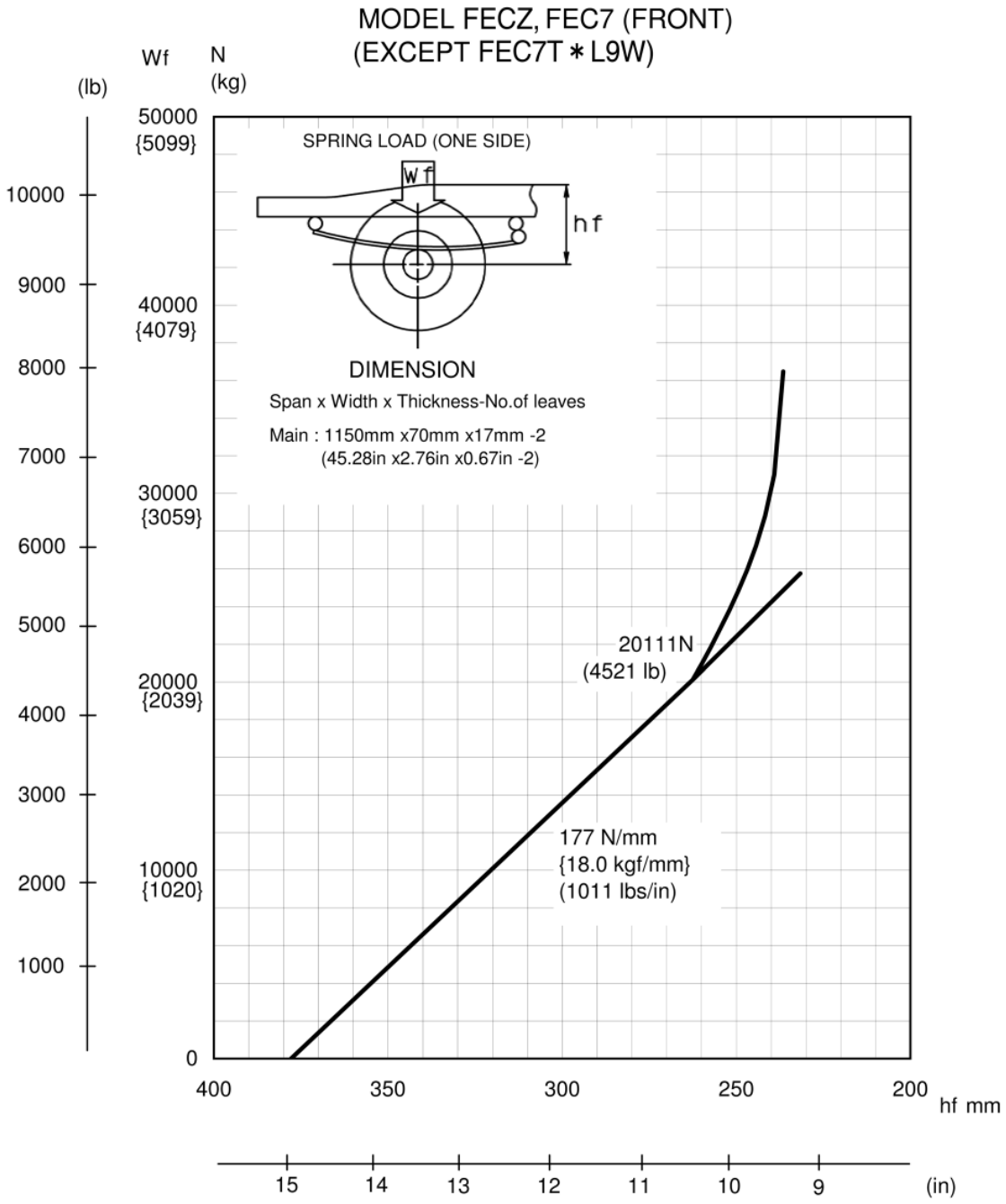
10.7.2 Differential and tire bound height

Model	Tire size	A mm (in)	B mm (in)	C mm (in)	D mm (in)
FECZTEL9SUH9	215/75R17.5	125 (4.9)	131 (5.2)	647 (25.5)	152 (6.0)
FECZTGL9SUH9	215/75R17.5	125 (4.9)	131 (5.2)	647 (25.5)	152 (6.0)
FECZTHL9SUH9	215/75R17.5	125 (4.9)	130 (5.1)	647 (25.5)	152 (6.0)
FECZTKL9SUH9	215/75R17.5	125 (4.9)	130 (5.1)	647 (25.5)	152 (6.0)
FEC7TEL9SUH9	215/75R17.5	125 (4.9)	131 (5.2)	647 (25.5)	152 (6.0)
FEC7TGL9SUH9	215/75R17.5	125 (4.9)	131 (5.2)	647 (25.5)	152 (6.0)
FEC7THL9SUH9	215/75R17.5	125 (4.9)	130 (5.1)	647 (25.5)	152 (6.0)
FEC7TKL9SUH9	215/75R17.5	125 (4.9)	130 (5.1)	647 (25.5)	152 (6.0)
FEC7THL9WUH9	215/75R17.5	175 (6.9)	80 (3.1)	647 (25.5)	157 (6.2)
FEC7TKL9WUH9	215/75R17.5	175 (6.9)	80 (3.1)	647 (25.5)	157 (6.2)

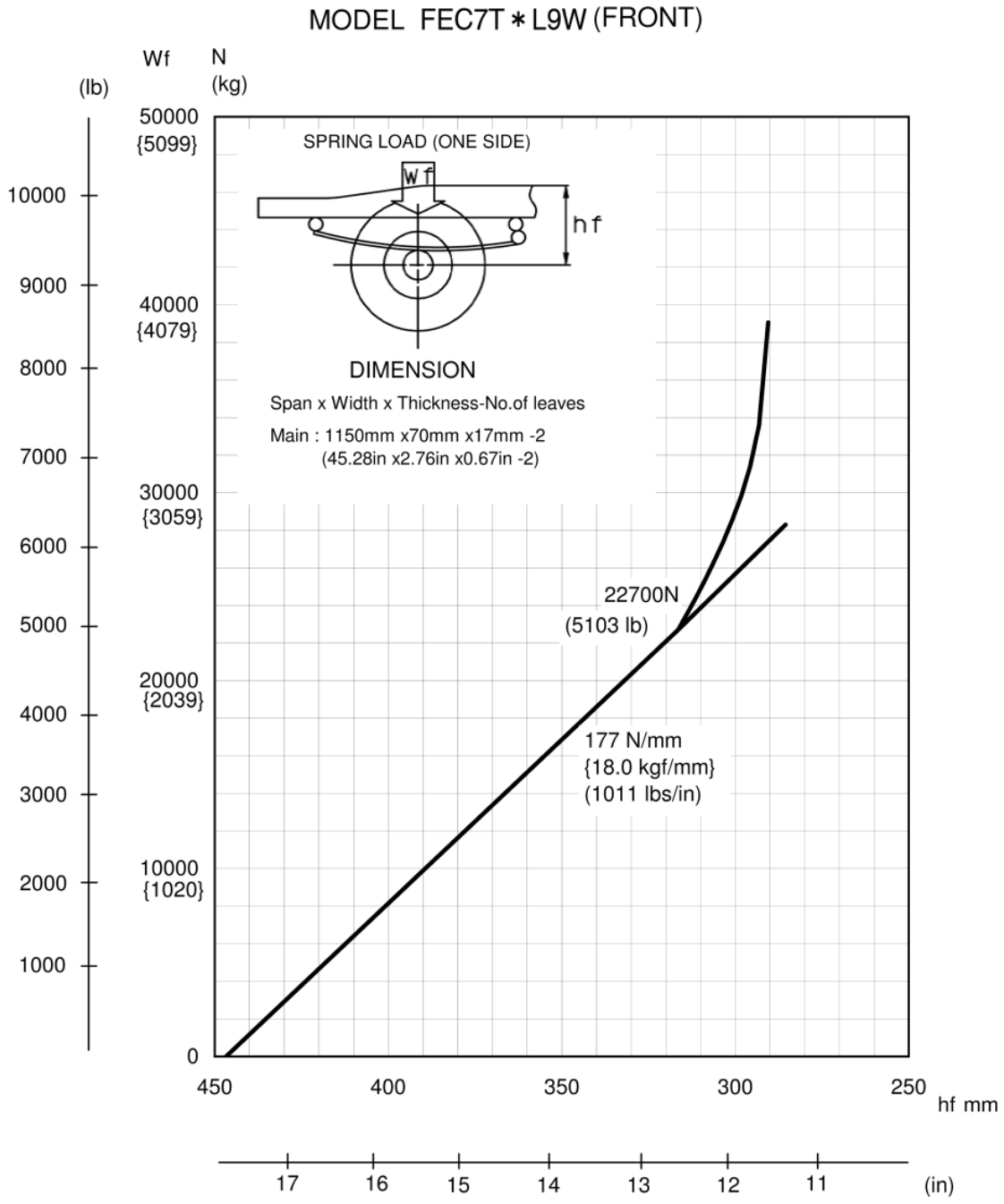


FECZ
FEC7

10.7.3 Front spring diagram

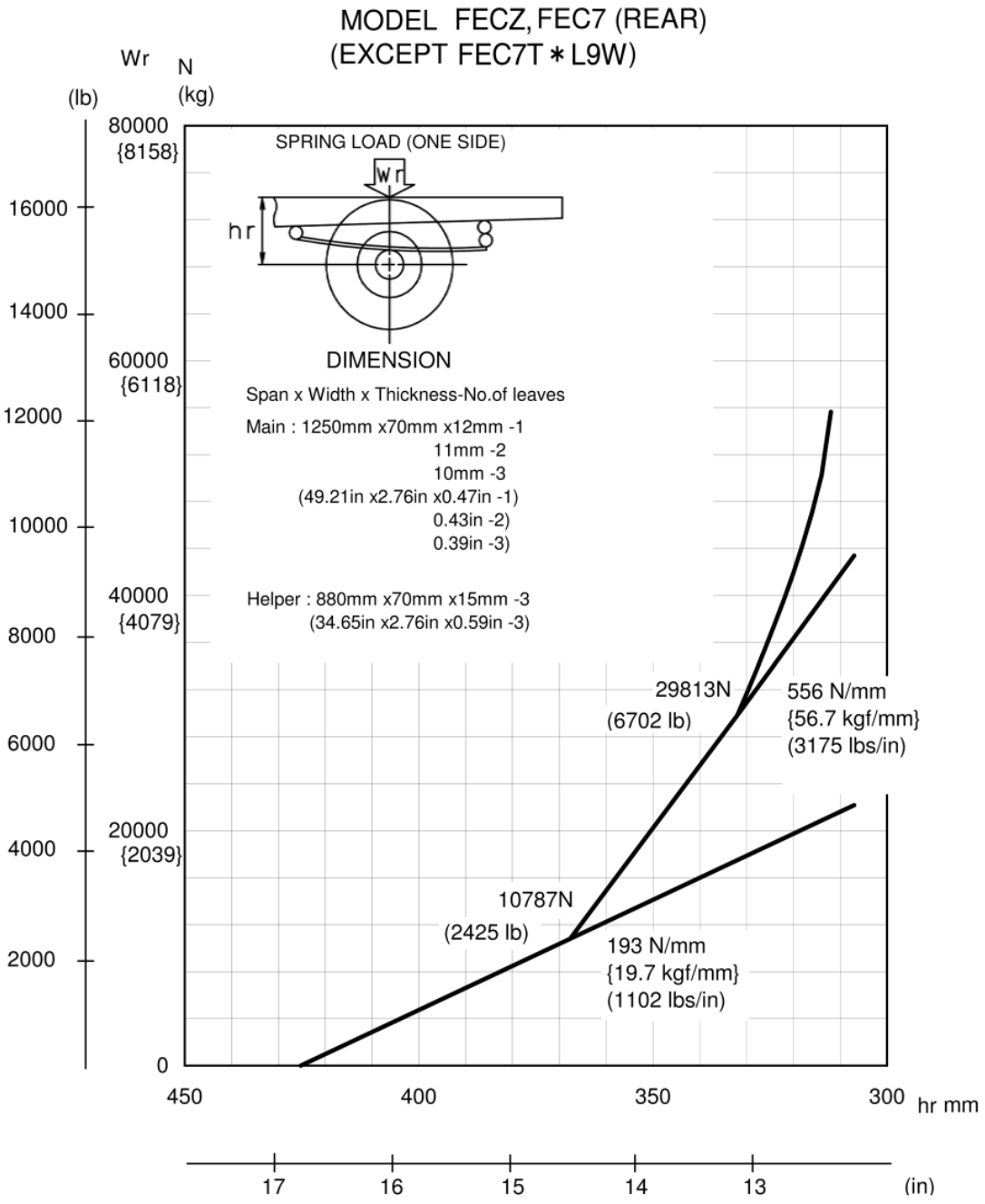


hf: Distance from front wheel center to upper surface of frame

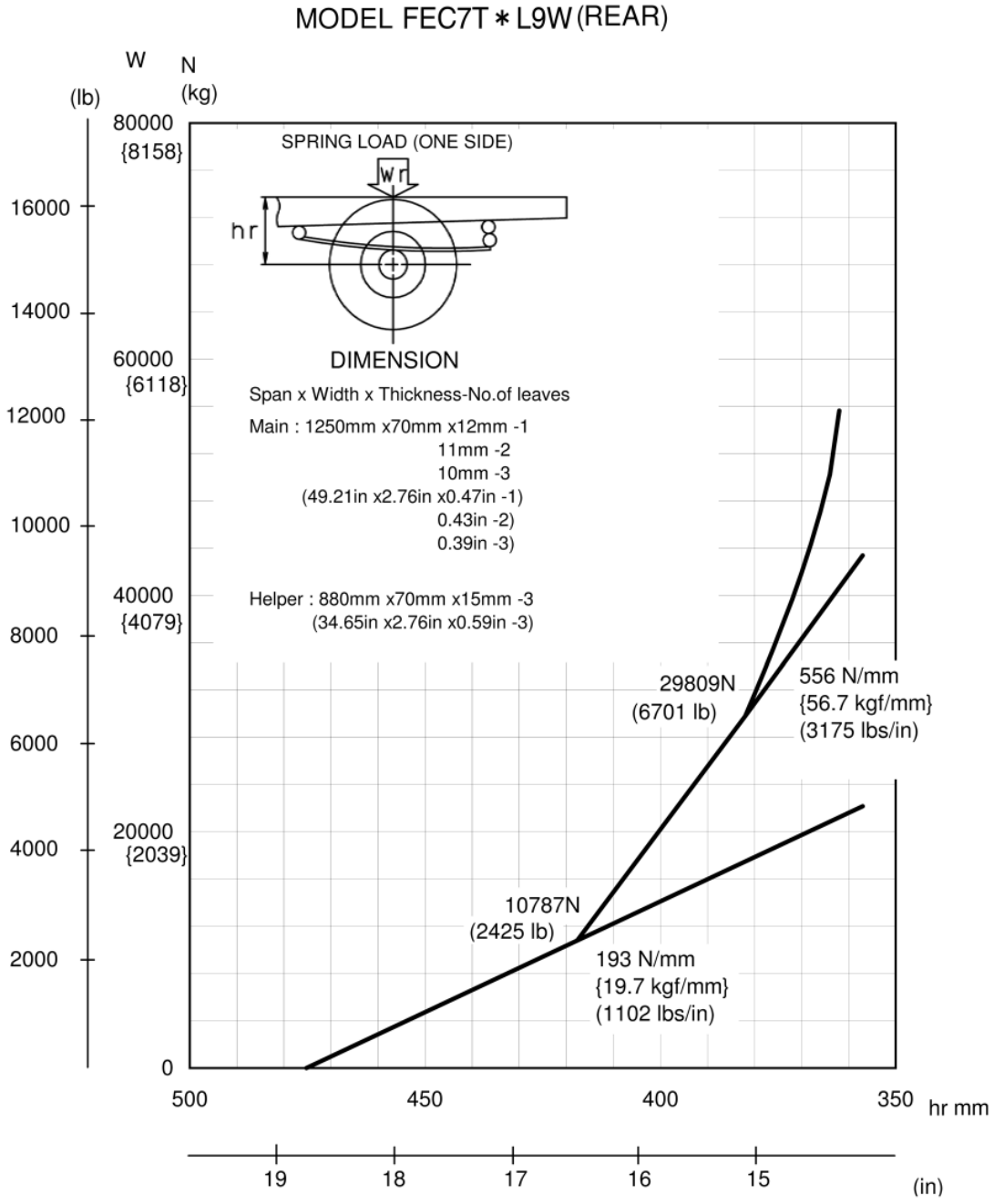


hf: Distance from front wheel center to upper surface of frame

10.7.4 Rear spring diagram

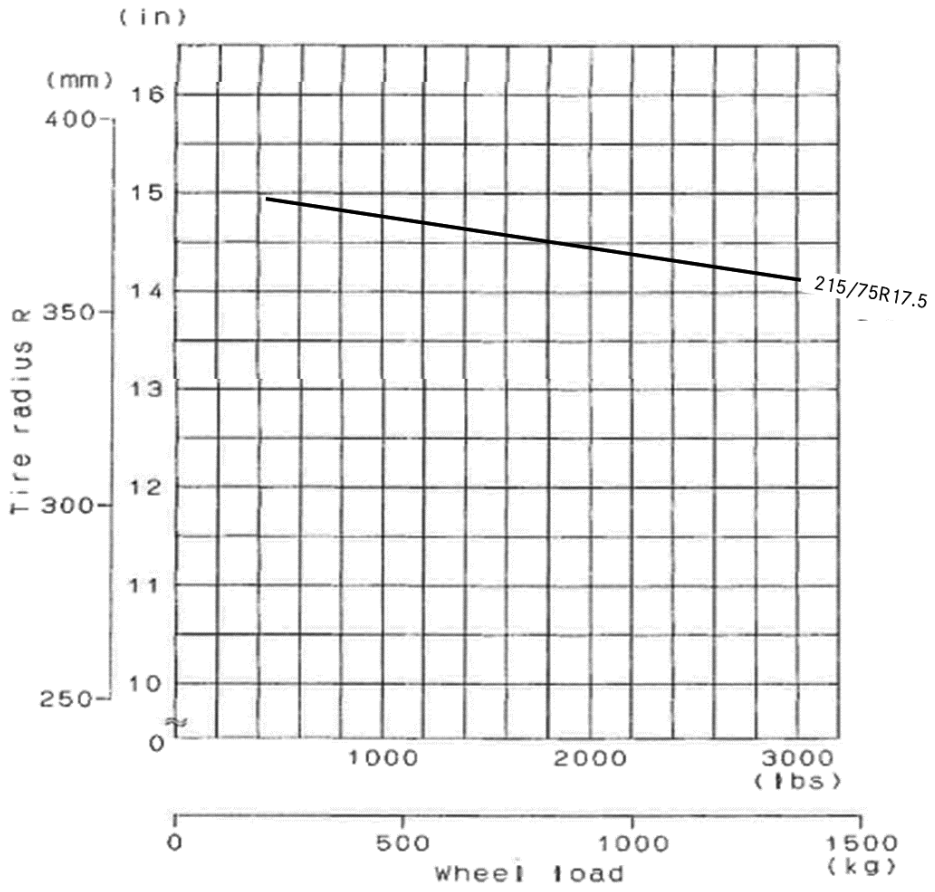


hr: Distance from rear wheel center to upper surface of frame



hr: Distance from rear wheel center to upper surface of frame

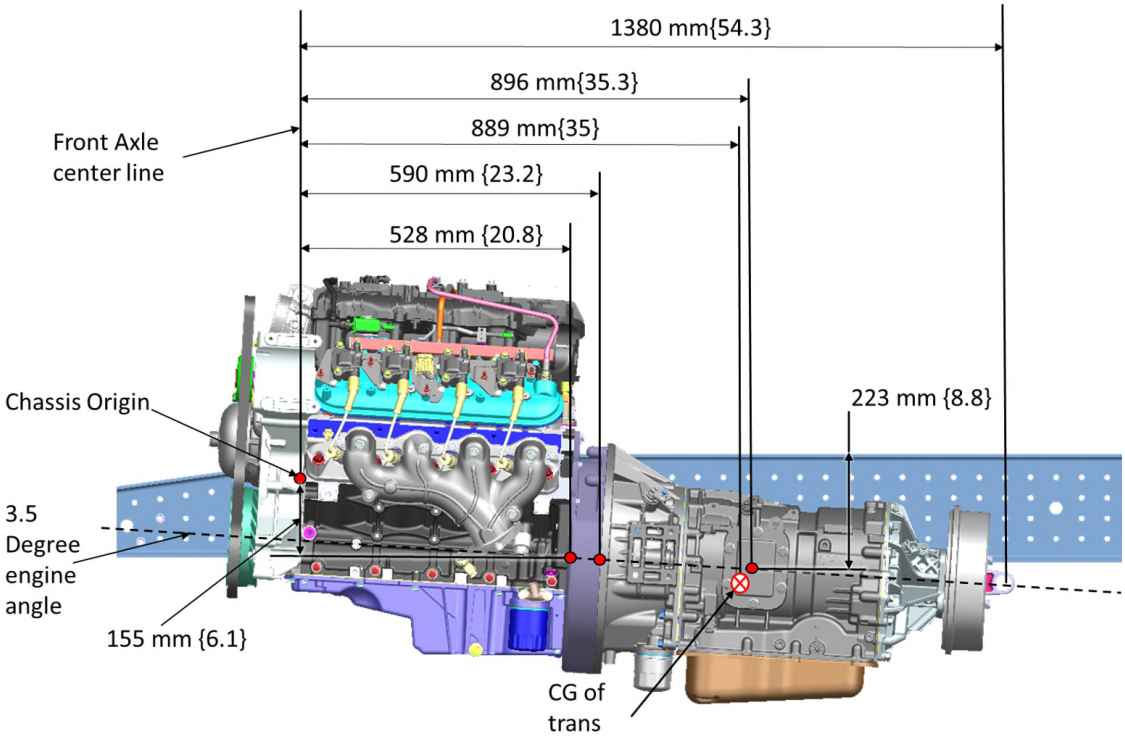
10.7.5 Tire radius calculating diagram



Single tire: Front-tire distributed load/2
Double tire: Rear-tire distributed load/4

10.8 Engine transmission assembly

<FE>



- Back of Cylinder Block

Unit : mm (in.)

Model	A	B	Offset of Engines from Chassis center line
FEC	470 (18.5)	146 (5.7)	-10 (-0.4) (Left side)

- Dimensions of transmission

Unit : mm (in.)

Transmission	Clutch	P	L1	L2	L3	L
M038S6	–	90 (3.5)	215 (8.5)	317 (12.5)	204.5 (8.0)	826.5 (32.5)

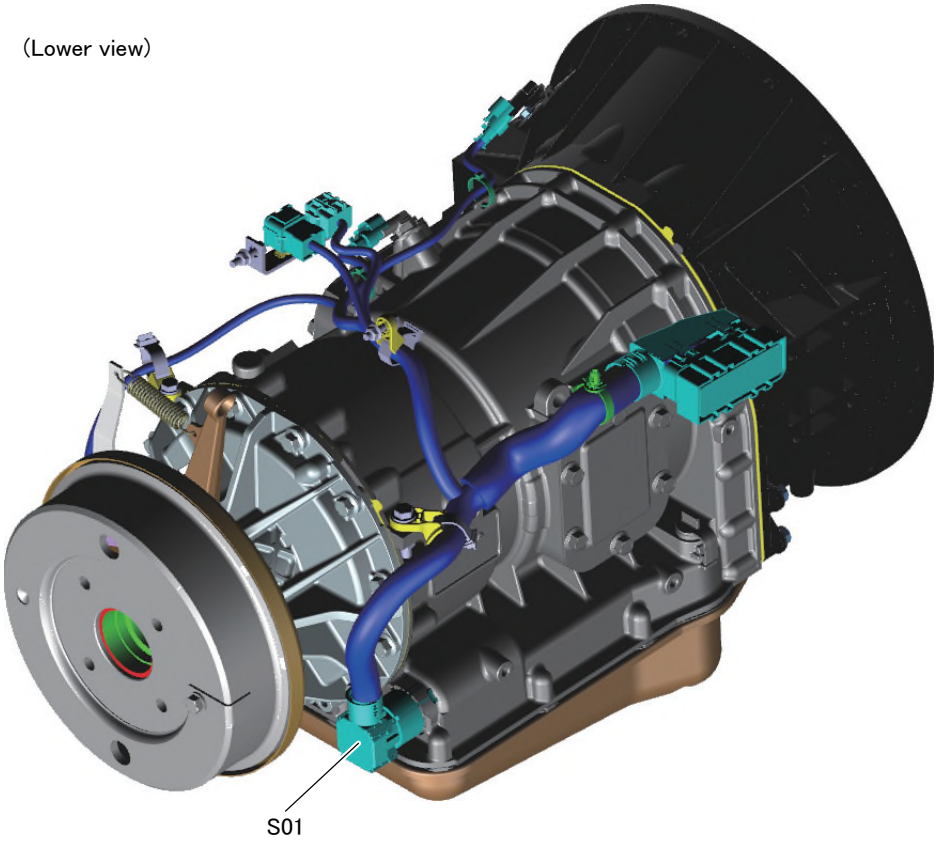
- Taking out center of PTO *1

Unit : mm (in.)

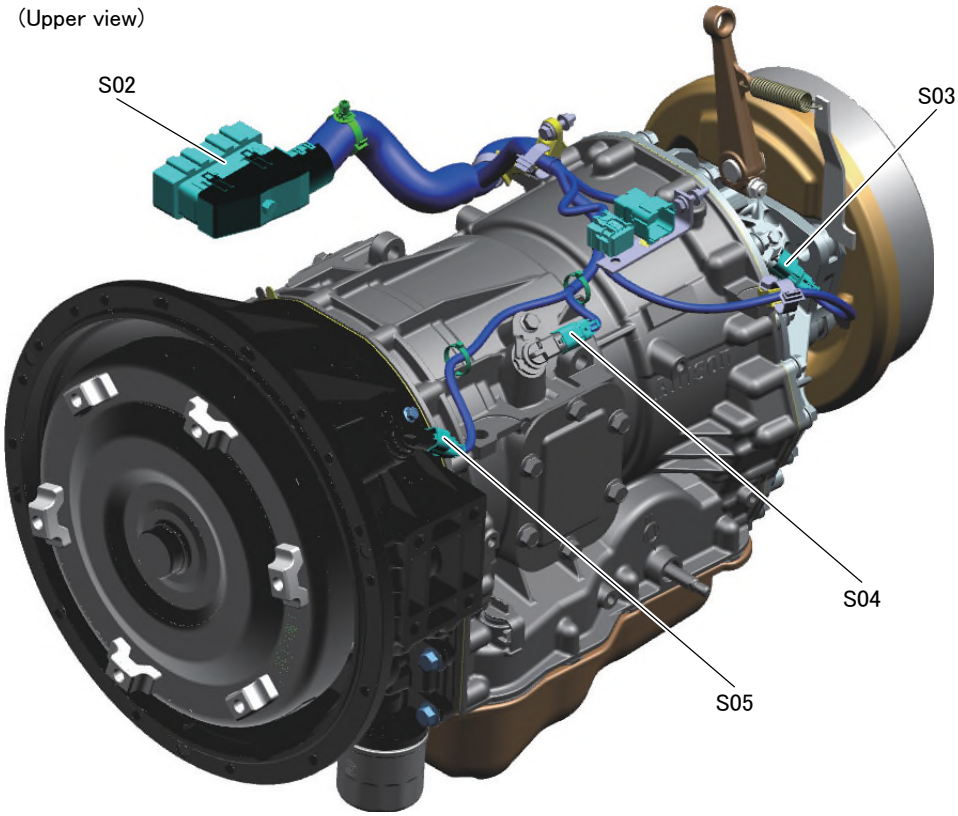
Model	Transmission	Frame thickness	196 N·m [145 lbs.ft, 20 kf·m]		392 N·m [290 lbs.ft, 40 kf·m]	
			X	Y	X	Y
FEC	M038S6	(6t)	985.6 (38.8)	302.5 (11.9)	870.7 (34.3)	313.7 (12.4)

S01 to 05

(Lower view)



(Upper view)

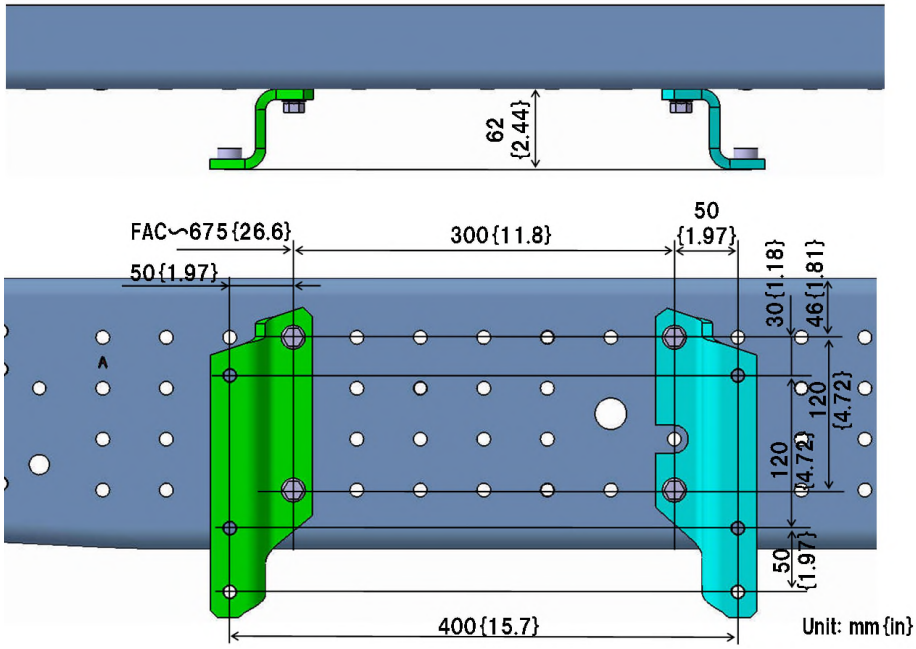


S01 Automatic transmission connector
S02 Automatic transmission electronic control unit
S03 Output speed sensor
S04 Turbine speed sensor
S05 Engine speed sensor

54-L10238S

10.10 Battery mounting layout

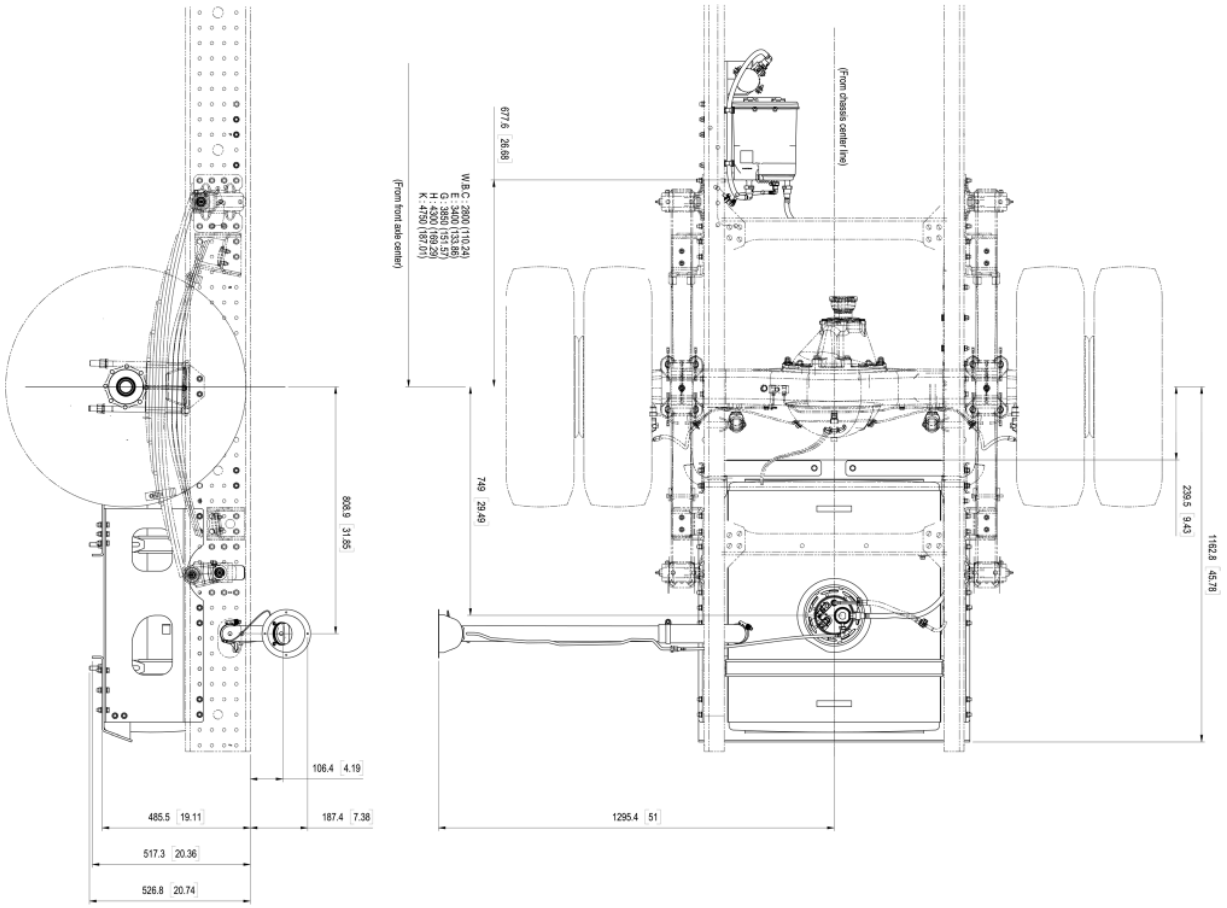
<FE>

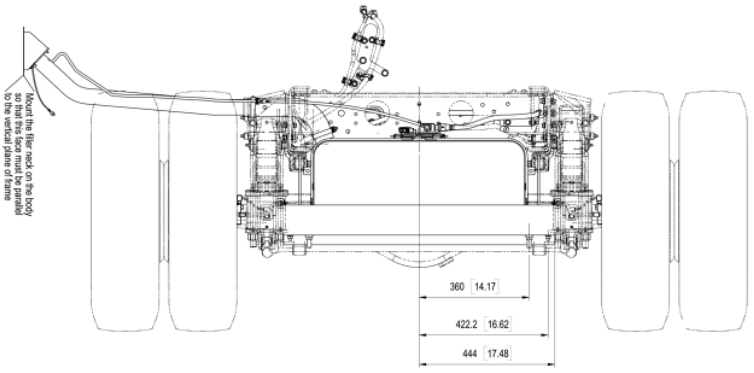


10.11 Fuel tank mounting layout

10.11.1 Fuel tank

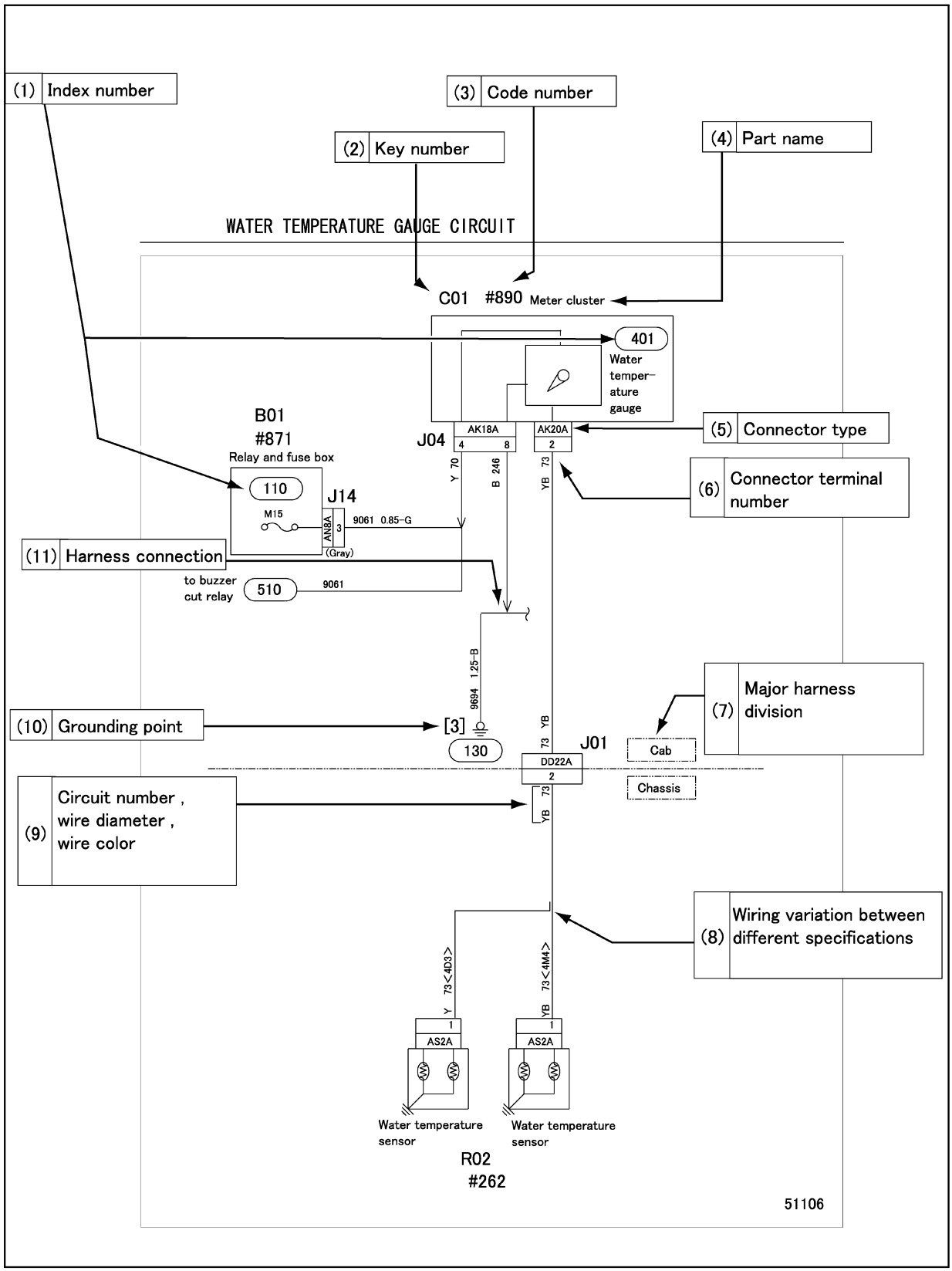
<FE>





10.12 Electrical systems

HOW TO READ CIRCUITS



(1) Index number: (100) - (999)

- Index numbers are used as reference numbers for electrical circuits. Each electrical circuit has been assigned its own index number.

(2) Key number: A01 - Z99

- Key numbers indicate parts installation locations. The installation location of a part can be easily found using its key number shown in a circuit diagram.

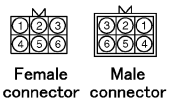
(3) Code number: #001 - #999

- Code numbers are reference numbers to find individual parts inspection procedures. The inspection procedure for a part can be found using its code number shown in a circuit diagram.

(4) Part name

(5) Connector type (type indication)

(6) Connector terminal number



Connector terminal numbering starts with the upper left corner for female connectors and with the upper right corner for male connectors.

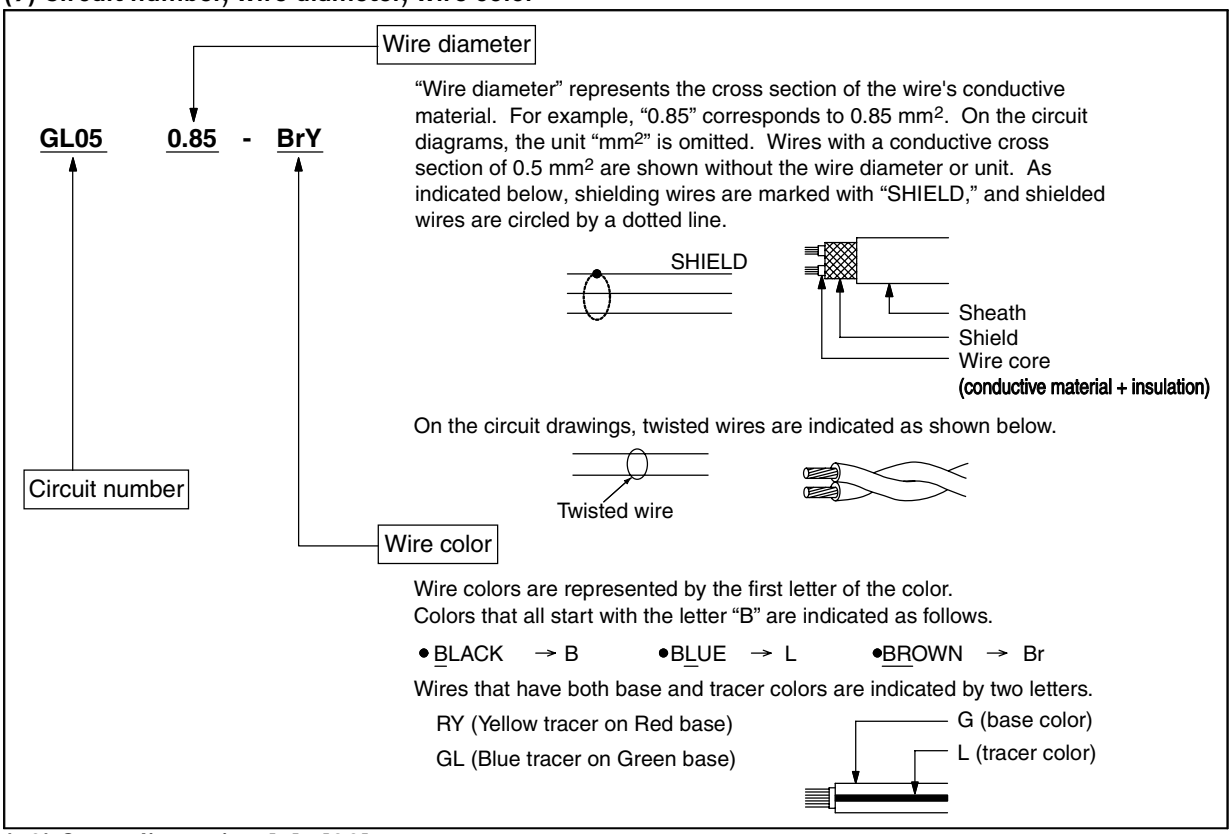
(7) Major harness division

- Major harness divisions are shown

(8) Wiring variations between different specifications

- Variations in wiring/circuit between different vehicle specifications are clearly indicated as shown.

(9) Circuit number, wire diameter, wire color



(10) Grounding point: [1] - [99]

- Locations where wires are grounded to the vehicle. All of the grounding points are listed in (130).

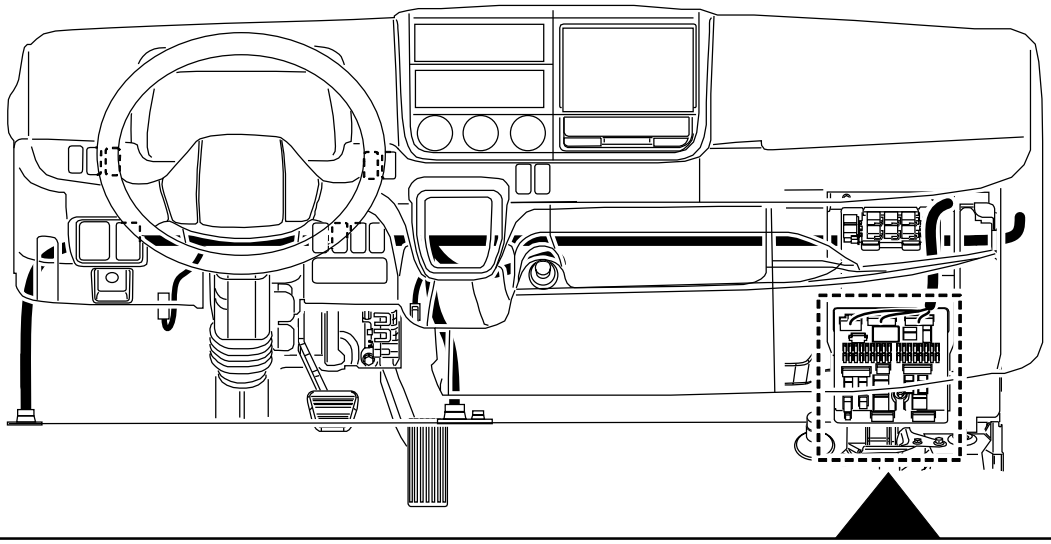
(11) Harness connection

- The arrow in the wiring diagram indicates where harnesse are connected, and NOT the flow of electricity.

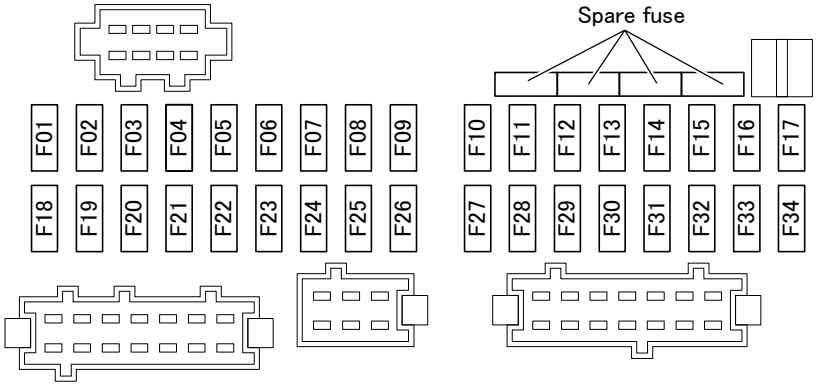
Wire color

Wire color		Insulation color + tracer					
B	Black	BW black/white	BY black/yellow	BR black/red	BG black/green	BL black/blue	
Br	Brown	BrW brown/white	BrB brown/black	BrY brown/yellow	BrR brown/red	BrG brown/green	
G	Green	GW green/white	GR green/red	GY green/yellow	GB green/black	GL green/blue	GO green/orange
Gr	Gray	GrL gray/blue	GrR gray/red				
L	Blue	LW blue/white	LR blue/red	LY blue/yellow	LB blue/black	LO blue/orange	LG blue/green
Lg	Light green	LgR light green/ red	LgY light green/ yellow	LgB light green/ black	LgW light green/ white		
O	Orange	OL orange/blue	OB orange/black	OG orange/green			
P	Pink	PB pink/black	PG pink/green	PL pink/blue	PW pink/white		
Pu	Purple						
R	Red	RW red/white	RB red/black	RY red/yellow	RG red/green	RL red/blue	RO red/orange
Sb	Sky blue						
V	Violet	VY violet/yellow	VW violet/white	VR violet/red	VG violet/green		
W	White	WR white/red	WB white/black	WL white/blue	WG white/green	WO white/orange	
Y	Yellow	YR yellow/red	YB yellow/black	YG yellow/green	YL yellow/blue	YW yellow/white	YO yellow/ orange
		YP yellow/pink	YV yellow/violet				

FUSE BOX

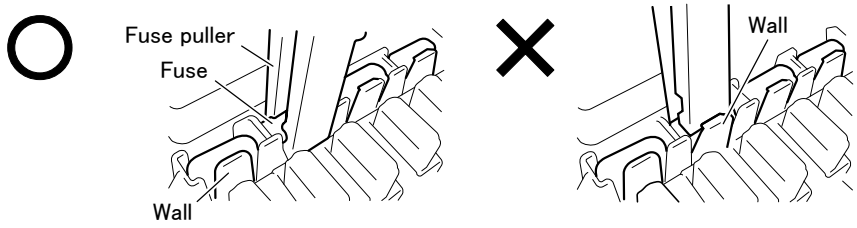


<Inside of SAM>



SAM : Signal detect and actuation modules

Removal of spare fuse



WARNING ⚠

- **To prevent possible injury, be sure to disconnect the negative (-) cable of the battery and insulate it with tape before removing fuses. (See Gr00.)**

CAUTION ⚠

- **If a fuse blows out, identify and remedy the cause, then replace the fuse.**
- **Be sure to use the fuse with the specified ampere.**
- **Insert the fuse puller into the gap on the outer side of the fuse holder wall to remove the spare fuse. Do not force the puller into the gap on the inner side of the fuse holder wall. Doing so will break the SAM and cause malfunctions or a fire.**

54-L10238FUSE-1

Fuse box

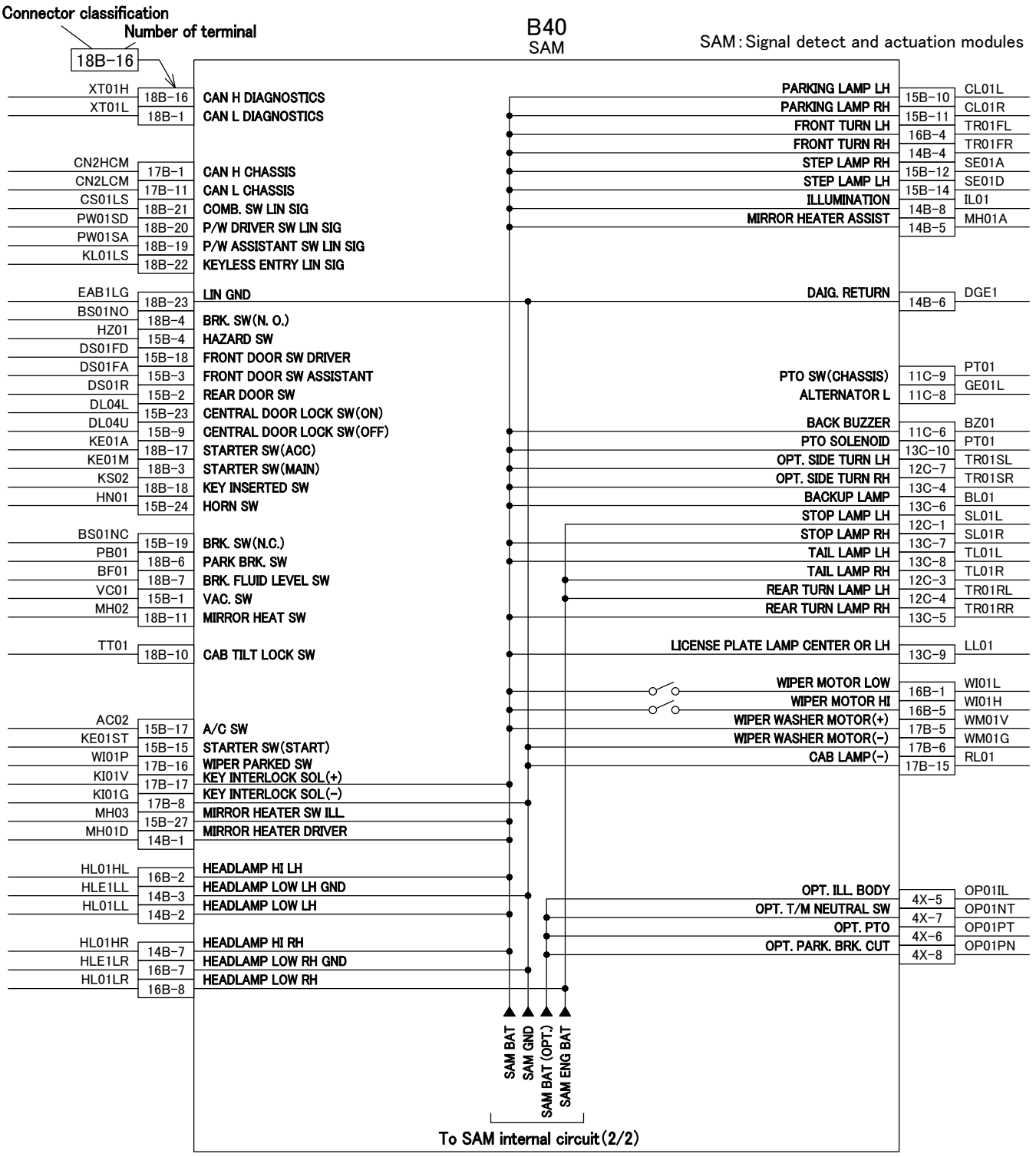
Fuse No.	Main load	Capacity
F01	Starter	10A
F02	—	—
F03	—	—
F04	Opt (IGN)	10A
F05	Power window (driver's seat side)	30A
F06	Canister ventilation relay	10A
F07	Power window (assistant driver's seat side)	30A
F08	Identification lamp	20A
F09	Meter cluster, diagnosis connector, combination switch	10A
F10	Stop lamp relay	10A
F11	Blower fan	30A
F12	Audio, keyless entry ECU	15A
F13	Starter switch, range selector lever	10A
F14	Horn	10A
F15	Audio	10A
F16	Cigarette lighter	20A
F17	—	—
F18	ABS ECU	10A
F19	Engine ECU	10A
F20	Van body dome light	10A
F21	CGW (CAN)	10A
F22	Meter cluster	15A
F23	CGW (CAN)	10A
F24	Automatic transmission ECU	10A
F25	Opt (ACC)	10A
F26	Opt (B)	10A
F27	Van body dome light	20A
F28	Injector	10A
F29	Injector	10A
F30	O^2 sensor	15A
F31	Engine ECU	20A
F32	Engine ECU, Air conditioner	10A
F33	—	—
F34	—	—

ABS : Anti-lock brake system
ECU : Electronic control unit
CAN : Controller area network

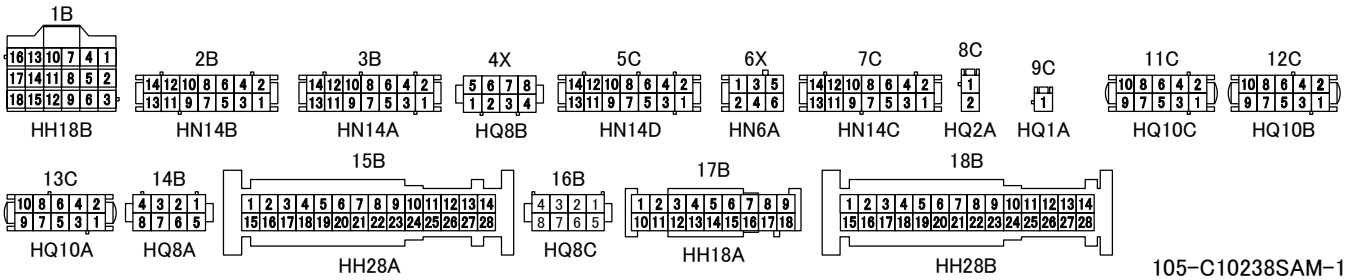
105 SAM INTERNAL CIRCUIT

(1/2)

A part of this circuit is omitted.



