

# Body/equipment mounting directives



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# 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.



# 1 Introduction

<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.

<u>FMVSS/CMVSS NO.</u>	<u>Title</u>
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.



# 1 Introduction

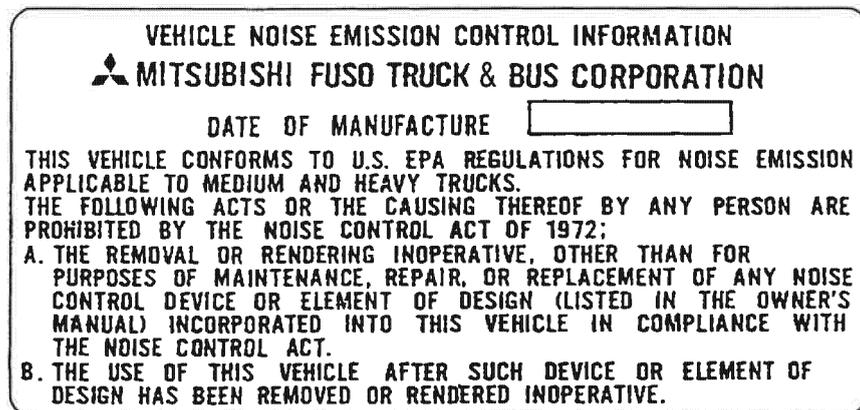
## NOISE REGULATIONS

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:

- 1 Introduction (▷ page 4)
- 2 General (▷ page 14)
- 3 Planning of bodies (▷ page 23)
- 4 Technical threshold values for planning (▷ page 39)
- 5 Damage prevention (▷ page 54)
- 6 Modifications to the basic vehicle (▷ page 83)
- 7 Construction of bodies (▷ page 145)
- 8 Electrics/electronics (▷ page 169)
- 9 Calculations (▷ page 207)
- 10 Technical data (▷ page 209)

Appendix  
Index

#### 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 Introduction

## 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.

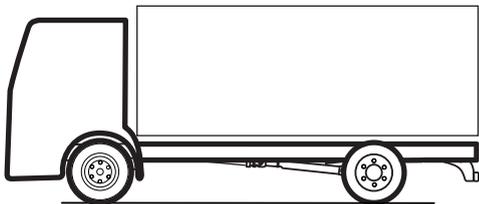
Additional information is available from any

MITSUBISHI FUSO Service Center

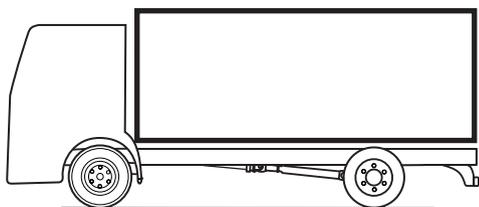
Your

**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.

This also applies for the editions on CD-ROM, DVD or other media.

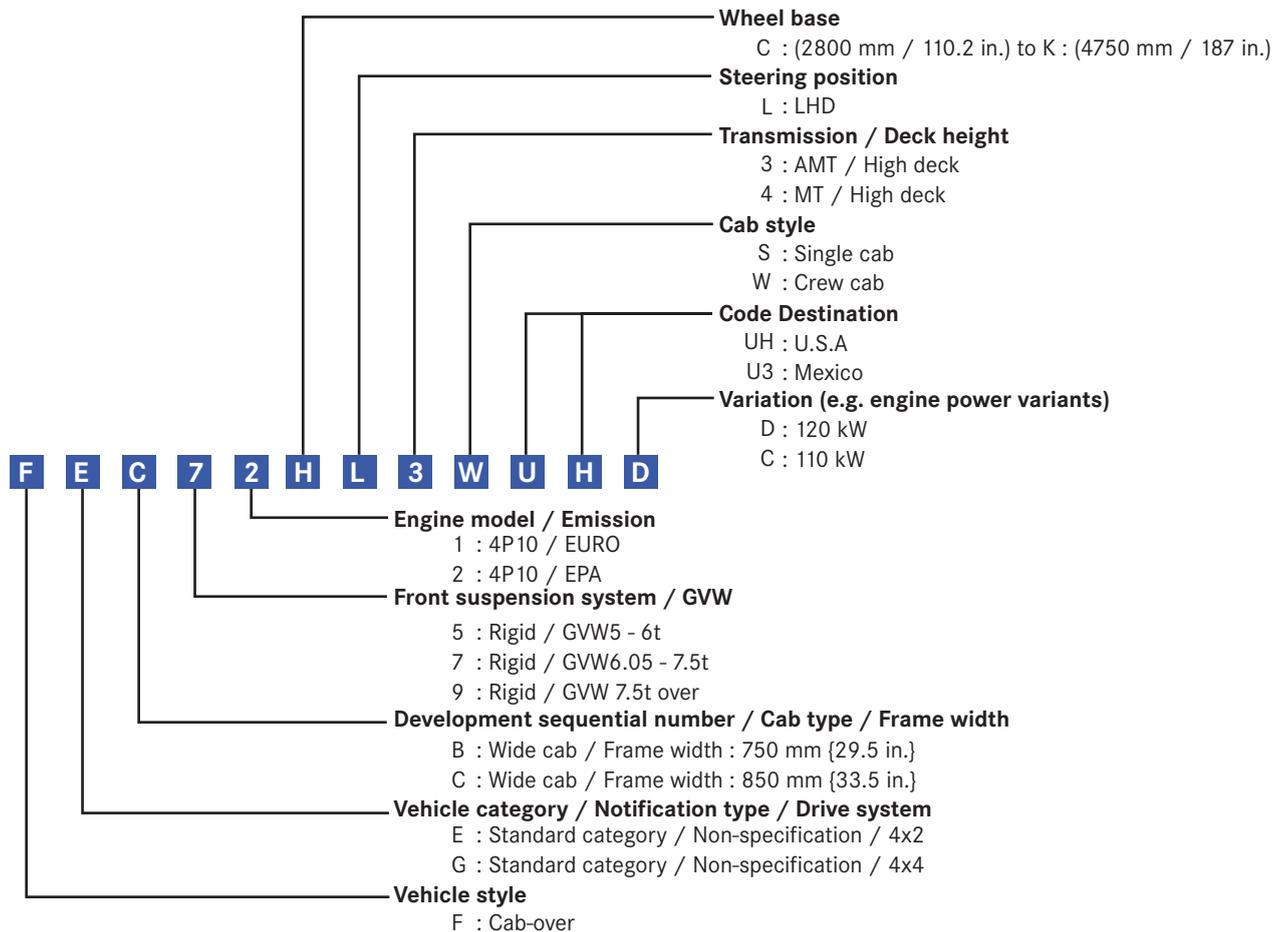
If you have any questions, please contact the department responsible ▷ page 15.

## 2 General

### 2.1 Vehicle and model designations

#### 2.1 Vehicle and model designations

##### 2.1.1 Model coding system



Before mounting necessary body parts/equipment, check the model designation and specifications of your vehicle ▷ page 210.



### 2.2 Technical advice and contact persons

#### 2.2 Technical advice and contact persons

Leighton Good, Manager - Product & Applications  
Mitsubishi Fuso Truck of America, Inc.  
2015 Center Square Road  
Logan Township, NJ 08085  
T: 856-467-3958  
F: 856-467-5553  
E: [wlgood@mitfuso.com](mailto:wlgood@mitfuso.com)



#### 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

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 General

### 2.5 Mitsubishi three diamonds and Fuso emblem

#### 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 15.



### 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 387.

#### 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.

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.

The vehicles are shipped after adequate consideration has been given to safety, reliability and maintainability. 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.

## 3 Planning of bodies

### 3.3 Dimensions, weights, overall vehicle height

#### 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 15.

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  $\pm 3\%$  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 Planning of bodies

### 3.4 About vehicle body incline

#### 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.

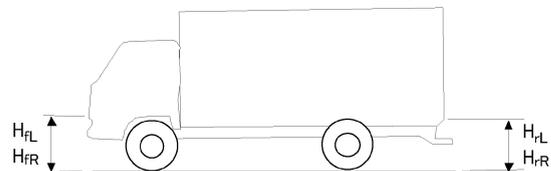
- Left-right weight difference
  - $|HfL - HfR| \leq 10\text{mm} \{0.39\text{in.}\}$
  - $|HrL - HrR| \leq 10\text{mm} \{0.39\text{in.}\}$
- Front-back deviation
  - $|(HfL - HfR) - (HrL - HrR)| \leq 10\text{mm} \{0.39\text{in.}\}$

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 Planning of bodies

### 3.4 About vehicle body incline

#### Lamps

The maximum total width of a vehicle should be as shown below in accordance with the specifications for the headlamps and position lamps.

Some versions of the F\*A model should be equipped with end outline marker lamps if the overall width is to be more than 2100 mm {82.7 in.}.

Unit: mm {in.}

MODEL	Maximum total width of vehicle
F*A	2250 {88.6}
F*B / F*C	2550 {100.4}

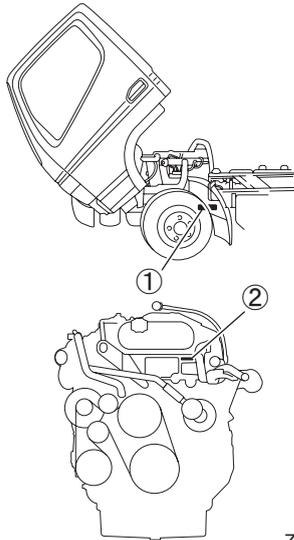


## 3 Planning of bodies

### 3.5 Vehicle type identification data

#### 3.5 Vehicle type identification data

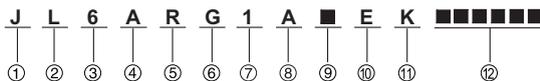
If presented at the time of repair or parts order, the chassis number ① and engine number ② will facilitate the quick and smooth processing of your requests.



Z21444

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

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



① Country	J: Japan
②, ③ Vehicle type	L, 6: Incomplete vehicle
④ Gross vehicle weight / Brake system	A: 10,001 to 14,000 lbs. / Hydraulic B: 14,001 to 16,000 lbs. / Hydraulic C: 16,001 to 19,500 lbs. / Hydraulic
⑤ Line	M: FEC52S N: FEC72S P: FEC72W R: FEC92S S: FGB72S
⑥ Series (wheel base)	C: 2.6 to 2.89 m (8.53 to 9.48 ft.) E: 3.2 to 3.49 m (10.49 to 11.44 ft.) G: 3.8 to 4.09 m (12.46 to 13.41 ft.) H: 4.1 to 4.39 m (13.45 to 14.40 ft.) K: 4.7 to 4.99 m (15.41 to 16.37 ft.)
⑦ Cab chassis type and make	1: Chassis cab for MITSUBISHI FUSO
⑧ Engine	A: 2.998 L Diesel turbo charged and charge air cooled
⑨ Check digit	
⑩ Model year	E: 2014
⑪ Plant	K: Kawasaki
⑫ Plant sequential number	

#### 3.5.2 Engine number

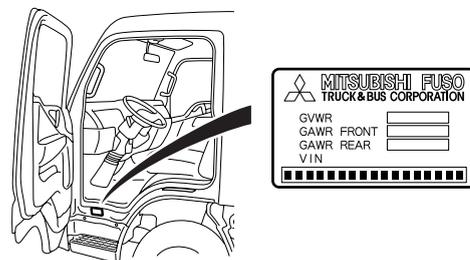
The engine number is indicated on the front side of the cylinder head.

Example: 4P10 - □□□□□□

Engine number  
Engine model

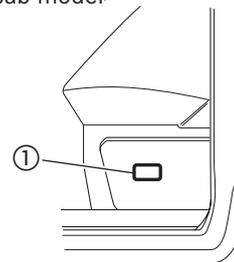
#### 3.5.3 Nameplate

A nameplate ① is located inside the cab.



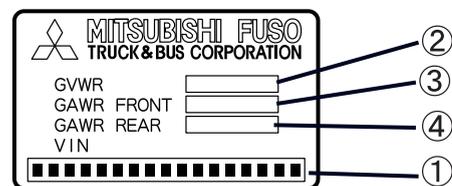
Z11959

<Crew-cab model>



Z22118

The nameplate shows the following.



- ① Vehicle identification number.
- ② Maximum permitted laden mass of the combination.
- ③ Maximum permitted load mass for front axle.
- ④ Maximum permitted load mass for rear axle.

#### 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.

<FG>

Be sure to fit tires of the same size and same type on all wheels.



#### Property damage

If tires of different sizes are fitted, the power train could be damaged.



#### 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 57 and Section 6 "Modifications to the basic vehicle" ▷ page 83.

#### 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 57 and Section 6 "Modifications to the basic vehicle" ▷ page 83.

#### 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 15.

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 120.

#### 3.9.1 EPA10, Euro IV



##### 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 EPA10 emissions legislation, the BlueTec<sup>®</sup> exhaust aftertreatment system is used, which is based on Selective Catalytic Reduction (SCR). BlueTec<sup>®</sup> diesel technology reduces the nitrogen oxide content of the exhaust gas by the injection DEF (Diesel Exhaust Fluid). The water-based DEF solution is injected into the hot exhaust gas via a metering valve. The exhaust gas is transformed in the rear silencer with catalytic converter (SCR catalytic converter). This technology requires components for which installation space is needed in the vehicle.

#### 3.9.2 BlueTec<sup>®</sup> exhaust gas aftertreatment

BlueTec<sup>®</sup> 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.

- SCR muffler
- Urea/DEF tank unit
- Dosing module
- Urea/DEF hose



##### Property damage

Don't take out the power supply for other electric components from the existing fuse.

Especially the function of BlueTec<sup>®</sup> exhaust gas after treatment can not work when the fuse of system is blowout.

BlueTec<sup>®</sup> exhaust gas after treatment requires a lot of electric power to work the heating device for freeze proofing in winter or cold region.



#### 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 Service Center 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 36.

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, coordinating 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 Planning of bodies

### 3.10 Maintenance and repairs

#### 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<sup>2</sup>} 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 Service Center 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 Service Center.

#### 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 15.

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 Service Center or body manufacturer advisors ▷ page 15.
- 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 170. Ask your MITSUBISHI FUSO Service Center.
- 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 Technical threshold values for planning

### 4.1 Vehicle overhang and technical wheelbases

#### 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 42.
- Take the weight of special equipment into consideration when making calculations.



## 4 Technical threshold values for planning

### 4.1 Vehicle overhang and technical wheelbases

#### 4.1.1 Maximum vehicle overhangs

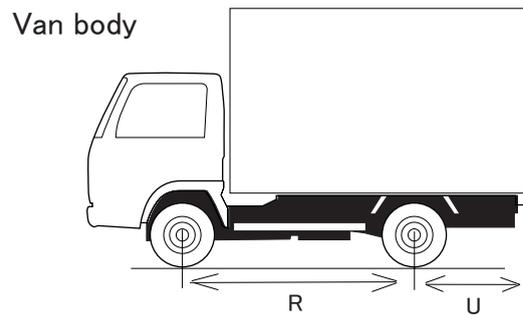
	Maximum vehicle overhang (U)
Van body	65% of wheelbase
Except Van body	50% of wheelbase

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

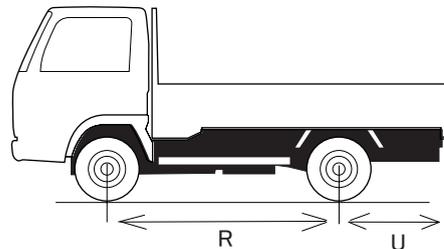
Example: Van body, lorry, etc.

#### **i** Additional information

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



#### Except Van body



R = Wheel base  
U = Rear over hang

## 4 Technical threshold values for planning

### 4.2 Weight distribution, CoG height, anti-roll bars

#### 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.

#### 4.2.3 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.

#### 4.2.1 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 the 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.

FEC52, FEC72, FEC92: 1575 mm {62 in.}

FGB72: 1524 mm {60 in.}



#### 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 15.



#### Property damage

The permissible front axle load must not be exceeded.

Observe the notes on product liability ▷ page 16.



## 4 Technical threshold values for planning

### 4.4 Clearance for the basic vehicle and bodies

#### 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.

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

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

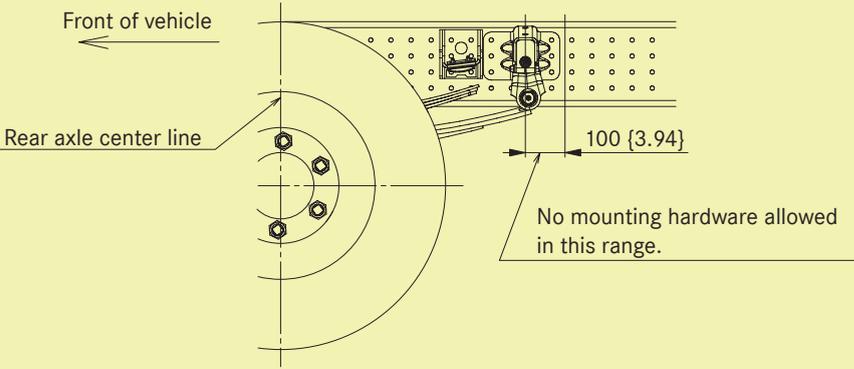
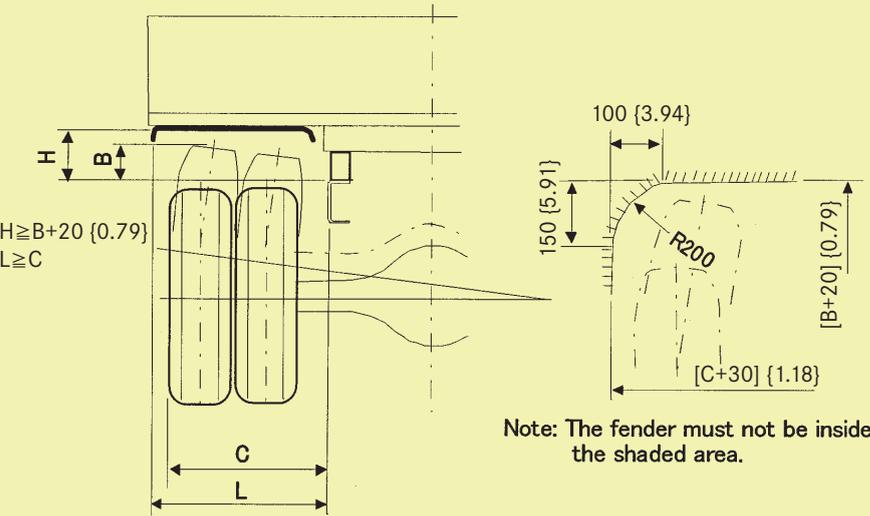
Unit: mm {in.}

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. Clutch and Transmission Assembly	Do not install any rear body part in the area of 100 {3.94} of rear part, because clutch and transmission ass'y is moved backward in the same inclination line of engine, to pull out the clutch spline shaft, when clutch and 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 Technical threshold values for planning

### 4.4 Clearance for the basic vehicle and bodies

Unit: mm {in.}

Part	Minimum Clearance and Notes
9. Rear springs	<p>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.</p> 
10. Space above rear axle	<p>Air and electrical lines such as the brake hose and wiring harness are laid on top of the rear axle.</p> <p>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.</p> <p>Refer to "Differential and tire bound height" ▷ page 273.</p>
11. Attaching the rear fender	<p>The clearance between the rear fender and tire must be designed to be optimum assuming that the vehicle is traveling in bad conditions.</p> <p>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 273.</p>  <p>Note: The fender must not be inside the shaded area.</p>

## 4 Technical threshold values for planning

### 4.4 Clearance for the basic vehicle and bodies

Unit: mm {in.}

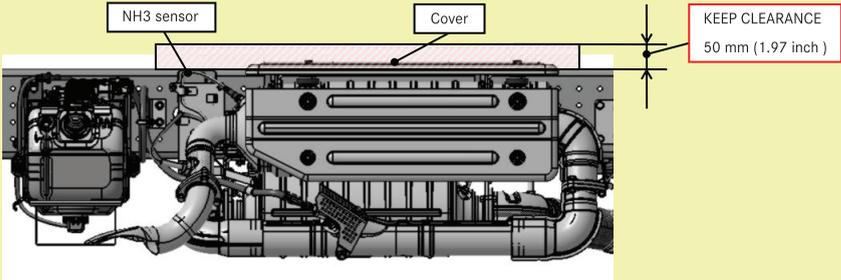
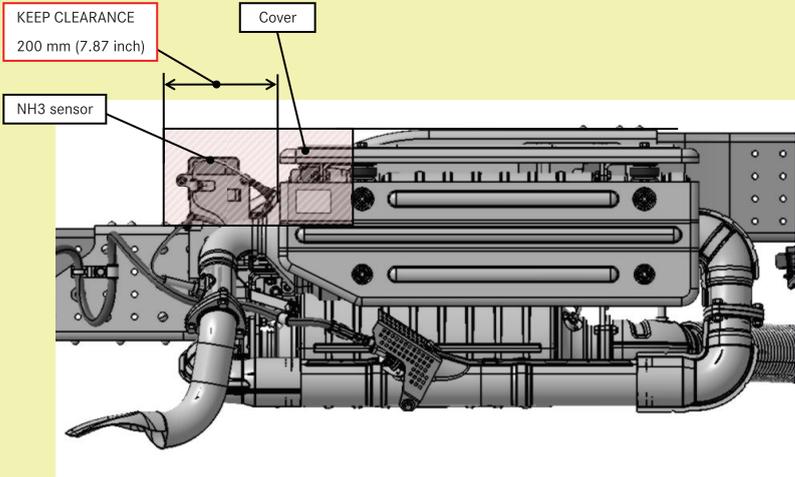
Part	Minimum Clearance and Notes																																					
12. The exhaust system	<p>The heat affection and the interference of the exhaust system is a quite important factor in the safety of the vehicle. Keep the clearance between the rear body parts and these parts at least following figures on the table.</p> <table border="1" data-bbox="576 495 1449 1440"> <thead> <tr> <th data-bbox="576 495 1082 533">Parts name</th> <th data-bbox="1082 495 1449 533">Minimum Clearance (mm)</th> </tr> </thead> <tbody> <tr> <td data-bbox="576 533 1082 571">Fuel hose and pipe</td> <td data-bbox="1082 533 1449 571">200 {7.87}</td> </tr> <tr> <td data-bbox="576 571 1082 609">Wiring harness</td> <td data-bbox="1082 571 1449 609">150 {5.91} (*100 {3.94})</td> </tr> <tr> <td data-bbox="576 609 1082 647">Fuel tank</td> <td data-bbox="1082 609 1449 647"></td> </tr> <tr> <td data-bbox="576 647 1082 685">Battery cable</td> <td data-bbox="1082 647 1449 685" rowspan="3">150 {5.91}</td> </tr> <tr> <td data-bbox="576 685 1082 723">Rubber parts</td> </tr> <tr> <td data-bbox="576 723 1082 761">Plastic parts</td> </tr> <tr> <td data-bbox="576 761 1082 799">Rear body floor</td> <td data-bbox="1082 761 1449 799"></td> </tr> <tr> <td data-bbox="576 799 1082 837">Brake booster</td> <td data-bbox="1082 799 1449 837"></td> </tr> <tr> <td data-bbox="576 837 1082 875">Brake hose and pipe</td> <td data-bbox="1082 837 1449 875" rowspan="4">100 {3.94}</td> </tr> <tr> <td data-bbox="576 875 1082 913">Oil pan</td> </tr> <tr> <td data-bbox="576 913 1082 952">Oil pipe</td> </tr> <tr> <td data-bbox="576 952 1082 990">Tire</td> </tr> <tr> <td data-bbox="576 990 1082 1028">Vacuum tank</td> <td data-bbox="1082 990 1449 1028">80 {3.15}</td> </tr> <tr> <td data-bbox="576 1028 1082 1066">Propeller shaft</td> <td data-bbox="1082 1028 1449 1066"></td> </tr> <tr> <td data-bbox="576 1066 1082 1104">Rear axle, Differential</td> <td data-bbox="1082 1066 1449 1104"></td> </tr> <tr> <td data-bbox="576 1104 1082 1142">Parking brake cable</td> <td data-bbox="1082 1104 1449 1142" rowspan="4">50 {1.97}</td> </tr> <tr> <td data-bbox="576 1142 1082 1180">Shock absorber bush</td> </tr> <tr> <td data-bbox="576 1180 1082 1218">Shackle bush</td> </tr> <tr> <td data-bbox="576 1218 1082 1256">Rear mud guard</td> </tr> <tr> <td data-bbox="576 1256 1082 1294">Shock absorber</td> <td data-bbox="1082 1256 1449 1294">30 {1.18}</td> </tr> <tr> <td data-bbox="576 1294 1082 1332">Mounting frame, Additional member etc.</td> <td data-bbox="1082 1294 1449 1332" rowspan="2">20 {0.79}</td> </tr> <tr> <td data-bbox="576 1332 1082 1370">Spring, Axle</td> </tr> </tbody> </table> <p>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.</p> <p>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.</p>	Parts name	Minimum Clearance (mm)	Fuel hose and pipe	200 {7.87}	Wiring harness	150 {5.91} (*100 {3.94})	Fuel tank		Battery cable	150 {5.91}	Rubber parts	Plastic parts	Rear body floor		Brake booster		Brake hose and pipe	100 {3.94}	Oil pan	Oil pipe	Tire	Vacuum tank	80 {3.15}	Propeller shaft		Rear axle, Differential		Parking brake cable	50 {1.97}	Shock absorber bush	Shackle bush	Rear mud guard	Shock absorber	30 {1.18}	Mounting frame, Additional member etc.	20 {0.79}	Spring, Axle
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Spring, Axle																																						



## 4 Technical threshold values for planning

### 4.4 Clearance for the basic vehicle and bodies

Unit: mm {in.}

Part	Minimum Clearance and Notes
	<p>NH3 sensor &lt;FE&gt;</p>  <p>NH3 sensor      Cover</p> <p>KEEP CLEARANCE 50 mm (1.97 inch)</p> <p>&lt;FG&gt;</p>  <p>KEEP CLEARANCE 200 mm (7.87 inch)</p> <p>Cover</p> <p>NH3 sensor</p>
13. Fuel tank	The fuel tank must be mounted so that refilling operations such as opening/closing the filler cap and pouring fuel are not obstructed.
14. Battery	Mounting hardware must be located so that battery removal/installation and inspection as well as battery cover detaching/attaching can be done easily.
15. Air dryer	The air dryer must be inspected and replaced periodically because it contains desiccant. Mounting hardware must be located so that removal/installation of the air dryer body is not obstructed.

## 4 Technical threshold values for planning

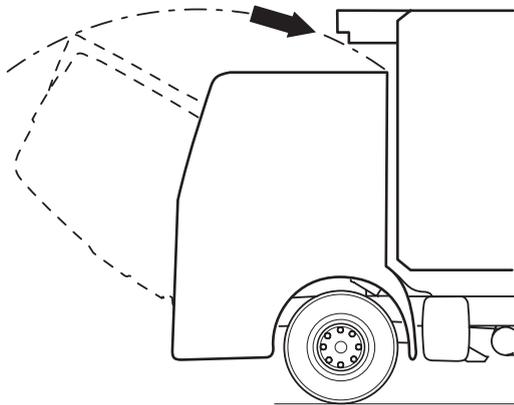
### 4.4 Clearance for the basic vehicle and bodies

#### **i** 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 256.



N60.80-2157-00

#### ***Cab tilting range clearance***

## 4 Technical threshold values for planning

### 4.5 Permissible load on cab roof

#### 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 Technical threshold values for planning

### 4.6 Vehicle body incline

#### 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:  $\Delta H_f$   
Left-right difference at the headlamp center height  
"Fig. 1 Front view"  
 $\Delta H_f = H_1 - H_2$   
Target:  $|\Delta H_f| \leq 10 \text{ mm } \{0.39 \text{ in.}\}$
- Rear tilt:  $\Delta H_r$   
Left-right difference at the stop lamp center height  
"Fig. 2 Rear view"  
 $\Delta H_r = h_1 - h_2$   
Target:  $|\Delta H_r| \leq 10 \text{ mm } \{0.39 \text{ in.}\}$
- Twisting in the longitudinal direction of the vehicle:  
 $T_w$   
 $T_w = \Delta H_f - \Delta H_r = (H_1 - H_2) - (h_1 - h_2)$   
Target:  $|T_w| \leq 10 \text{ mm } \{0.39 \text{ in.}\}$

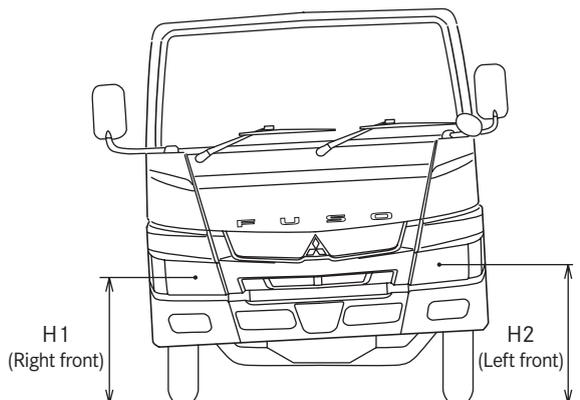


Fig. 1 Front view

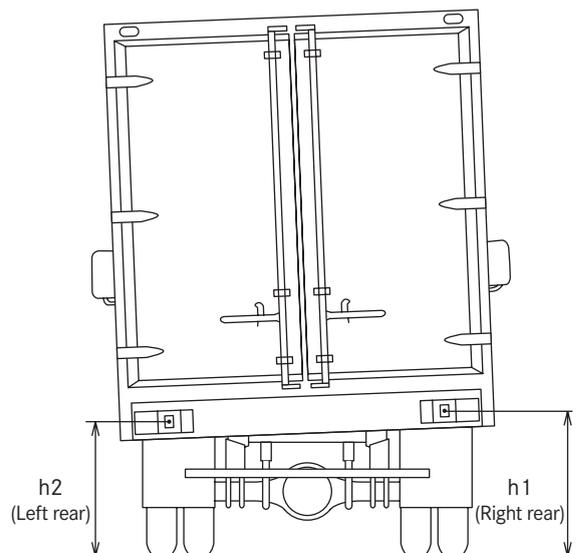


Fig. 2 Rear view

## 4 Technical threshold values for planning

### 4.6 Vehicle body incline

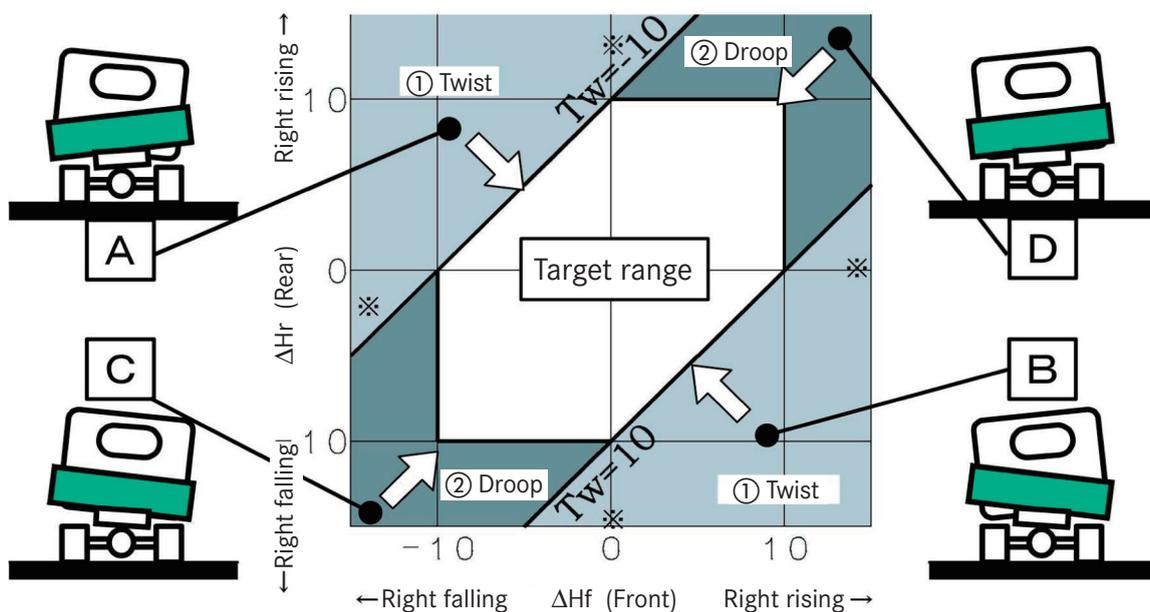
#### 4.6.2 Correction method

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]:  $|Tw| > 10 \text{ mm } \{0.39 \text{ in.}\}$ )

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

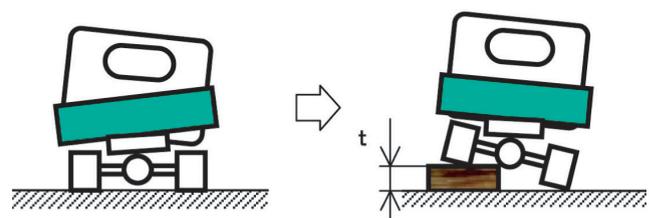
- Place chocks firmly beneath the front wheels.
- In the case of [A] ( $Tw < -10 \text{ mm } \{0.39 \text{ in.}\}$ ), place the left rear wheel on a plate of thickness  $t$  corresponding to the amount of twist. In the case of [B] ( $Tw > 10 \text{ mm } \{0.39 \text{ in.}\}$ ), place the right rear wheel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

## 4 Technical threshold values for planning

### 4.6 Vehicle body incline

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 50 (body is both tilted and twisted), the posture after this correction has been carried out sometimes becomes condition  or . In such a case, proceed with tilt correction.

Tilt correction ( and :  $|\Delta H_f| > 10 \text{ mm } \{0.39 \text{ in.}\}$ , or  $|\Delta H_r| > 10 \text{ mm } \{0.39 \text{ in.}\}$ )

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.

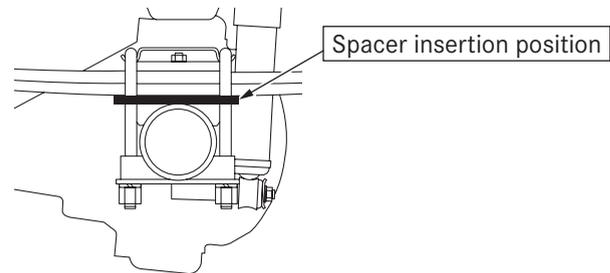


## 4 Technical threshold values for planning

### 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

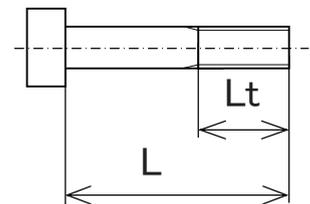


Spacer part number and insertion position

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

Center bolt

Model	Part No.	Size	Bolt Length L	Thread length Lt
FEC5	MK613560	M12X1.25	94	23
FEC7 (Single cab), FEC9	MK613561	M12X1.25	130	22
FEC7 (Crew cab)	MK613562	M12X1.25	181	23
FGB	MK527972	M12X1.25	211	24



- 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 15

#### 4.7 Others

##### 4.7.1 Non standard power take-off <For EPA10>

When non standard power take-off is used, see the dimensions listed on ▷ page 107 for the lead-out port diameter and transmission-related dimensions.

##### 4.7.2 PTO (power take-off) mode <For EPA10>

In the case of a vehicle fitted with a transmission PTO, it is possible to select one of the PTO modes shown in the table below. The PTO mode is set to mode 2 (#1) before the vehicle leaves the factory. When installing a PTO on a standard truck subsequent to delivery, select the PTO mode of the two modes shown in the table below which best matches the conditions of use of the installed PTO.



#### Risk of accident

Do not press the brake pedal while the PTO is operating. If you do press the brake pedal while the PTO is operating, the BOS will operate and the engine speed will fall, which may result in an unforeseen accident. [When PTO mode 1 (#2) is selected]

#### PTO (power take-off) mode

Unit: rpm

PTO mode (Control No.)	BOS	Engine speed at which PTO operates
2 (#1)	Non-operating	700 to 1,600 Default: 800
1 (#2)	Operating	Maximum 2,000

Note 1. The engine speed when the PTO is operating can be set to the desired range by switching the PTO mode.

For details, please contact nearest MITSUBISHI FUSO dealer or distributor.

2. The BOS (Brake override system) limits the engine torque when the brake pedal is pressed.

The BOS will not function when PTO mode 2 (#1) has been selected. To make a setting that enables the PTO to operate when the engine speed is 1,600 rpm or higher (the upper limit is 2,000 rpm), change to PTO mode 1 (#2).

When PTO mode 1 (#2) has been selected, if the brake pedal is pressed while the PTO is operating, the BOS will operate, and the engine speed will fall to the idling range. Caution the user not to press the brake pedal while the PTO is operating.

3. Only a transmission PTO can be used on a 4P10 model engine.



## 5 Damage prevention

### 5.1 Brake hoses/cables and lines

#### 5.1 Brake hoses/cables and lines

##### Risk of accident

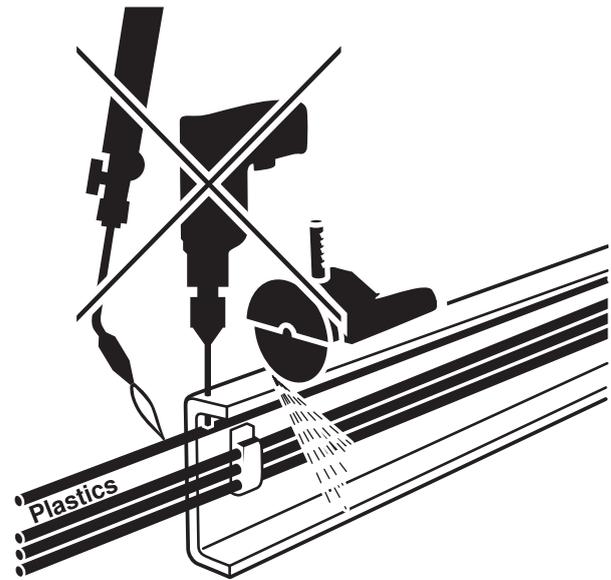
Work carried out incorrectly on the brake hoses, cables and lines may impair their function. This may lead to the failure of components or parts relevant to safety.

- 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 115.



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## 5 Damage prevention

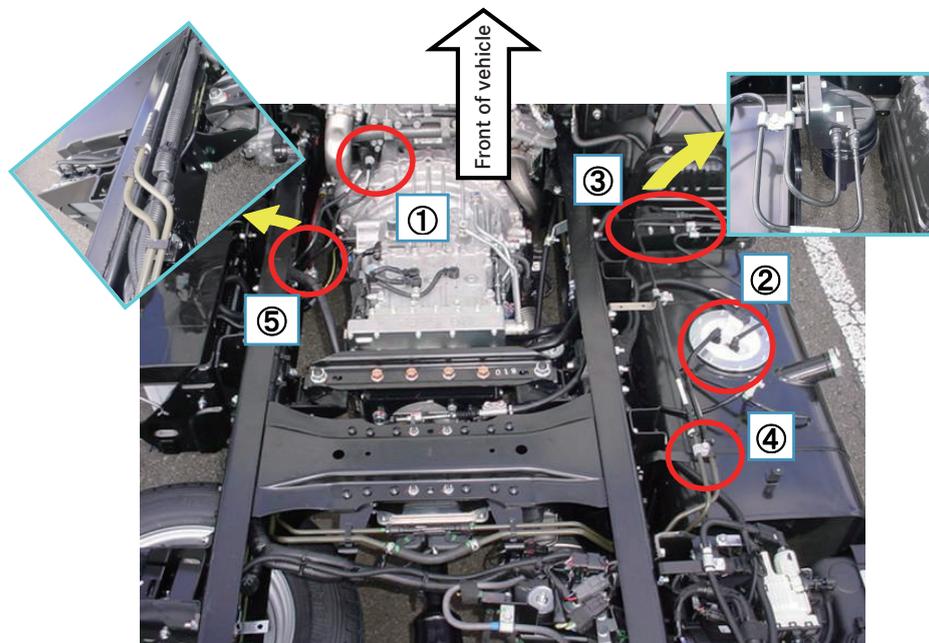
### 5.1 Brake hoses/cables and lines

#### 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

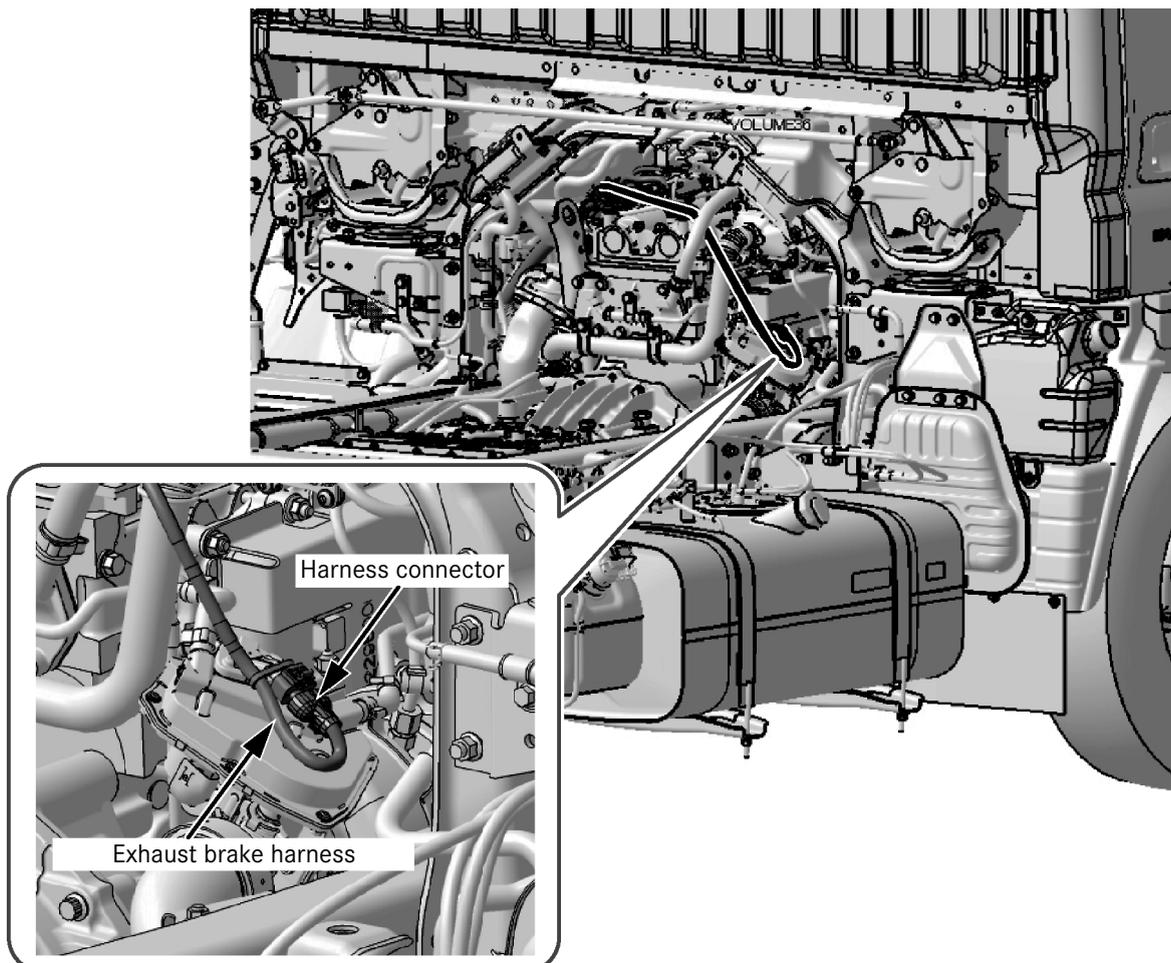


	Part	Precaution
①	Fuel connector at left rear of the engine	<ul style="list-style-type: none"> <li>Do not place your foot on the top of the engine.</li> <li>Do not pull the fuel hose.</li> </ul>
②	Top of the fuel tank	<ul style="list-style-type: none"> <li>Do not place your foot on the fuel tank.</li> </ul>
③	Fuel filter connection part	<ul style="list-style-type: none"> <li>Do not place your foot on the fuel hose.</li> </ul>
④	Vicinity of the fuel tank and the fuel filter	<ul style="list-style-type: none"> <li>Do not place your foot on the fuel hose</li> </ul>
⑤	Intermediate connector of the fuel system on the left side face of the transmission	<ul style="list-style-type: none"> <li>Do not place your foot on the fuel hose.</li> <li>Do not pull the fuel hose.</li> </ul>

## 5 Damage prevention

### 5.1 Brake hoses/cables and lines

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

##### Risk of injury

Welding work in the vicinity of the airbags can cause the restraint system to malfunction.

Welding work near the airbags is strictly forbidden.

The airbag could be triggered or may no longer function correctly.

##### 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.

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.}.

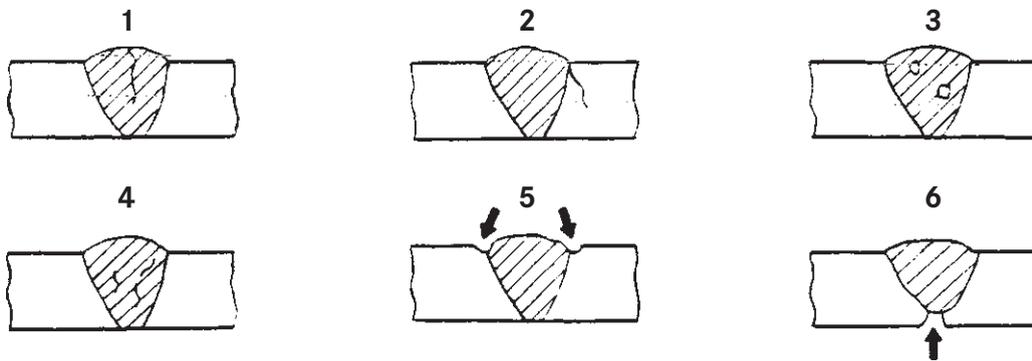


Fig. 1

- 1 Deposited metal cracking
- 2 Toe crack
- 3 Blow hole

- 4 Slag inclusion
- 5 Under cut
- 6 Poor penetration

#### **i** Additional information

Additional information on welded connections can be found in Section 6 "Modifications to the basic vehicles" ▷ page 83 and Section 8 "Electrics/electronics" ▷ page 169.

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 or 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.

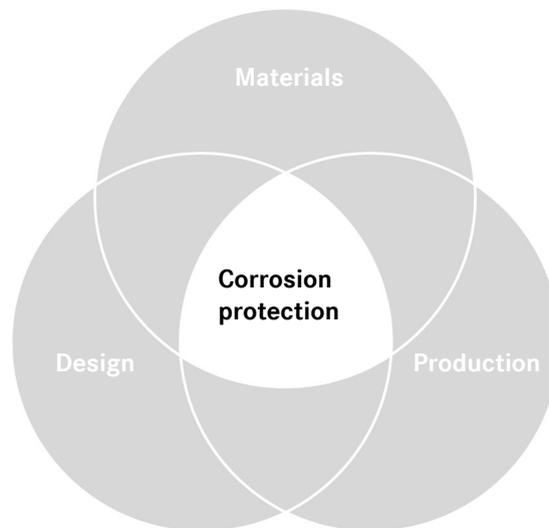
#### 5.3 Corrosion protection measures

##### 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.



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##### *Optimum corrosion protection*

## 5 Damage prevention

### 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 15.

### 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.

## 5.3 Corrosion protection measures

### 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, cathodic dip-priming and zinc-rich paint in sufficient coatings have proved satisfactory for this purpose.



## 5 Damage prevention

### 5.3 Corrosion protection measures

#### Corrosion prevention in welding work

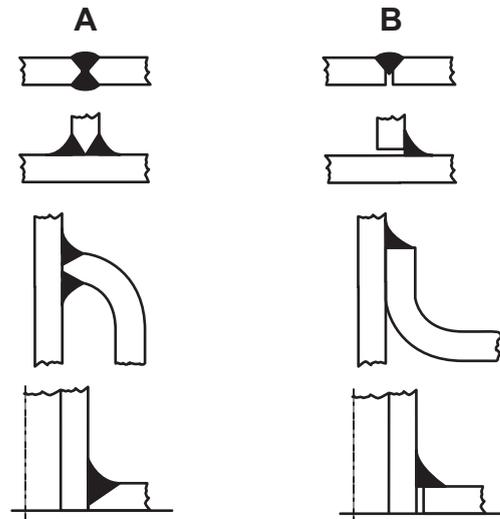
In order to avoid crevice corrosion at weld seams, the welds should be made in accordance with the examples shown.