SAM connector (harness side)



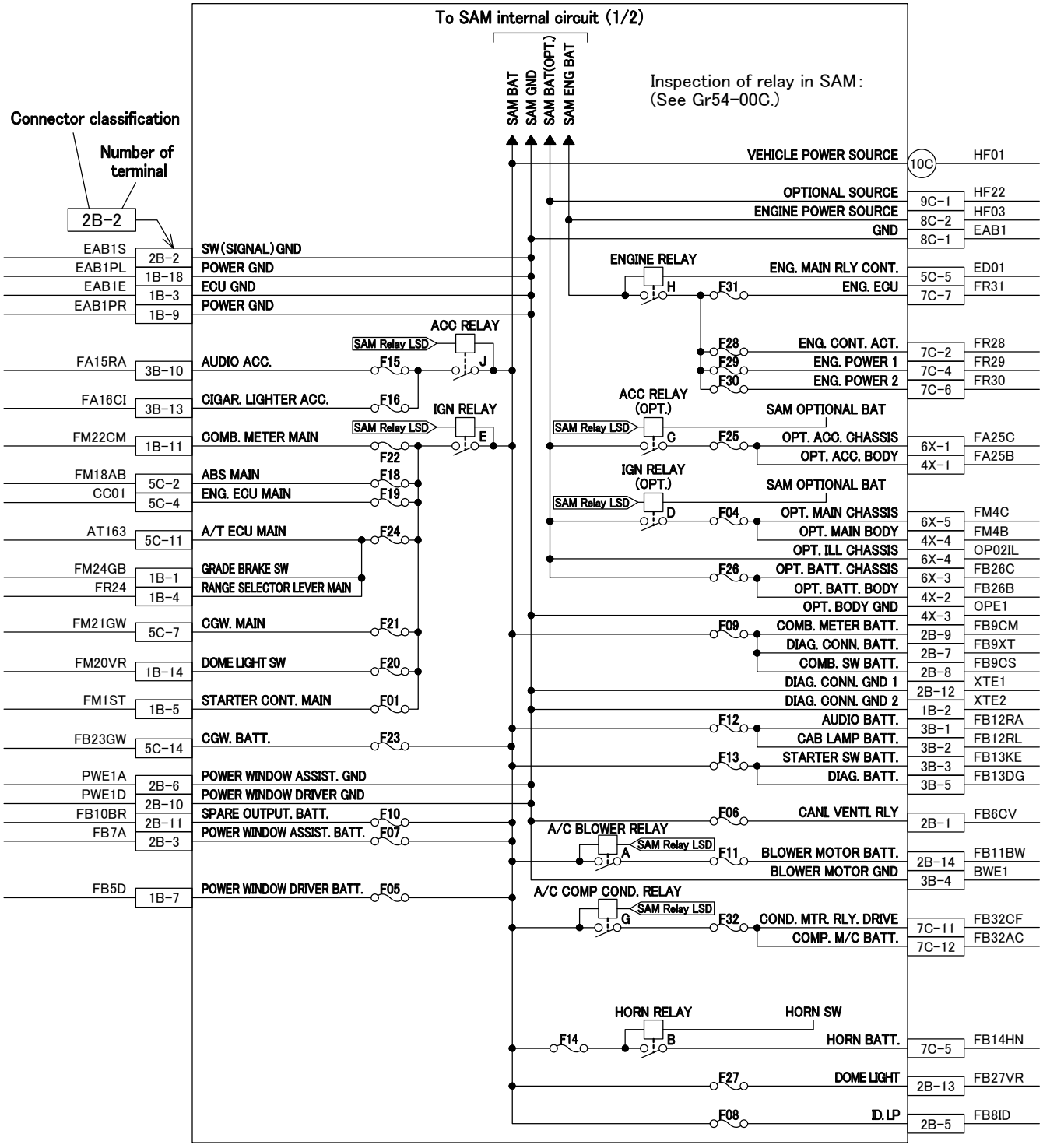
105-C10238SAM-1

(2/2)

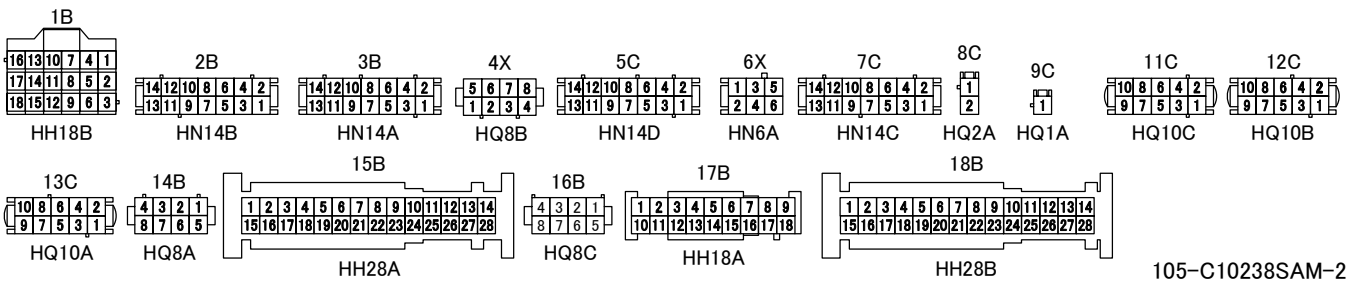
A part of this circuit is omitted.

B40
SAM

SAM : Signal detect and actuation modules



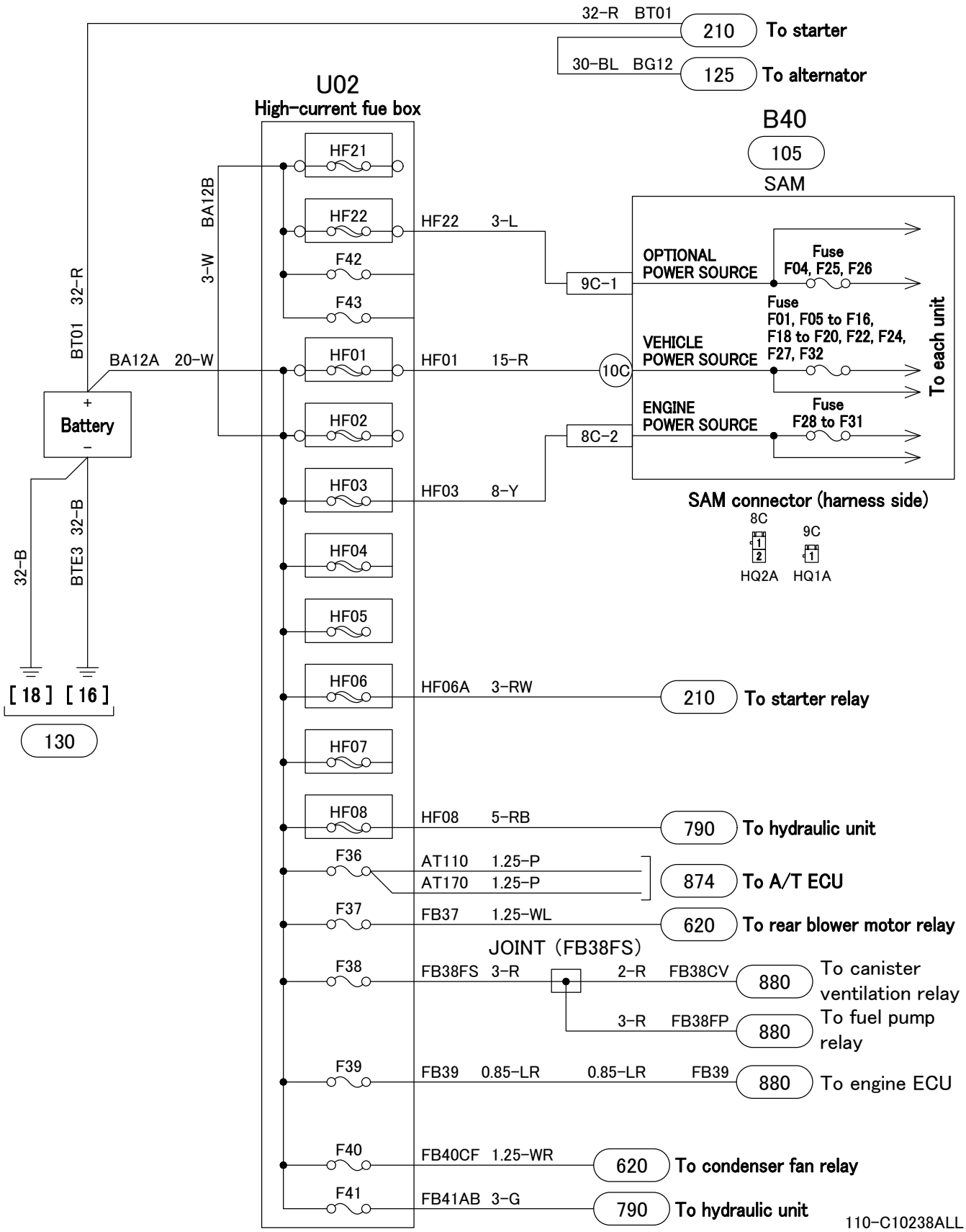
SAM connector (harness side)



105-C10238SAM-2

Battery → high-current fuse → SAM

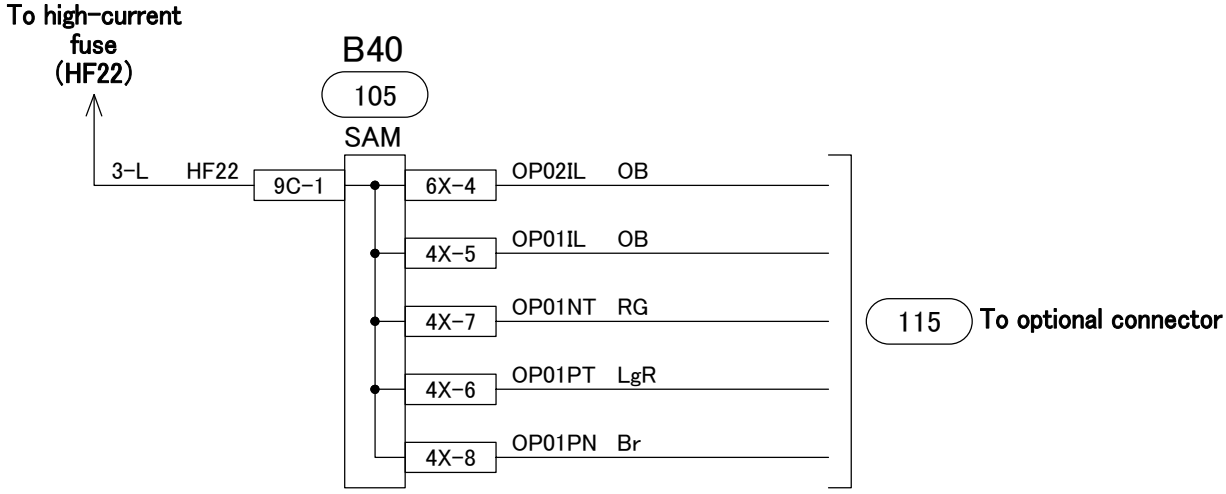
ECU : Electronic control unit
SAM : Signal detect and actuation modules
A/T : Automatic transmission



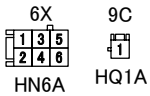
110-C10238ALL

SAM
(OPTIONAL BAT)

SAM : Signal detect and actuation modules

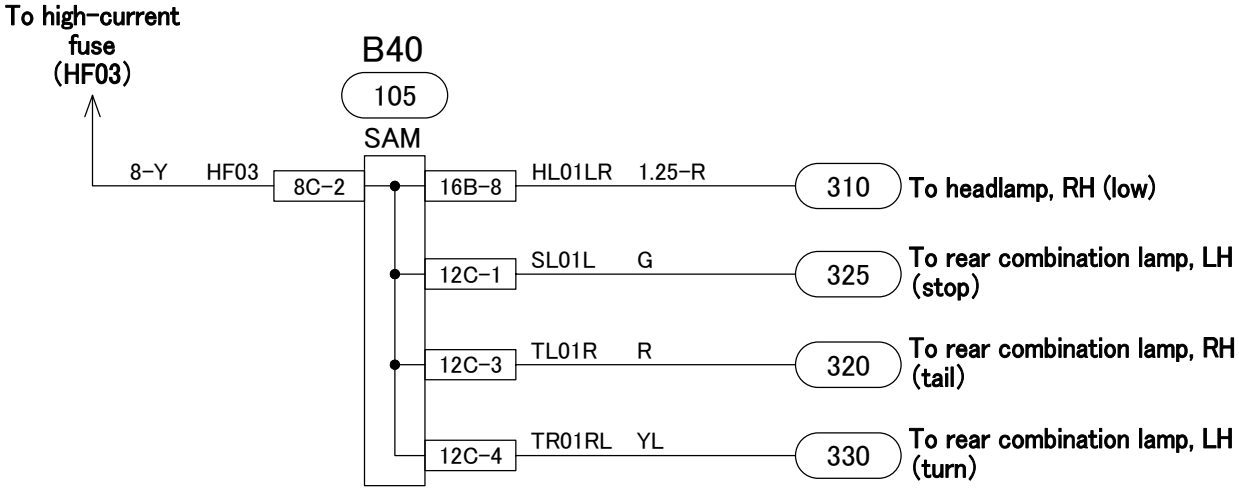


SAM connector (harness side)

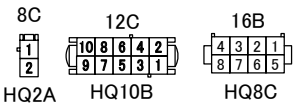


SAM
(ENG BAT)

SAM : Signal detect and actuation modules



SAM connector (harness side)

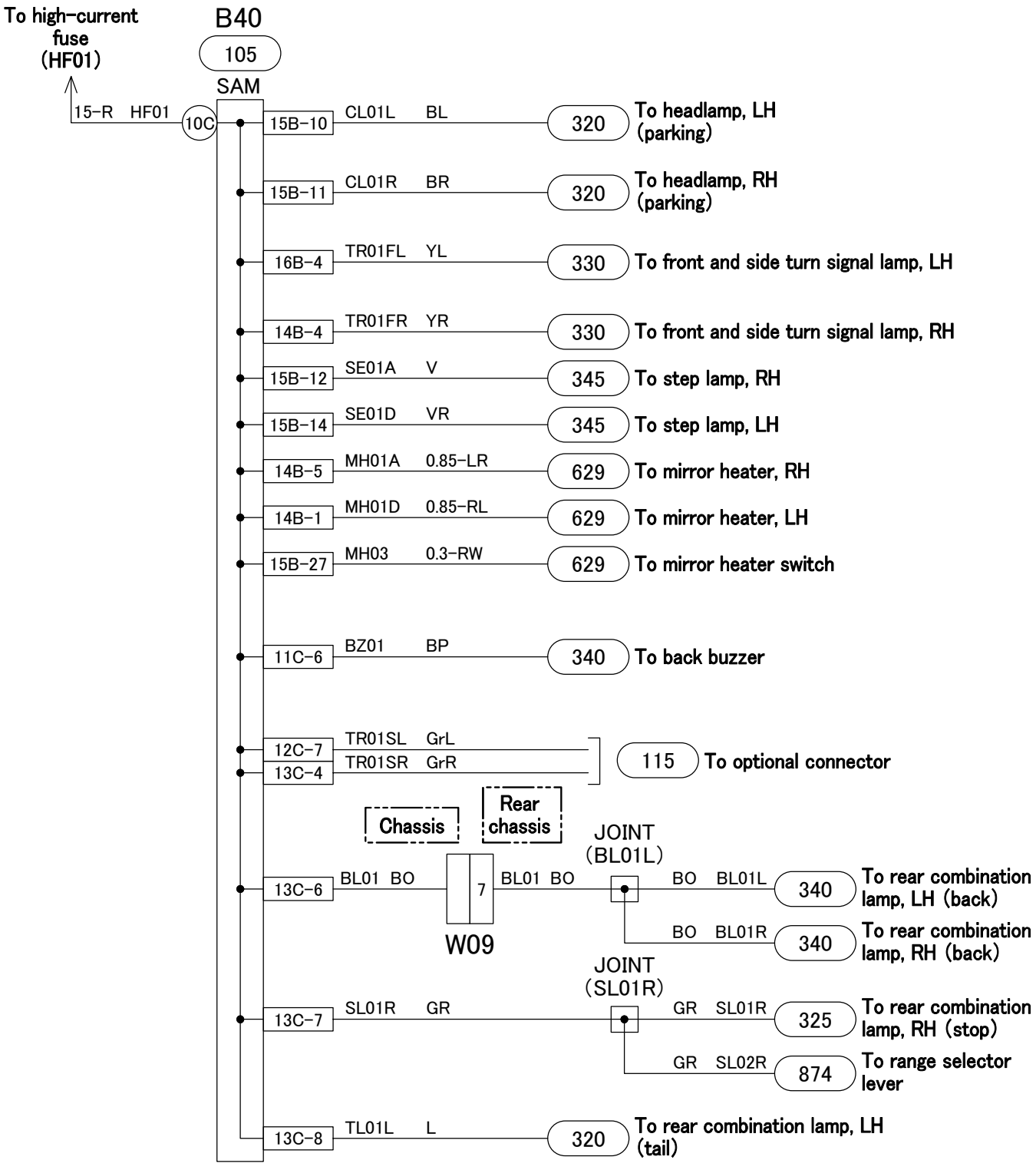


110-C10238EB

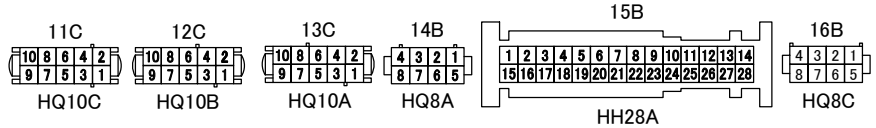
M E M O

SAM
(VEHICLE BAT)1/3

SAM : Signal detect and actuation modules



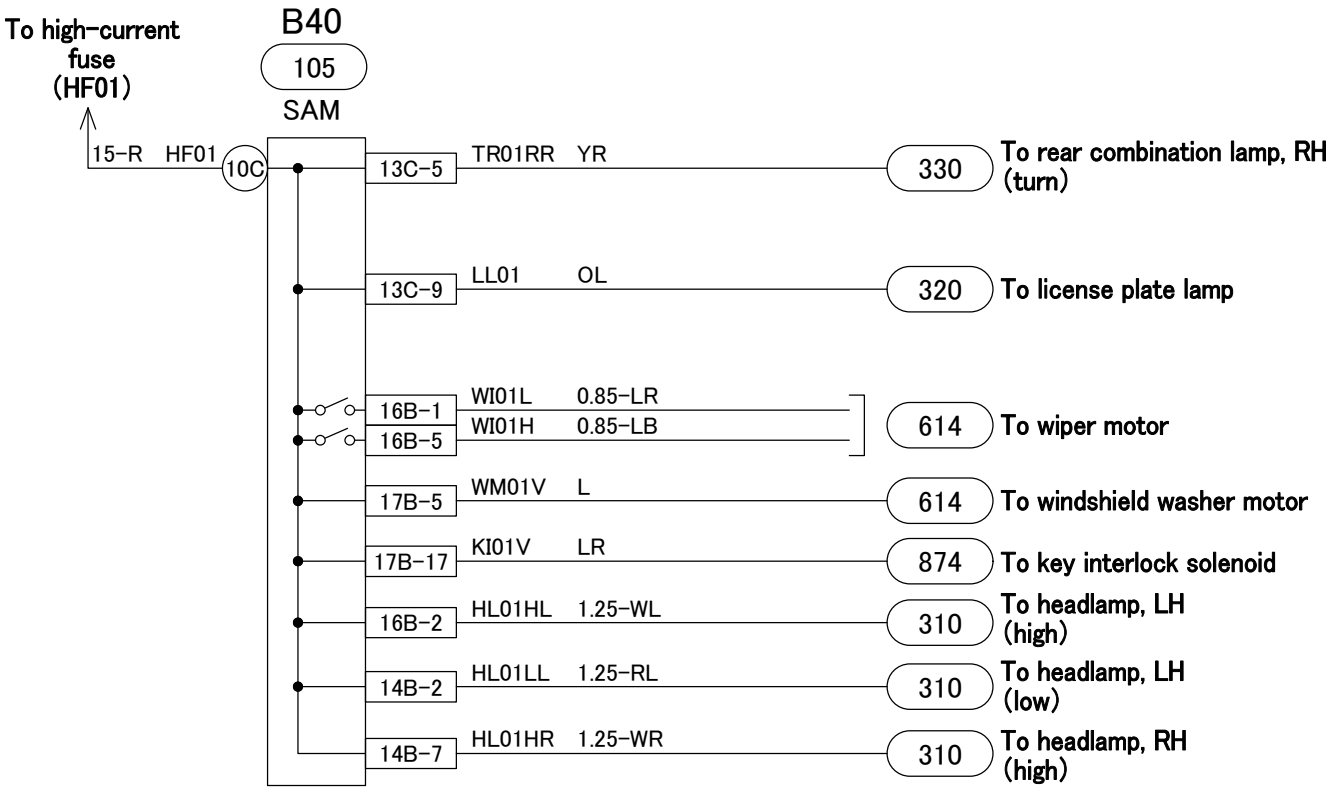
SAM connector (harness side)



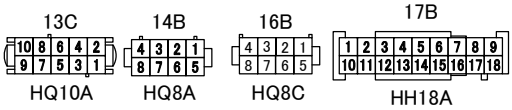
110-C10238VB-1

SAM
(VEHICLE BAT)2/3

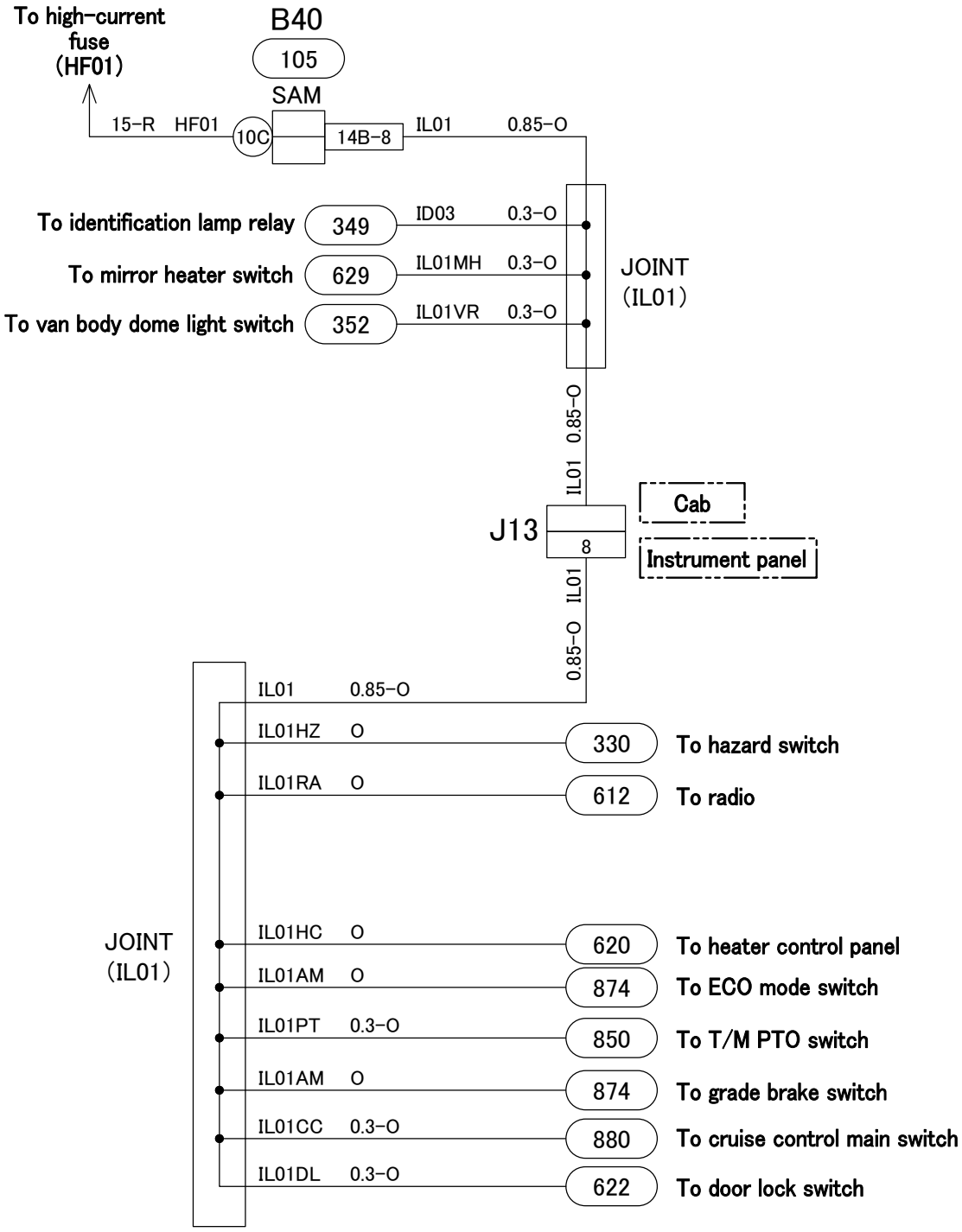
SAM : Signal detect and actuation modules



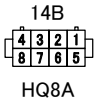
SAM connector (harness side)



SAM
(VEHICLE BAT)3/3



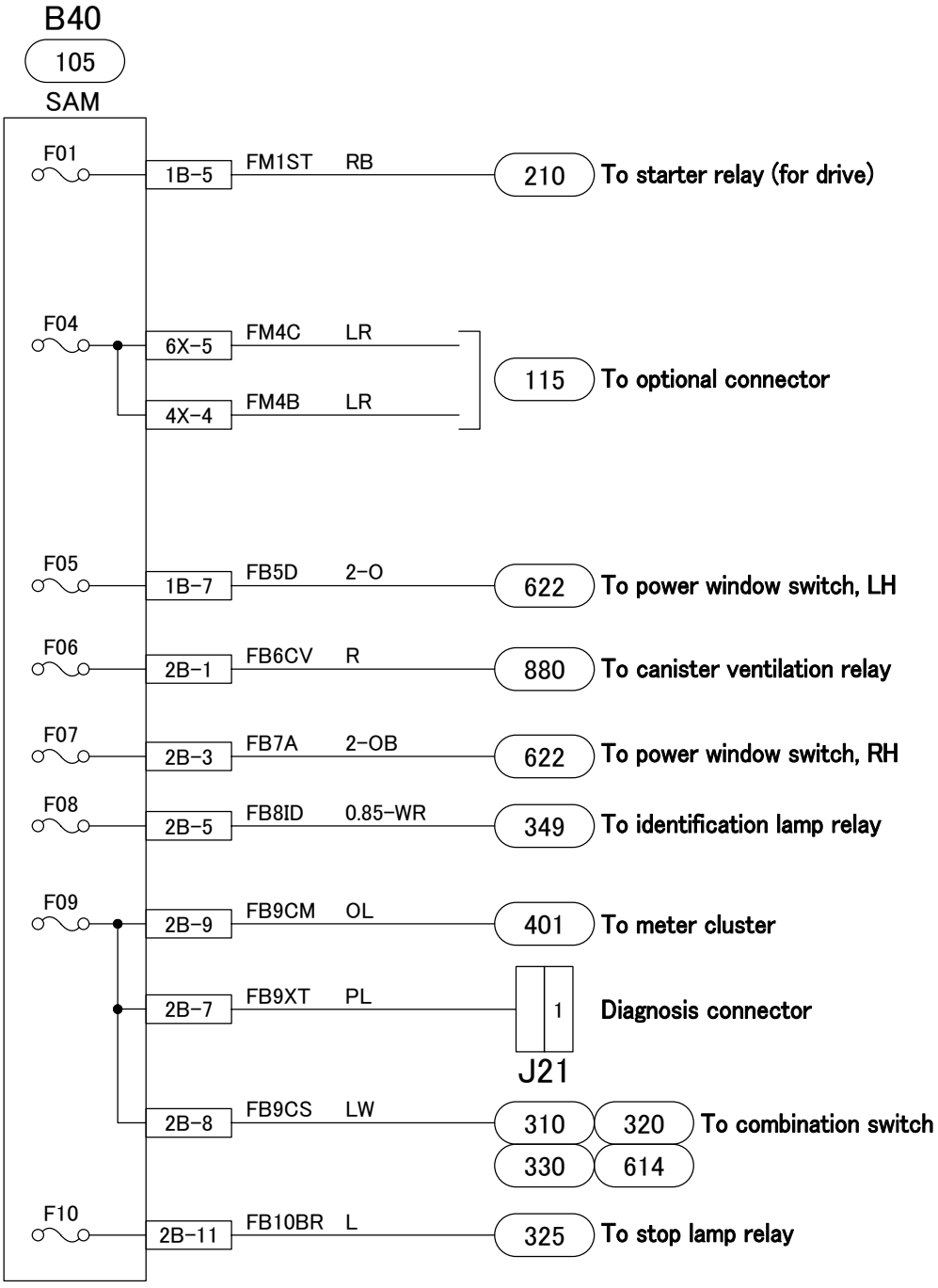
SAM connector (harness side)



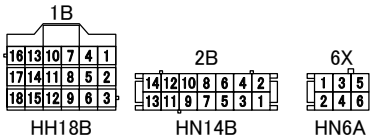
SAM : Signal detect and actuation modules
ECU : Electronic control unit
T/M : Transmission
PTO : Power take-off

110-C10238VB-3

SAM
(Fuse F01 to F10)



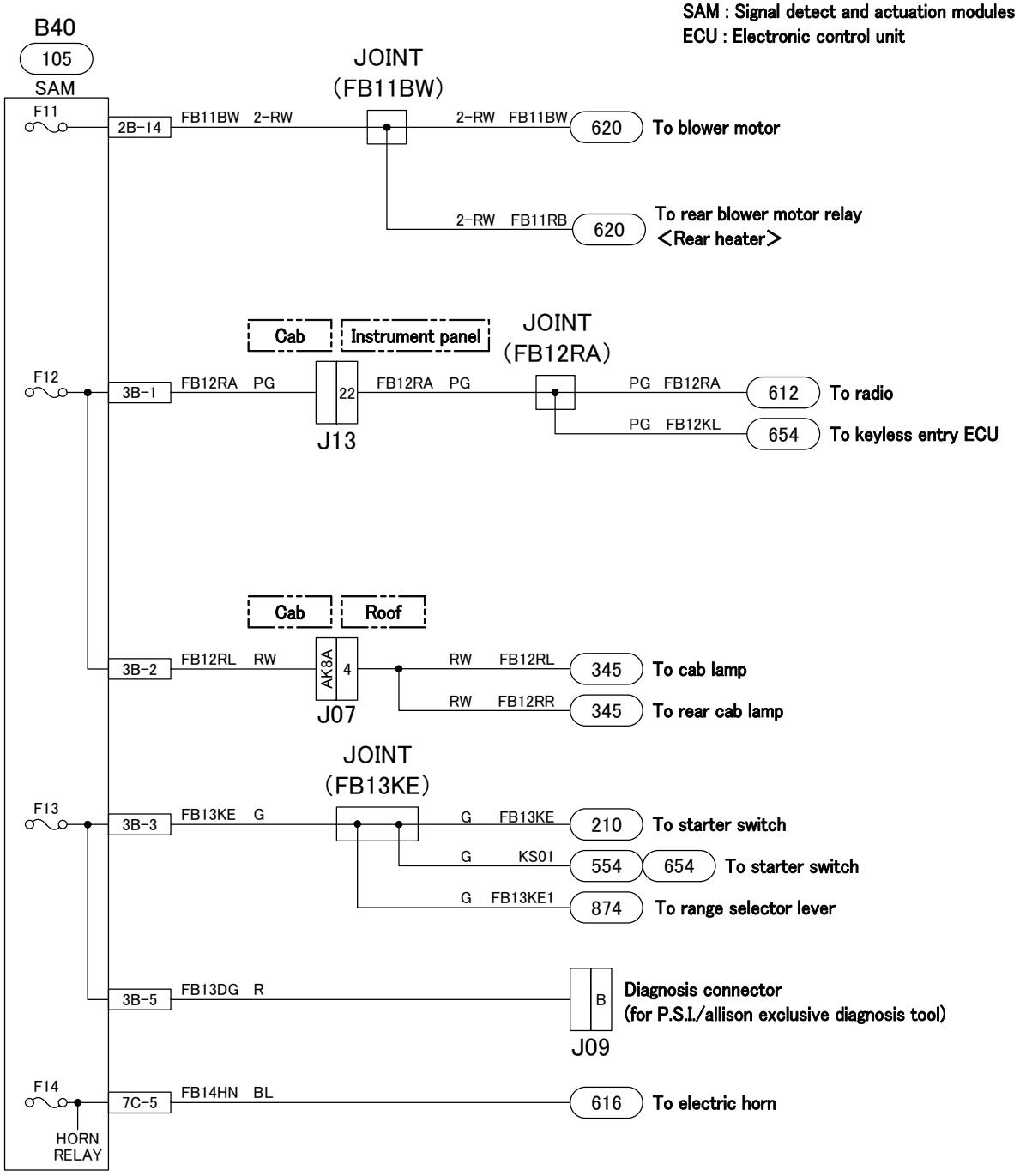
SAM connector (harness side)



SAM : Signal detect and actuation modules
ECU: Electronic control unit

110-C10238F01

SAM
(Fuse F11 to F14)

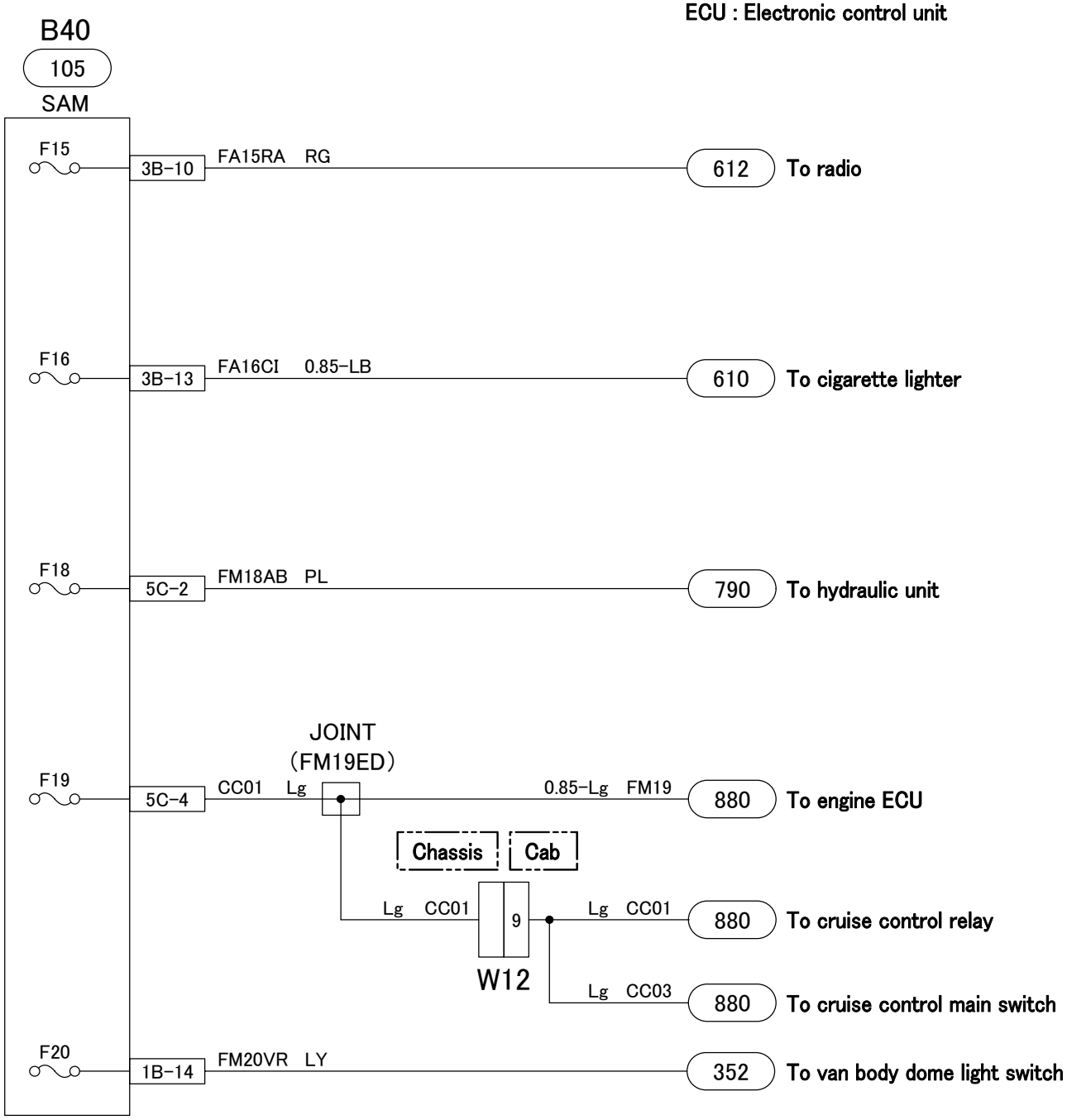


SAM connector (harness side)

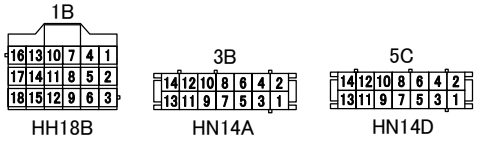
110-C10238F11

SAM
(Fuse F15 to F20)

SAM : Signal detect and actuation modules
ECU : Electronic control unit



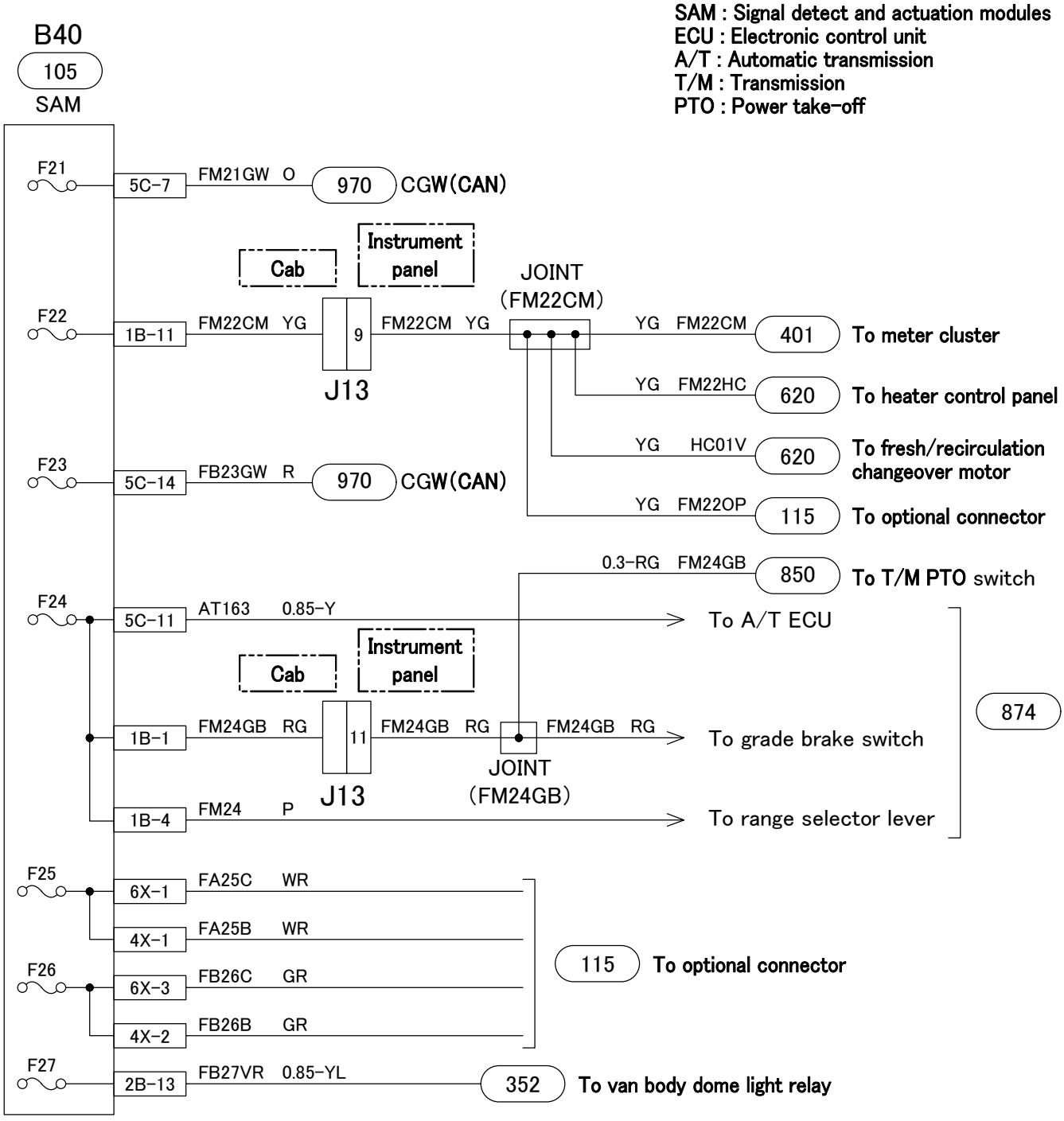
SAM connector (harness side)



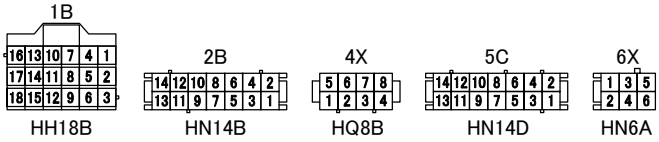
110-C10238F15

SAM
(Fuse F21 to F27)

CAN : Controller area network
SAM : Signal detect and actuation modules
ECU : Electronic control unit
A/T : Automatic transmission
T/M : Transmission
PTO : Power take-off

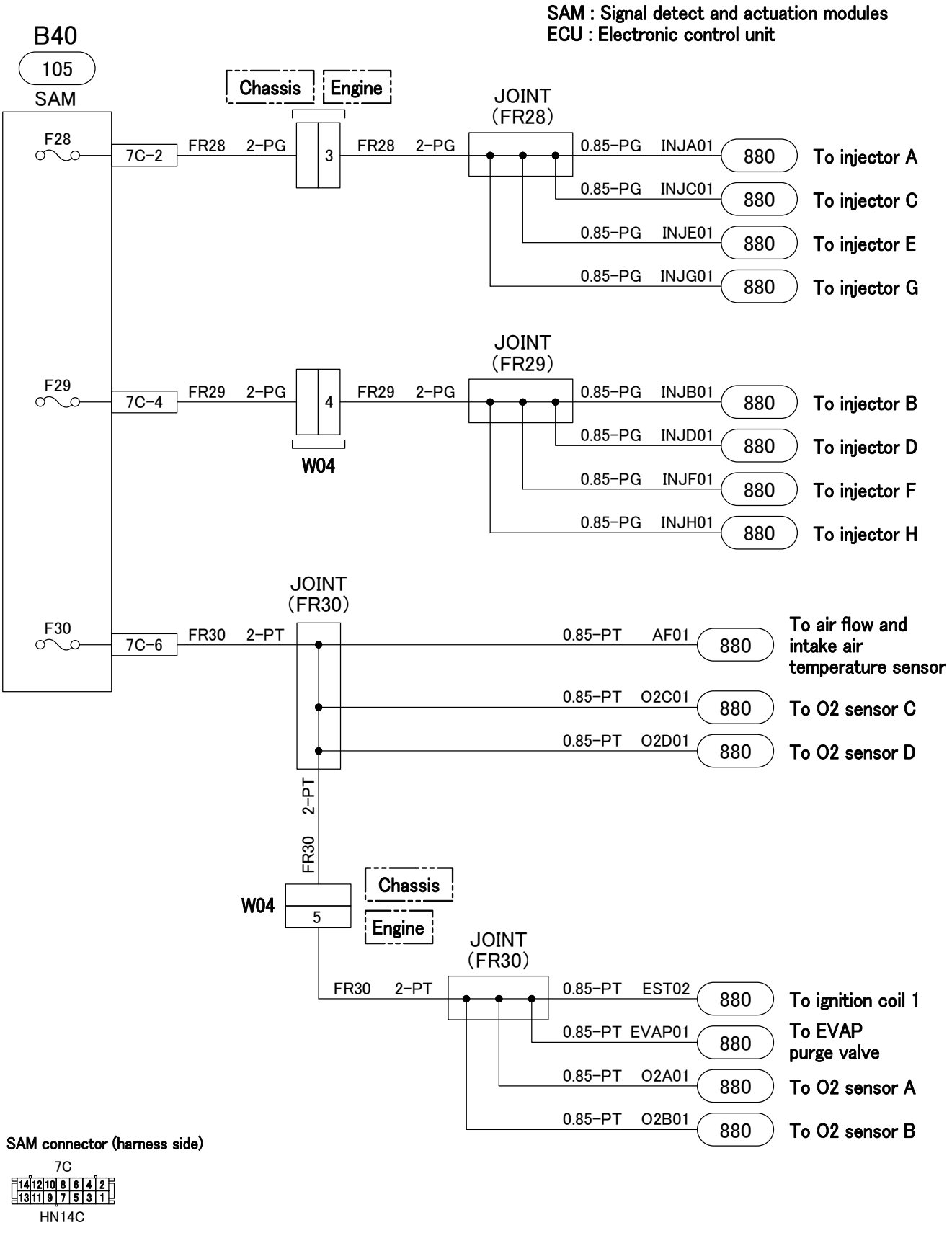


SAM connector (harness side)



110-C10238F22

SAM
(Fuse F28 to F30)