#### 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.



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#### **Example: Weld seams**

*A - Suitable*

*B - Unsuitable*

#### **i 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 Damage prevention

### 5.4 Bolted connections

#### 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 Damage prevention

### 5.4 Bolted connections

- Hex flange bolt

Unit: N·m {kgf·m}

Strength category	4T		7T		8T	
<b>Indication</b>						
<b>Nominal diameter mm</b>						
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	
<b>Indication</b>				
<b>Nominal diameter mm</b>				
	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}



## 5 Damage prevention

### 5.4 Bolted connections

- 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 Damage prevention

### 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

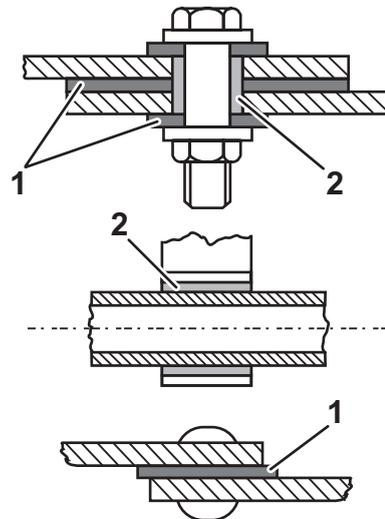
#### Insulation by coating

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 service center 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
- Contact 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
- Inner parts of drum brakes <FG>
- Inner surface of brake drums <FG>
- Contact areas between hubs and brake drums <FG>
- 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

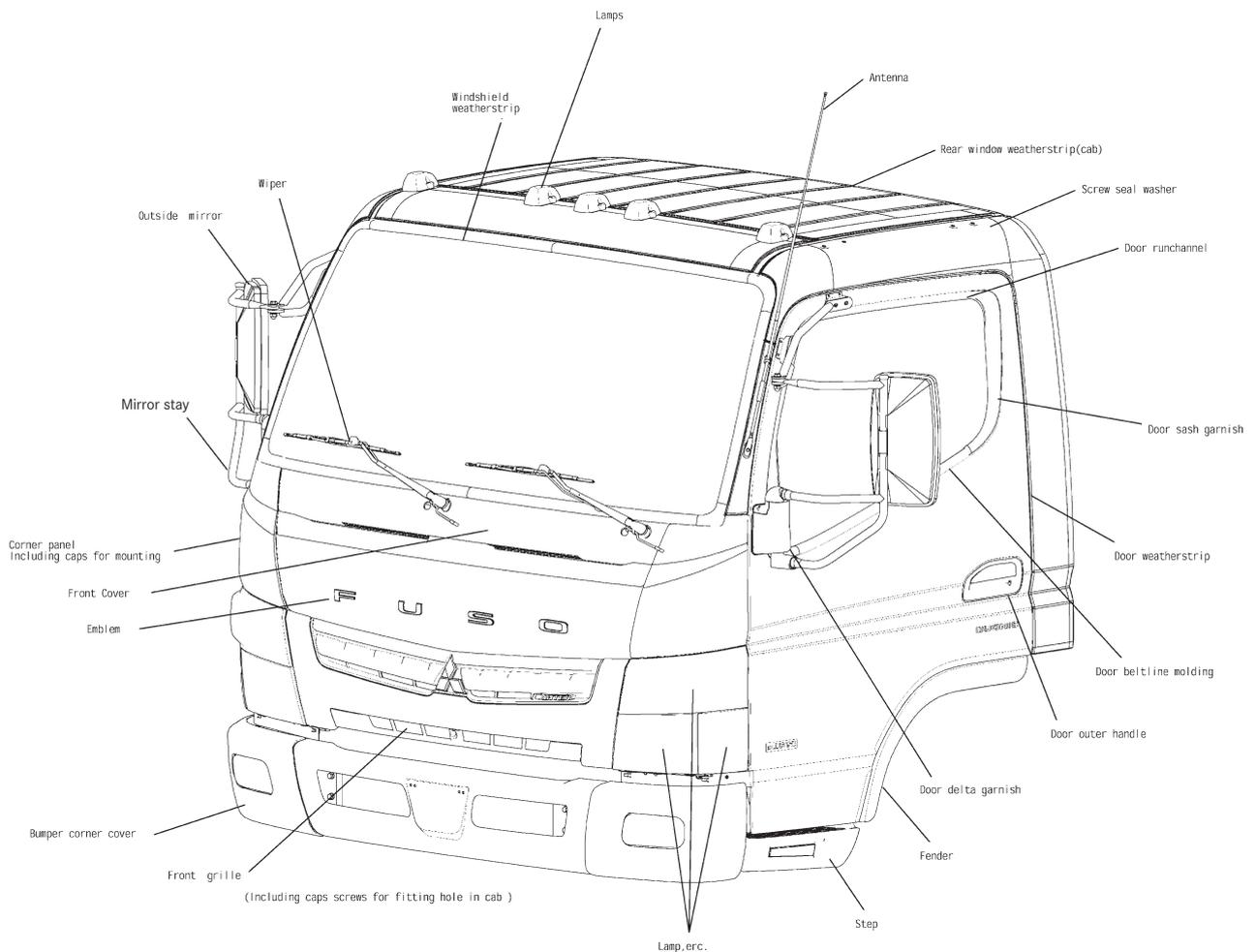
## 5 Damage prevention

### 5.5 Painting work

#### 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 Damage prevention

### 5.5 Painting work

#### 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	Acrose No. 6000	Dai Nippon Toryo



## 5 Damage prevention

### 5.5 Painting work

#### 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
<ul style="list-style-type: none"><li>Emblems</li><li>Front grille <sup>*1</sup></li><li>Corner panels <sup>*1</sup></li><li>Front cover</li><li>Steps</li><li>Fenders</li><li>Wipers</li><li>Antenna</li><li>Lamps</li><li>Outside mirrors, mirror stays</li><li>Bumper corner covers</li><li>Heat protector (at back of cab)</li><li>Sealing washers for screws</li></ul>	<ul style="list-style-type: none"><li>Door outer handles</li><li>Weatherstrips <sup>*2</sup></li><li>Caution labels</li><li>Door delta garnish</li><li>Door runchannels</li><li>Door sash garnish</li><li>Door beltline moldings</li></ul>

<sup>\*1</sup> 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)

<sup>\*2</sup> 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 Damage prevention

### 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	Manufacturer	Name of paint	
Kansai Paint	Retan PG80	Dai Nippon Toryo Co., Ltd.	Auto V Top Monarch	
	Retan PG60		Auto Squall	
	Acric #1000		Auto Across Super	
Rock Paint Co., Ltd.	38 Line Co-Rock		Auto Swift	
	79 Line Rock Ace		Acrytan 1000	
	73 Line Hi Rock		T-300LINE	
	35 Line Rock Lacquer	Nax Mighty Lac		
Isamu Paint Co., Ltd.	AU21	Nippon Paint Co., Ltd.	Nax Sperio	
	Hi-Art #3000		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
<p>3. Applying an intermediate coat</p>	<p>If the substrate (ED) is visible through the baked paint film, apply an intermediate coat.</p> <ul style="list-style-type: none"> <li>• 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}.</li> <li>• Wipe away misted areas using thinner.</li> <li>• Wait 3 to 5 minutes to allow the paint film to set, then force-dry it at 80°C {176°F} for 15 minutes.</li> <li>• After force-drying, allow the paint film to cool down, then wet-rub the intermediate coat with #600 waterproof sandpaper.</li> <li>• Using #800 waterproof sandpaper, finish the base painting area (the outer side of the intermediate coat) by wet-sanding.</li> </ul> <p>* If the substrate (ED) is not exposed, there is no need to apply an intermediate coat.</p> <p>Paint used:</p> <p style="padding-left: 20px;">Primer surfacer STX-2K-HS 2-liquid type paint hardener 25 % 2-liquid type paint thinner 10 % (STX-2K-TH-0D)</p>
<p>4. Applying the base coat</p>	<p>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})</p> <p>Lightly apply one coat of paint to the areas which the mist of the base coat (17130 colors) reach (shaded areas).</p> <p>Promptly proceed to the next process within 2 to 3 minutes (before the paint becomes touch-dry).</p> <p>In some cases this process can be omitted.</p> <p>[Paint blending]</p> <p>Use the undiluted paint after filtering it. Return the unused paint to its original container and store it.</p> <p>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.</p> <p>Wait for about 7 minutes to allow the paint to set, and then apply clear paint.</p> <p>[Mixing ratio of paint]</p> <p style="padding-left: 40px;">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)</p> <p style="padding-left: 40px;">(When the room temperature is between 20 and 25°C {68 and 77°F}) Base coat thinner 11050 (Standard 20°C)</p> <p style="padding-left: 40px;">(When the room temperature is between 25 and 35°C {77 and 95°F}) Base coat thinner 11040</p>

## 5 Damage prevention

### 5.5 Painting work

Process	Description of work																		
5. Clear painting	<p>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.</p> <p>[Mixing ratio of paint]</p> <table> <tr> <td>2-liquid type paint</td> <td>Clear</td> <td>20 – 60</td> <td>100</td> </tr> <tr> <td>2-liquid type paint</td> <td>MS hardner</td> <td></td> <td>50</td> </tr> <tr> <td>2-liquid type paint</td> <td>Thinner quick-drying</td> <td></td> <td>Approx. 10</td> </tr> </table> <p>(18 – 20 seconds by the use of Iwata cup<sup>*3</sup>)</p> <p>[Mixing ratio for ombre painting]</p> <table> <tr> <td>Clear paint blended according to the above</td> <td></td> <td>10</td> </tr> <tr> <td>2-liquid type paint</td> <td>Thinner For shading 11031</td> <td>50</td> </tr> </table> <p>* The blended clear paint can be used for up to about 4 hours at normal temperature.</p>	2-liquid type paint	Clear	20 – 60	100	2-liquid type paint	MS hardner		50	2-liquid type paint	Thinner quick-drying		Approx. 10	Clear paint blended according to the above		10	2-liquid type paint	Thinner For shading 11031	50
2-liquid type paint	Clear	20 – 60	100																
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2-liquid type paint	Thinner quick-drying		Approx. 10																
Clear paint blended according to the above		10																	
2-liquid type paint	Thinner For shading 11031	50																	
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, viscosity cup, NK-2 produced by ANEST IWATA Corporation.

For details, please address inquiries to MITSUBISHI FUSO's Service Center.



#### 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 <sup>*1</sup>
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, viscosity 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.) Neolider
  - 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

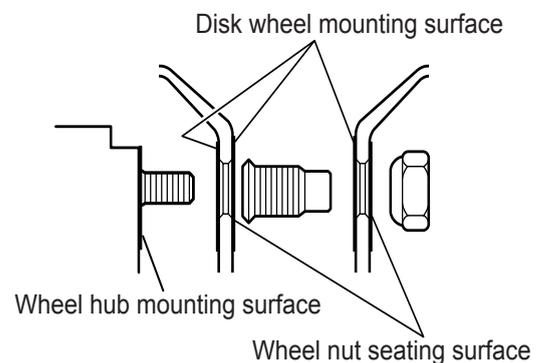
- When a repainted cab body is forced-dried, the temperature should not exceed 100 °C {180 °F} and the process must be completed within 60 minutes. When using a temperature above 100 °C {180 °F}, cover the glass surfaces with shields to prevent them from being heated beyond 100 °C {180 °F} or remove 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.



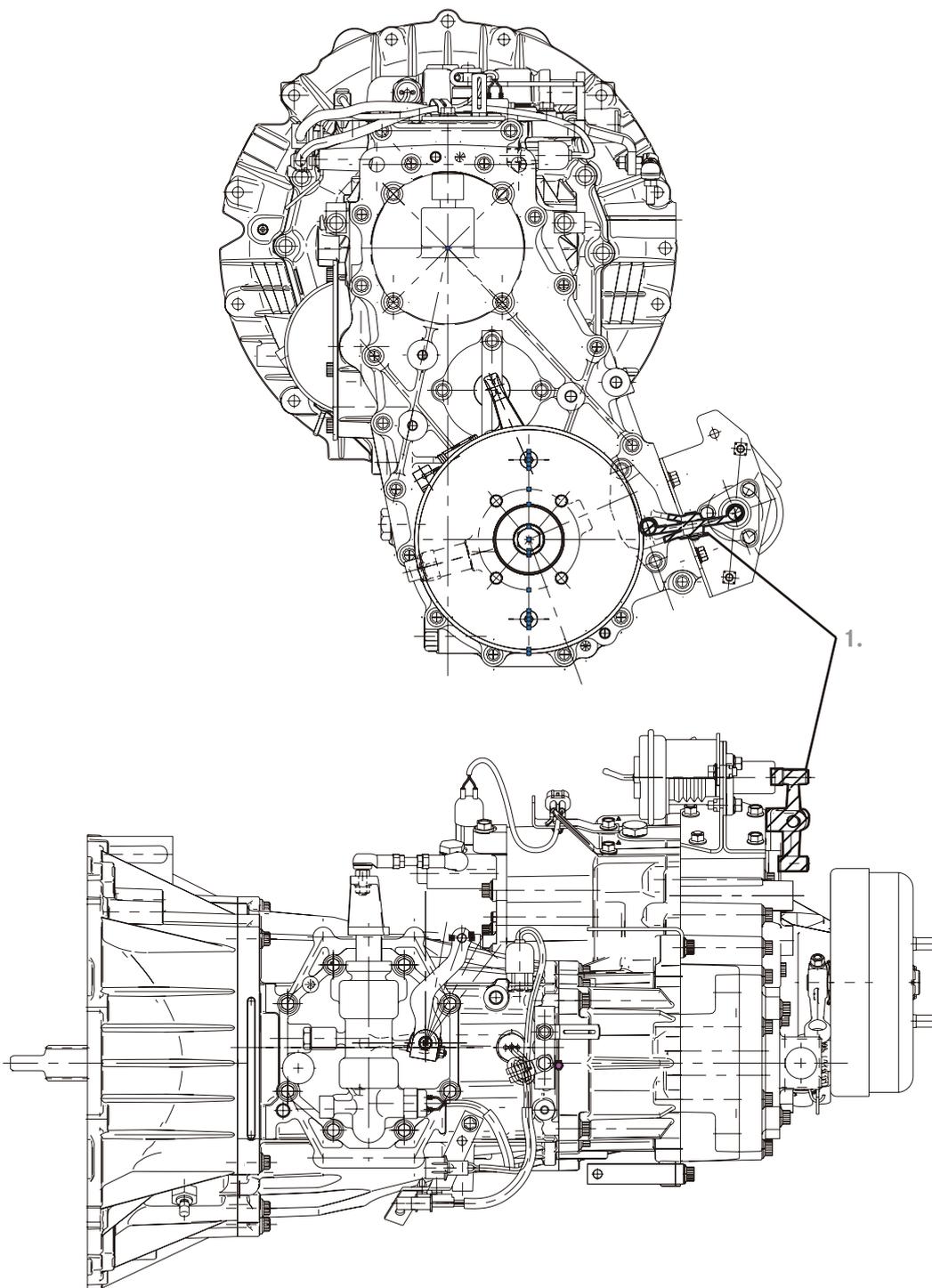
- If you removed parts, securely re-install them in their original positions. If you peeled off labels, obtain new labels and stick them in their original locations.

##### 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.

#### 5.5.8 Painting the Transmission with transfer <FG>

- Before painting the transmission, be sure to mask the hatched sections shown in the illustration below to prevent the adhesion of paint, otherwise there will be problems in shifting between 2WD and 4WD.



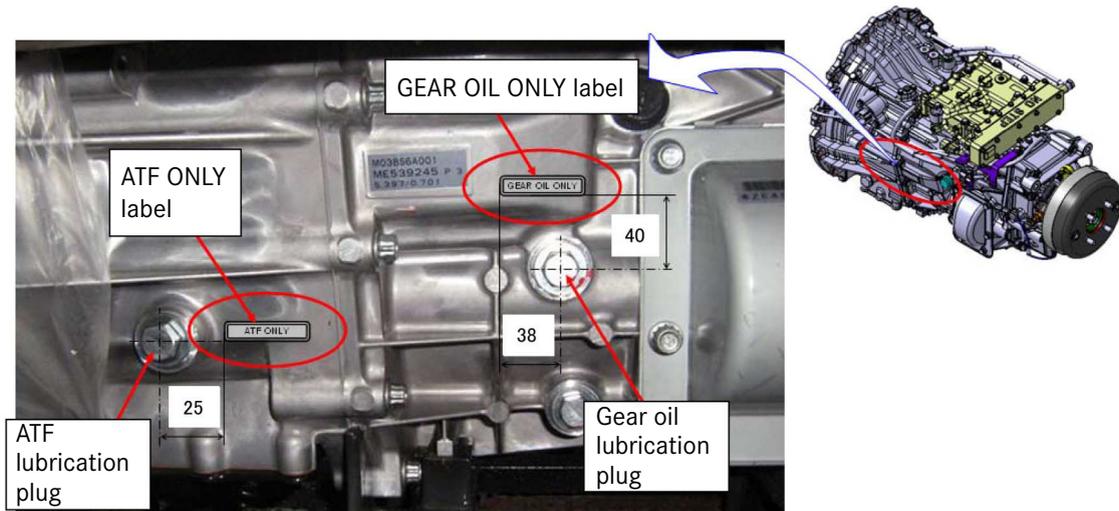
1. Prohibit area

## 5 Damage prevention

### 5.5 Painting work

#### 5.5.9 Precaution to be observed when painting the transmission (DUONIC®)

Mask the labels for prevention of the wrong oil from being inadvertently supplied to the transmission, which are located near the respective lubrication plugs (ATF ONLY and GEAR OIL ONLY) in order to prevent them from being rendered illegible as a result of painting.



#### 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 Damage prevention

### 5.10 Electromagnetic compatibility (EMC)

#### 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 10 and ▷ page 11 must be complied with.

## 5 Damage prevention

### 5.11 Storing and handing over the vehicle

#### 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 36.

##### 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 37.



#### 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 23 and Section 5 "Damage prevention" ▷ page 54.



- 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 15

#### 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  
          FGB ..... MJSH440 or  
                                  SAPH440 (JIS)  
                                  (SAE J410950X or  
                                  the equivalent)

## 6 Modifications to the basic vehicle

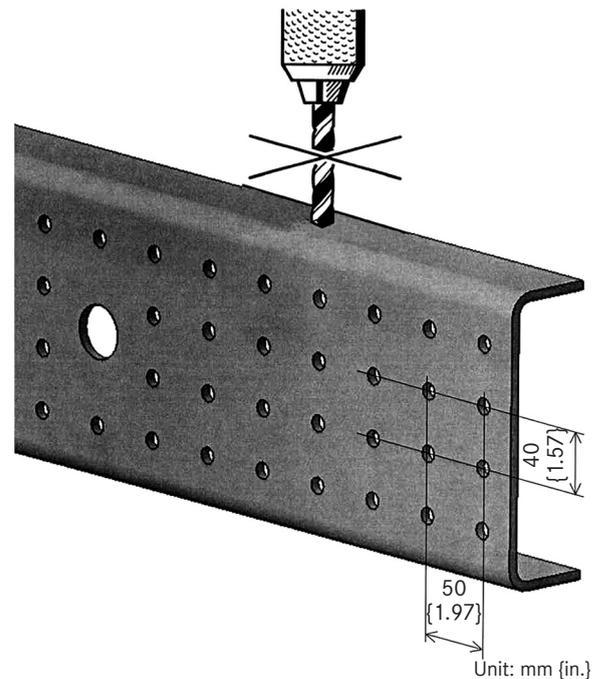
### 6.3 Drilling work on the vehicle frame

#### 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 Modifications to the basic vehicle

### 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.
- 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.

Crossmember type	Hole diameter	Center-to-center distance of holes
<ul style="list-style-type: none"> <li>Alligator type (see Fig. 1)</li> <li>Channel type (see Fig. 2)</li> </ul>	9 mm {0.35 in.} max.	30 mm {1.18 in.}* min.

Note\*: Maintain the dimensions of previously drilled holes.

Alligator type

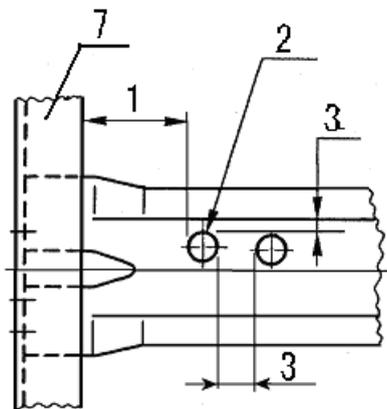


Fig. 1

- 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

Channel type

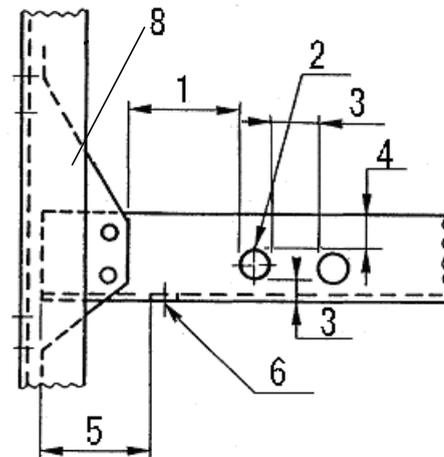


Fig. 2

- 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 Modifications to the basic vehicle

### 6.4 Welding work on the vehicle frame

#### 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 147.

#### Additional information

Further information on welded connections can be found in Section 5 "Damage prevention"  
▷ page 57.

#### 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.

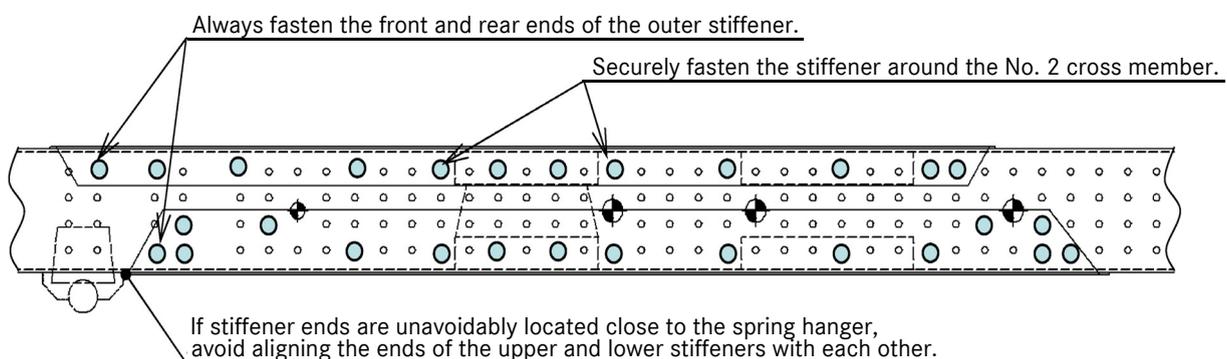
Tightening torque

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 Modifications to the basic vehicle

### 6.6 Modifications to the wheelbase

#### 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 15.

##### 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 cracks and fractures in the clutch housing, 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 262.

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 <sub>2</sub> gas shielded arc welding
SAPH440 (S355MC), HTP540 (S500MC)	Same as the side rail	SAPH440 (S355MC)	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 (SAPH440), follow the instructions below.

- 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.
- 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.

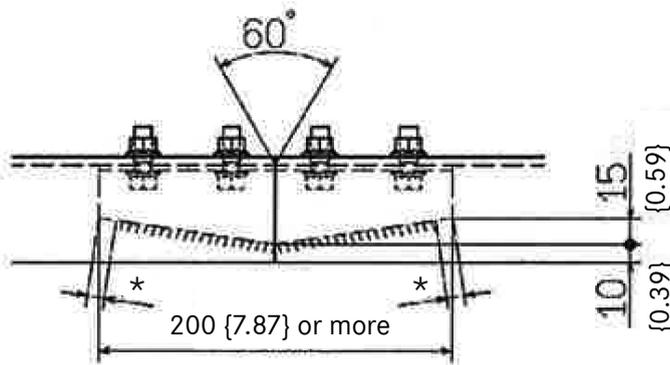
## 6 Modifications to the basic vehicle

### 6.7 Frame modifications

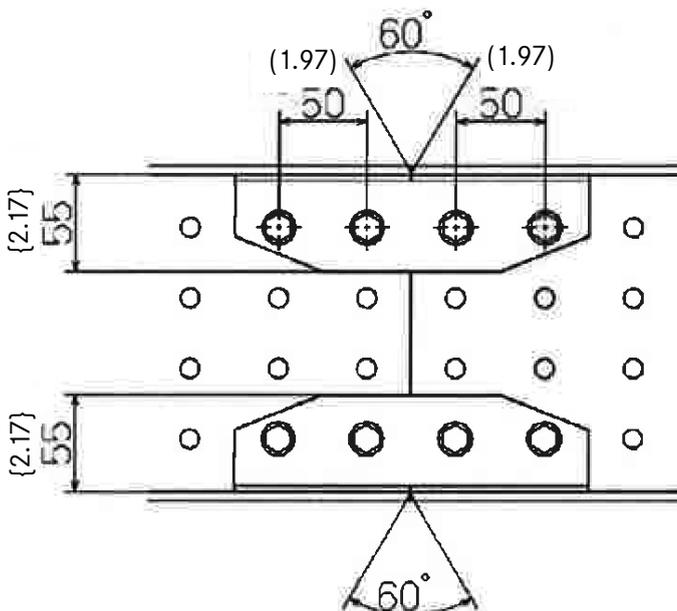
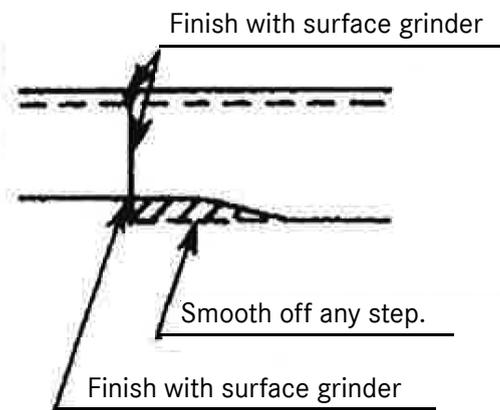
- Extending and shortening procedure  
Follow the reinforcement method described below.

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 \*.



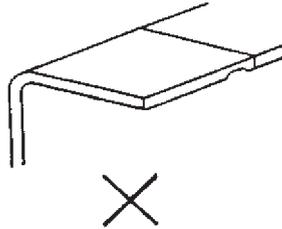
unit: mm {in.}

## 6 Modifications to the basic vehicle

### 6.7 Frame modifications

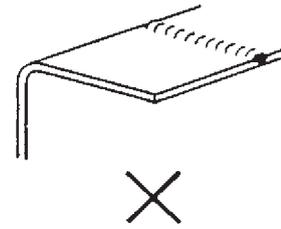
- Cautions for finishing the side rails.  
Be especially careful when finishing the flange end of the butt-welded side rails. Ensure a clean finish by grinding the weld so it is free of undercut, pileup or convex bead.

**Under cut**



**Fig. 3**

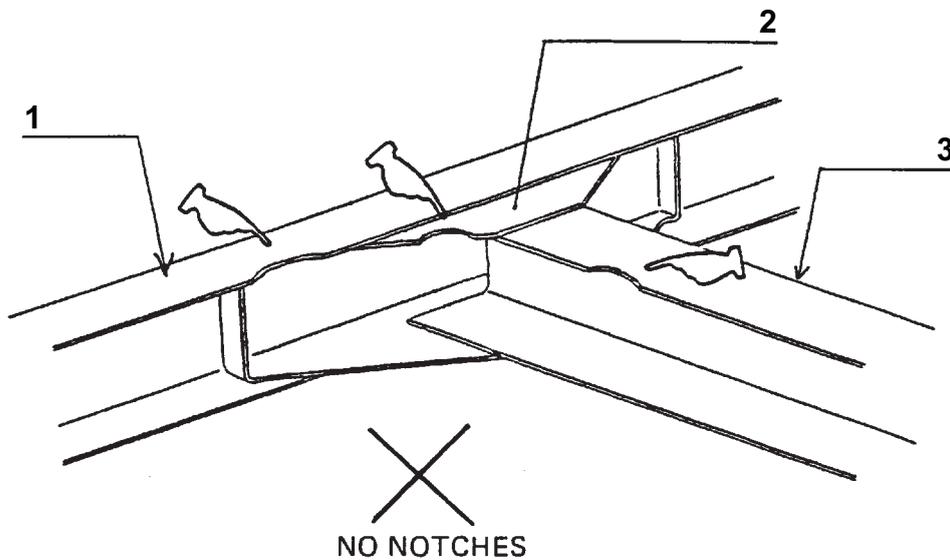
**Pile up**



**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 Modifications to the basic vehicle

### 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 (fuel tank, 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.

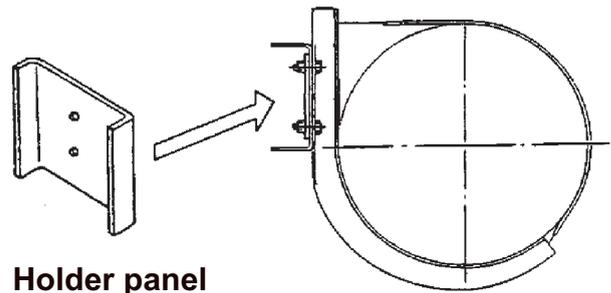


Fig. 1

## 6 Modifications to the basic vehicle

### 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

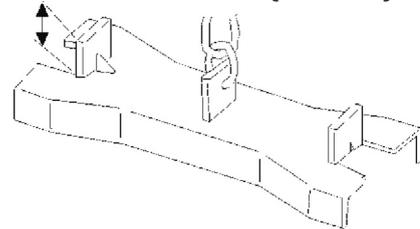
- The tightening bolt must be 30 mm {1.18 in.} or longer.
- Double nuts must be used for tightening.
- The structure having a height difference for preventing falling on the bracket.
- The structure having a stopper for preventing tightening nuts and bolts from falling.

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 Modifications to the basic vehicle

### 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

$\alpha$  : Load multiple of 2.5

$\beta$  : Required safety ratio of 1.3

(hoisted tire-carrier)

Apply the following load face down via the hoisting plate.

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

P : Test load

P<sub>o</sub> : Load applied on chain by tightening torque during standard tightening

W : tire of maximum set weight

$\alpha$  : Load multiple of 2.5

$\beta$  : Required safety ratio of 1.3

$\gamma$  : 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.

$$T = T_o \times \gamma \times \beta$$

T : Test torque

T<sub>o</sub> : Standard tightening torque

$\beta$  : Required safety ratio of 1.3

$\gamma$  : 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}/sec<sup>2</sup>) (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 Modifications to the basic vehicle

### 6.8 Mounting of implements and auxiliary components

Crank handle (reference)

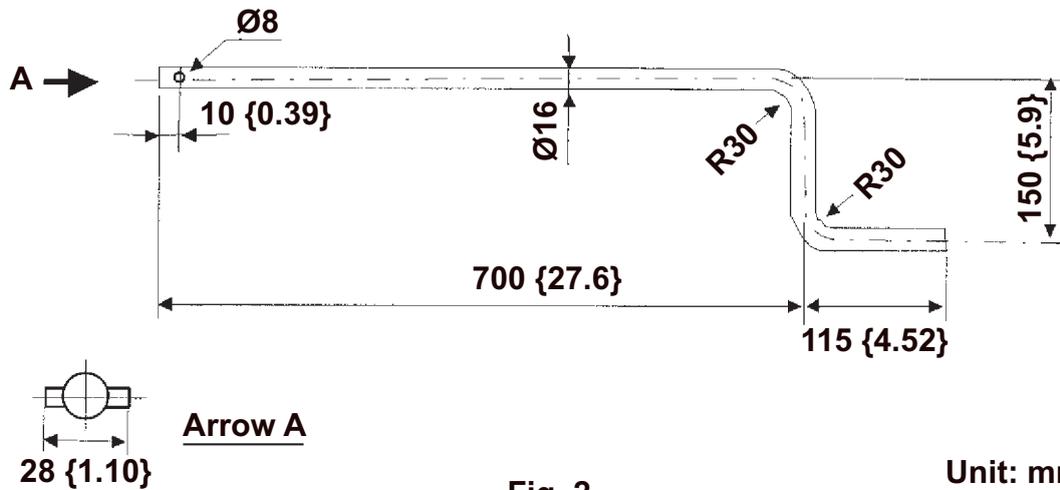


Fig. 2

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 Modifications to the basic vehicle

### 6.8 Mounting of implements and auxiliary components

#### 6.8.5 Front underrun protection

##### <Vehicle with front underrun protection>

All class N2 vehicles put into circulation must comply with EC Directive 2000/40/EC (front underrun protection) in order to conform with Directive 70/156/EEC, Annex II. The intended operation of a vehicle is to a great extent determined by the bodywork, so that the structure, design and equipment of the chassis must be carefully considered both with and without the front underrun protection. It is not possible to retrofit a front underrun protection on Canter. MITSUBISHI FUSO recommends that the approval and intended use be clarified with the authorities responsible beforehand.



## 6 Modifications to the basic vehicle

### 6.8 Mounting of implements and auxiliary components

#### 6.8.6 Rear underrun protection

##### <Vehicle with rear underrun protection>

In Germany, Article § 32b of the German vehicle licensing regulations requires an underrun protection when

- the distance between the rear of the vehicle and the final rear axle is more than 1,000 mm {39.4 in.}
- the ground clearance of the chassis as well as the main body parts exceeds 700 mm {27.6 in.} for the unladen vehicle across the entire width.

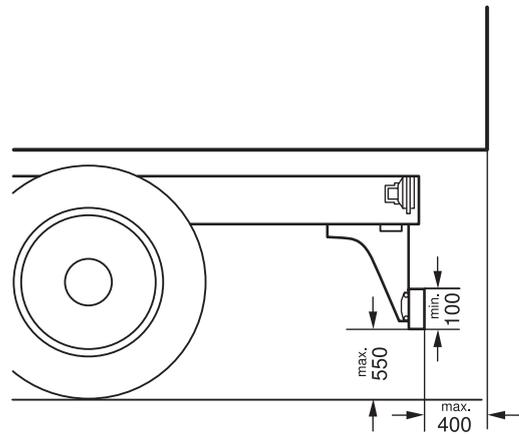
Exceptions to this regulation are semitrailer tractor vehicles, machines and vehicles whose purpose cannot be fulfilled if an underrun protection is fitted.

If an underrun protection is required, it must comply with EC Directive 70/221/EEC.

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 {21.7 in.}
- maximum width = width of rear axle (outer tire edge).
- minimum width: = Width of rear axle - 100 mm {3.94 in.} on each side (widest axle is authoritative)
- crossmember section height at least 100 mm {3.94 in.}.
- edge radius at least 2.5 mm {0.098 in.}.



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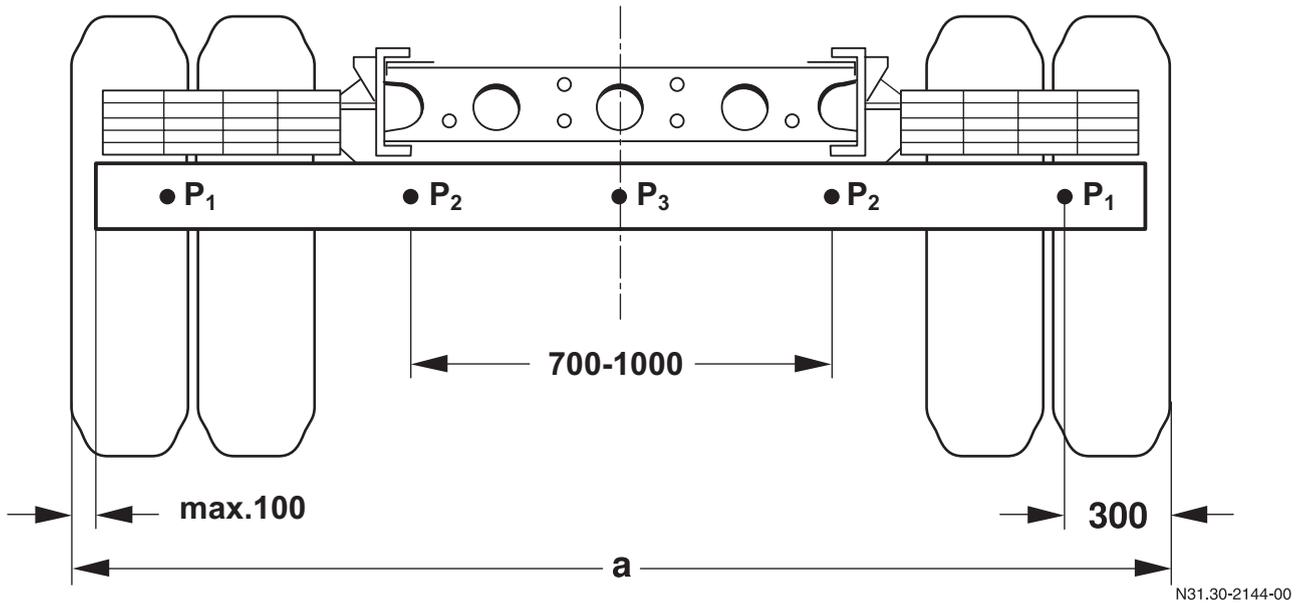
The rear underrun protection fitted at the factory complies with EC Directive 70/221/EEC. No modifications may be made. If modifications are unavoidable, they must be clarified in advance with the vehicle licensing agency responsible.

## 6 Modifications to the basic vehicle

### 6.8 Mounting of implements and auxiliary components

Check strength of underrun protection and its mounting in accordance with EC Directive 70/221/EEC.

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 {15.7 in.}.



*a = Rear axle width*

*P<sub>1</sub>, P<sub>2</sub>, P<sub>3</sub> = Load application points*

## 6 Modifications to the basic vehicle

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### 6.8 Mounting of implements and auxiliary components

#### 6.8.7 Side underrun protections

Mount components in accordance with local regulations.



#### 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 15.

- The content relating to in Section 2.5 Mitsubishi three diamonds and Fuso emblem must be complied with ▷ page 19.

#### 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.)

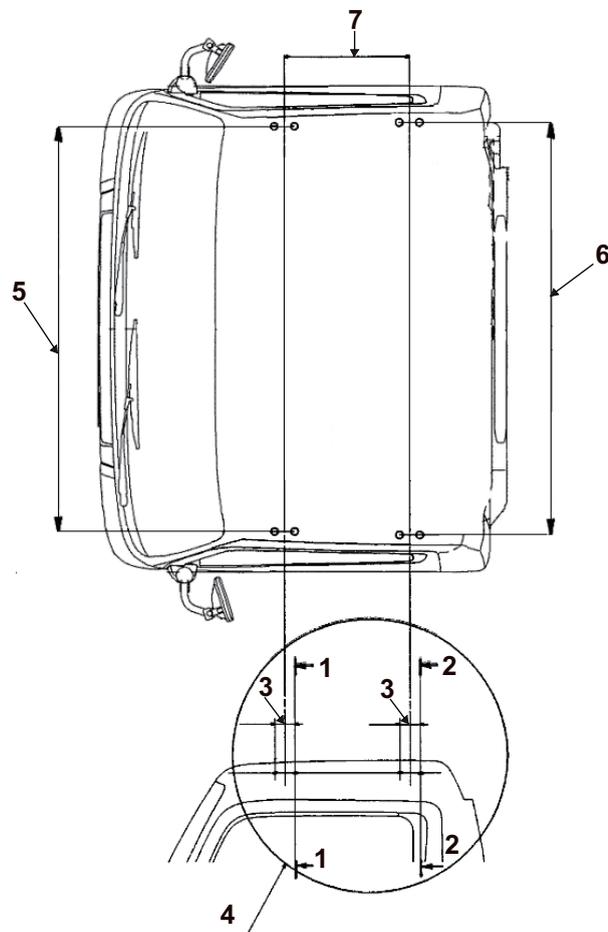
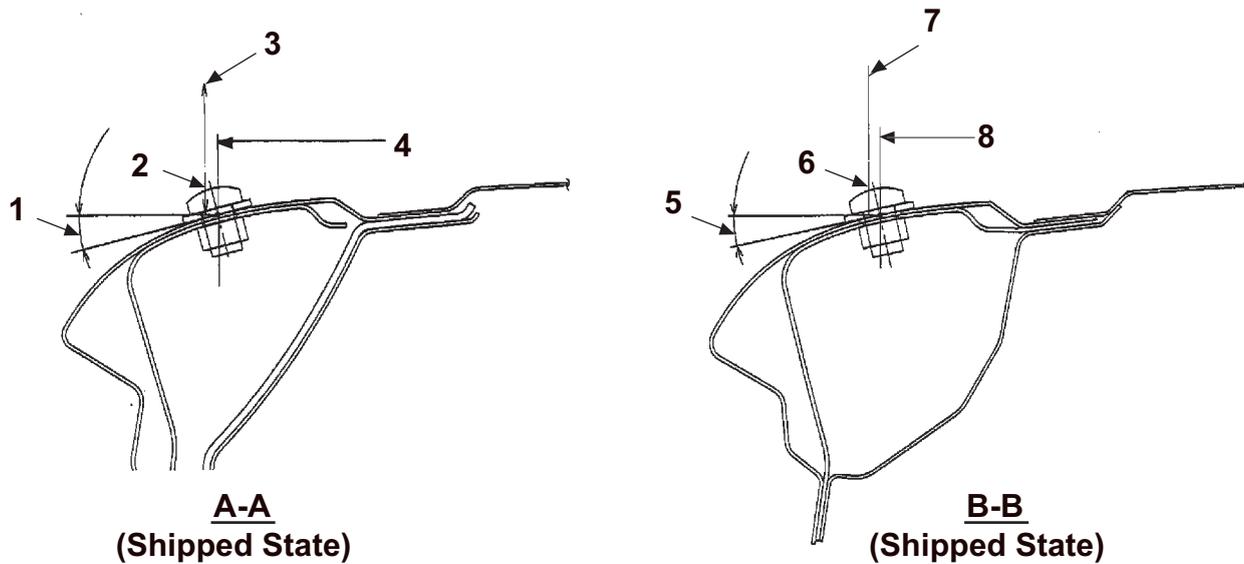


Fig. 1

- 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)

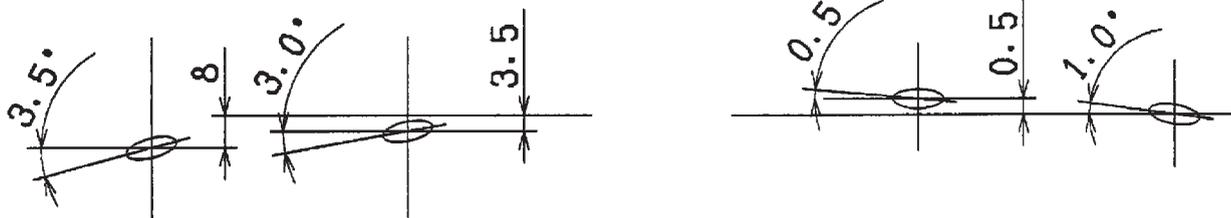
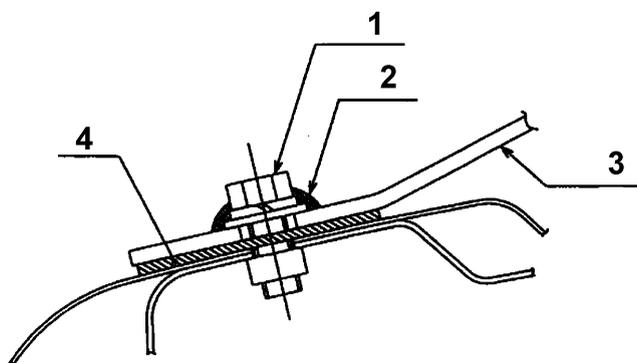


Fig. 2

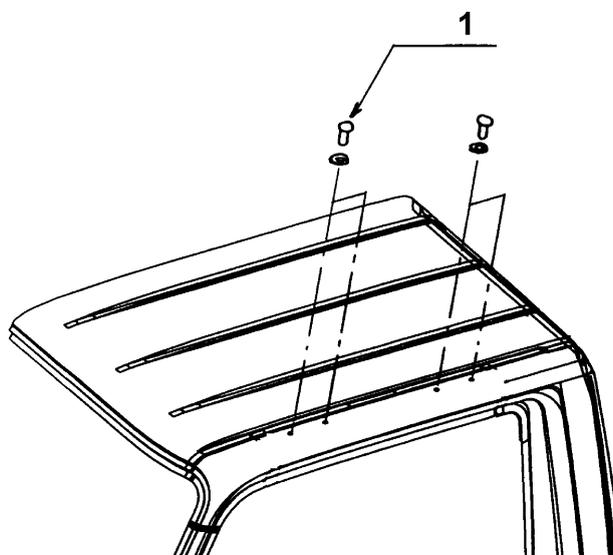
- 1 16.5° (Wide cab, Standard cab)
- 2 31.0 mm {1.22 in.} (Wide cab)  
29.0 mm {1.14 in.} (Standard cab)
- 3 roof top
- 4 1664 mm {66 in.} (Wide cab)  
1364 mm {53.7 in.} (Standard cab)

- 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.



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## 6 Modifications to the basic vehicle

### 6.11 Power take-offs

Portion in which the accelerator sensor connector is set on the chassis side



Fig. 2

List of set parts

Unit: mm {in.}

Kit part number	Description	Sub-harness length
MK630478	Cab back control kit	2500 {98.4}

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#### 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 15)

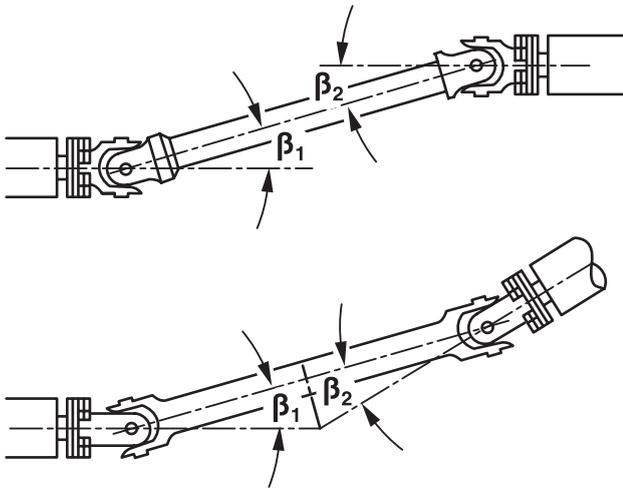
Observe the following when installing propeller shafts:

- 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 ( $\beta_1 = \beta_2$ ). They must not be greater than  $6^\circ$  or less than  $1^\circ$ .
- 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 Modifications to the basic vehicle

### 6.12 Installation of propeller shafts

#### 6.12.1 Types of angular offset



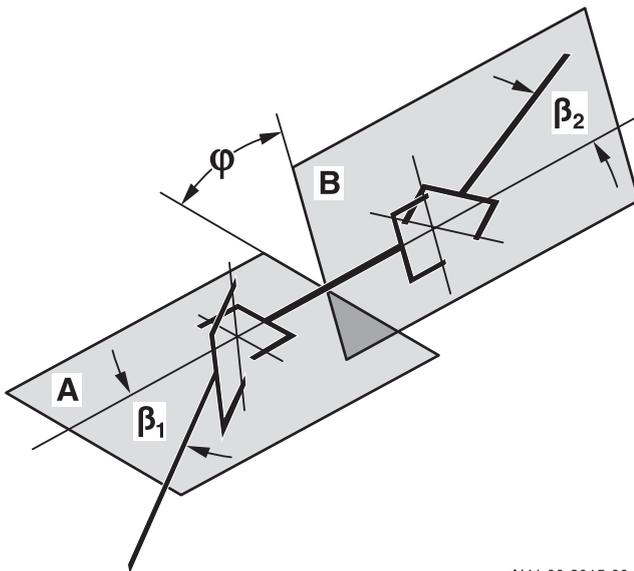
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#### **Angle in one plane (two-dimensional offset)**

$$\beta_1 = \beta_2$$

Upper = Z-type offset

Lower = W-type offset



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#### **Angles in two planes (three-dimensional offset)**

$$\beta_1 = \beta_2$$

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 54.

#### Disk brake



##### Property damage

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

Extreme caution is required in handling brake tubing because of the importance of the components due to brake safety. Tubing, joints, and brake components should be protected with covers during mounting work to prevent them from dents, damages, welding sparks, and heat and routing changes of tubing necessary for coupling with trailers, etc., should be performed in accordance with the following cautions.



## 6 Modifications to the basic vehicle

### 6.13 Brake systems

#### 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  $\sqrt[3]{\lambda r 0.8}$

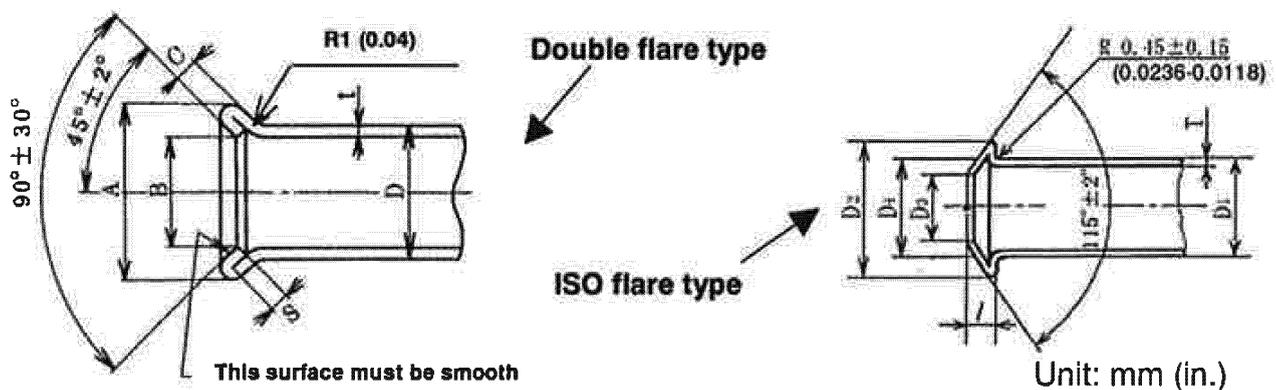


Fig. 1

## 6 Modifications to the basic vehicle

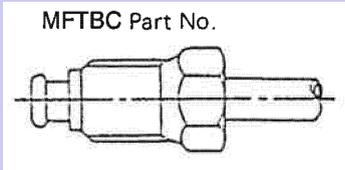
### 6.13 Brake systems

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.}	MFTBC Part No.  Fig. 2
4.75 4.76 {0.19}	MF65 1001 (Double flare type) MK678335 (ISO flare type)
6.35 {0.25}	MF65 1002 (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.

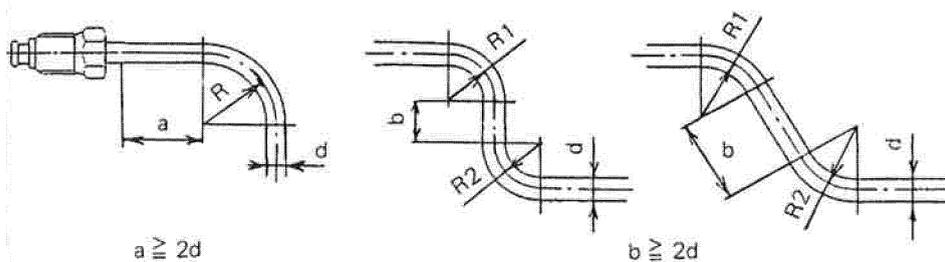


Fig. 3

- 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)

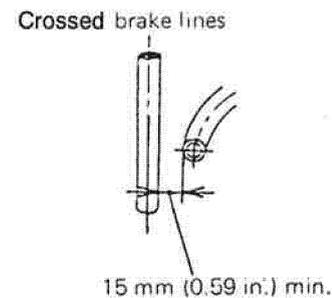


Fig. 4

- 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)

## 6 Modifications to the basic vehicle

### 6.13 Brake systems

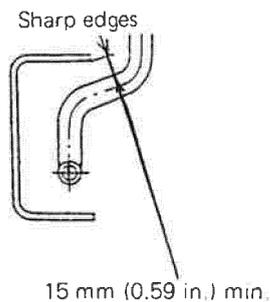


Fig. 5

- 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 43.
- 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 43.
- Position the connection nut in a location where it can be completely tightened without difficulty.

- Tighten the flare nuts to torque specified in ▷ page 117. 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

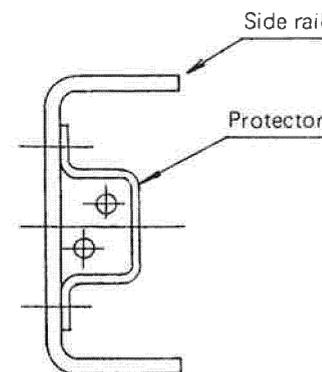


Fig. 6

#### 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 SCR and DPF systems>

##### 6.14.1 Exhaust gas purification devices (BlueTec® system) and sensors

- Exhaust gas purification devices (BlueTec® system) 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 (BlueTec® system) and engine proper from being adversely affected, do not relocate the exhaust gas purification devices (BlueTec® system), exhaust temperature sensor, differential pressure sensor, lambda sensor and NOx sensor.  
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.
- Exhaust gas purification devices and sensors are periodically removed for maintenance. Install them so that removal and reinstallation work can be carried out without any problems.

##### 6.14.2 BlueTec® system

###### BlueTec® exhaust gas aftertreatment

BlueTec® 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.

- SCR muffler
- Urea/DEF tank unit
- Dosing module
- Urea/DEF hose

#### **! Property damage**

Do not take out the power supply for other electric components from the existing fuse.

Especially the function of BlueTec® exhaust gas after treatment can not work when the fuse of system is blowout.

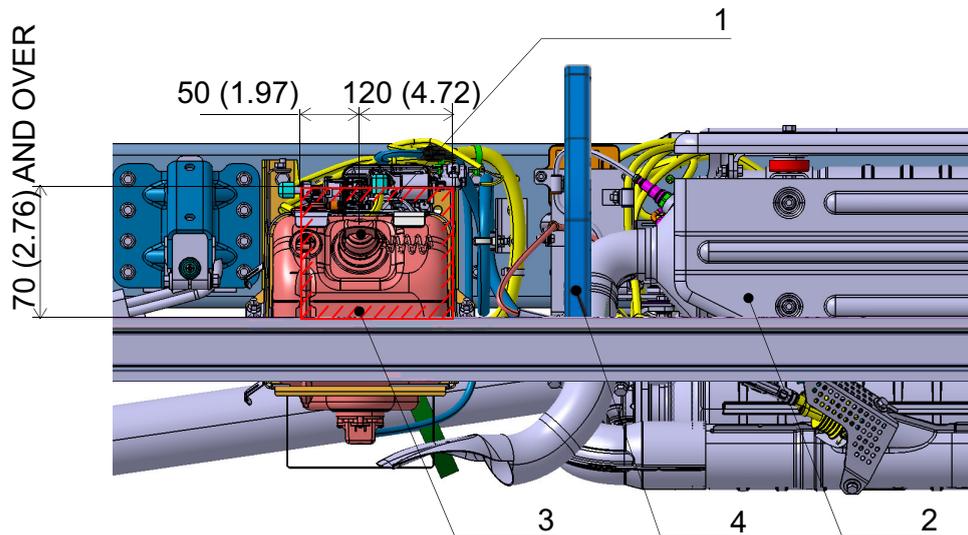
BlueTec® exhaust gas after treatment requires a lot of electric power to work the heating device for freeze proofing in winter or cold region.

## 6 Modifications to the basic vehicle

### 6.14 Exhaust system

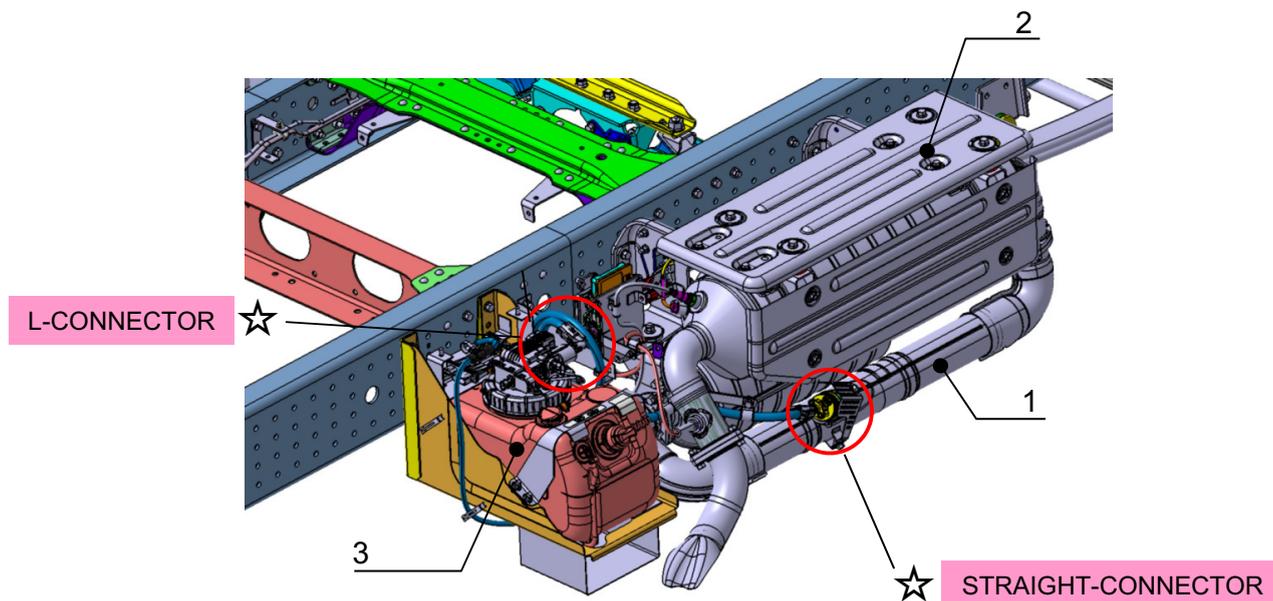
#### Installing a side guard and other parts around the Urea/DEF tank

- Care is required when installing a side guard around the Urea/DEF tank. Do not let the side guard and its mounting stay hide the filler cap of the tank and interfere with refilling the tank with AdBlue. Be sure to open up sufficient space around the cap to allow a filler gun of AdBlue to be inserted; typical dimensions of filler guns are shown in the figures below.
- Allow a clearance of at least 25 mm {0.98 in.} between the side guard, mud guard, etc. installed around the Urea/DEF tank and the following parts of the Urea/DEF tank: front end, rear end, and outer side.
- Avoid directly attaching parts to any of the Urea/DEF tank brackets.
- Maintain sufficient free space to insert DEF filler nozzle. (shaded area)



- 1 Cap  
2 Side guard

- 3 Urea/DEF tank  
4 Side guard mounting stay



- 1 Dosing module  
2 SCR muffler with Internal Catalyzer

- 3 Urea/DEF tank

AdBlue filler gun - Examples

Filler gun for dispensers

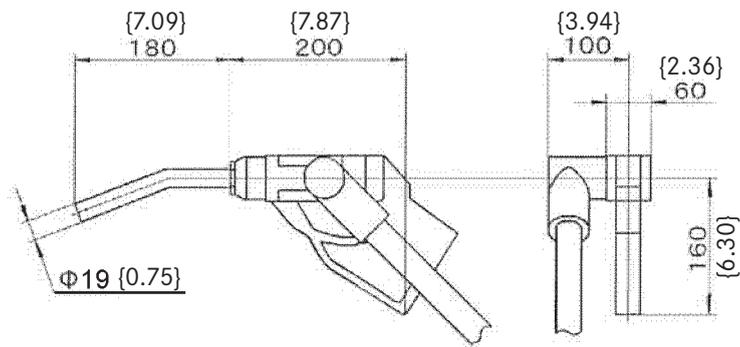


Fig. 2

Unit: mm {in.}

#### Urea/DEF and connection piping

The Urea/DEF tank with a urea pump module inside, the dosing module, and their connection piping are all installed conforming to the relevant exhaust gas control requirements. It is prohibited to relocate these components and change their piping when mounting the body or equipment.

There are Urea/DEF hose connecting ports near the points marked ☆ (2 places in total). After any operation including mounting the body or equipment near these areas, visually check that the clamps of the coupling connector is fully closed regardless of whether you touch the piping or not.

#### Property damage

Applying undue force to hoses may damage their connections. Do not pull on hoses or step on their connections.

## 6 Modifications to the basic vehicle

### 6.14 Exhaust system

#### 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.

<Vehicles with DPF system>

#### 6.14.3 Clearance between exhaust system parts and other parts

- The exhaust pipe and exhaust gas purification devices (DPF, Diesel Oxidation 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 45. 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 diesel particulate filter (DPF) integrated muffler and exhaust pipe. If this is impracticable, provide a shielding plate against heat to ensure safety.



#### Risk of accident and injury

The tail pipe (including Diesel Oxidation catalyst) of a DPF-equipped vehicle can become considerably hotter than that of a conventional vehicle during automatic regeneration. Provide sufficient clearance between the tail pipe and other parts.

#### 6.14.4 Exhaust gas purification devices (DPF, Diesel Oxidation catalyst) and sensors

- The muffler integrated with diesel particulate filter (DPF) 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 (DPF, Diesel Oxidation catalyst) and engine proper from being adversely affected, do not relocate the exhaust gas purification devices (DPF, Diesel Oxidation catalyst), exhaust temperature sensor or pressure sensor.  
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.
- The DPF-integrated muffler is periodically removed for maintenance. Install it so that removal and reinstallation work can be carried out without any problems.



#### 6.15 Fuel system

##### 6.15.1 Fuel tank

Do not connect the chassis-mounted fuel tank and the mounting bracket to the body-building part, because this may adversely affect the mounting strength of the fuel tank.

##### Precautions for relocating the fuel tank

When changing the fuel pipes, use the specified steel pipes, nylon tubes and joints indicated below. If you use poor quality parts, a fire may occur, so be sure to purchase genuine parts from your local MITSUBISHI FUSO parts dealer.

Nylon tube

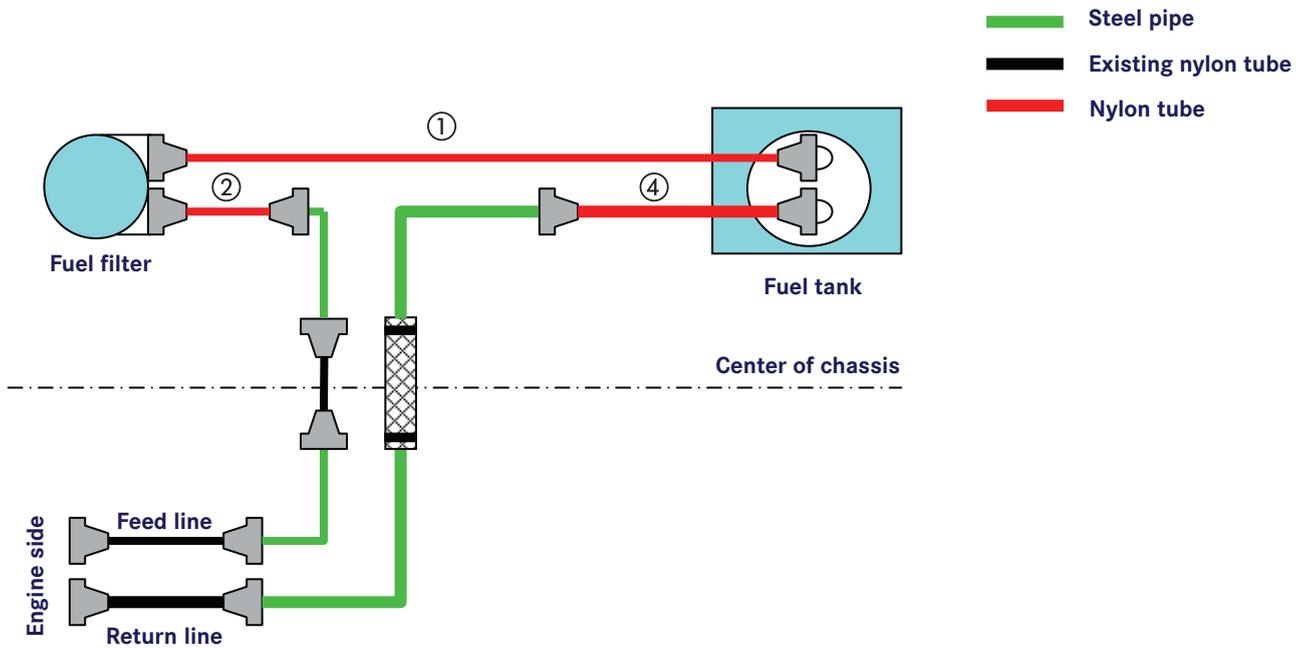
Unit: mm {in.}

Nominal diameter	Part number	Length	Applicable location
8 {0.31}	MK629953	1,000 {39.4}	Fuel tank – Fuel filter ①
	MK629955	1,500 {59.1}	Fuel tank – Fuel filter ①
	MK629957	2,000 {78.7}	Fuel tank – Fuel filter ①
	MK629959	3,000 {118.1}	Fuel tank – Fuel filter ①
	MK629961	1,000 {39.4}	Fuel filter – Main pipe ②
	MK629963	1,500 {59.1}	Fuel filter – Main pipe ②
	MK629965	2,000 {78.7}	Fuel filter – Main pipe ②
	MK629967	3,000 {118.1}	Fuel filter – Main pipe ②
	MK620244	2,000 {78.7}	Fuel filter – Joint ③
	MK620246	3,500 {137.8}	Fuel filter – Joint ③
10 {0.39}	MK629969	1,000 {39.4}	Return pipe – Fuel tank ④
	MK629971	1,500 {59.1}	Return pipe – Fuel tank ④
	MK629973	2,000 {78.7}	Return pipe – Fuel tank ④
	MK629975	3,000 {118.1}	Return pipe – Fuel tank ④
	MK620248	2,000 {78.7}	Joint – Fuel tank ⑤
	MK620250	3,500 {137.8}	Joint – Fuel tank ⑤

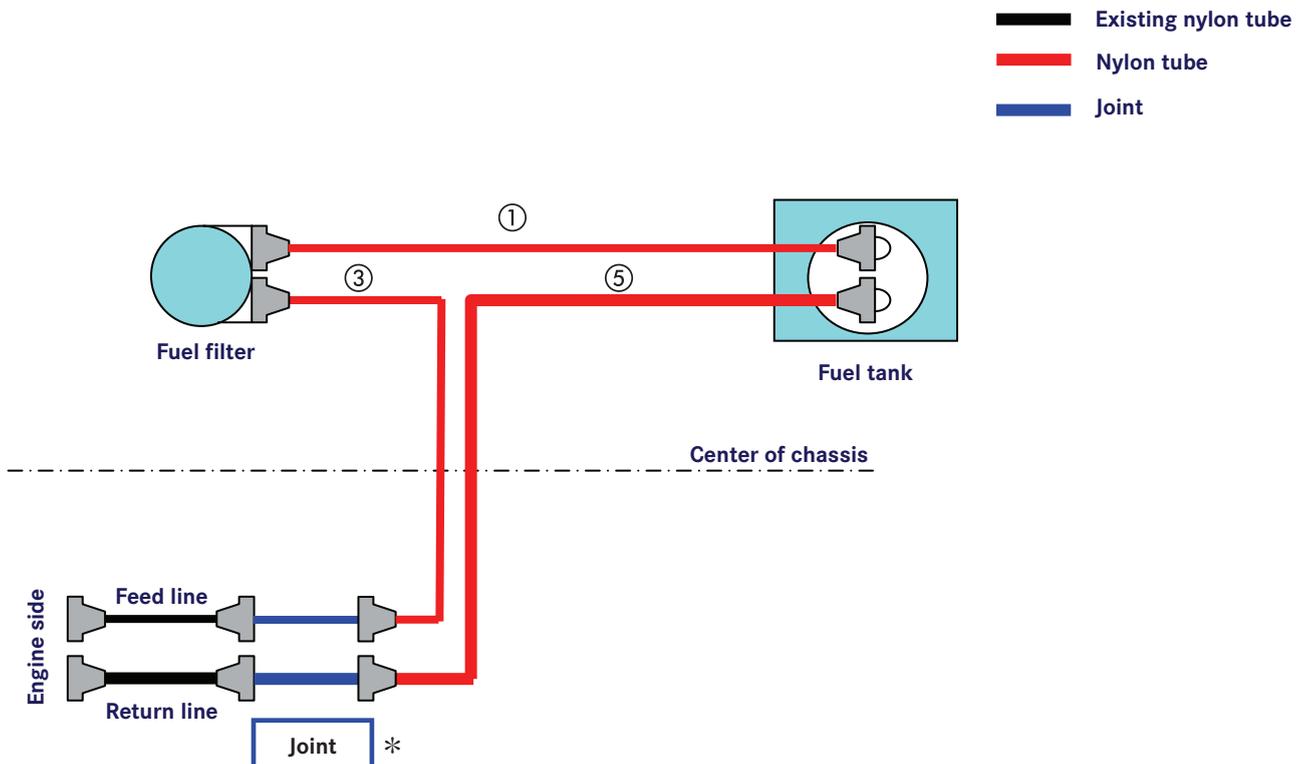
## 6 Modifications to the basic vehicle

### 6.15 Fuel system

Changing the fuel pipe layout - Example 1



Changing the fuel pipe layout - Example 2



## 6 Modifications to the basic vehicle

### 6.15 Fuel system

#### Joint

When changing the fuel pipes as shown in Example 2, remove the steel pipe on the left side of the vehicle, and use the specified joint shown below.

Note that the applicable part number differs according to the width of the frame assembly.

Unit: mm {in.}

Frame assembly width	Nominal diameter	Part number	Applicable location
750 {29.5}	8 {0.31}	MK620252 ML209664 (※ 1)	Feed side
750 {29.5}	10 {0.39}	MK620253 ML209665 (※ 1)	Return side
850 {33.5}	8 {0.31}	MK620254 ML209666 (※ 1)	Feed side
850 {33.5}	10 {0.39}	MK620255 ML209667 (※ 1)	Return side

(※ 1: Biodiesel B10 fuel is applicable)

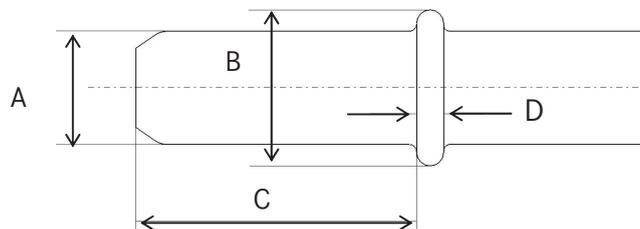
#### Steel pipes

Use steel pipes that have been rustproofed on both the inside and outside surfaces, and ensure that the shape of the ends of the pipes conforms to the figure below.

#### Rustproofing

- Inside surface : Copper plating  
(Plating thickness: 3  $\mu$  or more)
- Inside surface (biodiesel B10 fuel applicable)  
: Nickel plating  
(Plating thickness: 3  $\mu$  or more)
- Outside surface : Zinc plating  
(Plating thickness: 13  $\mu$  or more)

SAE J2044 standard type



Unit: mm {in.}

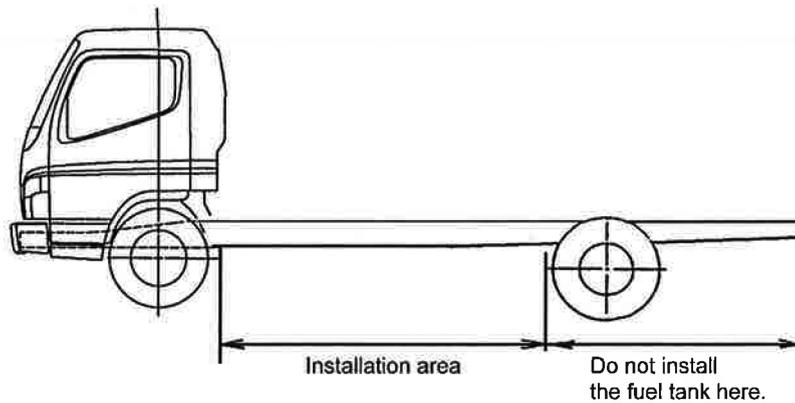
Nominal diameter D	A	B	C	D	
8 {0.31}	7.89 ± 0.06 {0.31 ± 0.0024}	10.98 ± 0.15 {0.43 ± 0.0059}	19.52 ± 0.25 {0.77 ± 0.0098}	1.6 ± 0.33 {0.063 ± 0.013}	* 8 mm (5/16") {0.31}
10 {0.39}	9.49 ± 0.06 {0.37 ± 0.0024}	12.94 ± 0.21 {0.51 ± 0.0083}	19.52 ± 0.25 {0.77 ± 0.0098}	1.6 ± 0.33 {0.063 ± 0.013}	* 9.5 mm (3/8") {0.37}

\* For details of the shape, refer to SAE J2044.

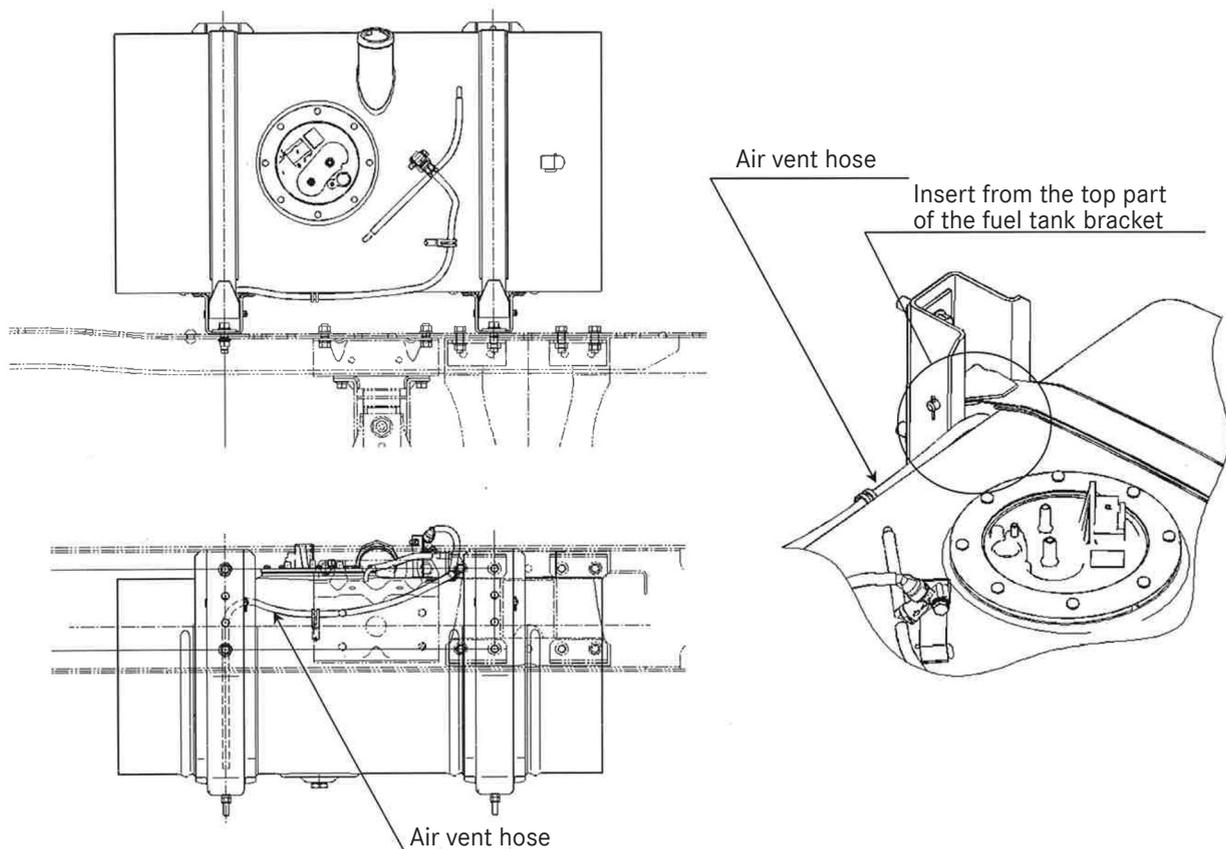
- Do not connect fuel hoses directly to each other. When you wish to extend the length of the fuel hose, connect it to the extension fuel hose via a nylon tube.
- Use steel pipes inside the engine compartment.
- Do not change the clips or the positions of clamps on parts of the engine and the frame which move relative to each other.
- Run fuel hoses and nylon tubes in such a way that they do not touch each other or touch metal pipes, electric wires etc., and then clamp them. If a fuel hose or a nylon tube is in contact with another tube or pipe, for example, it will wear and eventually become damaged, resulting in fuel spurting out or a fire occurring.
- Take care that the side guard and the fuel tank parts do not interfere with each other. Also, take steps to ensure that lubrication work is not impeded.
- Clamp the fuel hose at intervals of between 400 and 500 mm {15.7 and 19.7 in.} to ensure that its buckling does not occur. Use a sheet metal clip with rubber (MH020418), for example, to clamp the nylon tube. (The recommended bending radius is 80 mm {3.15 in.} or more for D = 8, and 120 mm {4.72 in.} or more for D = 10.)
- Maintain the steel pipe at least 15 mm {0.59 in.} from the corners of other parts, at least 25 mm {0.98 in.} from parts which move relative to each other, and fix it securely with clamps.
- In order to connect the feed side pipe and the return side pipe to the fuel tank, use nylon tubes and steel pipes whose end shape is stipulated in SAE J2044.
- If you use parts other than the above, fuel leakage is likely to occur, so be sure to use nylon tubes and prescribed steel pipes.
- Never use a rubber hose for the feed side piping.

#### Relocating the fuel tank

Install a FHWA-approved fuel tank within the wheel-base. Consult MFTA before installing it in other locations.



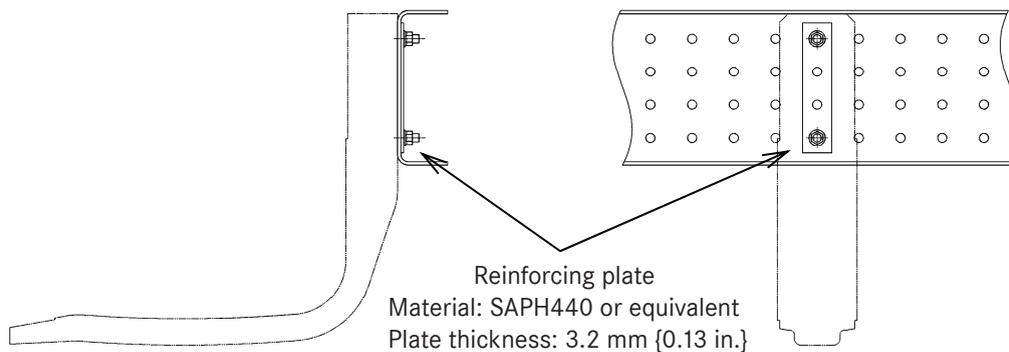
- After removing the fuel tank, firmly insert the air vent hose of the fuel tank into the bracket from the top, with the end face downward. When doing this, take care not to crush the air vent hose or allow it to become clogged.



#### Re-installing the fuel tank

- When re-installing the fuel tank, take adequate account of vibration, the mounting position, and mounting conditions, and ensure that there is no looseness or other problem. When using new brackets, ensure that they have adequate strength to support the fuel tank.

<Fuel tank fixing points - Reinforcement example>



- To connect the fuel tank to the frame, be sure to use flange nuts and flange bolts of the strength classification shown below, and tighten the bolts to the specified torque.

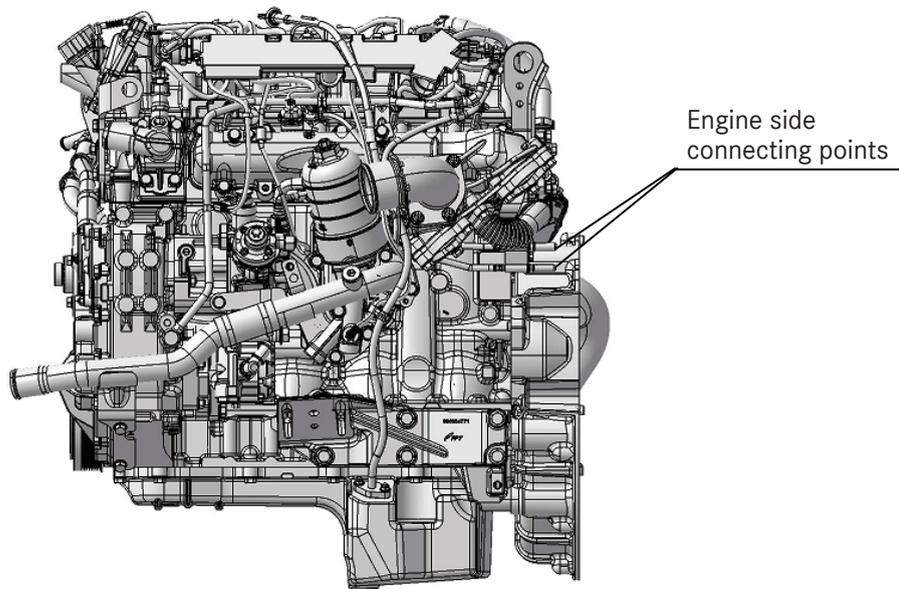
N·m [kgf·m] {lbs.ft}

	Size	Strength classification	Tightening torque
Flange bolts	M10	10T or more	90 - 110 [9.2 - 11.2] {67 - 81}
Flange nuts	M10	6T or more	

#### 6.15.2 Fuel filter

##### Relocating the fuel filter

- Relocation position
  - Move the fuel filter to a point within the wheel bases. (It is also possible to mount the fuel tank and the fuel filter separately on the left and right sides of the vehicle.)
  - When relocating the fuel filter to a point near the exhaust pipe, maintain it at a distance of at least 150 mm {5.91 in.} from the heat source. If it is difficult to secure this distance, be sure to install a heat shield. Do not relocate the fuel filter to a point that is almost directly above the exhaust pipe.
- Ensure that the water drainage outlet of the fuel filter does not protrude below the bottom surface of the fuel tank.
- Fix the fuel filter independently to the frame. (This also applies to the case where the fuel filter mounted on the fuel tank brackets is to be relocated.)
- The size of each relocating pipe must be  $\phi 8$  on the main side, and  $\phi 10$  on the return side. For details, refer to "6.15.1 Fuel Tank" ▸ page 125.
- Ensure that the length of each pipe between the engine side connecting point (see figure below) and the fuel tank is within 8.5 m {28 ft.}.

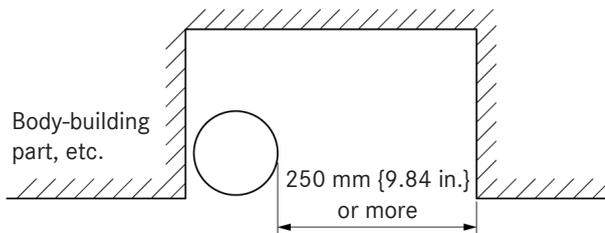


- Never connect fuel hoses directly to each other.
- Take care that dirt or other foreign matter does not enter the removed fuel pipe. (Particularly, be very careful of the part of the fuel pipe between the fuel filter and the engine.) Before installing a new pipe and fuel hose, confirm that there is no dirt or other foreign matter inside.  
If dirt or other foreign matter gets into the fuel filter, the parts of the fuel injection system are liable to break.
- Be careful that the fuel hose and nylon tube do not buckle and impede the supply of fuel.
  - Fuel hose: Secure a bending radius of at least 50 mm {1.97 in.} inside the hose.
  - Nylon tube: Recommended bending radius is at least 80 mm {3.15 in.} for D = 8, or 120 mm {4.72 in.} for D = 10.
- Secure the clearance indicated below between the fuel hose and the peripheral parts.
  - Electrical wires: 20 mm {0.79 in.} or more
  - When there is relative motion: 25 mm {0.98 in.} or more
  - When there is no relative motion: 15 mm {0.59 in.} or more
- Securely fix the pipes and wires in the vicinity of the fuel filter with clips to prevent them from moving. Install the clips at intervals of no more than 300 mm {11.8 in.}.
- If there is a possibility of the fuel filter becoming damaged due to flying stones or fallen objects, for example, install a protective cover, or the like.

- Secure a clearance around the fuel filter to enable work such as draining off the water in the fuel filter, bleeding off air or replacing the element. A clearance value is shown below for reference.

<Upward view>

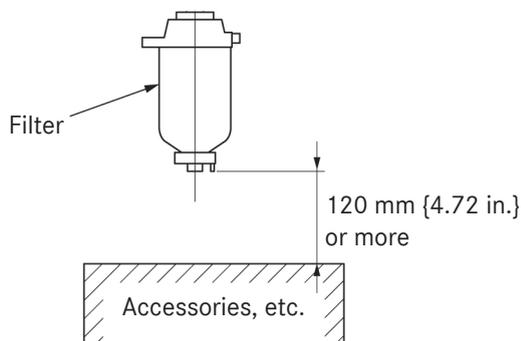
- Secure a space of at least 250 mm {9.84 in.} in at least one direction in the vicinity of the filter (to enable the filter wrench to be applied).



<Side view>

Secure the following space.

- The space at the bottom end of the filter must be at least 120 mm {4.72 in.} (to enable the filter wrench to be applied).



- Do not modify the fuel filter or the mounting bracket.
- When newly fabricating a fuel filter bracket, ensure that it has adequate strength in consideration of body vibration.
- When refurbishing the electrical wiring going to the fuel filter, refer to "10.13 Electrical wiring diagram"   
▷ page 301.
- If there is anything concerning the relocation work that you are not sure of, please consult with the department in charge of body-building and modification.   
"2.2 Technical advice and contact persons"   
▷ page 15.

#### 6.16 Others

##### 6.16.1 SRS air bag <For EuroIV>

Observe the following precautions when performing the body building and modification work on a vehicle equipped with an SRS air bag and seat belts with a pretensioner.

Failure to observe these precautions could prevent the air bag from working properly or deploy it at an unexpected timing during the work.

(SRS: an acronym for supplemental restraint system, meaning an auxiliary restraint system of the seat belts)

- Precautions for body building and modifications
  - (a) Modification of a front portion of the vehicle or mounting of a built body on the front surface of the cab may result in the SRS air bag not working properly. If such a modification is made or body building is performed, explain the precaution to the purchaser of the vehicle and alter the SRS air bag so as to make it inactive. For queries about the alteration procedure to make the air bag inactive and any special types of body building other than those given below, contact the responsible section. ▷ page 15
    - Modification of the front bumper, frame or cab at the front portion of the vehicle
    - Mounting of a grille guard or winch
    - Mounting of a snowplow
    - Body building of a front-stowing, and not hook-stowing, cab back crane (type of crane traveling with a hook suspended at the front of the cab)
  - (b) Never disassemble or modify the steering wheel (including the pad), airbag modules (driver's seat and front passenger seat), airbag ECU, sub-G sensor, ELR of the seatbelts fitted with pretensioners (driver's seat and front passenger seat) or the airbag harnesses.
  - (c) Do not install electrical parts or equipment related to body-building at a location that is on and higher than the steering wheel.
  - (d) The airbag ECU is installed on a bracket alongside the brake pedal on the cabin floor (in the case where a front passenger seat airbag is provided, a sub-sensor is also installed on the

floor at the rear of the washer tank on the front passenger seat side), so do not modify or reinforce the airbag ECU mounting bracket. Also, do not apply a strong impact to the bracket by kicking or striking it, for example.

- Precautions during electric welding
  - (a) Turn OFF the starter switch and disconnect the negative battery cable. Then, leave the vehicle to stand for 1 minute or more. This step is performed to let electricity stored in the backup capacitor disposed inside the ECU of the SRS air bag discharged. Wrap tape around the negative battery cable terminal for proper insulation. (Be sure to perform this step particularly for work related to electrical systems and cab.)
  - (b) Make a ground connection of the welding machine near the welding portion.
  - (c) After the welding operation, restore the battery cable to the original position and turn ON the starter switch. At this time, make sure that  does not appear on the multi-display. If the multi-display shows , never fail to contact the MITSUBISHI FUSO Service Center. ▷ page 15

If you carry out welding work in the vicinity of the airbag, you are likely to cause this restraint system to become defective. Never carry out welding in the vicinity of the airbag.

If you ignore this warning, the airbag is likely to deploy or fail to function correctly.

- Precautions during body building work
  - (a) The SRS air bag system parts are mounted around the steering wheel and seat belt retractor. Do not tap the areas around the SRS air bag system parts or otherwise apply impact to them.
  - (b) Do not remove any SRS air bag system parts.
  - (c) Do not modify harnesses and connectors of the SRS air bag system. Do not fix other harnesses to the air bag or pretensioner harness.
  - (d) Do not check the SRS air bag circuit using a multimeter or similar device.

- (e) When performing work involving heating to the cab (e.g. painting), if the temperature becomes 93°C {199°F} or higher, remove the air bag ECU, sub-G sensor, air bag module, clock spring, and the ELR of the seat belt with pretensioner in advance.

If these parts are to be removed, contact the responsible section in advance ▷ page 15.

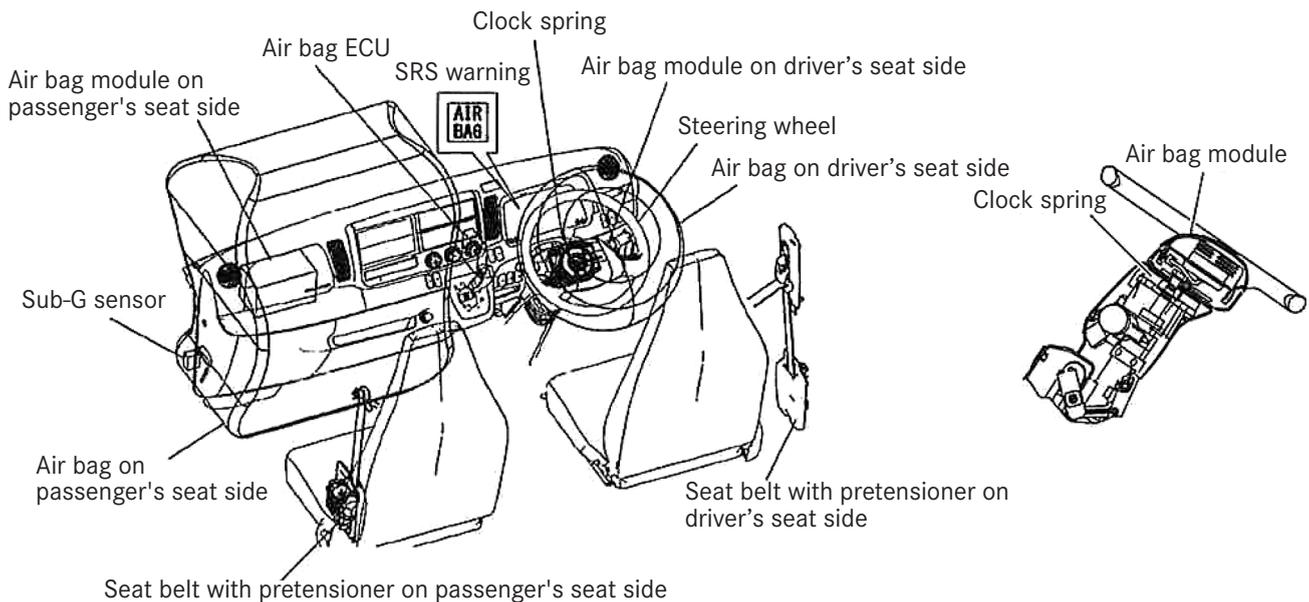
- (f) If the air bag module is removed, place it with the horn pad upper surface facing up on a flat site. Do not place any other object on the air bag module.
- (g) Use utmost care when handling the air bag module, air bag ECU and sub-G sensor. Do not drop it or subject it to water or oil.  
Never apply impact to the air bag ECU and sub-G sensor, in particular.  
Should it be dropped, replace it with a new one even if it looks all right on the outside.
- (h) Do not modify the electrical circuit of the SRS air bag.  
Never use a general-purpose multimeter.
- (i) Never source power from the SRS air bag fuse.
- (j) Do not turn the clock spring three turns or more from the neutral position (straight-ahead position), as a damaged internal harness could result.
- (k) Whenever removing the steering wheel or steering shaft joint, be sure to place the front tires in the straight-ahead position, remove the starter key, and lock the steering wheel.
- (l) During reinstallation of the steering wheel, make sure that the front tires are placed in the straight-ahead position and the clock spring in the neutral position.  
To bring the clock spring into its neutral position, follow these steps: turn the clock spring fully clockwise; turn it counterclockwise the number of turns specified on the label; and turn it until the alignment marks are aligned with each other.
- (m) After the work has been completed, use the SRS air bag warning to check that the system functions properly.  
Turn ON the starter switch and then check that the SRS air bag warning  does not appear on the meter cluster multi-display.

If the SRS air bag warning  appears, consult the MITSUBISHI FUSO Service Center  
▷ page 15.

- Miscellaneous

- (a) Be sure to consult the MITSUBISHI FUSO Service Center whenever performing any work other than those noted above, replacing or disposing of the SRS air bag, or discarding a vehicle equipped with the SRS air bag.

▷ page 15



#### 6.16.2 DUONIC®

##### **Cautions for vehicles with DUONIC® (mechanical automatic transmission)**

When removing the DUONIC® 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 DUONIC® 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 the DUONIC® 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**

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.

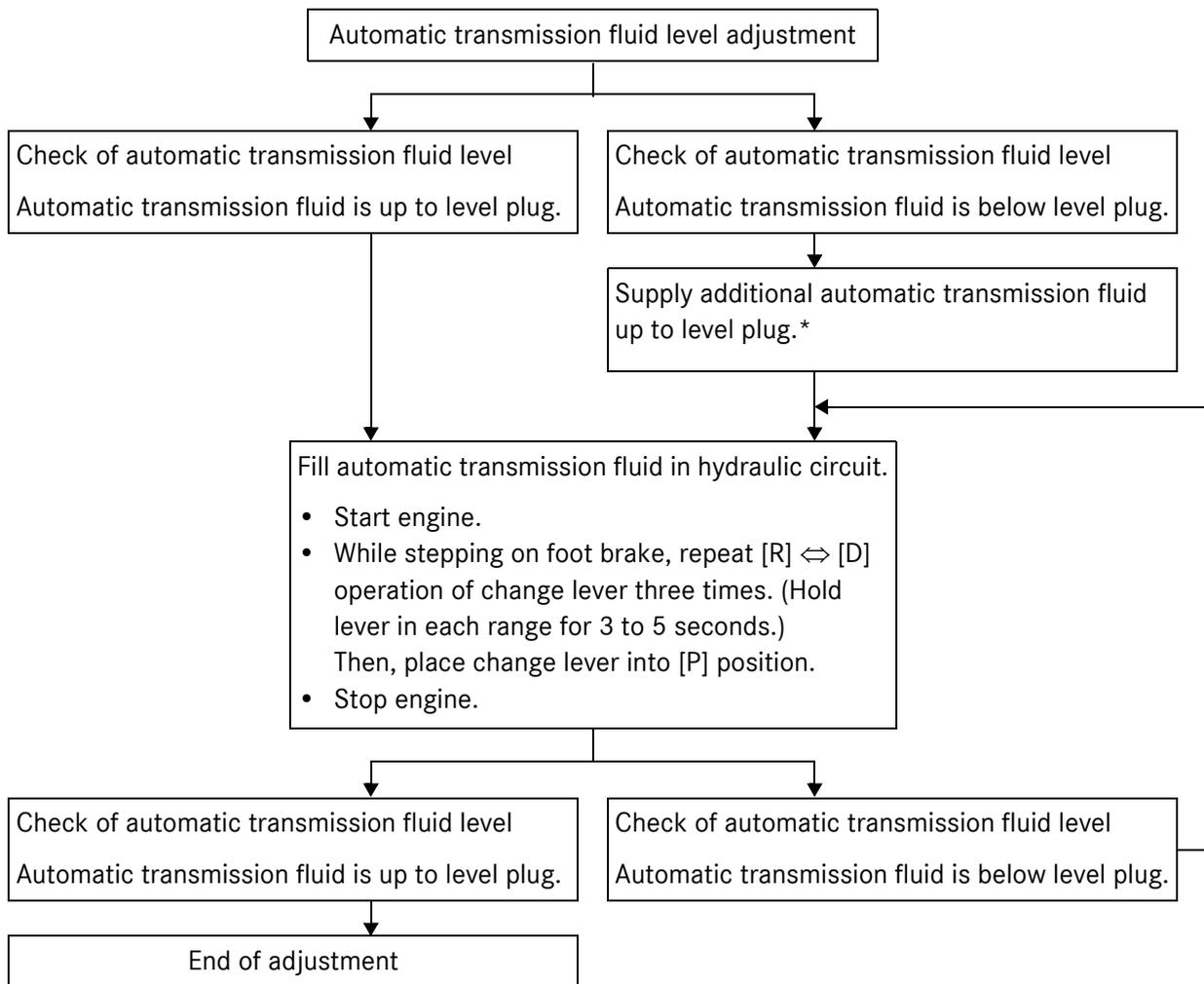


Fig. 1 Left view of transmission



Automatic transmission fluid level plug

Transmission fluid level plug

Fig. 2 Top view of transmission



Clutch housing breather

Transmission breather

#### Initialization of DUONIC® System

- In the initialization of the DUONIC® system, the following initial settings are memorized by the DUONIC electronic control unit: gear shift unit's gear position, clutch fill time, learned clutch torque value, and G sensor signal voltage on flat road. All of these settings are initialized with a single initialization operation, which must be performed every time the vehicle is serviced.
- Initialization of the DUONIC® system may help improve degradation of roll-off, creep or gear shift quality if that is experienced.
- The vehicle must be warmed up before performing initialization. With a cold engine or transmission, initialization may not be successfully completed when attempted.
- If any of the following service is performed, initialization must be performed following the procedure described.

Service	Initialization procedure
Inspection of automatic transmission fluid level and replacement of fluid	After inspection of automatic transmission fluid level and replacement of fluid, start the engine and cycle the shift lever to D and R several times to sufficiently circulate automatic transmission fluid before performing initialization. After initialization, test drive the vehicle.
Replacement of gear oil	After replacement of gear oil, perform initialization followed by test drive.
Work on engine or transmission	After any service on the engine or transmission, the DUONIC® system must be initialized as follows to prevent any possible degradation of driving quality due to possible change in the engine or transmission characteristics.

- While the engine or transmission is cold, initialization may be left uncompleted or learning values may be set inappropriate. To avoid such case, perform initialization after finishing transmission oil temperature adjustment by the procedure below.

#### Preparation before initialization of DUONIC<sup>®</sup> system

- Measure the oil temperature in the transmission using the FUSO Diagnostics.
- Adjust the transmission oil temperature to approximately 50°C by the method recommended below.
  - Repeat initialization several times. (With each time of initialization, the temperature rises by 10 to 12°C.)
  - Actually drive the vehicle to increase the transmission oil temperature up to the required level.
- When initialization is performed to eliminate feeling-related symptom, record initial setting reference values shown below. Comparison pre- and post-initialization values with these referent values can lead to the identification of the causes of symptoms.
- If feeling is not improved despite initialization of the DUONIC<sup>®</sup> system, check automatic transmission fluid level and repeat the initialization of DUONIC<sup>®</sup> system. Chances are that feeling will be improved this way.
- If driving quality or feeling is not improved despite initialization of the DUONIC<sup>®</sup> system, check automatic transmission fluid level, then repeat the initialization of the DUONIC<sup>®</sup> system. It can sometimes improve the feeling.

#### Property damage

DUONIC<sup>®</sup> system may make driving feeling bad if automatic transmission fluid level is not right.

#### Additional information

Every vehicle is different from each other. Thus, all vehicles do not necessarily show actual values within the reference values shown below.

#### Initial setting reference values

No.	Actual values	Description	FE and FG
1	Temperatures	Temperature of Transmission Oil	45 to 55°C {111.2 to 131°F}
2	Transmission	Position of cylinder 1 front	87.2 to 88.3%
3	Transmission	Position of cylinder 1 rear	11.6 to 12.7%
4	Transmission	Position of cylinder 2 front	11.3 to 12.8%
5	Transmission	Position of cylinder 2 rear	87.0 to 88.7%
6	Transmission	Position of cylinder 3 front	10.7 to 12.6%
7	Transmission	Position of cylinder 3 rear	87.8 to 89.8%
8	Clutch	Time for Filling Learning Value Inner Clutch	0.15 to 0.27 sec
9	Clutch	Time for Filling Learning Value Outer Clutch	0.08 to 0.22 sec
10	Clutch	Inner Clutch Current at 25 kgfm Clutch Torque	570 to 663 mA
11	Clutch	Inner Clutch Current at 5 kgfm Clutch Torque	341 to 412 mA
12	Clutch	Outer Clutch Current at 25 kgfm Clutch Torque	552 to 659 mA
13	Clutch	Outer Clutch Current at 5 kgfm Clutch Torque	369 to 435 mA
14	Clutch	Inner Clutch Current at Kiss Point	301 to 376 mA
15	Clutch	Outer Clutch Current at Kiss Point	296 to 366 mA

#### Initialization standby mode

- Prior to starting initialization, the vehicle must be placed in the initialization standby mode.

Ensure that the vehicle meets all of the following conditions.

- Software installation and coding have been completed on the engine and DUONIC electronic control units.
- Transmission oil temperature has been adjusted to approximately 50°C (45 to 55°C).
- Automatic transmission fluid level has been checked.
- The engine is stopped.
- The vehicle is stationary (with the brakes released) on a flat road and unloaded.
- The tire pressure has been set to specification.
- The cab tilt is locked.
- The starter key is in the ON position.
- The accelerator pedal is in the ON (50% or above) position.
- The foot brake is applied.
- The systems that are powered by the engine such as the air conditioner, the compressor for the freezer and the exhaust brake are stopped.
- The change lever is moved to D for one second and then set to A/M.
- The parking brake is applied for one second, then released for one second and then applied (pulled rather hard) again.



“1” flashes on the gear shift indicator, which means that the vehicle is now in the initialization standby mode.

Initialization (Initialization)



The vehicle goes back to the normal mode if the parking brake is released or the starter key is turned to the OFF position.

#### Initialization

Operator action	Vehicle action
With the vehicle in the initialization standby mode, set the accelerator pedal to OFF and the change lever to P before starting the engine.	<ul style="list-style-type: none"> <li>The progress of initialization process is indicated on the gear shift indicator as a flashing "2", "3", "4", "5" and "N".</li> <li>Initialization progress indicated on the gear shift indicator is as follows: <ul style="list-style-type: none"> <li>"2": The gear shift unit's gear position is being detected.</li> <li>"3": Clutch is being warmed up. G sensor voltage value is being corrected.</li> <li>"4": Clutch fill time is being learned.</li> <li>"5": Clutch torque is being learned.</li> <li>"N": Initialization is completed.</li> </ul> </li> </ul>
-	<ul style="list-style-type: none"> <li>Gearshift indicator "R" flashes on and off. → Initialization unsatisfactory. → Return to normal mode with parking brake off or key off, then repeat initialization.</li> <li>If gearshift indicator changes flashing from "2" to "R", gear shifting by gearshift unit may be difficult, in which case the vehicle is moved once, then initialization is performed. Chances are that problem will be solved this way.</li> <li>If gearshift indicator changes flashing from "3" to "R", G sensor may be installed out of place or G sensor signal may be abnormal.</li> <li>If gearshift indicator changes flashing from "4" to "R", clutch may be out of order.</li> <li>If gearshift indicator changes flashing from "5" to "R", engine may not be warm enough or clutch may be out of order.</li> <li>If initialization ends in failure again, check clutch and transmission.</li> </ul>

#### Initial setting reference values

No.	Description	Value	Remarks
1	Intermediate of Position of cylinder 1 front and rear	49.4 to 50.5%	(Position of cylinder 1 front + Position of cylinder 1 rear)/2
2	Intermediate of Position of cylinder 2 front and rear	49.2 to 50.8%	(Position of cylinder 2 front + Position of cylinder 2 rear)/2
3	Intermediate of Position of cylinder 3 front and rear	49.3 to 51.2%	(Position of cylinder 3 front + Position of cylinder 3 rear)/2

- After initialization is completed, check the above values (not indicated in the FUSO Diagnostics). If any post-initialization values largely deviate from above values (3% or more), repeat the initialization.
- If pre- and post-re-initialization values are the same, nothing is abnormal.
- Test run after initialization is completed and check that there is no feeling problem during driving and at speed change. If there is a shock or an abnormal sound at speed change, perform initialization of the DUONIC<sup>®</sup> system again.



#### Risk of accident

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



#### Resetting the initialization

- The DUONIC<sup>®</sup> system offers the possibility to reset the initialization values of gear shift unit's gear position, clutch fill time, learned clutch torque, and G sensor voltage on flat road so that these values are defaulted to those before the initialization. (This feature is designed to be used such as when driving quality has deteriorated after initialization.)

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.

#### Cautions during body equipment work on DUONIC<sup>®</sup> vehicle

The DUONIC<sup>®</sup> of the vehicle is a computerized and electronically controlled system; mishandling could cause system errors and in the worst case, breakdown of the computer itself. Therefore, body equipment work on the vehicle should be carried out while following the precautions given below.

#### General handling precautions

- Be sure not to change the tire size, final ratio, and speedometer gear ratio of a DUONIC<sup>®</sup> vehicle.
- Be sure not to alter DUONIC<sup>®</sup>-associated devices, sensors, harnesses and connectors in any way.
- Before disconnecting DUONIC<sup>®</sup>-associated connectors, set the starter switch of the vehicle to OFF. Before turning the starter switch ON, reconnect the disconnected connectors. If DUONIC<sup>®</sup>-associated device connectors are disconnected while power is supplied to the TCU, a warning lamp will light or the system may lose functionality.
- Before painting the transmission body, mask electric parts, harnesses, connectors, breathers, oil cooler pipe joints and other parts which should be covered. Furthermore, mask wrong fluid/oil supply preventive labels (ATF ONLY, GEAR OIL ONLY) attached near to appropriate fluid/oil plugs so that they are not covered with paint.
- After completing the body equipment work on the vehicle, make sure that the vehicle runs without any problem.

#### Power take-off for DUONIC® (mechanical automatic transmission)-equipped vehicle

The following procedures apply to the manufacturer-designated power take-off only.

The vehicle cannot be run while the power take-off is in operation.

#### Vacuum-type power take-off operation procedure

- With the engine running, place the shift lever into the P position (or N position).
- Set the power take-off main switch in the cab to ON.
- The indicator lamp  lights to indicate that the power take-off is in preparation.
- With the indicator lamp  on, the power take-off can be used.
- To clear this status, set the power take-off main switch in the cab to OFF. The indicator lamp  goes off and the indicator lamp  goes on. The power take-off is being released.  
The indicator lamp  goes off to indicate that the power take-off has been released.

#### Cable type power take-off operation procedure

- With the engine running, place the shift lever to the P position (or N position).
- Set the power take-off main switch in the cab to ON.
- The indicator lamp  lights.
- Connect the power take-off by means of the power take-off lever or damp lever.
- The indicator  goes on to indicate that the power take-off is operational.
- To release the power take-off, set the power take-off main switch in the cab to OFF. The indicator lamp  goes off and the indicator lamp  goes on to indicate that the power take-off is ready to be released.

Release the power take-off by means of the power take-off lever or damp lever. The indicator lamp  goes off to indicate that the power take-off has been released.