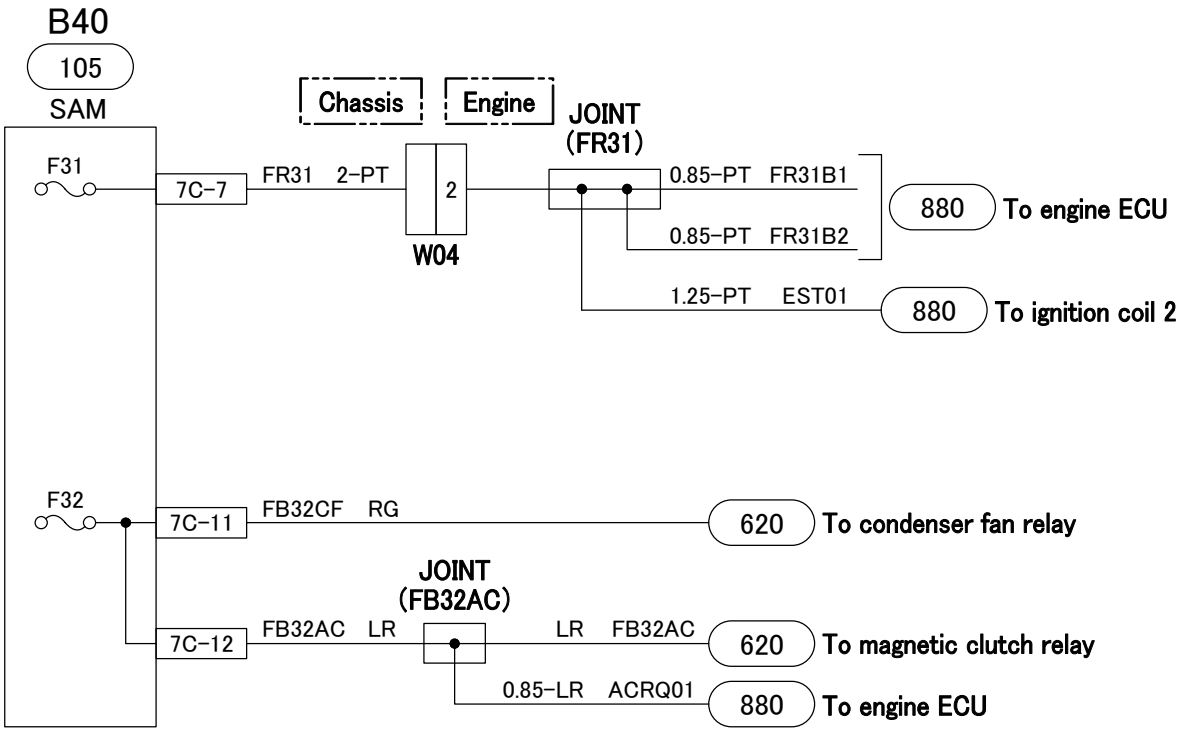


SAM connector (harness side)

110-C10238F28

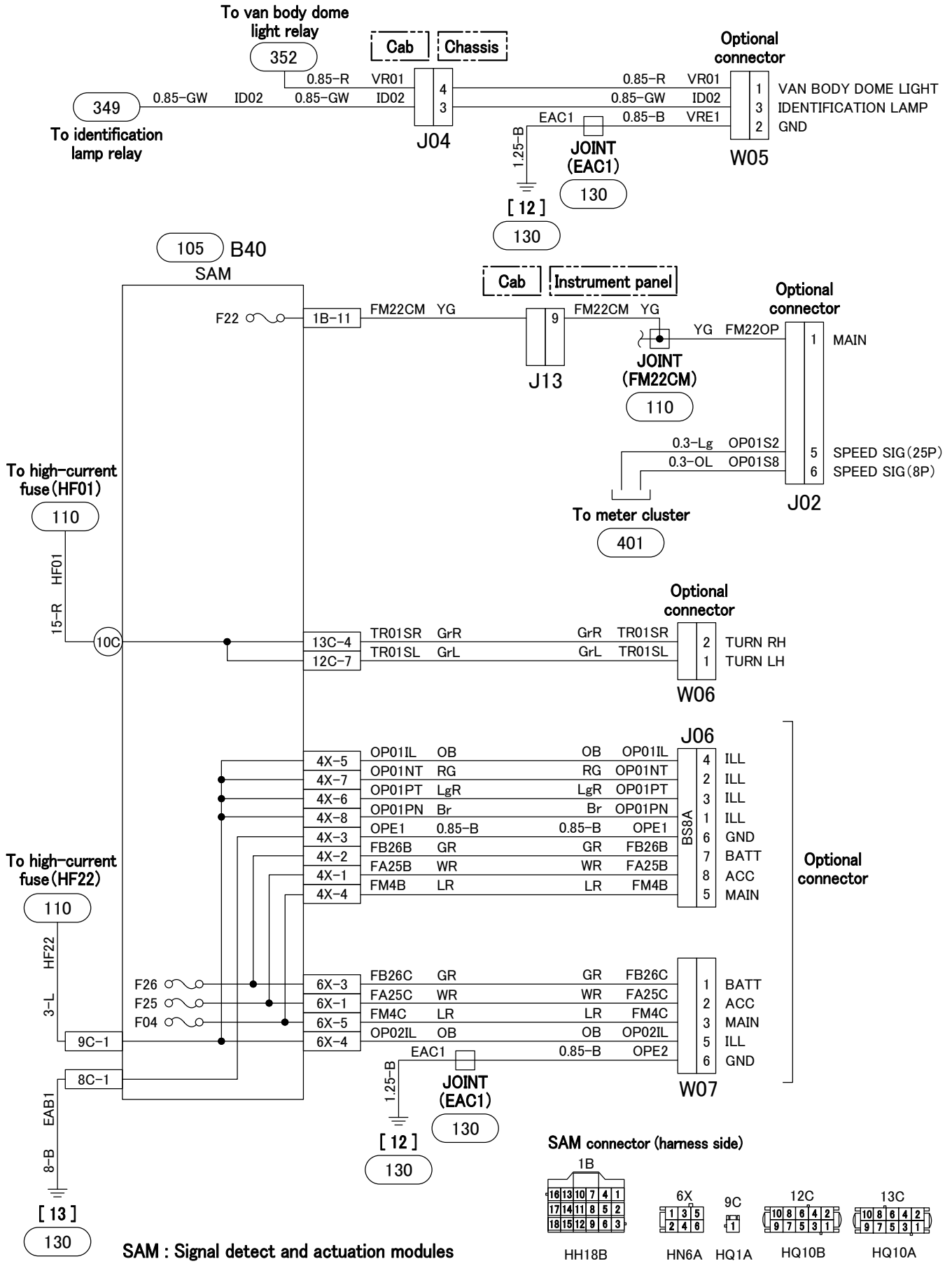
SAM
(Fuse F31 to F32)

SAM : Signal detect and actuation modules
ECU : Electronic control unit



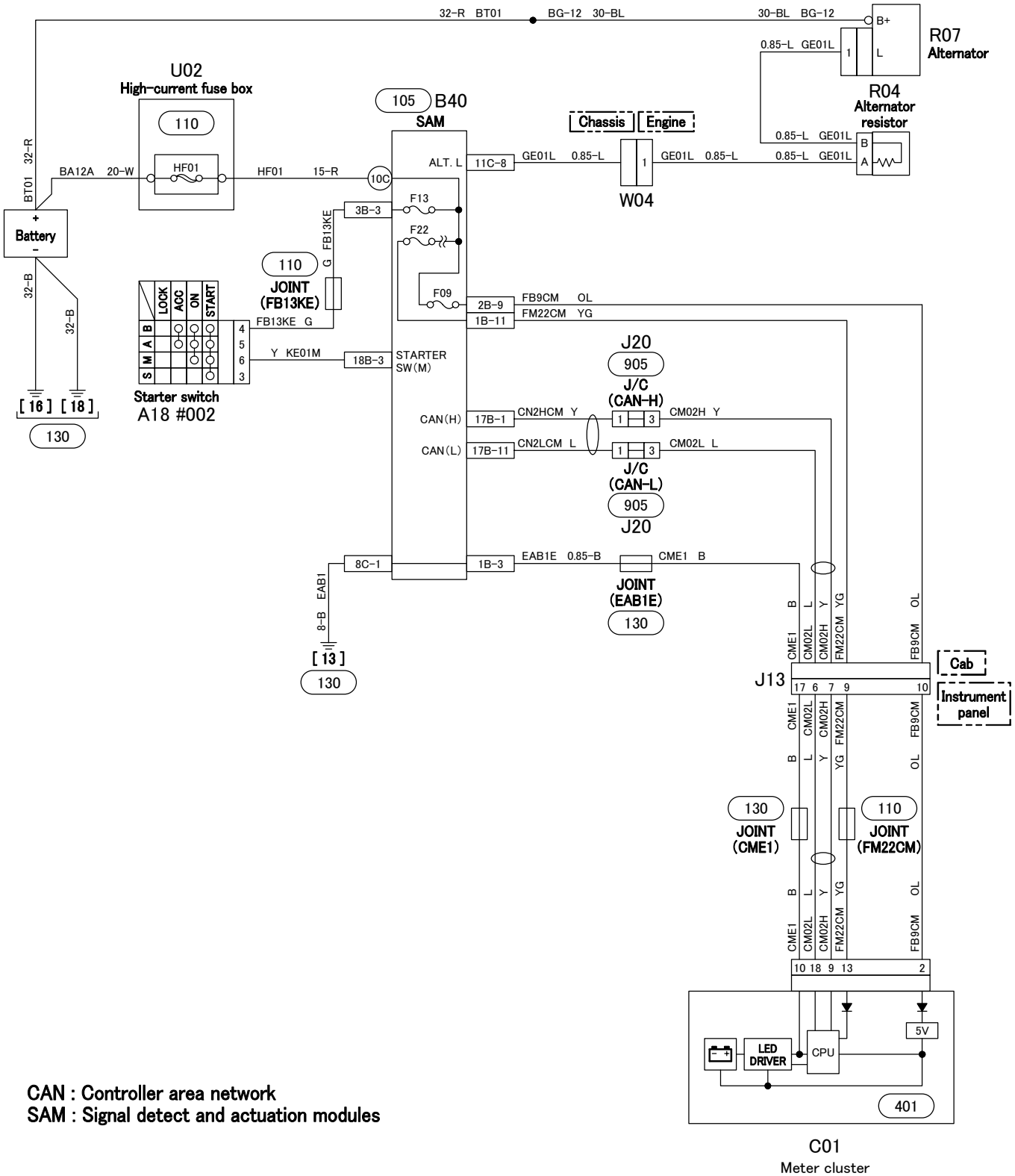
SAM connector (harness side)

110-C10238F31


To van body dome light relay
352
Cab
Chassis
Optional connector
0.85-R VR01
0.85-R VR01
VAN BODY DOME LIGHT
349
0.85-GW ID02
0.85-GW ID02
0.85-GW ID02
IDENTIFICATION LAMP
To identification lamp relay
EAC1
0.85-B VRE1
GND
J04
W05
1.25-B
JOINT (EAC1)
130
[12]
130
105 B40
SAM
Cab
Instrument panel
Optional connector
F22
1B-11
FM22CM YG
FM22CM YG
YG FM22OP
MAIN
J13
JOINT (FM22CM)
110
0.3-Lg OP01S2
0.3-OL OP01S8
SPEED SIG(25P)
SPEED SIG(8P)
J02
To meter cluster
401
To high-current fuse(HF01)
110
HF01
15-R
10C
Optional connector
13C-4
12C-7
TR01SR GrR
TR01SL GrL
GrR TR01SR
GrL TR01SL
TURN RH
TURN LH
W06
J06
4X-5
4X-7
4X-6
4X-8
4X-3
4X-2
4X-1
4X-4
OP01IL OB
OP01NT RG
OP01PT LgR
OP01PN Br
OPE1 0.85-B
FB26B GR
FA25B WR
FM4B LR
OB OP01IL
RG OP01NT
LgR OP01PT
Br OP01PN
0.85-B OPE1
GR FB26B
WR FA25B
LR FM4B
BS8A
ILL
ILL
ILL
ILL
GND
BATT
ACC
MAIN
Optional connector
To high-current fuse(HF22)
110
HF22
3-L
9C-1
8C-1
EAB1
8-B
[13]
130
F26
F25
F04
6X-3
6X-1
6X-5
6X-4
FB26C GR
FA25C WR
FM4C LR
OP02IL OB
GR FB26C
WR FA25C
LR FM4C
OB OP02IL
BATT
ACC
MAIN
ILL
GND
EAC1
0.85-B OPE2
W07
1.25-B
JOINT (EAC1)
130
[12]
130
SAM connector (harness side)
1B
6X
9C
12C
13C
HH18B
HN6A
HQ1A
HQ10B
HQ10A
SAM : Signal detect and actuation modules

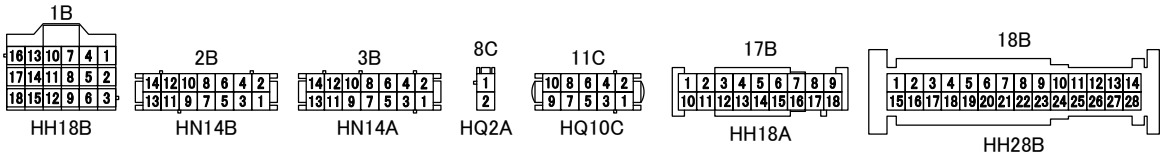
115-C10238

125 BATTERY CHARGING CIRCUIT



CAN : Controller area network
SAM : Signal detect and actuation modules

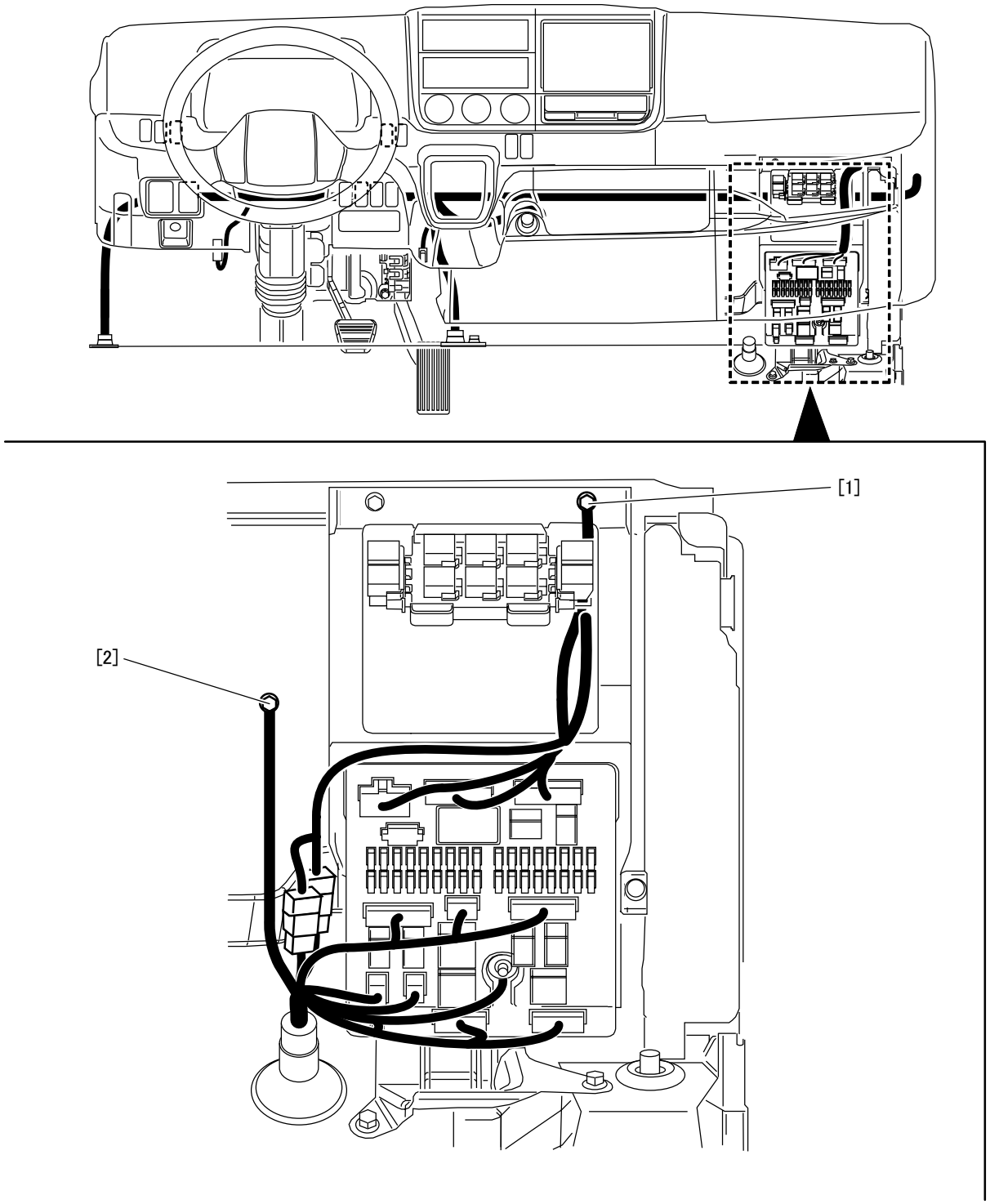
SAM connector (harness side)



125-C10238

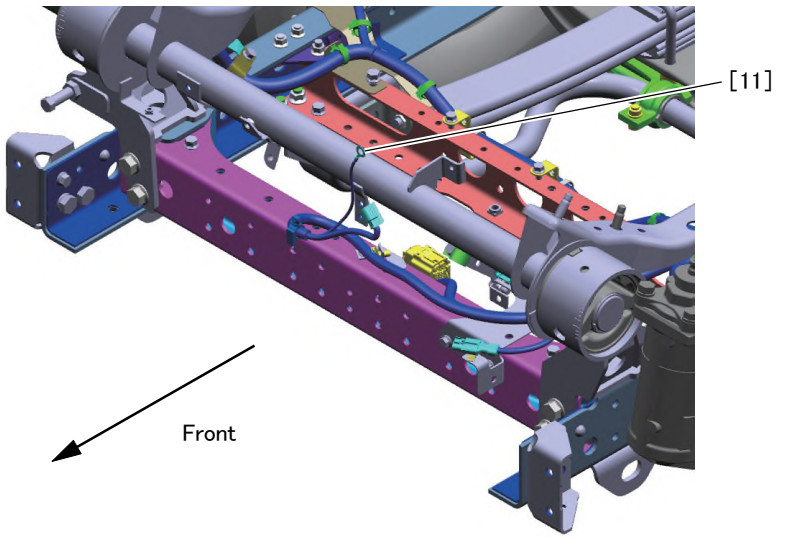
M E M O

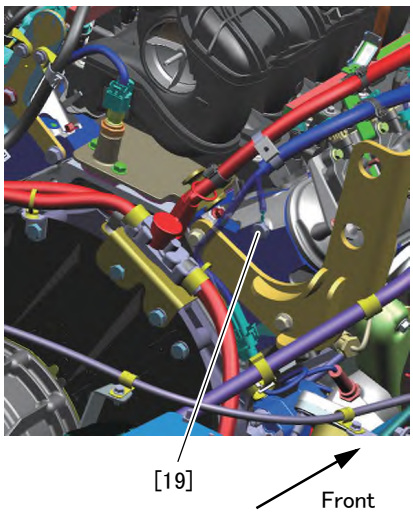
[1] to [2] Cab ground

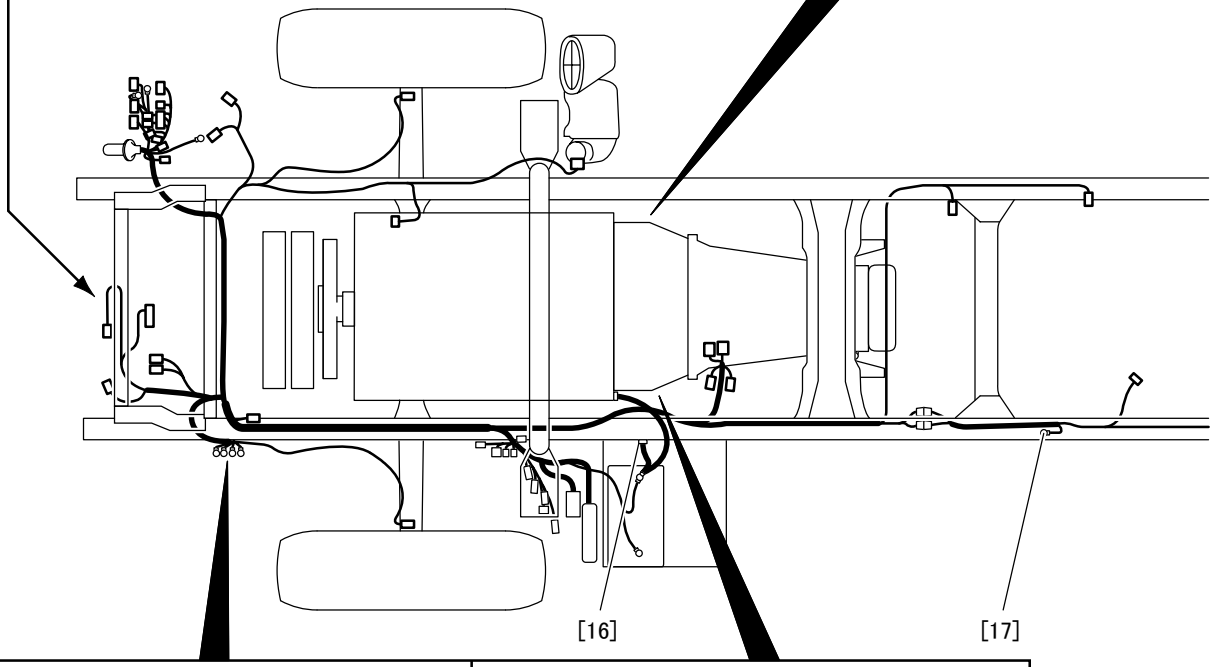


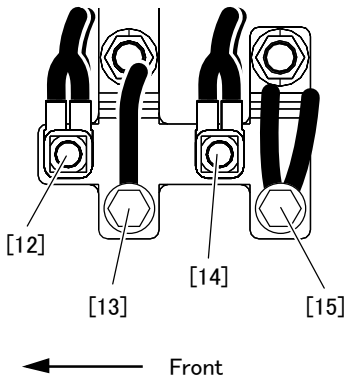
Location	Circuit No.	Wire diameter – wire color	Destination	Remarks
[1]	EAB2	1.25-B	JOINT (EAB2)	
[2]	EAB3	1.25-B	Frame ground ([12])	

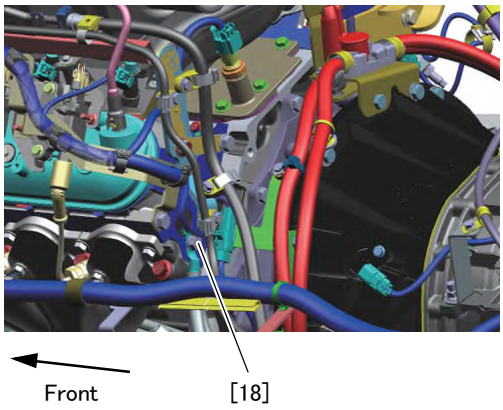
[11] to [19] Chassis ground











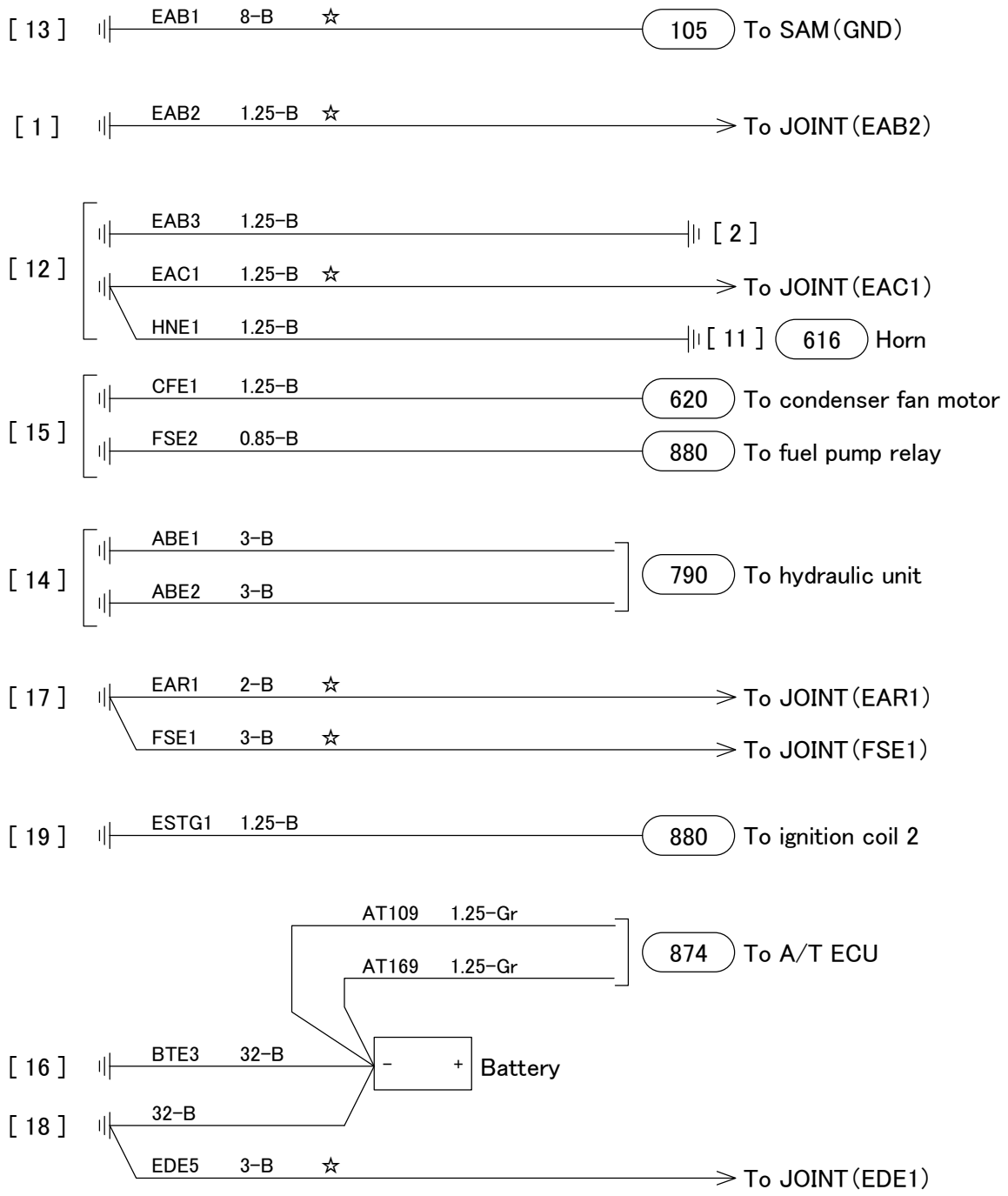
Location	Circuit No.	Wire diameter – wire color	Destination	Remarks
[11]	HNE1	1.25-B	Frame ground ([12])	Horn
[12]	EAB3	1.25-B	Cab ground ([2])	
	EAC1	1.25-B	JOINT (EAC1)	
	HNE1	1.25-B	Horn ground	
[13]	EAB1	8-B	SAM	
[14]	ABE1	3-B	Hydraulic unit	ABS
	ABE2	3-B		
[15]	CFE1	1.25-B	Condenser fan motor	
	FSE2	0.85-B	Fuel pump relay	
[16]	—	32-B	Battery	
[17]	EAR1	2-B	JOINT (EAR1)	
	FSE1	3-B	JOINT (FSE1)	
[18]	EDE5	3-B	JOINT (EDE1)	
	—	32-B	Battery	
[19]	ESTG1	1.25-B	Ignition coil 2	

SAM : Signal detect and actuation modules
ABS : Anti-lock brake system
ECU : Electronic control unit

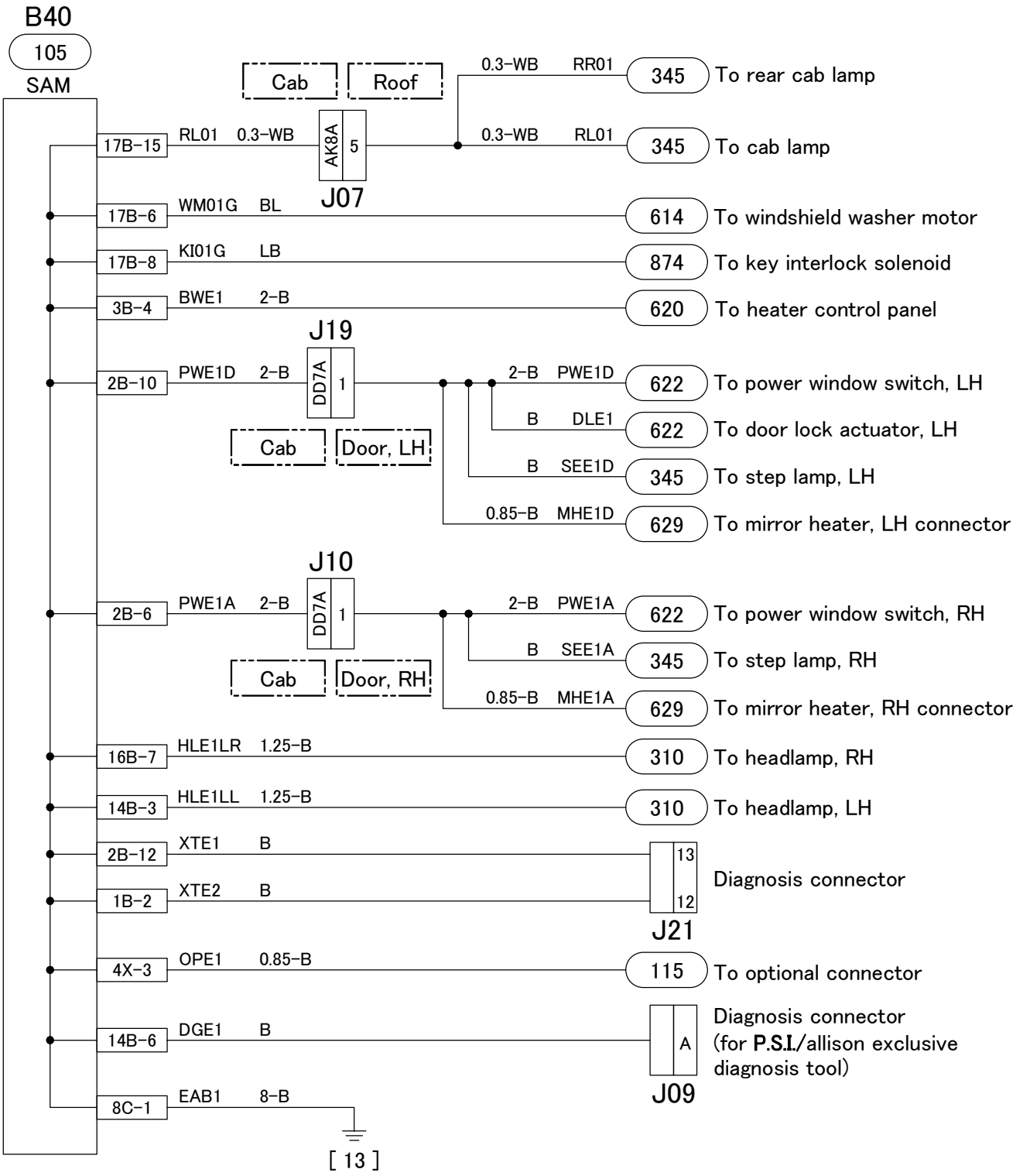
Entire ground

- This diagram indicates grounding points.
- See the following pages for branching of grounding (wiring for ☆). (in circuit No. order)

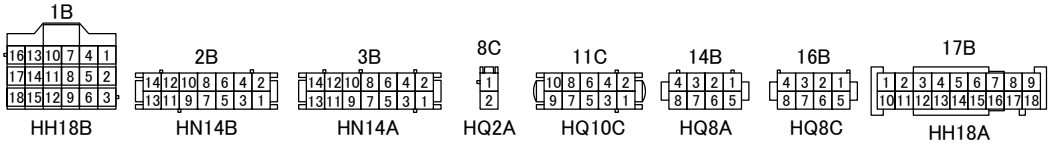
A/T : Automatic transmission
ECU : Electronic control unit
SAM : Signal detect and actuation modules



Circuit No. EAB1 ground (1/6)



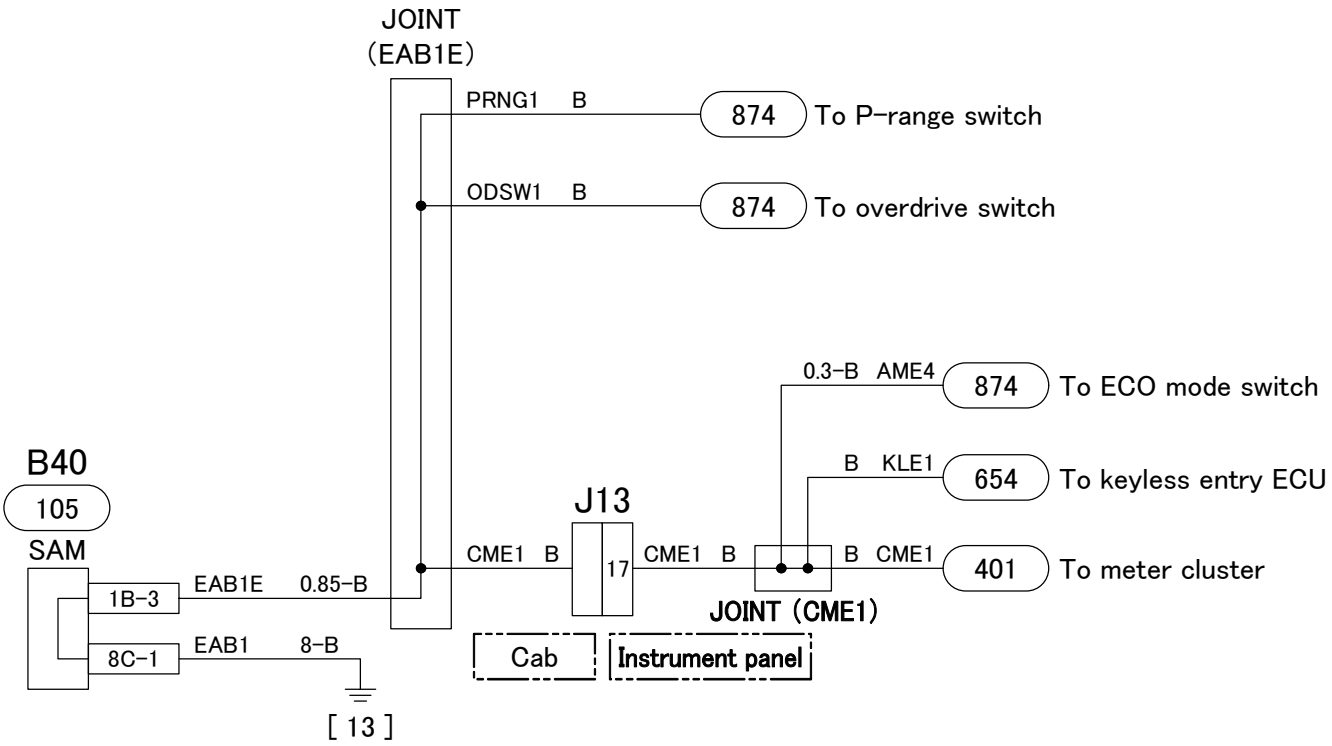
SAM connector (harness side)



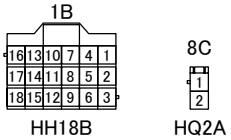
130-C10238EAB1-1

Circuit No. EAB1 ground (2/6)
＜JOINT(EAB1E)＞

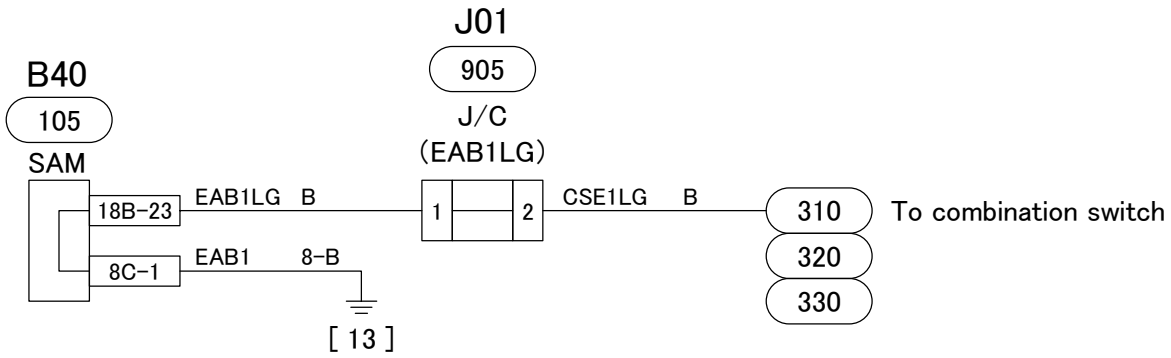
ECU : Electronic control unit



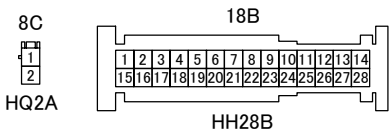
SAM connector (harness side)



Circuit No. EAB1 ground (3/6)
＜J/C(EAB1LG)＞

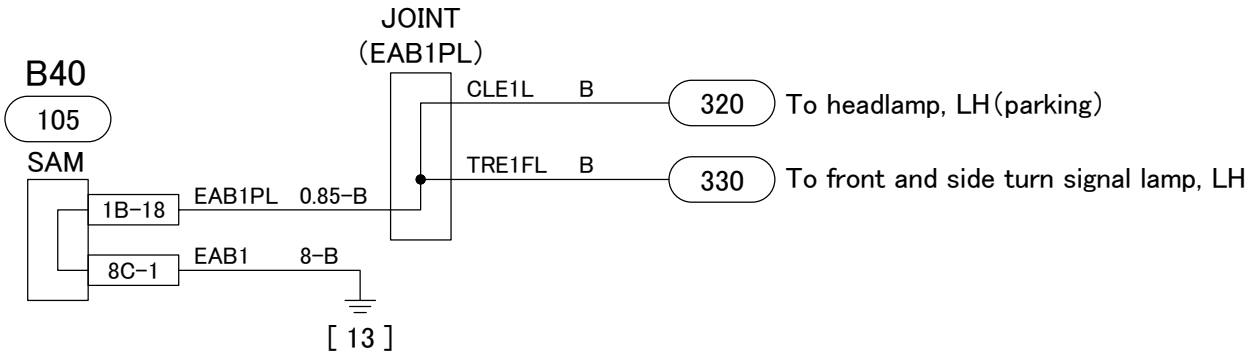


SAM connector (harness side)

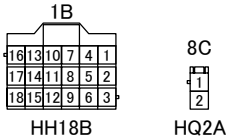


130-C10238EAB1-3

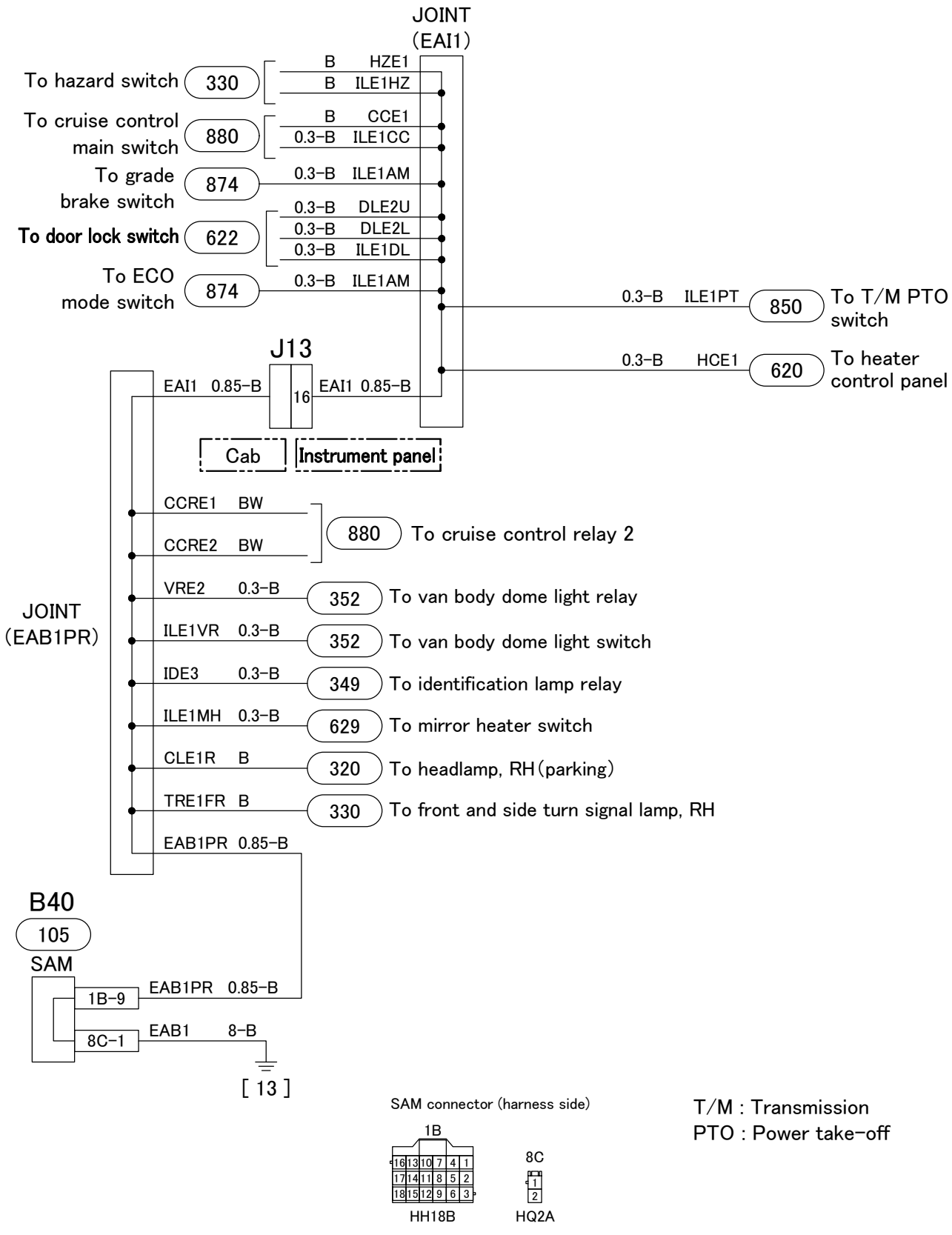
Circuit No. EAB1 ground (4/6)
＜JOINT(EAB1PL)＞



SAM connector (harness side)

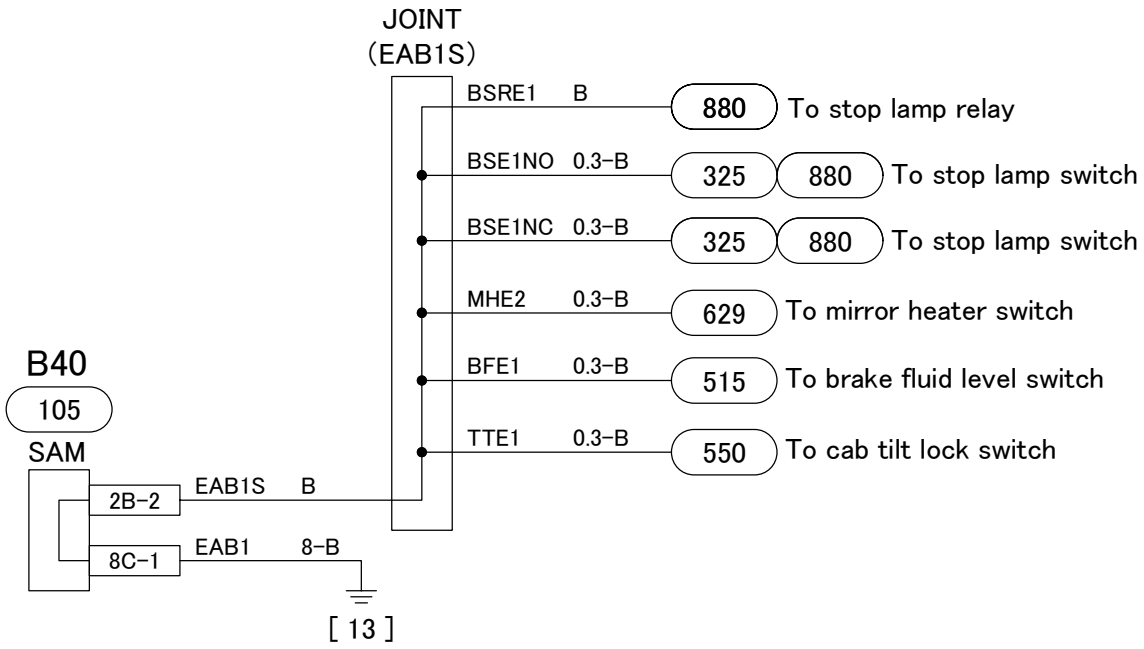


Circuit No. EAB1 ground (5/6)
＜JOINT(EAB1PR), JOINT(EAI1)＞

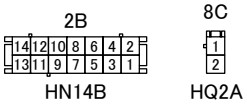


130-C10238EAB1-5

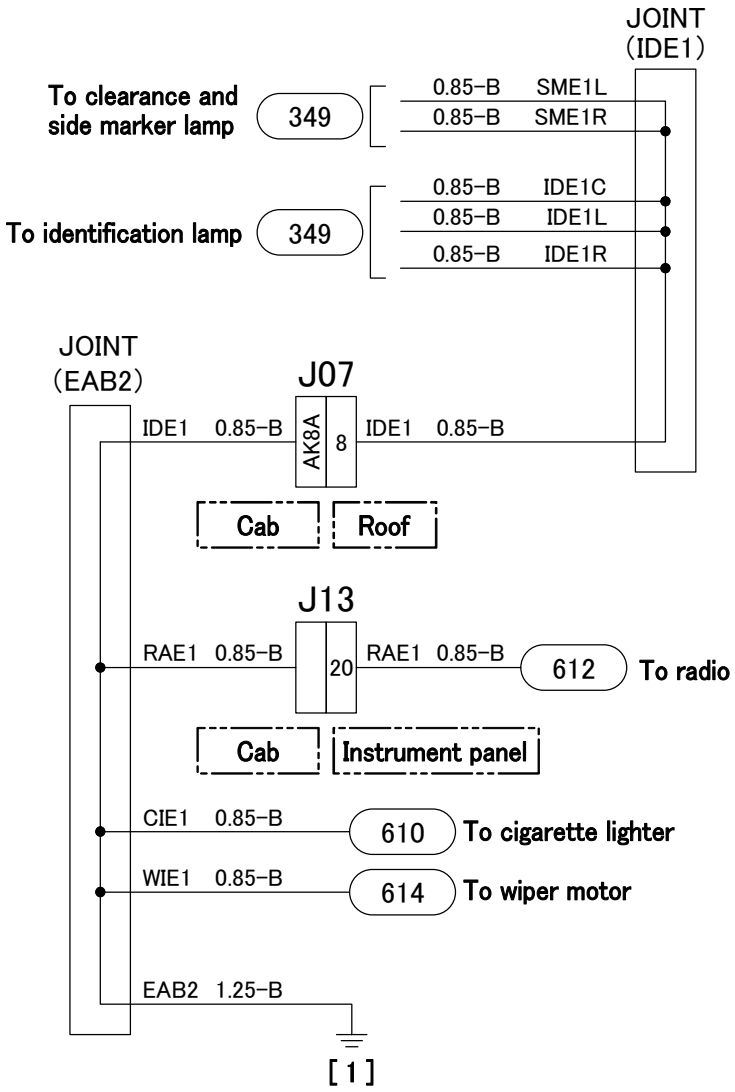
Circuit No. EAB1 ground (6/6)
＜JOINT(EAB1S)＞



SAM connector (harness side)



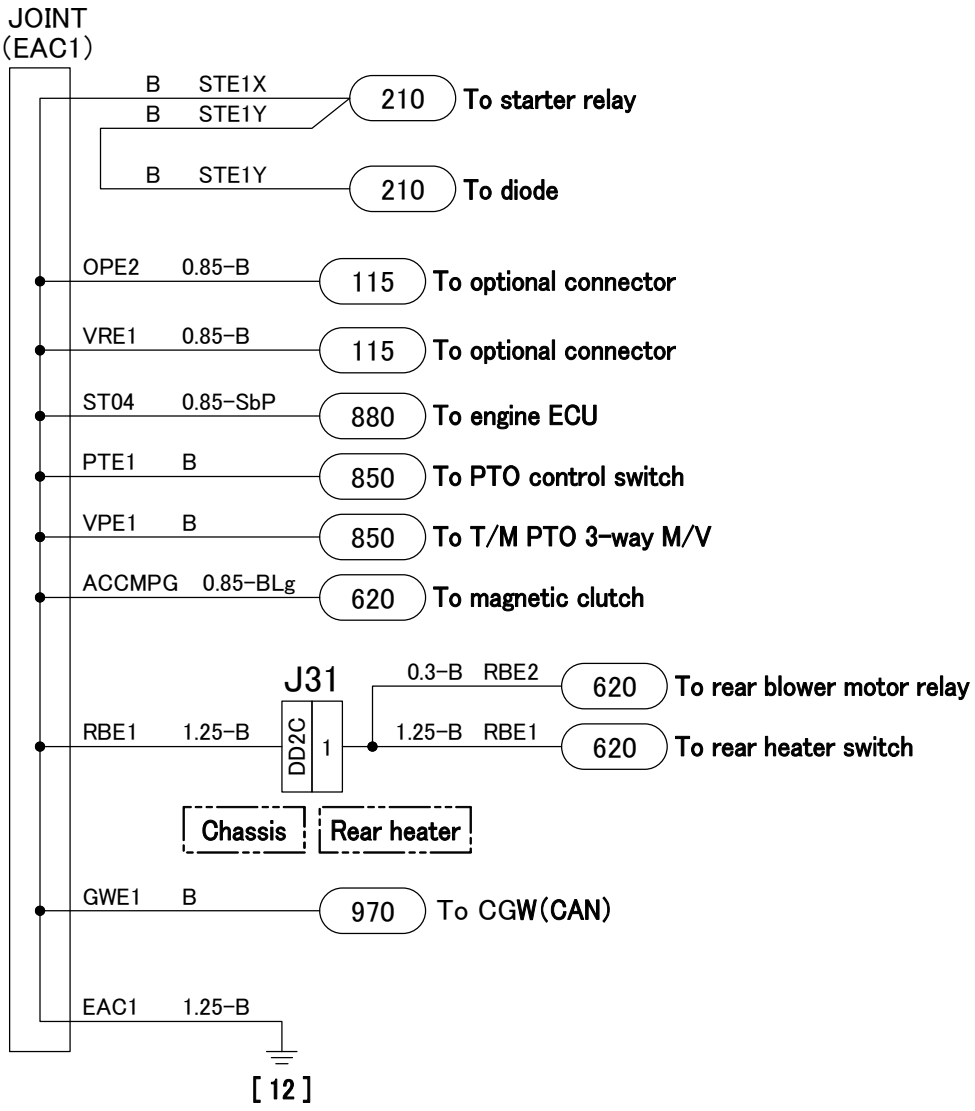
Circuit No. EAB2 ground



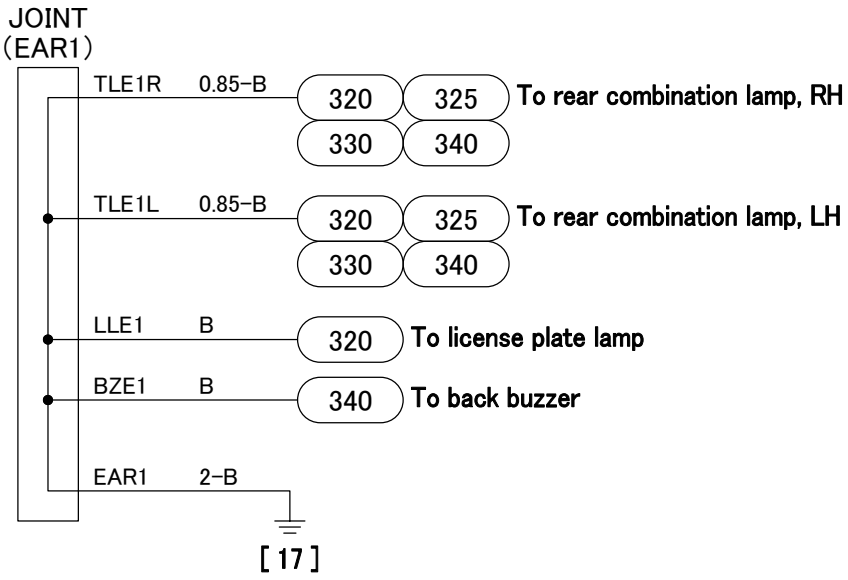
130-C10238EAB2

Circuit No. EAC1 ground

ECU : Electronic control unit
T/M : Transmission
PTO : Power take-off
M/V : Magnetic valve
CAN : Controller area network

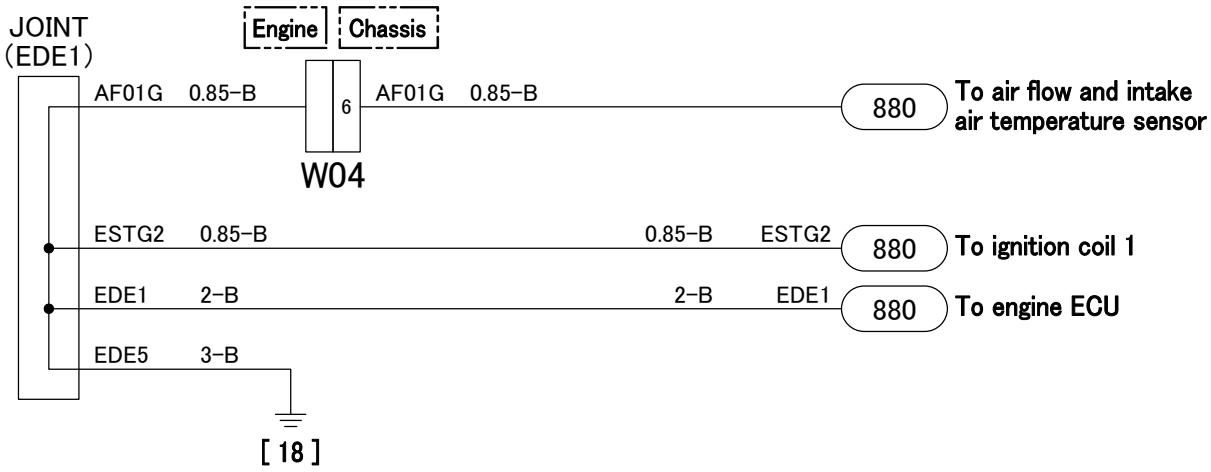


Circuit No. EAR1 ground

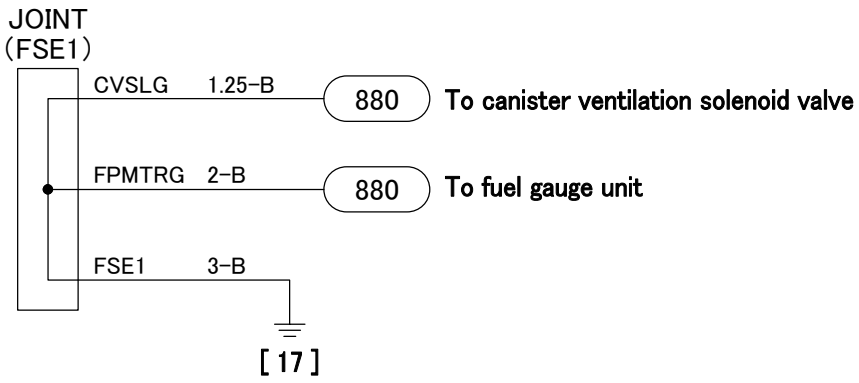


Circuit No. EDE1 ground

ECU : Electronic control unit

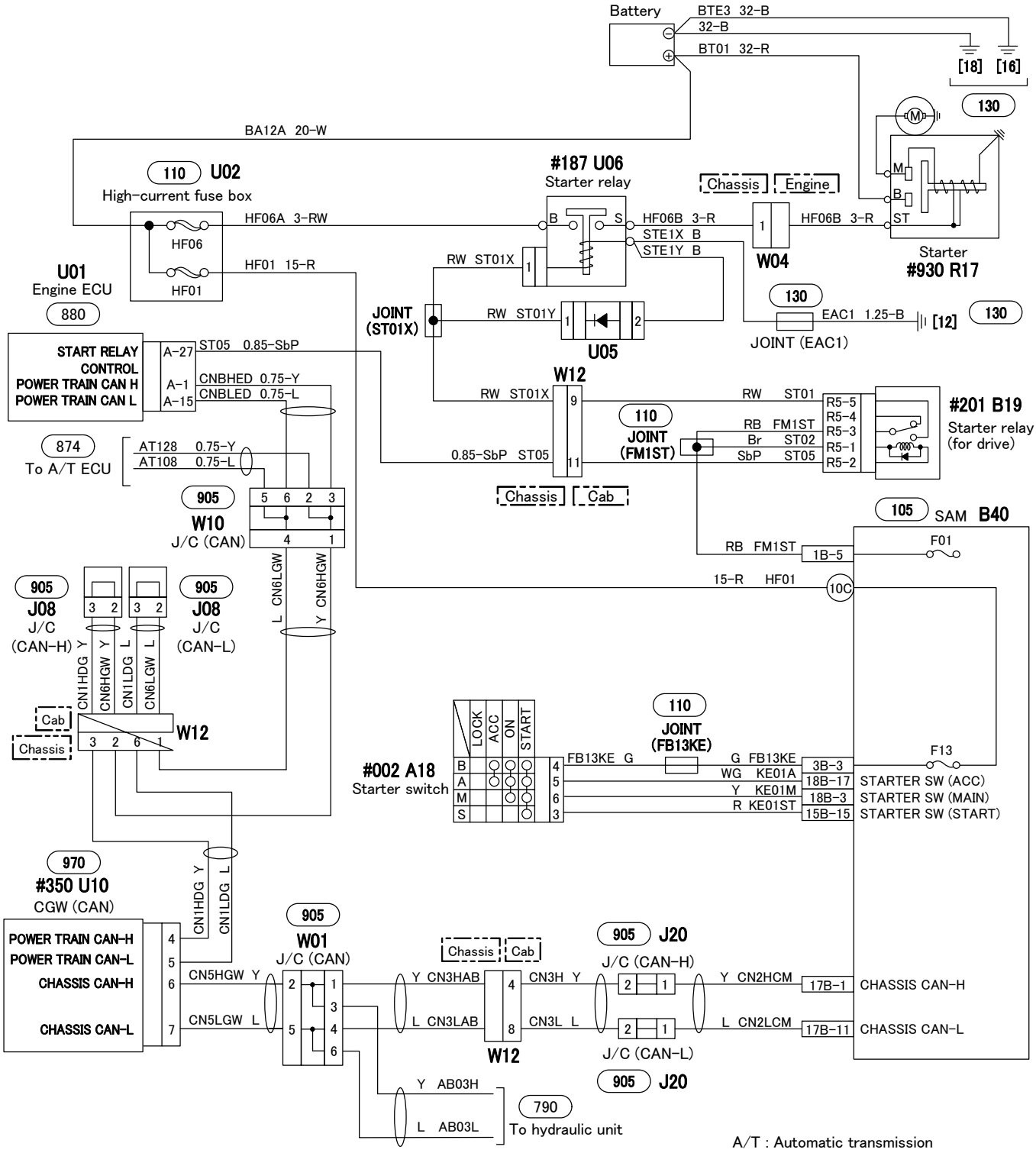


Circuit No. FSE1 ground



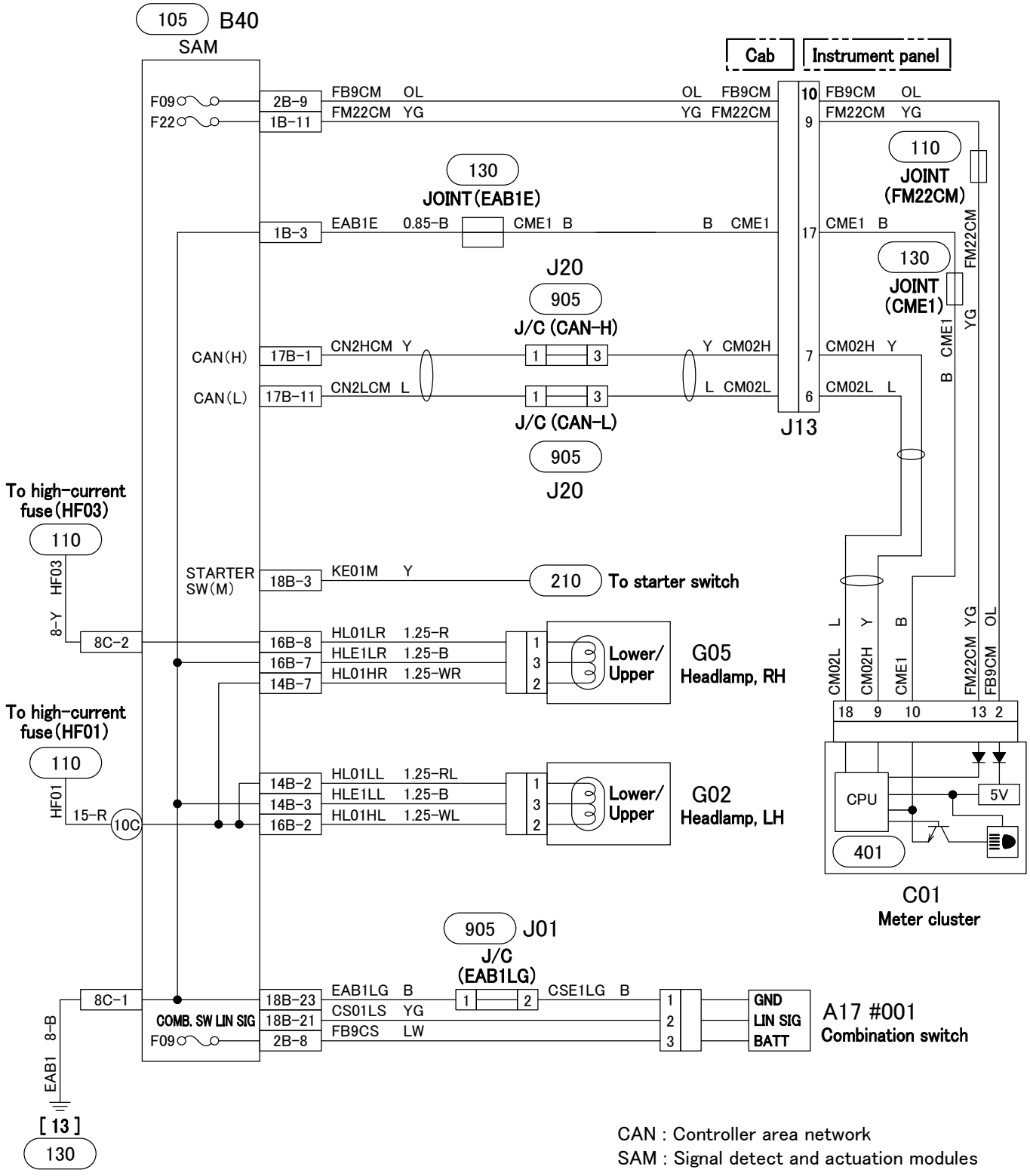
130-C10238FSE1

54-02 ENGINE STARTING, STOPPING AND PREHEATING CIRCUIT


Battery
BTE3 32-B
32-B
BT01 32-R
[18] [16]
130
BA12A 20-W
110 U02
High-current fuse box
HF06A 3-RW
HF06
HF01
HF01 15-R
U01
Engine ECU
880
START RELAY CONTROL
POWER TRAIN CAN H
POWER TRAIN CAN L
A-27
A-1
A-15
ST05 0.85-SbP
CNBHED 0.75-Y
CNBLED 0.75-L
874
To A/T ECU
AT128 0.75-Y
AT108 0.75-L
905
W10
J/C (CAN)
5 6 2 3
4 1
L CN6LGW
Y CN6HGW
905
J08
J/C
(CAN-H)
905
J08
J/C
(CAN-L)
CN1HDG Y
CN6HGW Y
CN1LDG L
CN6LGW L
Cab
Chassis
W12
3 2 6 1
970
#350 U10
CGW (CAN)
POWER TRAIN CAN-H
POWER TRAIN CAN-L
CHASSIS CAN-H
CHASSIS CAN-L
4
5
6
7
CN1HDG Y
CN1LDG L
905
W01
J/C (CAN)
CN5HGW Y
CN5LGW L
2 1 3 4 5 6
#187 U06
Starter relay
B S
HF06A 3-RW
HF06B 3-R
STE1X B
STE1Y B
RW ST01X
1
Chassis Engine
1
W04
HF06B 3-R
ST
M
B
Starter
#930 R17
130
JOINT
(ST01X)
RW ST01Y
1 2
U05
130
EAC1 1.25-B
[12]
JOINT (EAC1)
W12
RW ST01X
9
0.85-SbP ST05
11
RW ST01
RB FM1ST
Br ST02
SbP ST05
R5-5
R5-4
R5-3
R5-1
R5-2
110
JOINT
(FM1ST)
#201 B19
Starter relay
(for drive)
Chassis Cab
105 SAM B40
F01
RB FM1ST
1B-5
15-R HF01
10C
110
JOINT
(FB13KE)
FB13KE G
G FB13KE
F13
#002 A18
Starter switch
LOCK
ACC
ON
START
B
A
M
S
4
5
6
3
WG KE01A
Y KE01M
R KE01ST
3B-3
18B-17
18B-3
15B-15
STARTER SW (ACC)
STARTER SW (MAIN)
STARTER SW (START)
905 J20
J/C (CAN-H)
Chassis Cab
Y CN3HAB
CN3H Y
Y CN2HCM
17B-1
CHASSIS CAN-H
L CN3LAB
CN3L L
L CN2LCM
17B-11
CHASSIS CAN-L
W12
J/C (CAN-L)
905 J20
Y AB03H
L AB03L
790
To hydraulic unit
A/T : Automatic transmission
CAN : Controller area network
ECU : Electronic control unit
SAM : Signal detect and actuation modules
SAM connector (harness side)
1B
HH18B
3B
HN14A
15B
HH28A
17B
HH18A
18B
HH28B

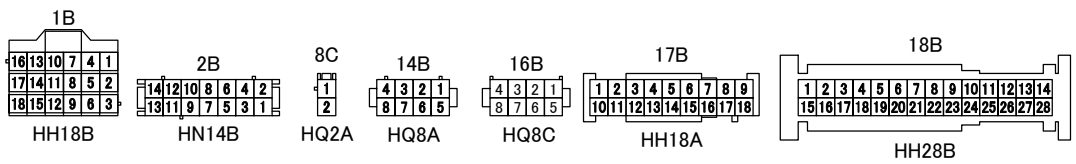
210-C10238

54-03 LIGHTING CIRCUIT

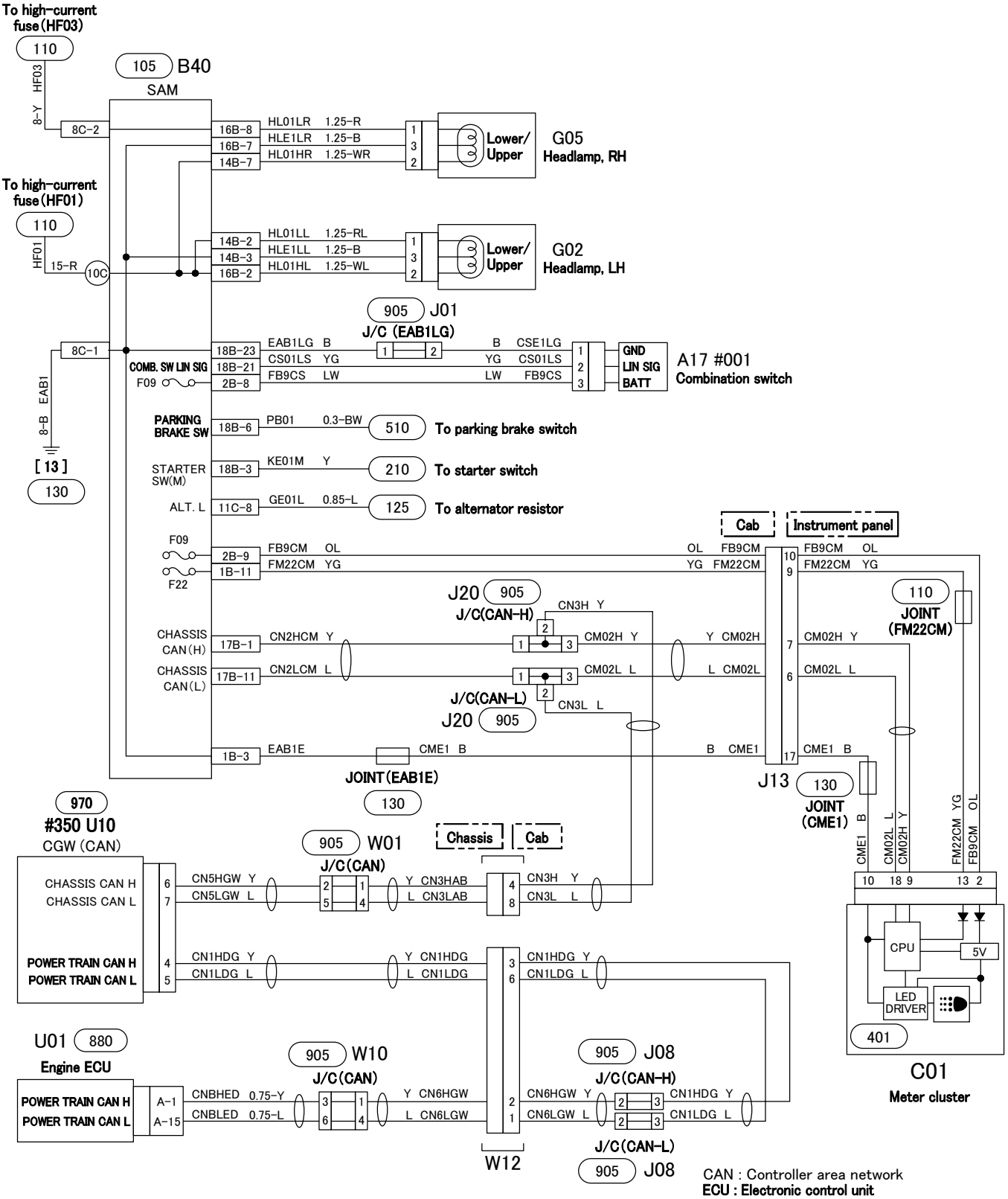


CAN : Controller area network
SAM : Signal detect and actuation modules

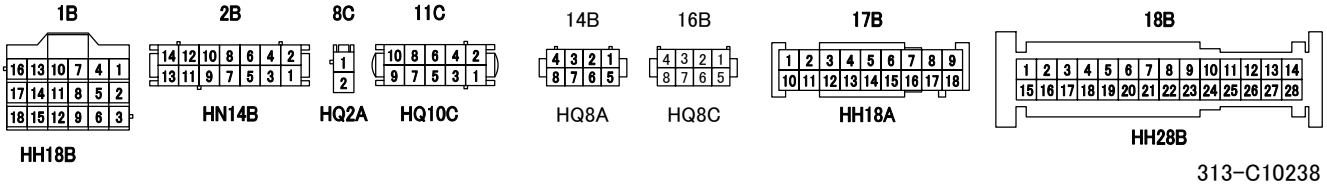
SAM connector (harness side)



310-C10238

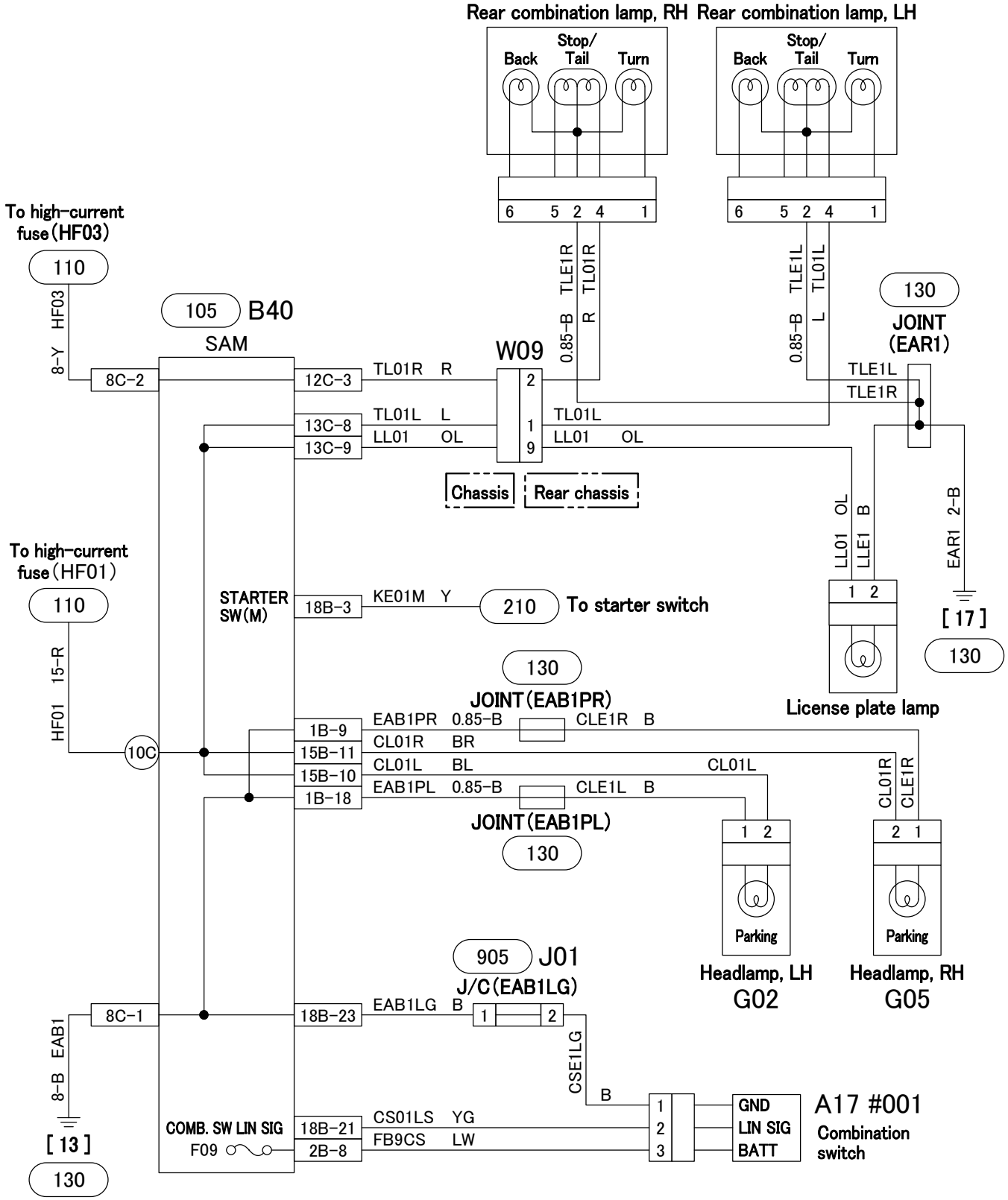


SAM connector (harness side)



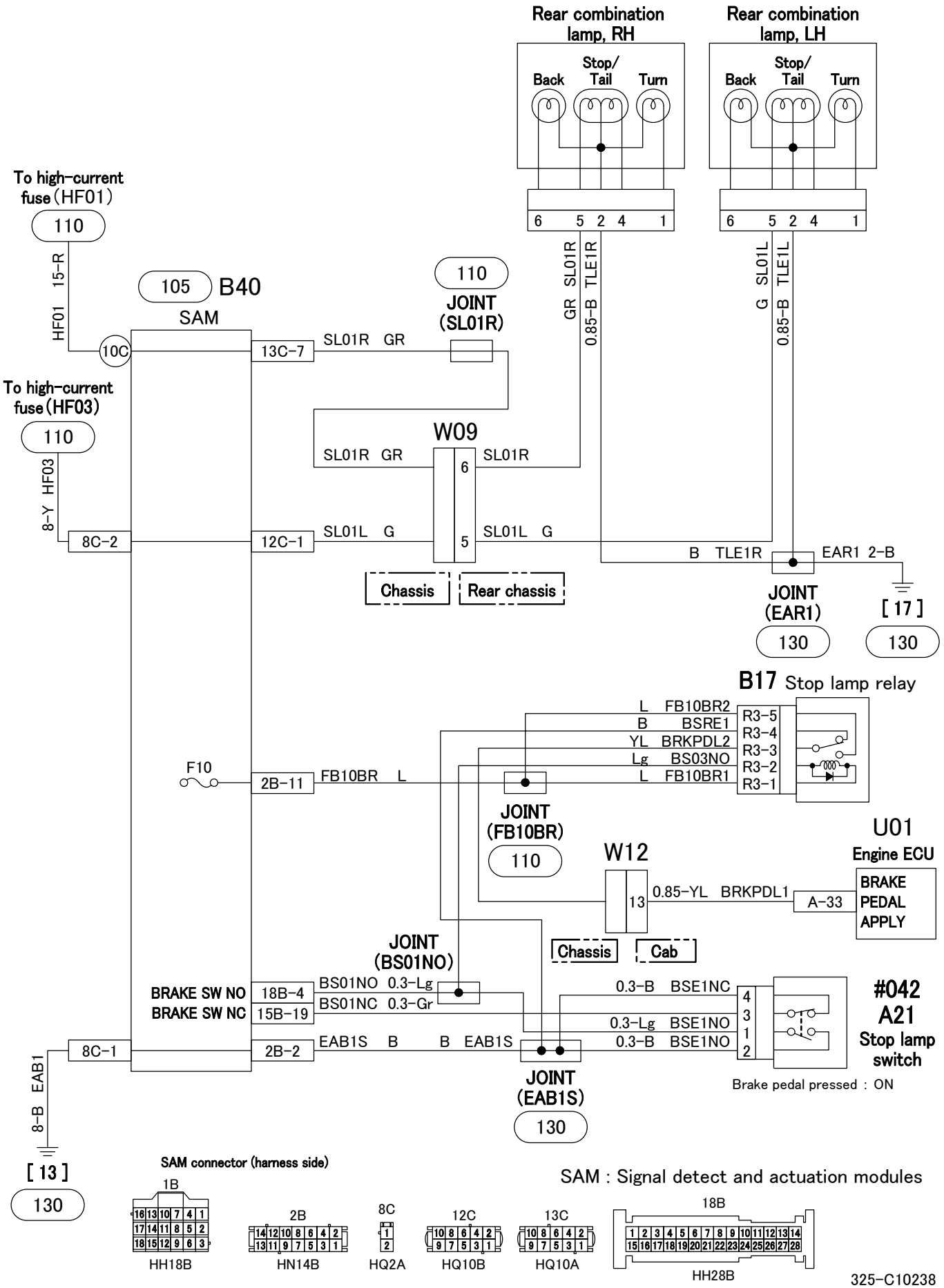
313-C10238

320 TAIL, PARKING AND LICENSE PLATE LAMPS CIRCUIT

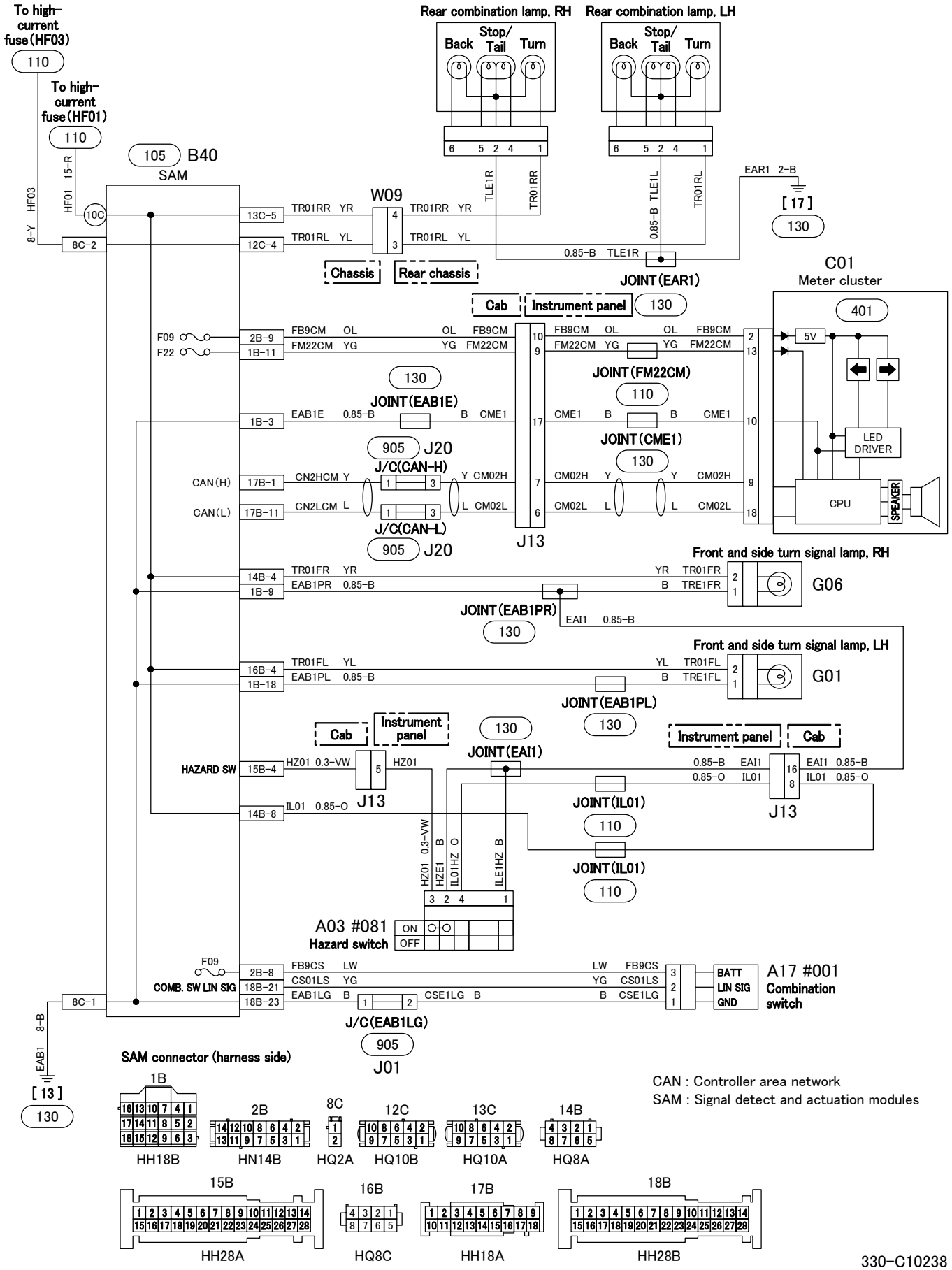


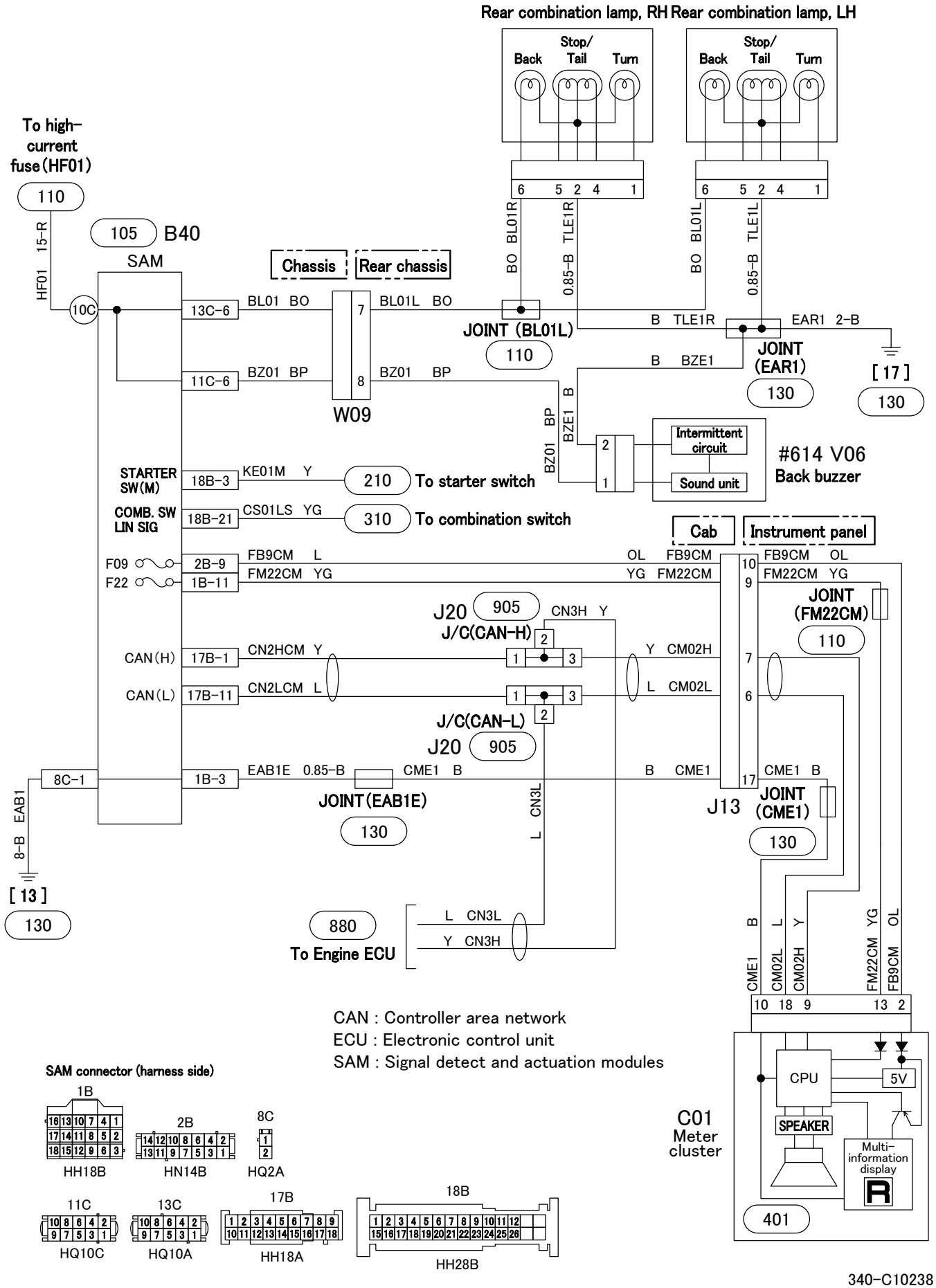
CAN : Controller area network
SAM : Signal detect and actuation modules

320-C10238


Rear combination lamp, RH
Rear combination lamp, LH
Back
Stop/ Tail
Turn
6 5 2 4 1
To high-current fuse (HF01)
110
HF01 15-R
105 B40
SAM
10C
13C-7
SL01R GR
110
JOINT (SL01R)
GR SL01R 0.85-B TLE1R
G SL01L 0.85-B TLE1L
To high-current fuse (HF03)
110
8-Y HF03
W09
6
5
8C-2
12C-1
SL01L G
B TLE1R
EAR1 2-B
Chassis
Rear chassis
JOINT (EAR1)
130
[17]
130
B17 Stop lamp relay
L FB10BR2 R3-5
B BSRE1 R3-4
YL BRKPDL2 R3-3
Lg BS03NO R3-2
L FB10BR1 R3-1
F10
2B-11
FB10BR L
JOINT (FB10BR)
110
W12
13
0.85-YL BRKPDL1
A-33
U01
Engine ECU
BRAKE PEDAL APPLY
Chassis
Cab
JOINT (BS01NO)
BRAKE SW NO
BRAKE SW NC
18B-4
15B-19
BS01NO 0.3-Lg
BS01NC 0.3-Gr
0.3-B BSE1NC
0.3-Lg BSE1NO
0.3-B BSE1NO
4
3
1
2
#042
A21
Stop lamp switch
Brake pedal pressed : ON
8C-1
2B-2
EAB1S B
B EAB1S
JOINT (EAB1S)
130
8-B EAB1
[13]
130
SAM connector (harness side)
1B
HH18B
2B
HN14B
8C
HQ2A
12C
HQ10B
13C
HQ10A
18B
HH28B
SAM : Signal detect and actuation modules
325-C10238

330 TURN SIGNAL AND HAZARD LAMP CIRCUIT

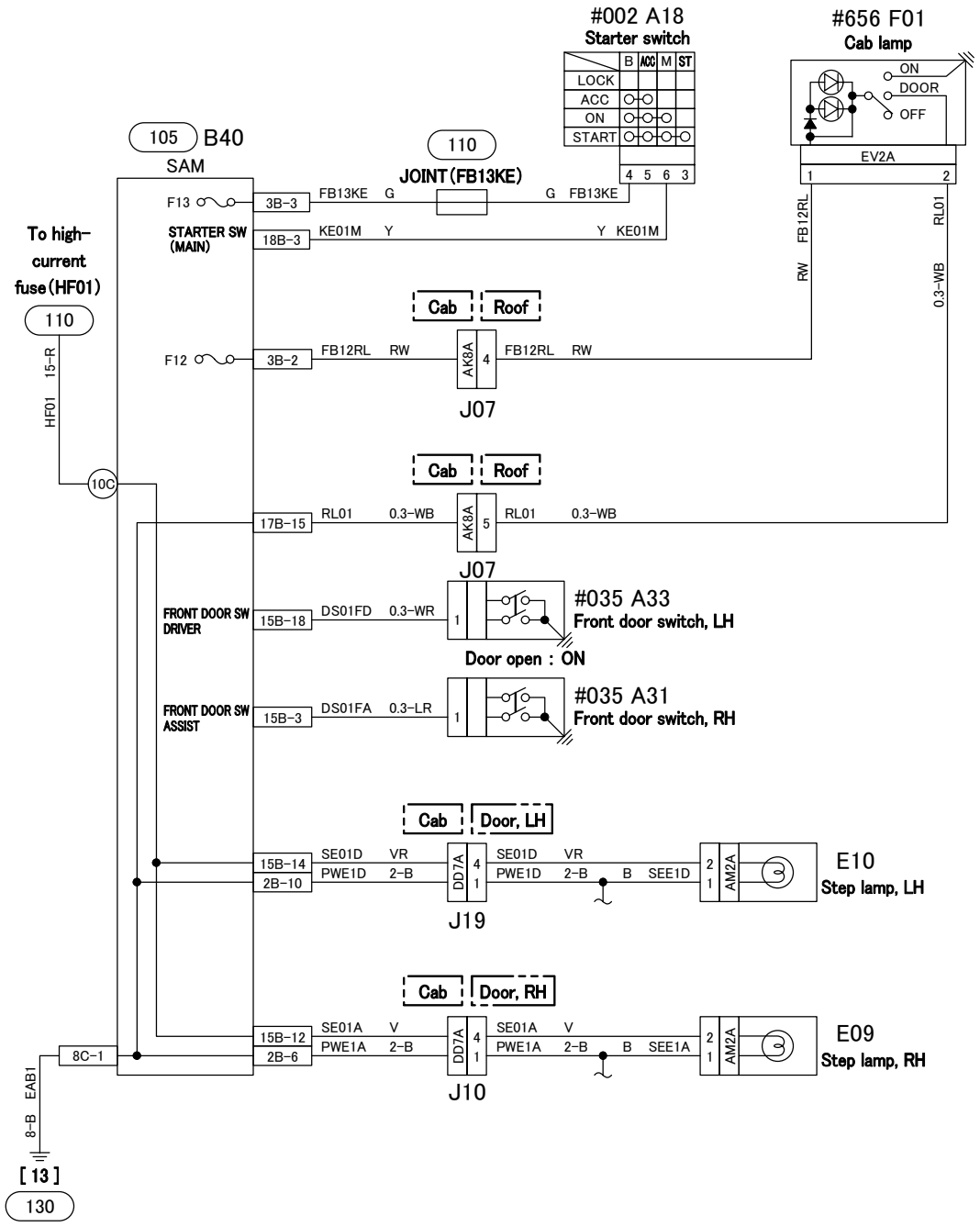



Rear combination lamp, RH
Rear combination lamp, LH
Stop/ Tail
Back
Turn
To high-current fuse (HF01)
110
HF01 15-R
105 B40
SAM
10C
Chassis
Rear chassis
13C-6
BL01 BO
BL01L BO
7
W09
8
11C-6
BZ01 BP
BZ01 BP
BO BL01R
0.85-B TLE1R
BO BL01L
0.85-B TLE1L
JOINT (BL01L)
110
B TLE1R
EAR1 2-B
JOINT (EAR1)
130
[17]
130
B BZE1
BZE1 B
BZ01 BP
2
1
Intermittent circuit
Sound unit
#614 V06
Back buzzer
STARTER SW(M)
18B-3
KE01M Y
210
To starter switch
COMB. SW LIN SIG
18B-21
CS01LS YG
310
To combination switch
Cab
Instrument panel
F09
F22
2B-9
1B-11
FB9CM L
FM22CM YG
OL FB9CM
YG FM22CM
10
9
FB9CM OL
FM22CM YG
JOINT (FM22CM)
110
J20
905
J/C(CAN-H)
CN3H Y
CAN(H)
17B-1
CN2HCM Y
Y CM02H
7
CAN(L)
17B-11
CN2LCM L
L CM02L
6
J/C(CAN-L)
J20
905
8C-1
1B-3
EAB1E 0.85-B
CME1 B
B CME1
17
CME1 B
JOINT (CME1)
130
J13
JOINT(EAB1E)
130
8-B EAB1
[13]
130
L CN3L
880
To Engine ECU
L CN3L
Y CN3H
CME1 B
CM02L L
CM02H Y
FM22CM YG
FB9CM OL
10 18 9
13 2
CPU
5V
SPEAKER
Multi-information display
R
C01
Meter cluster
401
CAN : Controller area network
ECU : Electronic control unit
SAM : Signal detect and actuation modules
SAM connector (harness side)
1B
HH18B
2B
HN14B
8C
HQ2A
11C
HQ10C
13C
HQ10A
17B
HH18A
18B
HH28B

340-C10238

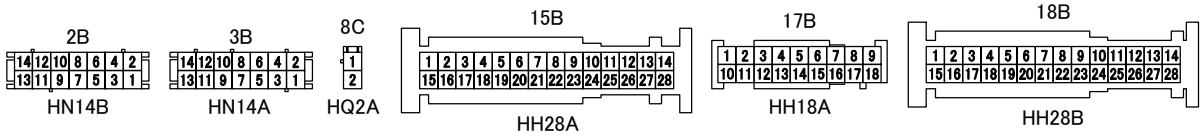
345 CAB LAMP CIRCUIT

<Except crew cab>



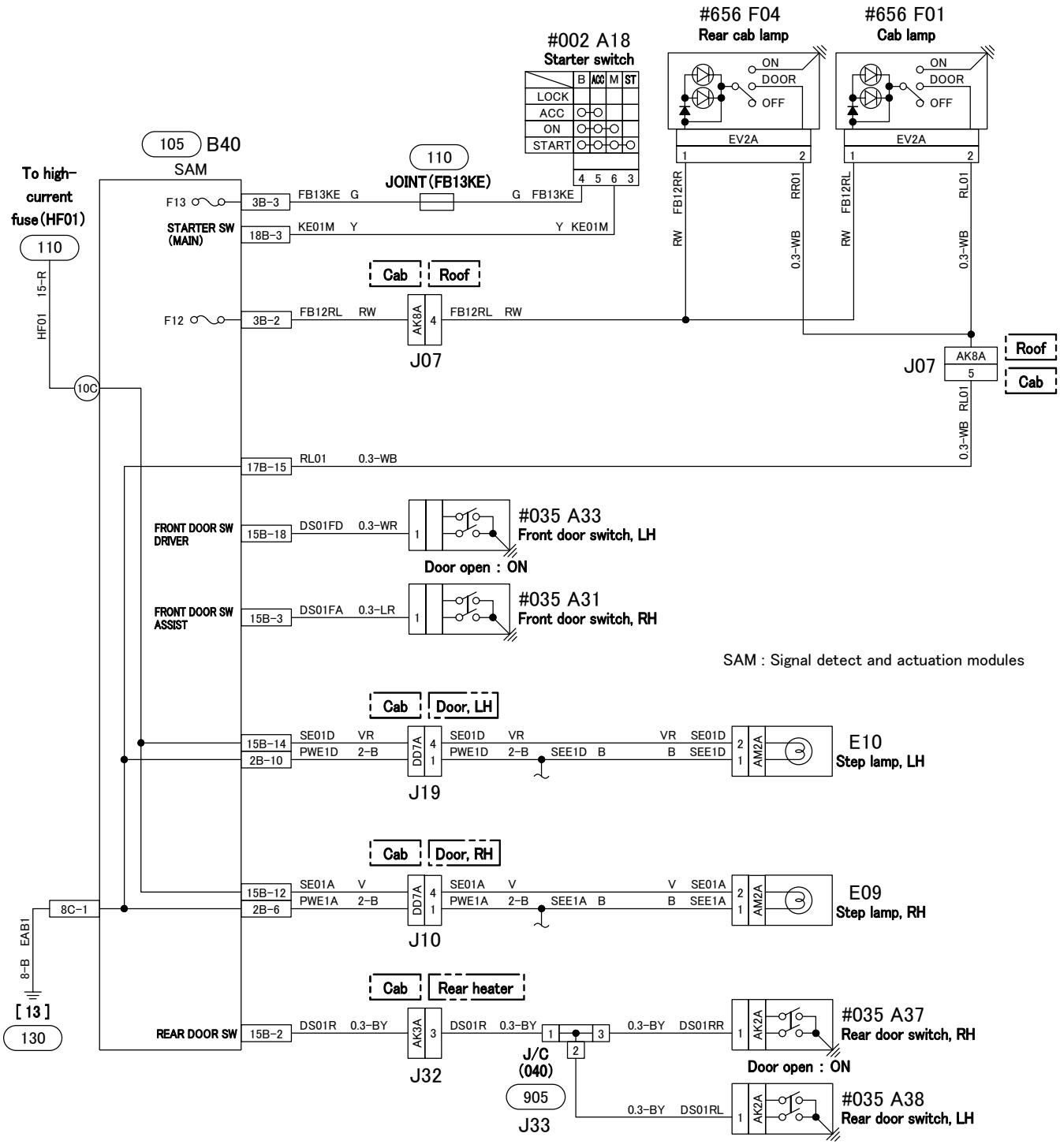
SAM : Signal detect and actuation modules

SAM connector (harness side)

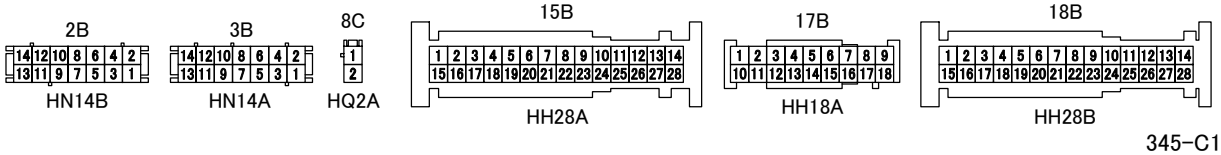


345-C10238-1

＜Crew cab＞

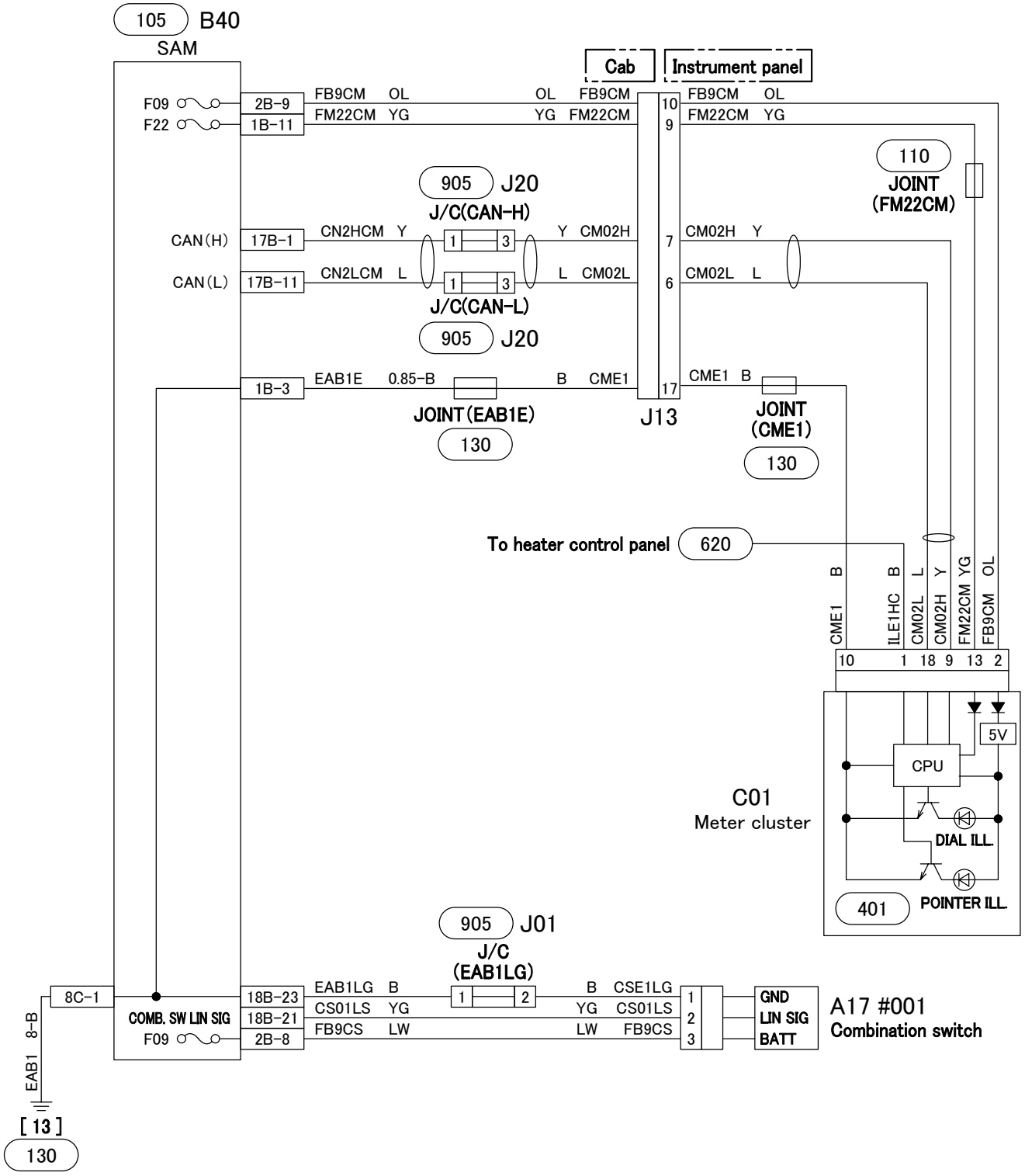


SAM connector (harness side)