#### Cautions

- The indicator lamp  may not show, depending on the sequence, operating speed or device response speed, which is not an abnormality.
- If the shift lever is in a position other than P or N, the power take-off is not connected even if the power take-off switch is turned ON. In the case where the shift lever is in a position other than P or N or the power take-off switch is turned to ON during running, the buzzer sounds and the warning indication of  appears on the meter. Turning the power take-off switch to OFF restores the state to normal.
- If the shift lever is placed into a position other than P or N or the power take-off switch is turned to ON when the power take-off is working, the buzzer sounds and the warning indication of  appears on the meter.

#### 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 and qualified 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.



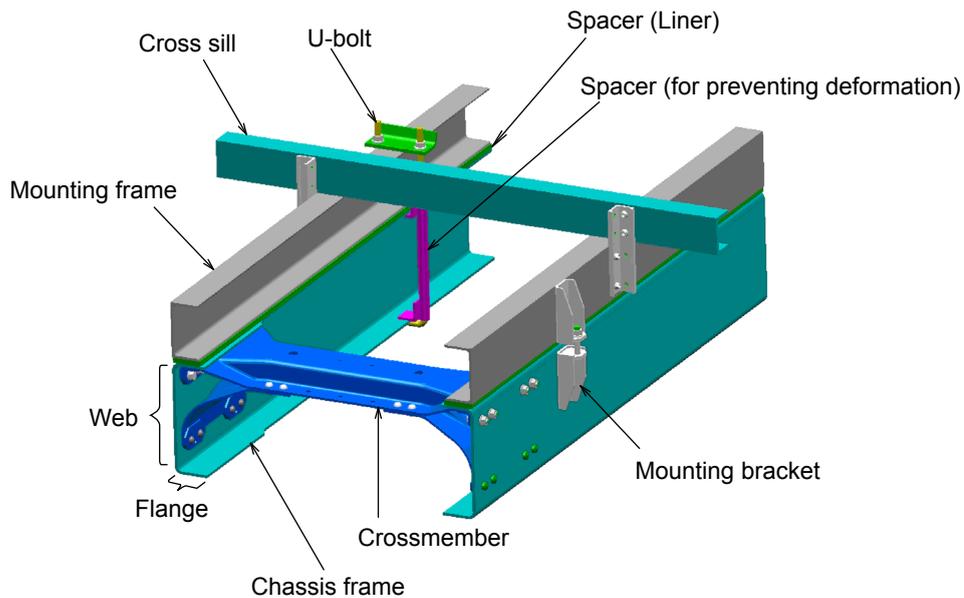
##### Additional information

Further information on bolted and welded connections can be found in Section 3 "Planning of bodies" ▷ page 23 and Section 5 "Damage prevention" ▷ page 54.



### 7.1.1 Body mounting methods

#### General



#### 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.
- For the strength calculation of the chassis frame and mounting frame, refer to "10.4 Weight distribution table" ▷ page 225 and "10.6.2 Frame section modulus" ▷ page 262.
- 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<sup>2</sup>}

Condition	Material	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 Construction of bodies

## 7.2 Mounting frame

### 7.2 Mounting frame

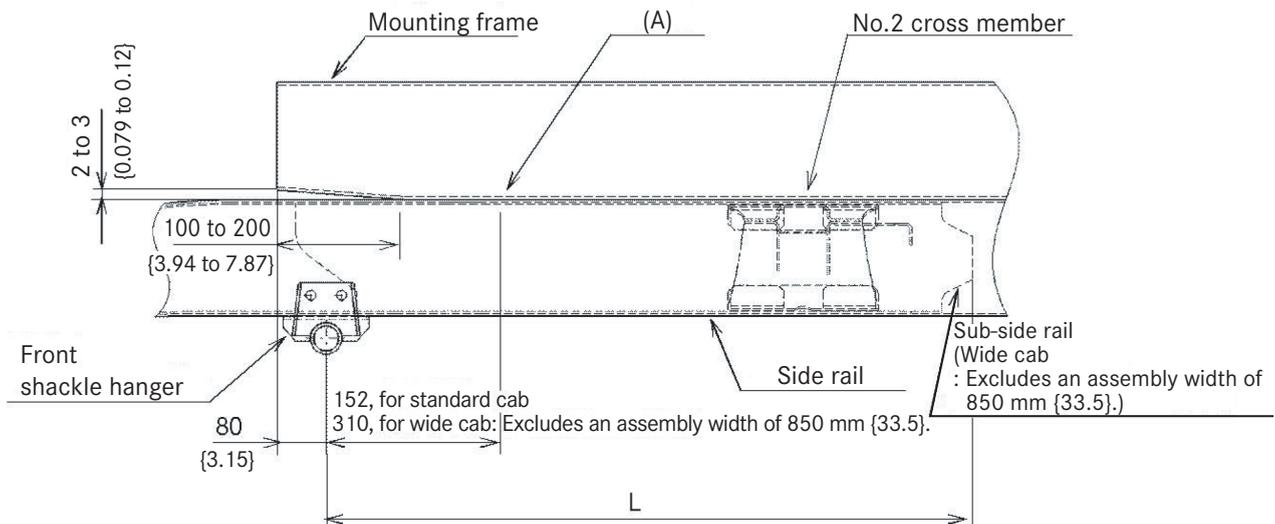
All bodies require a mounting frame or a substructure that assumes the function of a mounting frame to ensure a reliable connection between the chassis and the body.

#### **!** 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.

#### 7.2.1 Mounting frame

- 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
Standard cab	1050 {41.3}
Wide cab	1100 {43.3}

Note: (A) indicates the part of the frame assembly that has been enlarged (standard cab: 700 mm {27.6 in.} assembly width; wide cab: 750 mm {29.5 in.} assembly width).

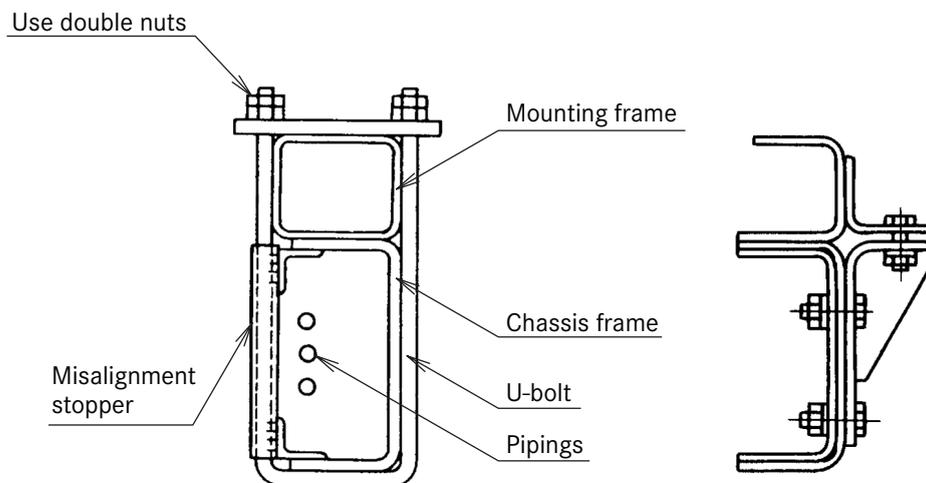


## 7 Construction of bodies

### 7.2 Mounting frame

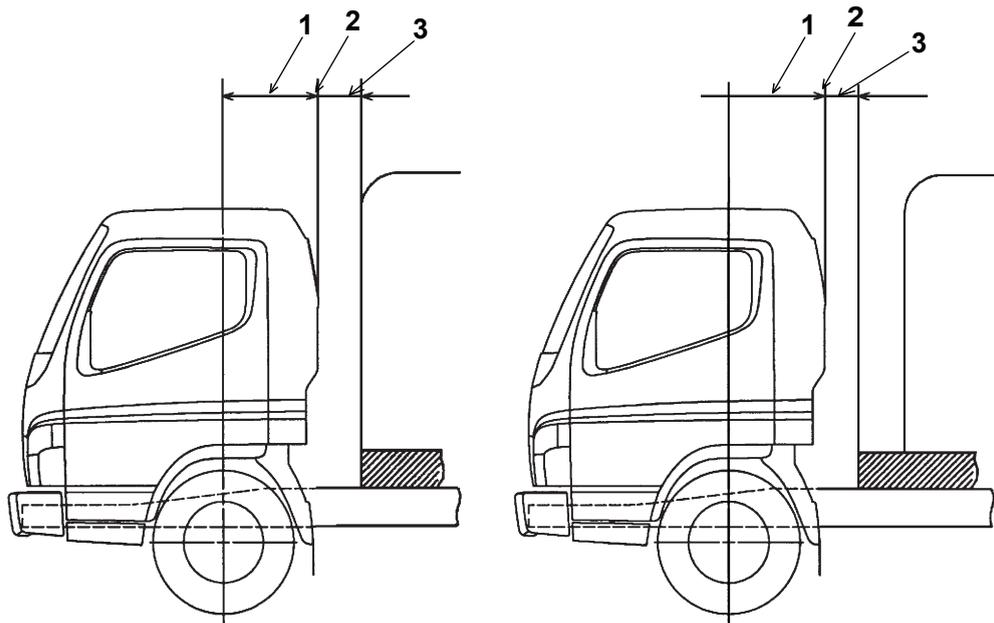
- Carry out the following in order to prevent stress concentrating at the front end of the mounting frame. Make the length of the tapered part of the bottom end of the mounting frame between 100 and 200 mm {3.94 and 7.87 in.}, and end the taper at a point that is not past (A). If a taper cannot be secured, 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 forward 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.



#### 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.}

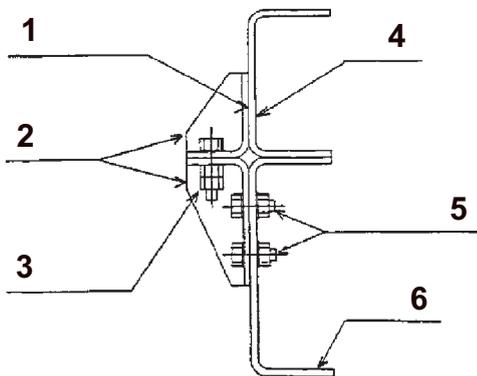
## 7 Construction of bodies

### 7.2 Mounting frame

#### 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.

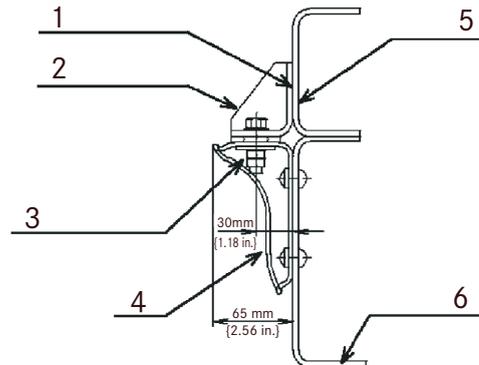
- Attach the mounting brackets to the chassis frame with bolts whenever possible. Be especially careful not to damage any pipes, hoses, and wiring harnesses attached to or around the frame.
- Do not attach brackets close to the ends of crossmembers, gussets or stiffeners. Brackets should be installed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



**Fig. 1**

- 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.



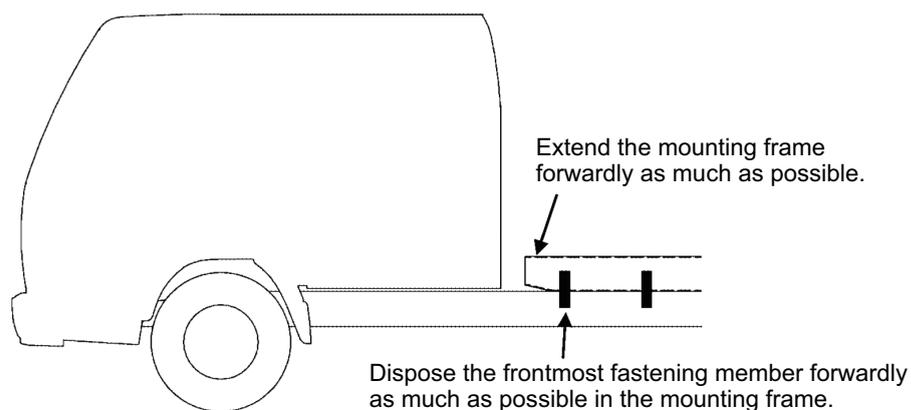
**Fig. 2**

- 1 Attached by welding
- 2 Mounting bracket
- 3 Use double nuts With washer (more than  $\phi 32$  mm { $\phi 1.26$  in.})
- 4 Genuine mounting bracket
- 5 Mounting frame
- 6 Chassis frame

## 7 Construction of bodies

### 7.2 Mounting frame

- Use the following procedure as a guide for mounting the mounting frame on a double cab vehicle.



- Examples of front-end shape of mounting frames

(a) Install the mounting frame having the shape as shown in Fig. 3 to gradually reduce the stress concentrations in the front end.

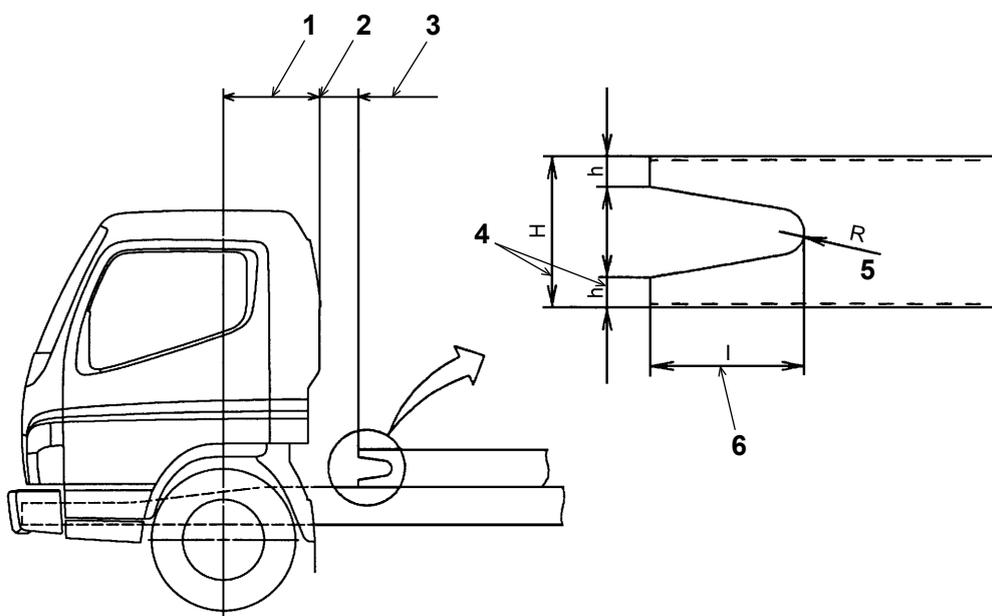


Fig. 3

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

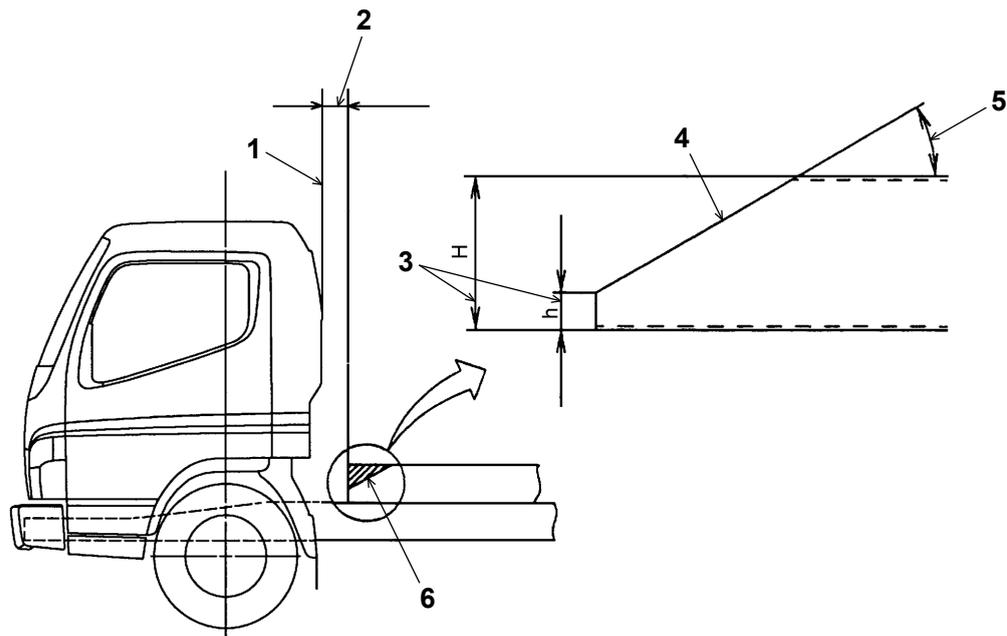
6 "l" must not be less than 2/3H(two thirds of "H")



## 7 Construction of bodies

### 7.2 Mounting frame

(b) The shape of the mounting frame front end as shown in Fig. 3 is highly desirable. However, if there is enough room behind the cab, the shape as shown in Fig. 4 is also acceptable.



**Fig. 4**

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

## 7 Construction of bodies

### 7.2 Mounting frame

(c) If it is difficult to shape the front end of the mounting frame as described in Fig. 3 and Fig. 4, cut it to the shape as shown in Fig. 5 before installation.

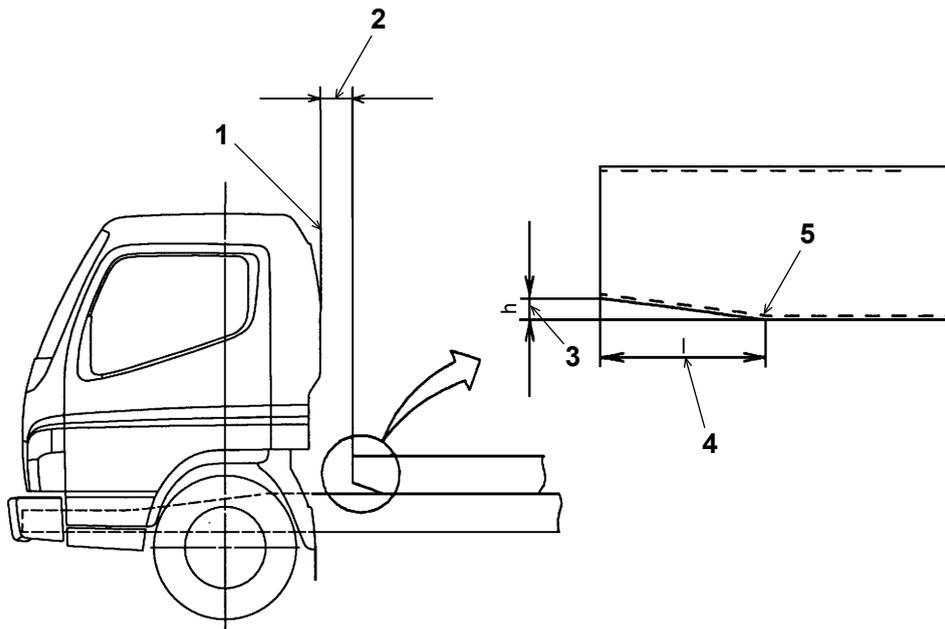


Fig. 5

- 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 Construction of bodies

### 7.2 Mounting frame

(d) When building a body to the frame of a 4 WD vehicle (FGB model), follow the instructions below.

- In the case of an ordinary body  
Join the front end to the FR side rail (1). If this is not possible, join the body to the section where the RR side rail and kick-down rail overlap (2).

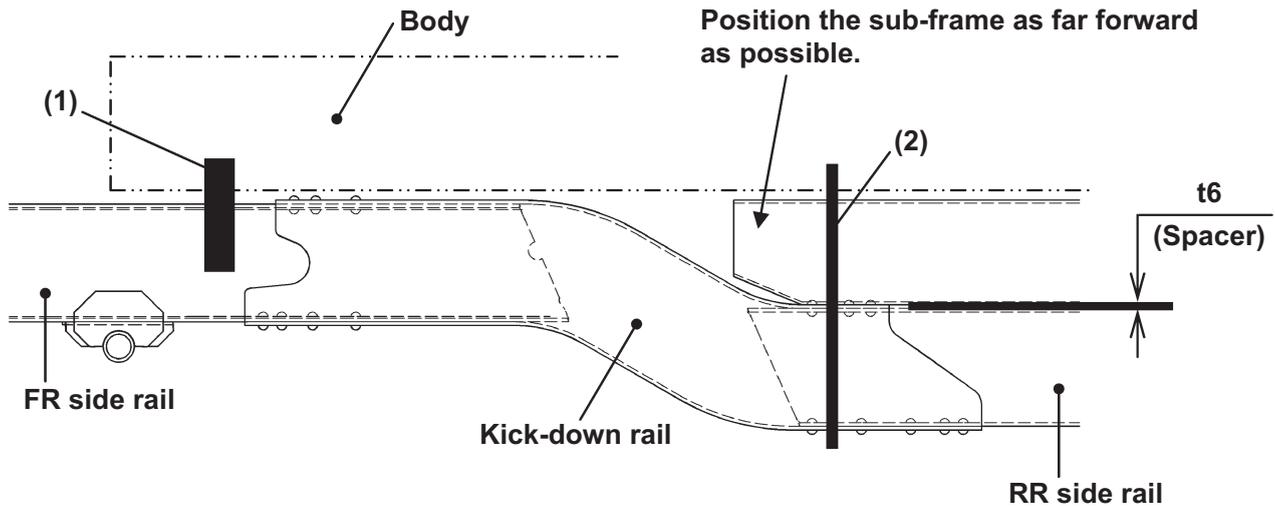


Fig. 6

- In the case of a body that applies concentrated load or excessive force to the frame, or if an excessive twisting force may be applied to the frame on rough roads or muddy ground  
Add an L-shaped reinforcing member as shown below.  
Use M10 bolts (8T) and nuts (6T) with a tightening torque of 60 to 80 N·m {43 to 58 ft.lbs, 6 to 8 kgf·m} to secure the member together with the existing battery, fuel tank, spare tire hanger, etc.

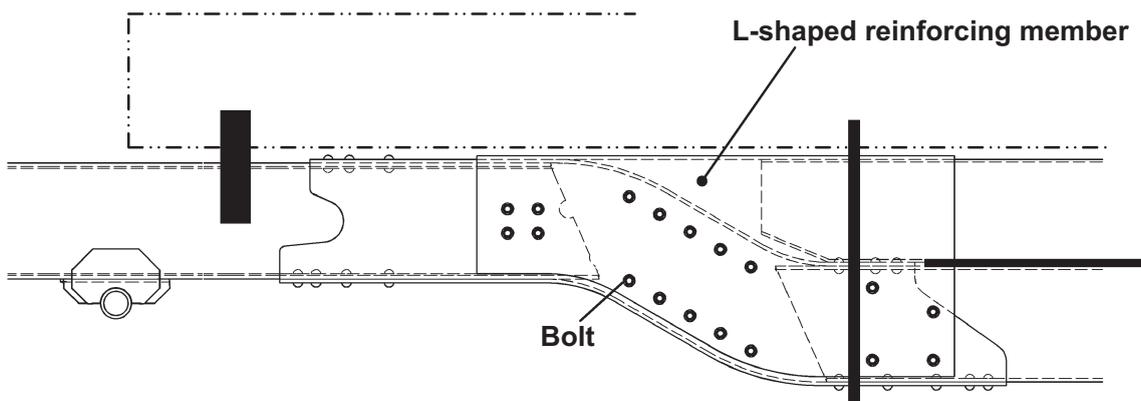


Fig. 7

## 7 Construction of bodies

### 7.2 Mounting frame

- If the chassis frame changes its width behind the cab back as shown in Fig. 8 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.

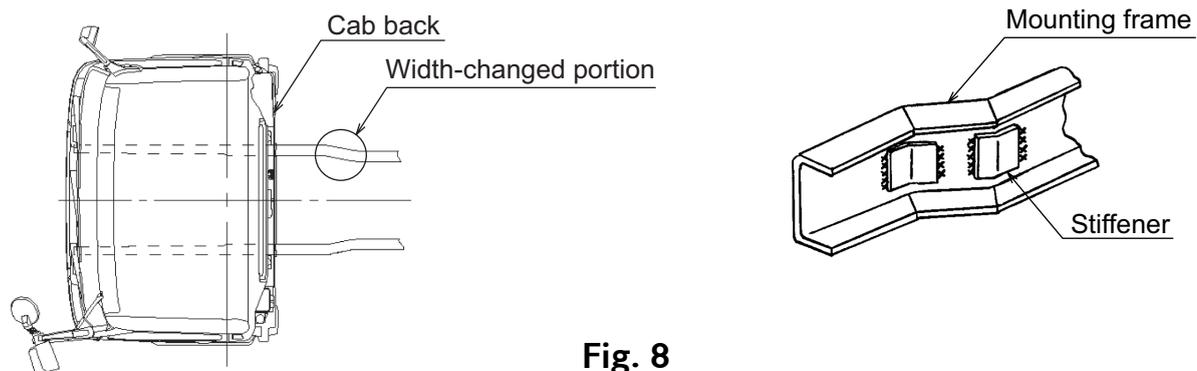
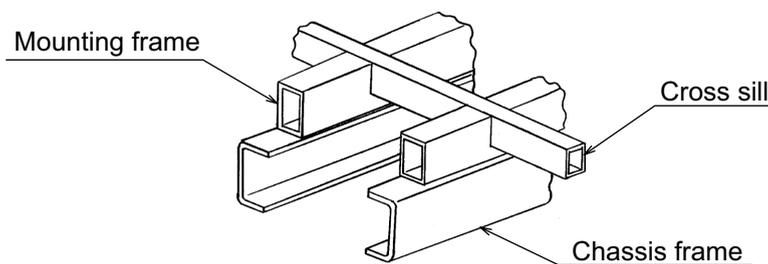


Fig. 8

#### Other notes

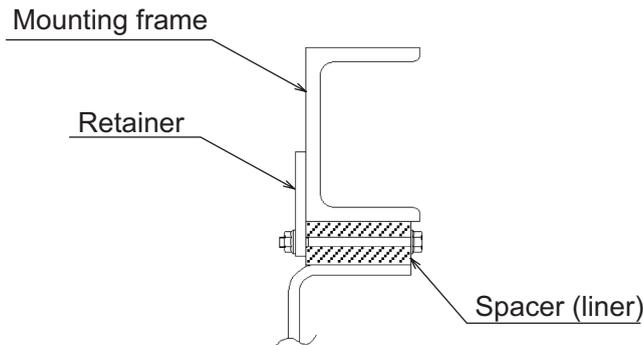
- If, for the sake of a low deck design, the mounting frame and the cross sill must be arranged on the same plane, pass the cross sill member through the mounting frame.



#### 7.3 Mounting frame attachment

##### 7.3.1 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.

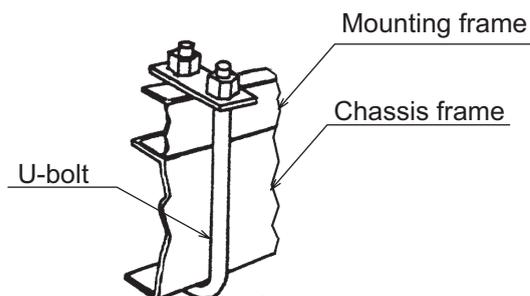


Installation of out-of-position preventive retainer

##### 7.3.2 Fastening mounting frame to chassis frame (securing mounted body)

###### 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.

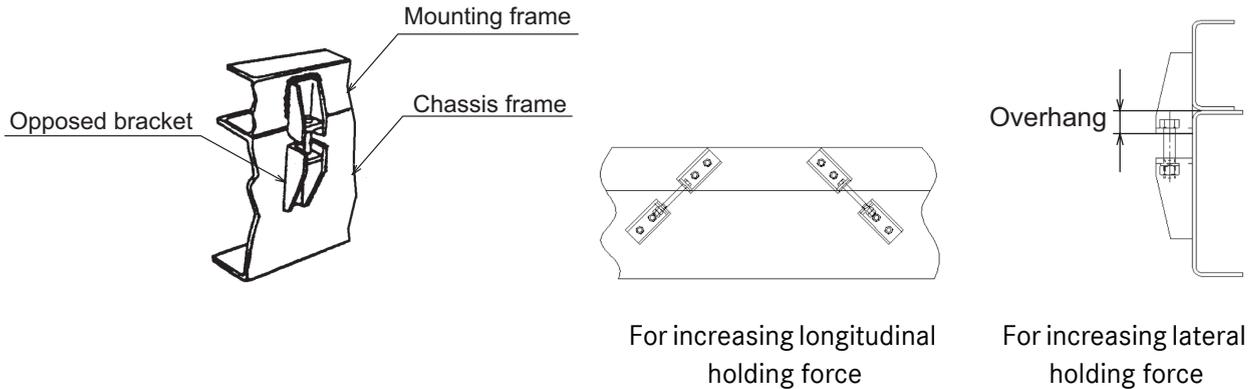


## 7 Construction of bodies

### 7.3 Mounting frame attachment

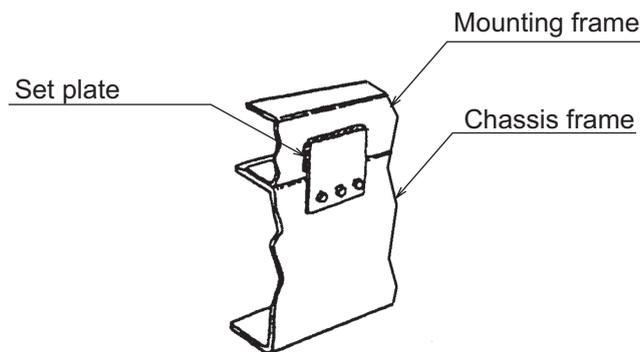
- Opposed bracket

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.



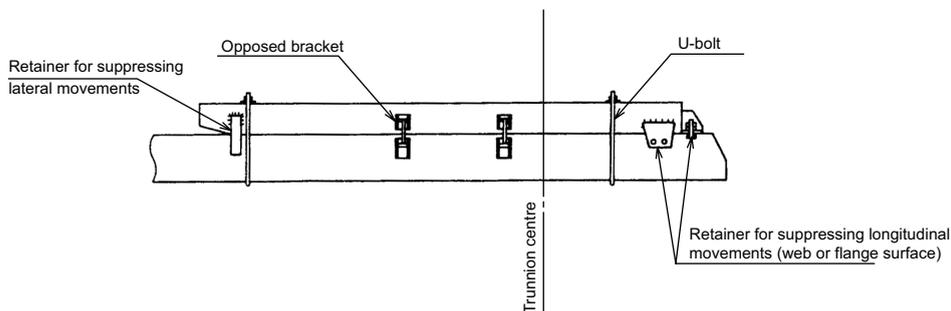
- Mounting flange

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

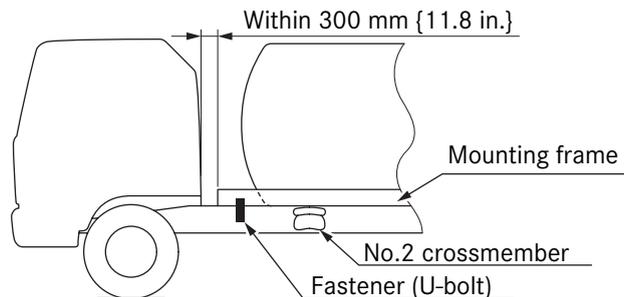
- When fastening the mounting frame to the chassis frame using U-bolts and opposed brackets, use retainers for preventing longitudinal and lateral movements together.



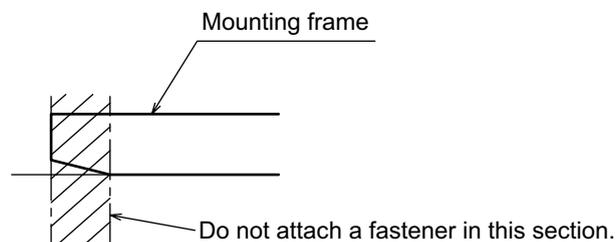
## 7 Construction of bodies

### 7.3 Mounting frame attachment

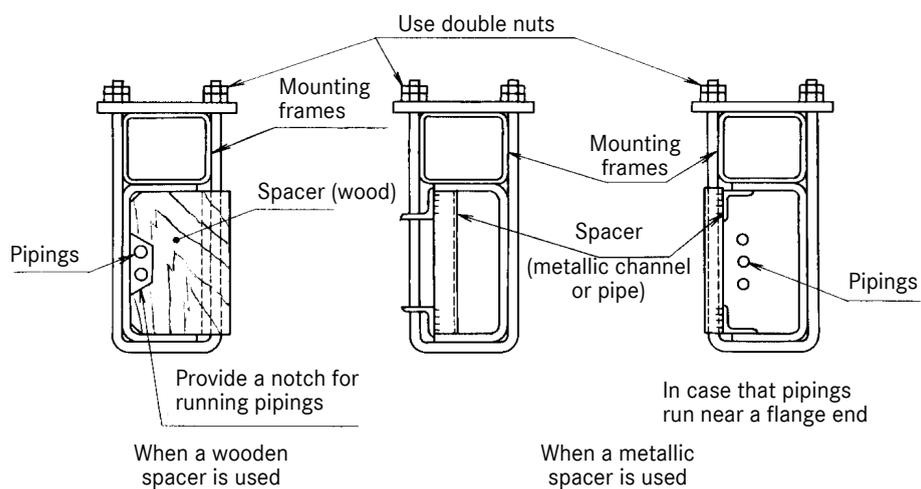
- Even if the distance between the cab back and body front end is larger, extend the mounting frame to near the cab back and secure it at a position before a No.2 crossmember with a fastener.



- 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.

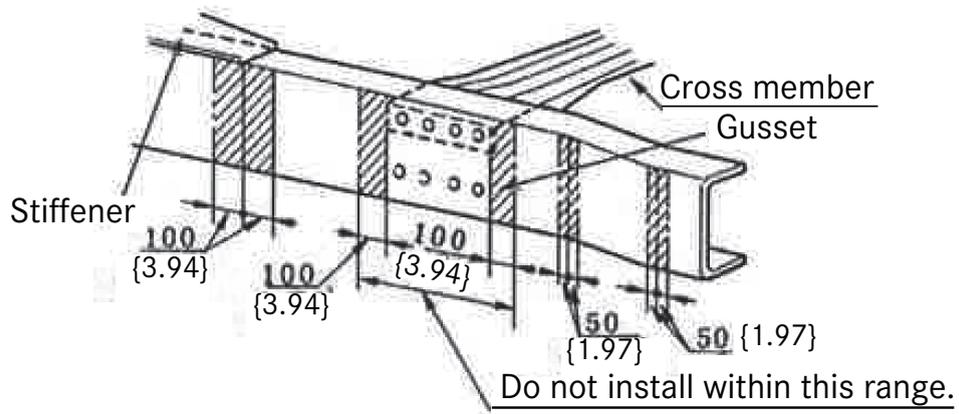


- When the mounting frame and chassis frame are combined with a U-bolt, insert a spacer in the chassis frame at the combined position to prevent the side rail flanges from deforming. When attaching the U-bolt near a hot component such as a muffler, use a metallic spacer, not a wooden spacer which can 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 83.
- 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.

### 7.3 Mounting frame attachment



Unit: mm {in.}

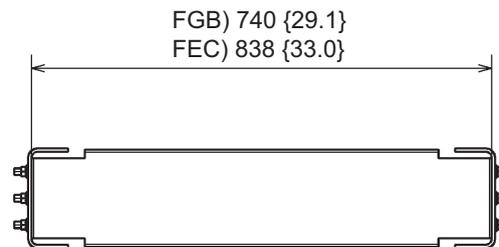
#### 7.4 Others

##### 7.4.1 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 243.

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.

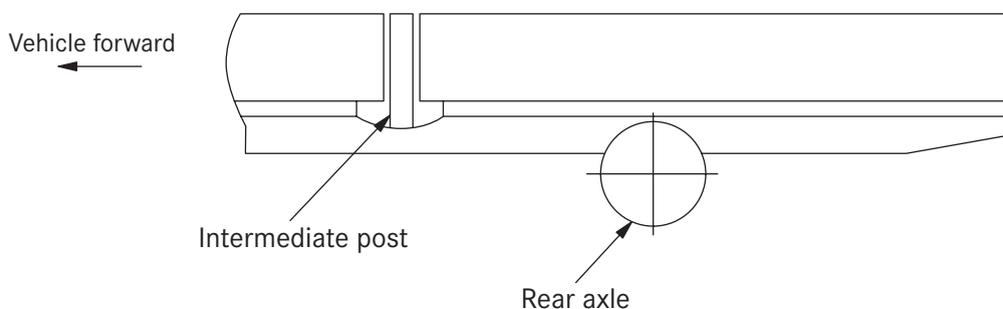


Unit: mm {in.}

View seen from the rear of the vehicle

##### 7.4.2 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 sideways swinging of a gate to open or close it during loading.

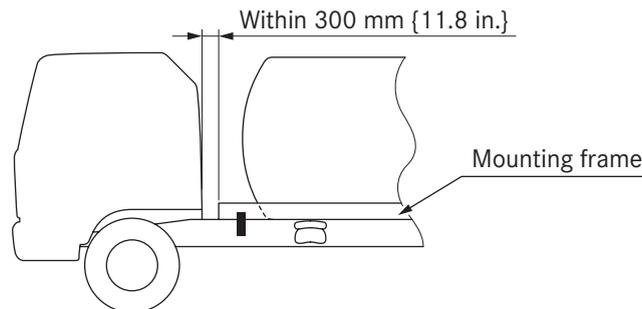


- When installing an intermediate post on a truck with a long wheelbase, taking the chassis frame deflection during loading into consideration, provide an ample space between the post and the side gate so that trouble-free side gate opening/closing operations may be assured.

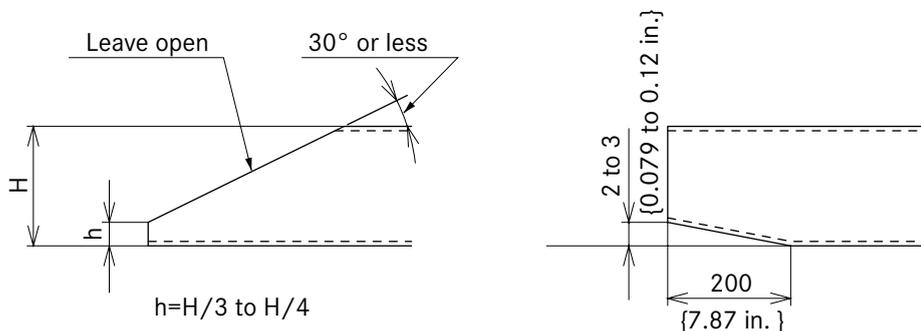
### 7.4.3 Tank truck, powder carrying vehicle

#### Mounting frame

- For reducing cab vibrations and protecting the chassis frame, extend the mounting frame forward until its front end comes within a range of 300 mm {11.8 in.} from the cab back end face (to the extent not affecting cab tilting).

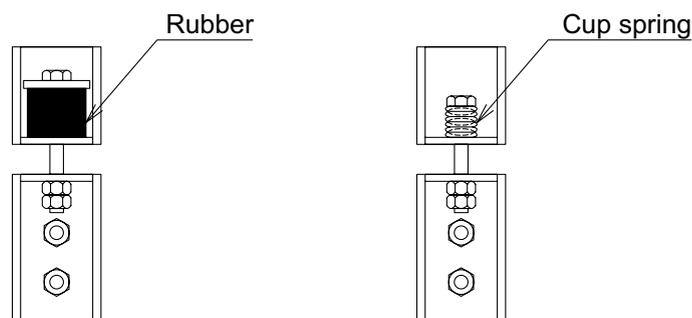


- Cut off the front end of the mounting frame slant or taper to prevent stress concentration.

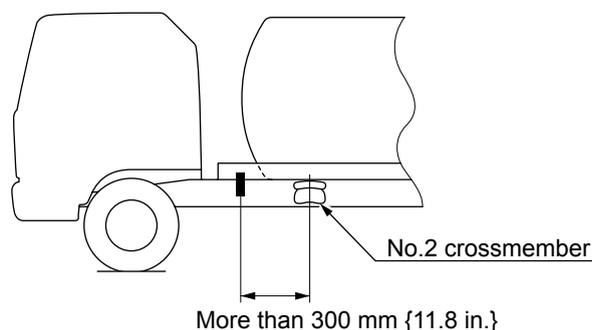


#### Fastening of body

- 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.

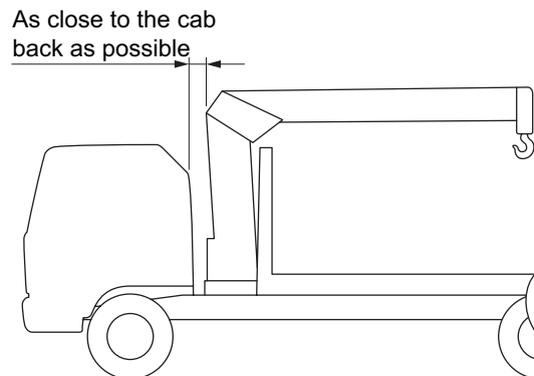


- Locate the forefront fastener at least 300 mm {11.8 in.} ahead from the No.2 crossmember to reduce the load input on the chassis frame.

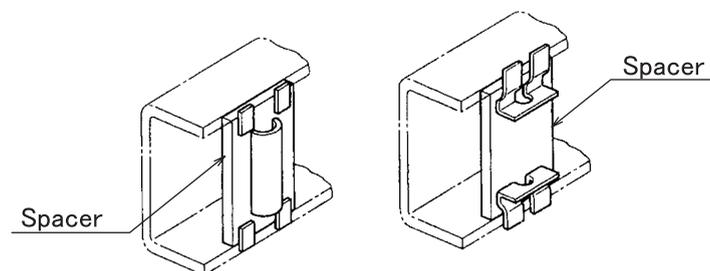


#### 7.4.4 Loading crane

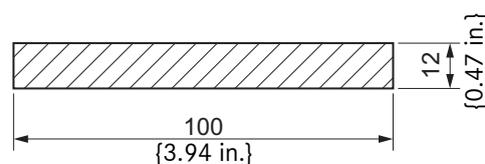
- Be sure to use a mounting frame of box construction for ensuring higher rigidity.
- For reducing cab vibrations and protecting a chassis frame, mount the crane at a position as close to the cab back as possible.



- 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  $1200 \text{ mm}^2$  {1.86 in.<sup>2</sup>}.



- Avoid inserting a spacer (liner) between the frames. This can lead to reduced fastening force.
- 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 89.

#### 7.4.5 Fuel tank

##### (1) Wheel base mount type



#### Risk of fire

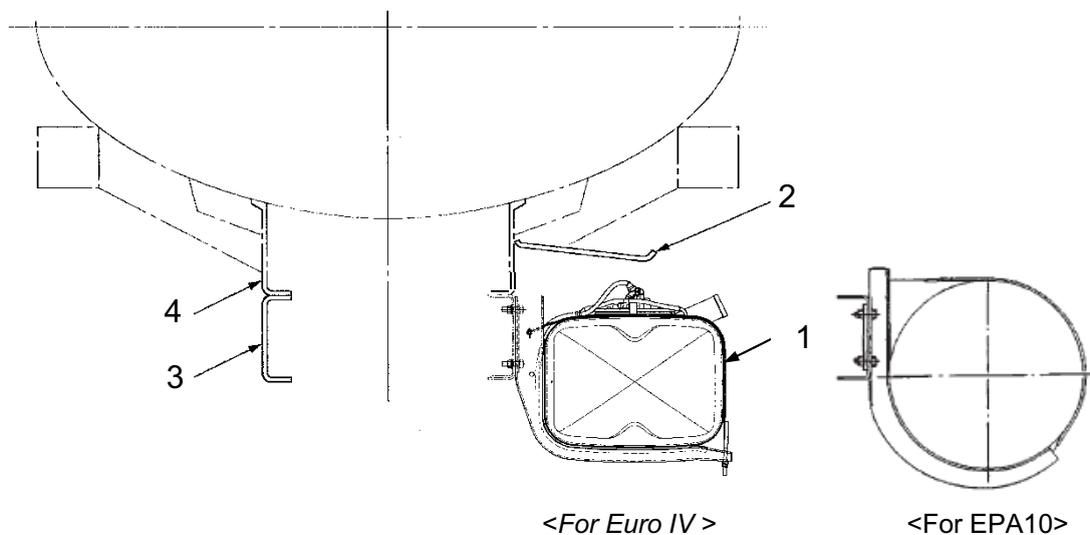
Firmly attach the airvent hose to the Fuel Tank Bracket if it comes away when relocating the fuel tank. ▷ page 129

#### Attaching the splash guard protective cover

To protect the fuel hoses, a protection cover must be attached over the fuel hoses for the vehicle which has a large space between the tank and the body. (e.g. concrete mixer, tankbody)

Fig. 1 shows an example of a cover installed on a vehicle equipped as a lorry.

Fig.1



- 1 Fuel tank
- 2 Cover bracket
- 3 Chassis frame
- 4 Mounting frame

#### Instructions for relocating the tank, adding on the auxiliary tank, and increasing its capacity

- A letter of no objection is required from the department responsible when relocating the tank, adding on the auxiliary tank, or increasing its capacity and following must be considered.
- Use MITSUBISHI FUSO authorized fuel hose when replace it.
- Keep the distance from the filler end and the end of air vent hose to;
  - Over 300 mm { 11.8 in.} to exhaust exit
  - Over 200 mm {7.87 in.} to exposed electric terminal
- Don't connect the fuel piping over the exhaust pipes. Set the connection point where the fuel will not splash on the exhaust system even if it will leak.
- Install the tank securely to be free from loosen or other defect with consideration the effect of vibration, layout, and others. New bracket must be designed to have sufficient strength.
- Use legally conformed auxiliary tank for your local regulations.
- Don't open the plug for auxiliary tank except the mounting process of the auxiliary tank.
- Don't modify the MITSUBISHI FUSO genuine tank.
- Use following flange bolt and nut for mounting the tank, and tighten them with following torque.  
Some of the bolts that fix the tank on the frame are tightened with frame component such as C/MBR. These bolts and nuts must be tightened securely again with new bolts and nuts if you remove them through the relocating process.

Unit: N·m [kgf·m] {lbs.ft}

	Size	Strength Grade	Tightening torque
BOLT, FLANGE	M10	10T or more	90 - 110 [9.2 - 11.2]
NUT, FLANGE	M10	6T	{67 - 81}

#### (2) Overhang mount type

##### Cautions relating to fuel tank

Be cautious while installing the rear fuel tank piping. Do not let it interfere with the body.

Do not allow foreign materials to enter the fuel tank and related parts.

Install all fuel hoses so that there is no slack, or broken parts and make sure that the hose is free to accept fuel. If a hose is too long, shortening may be required.

The temporary rubber cap on the fuel tank filler frame pass through must be removed. Clip part number MH021308 must be reused.

When inserting fuel filler hose MK517156, make sure that the hose is completely against the seat (spool) of the filler pipe. Install in accordance with the illustration printed below. Make sure there is no interference with the breather hose.

Remove the two tie wraps that temporarily hold the breather hose in the shipping position.

Insert more than 20 mm {0.79 in.} of the breather hose MK456266 to the filler end pipe and retain it using clamp MH021302.

Position the breather hose using clamps MH020945 to points indicated in the illustration below. Secure breather hose to the filler pipe using tie wraps ME292602 in two places. Refer to Fig. 1, Fig. 2 and indicated in Section 9.13 Fuel tank mounting layout.

The fuel filler end 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.

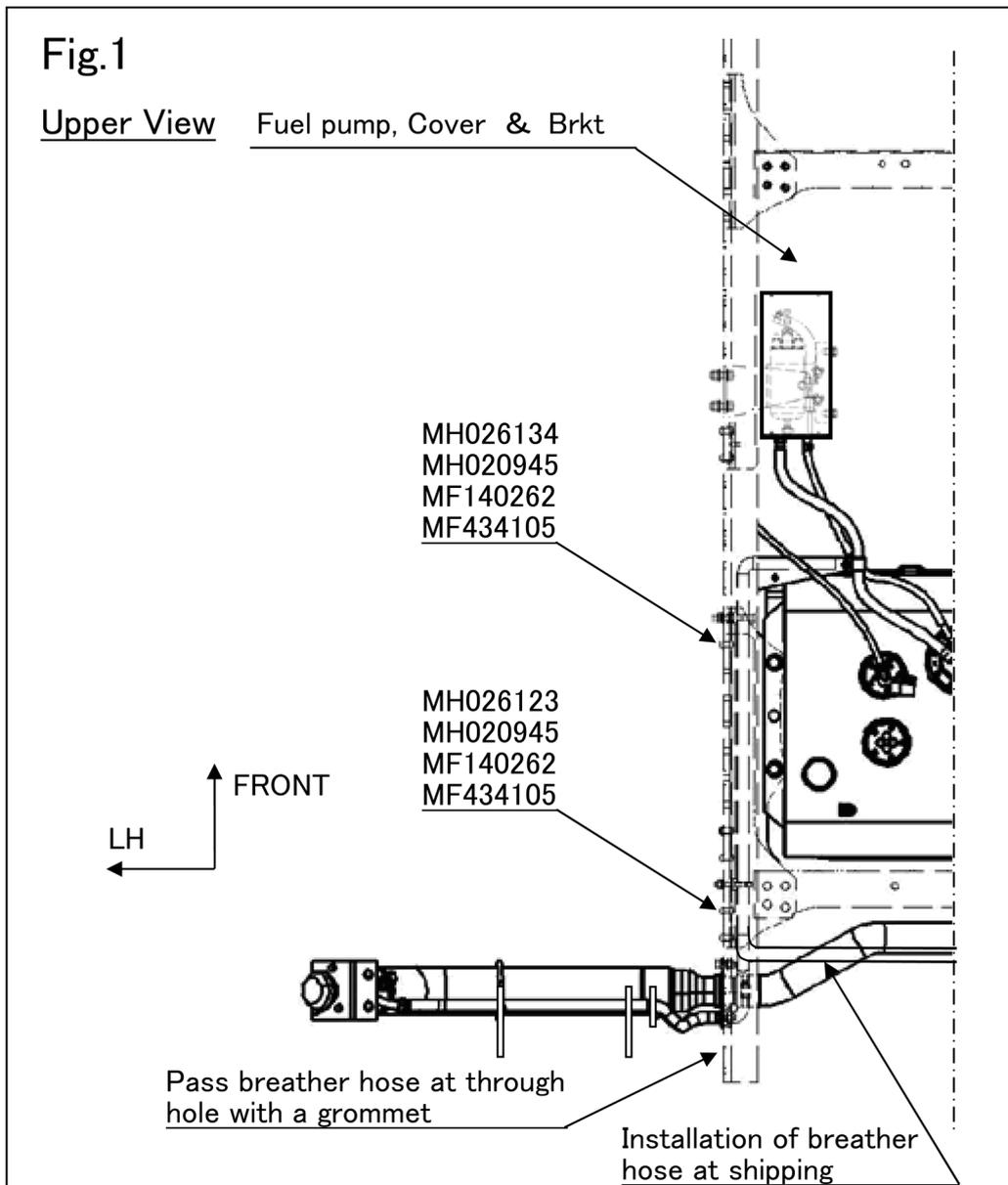
The fuel filler pipe MUST be located at least 171.5 mm {6.75 in.} above the height of the upper truck frame flange. This will allow satisfactory fill speed.

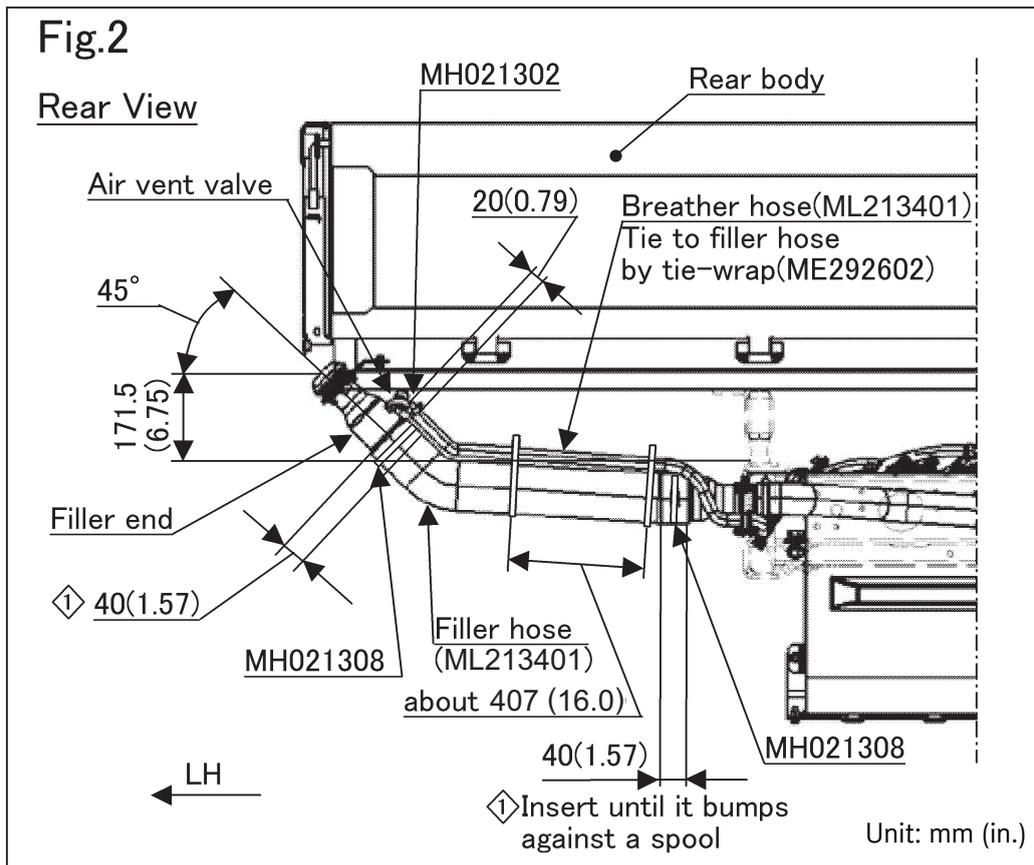
Attach the fuel cap tether. See Section 9.13 Fuel tank mounting layout.

The air vent valve inclination must be approximately 25 degrees to vertical.

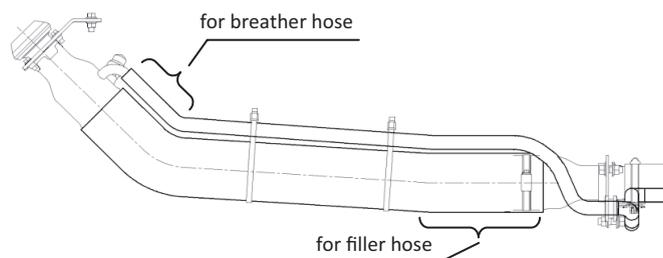
Attach caution label MK587871 where it will be readily seen.

Inspect the system and ensure that all attaching hardware is secure. Make sure there are no leaks or restrictions.





To shorten filler and breather hoses in these straight area for bodies less than 102 inch wide.



Unit: N·m {ft.lbs, kgf·m}

Part	Tightening torque	Remarks
Screw of Clamp	3.9 ± 1.0 {2.9 ± 0.7, 0.4 ± 0.1}	-
Filler end	8 to 12 {5.9 to 8.8, 0.8 to 1.2}	With tether of filler cap

#### 7.4.6 Instructions for relocating the tank

- Avoid unnecessary moving of the fuel tank. If it is necessary to do so, follow the cautions listed below and obtain the advice from MFTA.
  - Use MITSUBISHI FUSO authorized fuel hose when replacing.
  - Keep the distance from the filler end and the end of air vent hose to;
    - Over 300 mm {11.8 in.} to exhaust exit
    - Over 200 mm {7.87 in.} to exposed electric terminal
  - Don't connect the fuel piping over the exhaust pipes. Set the connection point where the fuel will not splash on the exhaust system even if it will leak.
  - Install the tank securely to be free from loosening or other defect with consideration of the effect of vibration, layout, and other factors. Any custom mounting brackets must be designed for sufficient strength.
- Don't modify the MITSUBISHI FUSO genuine tank.
  - Use following flange bolt and nut for mounting the tank, and tighten them with following torque. Some of the bolts that fix the tank on the frame are tightened with frame component such as C/MBR. These bolts and nuts must be tightened securely again with new parts if you remove them through the relocating process.
  - Prevent direct contact of any metal parts (as clamp to fix the fuel pump to brkt) to the fuel pump housing to avoid electro chemical corrosion: use plastic or rubber isolation between the fuel pump and brkt.
  - Attach a cover to the fuel pump, and the fuel pump must be installed in the position that does not catch mud and spray.

Unit: N·m {ft.lbs, kgf·m}

Model	Name	Size	Strength Grade	Tightening torque
FE	BOLT, FLANGE	M10	8T or more	50 to 65 {37 to 48, 5.1 to 6.6}
	NUT, FLANGE	M10	6T	
	BOLT	M14	8.8 or more	130 to 170 {95 to 125, 13.3 to 17.3}
	NUT, FLANGE	M14	6T	
FG	BOLT, FLANGE	M10	10T	90 to 110 {66 to 81, 9.2 to 11.2}
	NUT, FLANGE	M10	6T	

#### 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 10 and ▷ page 11.



### 8.1 Electrical system

#### 8.1.1 Signal detection and actuation module-related parts

Unit: N·m {ft.lbs, kgf·m}

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

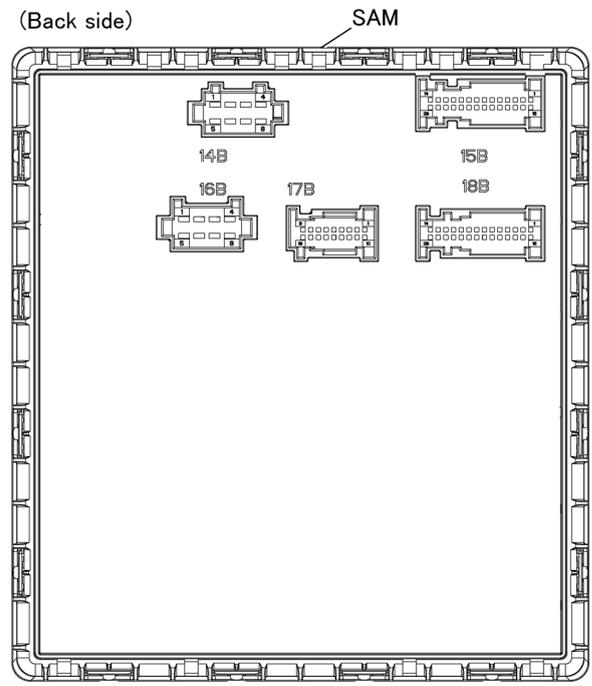
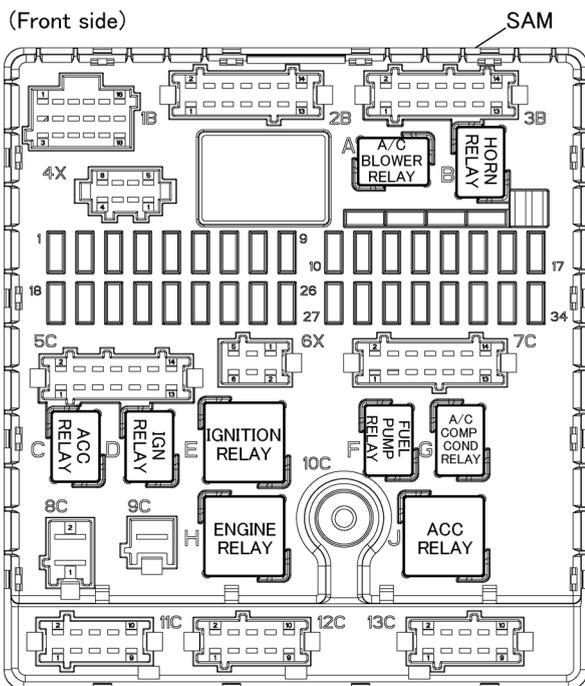
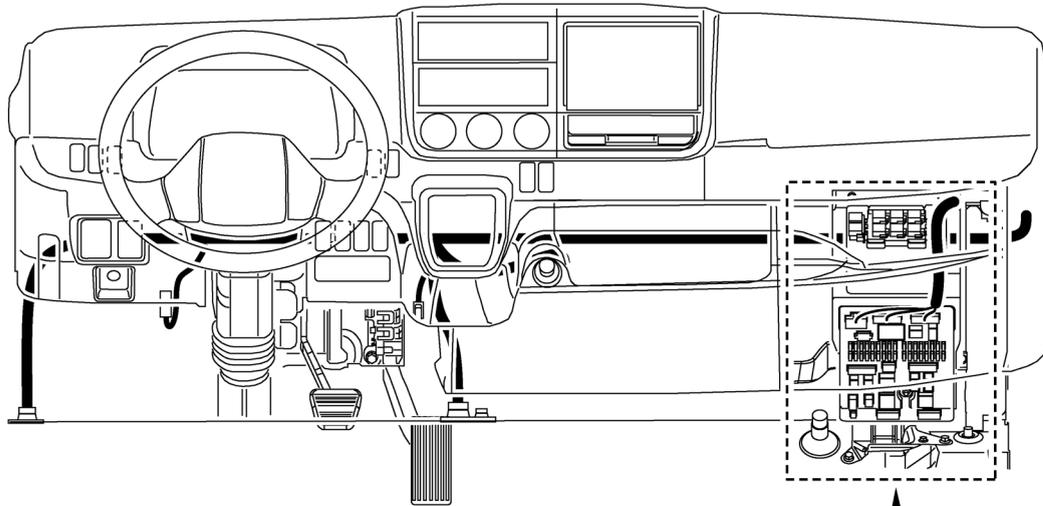
The signal detection and actuation module is an integrated unit with the control and power distribution functions for electric parts of the cab and body equipment.

- (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 extreme 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.

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.



#### 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 189.
- (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 Service Center or your contact person ▷ page 15.
  - Body building or modification of any of the following electrical parts requires that the SAM control unit parameters be changed. Consult a MITSUBISHI FUSO Service Center. 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 170.

### 8.2 Electric wiring

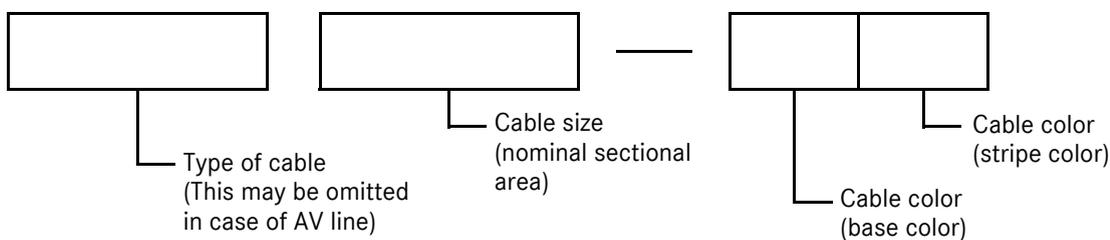
#### 8.2.1 General precautions

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
  - Stripe color: White
  - Base color: Green
  - Cable size: 0.85 mm<sup>2</sup> {0.033 in.<sup>2</sup>}
- AVX1.25 - L
  - Base color: Blue (no stripe color)
  - Cable size: 1.25 mm<sup>2</sup> {0.049 in.<sup>2</sup>}
  - Type of cable: AVX line

##### 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.

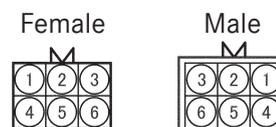
#### 8.2.3 Connector code

##### 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 174.
- 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 174.

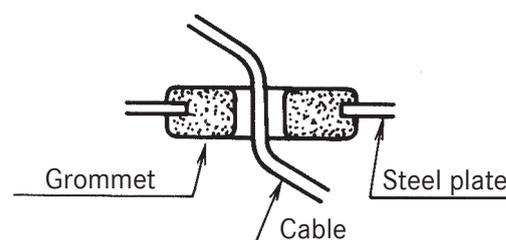
##### Wiring procedure

- 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.

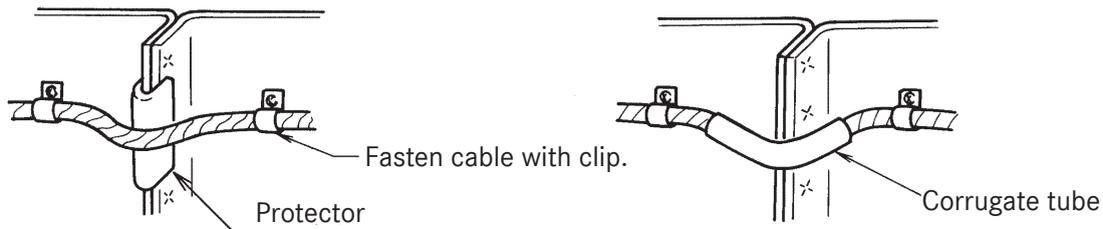
Unit: mm {in.}

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.



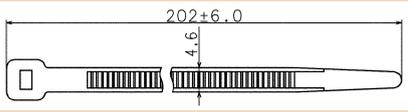
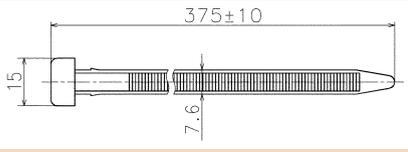
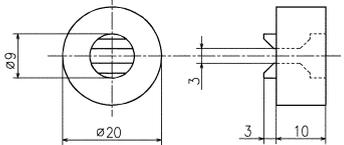
- If a harness exists nearby, tape the cable along to the harness. It is positively prohibitive to lay cables along the brake piping (including brake hose and brake pipe), fuel piping (including all metal and rubber hoses) and grease piping. Maintain clearances between cable and existing harness.

Unit: mm {in.}

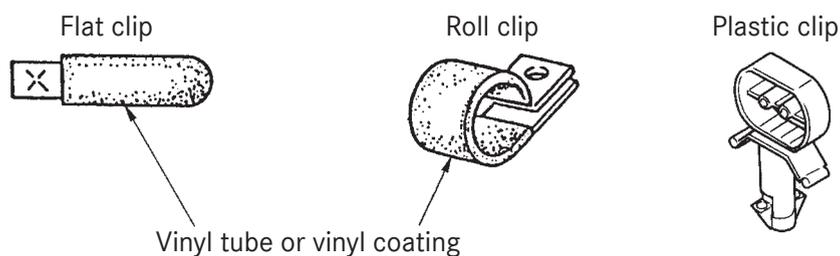
Wiring method	Minimum clearance
Parallel	10 {0.39}
Crossover	20 {0.79}

- For clearance between cable and exhaust system part, see "4.4 Clearance for the basic vehicle and bodies" ▷ page 43.
- 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-resistant vinyl tape or fasten with metal sheet clamps (rubber- or vinyl-coated). Do not use non-heat-resistant 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 tape.
- 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.

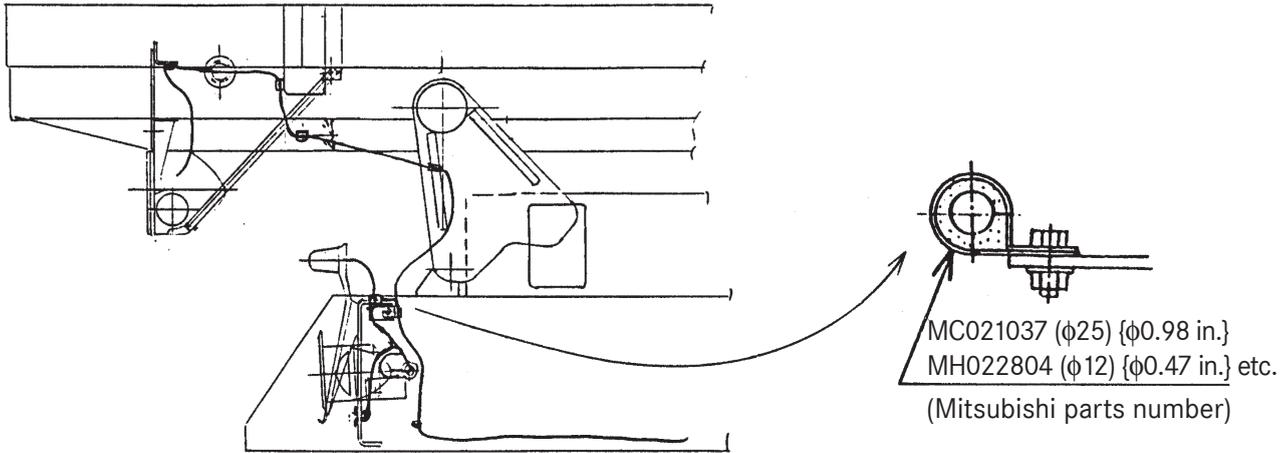


Given below are the standard limits of spacing for cable clamps.

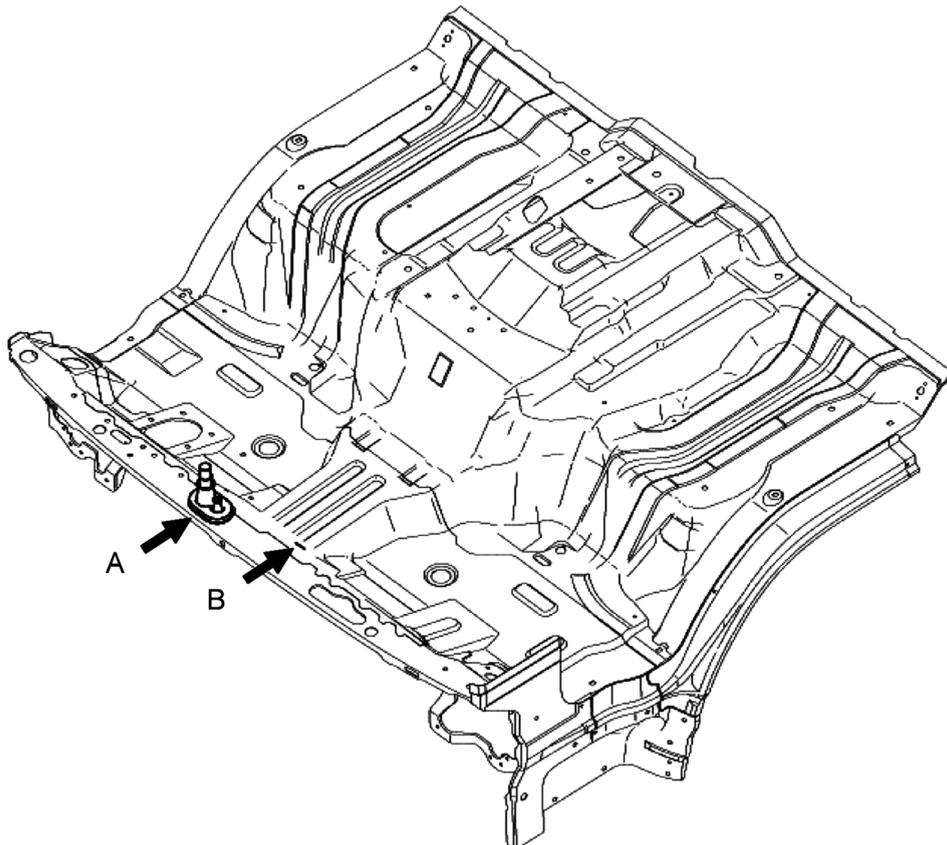
Unit: mm {in.}

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}

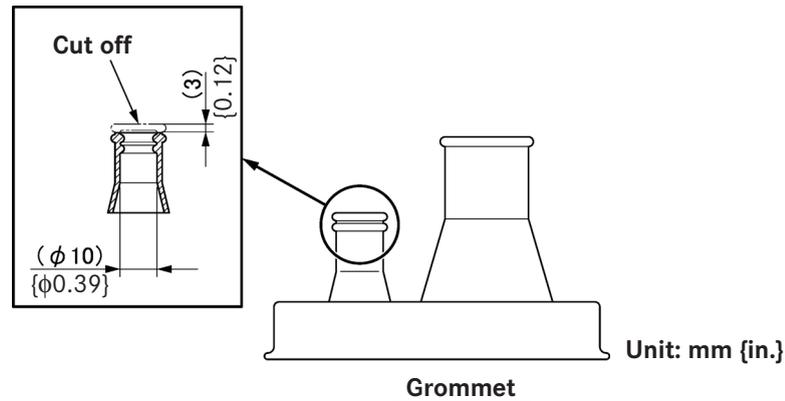
For cables to rotary portions of dump hinge and other custom-built truck body parts and vibrating bodies of engine, transmission, etc., use solid rubber clips.



- 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.



#### 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.

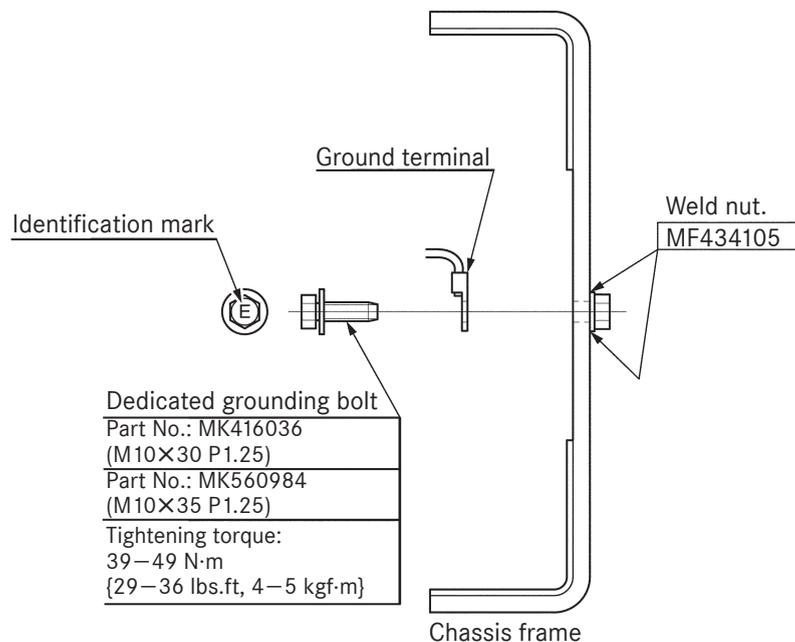
#### 8.2.6 Grounding

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.

### 8.2.7 Fuse

- (a) Do not route power wiring from any fuse for unintended use. The existing fuse on the chassis side is of the optimum capacity for the service load, frequency of use, etc. When installing an additional electrical device associated with body equipment, do not connect parts or harnesses which may provide an error signal to the chassis power line or ground line.

Be sure to lead out power☆ for body equipment-related apparatus and lamps via designated appropriate connectors. For further details, see "8.4.5 Mounting location of optional terminal" ▷ page 189.

Fuses in the cab are provided on the signal detection and actuation module control unit.

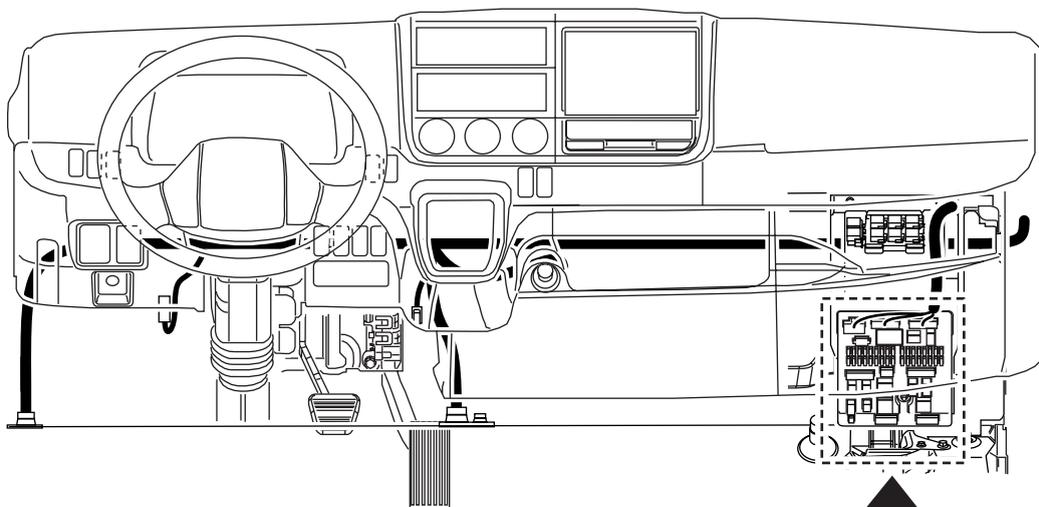
When removing and reinstalling them, do so securely one by one. For other precautions on the signal detection and actuation module, see "8.1.1 Signal detection and actuation module-related parts" (▷ page 170).

- (b) Mid-point extension of existing wiring or the use of a larger capacity fuse could cause an excessive current to flow in the power fuse box, resulting in a fire.

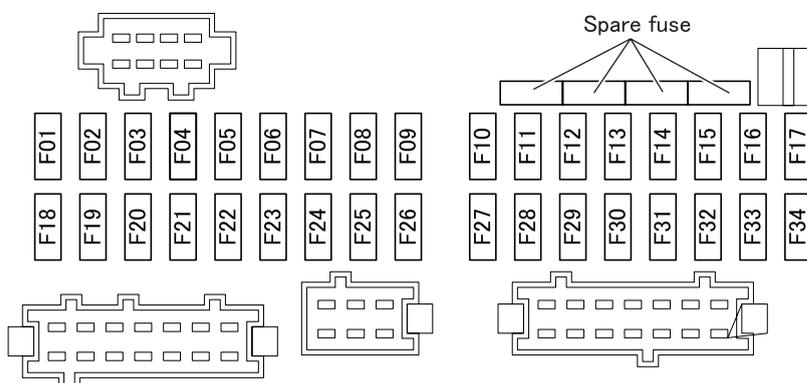
The power supply voltage may differ depending upon the fuse. Verify the power supply voltage by referring to "Power supply voltage" ▷ page 186.

- (c) Arrangement of power fuses, relay in the instrument panel, sensors and ECU

- Fuse layout drawing



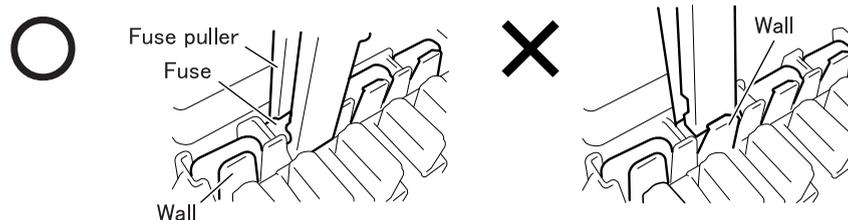
<Inside of SAM>



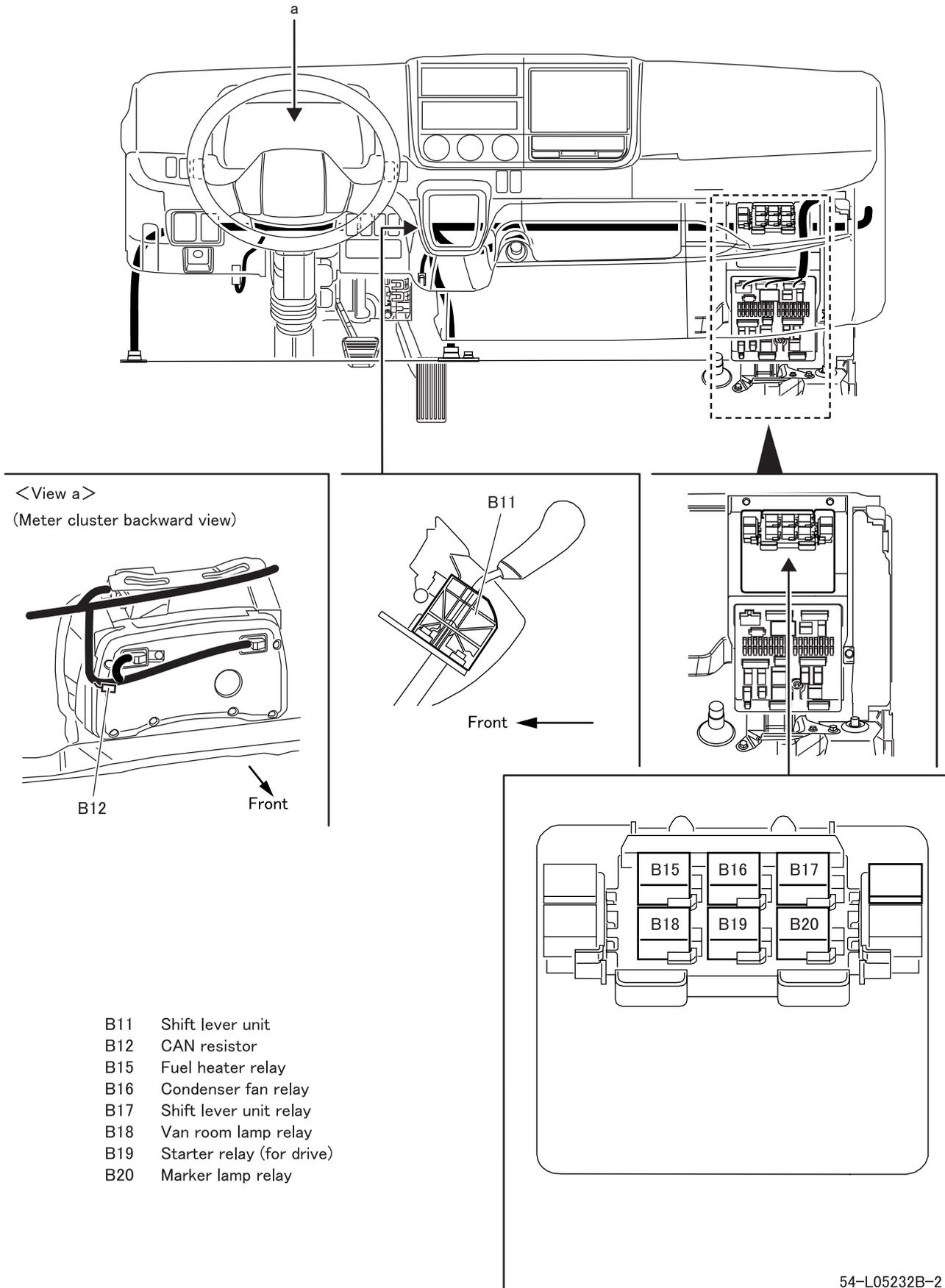
Fuse No.	Major load	Capacity
F01	Starter	10A
F02	-	-
F03	-	-
F04	Optional power (IGN)	10A
F05	Power window (driver's seat side)	30A
F06		
F07	Power window (passenger side)	30A
F08	ID lamp (FMVSS108 equivalent)	20A
F09	Meter, diaphragm tachometer, diagnosis connector	10A
F10	-	-
F11	Blower fan	30A
F12	Audio, interior lamp	15A
F13	Starter switch, ISS ECU	10A
F14	Horn	10A
F15	Audio	10A
F16	Power mirror, power socket (cigarette lighter)	20A
F17	Fuel heater	20A
F18	ABS ECU	10A
F19	Engine ECU	15A
F20	4WD M/V	10A
F21	-	10A
F22	Meters, A/C control	15A
F23	-	10A
F24	DUONIC <sup>®</sup> ECU	10A
F25	Optional power supply (ACC)	10A
F26	Optional power supply (B+)	10A
F27	Van body dome lamp	20A
F28	Engine ECU	15A
F29	BlueTec <sup>®</sup> system	20A
F30	BlueTec <sup>®</sup> system	20A
F31	Engine ECU	20A
F32	Air conditioner	10A
F33	-	-
F34	Fuel pump	15A

- Removal of spare fuse  
To remove the spare fuse, insert a fuse puller from outside the wall holding the spare fuse.

Do not insert the puller from inside the wall, as doing so could damage the fuse holder and cause electrical failure or fire.



- Arrangement of relay in the instrument panel, sensors and ECU



### 8.3 Handling of electric/electronic equipment

#### 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)
- Mechanical automatic transmission (DUONIC®)
- 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

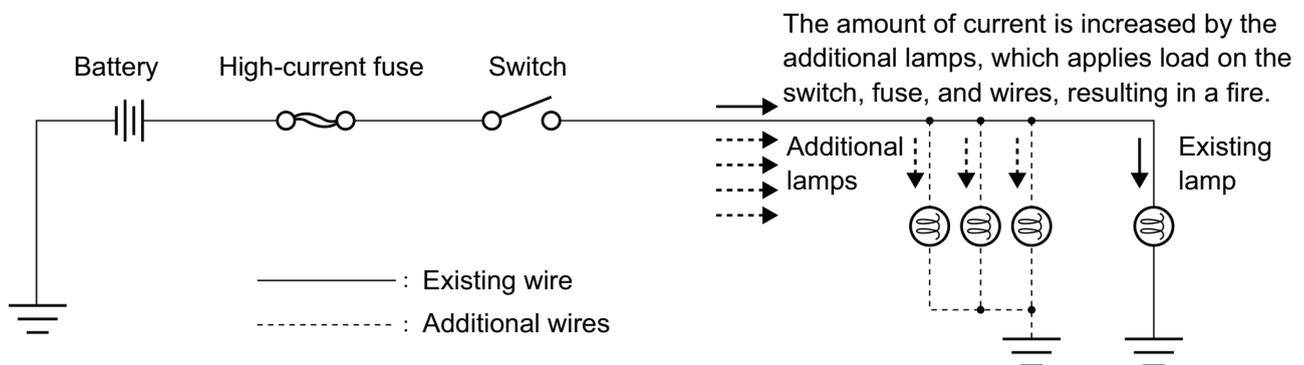
##### 8.4.1 Taking power from the existing wiring

- (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

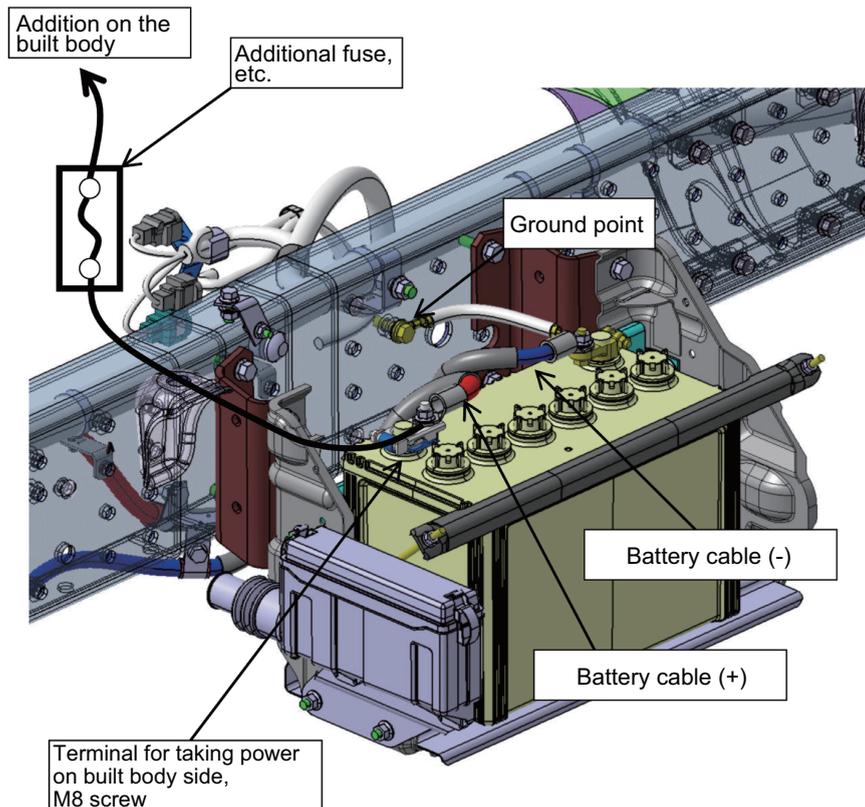
Take power by way of the onboard battery terminal only when doing that is absolutely necessary to achieve body building. If it is done unavoidably, observe the following precautions.

- Add a fuse of a correct type to any additional wire to thereby protect the circuit.
- Use a wire of  $5.0 \text{ mm}^2$  { $0.2 \text{ in.}^2$ } or more for the additional wire ("between battery terminal and fuse" of the next figure (▷ page 187). Set the wire as short as possible and make sure that its jacket is not damaged to result in a short.
- 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 187).

- 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.
- 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	Type	Specifications	Wire size (mm <sup>2</sup> ) [upper] and wire permissible current (A) [lower]						(mm <sup>2</sup> ) (in. <sup>2</sup> ) (A)
			0.3 0.012	0.5 0.020	0.85 0.033	1.25 0.049	2.0 0.079	3.0 0.120	
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:

$$10 \times 0.7 = 7 \text{ (A)}$$

→ 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

#### 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.

#### 8.4.4 Lines, plug connections and control units

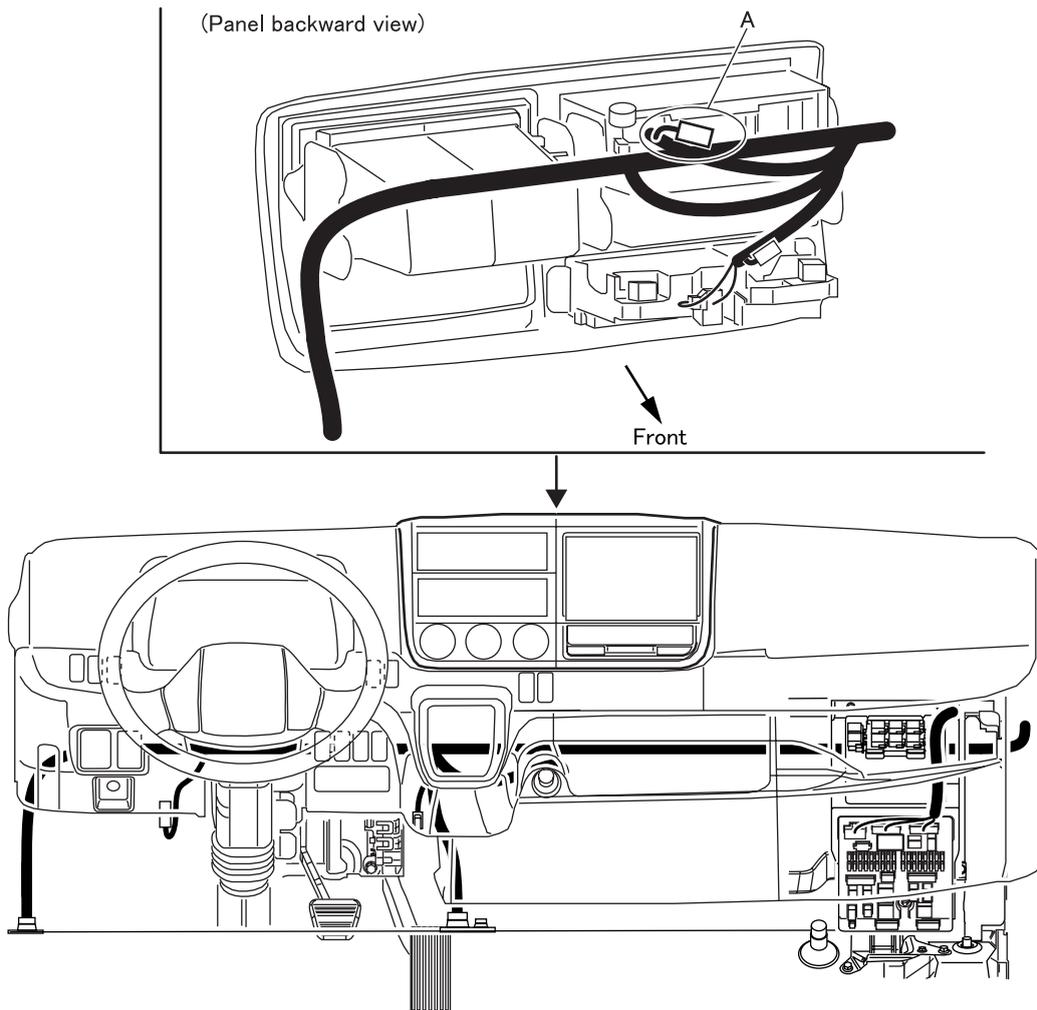
- A plug connection must not be unplugged from or plugged into the control unit(s) while the ignition is on.
- Lines must be protected from heat by means of insulation.
- Route cables in such a way that chafing cannot occur, particularly at crossover points and sharp edges. If necessary, use cable ducts, 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 15.

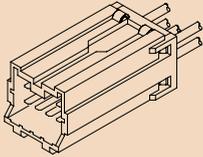
#### Additional information

Installing additional electrical consumers  
▷ page 176.

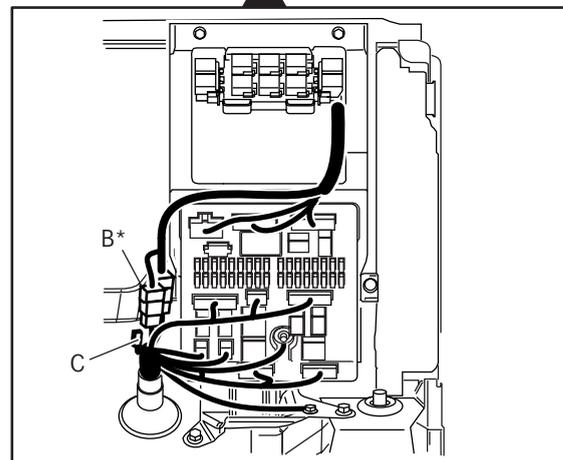
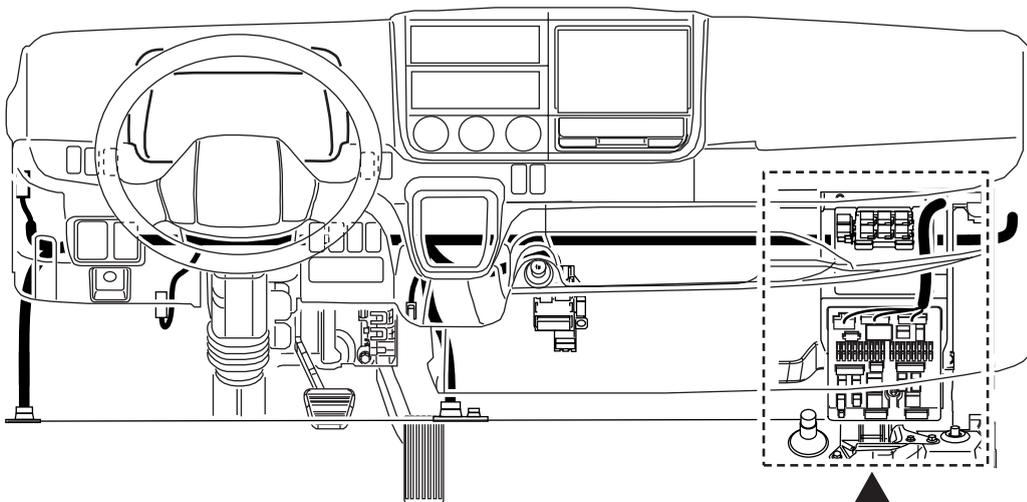
### 8.4.5 Mounting location of optional terminal

- Inside Cab



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

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



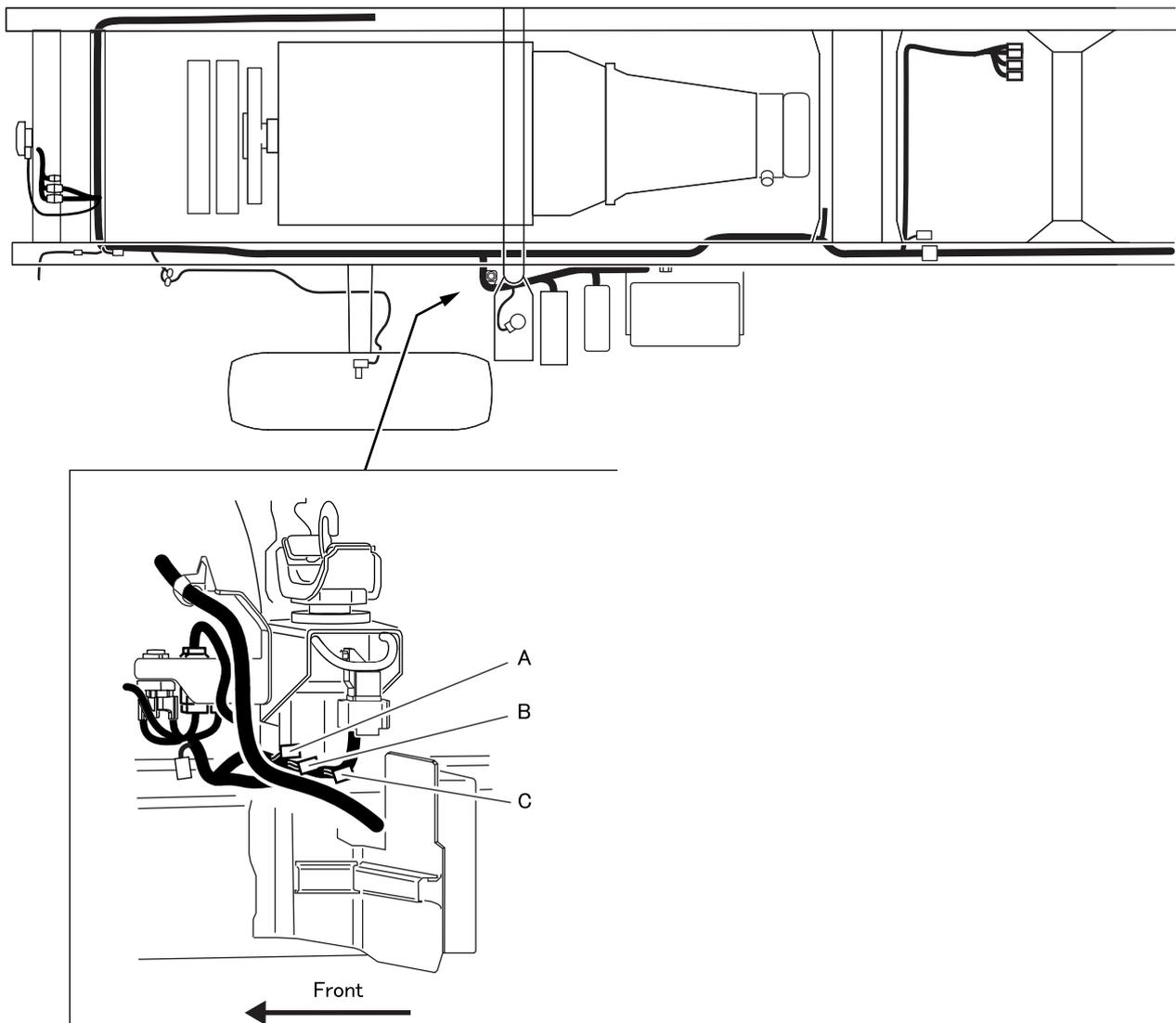
No.	Part Name	Connector No.	Circuit Description				Mating Connector
			No.	Circuit	Line color	Load	
B	OPTION CONNECTOR (Only When sub harness (MK649751) is arranged)		01	PARKING ON	Br	*1	
			02	NEUTRAL	R-G	*1	
			03	PTO	Lg-R	*1	
			04	ILL	O-B	*1	
			05	MAIN	L-R	*1	
			06	GND	B	10A	
			07	BATT	G-R	*1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

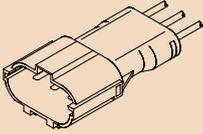
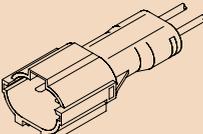
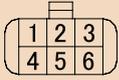
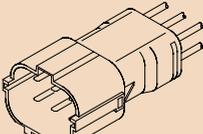
-: The connector marked with - is used for signal cabling only, not used to connect the loads.

\*: Note that, some of the circuit capacities are for SIGNAL-LEVEL amperage only, please refer ▷ page 170.

\*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



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

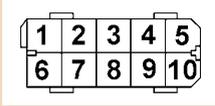
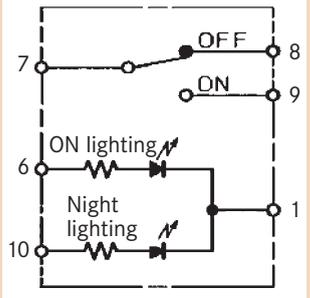
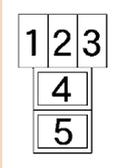
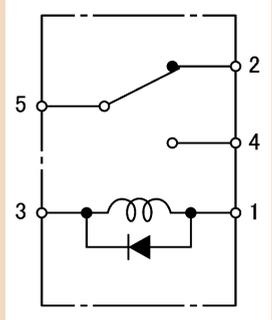
-: The connector marked with - is used for signal cabling only, not used to connect the loads.

\*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.

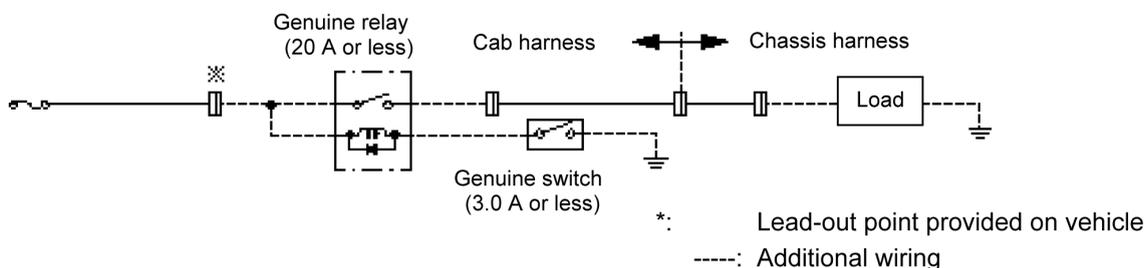
\*2: Loads to be connected to the connector marked with \*2 should be arranged so that the total value of the connector output in each of the cab and chassis side shall not exceed the permissible current.

### 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	 <p>MCP2.8 type connector Housing: A0145450026 Terminal: A0145451126KZ (wire diameter: 0.3 mm<sup>2</sup> {0.012 in.<sup>2</sup>}) A0135457626KZ (wire diameter: 0.5 to 0.85 mm<sup>2</sup> {0.020 to 0.033 in.<sup>2</sup>})</p>	
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	 <p>Connector type EQ5A (MH059820)</p>	 <p>3: Power supply side 1: Ground side</p>

#### Notes:

- 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.
- 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.
- 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.

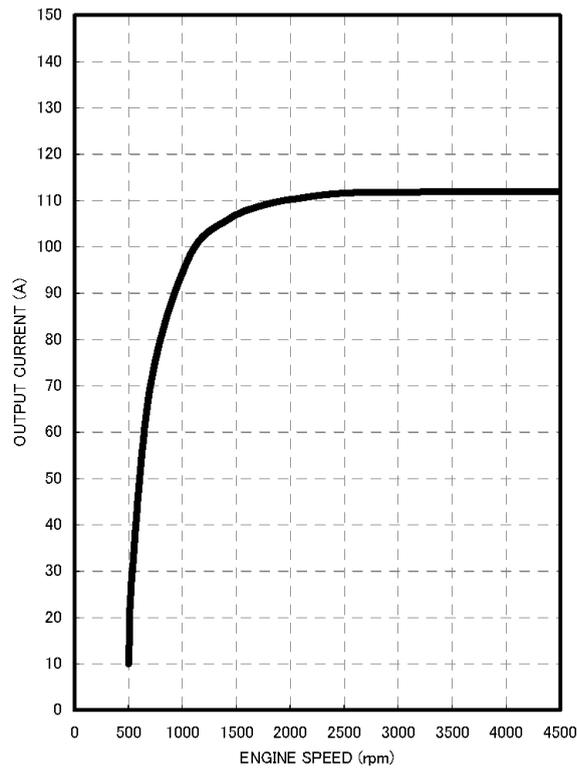
- When there is a lot of night work
- When working for a long time with the engine idling
- When many large load electrical auxiliary equipments are connected

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.