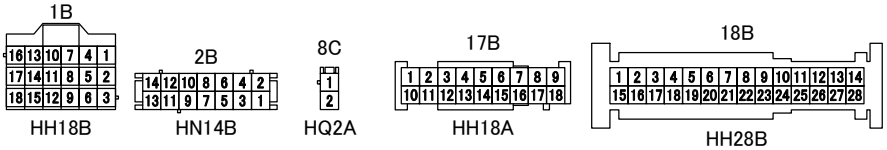
345-C10238-2

348 ILLUMINATION LAMP CIRCUIT

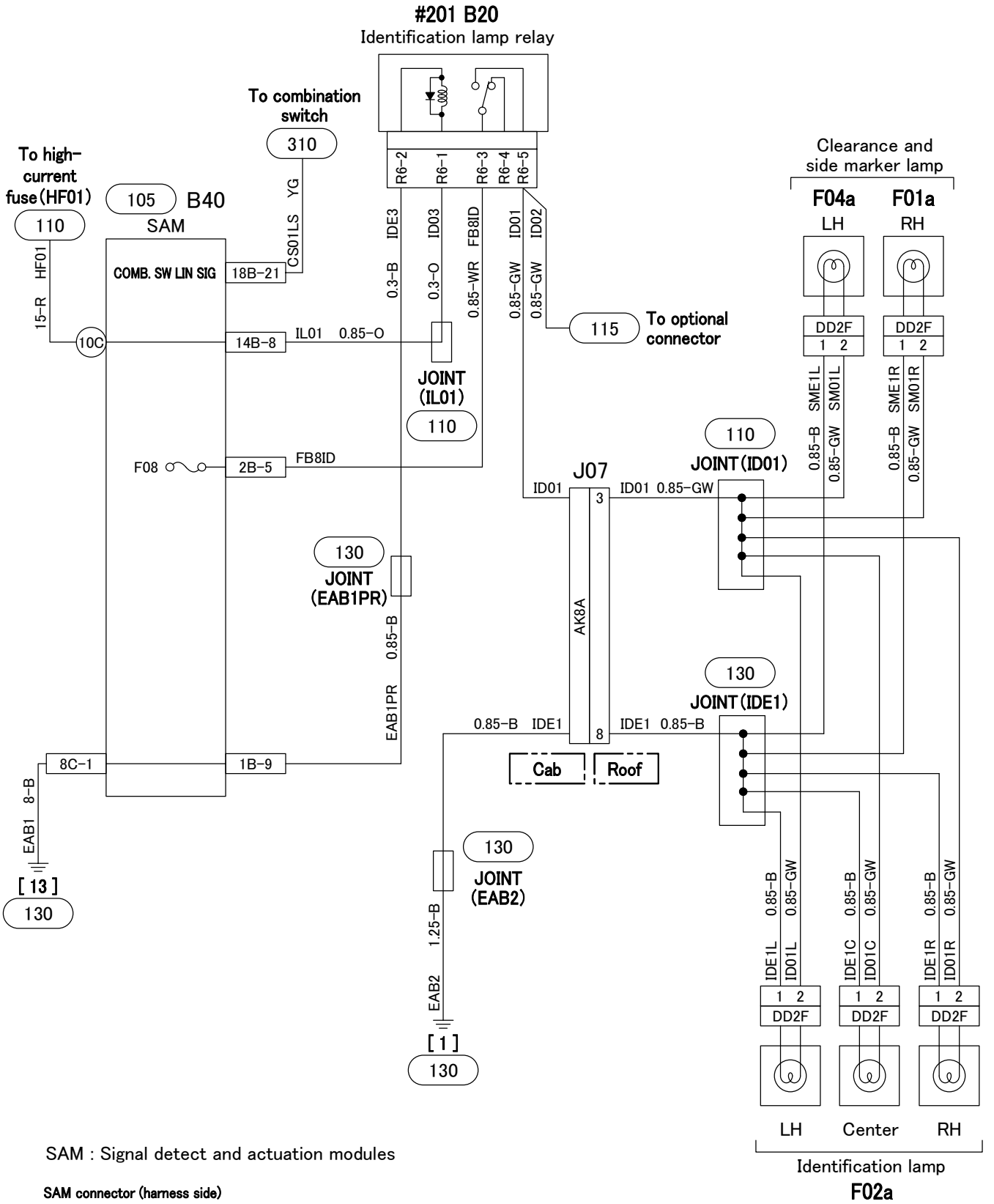


CAN : Controller area network
SAM : Signal detect and actuation modules

SAM connector (harness side)

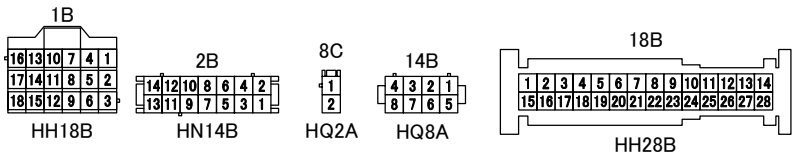


348-C10238



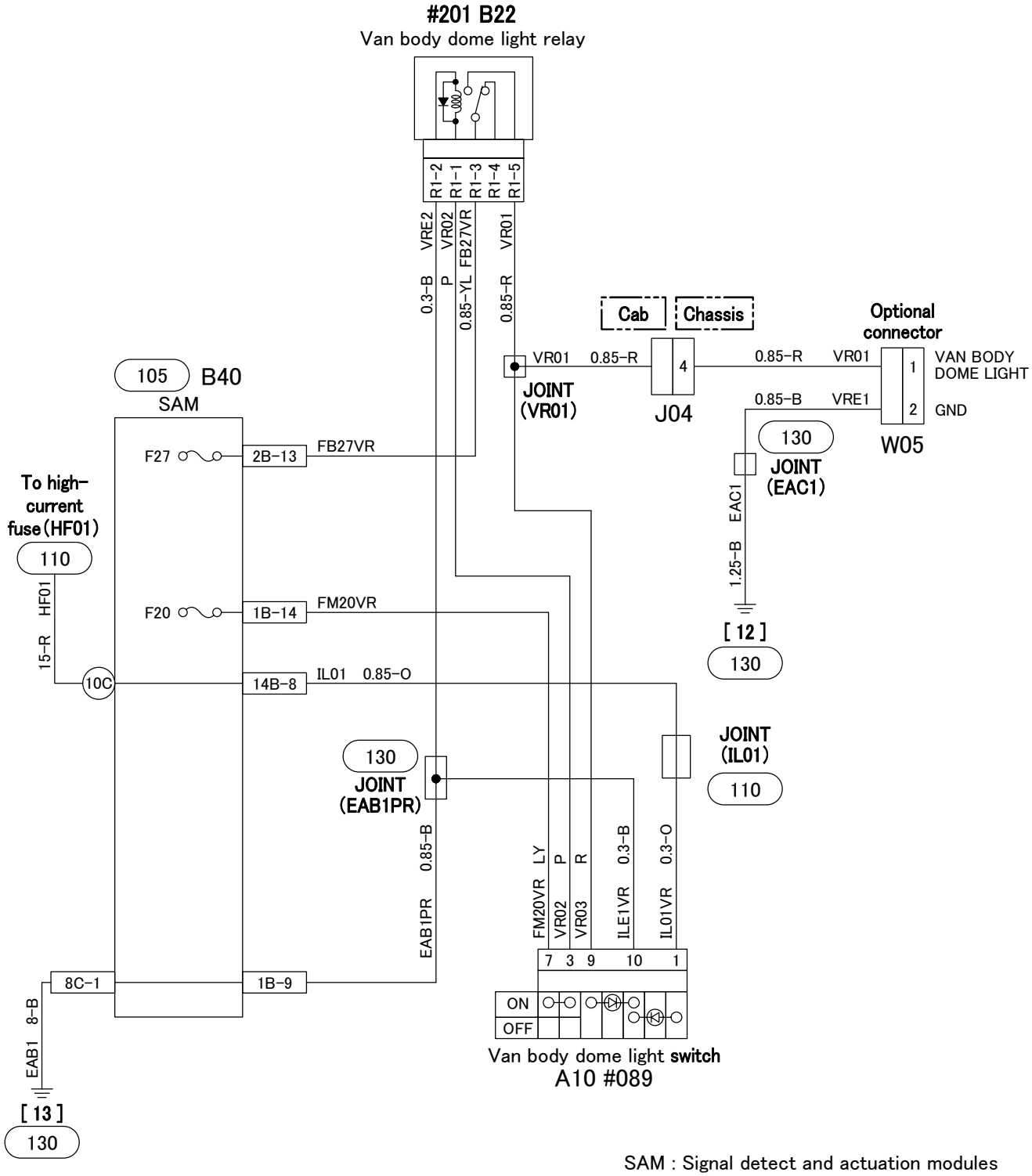
SAM : Signal detect and actuation modules

SAM connector (harness side)



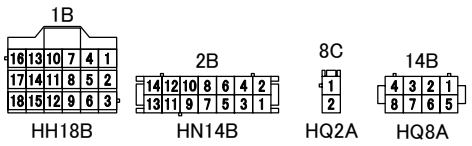
349-C10238

352 VAN BODY DOME LIGHT CIRCUIT



SAM : Signal detect and actuation modules

SAM connector (harness side)

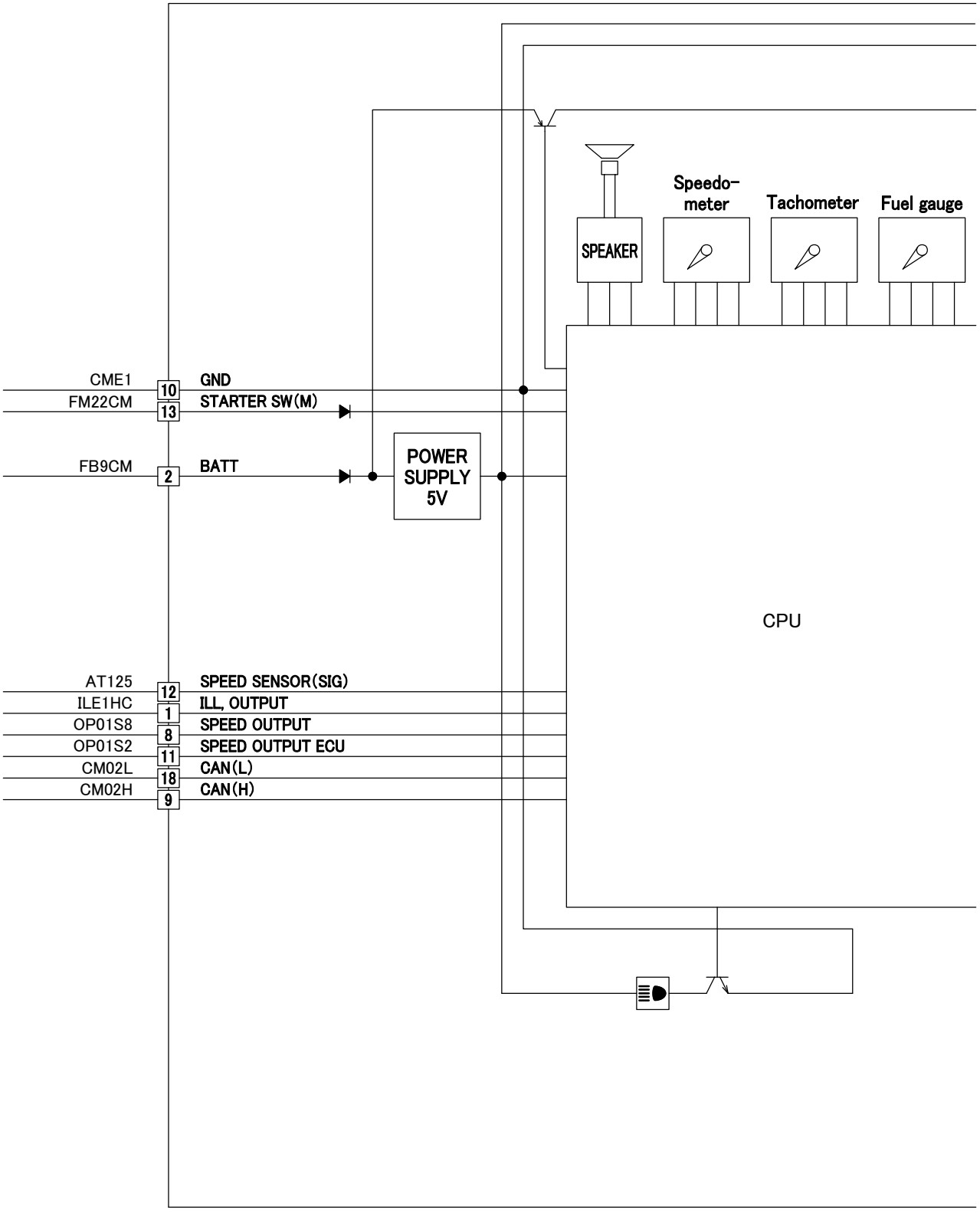


352-C10238

54-04 METER CIRCUIT

401 METER CLUSTER INTERNAL CIRCUIT

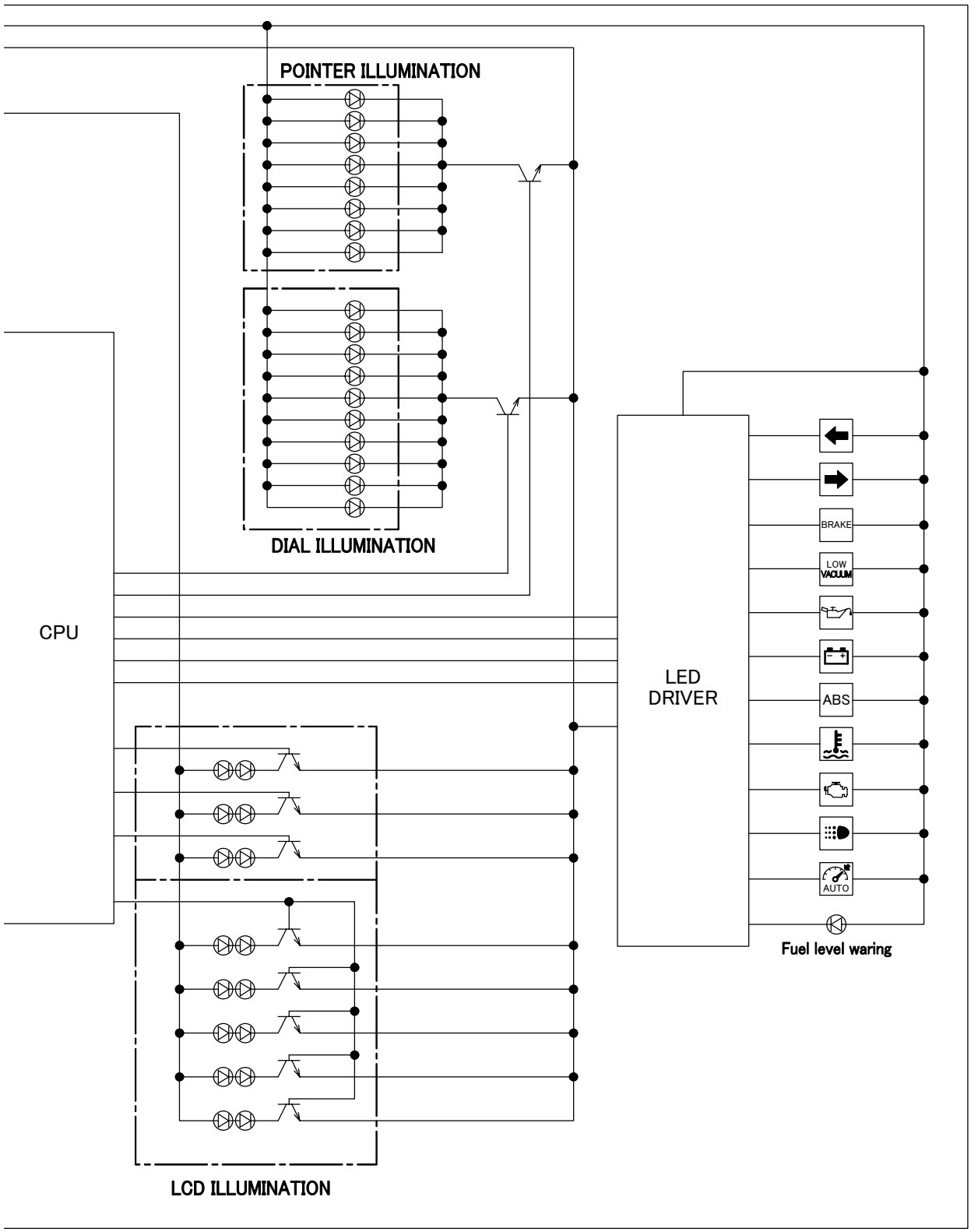
(1/2)

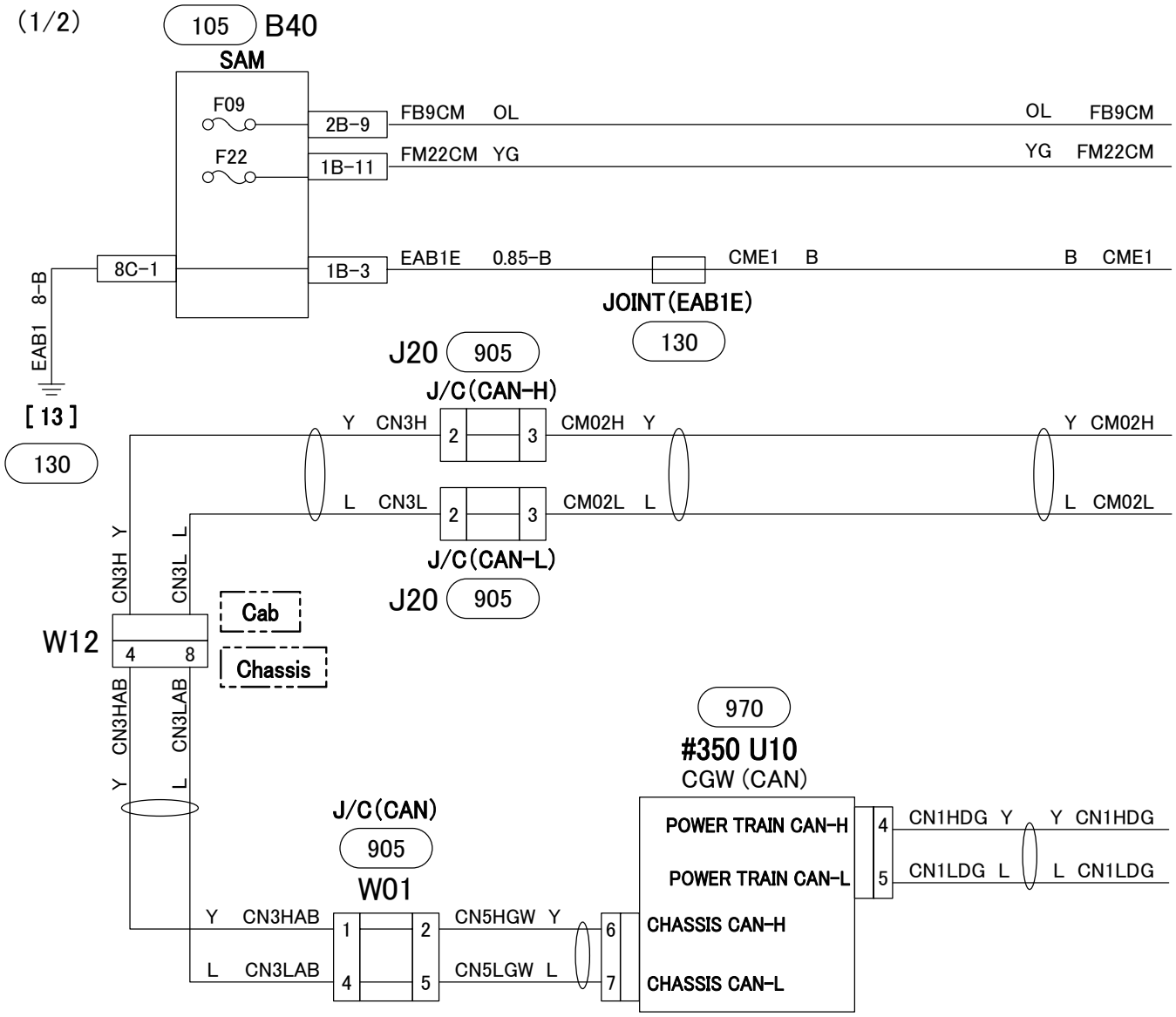


CAN : Controller area network

401-C10238-1

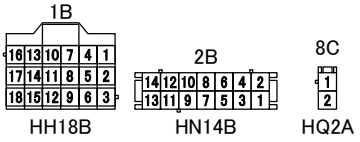
(2/2)


POINTER ILLUMINATION
DIAL ILLUMINATION
CPU
LED
DRIVER
BRAKE
LOW
VACUUM
ABS
AUTO
Fuel level waring
LCD ILLUMINATION



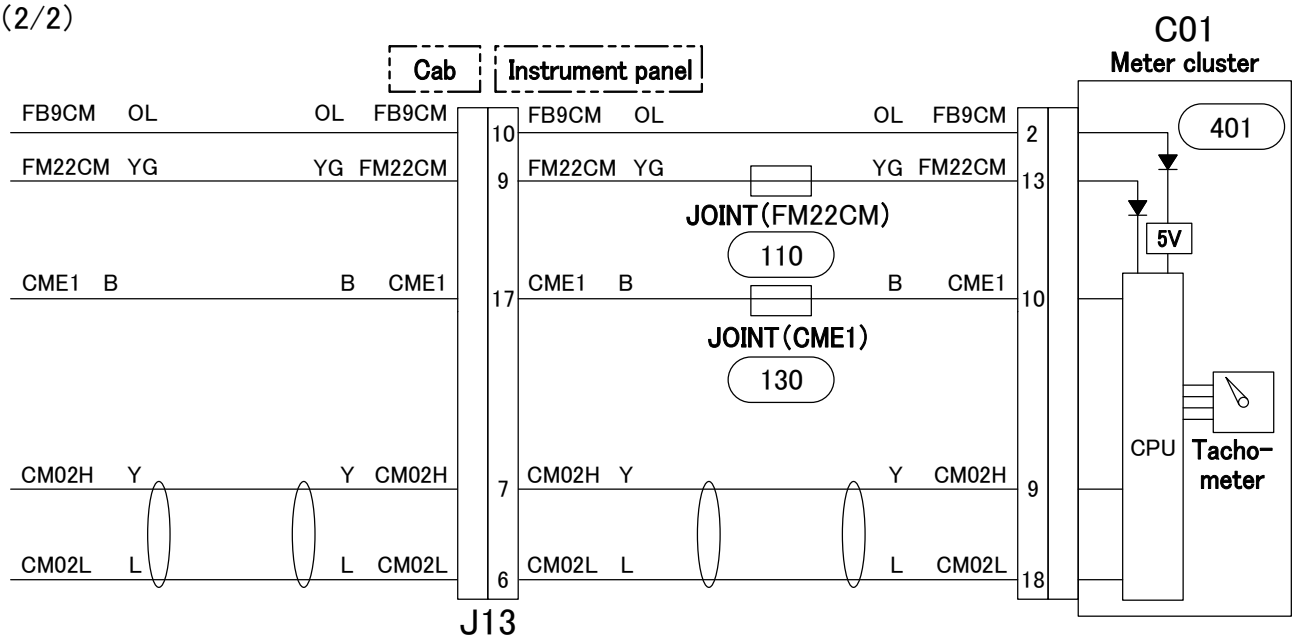
CAN : Controller area network
SAM : Signal detect and actuation modules

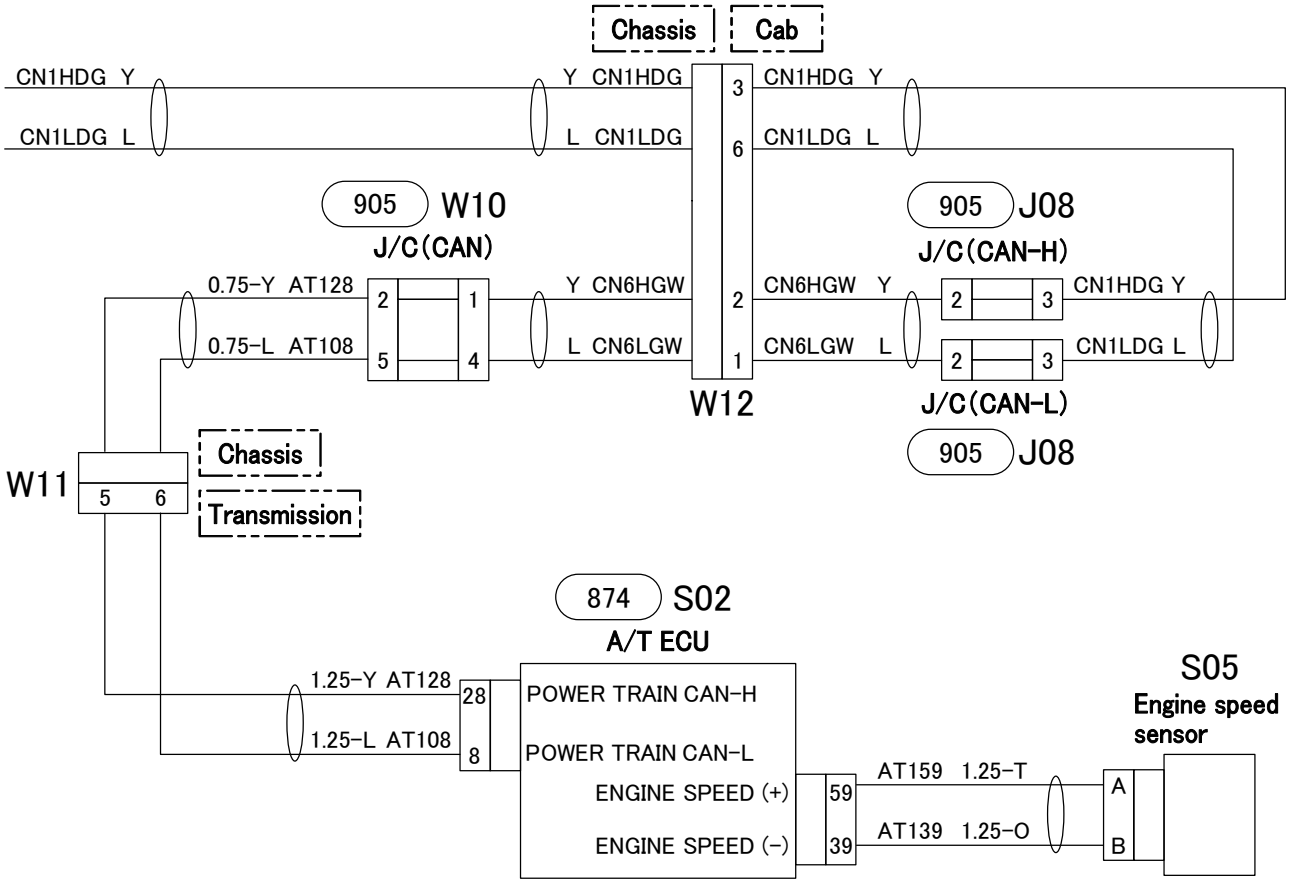
SAM connector (harness side)



410-C10238-1

(2/2)

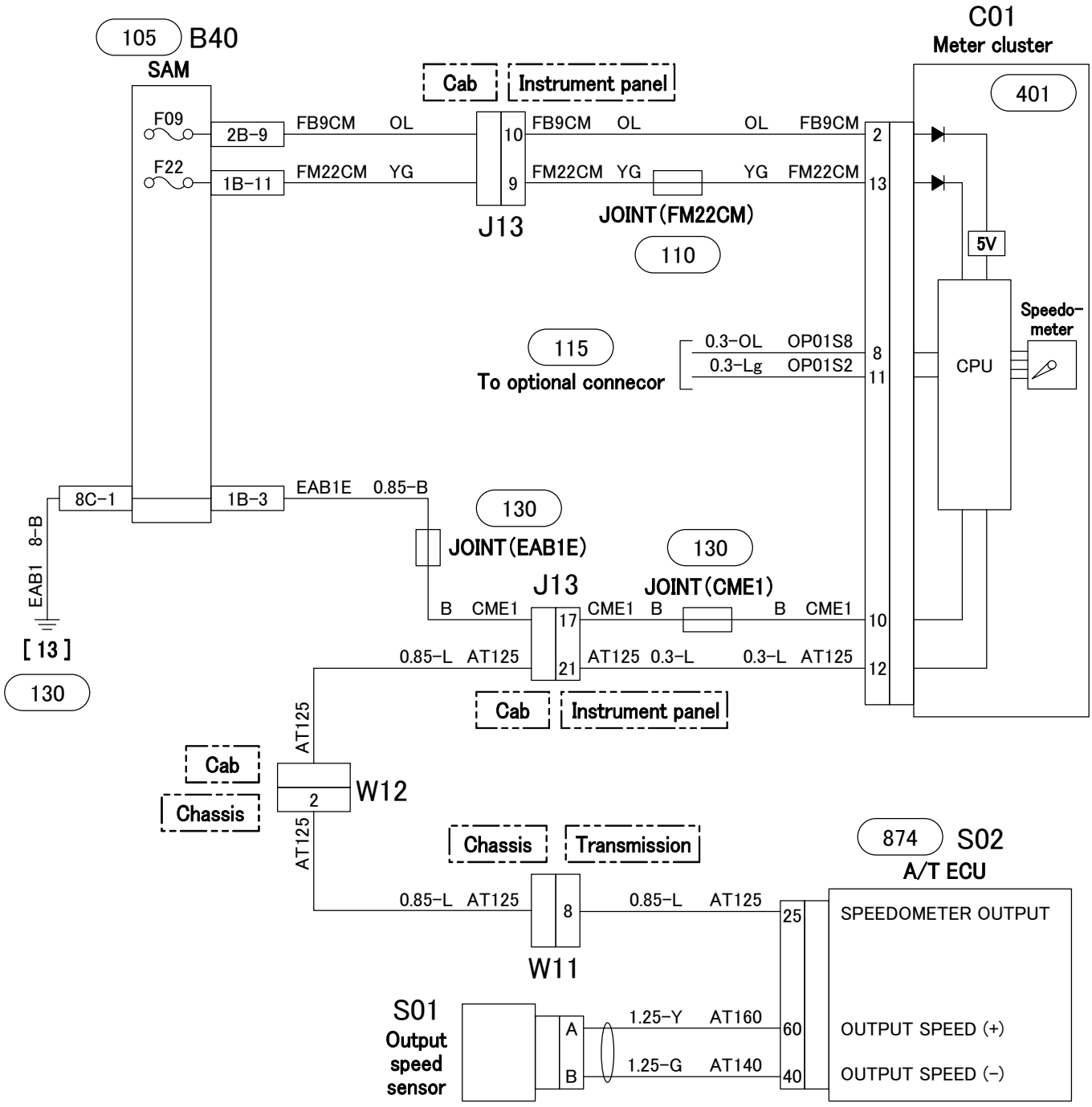




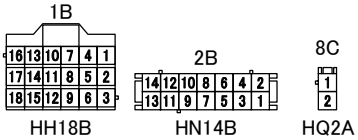
A/T : Automatic transmission
CAN : Controller area network
ECU : Electronic control unit

410-C10238-2

412 SPEEDOMETER CIRCUIT



SAM connector (harness side)

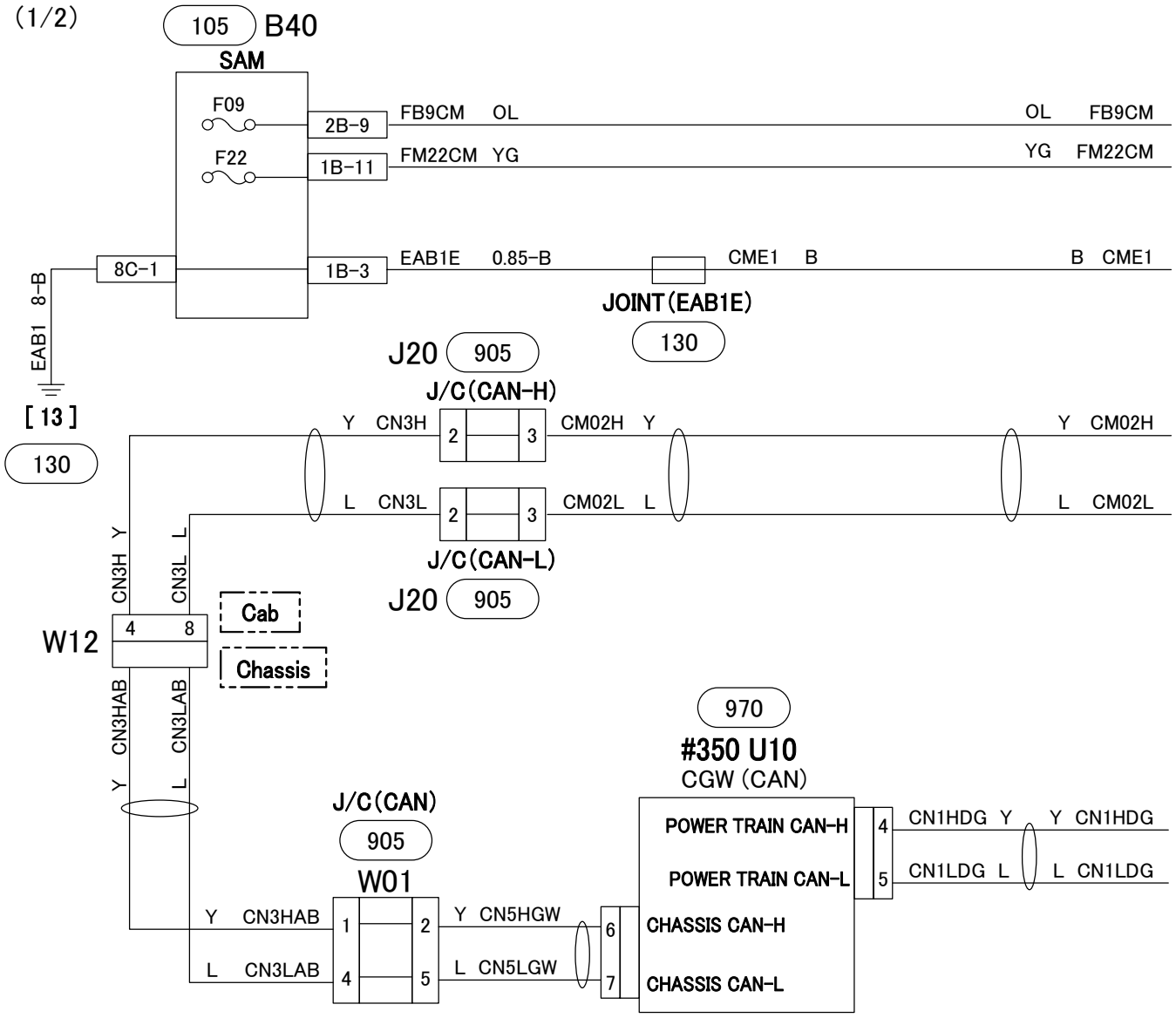


A/T : Automatic transmission
ECU : Electronic control unit
SAM : Signal detect and actuation modules

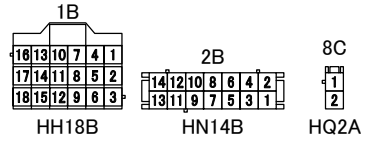
412-C10238

M E M O

420 FUEL GAUGE CIRCUIT



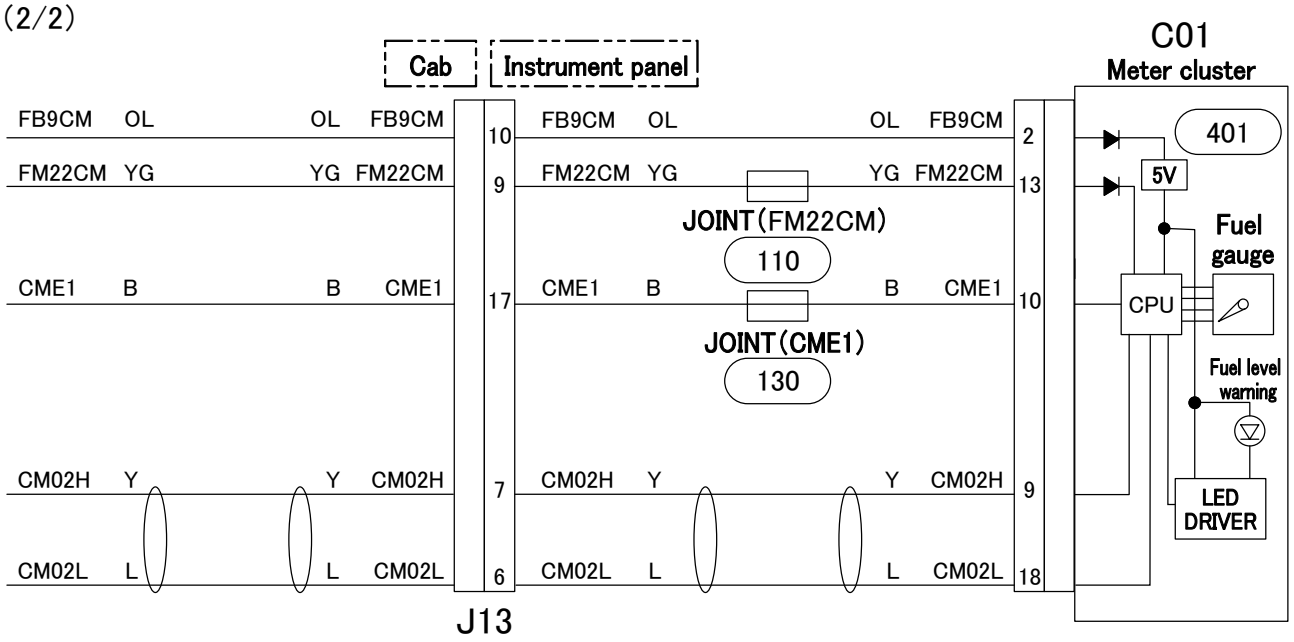
SAM connector (harness side)

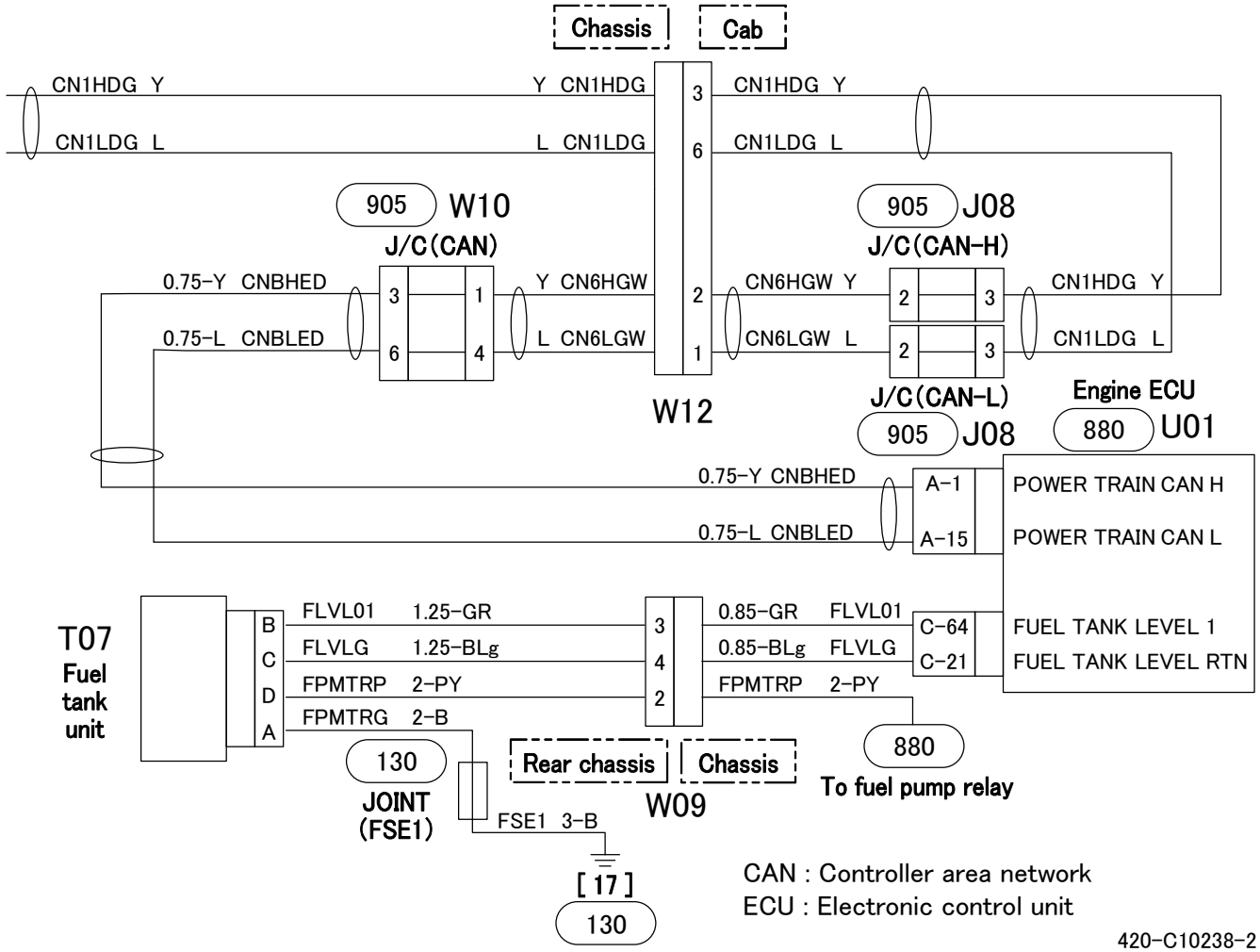


CAN : Controller area network
SAM : Signal detect and actuation modules

420-C10238-1

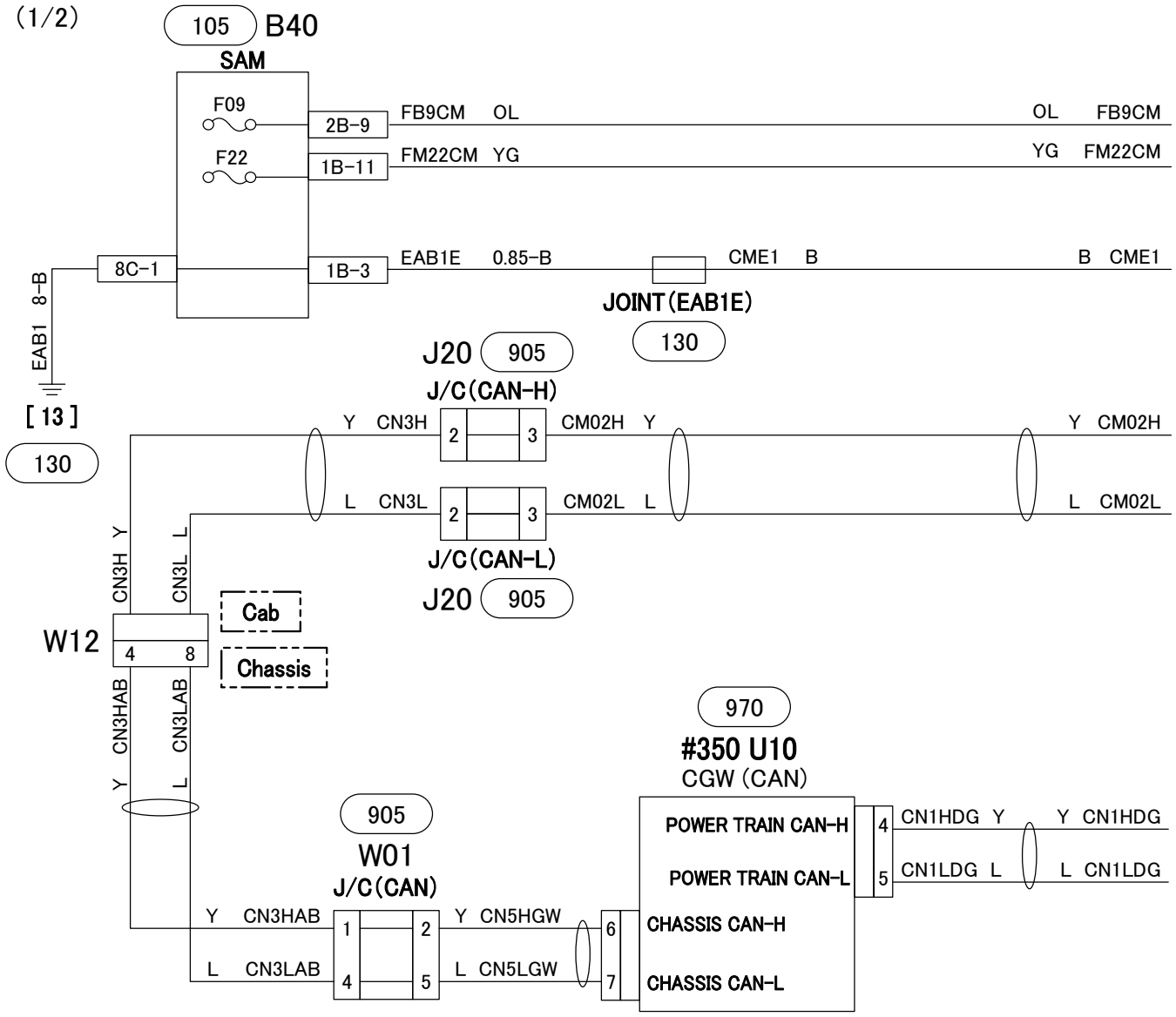
(2/2)



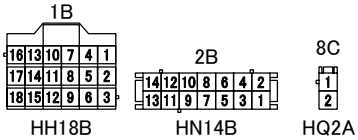


420-C10238-2

425 WATER TEMPERATURE GAUGE CIRCUIT



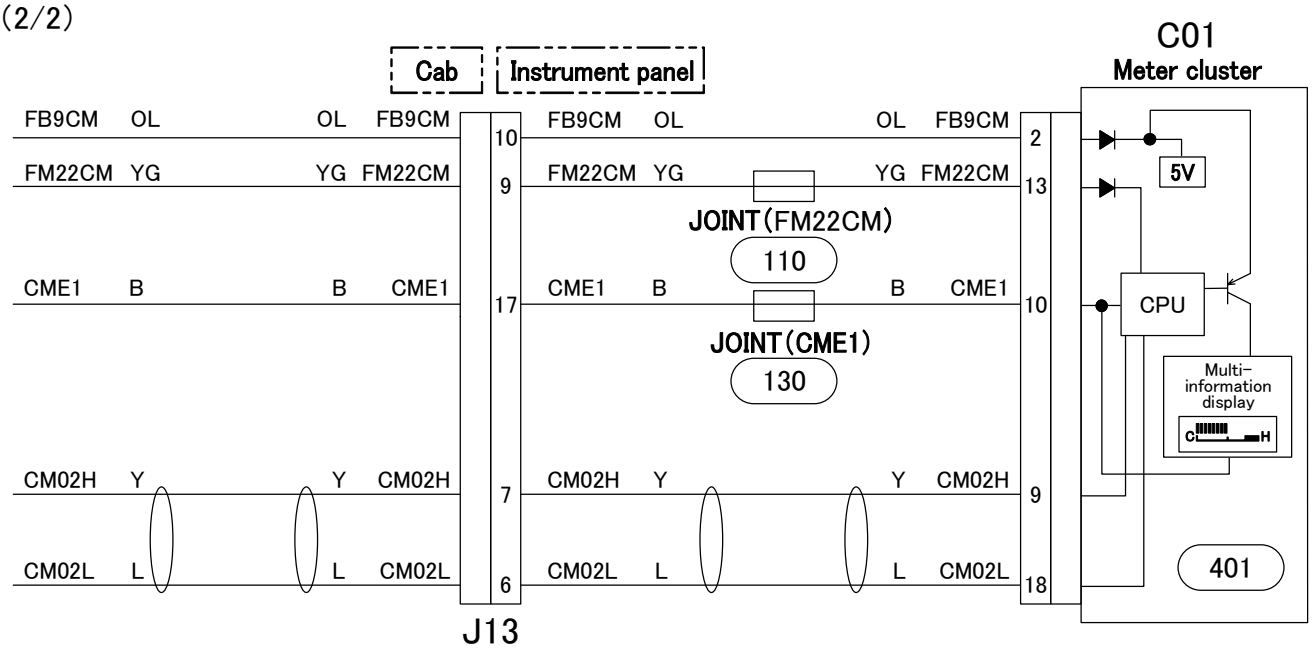
SAM connector (harness side)