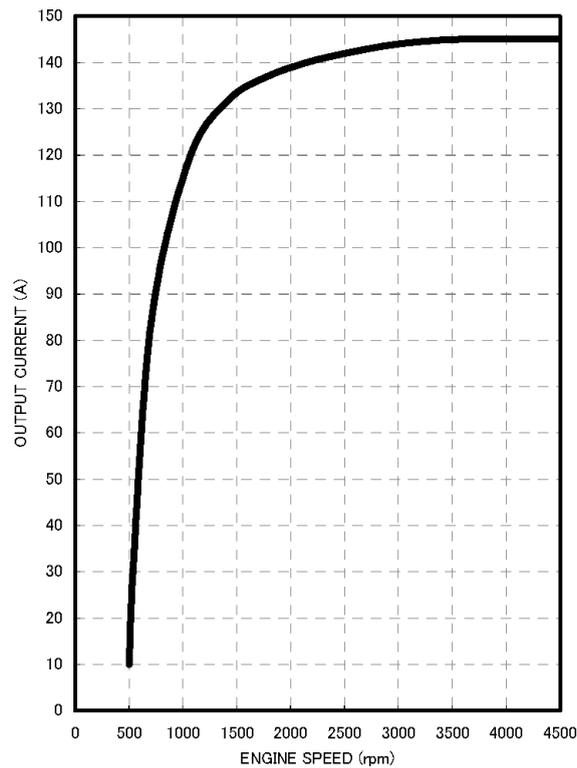
### 8.5 Charging/discharging balance

- Engine Alternator Performance Curves

4P10 Engine Alternator Performance Curve  
Nominal output: 12V-110A



4P10 Engine Alternator Performance Curve  
Nominal output: 12V-140A



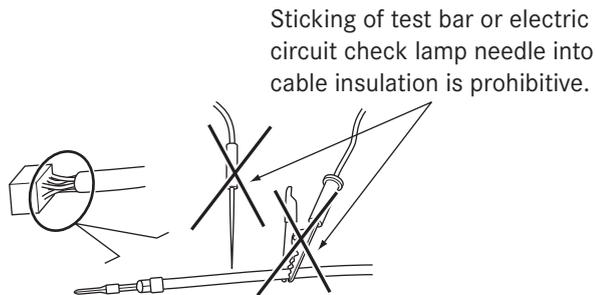
140-Ampere alternator is standard equipment

### 8.6 Electric circuit continuity check

#### 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.

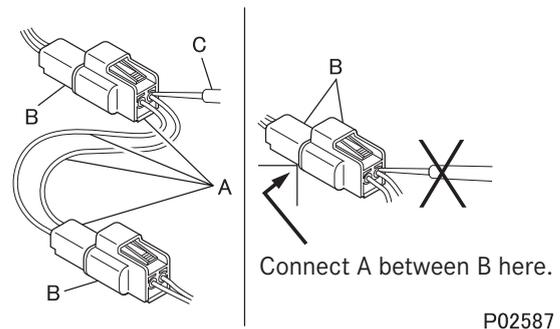


#### 8.6.1 Check procedures

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

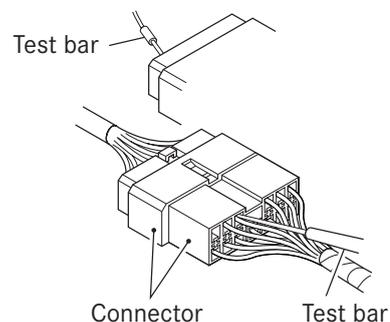
###### Waterproof connector

- 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

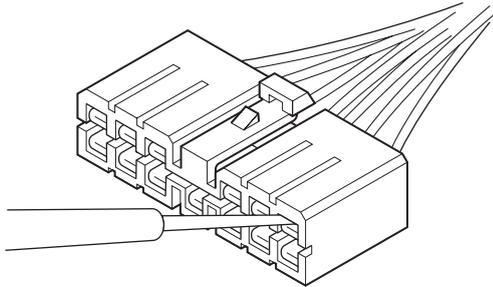
- Insert the test bar from the harness side.
- If joined connectors are so small that test bar cannot be inserted, such as control unit connectors, do not push in the test bar by force but use a superfine pointed test bar.



#### Continuity check with connectors disjoined

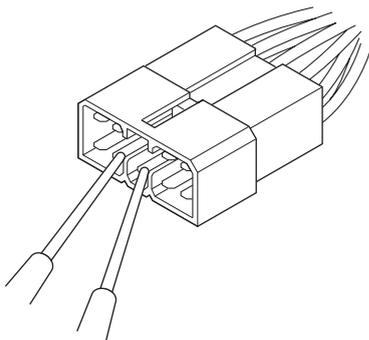
##### *Check with female connector pins*

- 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

#### 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 199

Before carrying out welding, carry out the following work.

(a) Turn OFF the starter switch

(b) Disconnect the battery cables from negative terminals of the batteries, and cover the ends of the cables.

Disconnect the harness connectors connected to the 12 V and 24 V terminals of the battery equalizer from the positive terminals of the batteries, and cover the ends of the cables.

(c) Wait for at least one minute. (because SRS airbags are installed)

(d) 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.

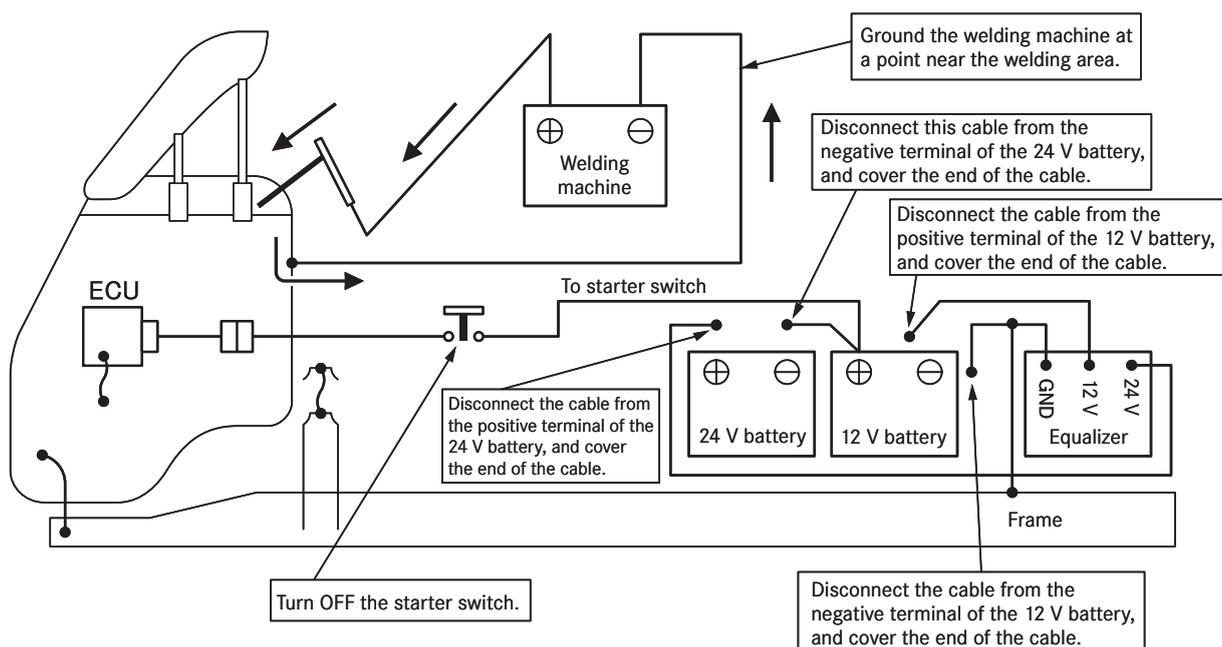
When grounding the cabin itself, remove the paint from the grounding point.

- 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.



Change to 12 V system

### 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.

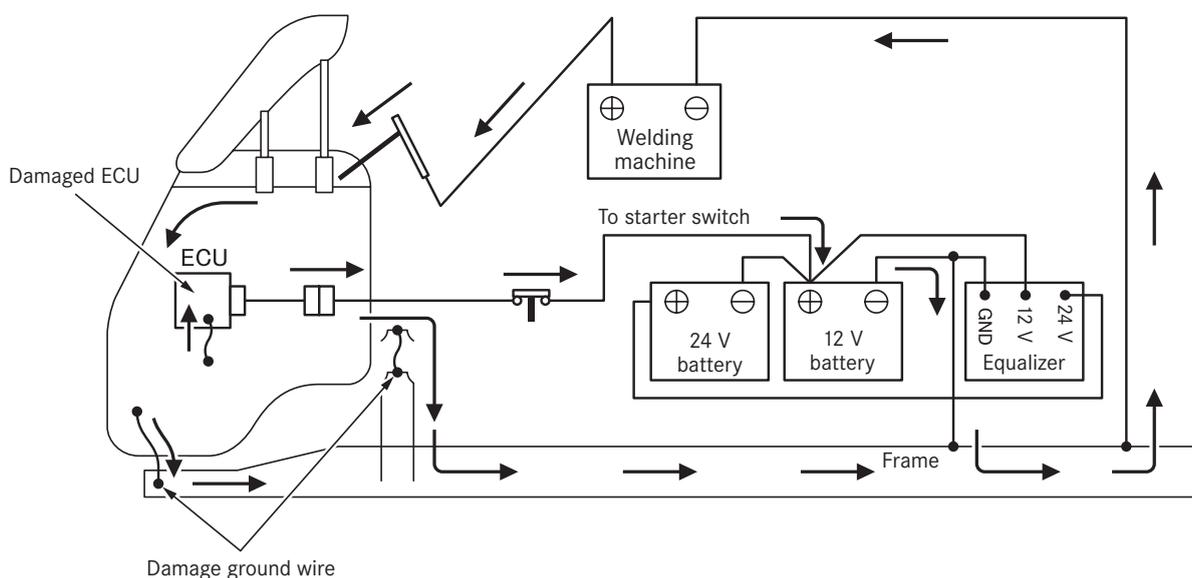
- (b) Confirm that the starter switch is OFF.
- (c) If you wait for at least 30 seconds before reconnecting the battery cables that you disconnected from the positive and negative terminals in step (a), the needle of each meter in the meter cluster will move. Note, however, that this is due to the operation 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 SRS airbag when carrying out welding work, refer to ▷ page 133.
- (f) For the precautions to observe concerning the BlueTec<sup>®</sup> exhaust gas aftertreatment when carrying out welding work, refer to ▷ page 124.

- 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.



#### Change to 12 V system

### 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

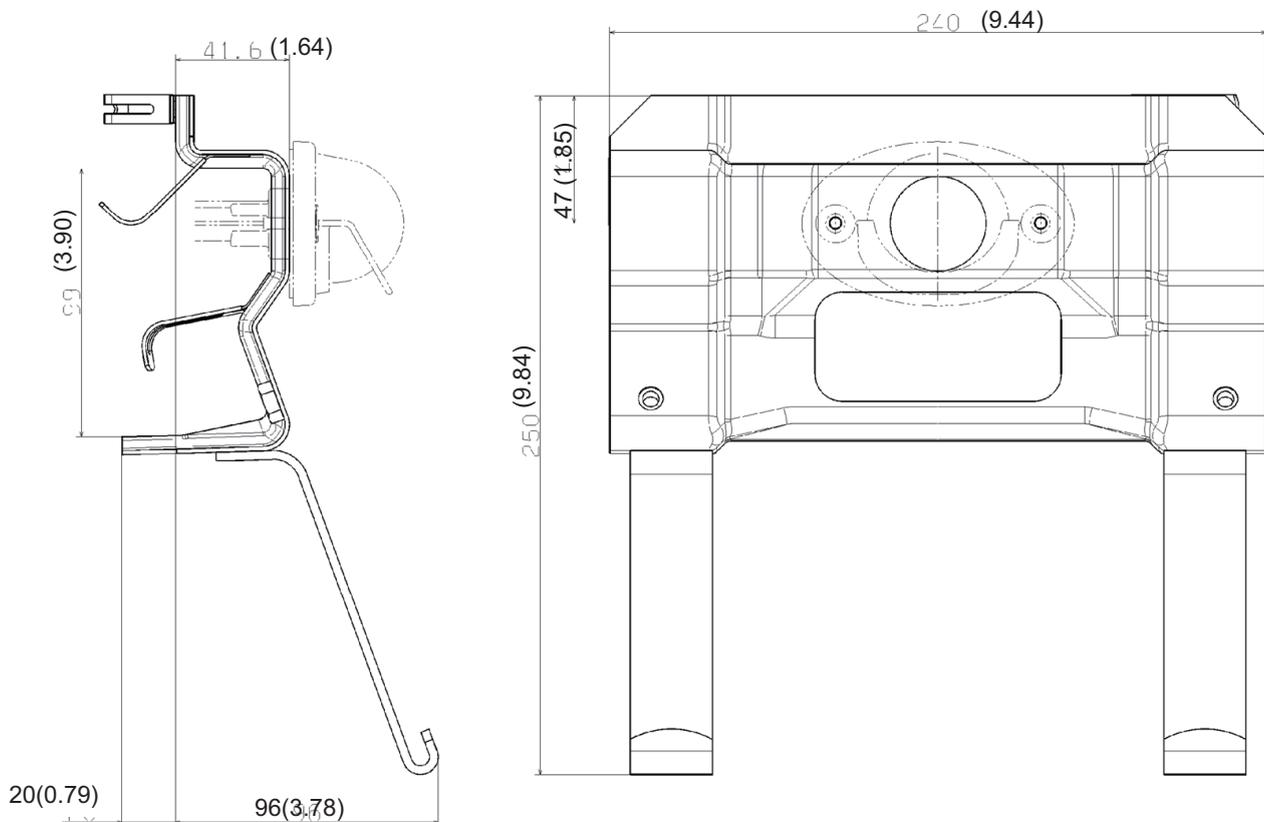
- License plate holder

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.

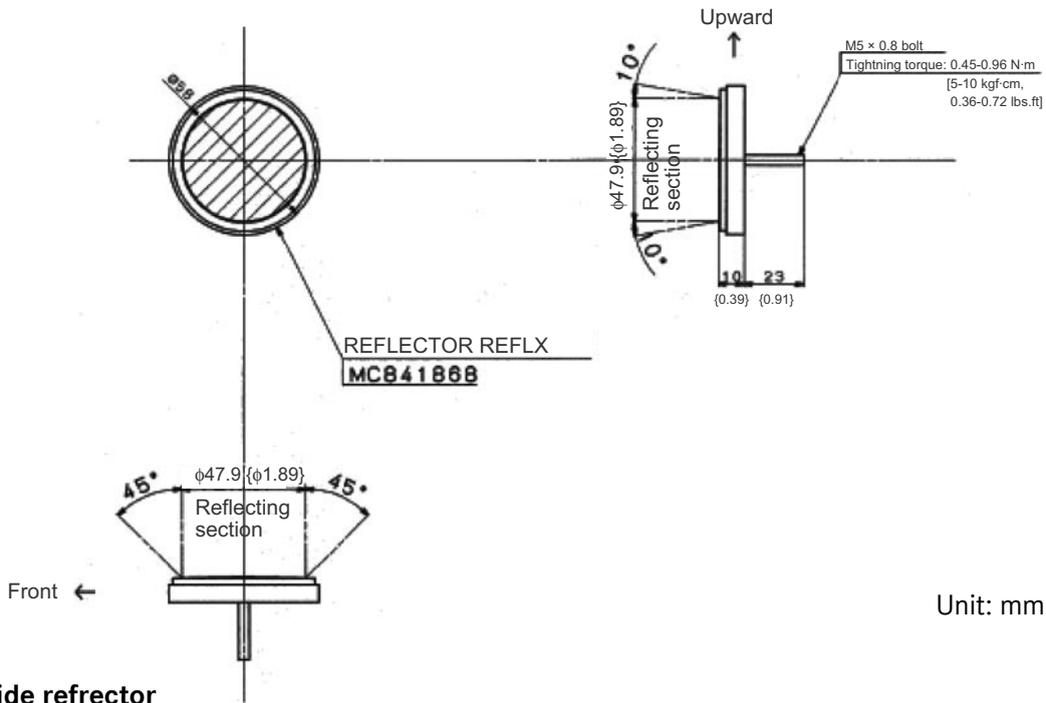
The front side reflector, removed from the frame, can no longer be reused. Use a new part if replacement is necessary for a damage one.

### 8.8.2 Side reflector

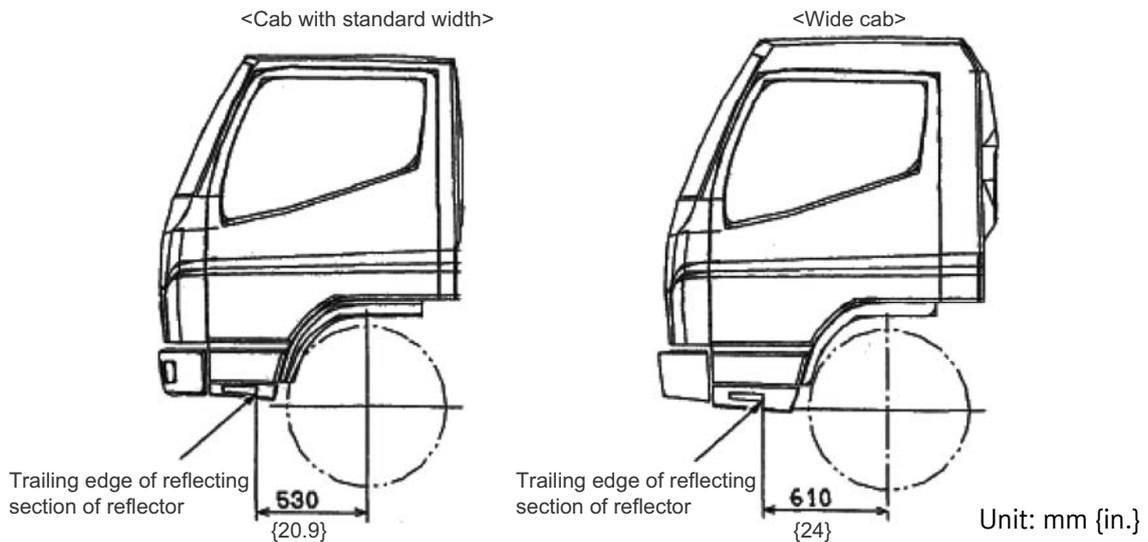
The side reflectors must be removed before starting the body mounting work.

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

#### Side reflector



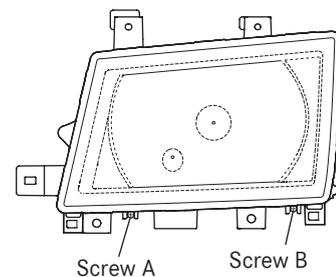
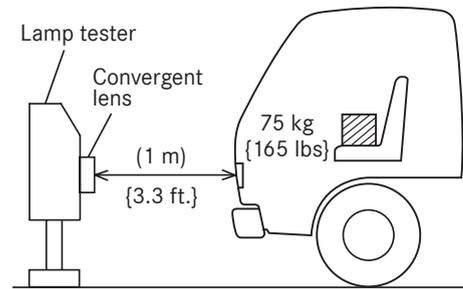
#### Front side reflector



#### 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.

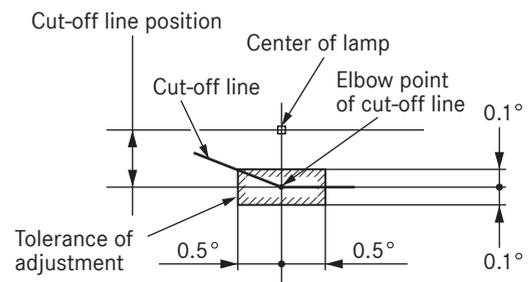


##### Adjustment

- 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.

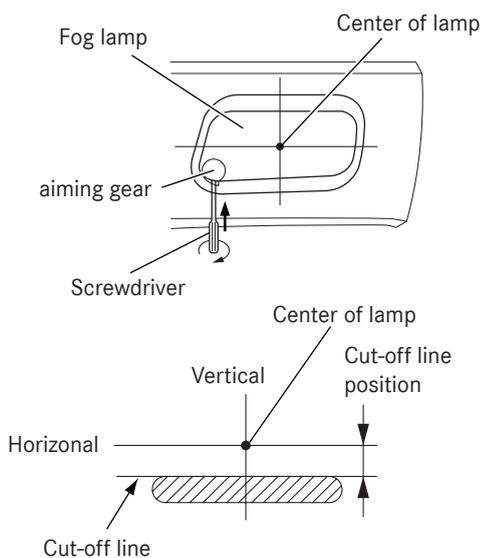
	Optical axis adjustment direction							
	Right headlamp				Left headlamp			
	Up	Down	Left	Right	Up	Down	Left	Right
Screw A	Counter-clockwise	Clockwise			Counter-clockwise	Clockwise		
Screw B	Counter-clockwise	Clockwise	Counter-clockwise	Clockwise	Counter-clockwise	Clockwise	Clockwise	Counter-clockwise

### 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

	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 192.)

##### 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 15.

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 optional connectors/positions. ▷ page 189, ▷ page 190.

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 170, ▷ page 189.

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 terminal inside cab ▷ page 189.
- 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 10 and ▷ page 11 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:

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

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

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

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

$R$  = Theoretical wheelbase (mm {in.})

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

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

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

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

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

		
		
		
-	28. June. 2013	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.

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AdBlue®: The registered trademark of German Association of the Automobile Industry  
DUONIC®: A brand of Daimler AG

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# Body/equipment mounting directives

<Common section>



**mitsubishi** **FUSO TRUCK & BUS CORPORATION**

June 2013 TL203

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### 10.1 Model line-up

	Model	Type	Drive system	Crew	Engine			G.V.W. {kg (lbs)}	G.C.W. {kg (lbs)}	Tire					
					Model	Output {kw}	Torque {Nm}								
FE125	FEC52CL3SUHD	Forward control tilt cab	4×2	3	4P10	120	400	5670 (12500)	9170 (20215)	215/85R16					
	FEC52EL3SUHD														
	FEC52GL3SUHD														
	FEC52HL3SUHD														
FE160	FEC72CL3SUHD														
	FEC72EL3SUHD														
	FEC72GL3SUHD														
	FEC72HL3SUHD														
FE160 CREW CAB	FEC72KL3SUHD							7	3	4P10	120	400	7255 (15995)	10755 (23710)	215/75R17.5
	FEC72HL3WUHD														
FE180	FEC72KL3WUHD														
	FEC92CL3SUHD		3	4P10	120	400	8160 (17995)	11660 (25710)	215/75R17.5						
	FEC92EL3SUHD														
	FEC92GL3SUHD														
FEC92HL3SUHD															
FG4X4	FEC92KL3SUHD	4×4	3	4P10	120	400	6375 (14050)	9875 (21765)	235/85R16						
	FGB72EL3SUHD														



### 10.2 Specifications

#### 10.2.1 Specifications

Model	FEC52CL3SUHD	FEC52EL3SUHD	FEC52GL3SUHD
Emission	EPA10	EPA10	EPA10
Wheelbase {mm (inch)}	2800 (110.2)	3400 (133.9)	3850 (151.6)
Tread {mm (inch)} Front	1675 (65.9)	1675 (65.9)	1675 (65.9)
Rear	1660 (65.4)	1660 (65.4)	1660 (65.4)
Cab&Chassis weight {kg (lb)}	2370 (5226)	2405 (5303)	2420 (5336)
Front	1535 (3385)	1565 (3451)	1580 (3484)
Rear	835 (1841)	840 (1852)	840 (1852)
Max. G.V.W. {kg (lb)}	5670 (12500)	5670 (12500)	5670 (12500)
Max. G.C.W. {kg (lb)}	9170 (20215)	9170 (20215)	9170 (20215)
Model	4P10-2AT5	4P10-2AT5	4P10-2AT5
Max. Output (EEC)	120 kW / 3400 rpm	120 kW / 3400 rpm	120 kW / 3400 rpm
Max. Torque (EEC)	400 Nm / 1300 rpm	400 Nm / 1300 rpm	400 Nm / 1300 rpm
Clutch	-	-	-
Transmission	M038S6	M038S6	M038S6
Gear ratio	5.397 - 3.788 - 2.310 - 1.474 - 1.000 - 0.701 Rev. 5.397	5.397 - 3.788 - 2.310 - 1.474 - 1.000 - 0.701 Rev. 5.397	5.397 - 3.788 - 2.310 - 1.474 - 1.000 - 0.701 Rev. 5.397
Propeller shaft	P3	P3	P3
Transfer	-	-	-
Rear axle	R033T	R033T	R033T
Final reduction gear	D033H	D033H	D033H
Ratio	4.875	4.875	4.875
Front axle	F200T	F200T	F200T
Tires	215/85R16	215/85R16	215/85R16
Wheels	16X6K-127-9t, 5 studs	16X6K-127-9t, 5 studs	16X6K-127-9t, 5 studs
Steering angle (in/out)	49°/36°	49°/36°	49°/36°
SRS air bag	-	-	-
Servic brake	hydraulic vacuum assisted 2 circuit split system	hydraulic vacuum assisted 2 circuit split system	hydraulic vacuum assisted 2 circuit split system
Parking brake	Mechanical, internal expanding type mounted on the rear end of the transmission case	Mechanical, internal expanding type mounted on the rear end of the transmission case	Mechanical, internal expanding type mounted on the rear end of the transmission case
Front suspension	Semi-elliptic laminated leaf spring with shock absorbers and stabilizer	Semi-elliptic laminated leaf spring with shock absorbers and stabilizer	Semi-elliptic laminated leaf spring with shock absorbers and stabilizer
Rear suspension	Semi-elliptic laminated leaf spring with shock absorbers and stabilizer	Semi-elliptic laminated leaf spring with shock absorbers and stabilizer	Semi-elliptic laminated leaf spring with shock absorbers and stabilizer
P.T.O.	-	-	-
Fuel system	Injection pump	Unit pump	Unit pump
Governor	Electronic control governor	Electronic control governor	Electronic control governor
Fuel tank	113 L	113 L	113 L
Exhaust system	DPF+SCR	DPF+SCR	DPF+SCR
Electrical	Voltage	-	-
Alternator	12 V-110 A	12 V-110 A	12 V-110 A
Batteries	12 Volts (115D31L x 2)	12 Volts (115D31L x 2)	12 Volts (115D31L x 2)
Cab	Wide, Single	Wide, Single	Wide, Single
Crew	3	3	3

Model		FEC52HL3SUHD	FEC72CL3SUHD	FEC72EL3SUHD
Emission		EPA10	EPA10	EPA10
Wheelbase {mm (inch)}		4300 (169.3)	2800 (110.2)	3400 (133.9)
Tread {mm (inch)}	Front	1675 (65.9)	1675 (65.9)	1675 (65.9)
	Rear	1660 (65.4)	1670 (65.7)	1670 (65.7)
Cab&Chassis weight {kg (lb)}		2450 (5402)	2495 (5501)	2530 (5579)
	Front	1600 (3528)	1575 (3473)	1605 (3539)
	Rear	850 (1874)	920 (2029)	925 (2040)
Max. G.V.W. {kg (lb)}		5670 (12500)	7255 (15995)	7255 (15995)
Max. G.C.W. {kg (lb)}		9170 (20215)	10755 (23710)	10755 (23710)
Model		4P10-2AT5	4P10-3AT5	4P10-3AT5
Max. Output (EEC)		120 kW / 3400 rpm	120 kW / 3400 rpm	120 kW / 3400 rpm
Max. Torque (EEC)		400 Nm / 1300 rpm	400 Nm / 1300 rpm	400 Nm / 1300 rpm
Clutch		-	-	-
Transmission		M038S6	M038S6	M038S6
	Gear ratio	5.397 - 3.788 - 2.310 - 1.474 - 1.000 - 0.701 Rev. 5.397	5.397 - 3.788 - 2.310 - 1.474 - 1.000 - 0.701 Rev. 5.397	5.397 - 3.788 - 2.310 - 1.474 - 1.000 - 0.701 Rev. 5.397
Propeller shaft		P3	P3	P3
Transfer		-	-	-
Rear axle		R033T	R035T	R035T
Final reduction gear		D033H	D035H	D035H
	Ratio	4.875	5.285	5.285
Front axle		F200T	F350T	F350T
Tires		215/85R16	215/75R17.5	215/75R17.5
Wheels		16X6K-127-9t, 5 studs	17.5X6.00-127-9t, 6 studs	17.5X6.00-127-9t, 6 studs
Steering angle (in/out)		49°/36°	45°/34°	45°/34°
SRS air bag		-	-	-
Servic brake		hydraulic vacuum assisted 2 circuit split system	hydraulic vacuum assisted 2 circuit split system	hydraulic vacuum assisted 2 circuit split system
Parking brake		Mechanical, internal expanding type mounted on the rear end of the transmission case	Mechanical, internal expanding type mounted on the rear end of the transmission case	Mechanical, internal expanding type mounted on the rear end of the transmission case
Front suspension		Semi-elliptic laminated leaf spring with shock absorbers and stabilizer	Semi-elliptic laminated leaf spring with shock absorbers and stabilizer	Semi-elliptic laminated leaf spring with shock absorbers and stabilizer
Rear suspension		Semi-elliptic laminated leaf spring with shock absorbers and stabilizer	Semi-elliptic laminated leaf spring with shock absorbers and stabilizer	Semi-elliptic laminated leaf spring with shock absorbers and stabilizer
P.T.O.		-	-	-
Fuel system	Injection pump	Unit pump	Unit pump	Unit pump
	Governor	Electronic control governor	Electronic control governor	Electronic control governor
Fuel tank		113 L	113 L	113 L
Exhaust system		DPF+SCR	DPF+SCR	DPF+SCR
Electrical	Voltage	-	-	-
	Alternator	12 V-110 A	12 V-110 A	12 V-110 A
	Batteries	12 Volts (115D31L x 2)	12 Volts (115D31L x 2)	12 Volts (115D31L x 2)
Cab		Wide, Single	Wide, Single	Wide, Single
Crew		3	3	3

Model		FEC72GL3SUHD	FEC72HL3SUHD	FEC72KL3SUHD
Emission		EPA10	EPA10	EPA10
Wheelbase {mm (inch)}		3850 (151.6)	4300 (169.3)	4750 (187)
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)}		2545 (5612)	2575 (5678)	2595 (5722)
	Front	1620 (3572)	1640 (3616)	1650 (3638)
	Rear	925 (2040)	935 (2062)	945 (2084)
Max. G.V.W. {kg (lb)}		7255 (15995)	7255 (15995)	7255 (15995)
Max. G.C.W. {kg (lb)}		10755 (23710)	10755 (23710)	10755 (23710)
Model		4P10-3AT5	4P10-3AT5	4P10-3AT5
Max. Output (EEC)		120 kW / 3400 rpm	120 kW / 3400 rpm	120 kW / 3400 rpm
Max. Torque (EEC)		400 Nm / 1300 rpm	400 Nm / 1300 rpm	400 Nm / 1300 rpm
Clutch		-	-	-
Transmission		M038S6	M038S6	M038S6
	Gear ratio	5.397 - 3.788 - 2.310 - 1.474 - 1.000 - 0.701 Rev. 5.397	5.397 - 3.788 - 2.310 - 1.474 - 1.000 - 0.701 Rev. 5.397	5.397 - 3.788 - 2.310 - 1.474 - 1.000 - 0.701 Rev. 5.397
Propeller shaft		P3	P3	P3
Transfer		-	-	-
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 vacuum assisted 2 circuit split system	hydraulic vacuum assisted 2 circuit split system	hydraulic vacuum assisted 2 circuit split system
Parking brake		Mechanical, internal expanding type mounted on the rear end of the transmission case	Mechanical, internal expanding type mounted on the rear end of the transmission case	Mechanical, internal expanding type mounted on the rear end of the transmission case
Front suspension		Semi-elliptic laminated leaf spring with shock absorbers and stabilizer	Semi-elliptic laminated leaf spring with shock absorbers and stabilizer	Semi-elliptic laminated leaf spring with shock absorbers and stabilizer
Rear suspension		Semi-elliptic laminated leaf spring with shock absorbers and stabilizer	Semi-elliptic laminated leaf spring with shock absorbers and stabilizer	Semi-elliptic laminated leaf spring with shock absorbers and stabilizer
P.T.O.		-	-	-
Fuel system	Injection pump	Unit pump	Unit pump	Unit pump
	Governor	Electronic control governor	Electronic control governor	Electronic control governor
Fuel tank		113 L	113 L	113 L
Exhaust system		DPF+SCR	DPF+SCR	DPF+SCR
Electrical	Voltage	-	-	-
	Alternator	12 V-110 A	12 V-110 A	12 V-110 A
	Batteries	12 Volts (115D31L x 2)	12 Volts (115D31L x 2)	12 Volts (115D31L x 2)
Cab		Wide, Single	Wide, Single	Wide, Single
Crew		3	3	3

Model		FEC72HL3WUHD	FEC72KL3WUHD	FEC92CL3SUHD
Emission		EPA10	EPA10	EPA10
Wheelbase {mm (inch)}		4300 (169.3)	4750 (187)	2800 (110.2)
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)}		2795 (6163)	2810 (6196)	2495 (5501)
	Front	1795 (3958)	1815 (4002)	1575 (3473)
	Rear	1000 (2205)	995 (2194)	920 (2029)
Max. G.V.W. {kg (lb)}		7255 (15995)	7255 (15995)	8160 (17995)
Max. G.C.W. {kg (lb)}		10755 (23710)	10755 (23710)	11660 (25710)
Model		4P10-3AT5	4P10-3AT5	4P10-3AT5
Max. Output (EEC)		120 kW / 3400 rpm	120 kW / 3400 rpm	120 kW / 3400 rpm
Max. Torque (EEC)		400 Nm / 1300 rpm	400 Nm / 1300 rpm	400 Nm / 1300 rpm
Clutch		-	-	-
Transmission		M038S6	M038S6	M038S6
	Gear ratio	5.397 - 3.788 - 2.310 - 1.474 - 1.000 - 0.701 Rev. 5.397	5.397 - 3.788 - 2.310 - 1.474 - 1.000 - 0.701 Rev. 5.397	5.397 - 3.788 - 2.310 - 1.474 - 1.000 - 0.701 Rev. 5.397
Propeller shaft		P3	P3	P3
Transfer		-	-	-
Rear axle		R035T	R035T	R035T
Final reduction gear		D035H	D035H	D035H
	Ratio	5.285	5.285	6.166
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 vacuum assisted 2 circuit split system	hydraulic vacuum assisted 2 circuit split system	hydraulic vacuum assisted 2 circuit split system
Parking brake		Mechanical, internal expanding type mounted on the rear end of the transmission case	Mechanical, internal expanding type mounted on the rear end of the transmission case	Mechanical, internal expanding type mounted on the rear end of the transmission case
Front suspension		Semi-elliptic laminated leaf spring with shock absorbers and stabilizer	Semi-elliptic laminated leaf spring with shock absorbers and stabilizer	Semi-elliptic laminated leaf spring with shock absorbers and stabilizer
Rear suspension		Semi-elliptic laminated leaf spring with shock absorbers and stabilizer	Semi-elliptic laminated leaf spring with shock absorbers and stabilizer	Semi-elliptic laminated leaf spring with shock absorbers and stabilizer
P.T.O.		-	-	-
Fuel system	Injection pump	Unit pump	Unit pump	Unit pump
	Governor	Electronic control governor	Electronic control governor	Electronic control governor
Fuel tank		113 L	113 L	113 L
Exhaust system		DPF+SCR	DPF+SCR	DPF+SCR
Electrical	Voltage	-	-	-
	Alternator	12 V-140 A	12 V-140 A	12 V-110 A
	Batteries	12 Volts (115D31L x 2)	12 Volts (115D31L x 2)	12 Volts (115D31L x 2)
Cab		Wide, Crew	Wide, Crew	Wide, Single
Crew		7	7	3

Model		FEC92EL3SUHD	FEC92GL3SUHD	FEC92HL3SUHD
Emission		EPA10	EPA10	EPA10
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)}		2530 (5579)	2545 (5612)	2575 (5678)
	Front	1605 (3539)	1620 (3572)	1640 (3616)
	Rear	925 (2040)	925 (2040)	935 (2062)
Max. G.V.W. {kg (lb)}		8160 (17995)	8160 (17995)	8160 (17995)
Max. G.C.W. {kg (lb)}		11660 (25710)	11660 (25710)	11660 (25710)
Model		4P10-3AT5	4P10-3AT5	4P10-3AT5
Max. Output (EEC)		120 kW / 3400 rpm	120 kW / 3400 rpm	120 kW / 3400 rpm
Max. Torque (EEC)		400 Nm / 1300 rpm	400 Nm / 1300 rpm	400 Nm / 1300 rpm
Clutch		-	-	-
Transmission		M038S6	M038S6	M038S6
	Gear ratio	5.397 - 3.788 - 2.310 - 1.474 - 1.000 - 0.701 Rev. 5.397	5.397 - 3.788 - 2.310 - 1.474 - 1.000 - 0.701 Rev. 5.397	5.397 - 3.788 - 2.310 - 1.474 - 1.000 - 0.701 Rev. 5.397
Propeller shaft		P3	P3	P3
Transfer		-	-	-
Rear axle		R035T	R035T	R035T
Final reduction gear		D035H	D035H	D035H
	Ratio	6.166	6.166	6.166
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 vacuum assisted 2 circuit split system	hydraulic vacuum assisted 2 circuit split system	hydraulic vacuum assisted 2 circuit split system
Parking brake		Mechanical, internal expanding type mounted on the rear end of the transmission case	Mechanical, internal expanding type mounted on the rear end of the transmission case	Mechanical, internal expanding type mounted on the rear end of the transmission case
Front suspension		Semi-elliptic laminated leaf spring with shock absorbers and stabilizer	Semi-elliptic laminated leaf spring with shock absorbers and stabilizer	Semi-elliptic laminated leaf spring with shock absorbers and stabilizer
Rear suspension		Semi-elliptic laminated leaf spring with shock absorbers and stabilizer	Semi-elliptic laminated leaf spring with shock absorbers and stabilizer	Semi-elliptic laminated leaf spring with shock absorbers and stabilizer
P.T.O.		-	-	-
Fuel system	Injection pump	Unit pump	Unit pump	Unit pump
	Governor	Electronic control governor	Electronic control governor	Electronic control governor
Fuel tank		113 L	113 L	113 L
Exhaust system		DPF+SCR	DPF+SCR	DPF+SCR
Electrical	Voltage	-	-	-
	Alternator	12 V-110 A	12 V-110 A	12 V-110 A
	Batteries	12 Volts (115D31L x 2)	12 Volts (115D31L x 2)	12 Volts (115D31L x 2)
Cab		Wide, Single	Wide, Single	Wide, Single
Crew		3	3	3

Model		FEC92KL3SUHD	FGB72EL3SUHD	
Emission		EPA10	EPA10	
Wheelbase {mm (inch)}		4750 (187)	3415 (134.4)	
Tread {mm (inch)}	Front	1675 (65.9)	1650 (65)	
	Rear	1670 (65.7)	1560 (61.4)	
Cab&Chassis weight {kg (lb)}		2595 (5722)	2720 (5998)	
	Front	1650 (3638)	1835 (4046)	
	Rear	945 (2084)	885 (1951)	
Max. G.V.W. {kg (lb)}		8160 (17995)	6375 (14050)	
Max. G.C.W. {kg (lb)}		11660 (25710)	9875 (21765)	
Model		4P10-3AT5	4P10-3AT5	
Max. Output (EEC)		120 kW / 3400 rpm	120 kW / 3400 rpm	
Max. Torque (EEC)		400 Nm / 1300 rpm	400 Nm / 1300 rpm	
Clutch		-	-	
Transmission		M038S6	M038S6	
	Gear ratio	5.397 - 3.788 - 2.310 - 1.474 - 1.000 - 0.701 Rev. 5.397	5.397 - 3.788 - 2.310 - 1.474 - 1.000 - 0.701 Rev. 5.397	
Propeller shaft		P3	P3	
Transfer		-	TF3	
Rear axle		R035T	R035T	
Final reduction gear		D035H	D035H	
	Ratio	6.166	5.285	
Front axle		F350T	F200TW	
Tires		215/75R17.5	235/85R16	
Wheels		17.5X6.00-127-9t, 6 studs	16X6K-135-9t, 6 studs	
Steering angle (in/out)		45°/34°	35°/34°	
SRS air bag		-	-	
Servic brake		hydraulic vacuum assisted 2 circuit split system	hydraulic vacuum assisted 2 circuit split system	
Parking brake		Mechanical, internal expanding type mounted on the rear end of the transmission case	Mechanical, internal expanding type mounted on the rear end of the transmission case	
Front suspension		Semi-elliptic laminated leaf spring with shock absorbers and stabilizer	Semi-elliptic laminated leaf spring with shock absorbers and stabilizer	
Rear suspension		Semi-elliptic laminated leaf spring with shock absorbers and stabilizer	Semi-elliptic laminated leaf spring with shock absorbers and stabilizer	
P.T.O.		-	-	
Fuel system	Injection pump	Unit pump	Unit pump	
	Governor	Electronic control governor	Electronic control governor	
Fuel tank		113 L	125 L	
Exhaust system		DPF+SCR	DPF+SCR	
Electrical	Voltage	-	-	
	Alternator	12 V-110 A	12 V-110 A	
	Batteries	12 Volts (115D31L x 2)	12 Volts (115D31L x 2)	
Cab		Wide, Single	Wide, Single	
Crew		3	3	

### 10.2.2 Axle and tire load carrying capacity

Max. GVW kg (lbs)	Vehicle Model	Max. Output kw (rpm)	Tire size			Axle Capacity kg (lb)	
			215/85R16	215/75R17.5	235/85R16	Front	Rear
5670 (12500)	FEC52CL3SUHD	120 (3400)	×			2430 (5360)	4480 (9880)
	FEC52EL3SUHD		×				
	FEC52GL3SUHD		×				
	FEC52HL3SUHD		×				
7255 (15995)	FEC72CL3SUHD				×	2900 (6390)	5760 (12700)
	FEC72EL3SUHD				×		
	FEC72GL3SUHD				×		
	FEC72HL3SUHD				×		
	FEC72HL3WUHD				×		
	FEC72KL3SUHD				×		
	FEC72KL3WUHD				×		
8160 (17995)	FEC92CL3SUHD				×	2600 (5370)	4300 (9480)
	FEC92EL3SUHD			×			
	FEC92GL3SUHD			×			
	FEC92HL3SUHD			×			
	FEC92KL3SUHD			×			
6375 (14050)	FGB72EL3SUHD			×			
Tire Capacity (kg)* 1		Front	1215X2=2430	1600X2=3200	1380X2=2760		
		Rear	1120X4=4480	1550X4=6200	1260X4=5040		

\* 1 At Maximum information pressure (kPa, cold: Fr/Re)

215/85R16 550/550 (kPa), 80/80 (PSI)

215/75R17.5 690/690 (kPa), 100/100 (PSI)

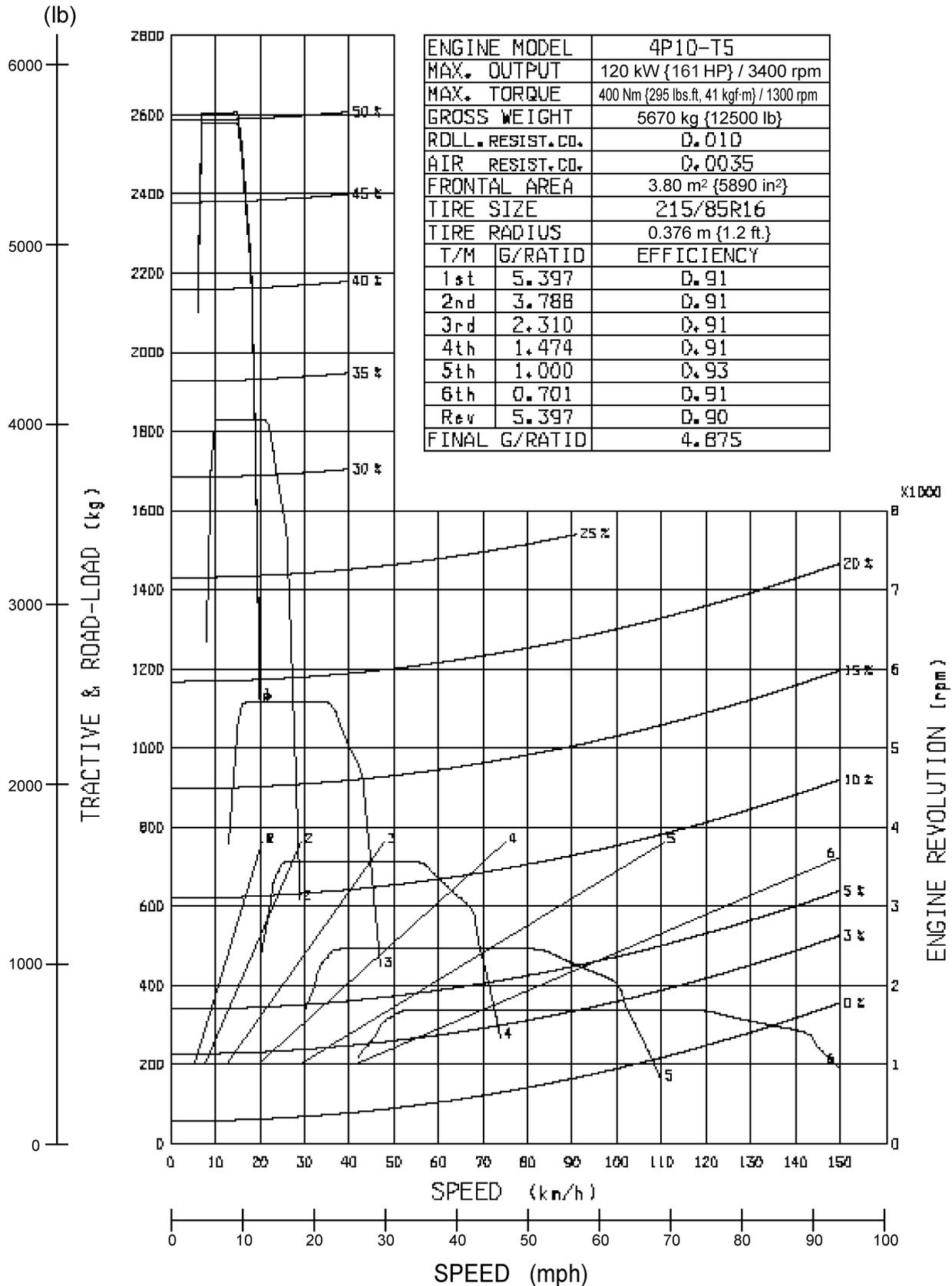
235/85R16 550/550 (kPa), 80/80 (PSI)



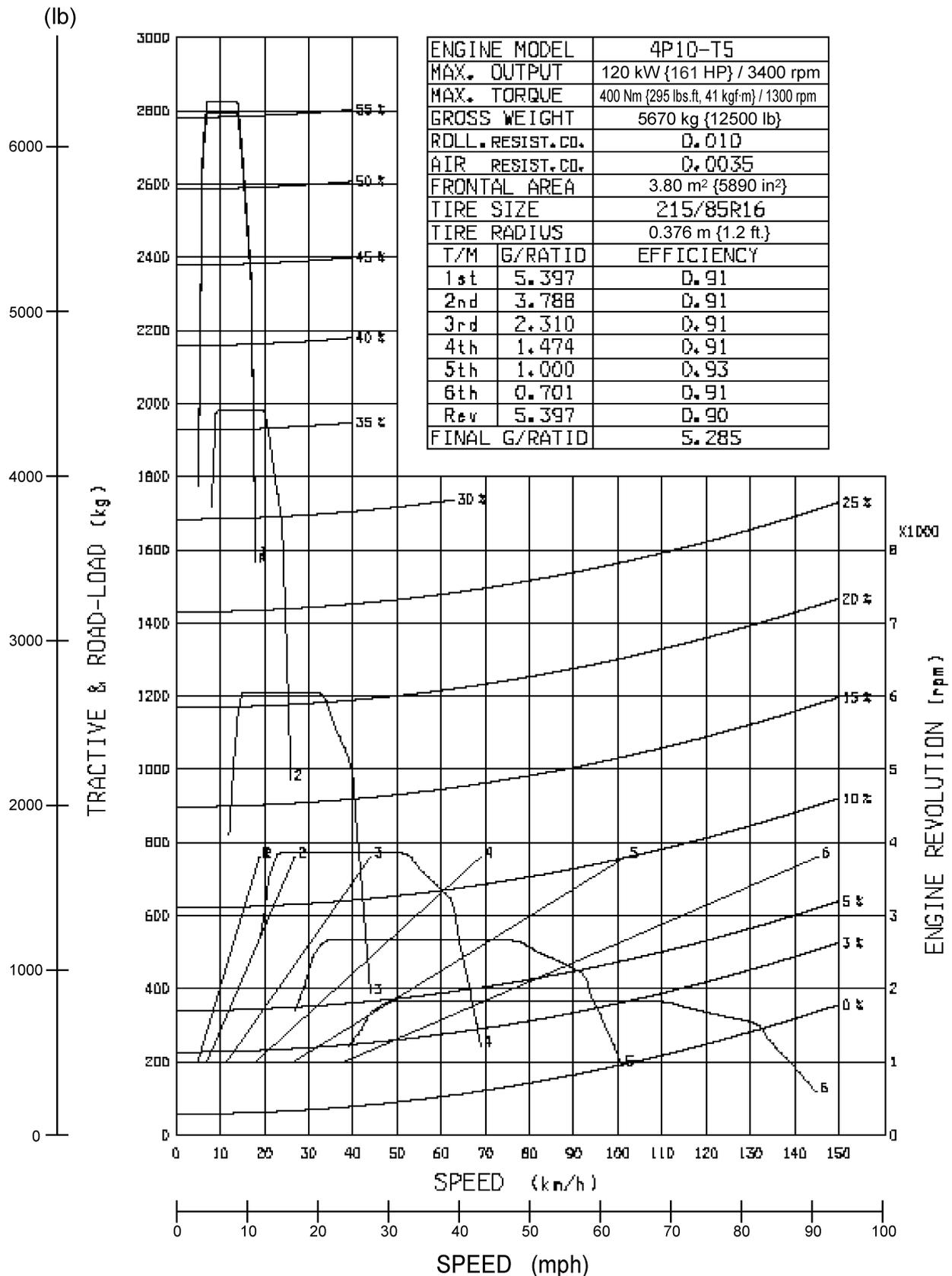
### 10.3 Performance curve

#### 10.3.1 Vehicle performance curve

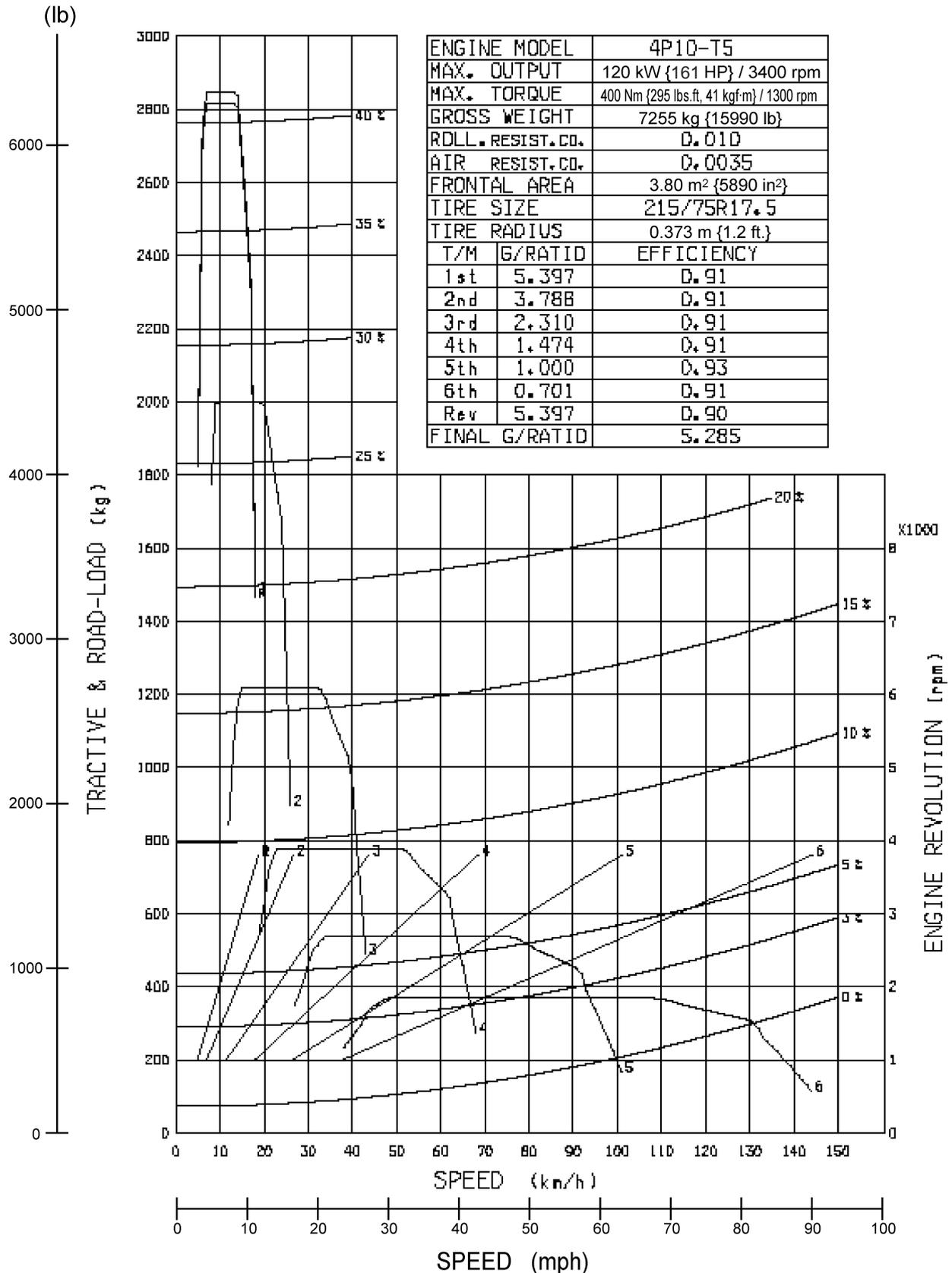
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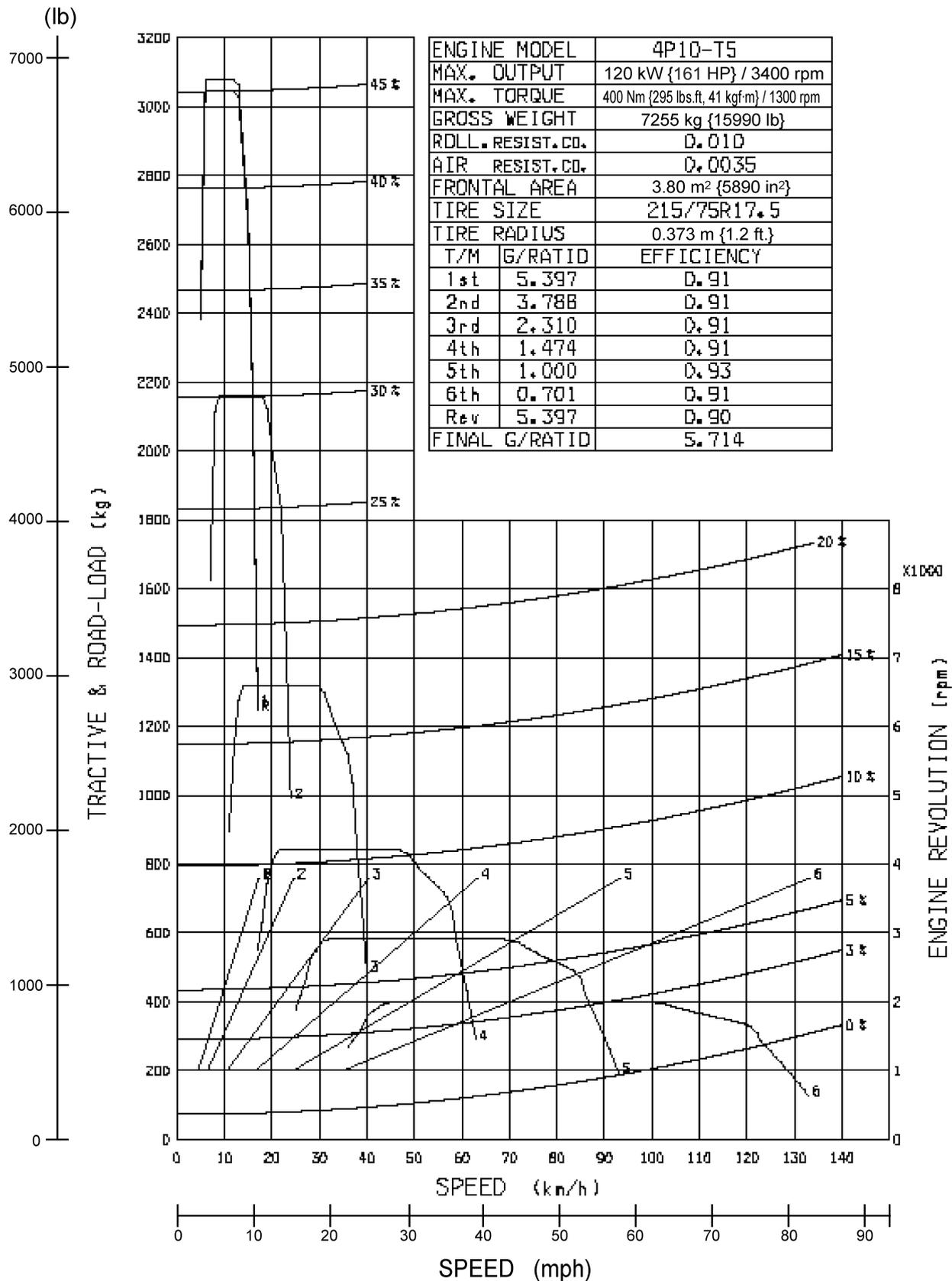
FEC52 4P10-T5



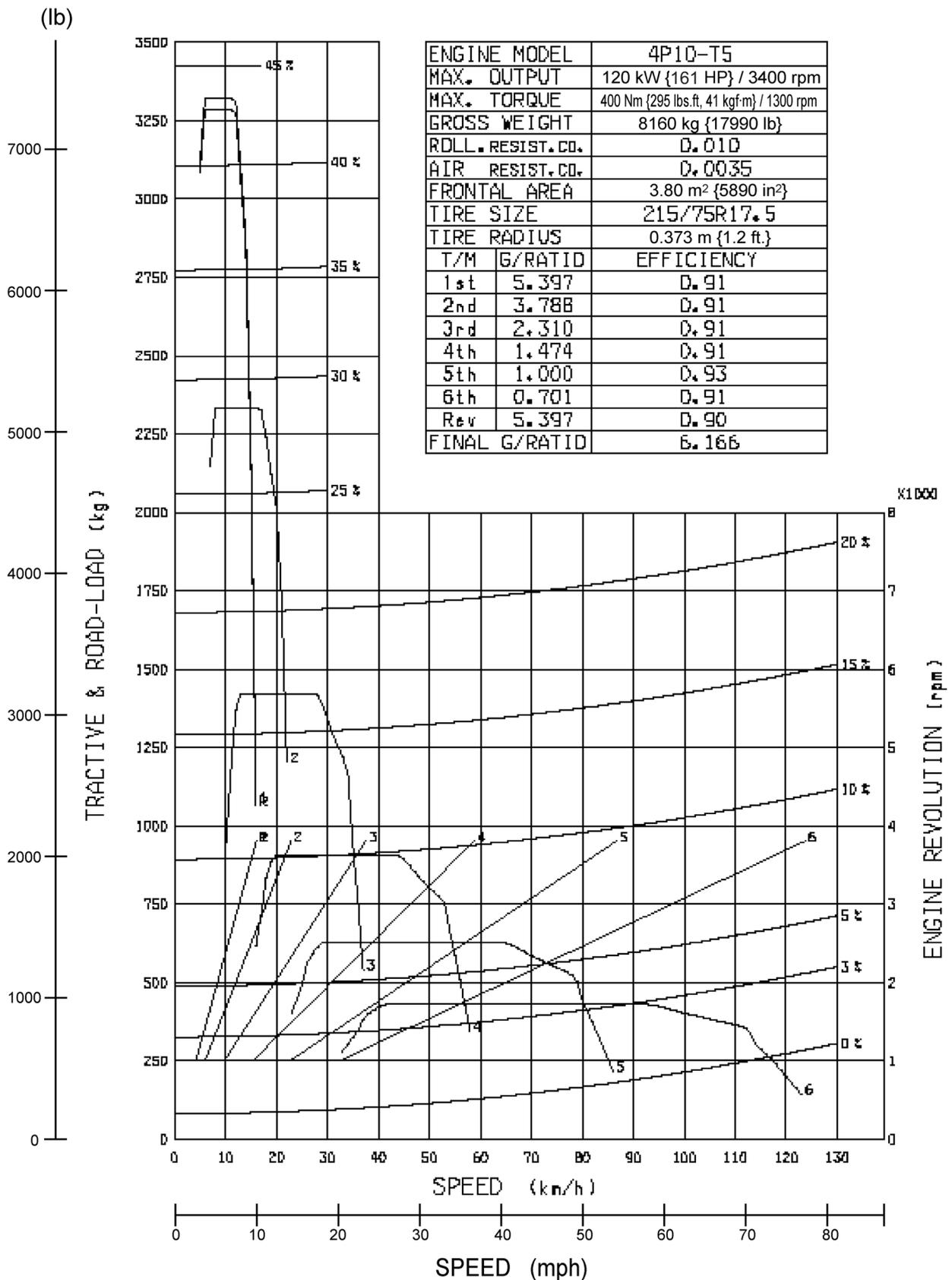
FEC72 4P10-T5

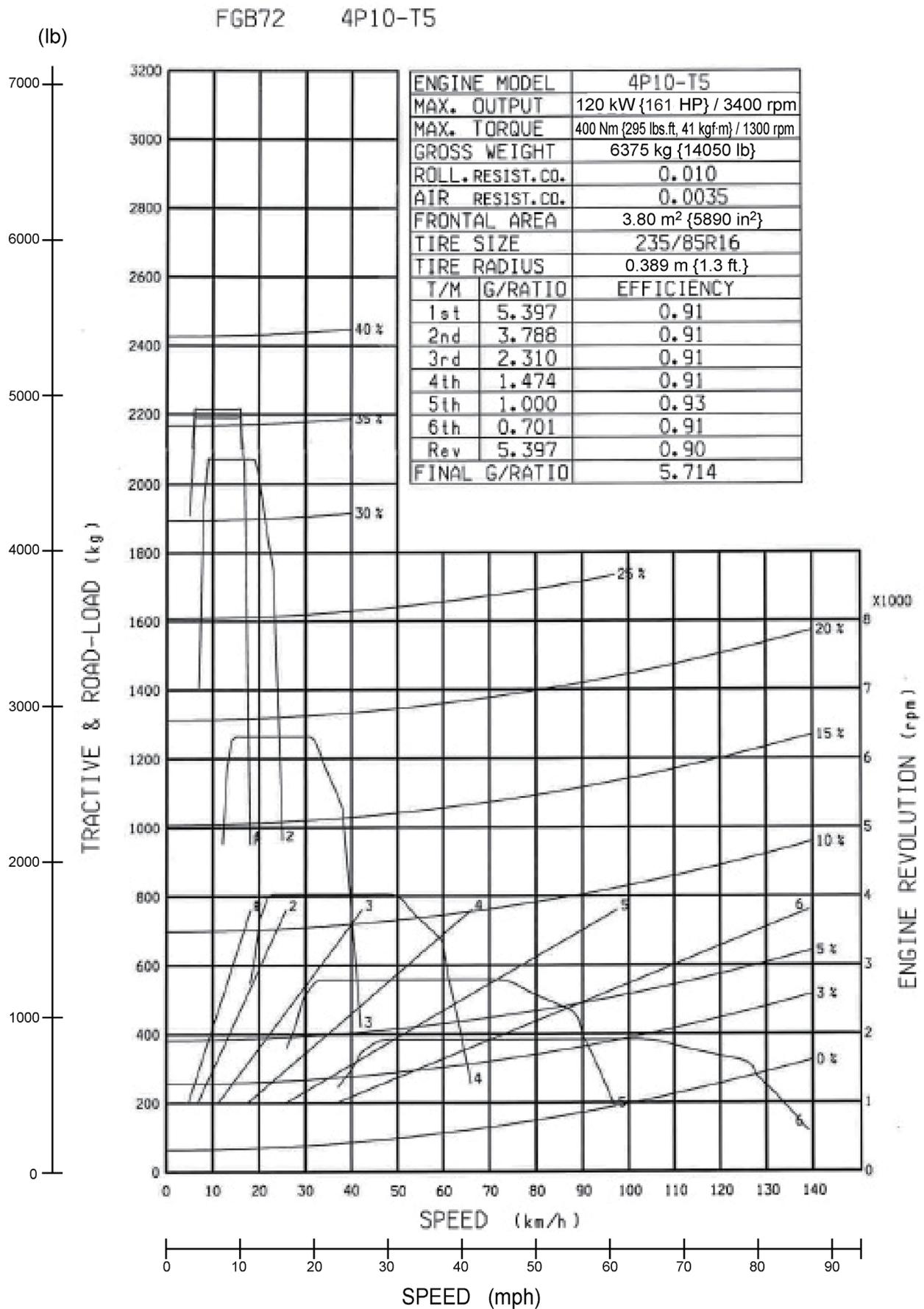


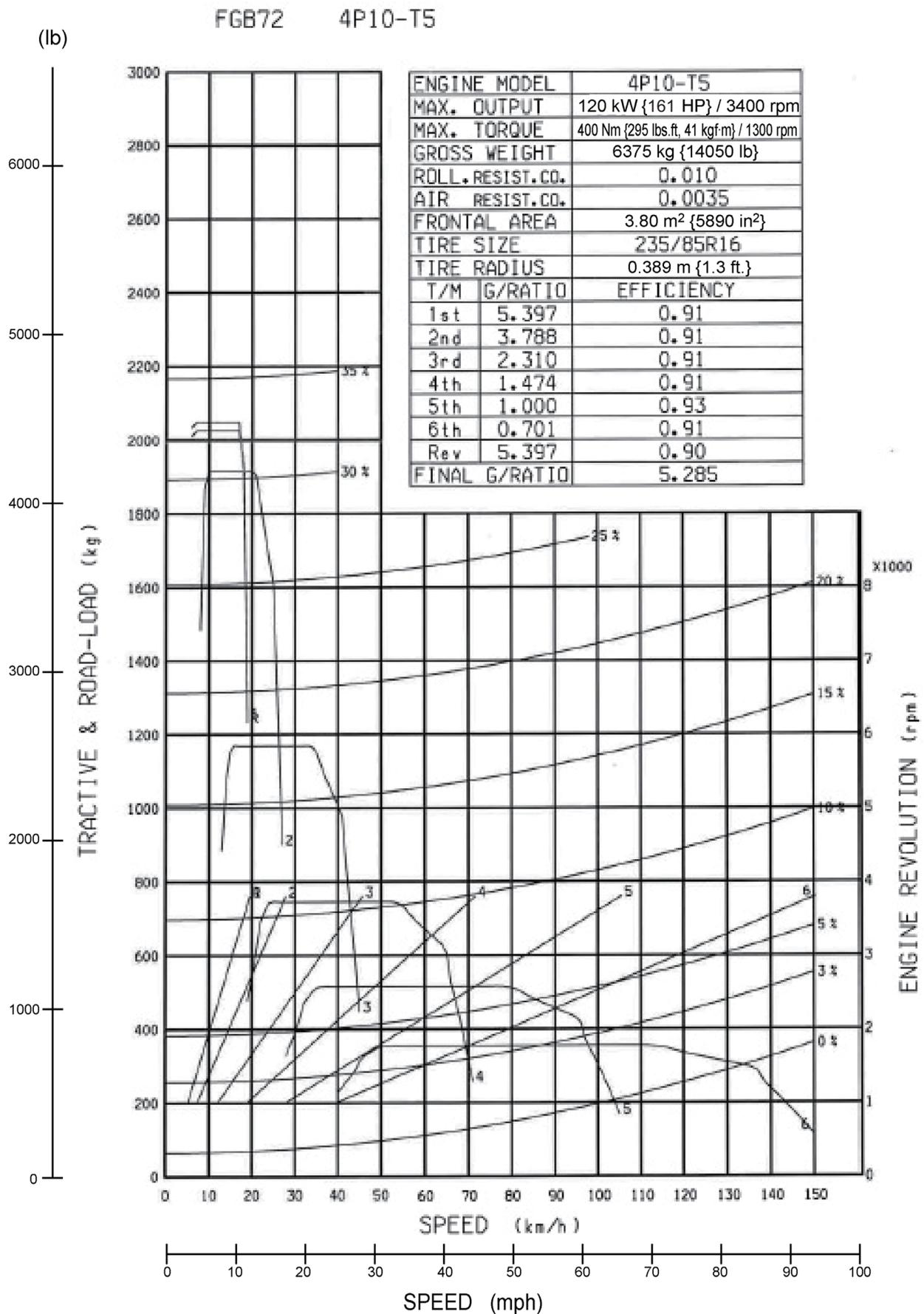
FEC72 4P10-T5



FEC92 4P10-T5

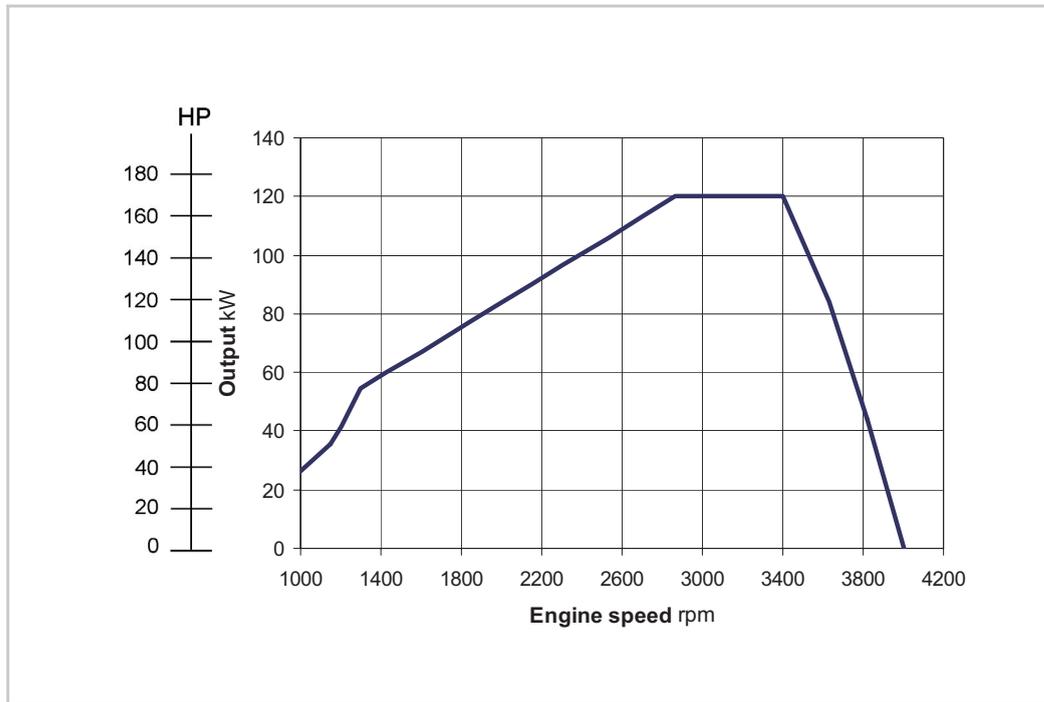




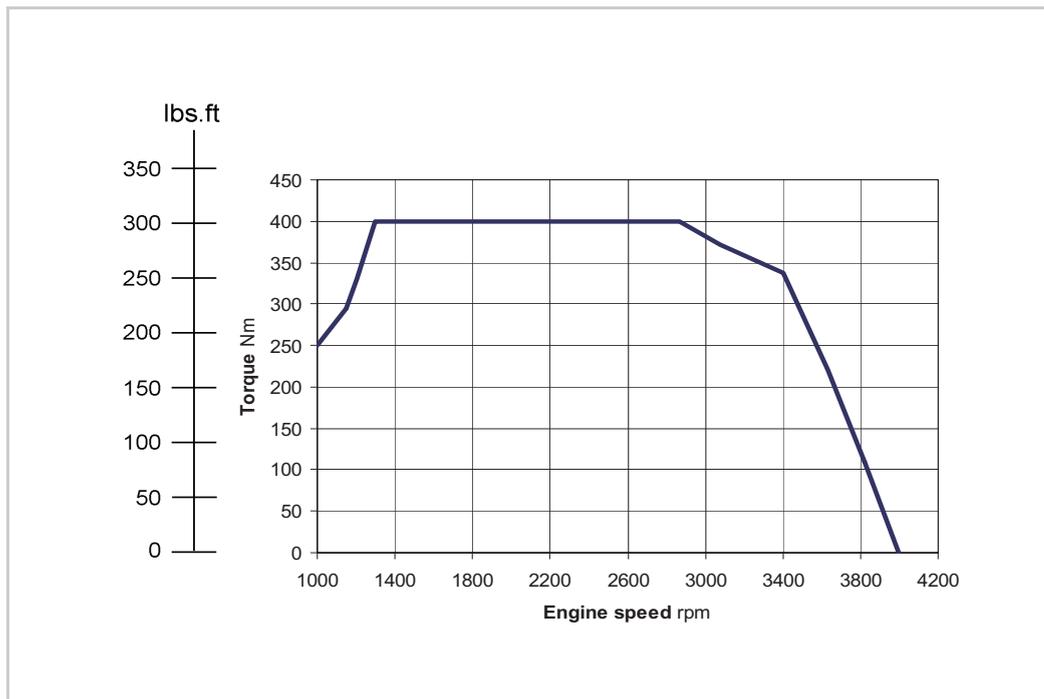


### 10.3.2 Engine performance curve

Output



Torque





























## 10.4 Weight distribution table

Model: FEC92GL3SUHD 120 (163) {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 (-3.3)	13.9 (31)	-2.9 (-6.4)
Steering system	41 (90)	-0.719 (-2.4)	48.7 (105)	-7.7 (-17)
Engine control system	0 (0)	-1.000 (-3.3)	0.5 (1.1)	-0.1 (-0.2)
Brake, clutch control system	22 (49)	-1.000 (-3.3)	27.7 (61)	-5.7 (-13)
Air intake system	24 (53)	0.524 (1.7)	21.1 (47)	3.3 (7.3)
Parking brake system	5 (11)	0.085 (0.3)	4.9 (11)	0.1 (0.2)
Remote control system	9 (20)	0.196 (0.6)	8.5 (19)	0.5 (1.1)
Cab assembly, Front cab mounting	355 (780)	-0.300 (-1)	382.7 (845)	-27.7 (-61)
Cooling system	28 (62)	-0.320 (-1)	30.3 (67)	-2.3 (-5.1)
Engine, Transmission assembly	430 (945)	0.401 (1.3)	385.1 (850)	44.8 (99)
Rear cab mounting	44 (97)	-0.223 (-0.7)	46.5 (100)	-2.5 (-5.5)
Battery	62 (135)	0.889 (2.9)	47.7 (105)	14.3 (32)
Fuel system	136 (300)	4.280 (14)	-15.2 (-34)	151.3 (335)
Exhaust system	69 (150)	1.420 (4.7)	43.5 (96)	25.4 (56)
Propeller shaft assembly	23 (51)	2.430 (8.0)	8.5 (19)	14.5 (32)
Electric system	10 (22)	1.950 (6.4)	4.9 (11)	5.1 (11)
Frame and others	311 (685)	1.990 (6.5)	150.4 (330)	160.9 (355)
Engine and T/M cover	3 (6.6)	0.401 (1.3)	2.4 (5.3)	0.3 (0.7)
A/C unit	27 (60)	-0.780 (-2.6)	32.5 (72)	-5.5 (-12)
Electric others	39 (86)	-0.800 (-2.6)	46.7 (100)	-8.0 (-18)
ECU	4 (8.8)	-0.896 (-2.9)	4.9 (11)	-0.9 (-2.0)
SCR tank	18 (40)	1.975 (6.5)	8.6 (19)	9.1 (20)
			1304.8 (2880)	366.3 (805)
Sprung weight	1671 (36810)		1305 (2880)	366 (805)
Unsprung weight	872 (1920)		310 (685)	562 (1240)
Chassis Cab weight	2543 (5610)		1615 (3560)	928 (2050)
	2545 (5610)		1615 (3560)	930 (2050)

\* 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: FGB72EL3SUHD 120 (163) {kW(HP)}

Wheelbase {m (ft)} : 3.415 (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)	-0.977 (-3)	14.1 (31)	-3.1 (-7)
Steering system	39 (86)	-0.704 (-2)	47.0 (105)	-8.0 (-19)
Engine control system	0 (0)	-1.000 (-3)	0.5 (1.1)	-0.1 (-0.2)
Brake, clutch control system	22 (49)	-0.985 (-3)	28.3 (62)	-6.3 (-11)
Air intake system	24 (53)	0.549 (1.8)	20.4 (45)	3.9 (8.6)
Parking brake system	5 (11)	-0.100 (-0.2)	5.1 (11)	-0.1 (-0.2)
Remote control system	9 (20)	0.211 (0.7)	8.4 (19)	0.6 (1.3)
Cab assembly, Front cab mounting	356 (785)	-0.285 (-0.9)	385.2 (850)	-29.7 (-65)
Cooling system	28 (62)	-0.305 (-1)	30.5 (67)	-2.5 (-6)
Engine, Transmission assembly	497 (1100)	0.530 (1.7)	419.4 (925)	77.1 (170)
Rear cab mounting	44 (97)	-0.208 (-0.7)	46.7 (100)	-2.7 (-6)
Battery	62 (135)	0.904 (3.0)	45.6 (100)	16.4 (36)
Fuel system	158 (350)	3.855 (13)	-20.4 (-43)	178.8 (395)
Exhaust system	71 (155)	1.445 (4.7)	41.0 (90)	30.1 (66)
Propeller shaft assembly	32 (71)	2.275 (7.5)	10.7 (24)	21.3 (47)
Electric system	10 (22)	1.720 (5.6)	5.0 (11)	5.0 (11)
Frame and others	298 (655)	1.756 (5.8)	144.8 (320)	153.3 (335)
Engine and T/M cover	3 (6.6)	0.386 (1.3)	2.6 (5.7)	0.3 (0.7)
A/C unit	27 (60)	-0.765 (-3)	33.0 (73)	-6.0 (-11)
Electric others	39 (86)	-0.794 (-3)	47.7 (105)	-9.0 (-18)
ECU	4 (8.8)	-0.881 (-3)	5.0 (11)	-1.0 (-2)
Transfer	18 (40)	2.000 (6.6)	7.3 (16)	10.4 (23)
SCR tank				
			1327.9 (2930)	428.7 (945)
Sprung weight	1757 (3870)		1328 (2930)	429 (945)
Unsprung weight	953 (2100)		403 (890)	550 (1210)
Chassis Cab weight *2	2710 (5970)		1731 (3820)	979 (2160)
	2710 (5970)		1730 (3810)	980 (2160)

\* 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

### Optional equipment

The following additional weight must be taken into consideration when calculating vehicle weight.

Group	Option	Mass Variation [kg (lb)]	Mass Center Position (distance from FrAxle center) [m (ft)]* 1		Remark
			Wide Cab		
			Single	Crew	
Chassis	T/M PTO (20kgfm, vacuum, separate connected pump, with flange)	+12kg	+0.401 (+1.30)	+0.401 (+1.30)	
	T/M PTO (40kgfm, vacuum, separate connected pump, with flange)	+13kg	+0.401 (+1.30)	+0.401 (+1.30)	
	125L Side mount fuel tank	+139 (+306)	+1.835 (+6.0)	-	Wheel base: E 3400 (133.9)
		-135 (-298)	+3.830 (+13.0)	-	
		+139 (+306)	+1.835 (+6.0)	-	Wheel base: G 3850 (151.6)
		-135 (-298)	+4.280 (+14.0)	-	
		+139 (+306)	+1.835 (+6.0)	+2.735 (+9.0)	Wheel base: H 4300 (169.3)
		-135 (-298)	+4.730 (+16.0)	+4.730 (+16.0)	
		+139 (+306)	+1.835 (+6.0)	+2.735 (+9.0)	Wheel base: K 4750 (187.0)
		-135 (-298)	+5.180 (+17.0)	+5.180 (+17.0)	

Note. - \*1 Distance from Fr. Axle Center ; +: backward, -: forward



### 10.5 Chassis cab drawings

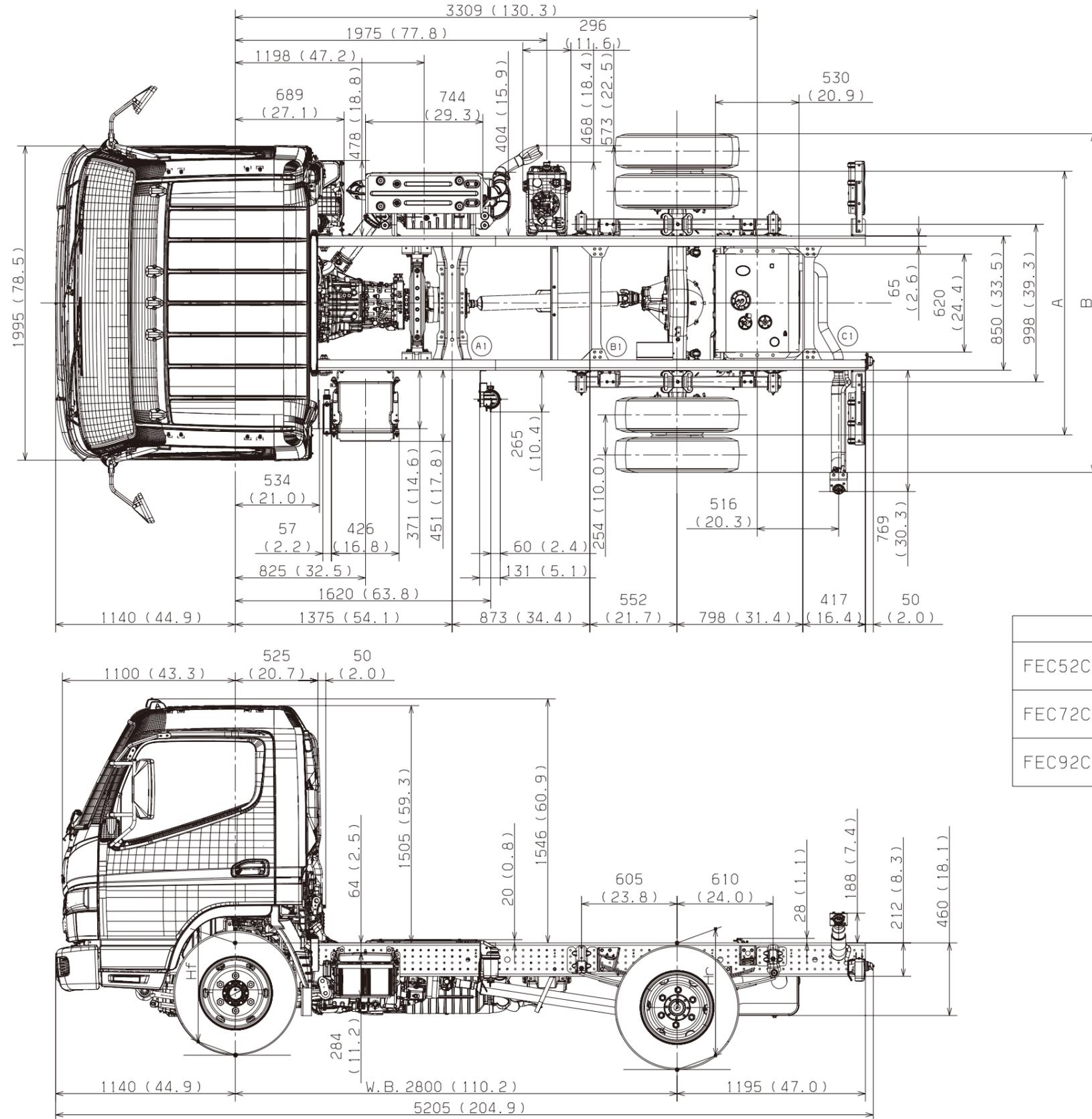
#### 10.5.1 Chassis cab drawings

Model	Page	Down Load
FEC52CL3SUHD	244	.dxf
FEC72CL3SUHD		
FEC92CL3SUHD		
FEC52EL3SUHD	245	.dxf
FEC72EL3SUHD		
FEC92EL3SUHD		
FEC52GL3SUHD	246	.dxf
FEC72GL3SUHD		
FEC92GL3SUHD		
FEC52HL3SUHD	247	.dxf
FEC72HL3SUHD		
FEC92HL3SUHD		

Model	Page	Down Load
FEC72HL3WUHD	248	.dxf
FEC72KL3SUHD	249	.dxf
FEC92KL3SUHD		
FEC72KL3WUHD	250	.dxf
FGB72EL3SUHD	251	.dxf



10.5 Chassis cab drawings



	TIRE SIZE	A	B
FEC52CL3SUHD	215/85R16	1660 (65.4)	2143 (84.4)
FEC72CL3SUHD	215/75R17.5	1670 (65.7)	2144 (84.4)
FEC92CL3SUHD			

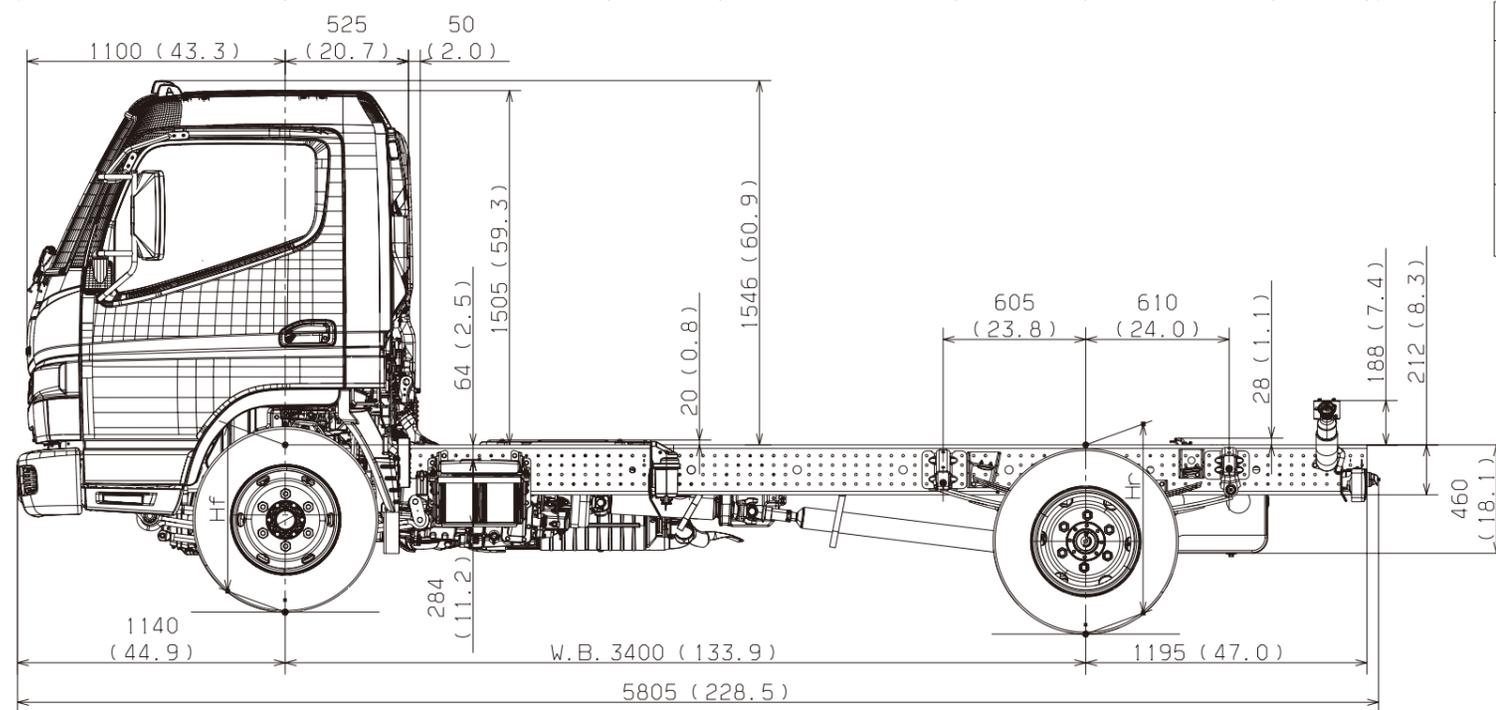
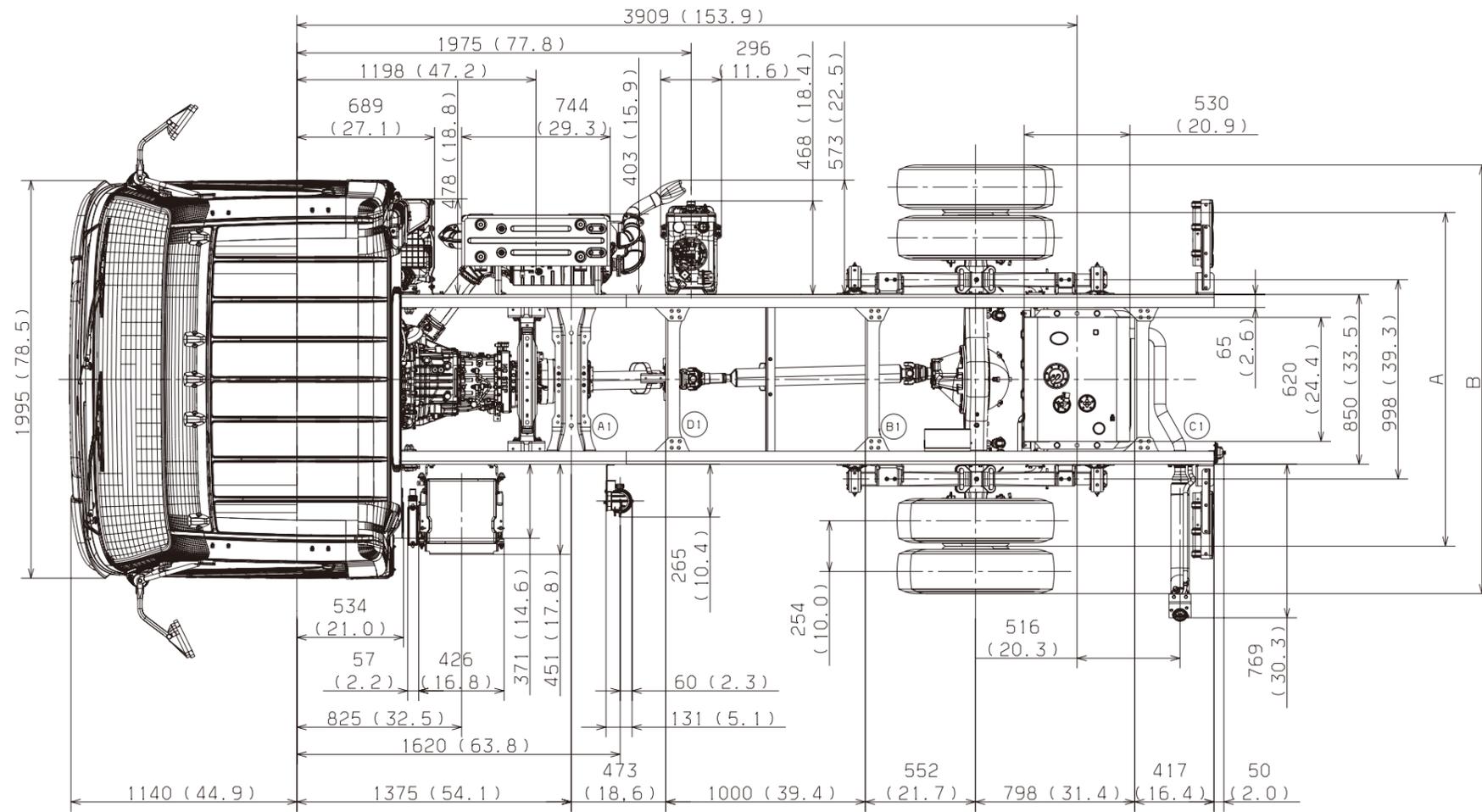
CHASSIS CAB  
DRAWINGS

FEC52CL3SUHD  
FEC72CL3SUHD  
FEC92CL3SUHD  
UNIT :mm(in.)  
SCALE :1/30

215/75R17.5



10.5 Chassis cab drawings



	TIRE SIZE	A	B
FEC52EL3SUHD	215/85R16	1660 (65.4)	2143 (84.4)
FEC72EL3SUHD	215/75R17.5	1670 (65.7)	2144 (84.4)
FEC92EL3SUHD			

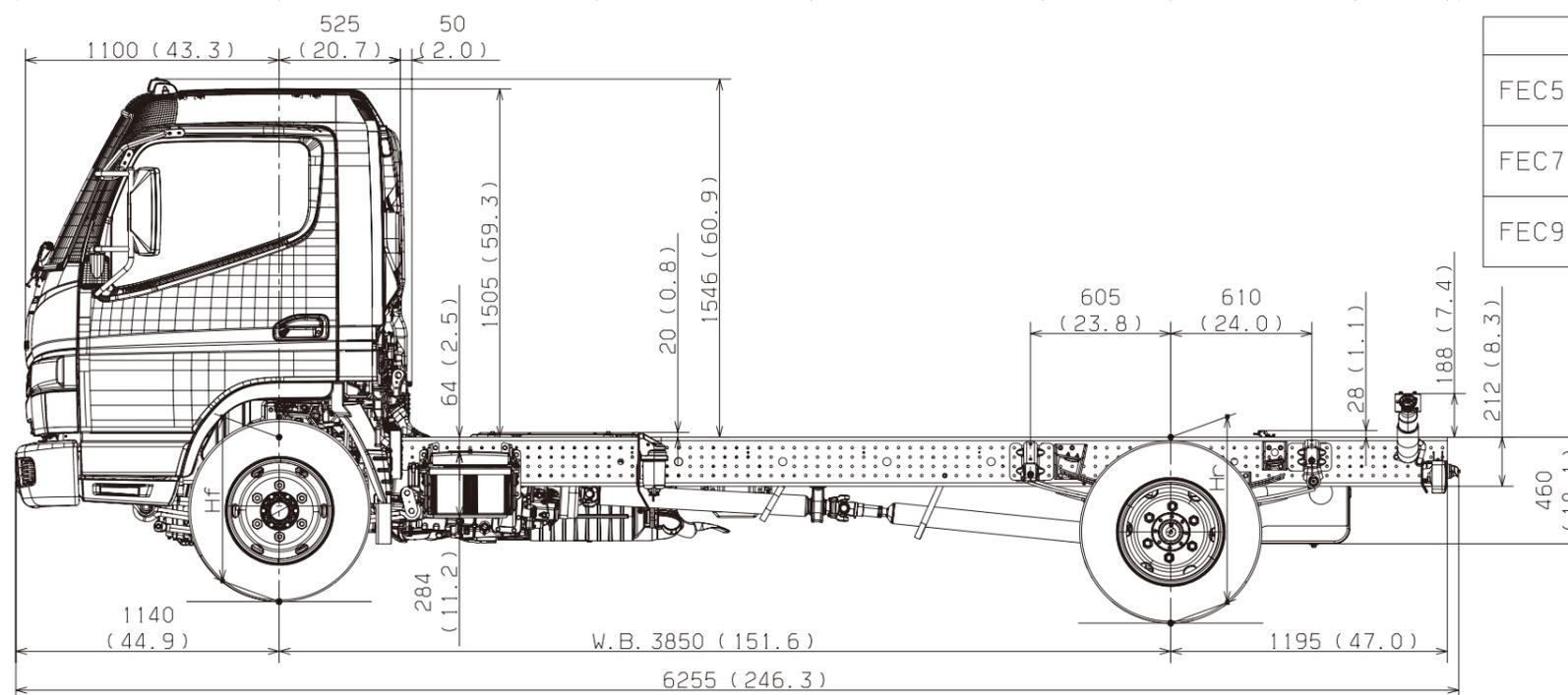
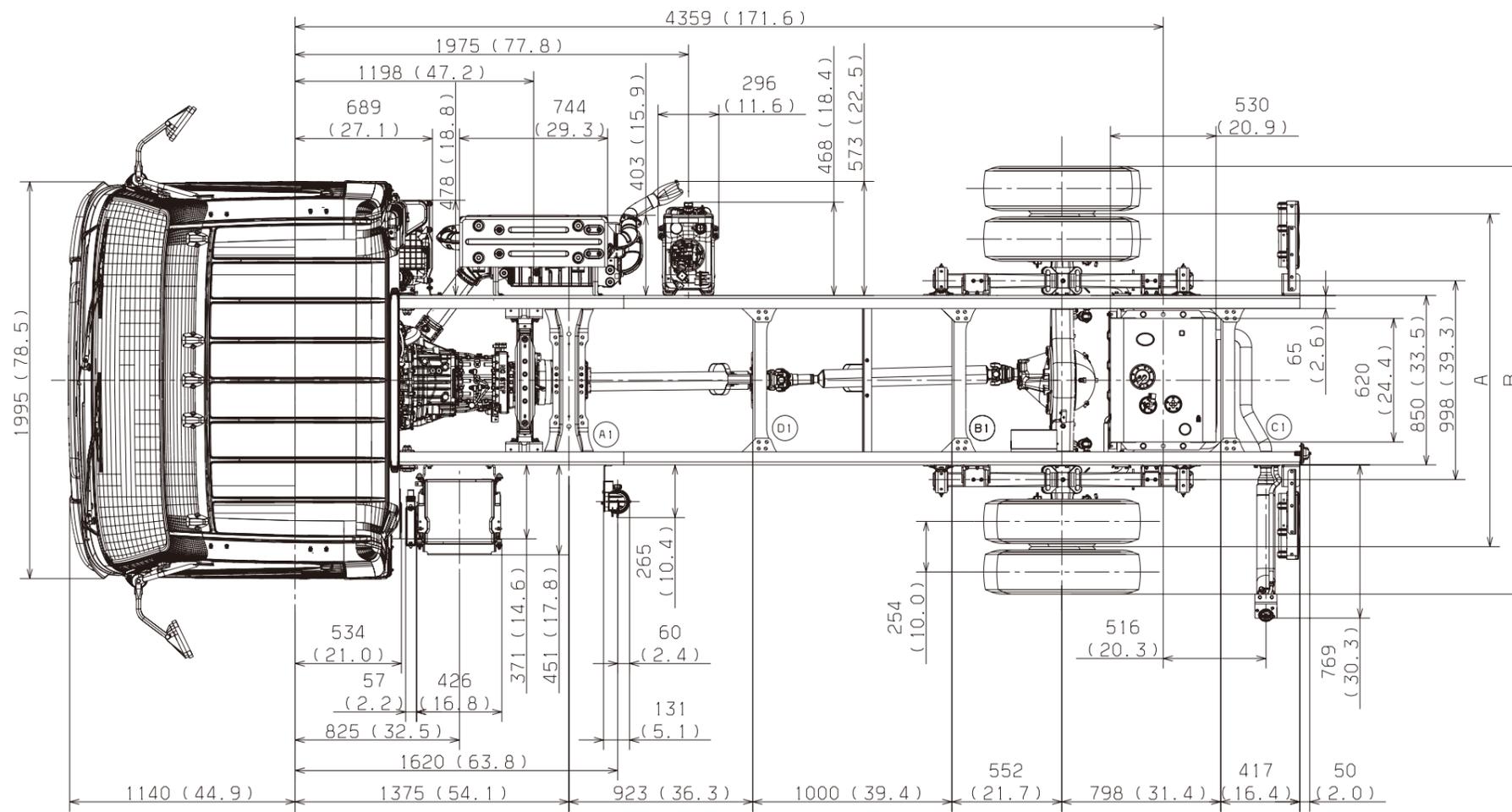
CHASSIS CAB  
DRAWINGS

FEC52EL3SUHD  
FEC72EL3SUHD  
FEC92EL3SUHD  
UNIT :mm(in.)  
SCALE :1/30

215/75R17.5



10.5 Chassis cab drawings



	TIRE SIZE	A	B
FEC52GL3SUHD	215/85R16	1660 (65.4)	2143 (84.4)
FEC72GL3SUHD	215/75R17.5	1670 (65.7)	2144 (84.4)
FEC92GL3SUHD			