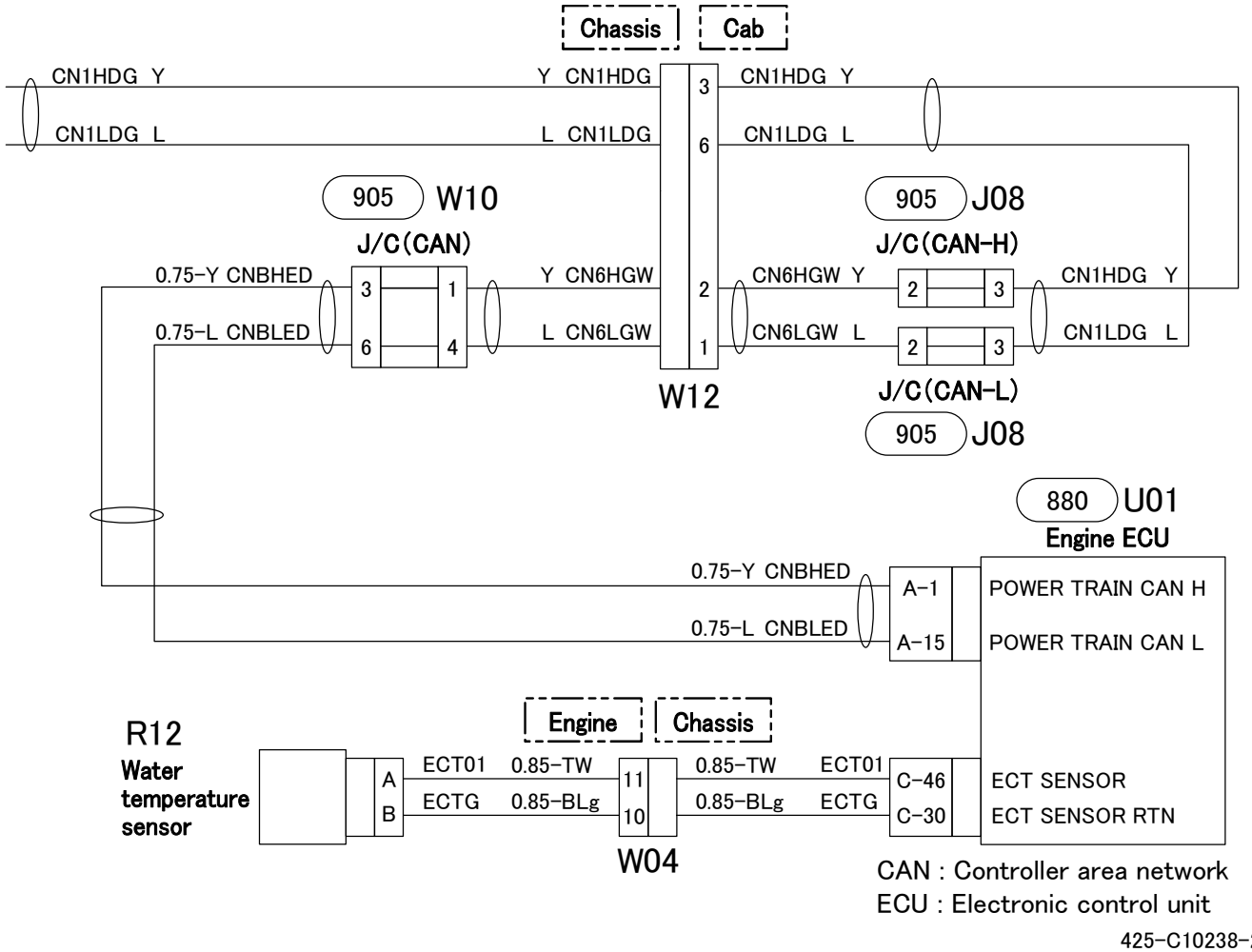


CAN : Controller area network
SAM : Signal detect and actuation modules

425-C10238-1

(2/2)



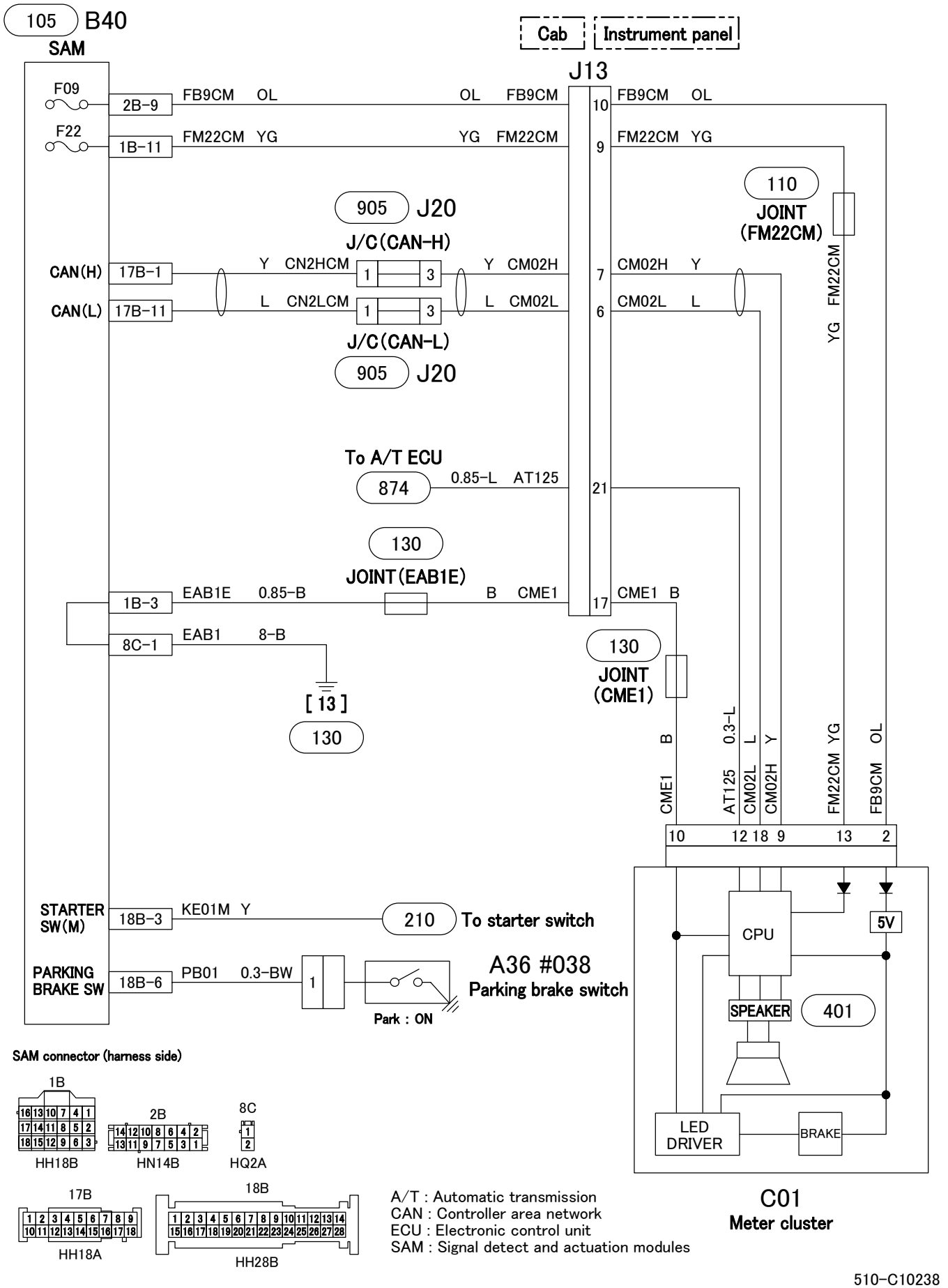


CAN : Controller area network
ECU : Electronic control unit

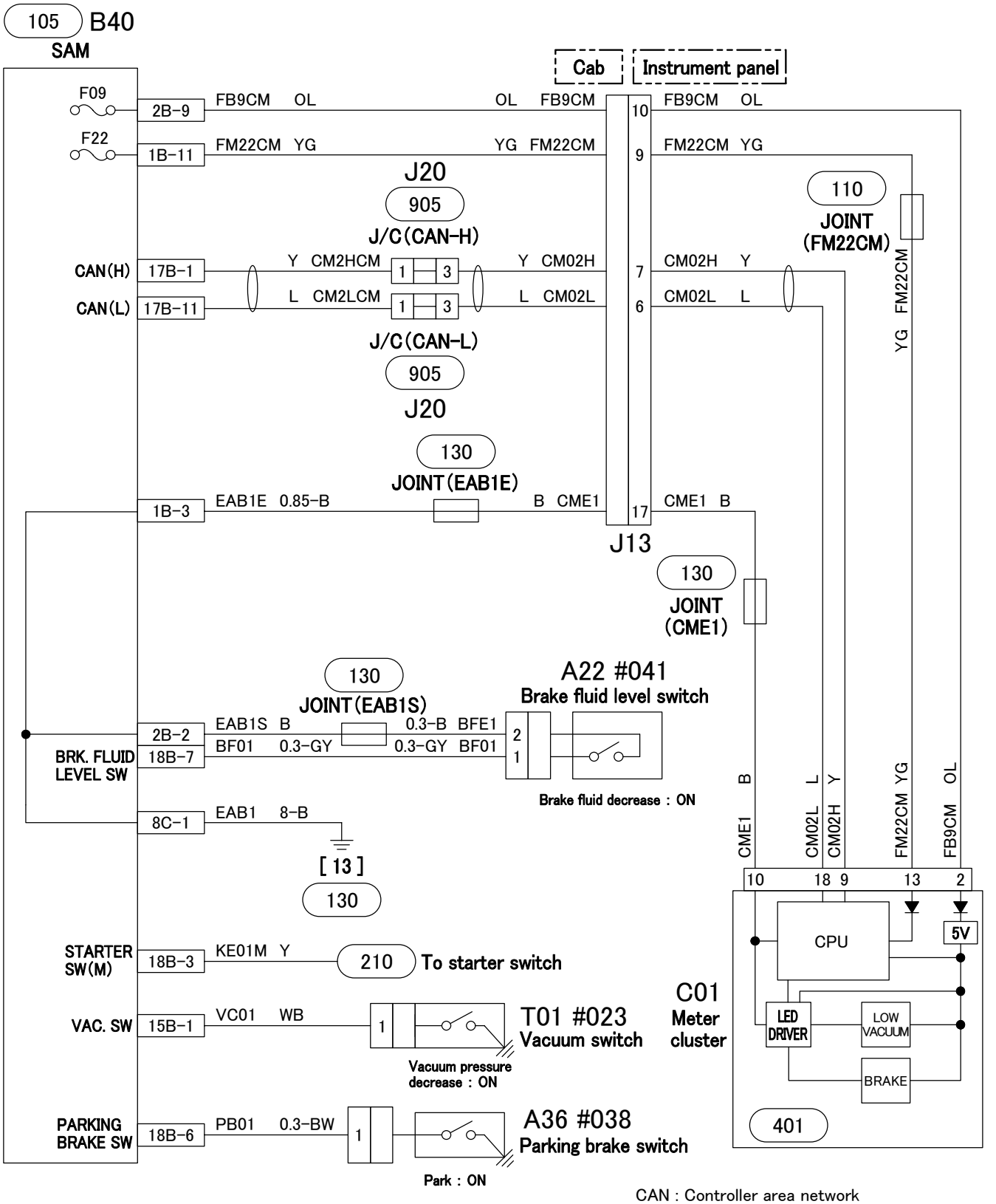
425-C10238-2

54-05 INDICATOR AND WARNING LAMP CIRCUIT

510 PARKING BRAKE INDICATOR CIRCUIT

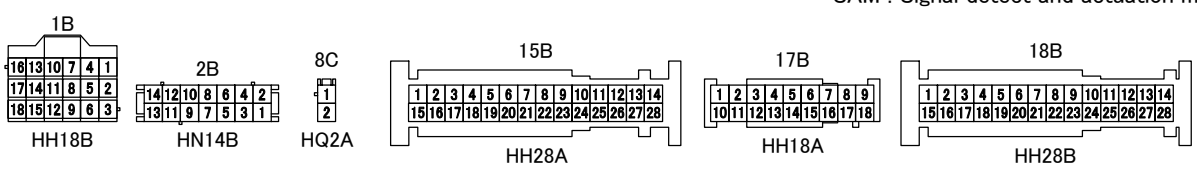


510-C10238



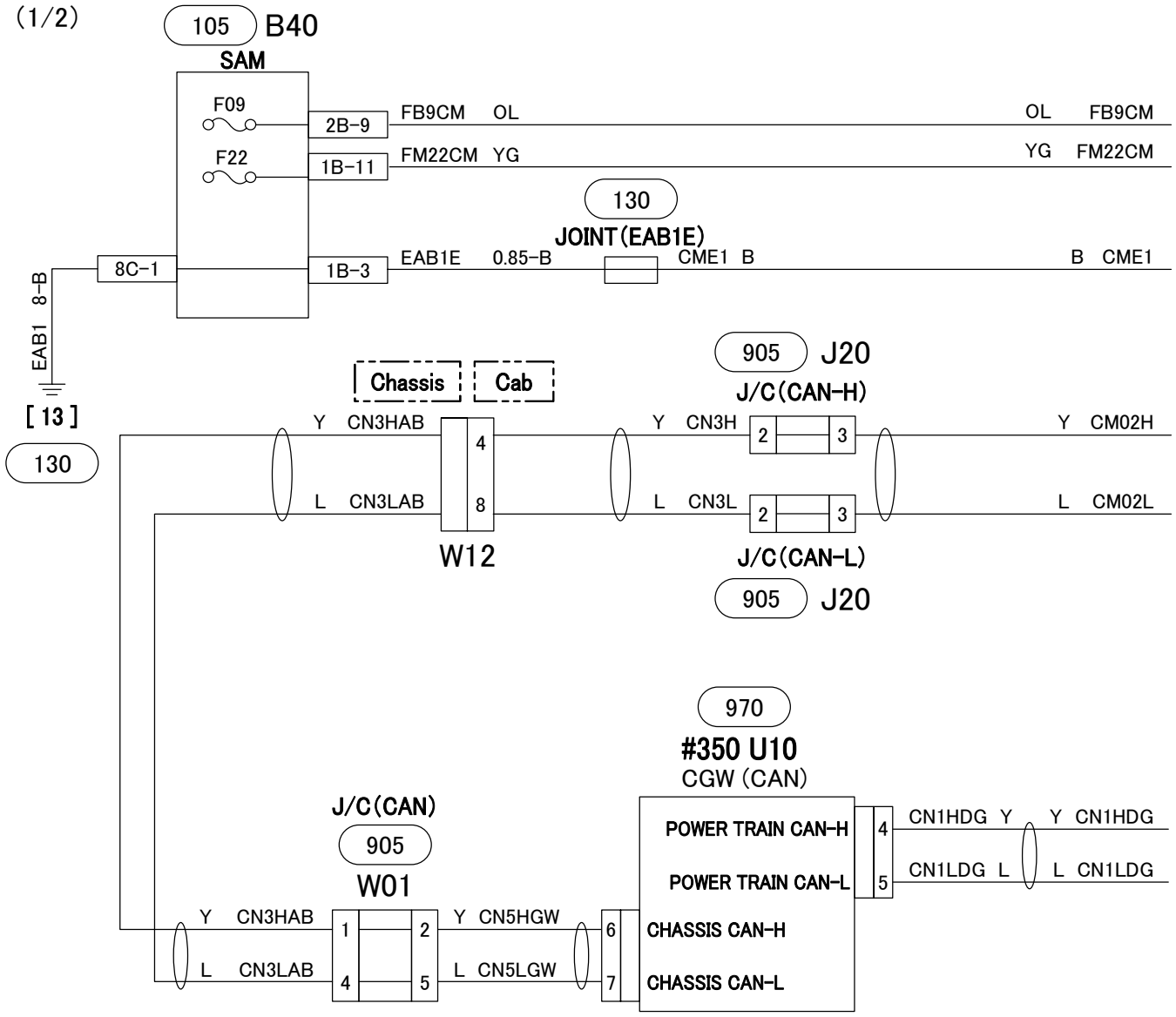
CAN : Controller area network
SAM : Signal detect and actuation modules

SAM connector (harness side)



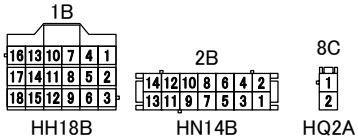
515-C10238

536 ENGINE OIL PRESSURE WARNING CIRCUIT



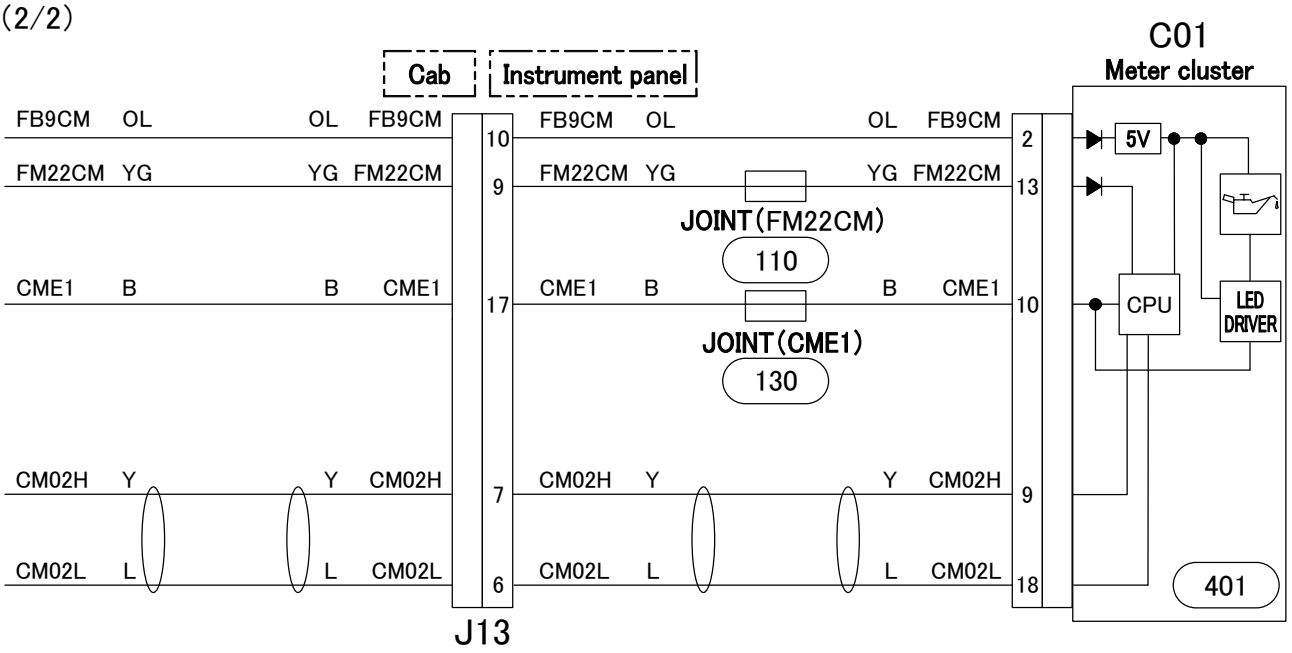
CAN : Controller area network
SAM : Signal detect and actuation modules

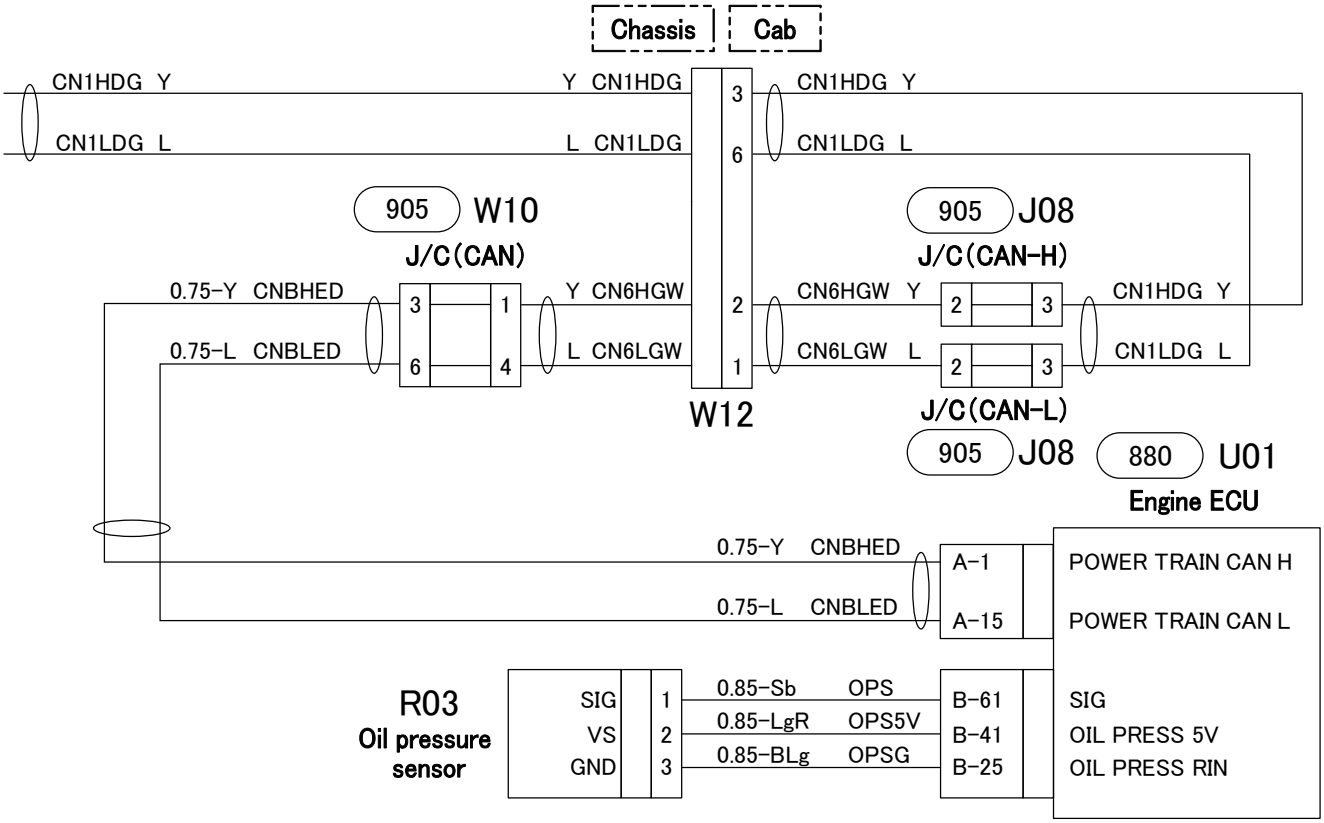
SAM connector (harness side)



536-C10238-1

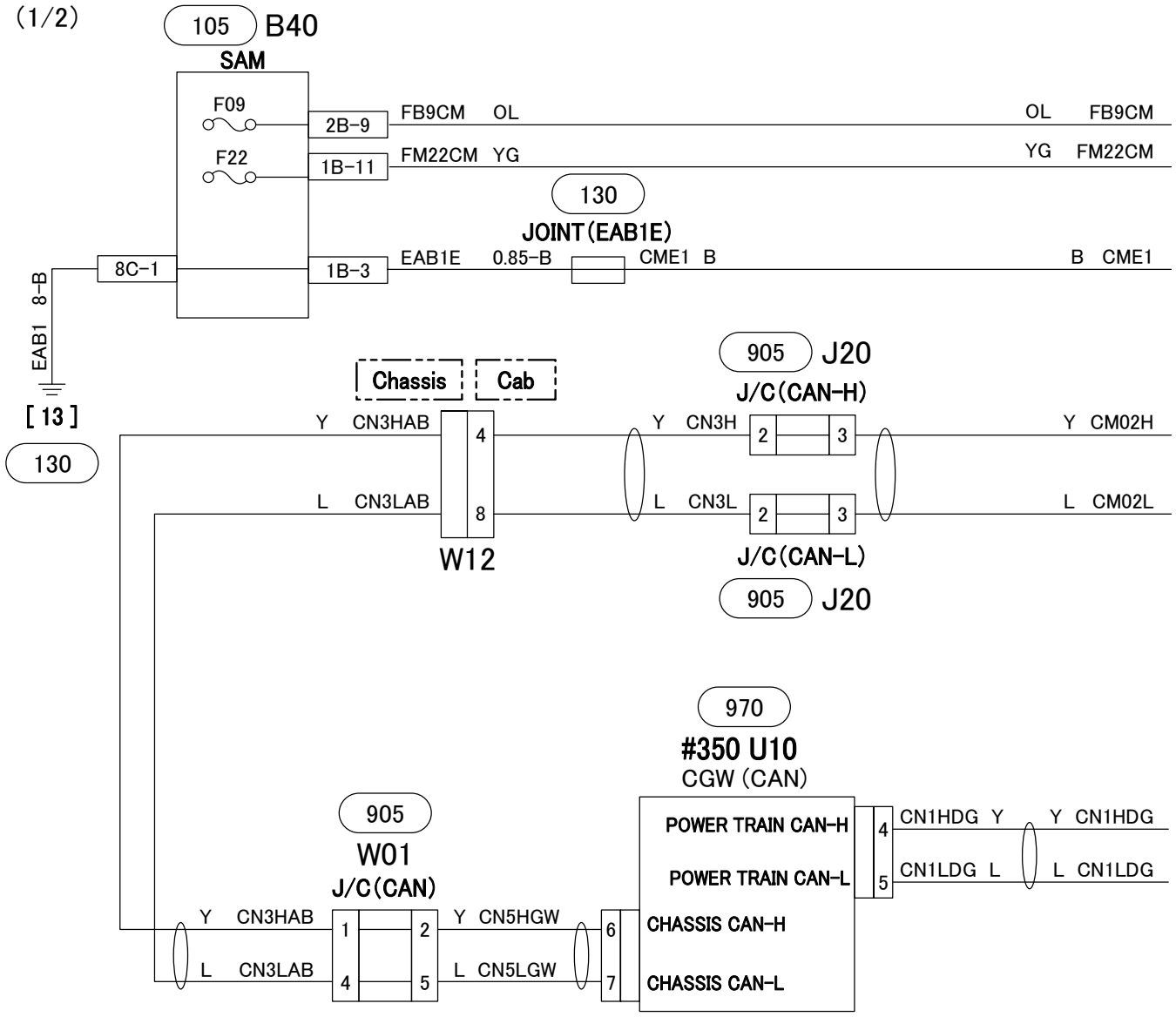
(2/2)





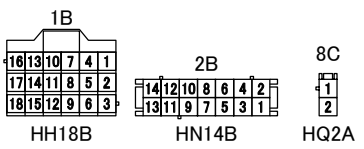
CAN : Controller area network
ECU : Electronic control unit

537 OVERHEATING WARNING CIRCUIT



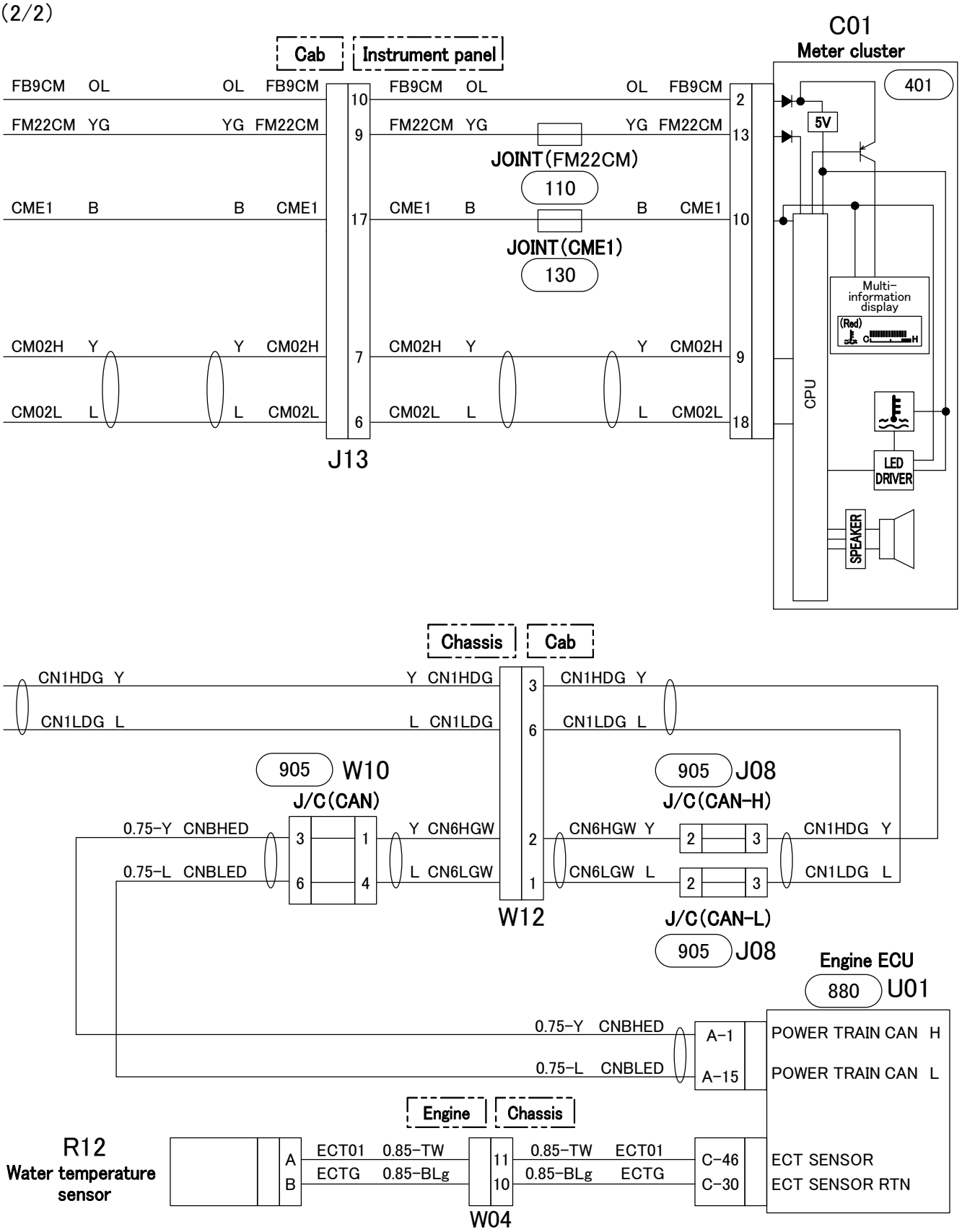
CAN : Controller area network
SAM : Signal detect and actuation modules

SAM connector (harness side)



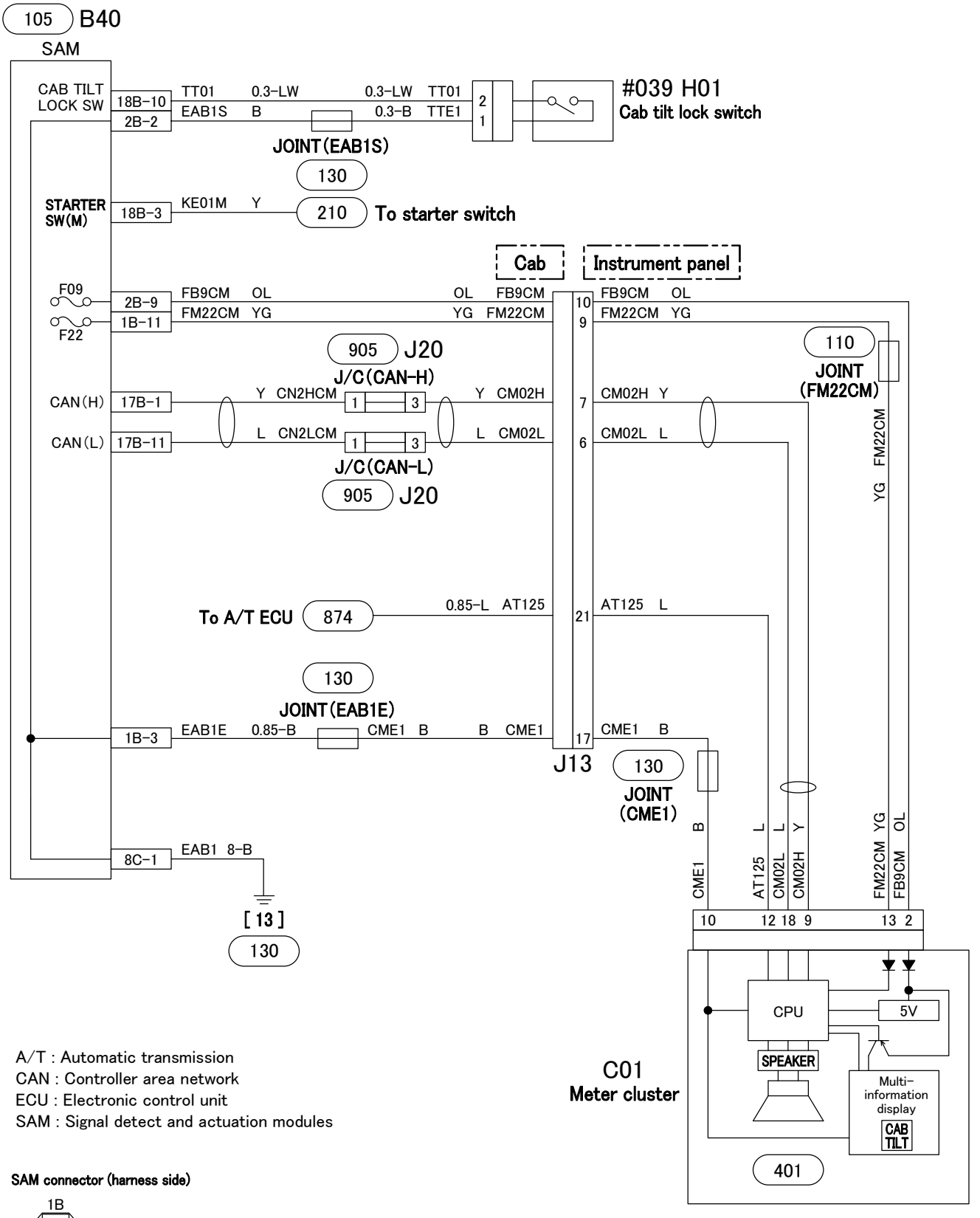
537-C10238-1

(2/2)



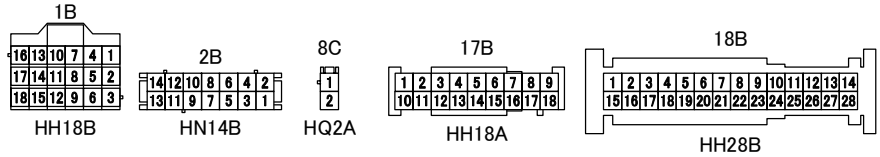
CAN : Controller area network
ECU : Electronic control unit

550 CAB TILT WARNING CIRCUIT

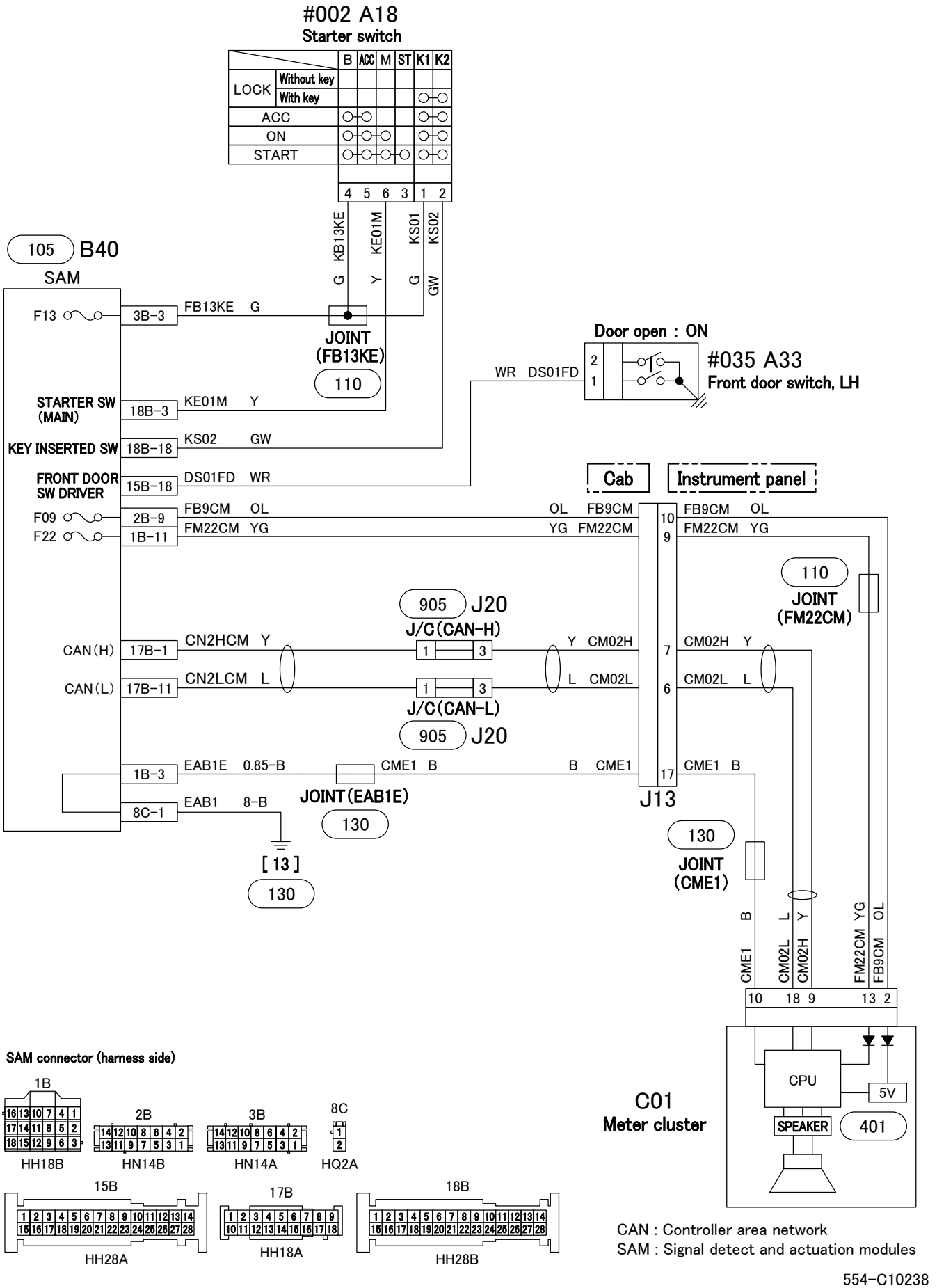


A/T : Automatic transmission
CAN : Controller area network
ECU : Electronic control unit
SAM : Signal detect and actuation modules

SAM connector (harness side)



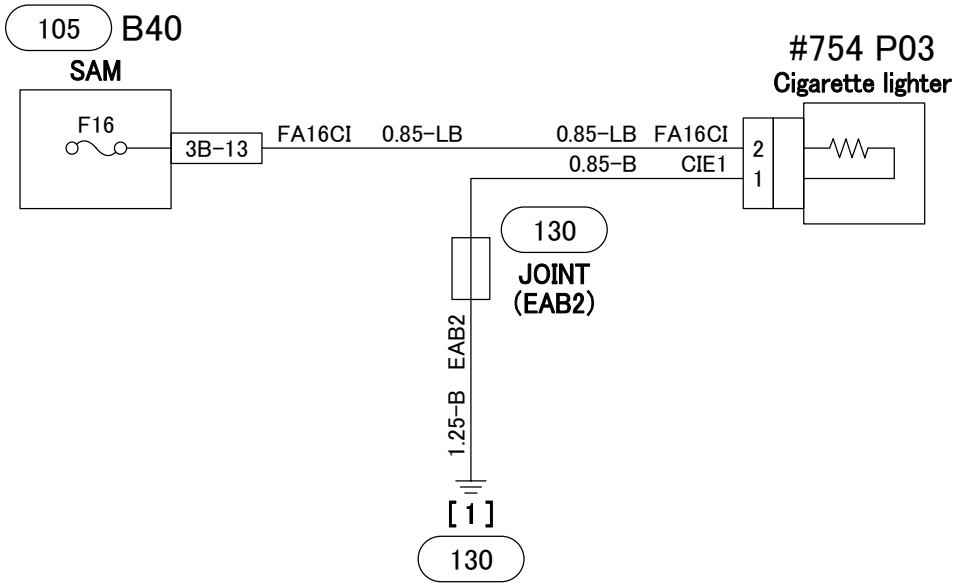
550-C10238



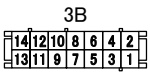
CAN : Controller area network
SAM : Signal detect and actuation modules

554-C10238

54-06 CAB SIDE ELECTRICAL CIRCUIT

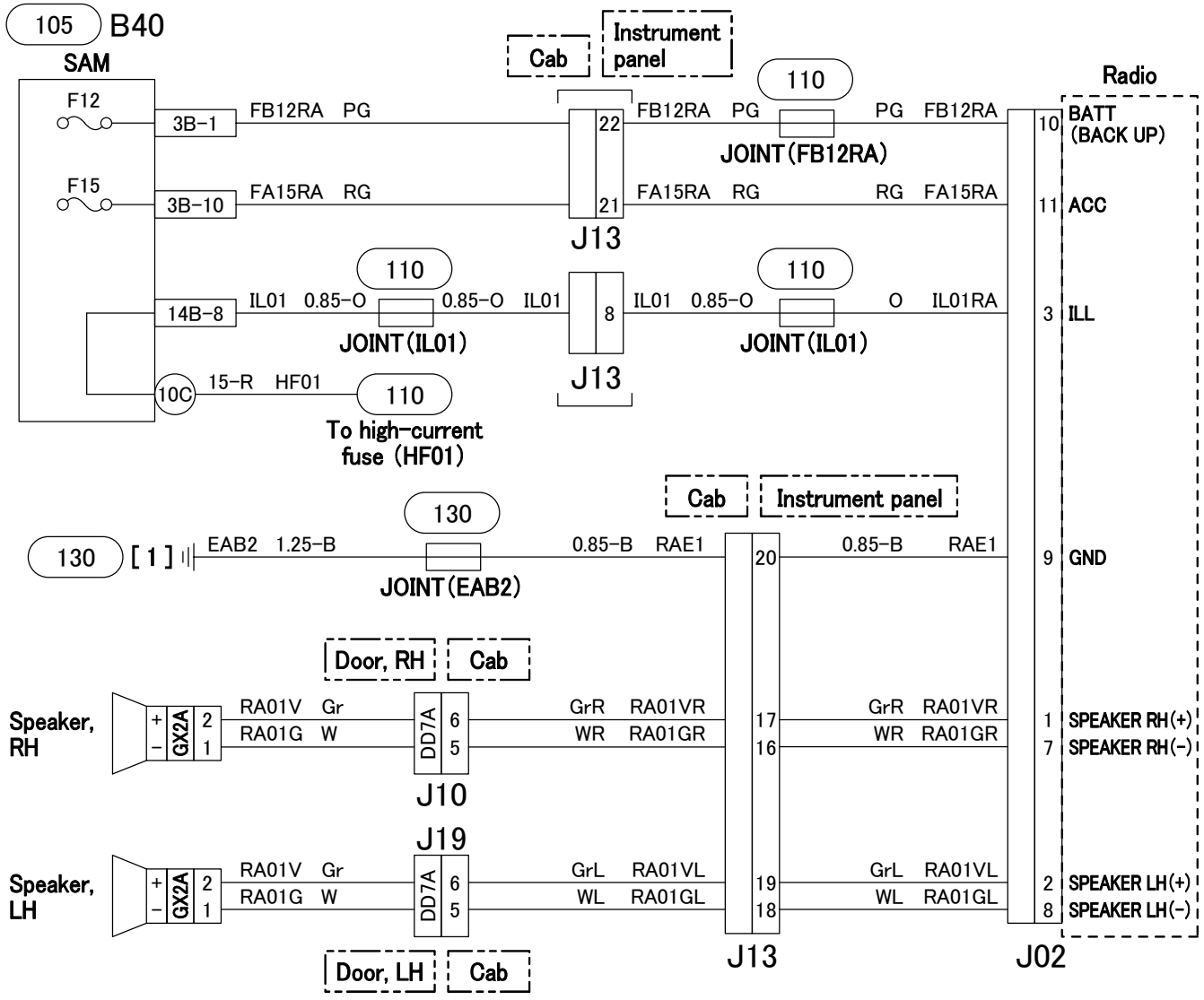


SAM connector (harness side)

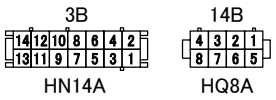


SAM : Signal detect and actuation modules

610-C10238

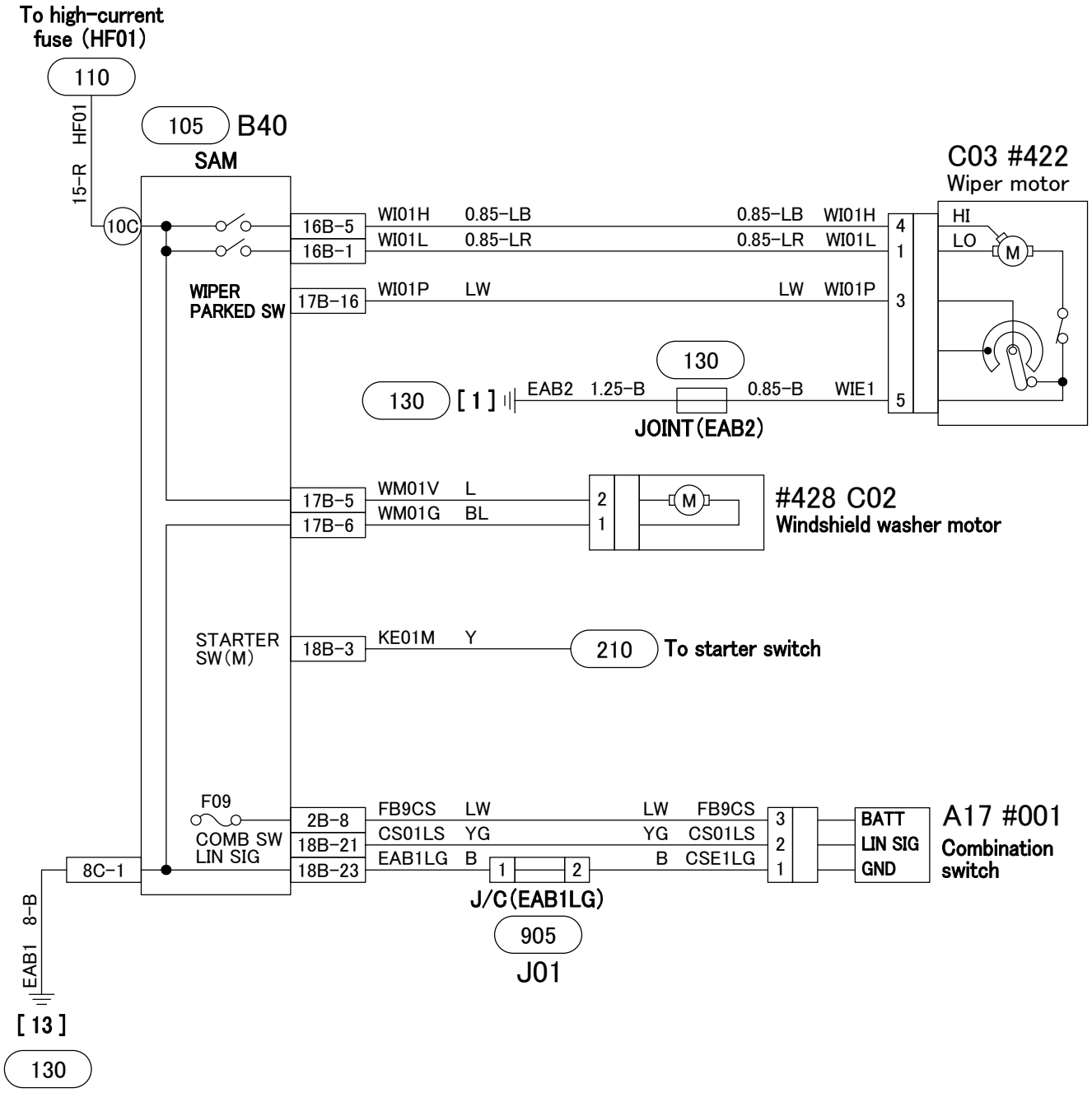


SAM connector (harness side)



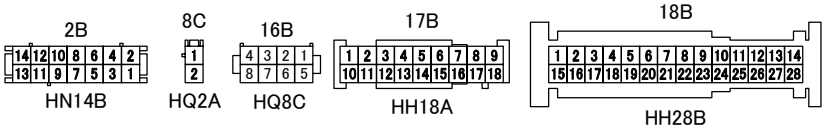
SAM : Signal detect and actuation modules

612-C10238

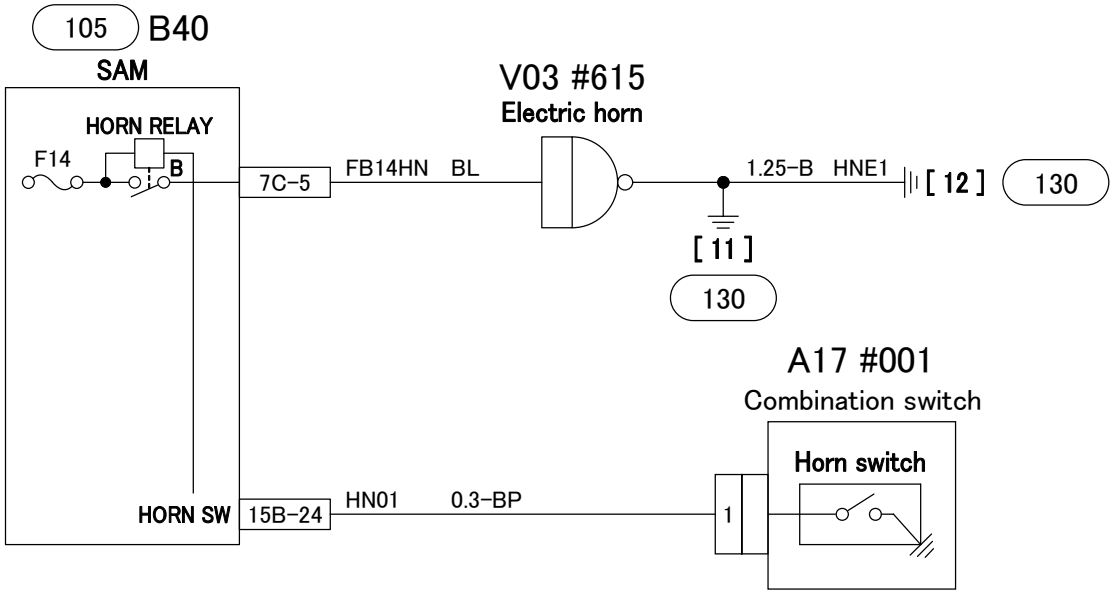


SAM : Signal detect and actuation modules

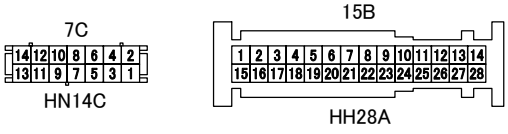
SAM connector (harness side)



614-C10238

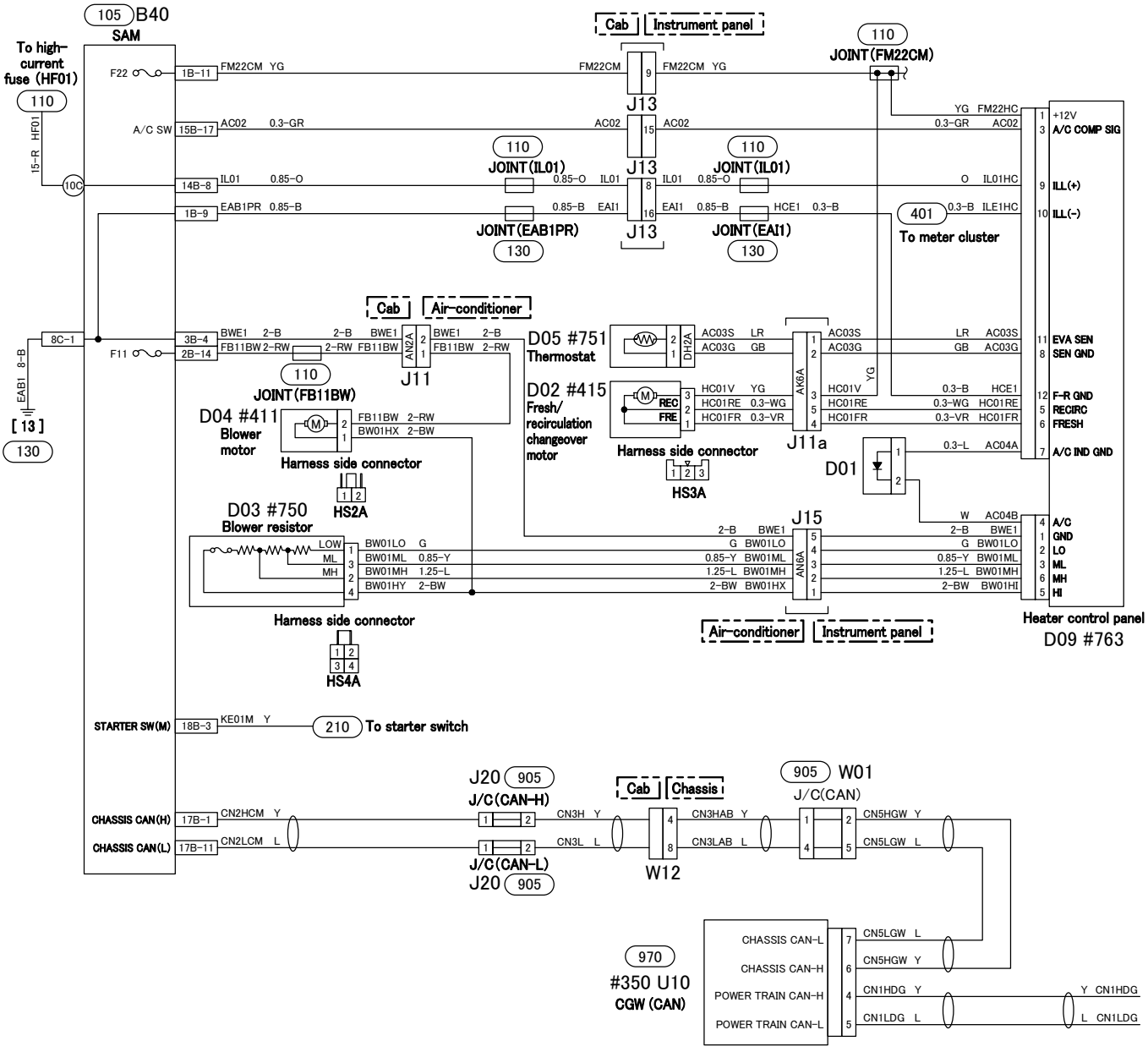


SAM connector (harness side)

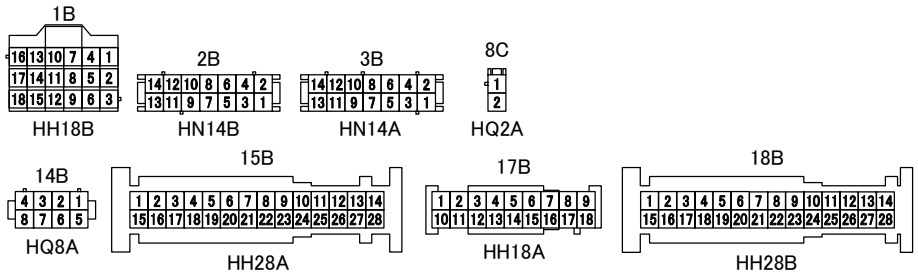


SAM : Signal detect and actuation modules

<Manual air-conditioner> (1/2)



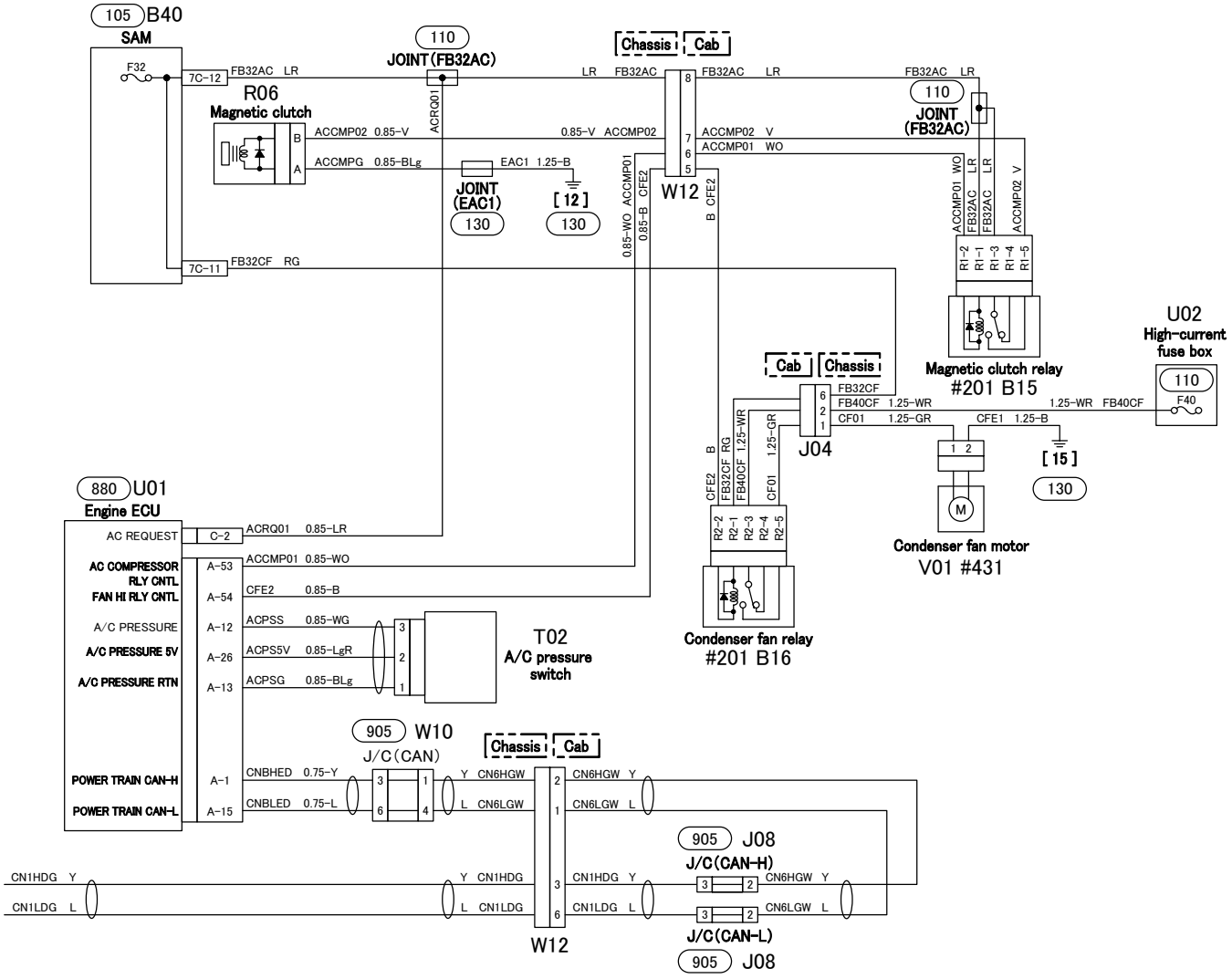
SAM connector (harness side)



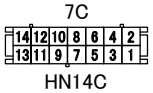
CAN : Controller area network
SAM : Signal detect and actuation modules

620-C10238M-1

＜Manual air-conditioner＞(2/2)

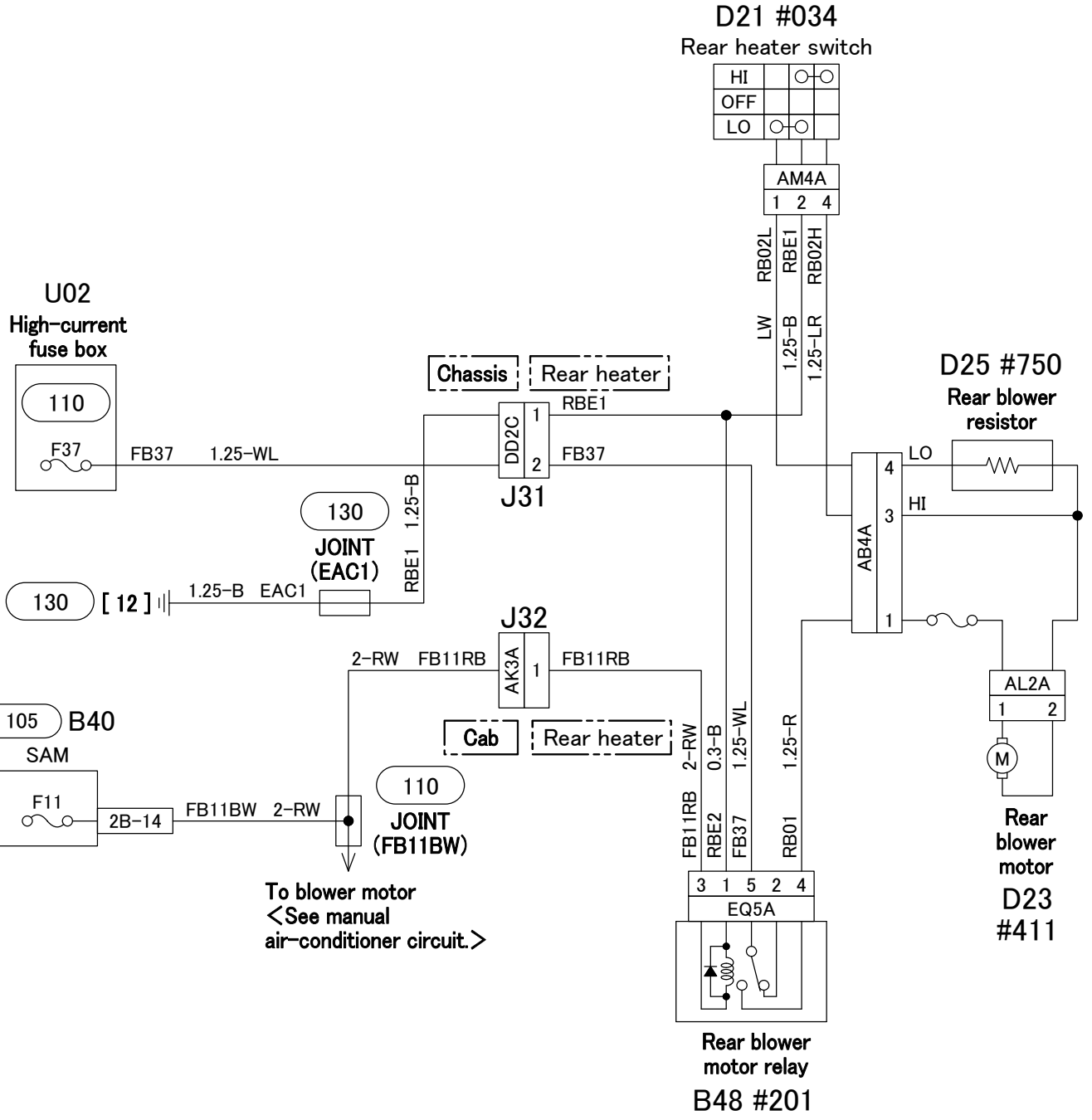


SAM connector (harness side)

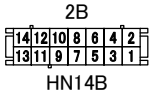


ECU : Electronic contol unit
CAN : Controller area network
SAM : Signal detect and actuation modules

＜Rear heater＞

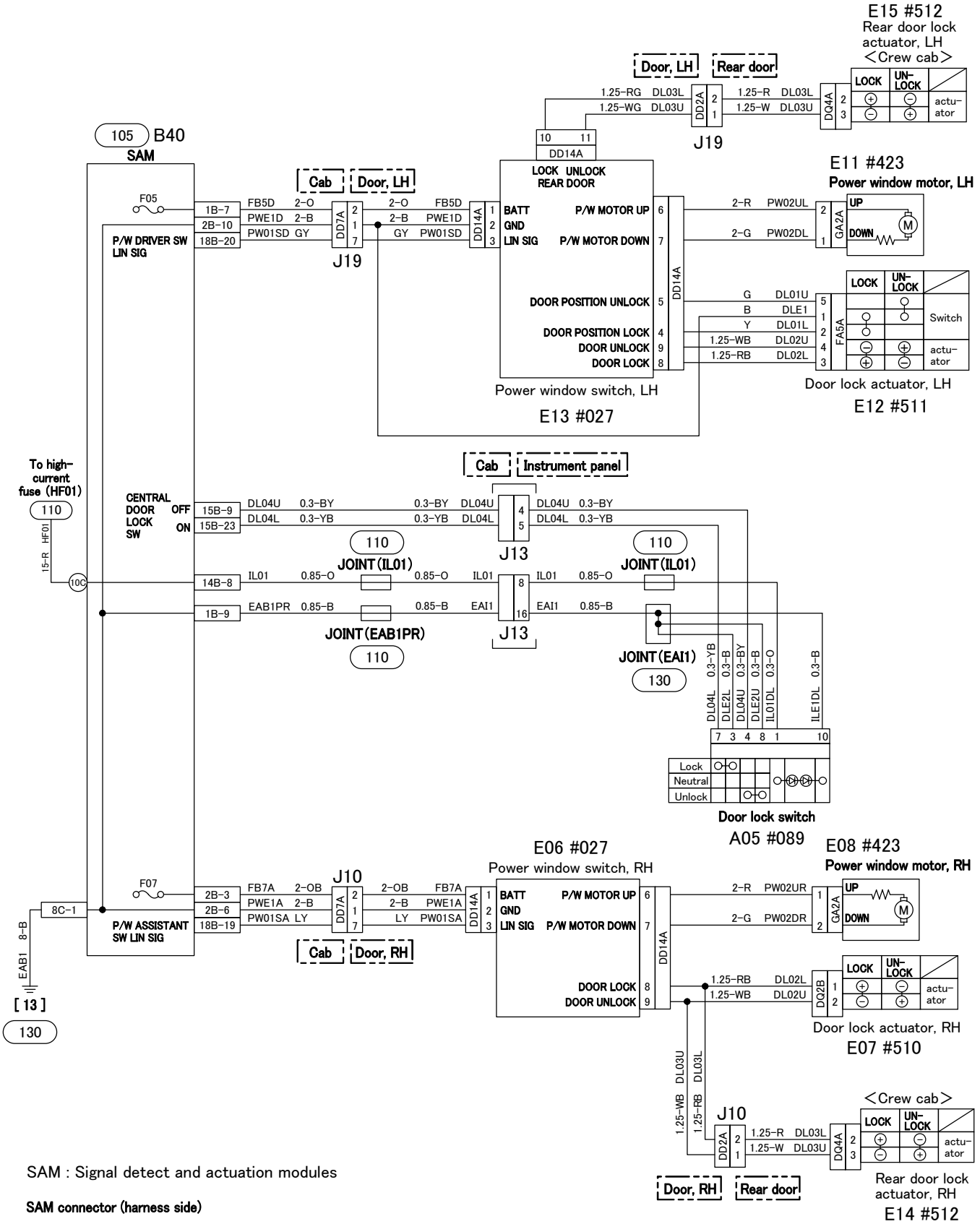


SAM connector (harness side)



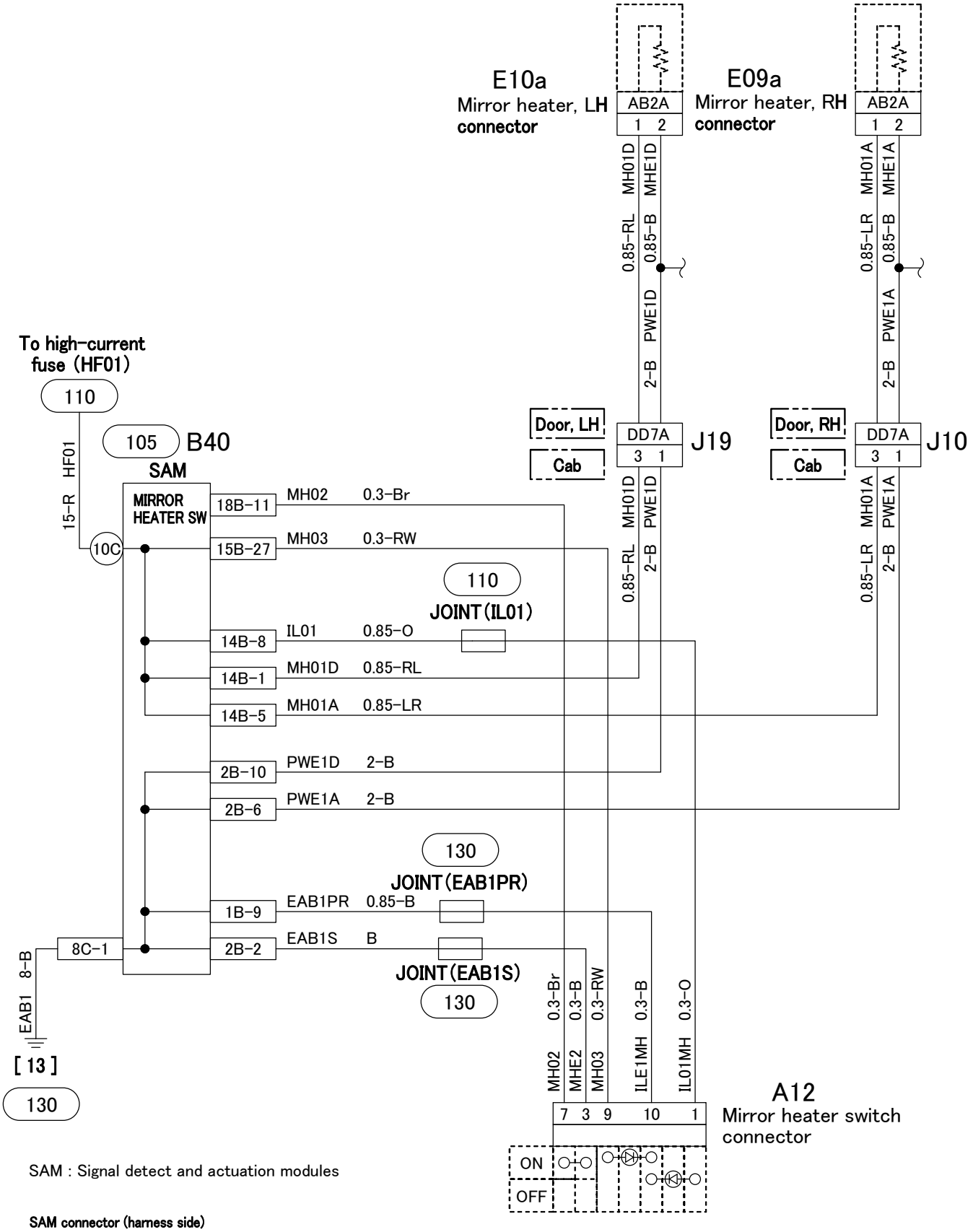
SAM : Signal detect and actuation modules

620-C10238H

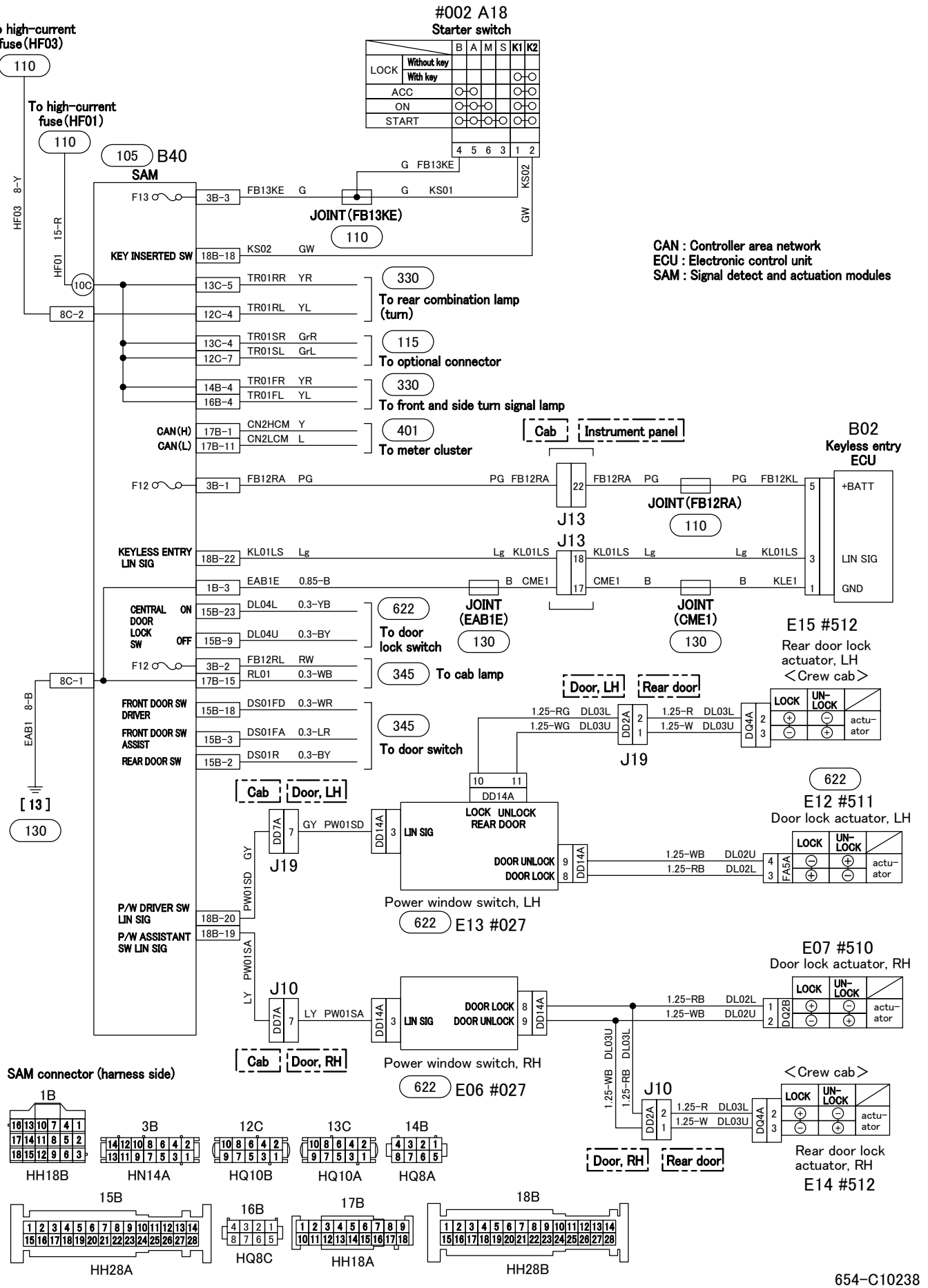

E15 #512
Rear door lock actuator, LH
<Crew cab>
Door, LH
Rear door
1.25-RG DL03L
1.25-WG DL03U
1.25-R DL03L
1.25-W DL03U
DD2A
DQ4A
LOCK
UN-LOCK
actu-ator
J19
105 B40
SAM
10 11
DD14A
Cab
Door, LH
LOCK UNLOCK
REAR DOOR
E11 #423
Power window motor, LH
F05
1B-7
2B-10
18B-20
FB5D 2-O
PWE1D 2-B
PW01SD GY
DD7A
P/W DRIVER SW LIN SIG
BATT
GND
LIN SIG
P/W MOTOR UP
P/W MOTOR DOWN
DOOR POSITION UNLOCK
DOOR POSITION LOCK
DOOR UNLOCK
DOOR LOCK
DD14A
2-R PW02UL
2-G PW02DL
GA2A
UP
DOWN
G DL01U
B DLE1
Y DL01L
1.25-WB DL02U
1.25-RB DL02L
FA5A
Switch
Power window switch, LH
E13 #027
Door lock actuator, LH
E12 #511
To high-current fuse (HF01)
110
HF01
15-R
10C
CENTRAL DOOR LOCK SW
OFF
ON
15B-9
15B-23
DL04U 0.3-BY
DL04L 0.3-YB
Cab
Instrument panel
J13
JOINT (IL01)
14B-8
IL01 0.85-O
1B-9
EAB1PR 0.85-B
JOINT (EAB1PR)
JOINT (EAI1)
130
DL04L 0.3-YB
DLE2L 0.3-B
DL04U 0.3-BY
DLE2U 0.3-B
IL01DL 0.3-O
ILE1DL 0.3-B
Lock
Neutral
Unlock
Door lock switch
A05 #089
E06 #027
Power window switch, RH
E08 #423
Power window motor, RH
F07
2B-3
2B-6
18B-19
FB7A 2-OB
PWE1A 2-B
PW01SA LY
J10
8C-1
P/W ASSISTANT SW LIN SIG
EAB1 8-B
[13]
130
Cab
Door, RH
2-R PW02UR
2-G PW02DR
DQ2B
Door lock actuator, RH
E07 #510
1.25-WB DL03U
1.25-RB DL03L
<Crew cab>
Door, RH
Rear door
Rear door lock actuator, RH
E14 #512
SAM : Signal detect and actuation modules
SAM connector (harness side)
1B
2B
8C
14B
15B
18B
HH18B
HN14B
HQ2A
HQ8A
HH28A
HH28B

622-C10238

629 MIRROR HEATER CIRCUIT



629-C10238

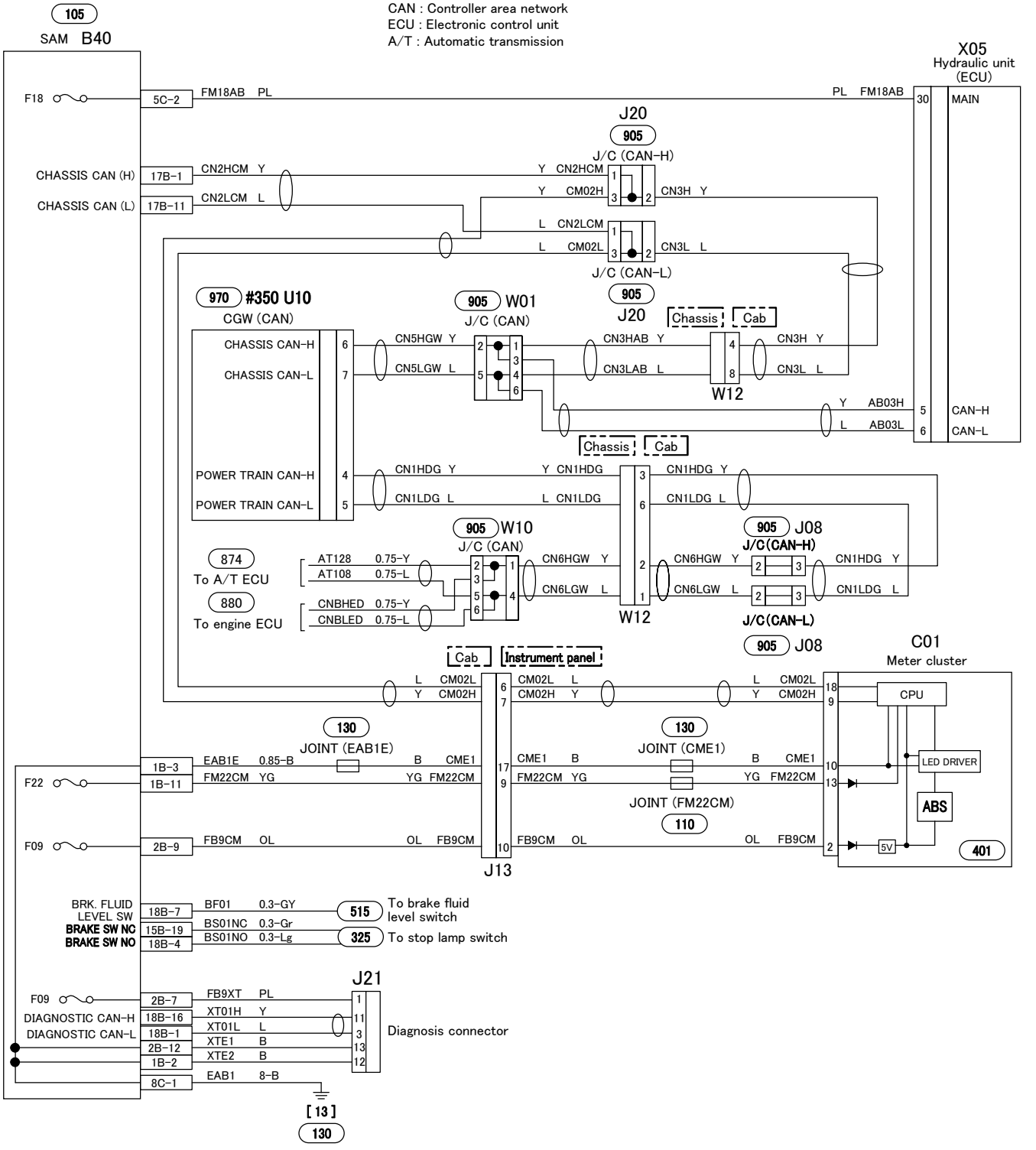

#002 A18
Starter switch
B A M S K1 K2
LOCK Without key
With key
ACC
ON
START
4 5 6 3 1 2
To high-current fuse(HF03)
110
To high-current fuse(HF01)
110
105 B40
SAM
HF03 8-Y
HF01 15-R
F13
3B-3 FB13KE G
G FB13KE
G KS01
KS02
GW
JOINT(FB13KE)
110
KEY INSERTED SW
18B-18 KS02 GW
10C
8C-2
13C-5 TR01RR YR
12C-4 TR01RL YL
330
To rear combination lamp (turn)
13C-4 TR01SR GrR
12C-7 TR01SL GrL
115
To optional connector
14B-4 TR01FR YR
16B-4 TR01FL YL
330
To front and side turn signal lamp
CAN(H) 17B-1 CN2HCM Y
CAN(L) 17B-11 CN2LCM L
401
To meter cluster
Cab
Instrument panel
B02
Keyless entry ECU
F12
3B-1 FB12RA PG
PG FB12RA
22
FB12RA PG
PG FB12KL
5 +BATT
JOINT(FB12RA)
110
J13
J13
KEYLESS ENTRY LIN SIG
18B-22 KL01LS Lg
Lg KL01LS
18
KL01LS Lg
Lg KL01LS
3 LIN SIG
1B-3 EAB1E 0.85-B
B CME1
17
CME1 B
B KLE1
1 GND
JOINT (EAB1E)
130
JOINT (CME1)
130
CENTRAL DOOR LOCK SW ON
OFF
15B-23 DL04L 0.3-YB
15B-9 DL04U 0.3-BY
622
To door lock switch
F12
3B-2 FB12RL RW
17B-15 RL01 0.3-WB
345
To cab lamp
8C-1
E15 #512
Rear door lock actuator, LH
<Crew cab>
Door, LH
Rear door
FRONT DOOR SW DRIVER
FRONT DOOR SW ASSIST
REAR DOOR SW
15B-18 DS01FD 0.3-WR
15B-3 DS01FA 0.3-LR
15B-2 DS01R 0.3-BY
345
To door switch
1.25-RG DL03L
1.25-WG DL03U
DD2A
1.25-R DL03L
1.25-W DL03U
DQ4A
LOCK UN-LOCK actu-ator
J19
EAB1 8-B
[13]
130
Cab
Door, LH
10 11
DD14A
622
E12 #511
Door lock actuator, LH
DD7A 7 GY PW01SD
DD14A 3 LIN SIG
LOCK UNLOCK REAR DOOR
DOOR UNLOCK 9
DOOR LOCK 8
DD14A
1.25-WB DL02U
1.25-RB DL02L
FA5A
J19
Power window switch, LH
622 E13 #027
P/W DRIVER SW LIN SIG
18B-20
P/W ASSISTANT SW LIN SIG
18B-19
GY PW01SD
LY PW01SA
E07 #510
Door lock actuator, RH
J10
DD7A 7 LY PW01SA
DD14A 3 LIN SIG
DOOR LOCK 8
DOOR UNLOCK 9
DD14A
1.25-RB DL02L
1.25-WB DL02U
DQ2B
Cab
Door, RH
Power window switch, RH
622 E06 #027
1.25-WB DL03U
1.25-RB DL03L
J10
DD2A
1.25-R DL03L
1.25-W DL03U
DQ4A
<Crew cab>
Door, RH
Rear door
Rear door lock actuator, RH
E14 #512
SAM connector (harness side)
1B HH18B
3B HN14A
12C HQ10B
13C HQ10A
14B HQ8A
15B HH28A
16B HQ8C
17B HH18A
18B HH28B
CAN : Controller area network
ECU : Electronic control unit
SAM : Signal detect and actuation modules

654-C10238

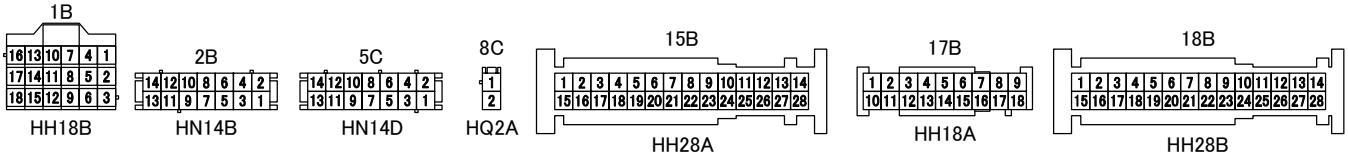
54-07 CHASSIS SIDE ELECTRICAL CIRCUIT

(1/2)

SAM : Signal detect and actuation modules
CAN : Controller area network
ECU : Electronic control unit
A/T : Automatic transmission

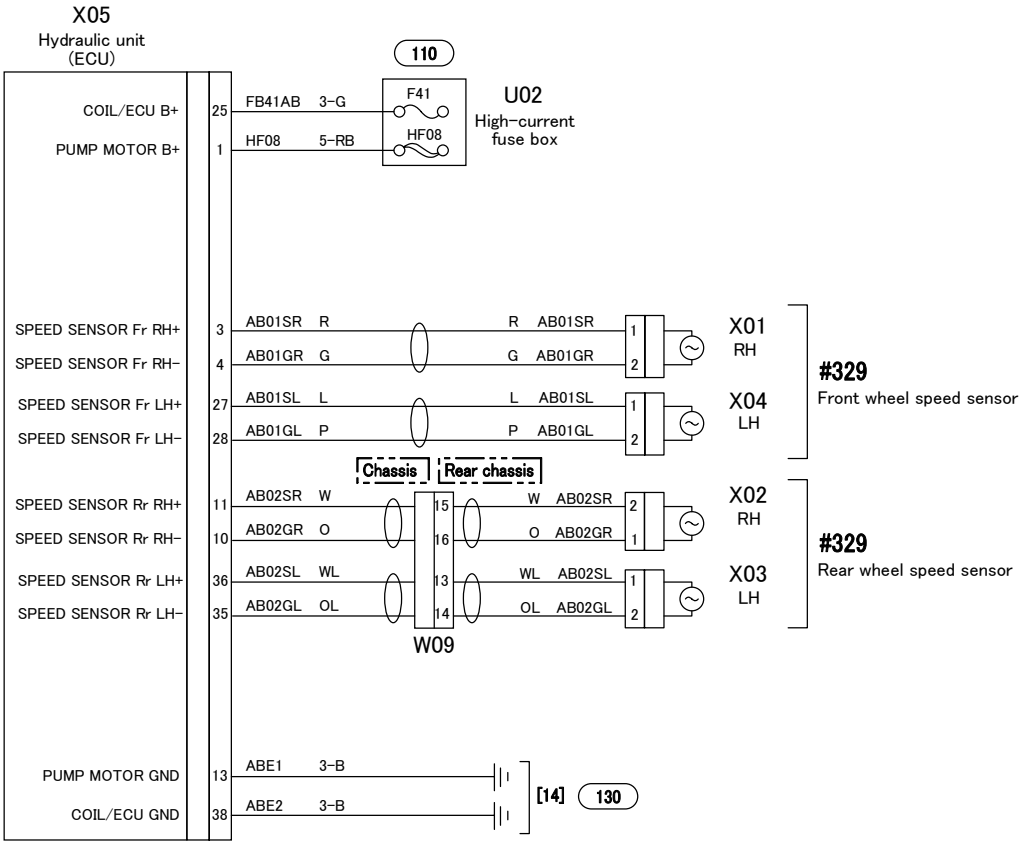


SAM connector (harness side)



790-C10238-1

(2/2)

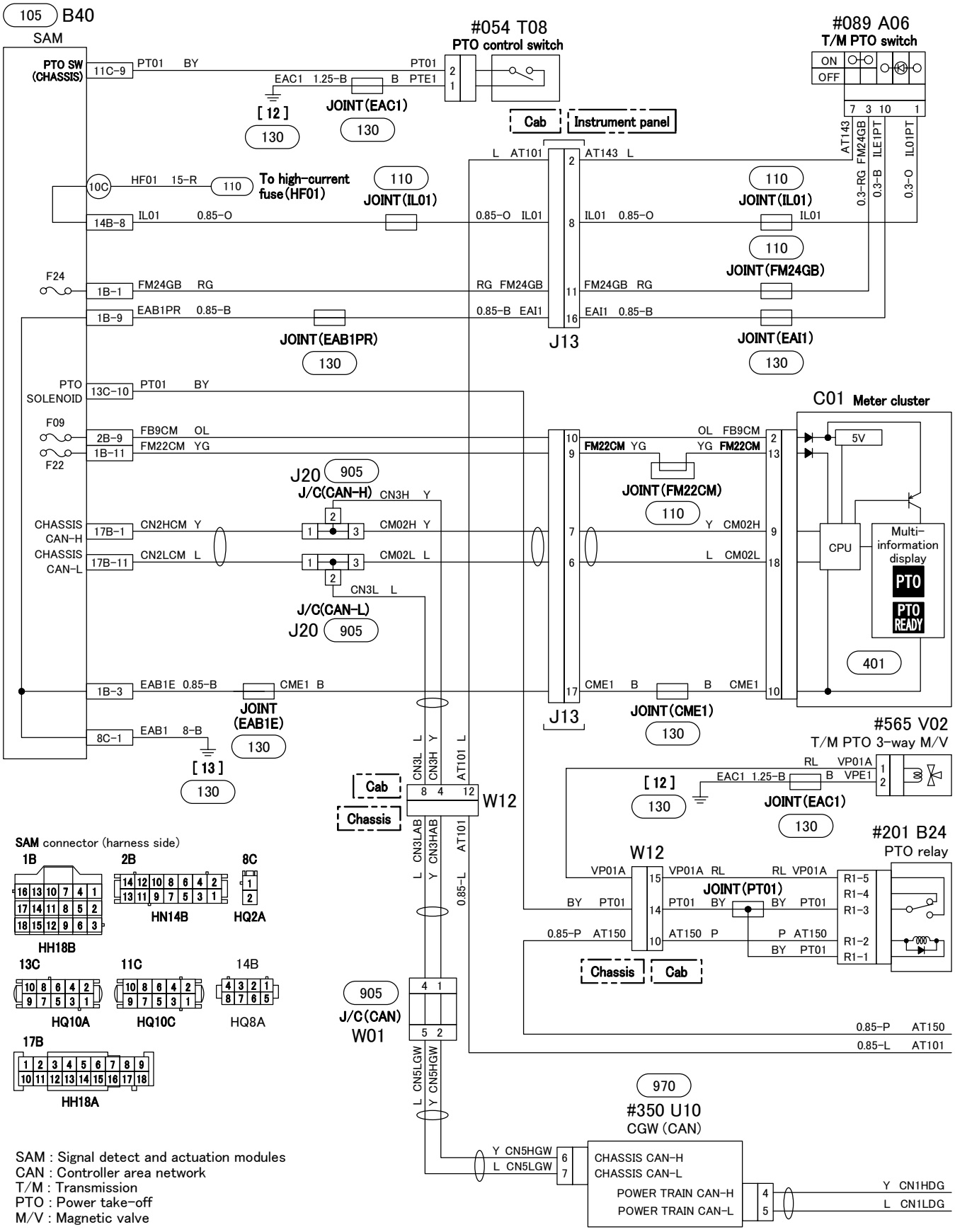


ECU : Electronic control unit

54-08 ENGINE AND TRANSMISSION SIDE ELECTRICAL CIRCUIT

850 TRANSMISSION POWER TAKE-OFF CIRCUIT

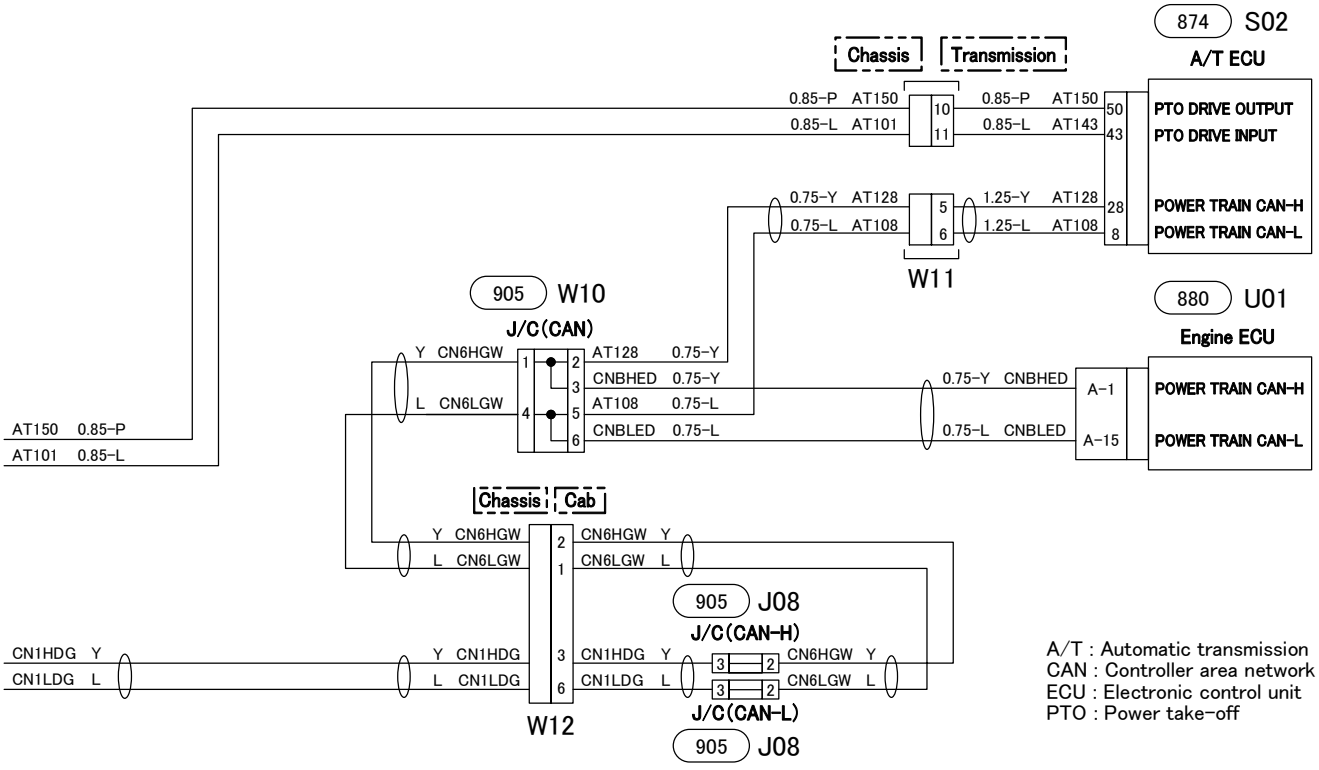
(1/2)



SAM : Signal detect and actuation modules
CAN : Controller area network
T/M : Transmission
PTO : Power take-off
M/V : Magnetic valve

850-C10238-1

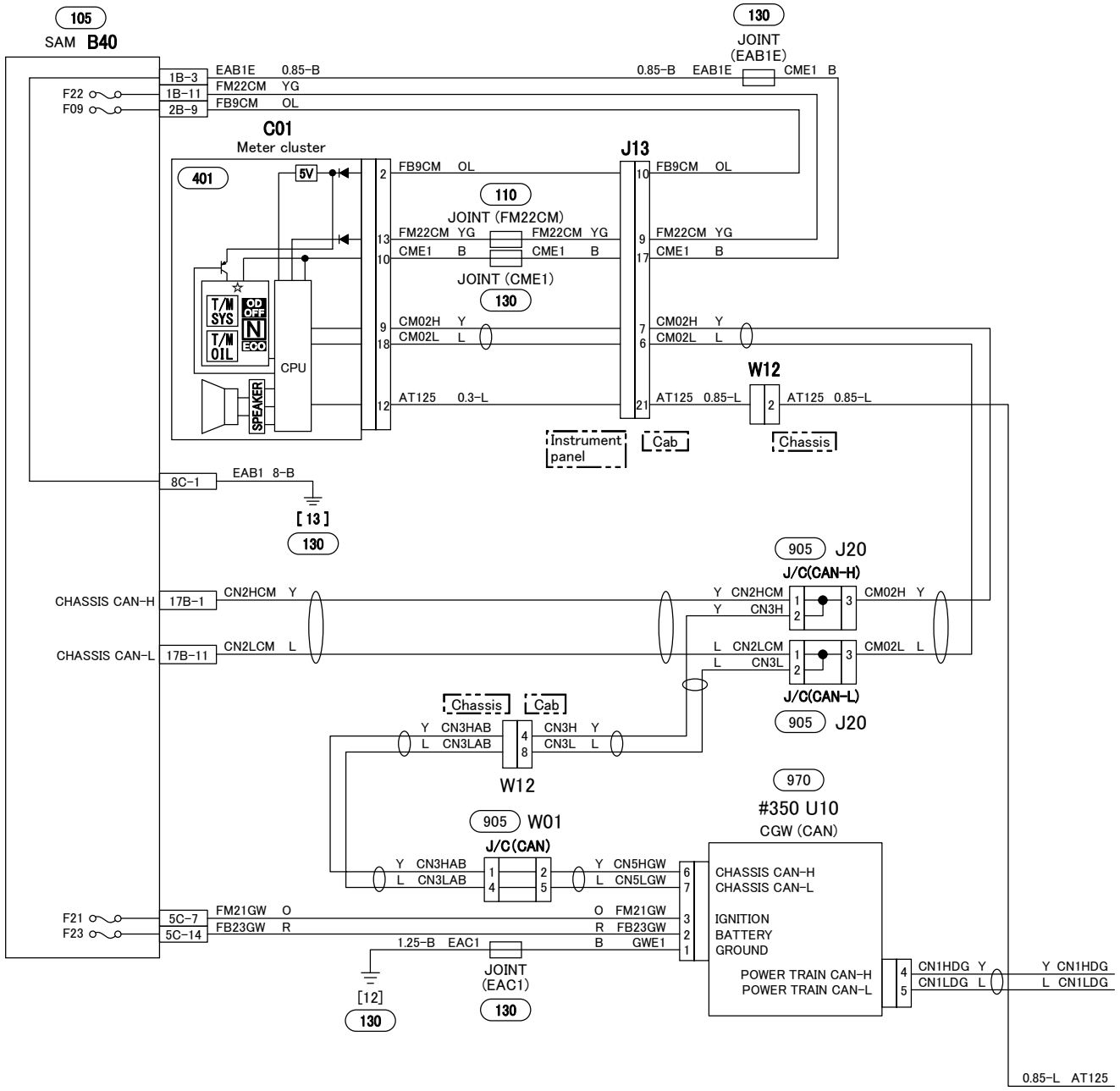
(2/2)



A/T : Automatic transmission
CAN : Controller area network
ECU : Electronic control unit
PTO : Power take-off

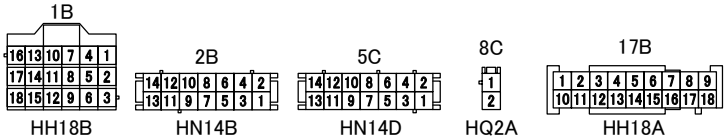
850-C10238-2

(1/3)



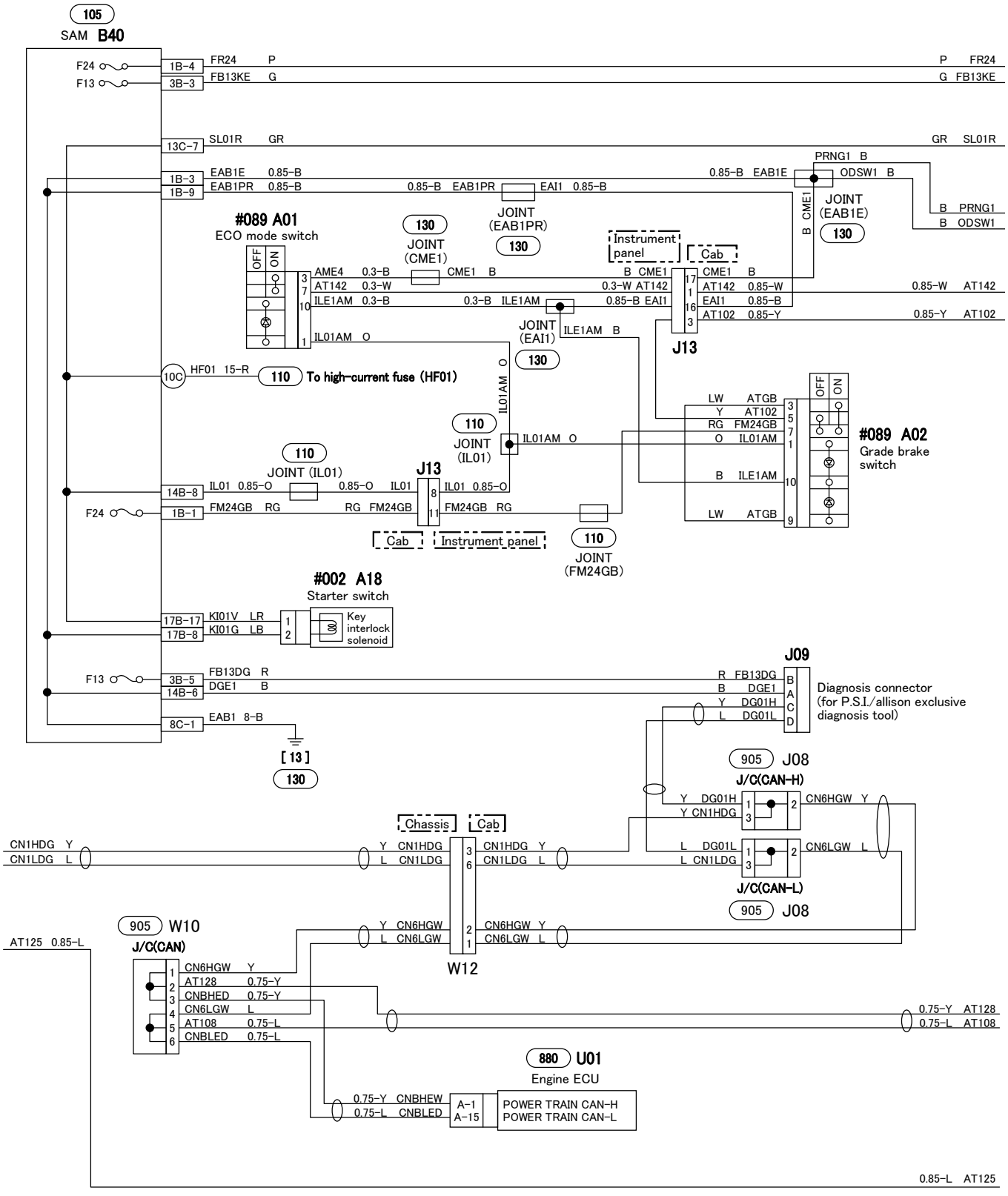
SAM : Signal detect and actuation modules
CAN : Controller area network
☆ : Multi-information display

SAM connector (harness side)

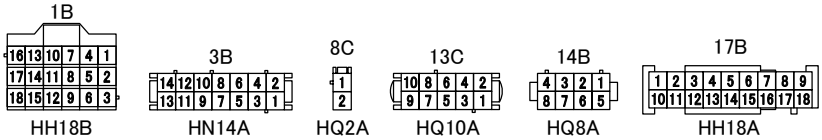


874-C10238-1

(2/3)



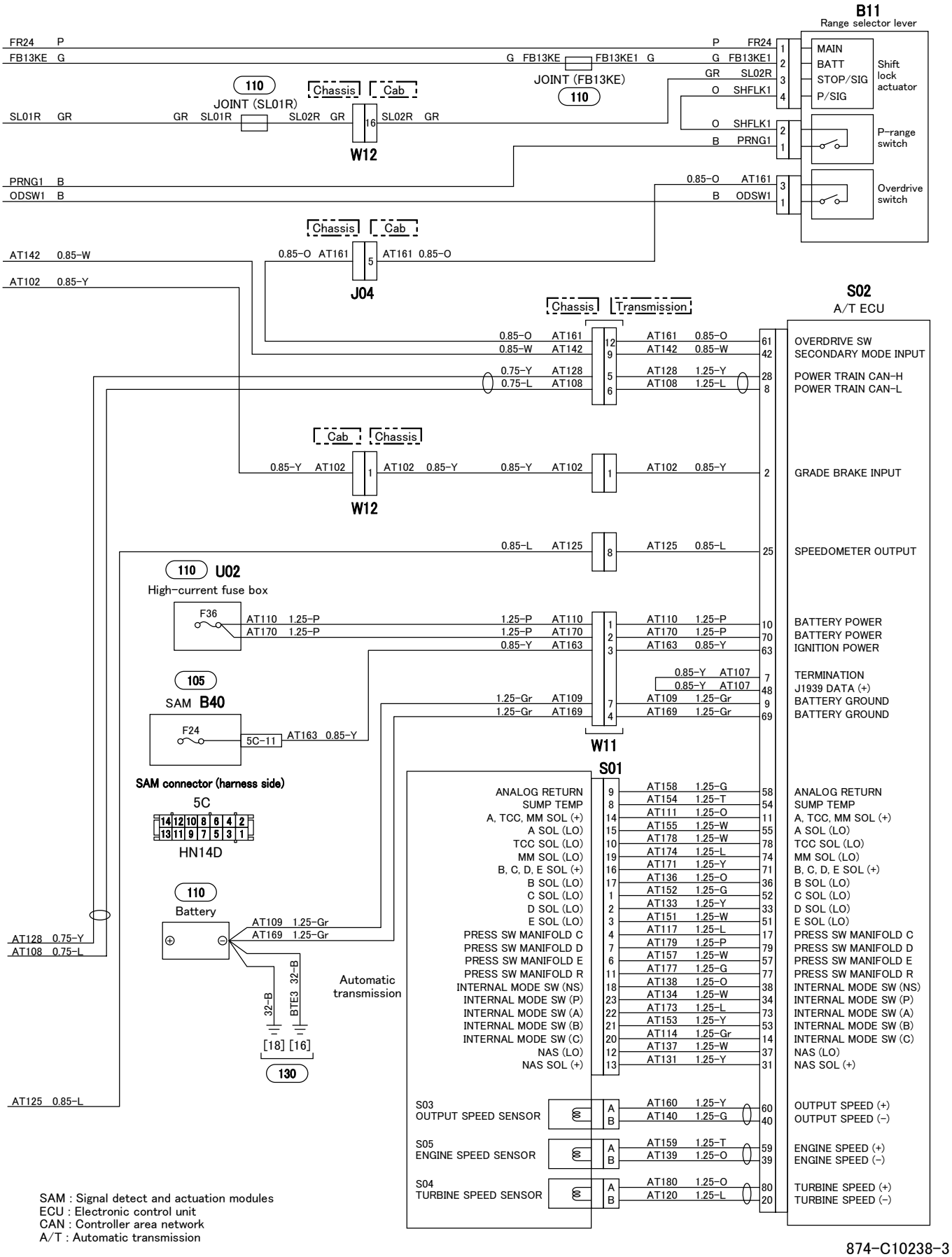
SAM connector (harness side)



SAM : Signal detect and actuation modules
ECU : Electronic control unit
CAN : Controller area network

874-C10238-2

(3/3)

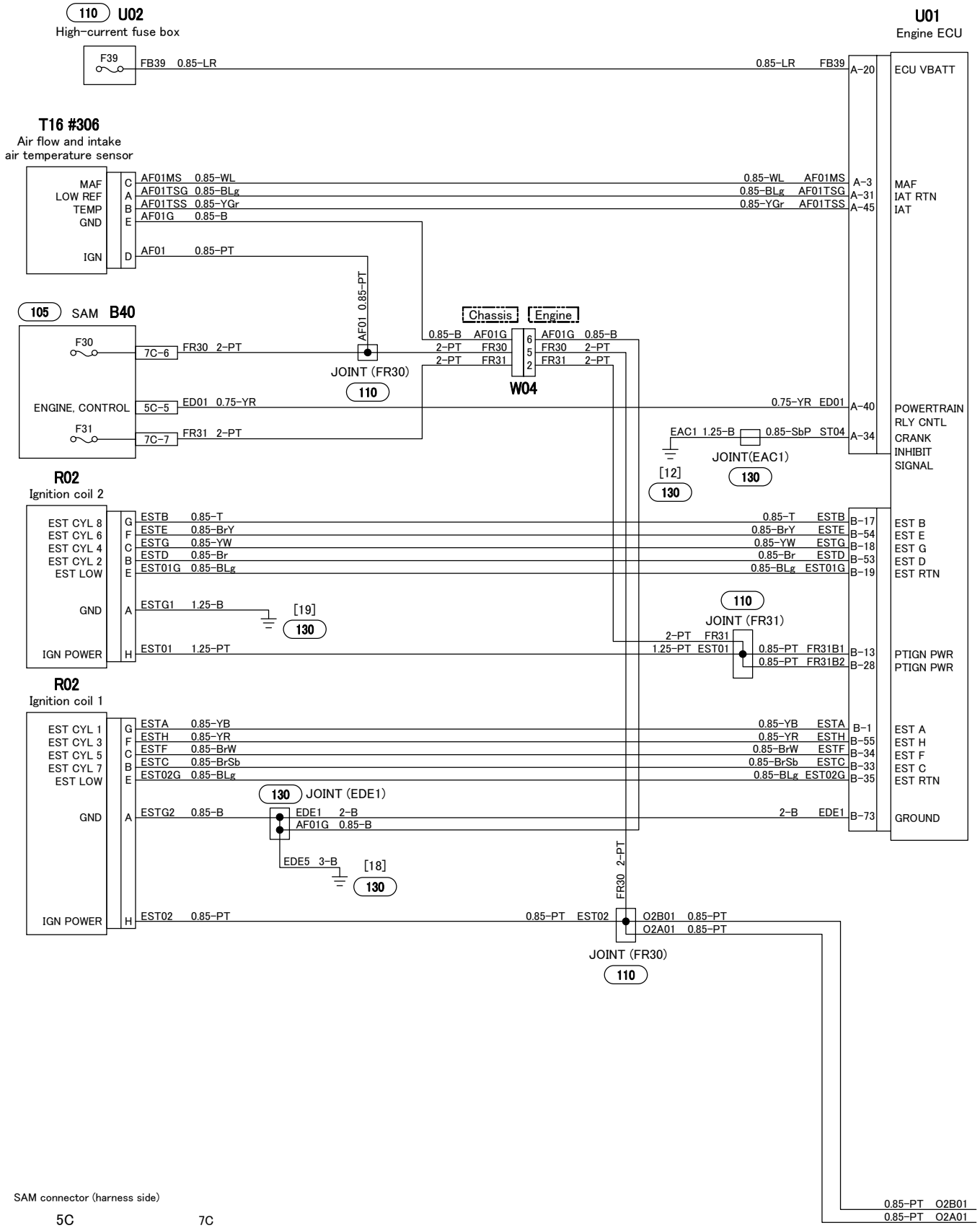


SAM : Signal detect and actuation modules
ECU : Electronic control unit
CAN : Controller area network
A/T : Automatic transmission

874-C10238-3

M E M O

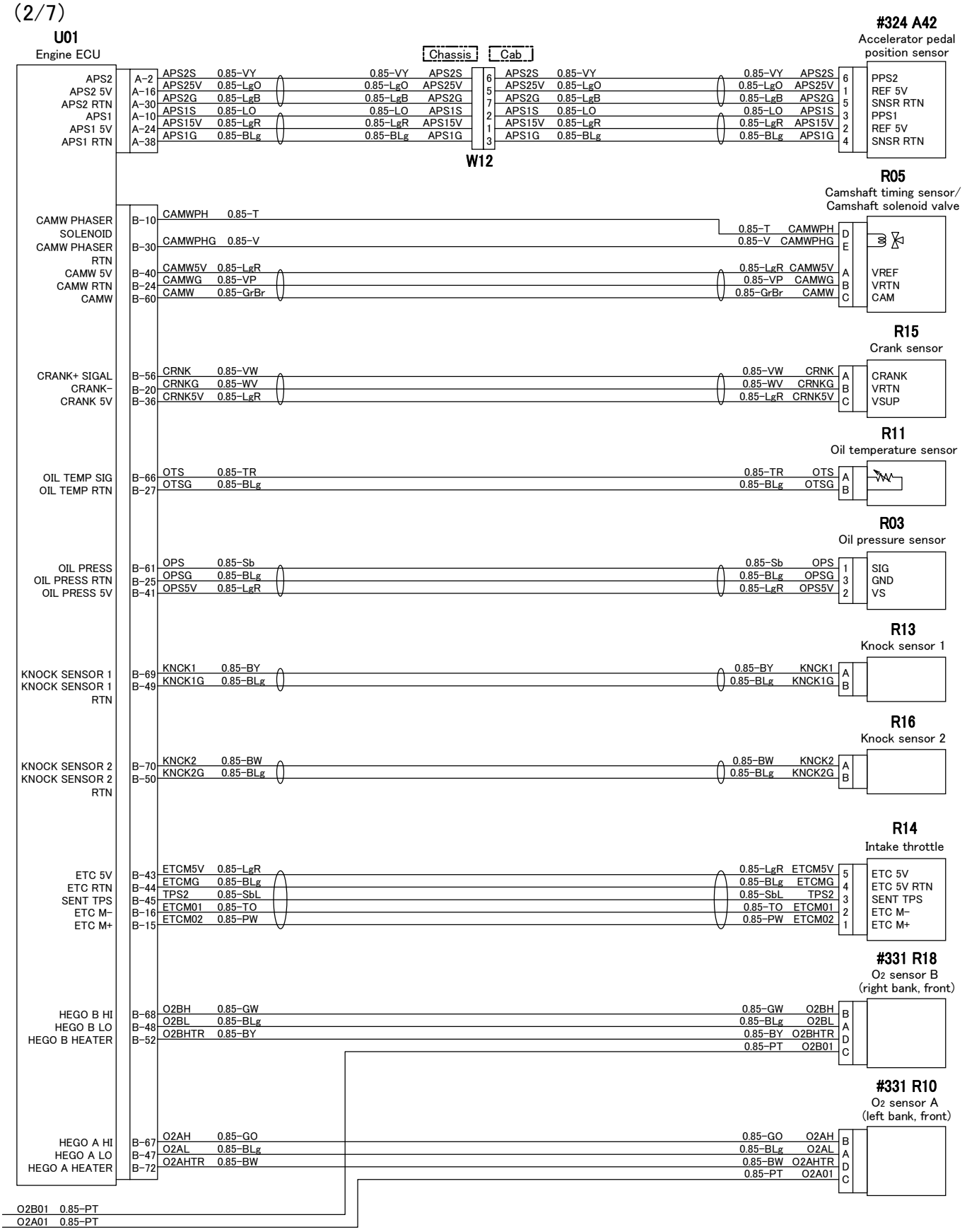
(1/7)



SAM : Signal detect and actuation modules
ECU : Electronic control unit

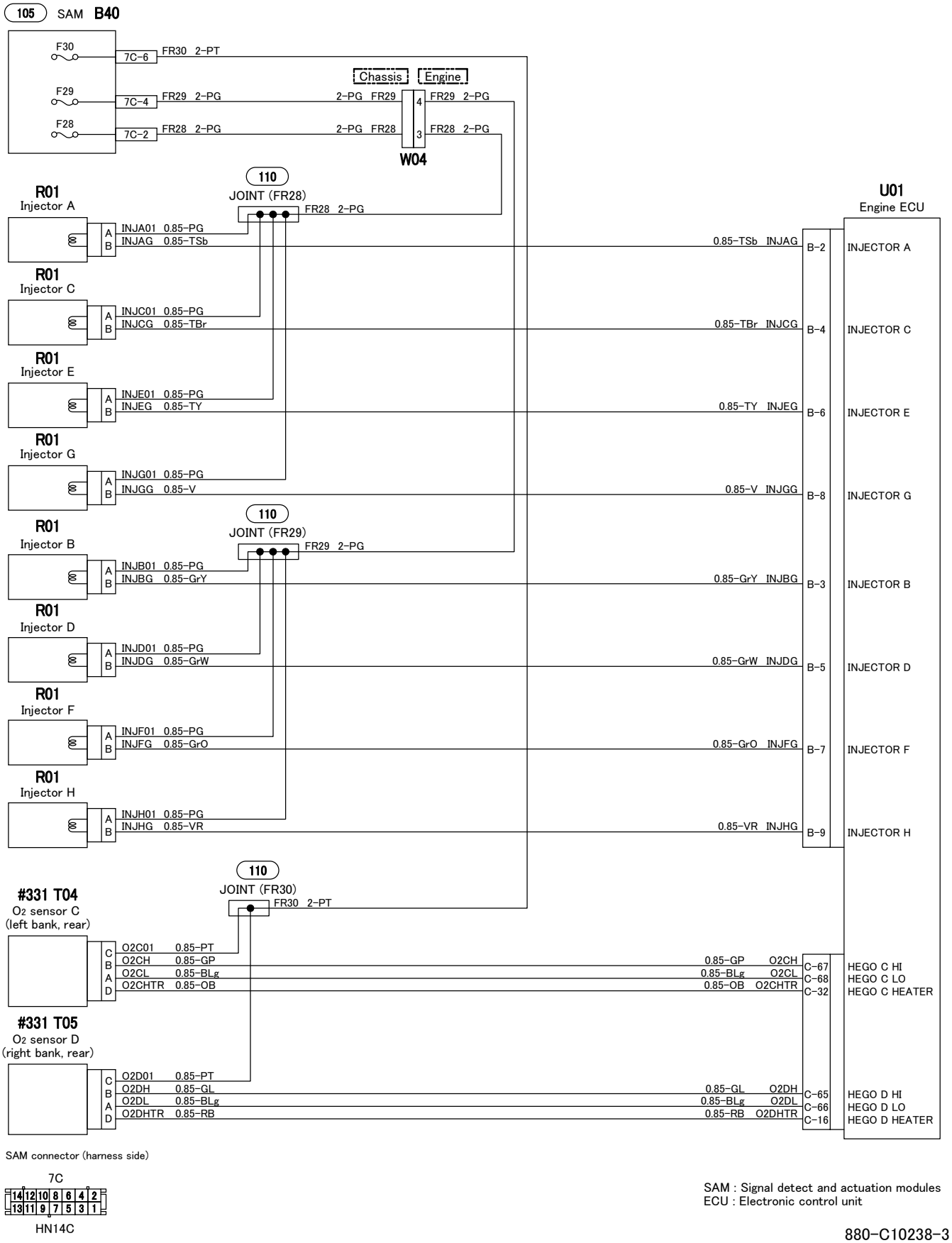
880-C10238-1

(2/7)



ECU : Electronic control unit

(3/7)



SAM connector (harness side)

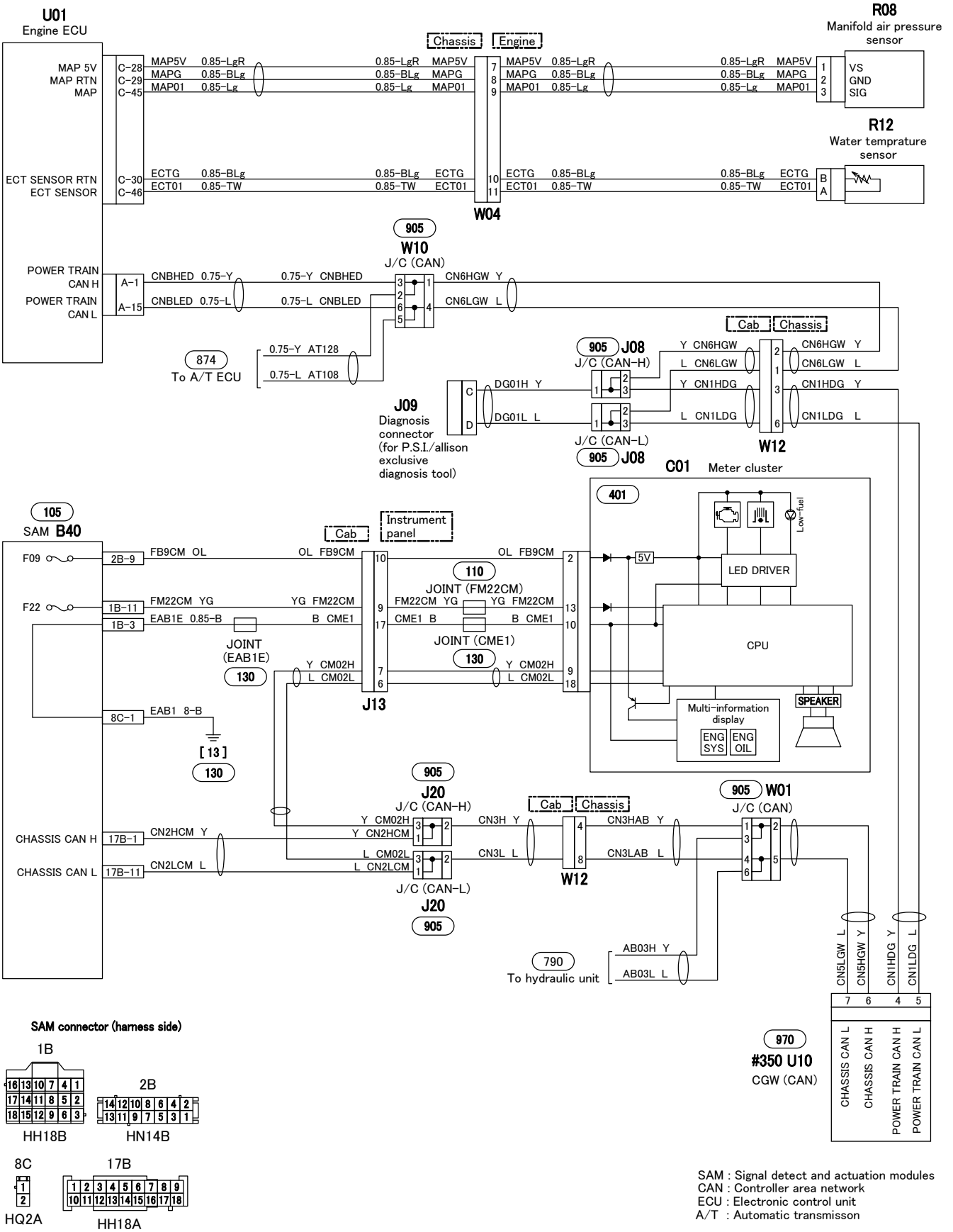
7C

HN14C

SAM : Signal detect and actuation modules
ECU : Electronic control unit

880-C10238-3

(4/7)

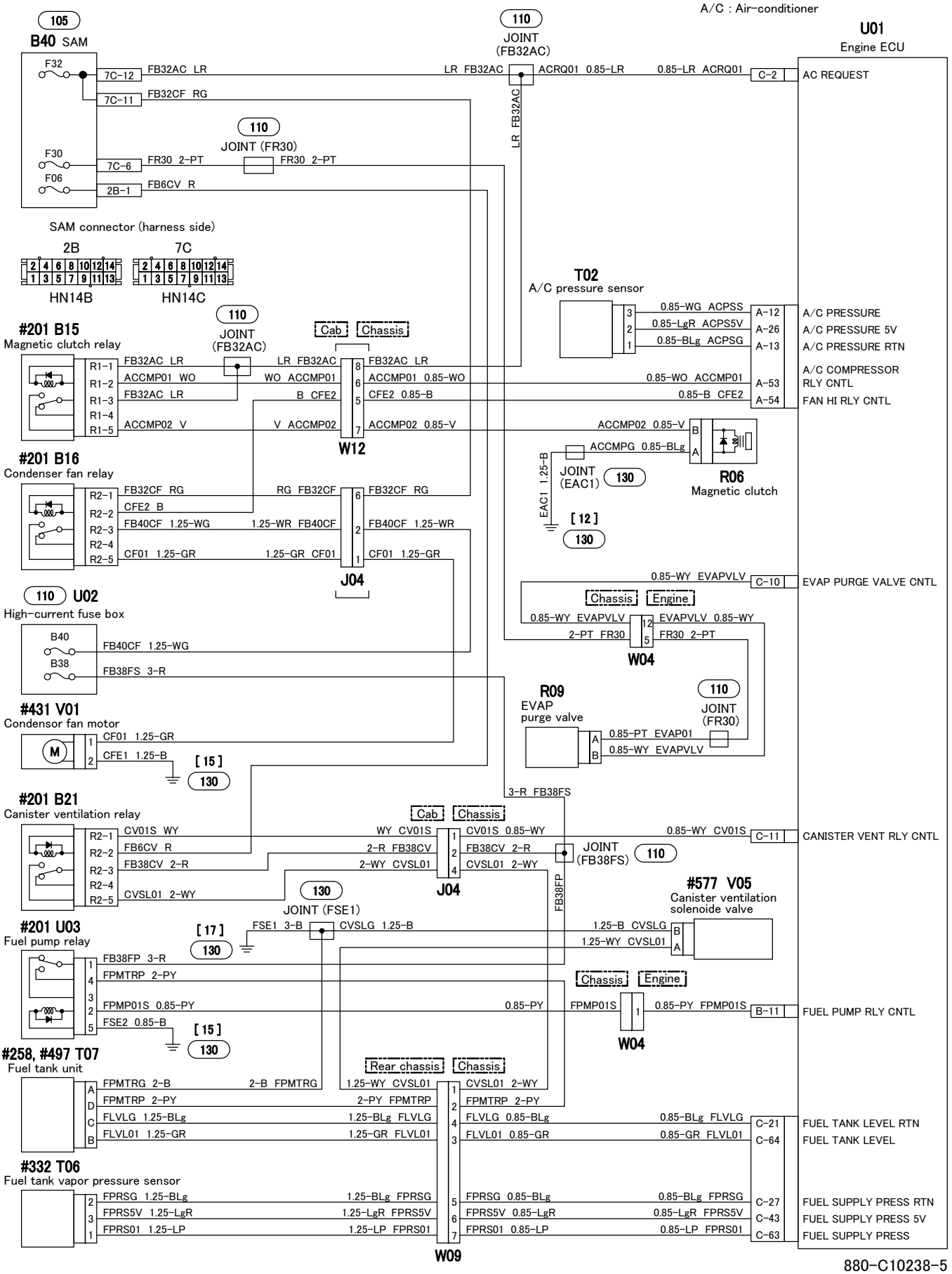


SAM : Signal detect and actuation modules
CAN : Controller area network
ECU : Electronic control unit
A/T : Automatic transmisson

880-C10238-4

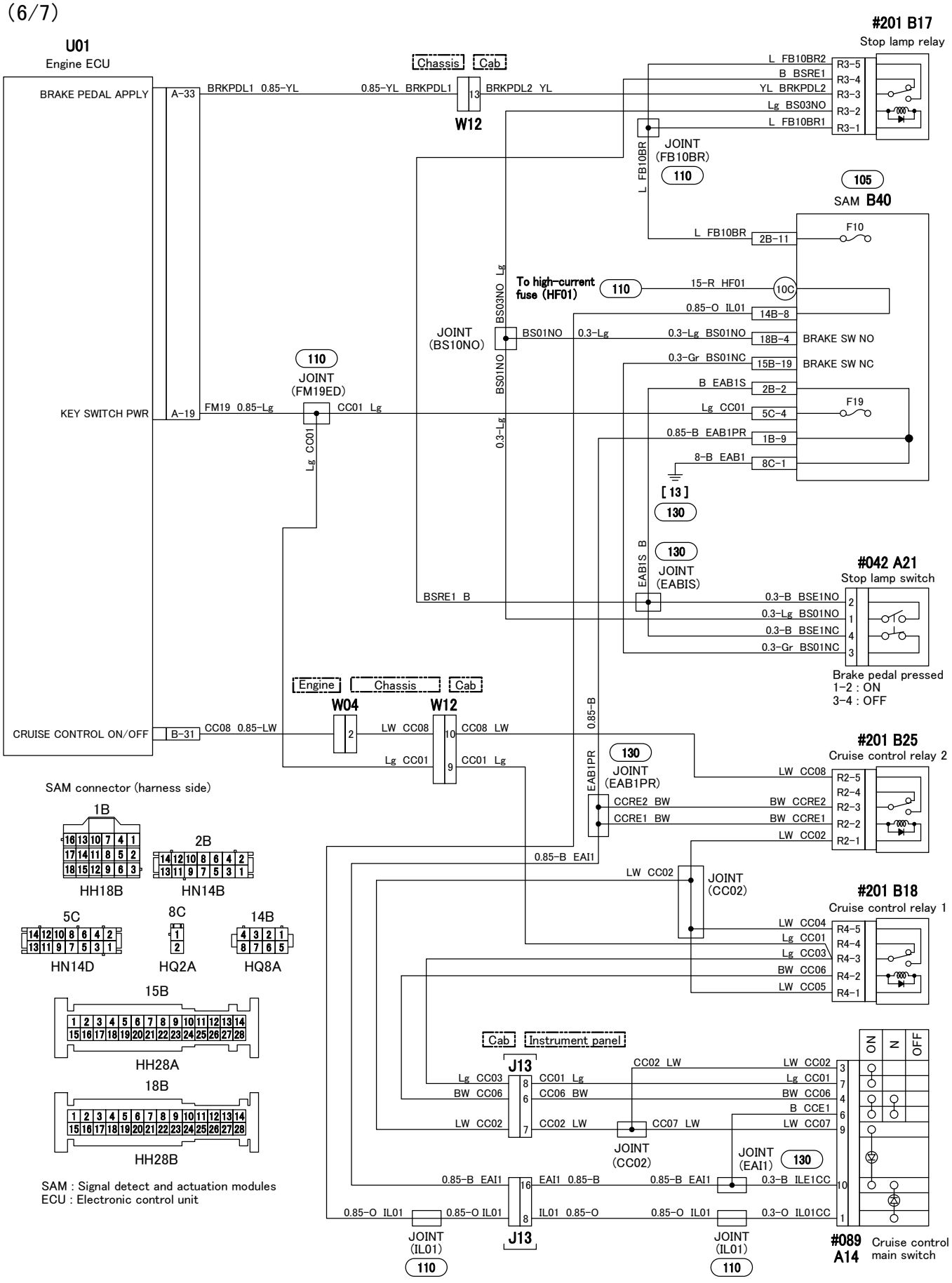
(5/7)

SAM : Signal detect and actuation modules
ECU : Electronic control unit
A/C : Air-conditioner



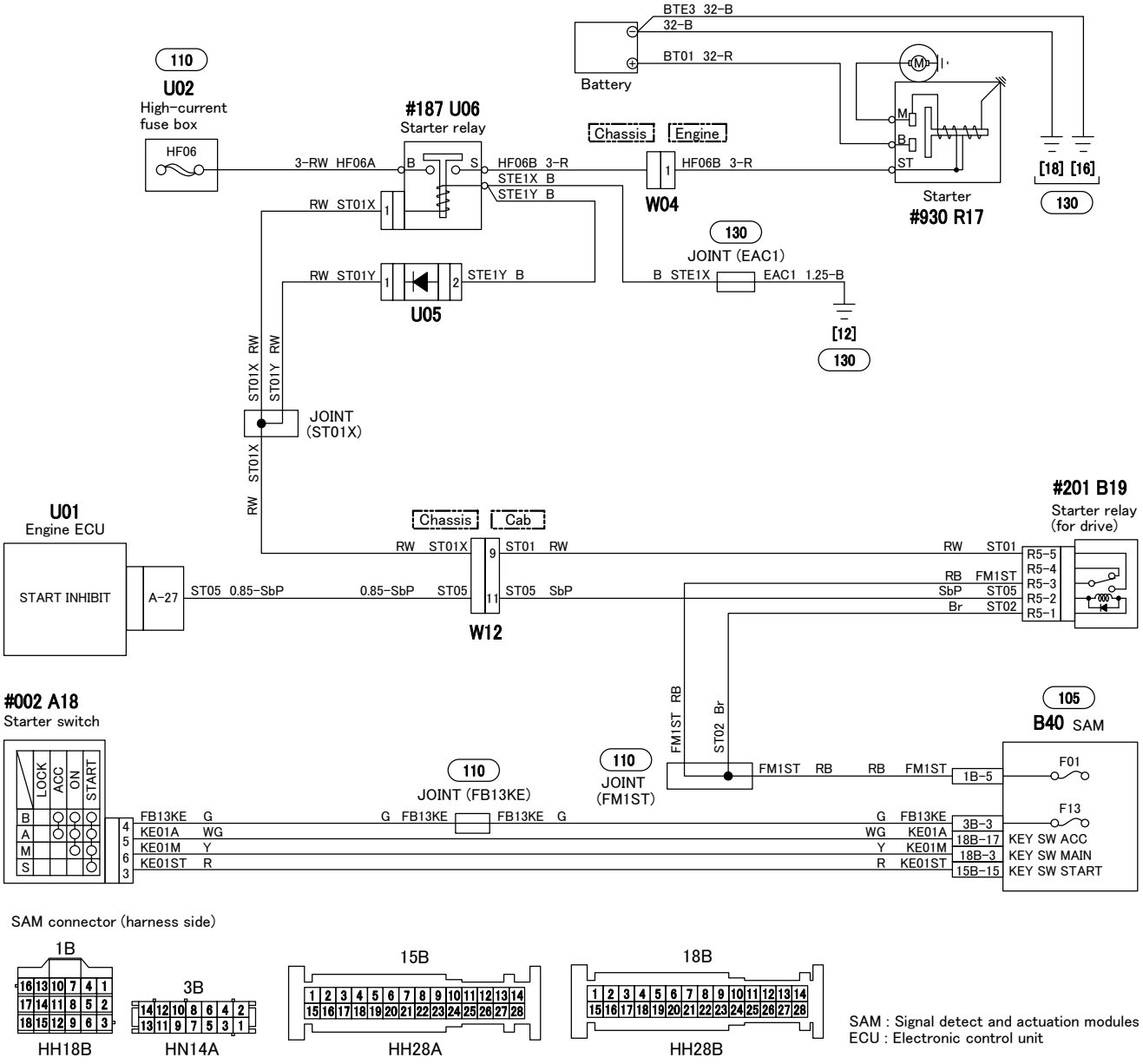
880-C10238-5

(6/7)



880-C10238-6

(7/7)



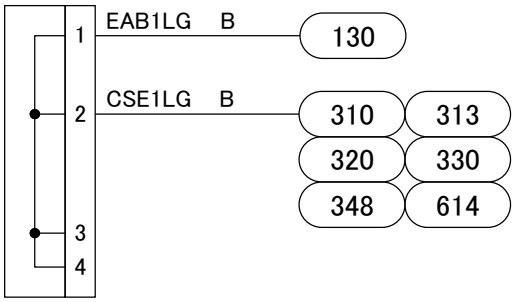
880-C10238-7

54-09 OTHER CIRCUIT

(1/2)

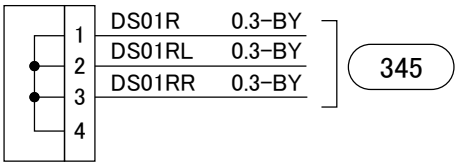
Ground (EAB1LG)

1	2	3	4
EAB1LG	CSE1LG	–	–



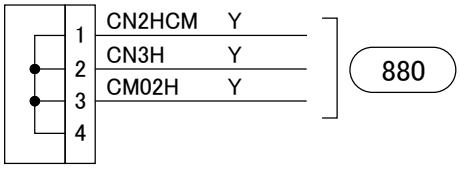
Rear door switch (040)

1	2	3	4
DS01R	DS01RL	DS01RR	–



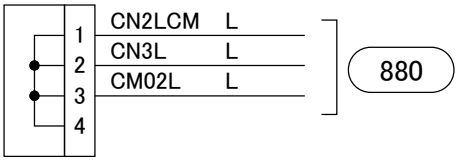
Meter cluster (CAN-H)

1	2	3	4
CN2HCM	CN3H	CM02H	–



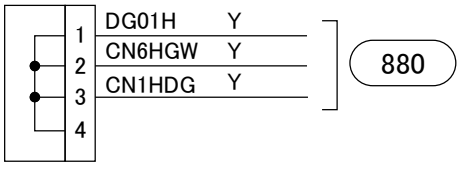
Meter cluster (CAN-L)

1	2	3	4
CN2LCM	CN3L	CM02L	–



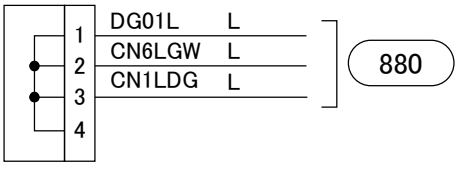
SAM (CAN-H)

1	2	3	4
DG01H	CN6HGW	CN1HDG	–



SAM (CAN-L)

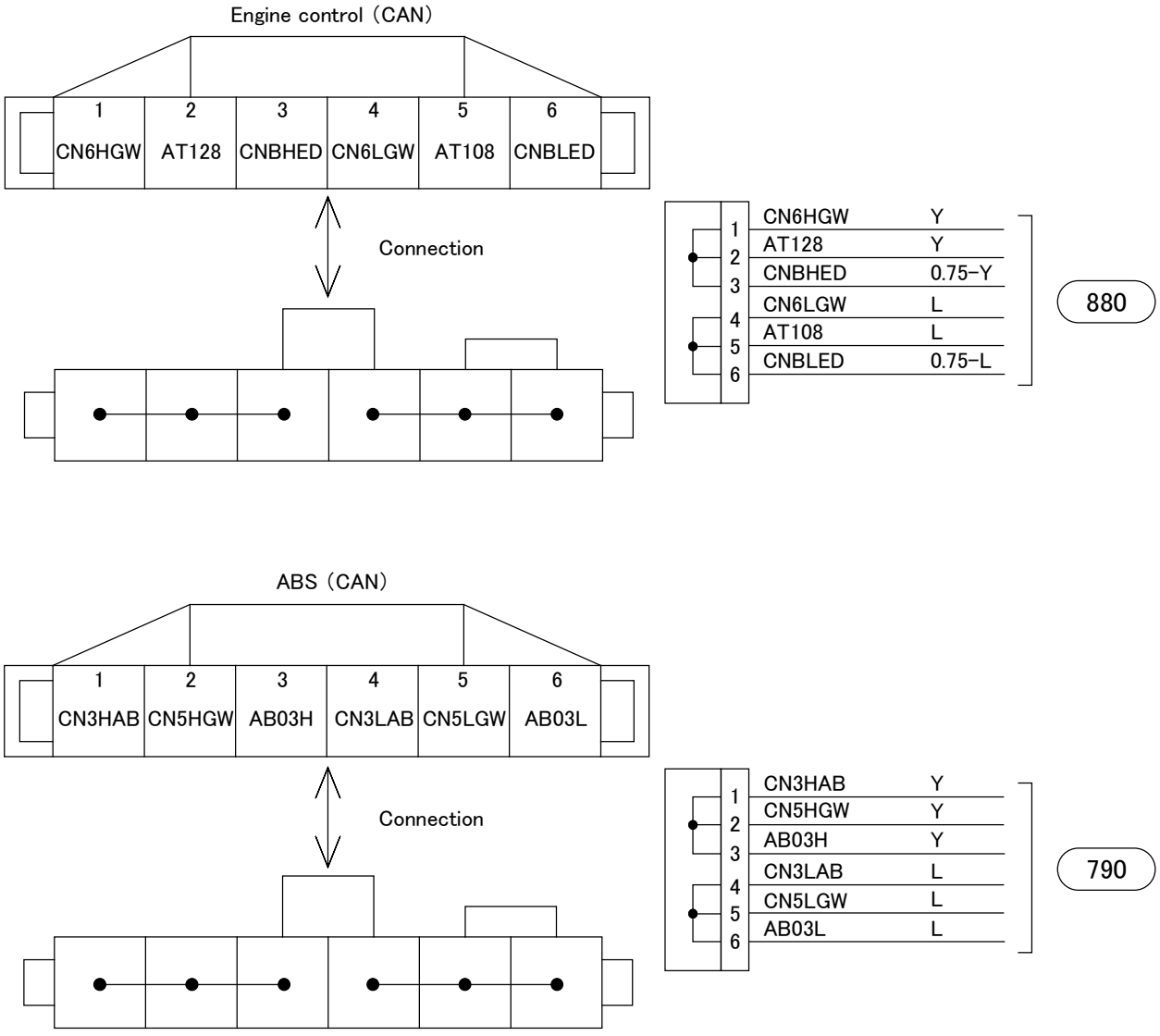
1	2	3	4
DG01L	CN6LGW	CN1LDG	–



CAN : Controller area network
SAM : Signal detect and actuation modules

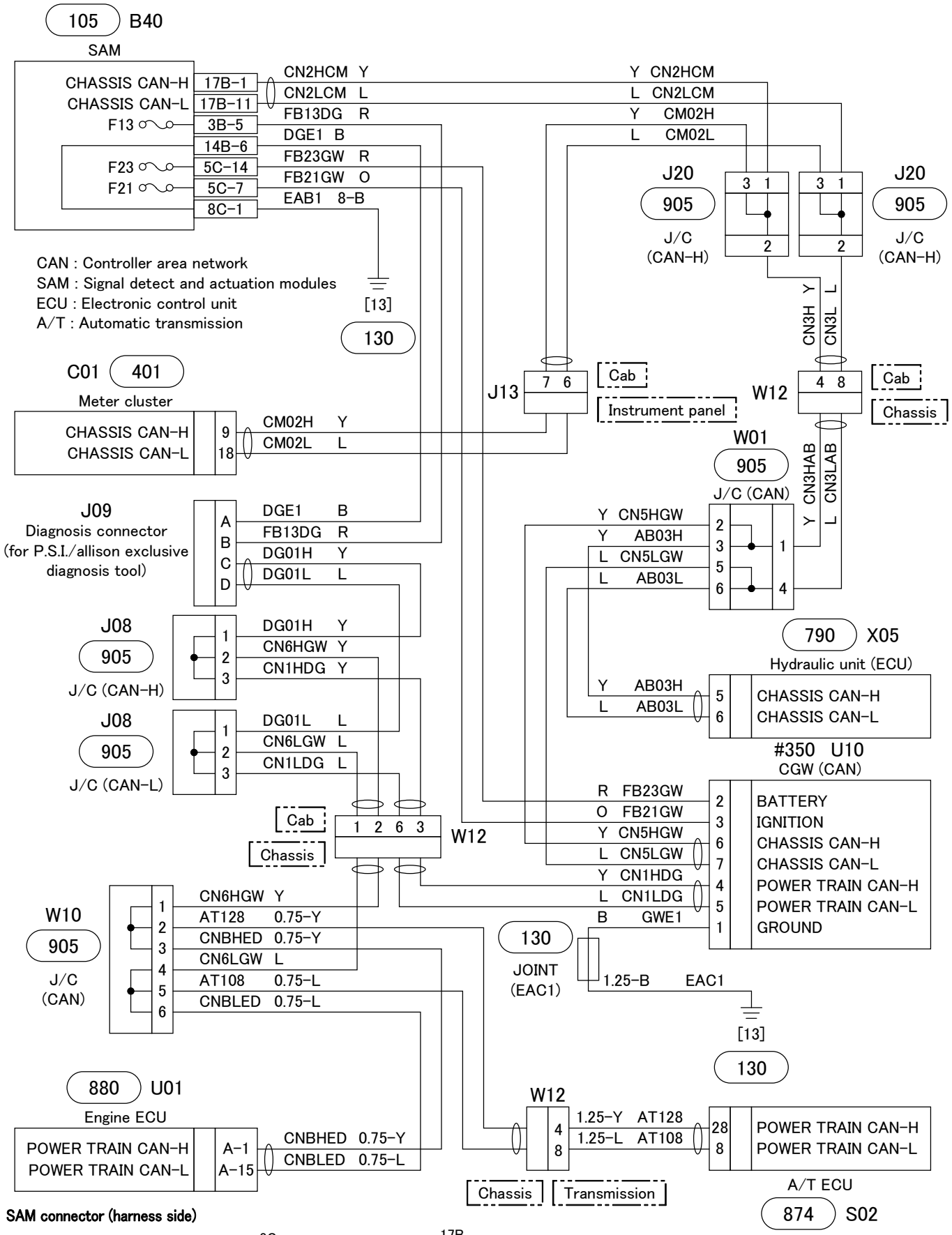
905-C10238-1

(2/2)



ABS : Anti-lock brake system
CAN : Controller area network

970 CGW CIRCUIT



970-C10238

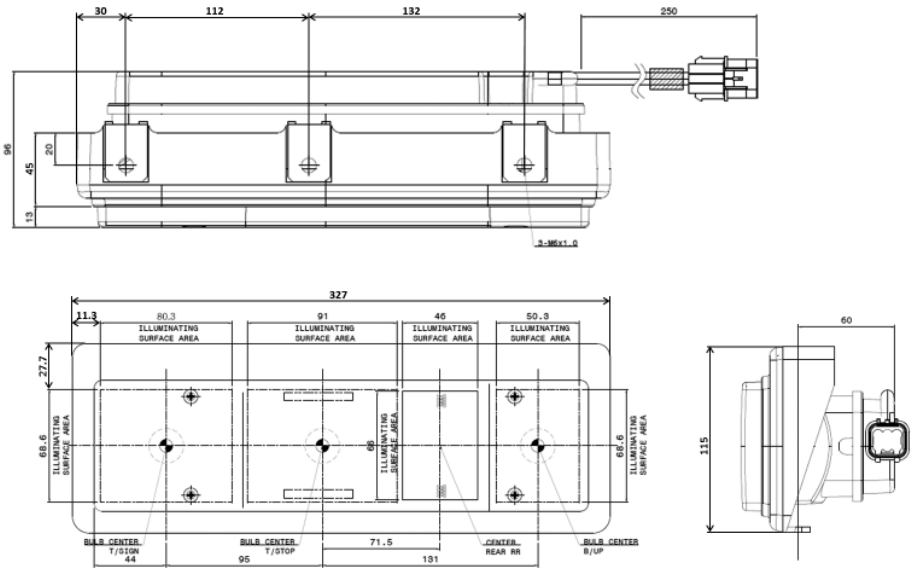
10.13 Other equipment

10.13.1 Installing rear lamp

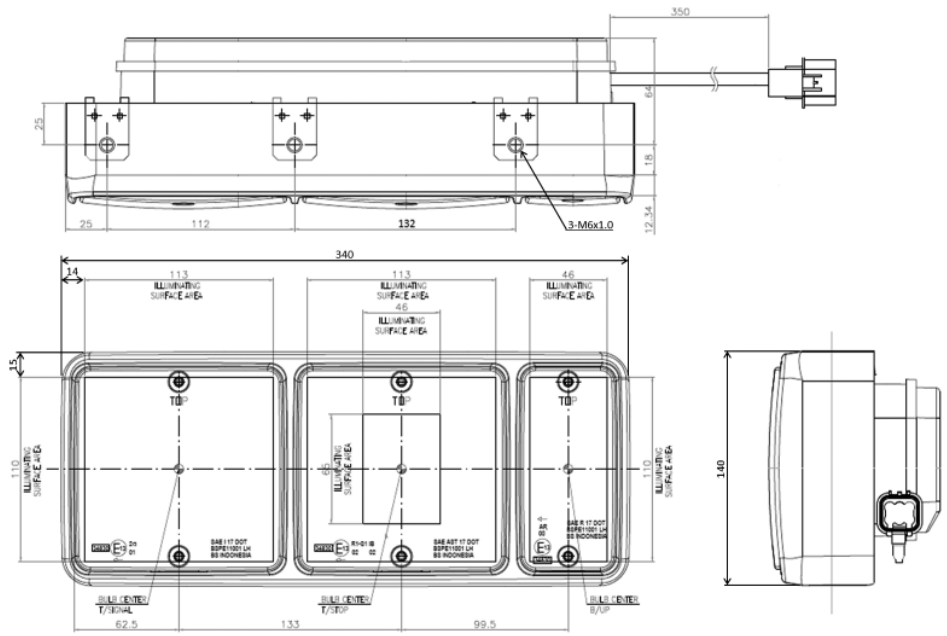
(1) Rear combination lamp

Use the rear combination lamps and license plate lamps which have been installed as standard MFTBC equipment, but don't use the original bracket which holds the lamps.

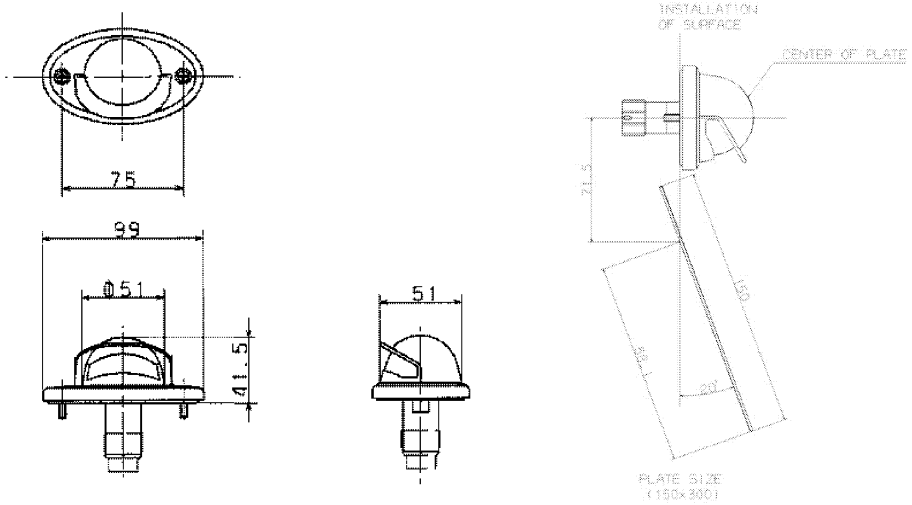
<Small type>



<Large type>



(2) License plate lamp



10.13.2 Label and markings

- When peeling off a label or emblem, order the part number from the responsible division and attach the label or emblem while referring to ▷ page 343.

(1) List of the attaching locations of labels and emblems

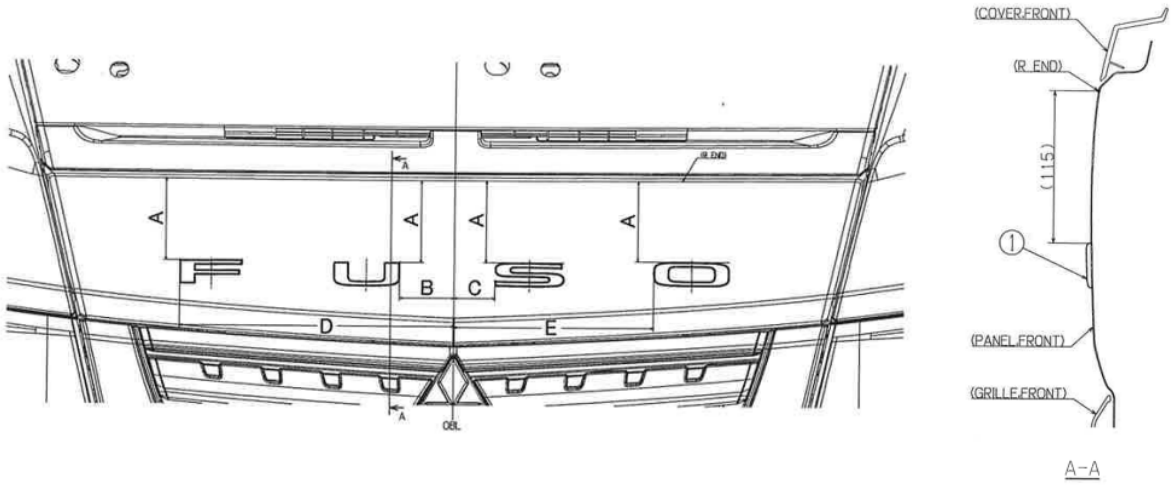
Locations / Description	Front face of cab	RH and LH doors
FUSO	○	–

NOTE: Types of the label and emblem attaching on a vehicle differ depending on the vehicle types.

(2) Installation of marks

Clean the indicated areas where the CUSTOM mark are to be stuck, peel off the backing paper from each sticker, and affix it in position according to the illustration.

Attaching procedure of the labels and emblems



Unit: mm (in.)

Cab width	A	B	C	D	E
Standard	115 (4.53)	78 (3.07)	60 (2.36)	390 (15.4)	285 (11.2)
Wide	115 (4.53)	103 (4.06)	85 (3.35)	465 (18.3)	360 (14.2)

Index

V

W

Revision record <Technical data section>

–	27. Apr. 2018	Newly issued
Rev. code	Date issued	Remarks

NOTE:

1, Chapter 1-9 is Common Section for all markets and to be revised without any special notification. Therefore, please note that this version is not necessarily the latest one.

2, Chapter 10 is for specific market(s). MFTBC will distribute the latest version whenever it will be revised.

Body/equipment mounting directives

<Technical data section>

CANTER

for FE Gas gasoline-engined vehicle

MITSUBISHI FUSO TRUCK & BUS CORPORATION

April 2018 TL2UX