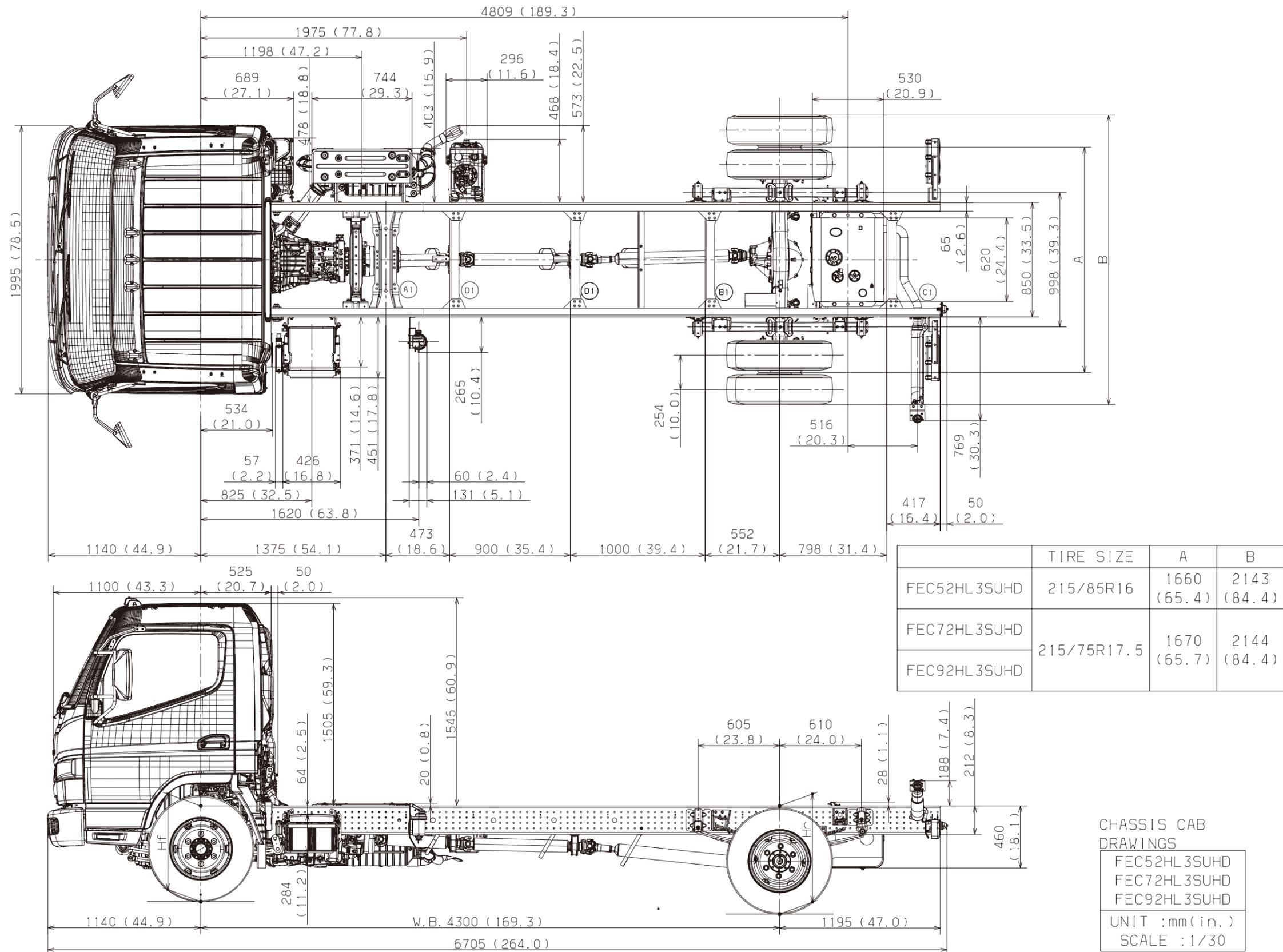
CHASSIS CAB  
DRAWINGS

FEC52GL3SUHD  
FEC72GL3SUHD  
FEC92GL3SUHD  
UNIT :mm(in.)  
SCALE :1/30

215/75R17.5



10.5 Chassis cab drawings



CHASSIS CAB  
DRAWINGS

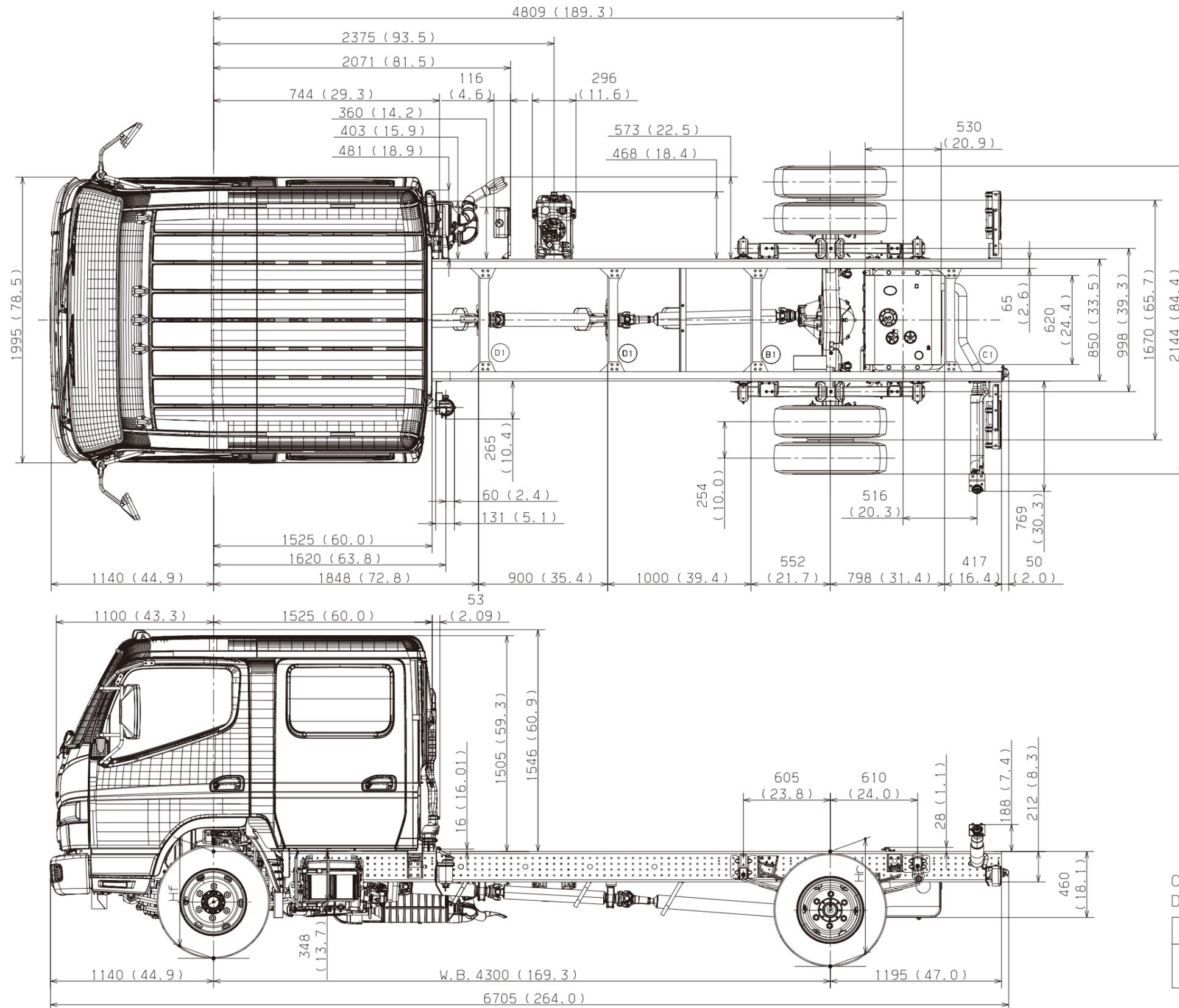
FEC52HL3SUHD  
FEC72HL3SUHD  
FEC92HL3SUHD

UNIT :mm(in.)  
SCALE :1/30

215/75R17.5



10.5 Chassis cab drawings



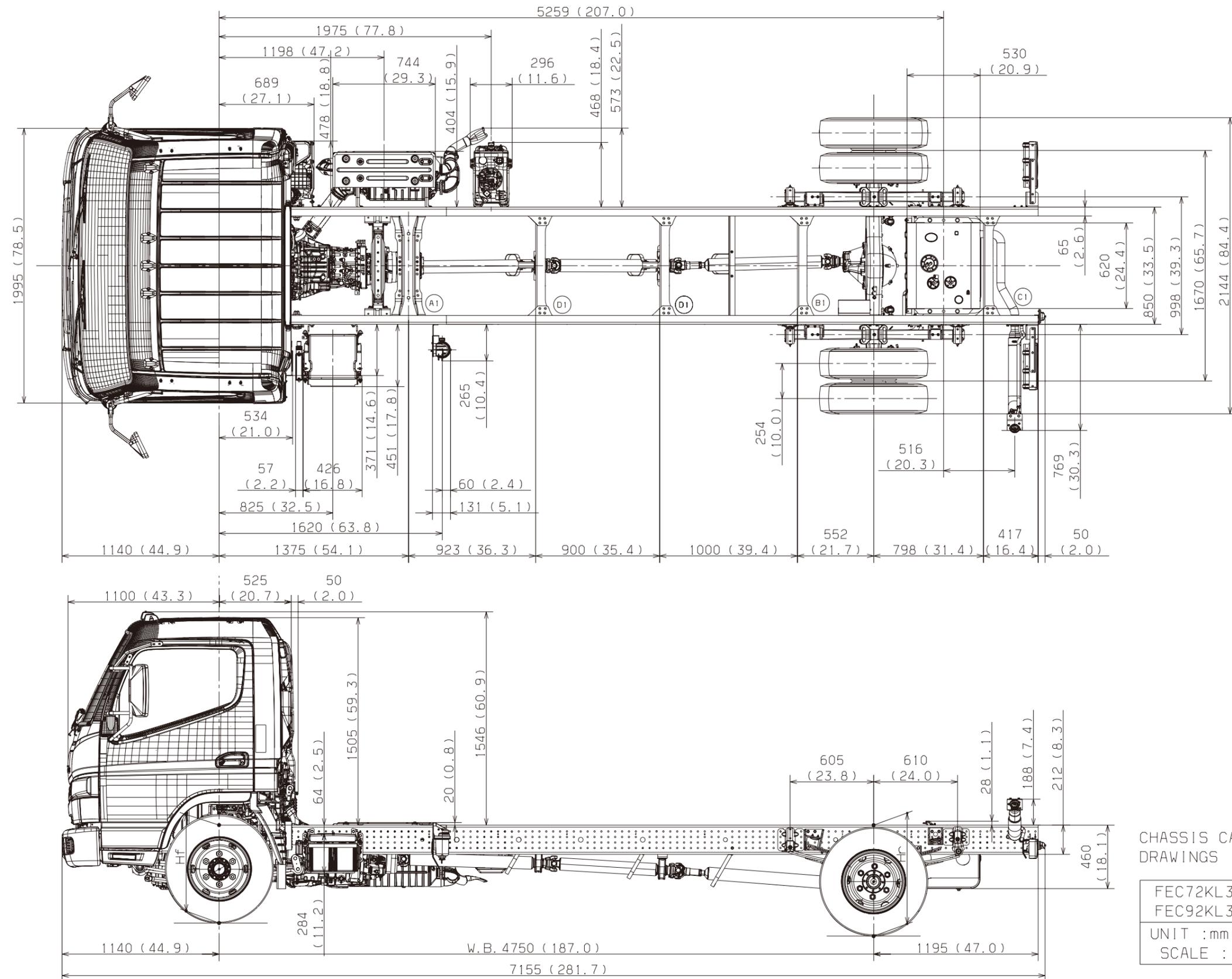
CHASSIS CAB  
DRAWINGS

FEC72HL3WUHD  
UNIT :mm(in.)  
SCALE :1/30

215/75R17.5



10.5 Chassis cab drawings



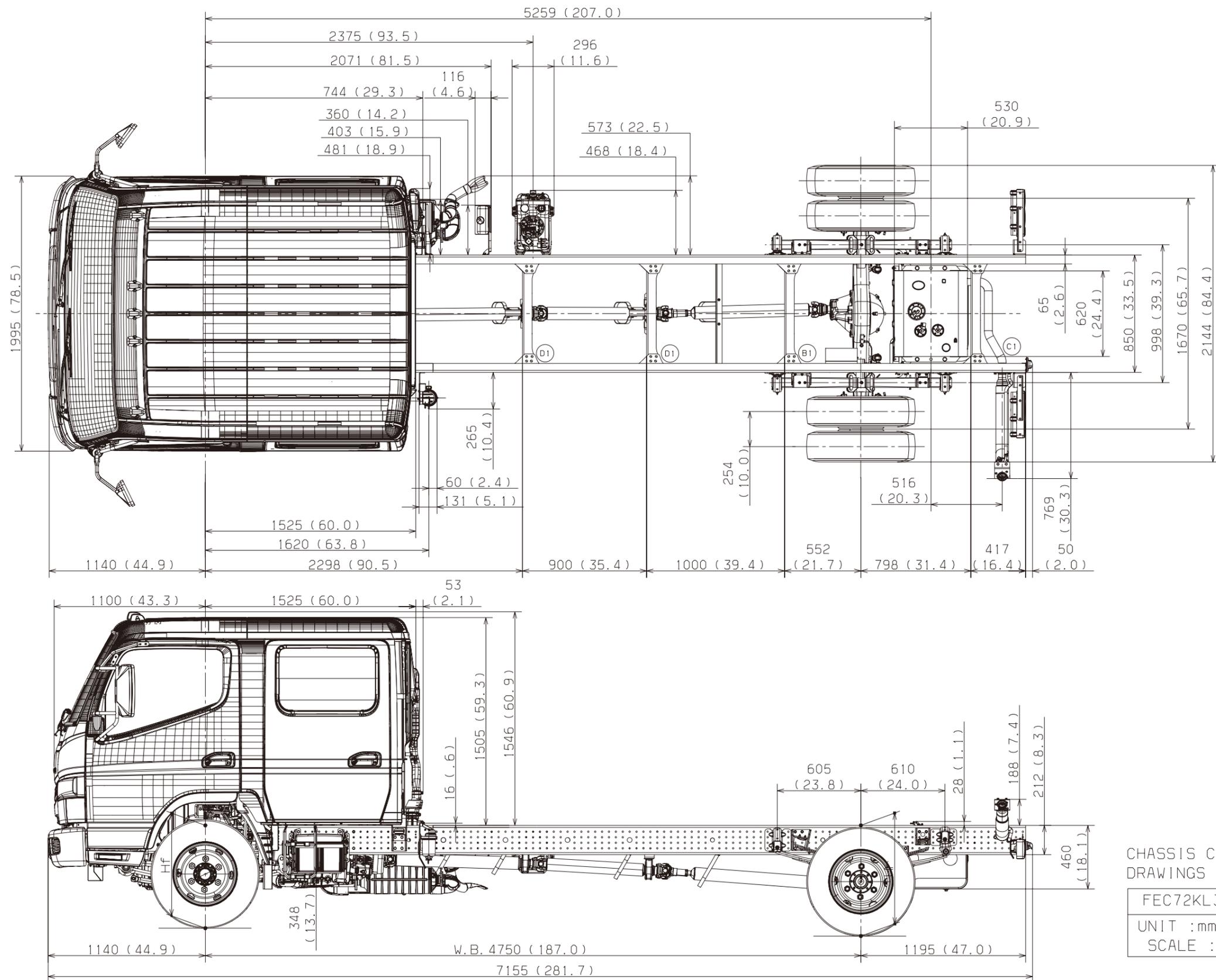
CHASSIS CAB  
DRAWINGS

FEC72KL3SUHD
FEC92KL3SUHD
UNIT :mm(in.)
SCALE :1/30

215/75R17.5



10.5 Chassis cab drawings



CHASSIS CAB  
DRAWINGS

FEC72KL3WUHD

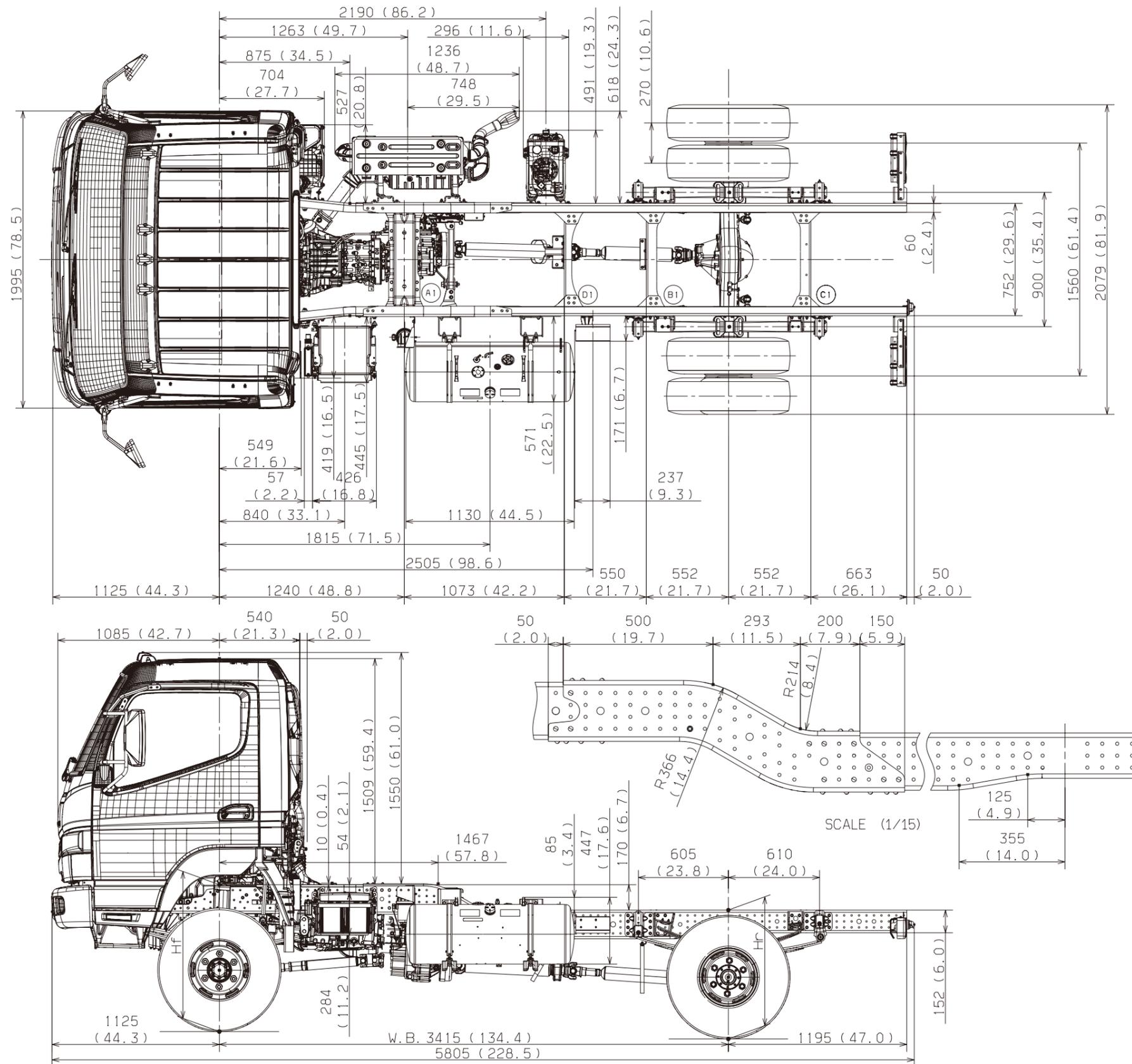
UNIT :mm(in.)

SCALE :1/30

215/75R17.5



10.5 Chassis cab drawings



CHASSIS CAB  
DRAWINGS

FGB72EL3SUHD

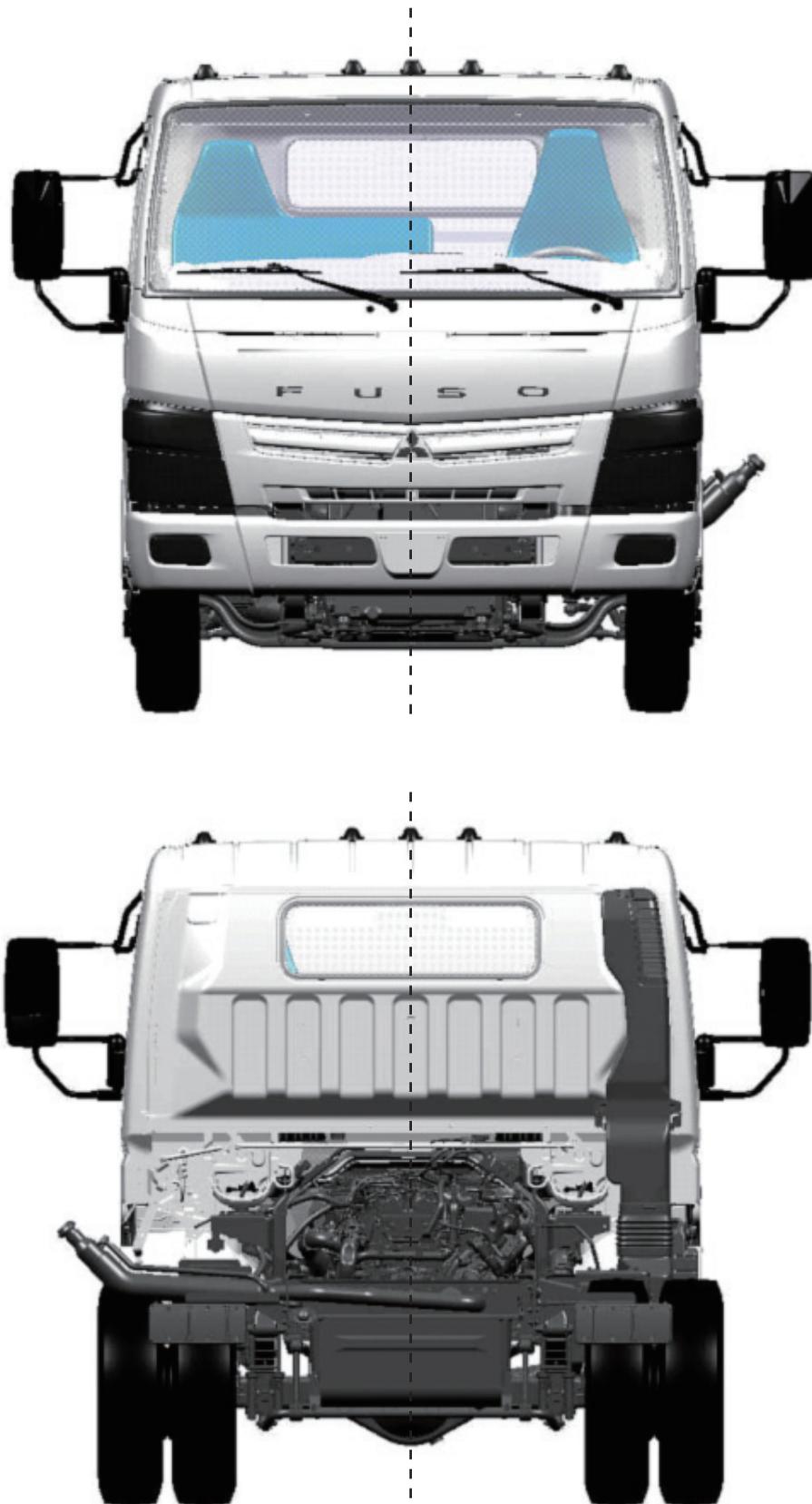
UNIT :mm(in.)  
SCALE :1/30

235/85R16

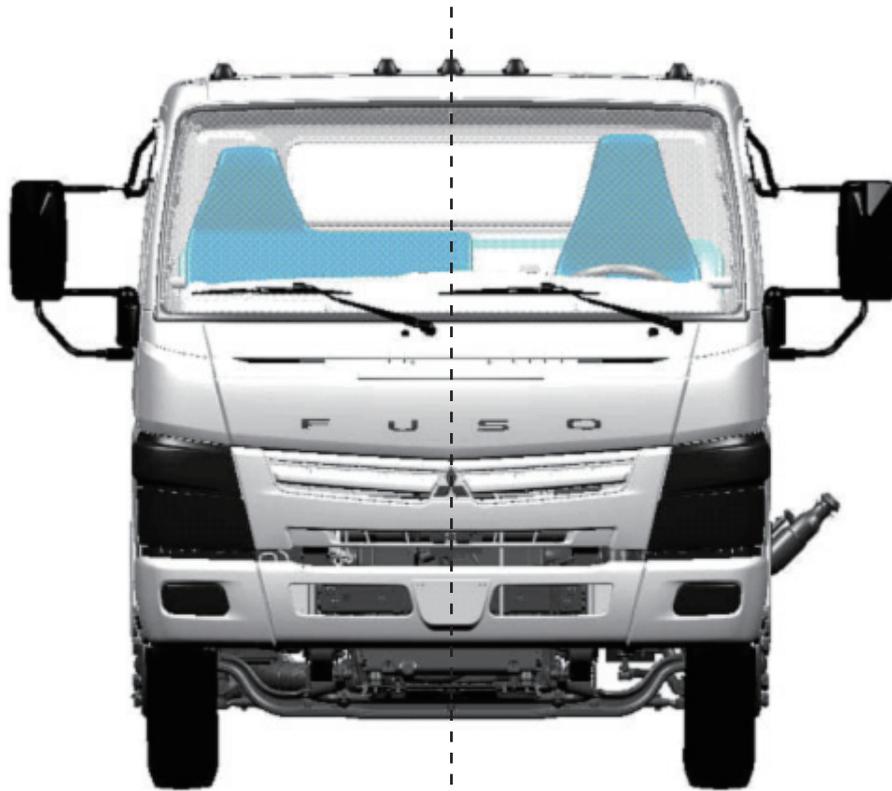


### 10.5.2 Cab drawings

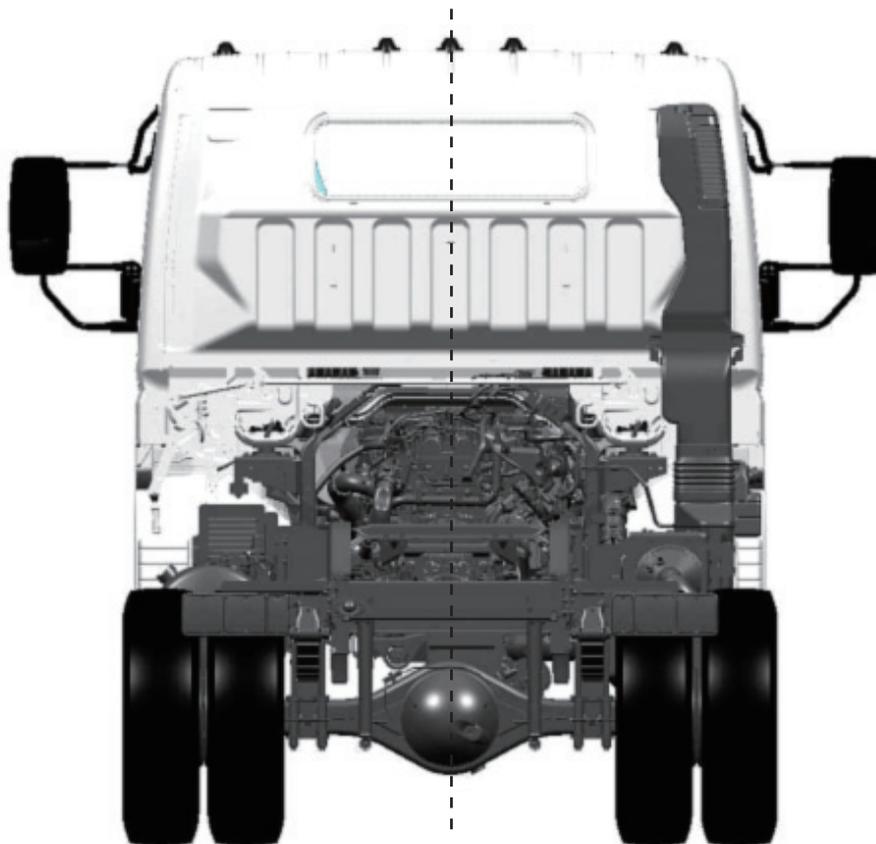
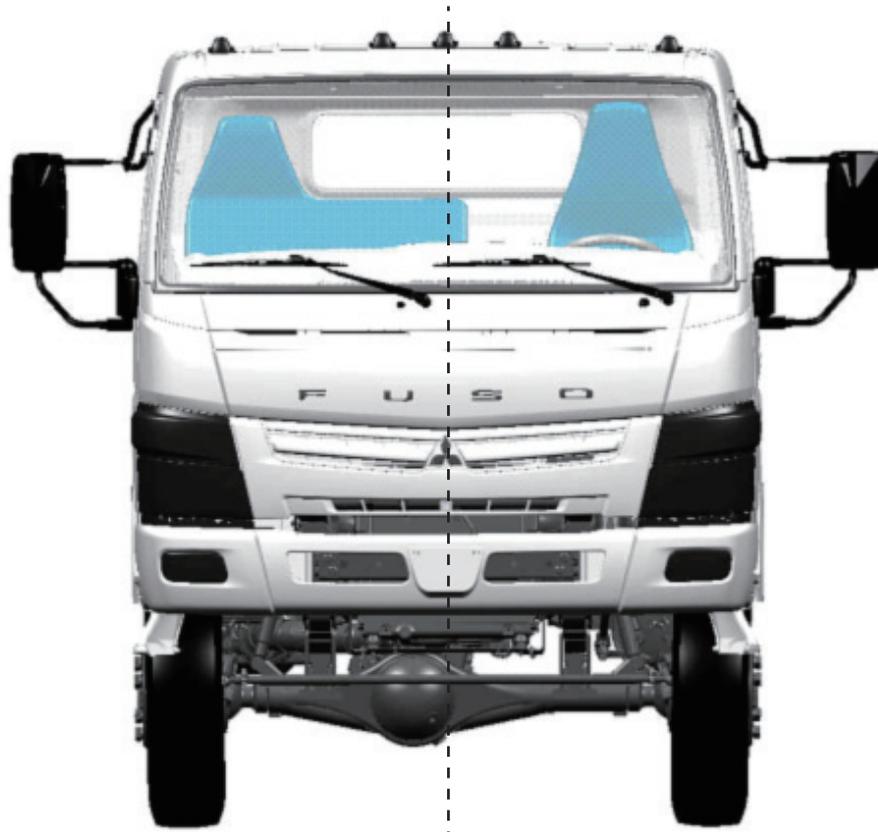
Model	Page
FEC52CL3SUHD	253
FEC52EL3SUHD	
FEC52GL3SUHD	
FEC52HL3SUHD	
FEC72CL3SUHD	
FEC72EL3SUHD	
FEC72GL3SUHD	
FEC72HL3SUHD	
FEC72KL3SUHD	
FEC92CL3SUHD	
FEC92EL3SUHD	
FEC92GL3SUHD	
FEC92HL3SUHD	
FEC92KL3SUHD	
FEC72HL3WUHD	254
FEC72KL3WUHD	
FGB72EL3SUHD	255



Single cab

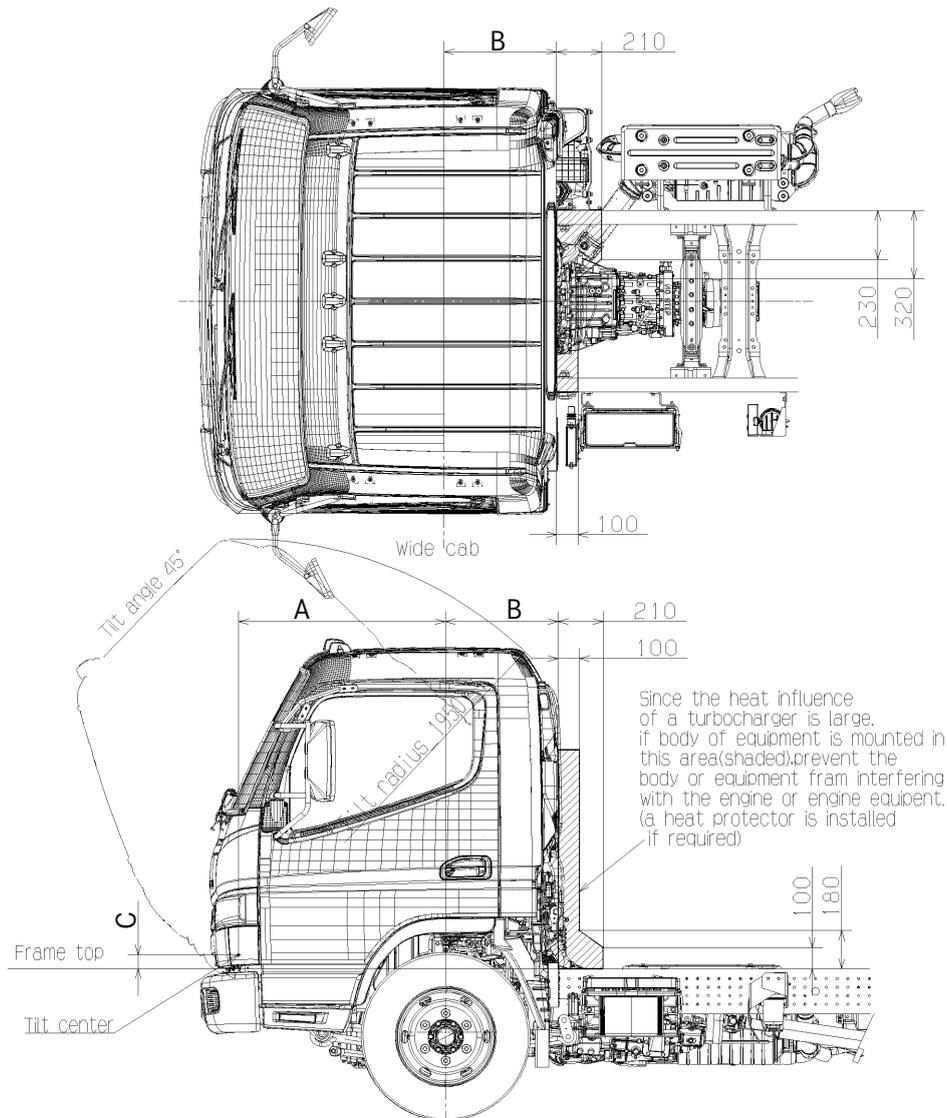


Crew cab



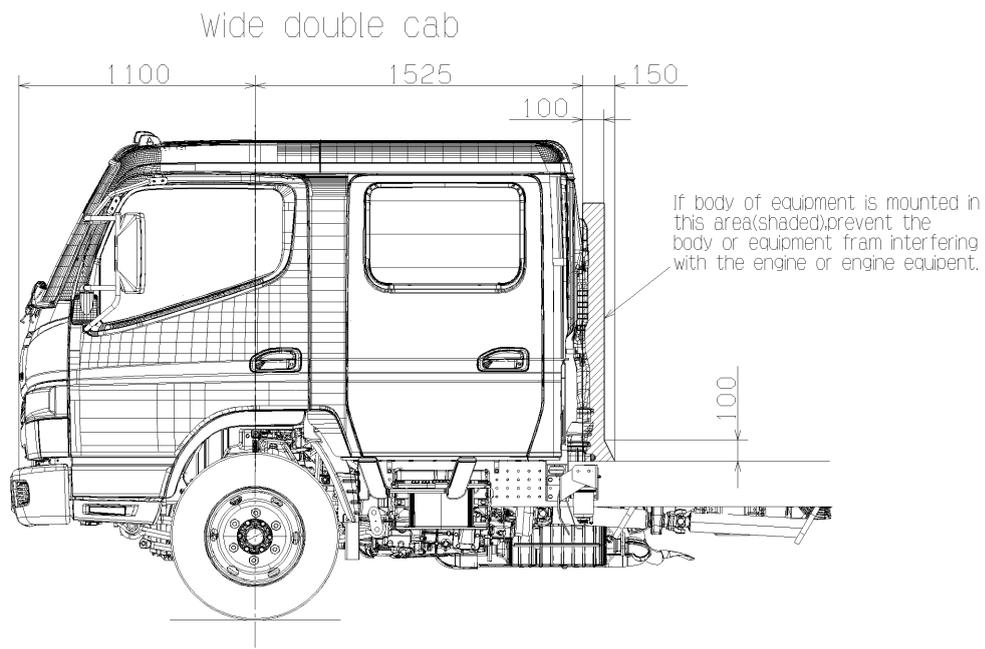
FG single cab

### 10.5.3 Cab side view



unit: mm (inch)

	<b>A : Front axle center to cab tilt center</b>	<b>B : Front axle center to cab end</b>	<b>C : Top surface of frame to cab tilt center</b>
FEC	965 (37.99)	525 (20.67)	55 (2.17)
FGB	950 (37.40)	540 (21.26)	65 (2.56)



### 10.6 Frame structure

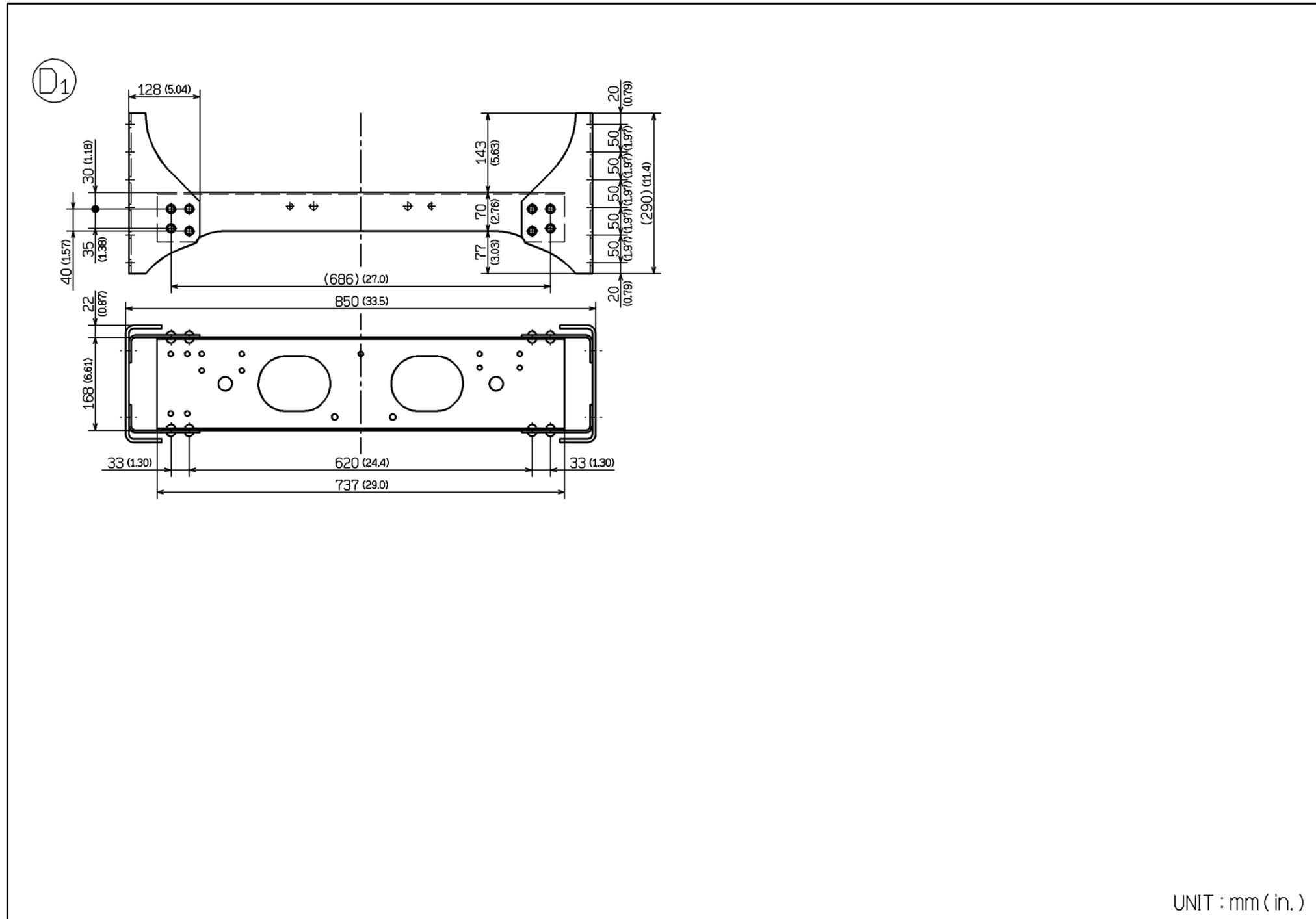
#### 10.6.1 Detail of crossmembers

Model	Section	Page	Down Load
FE	A-A, B-B, C-C	259	.dxf
	D-D	260	.dxf
FG	A-A, D-D	261	.dxf

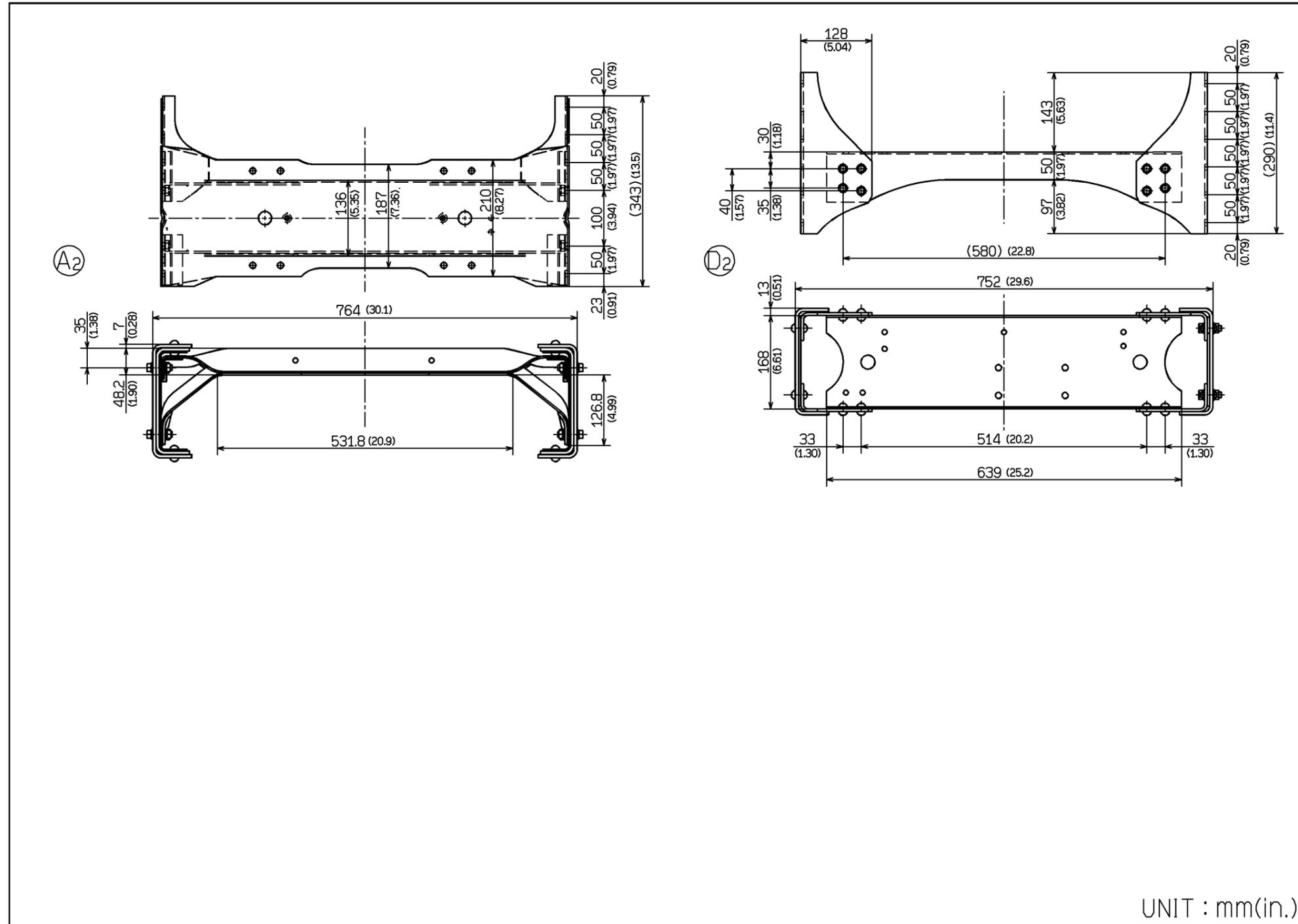




10.6 Frame structure



10.6 Frame structure



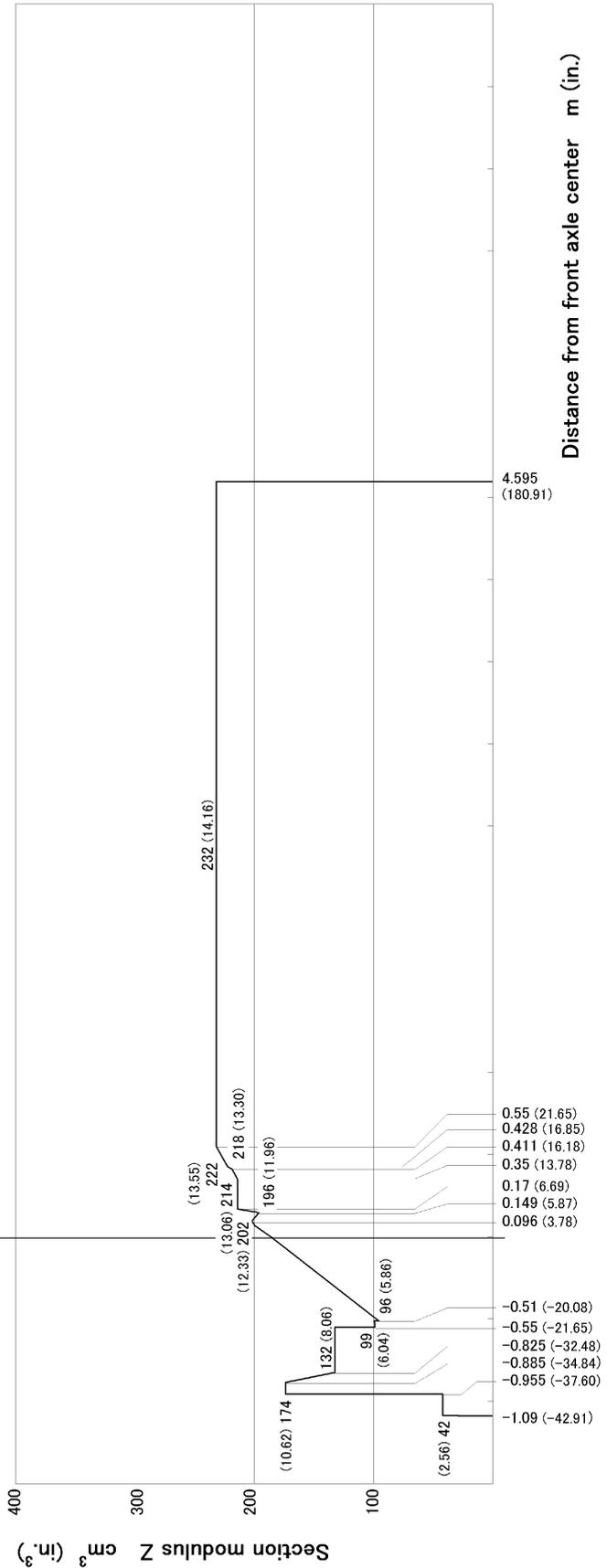
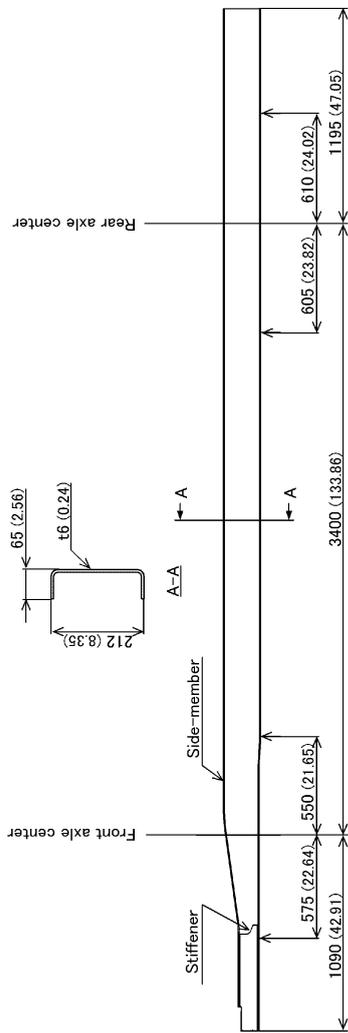
#### 10.6.2 Frame section module

Model	Page
FEC□2C	263
FEC□2E	264
FEC□2G	265
FEC□2H	266
FEC□2K	267
FGB□2E	268



Model FEC□2E Chassis frame section modulus

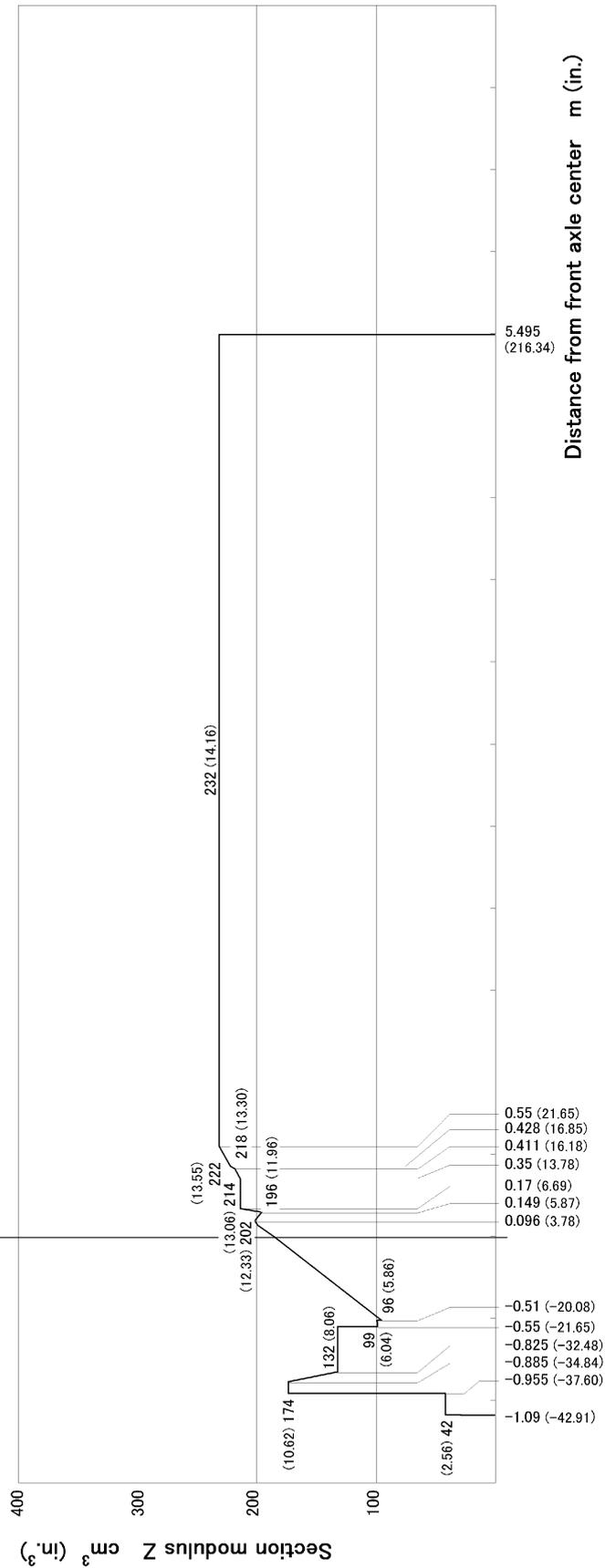
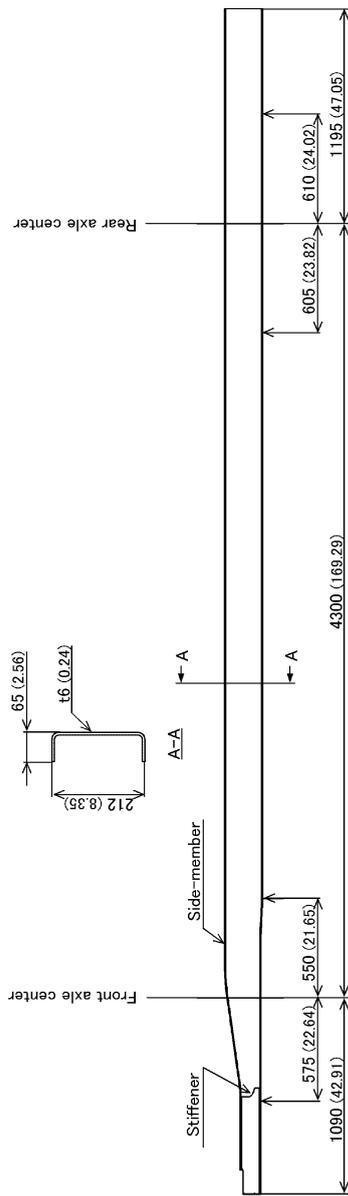
Side-member	HTP540
Material	540Mpa
Tensile strength	390Mpa
Yield point	
Stiffener	MJSH440
Material	440Mpa
Tensile strength	305Mpa
Yield point	





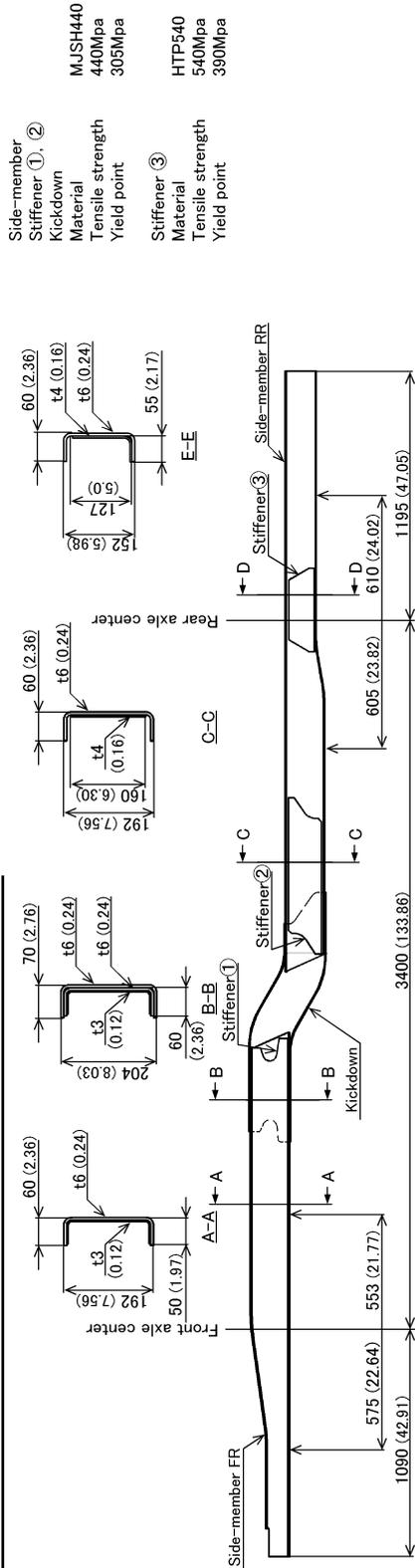
Model FEC□2H Chassis frame section modulus

Side-member	HTP540
Material	540Mpa
Tensile strength	390Mpa
Yield point	
Stiffener	MJSH440
Material	440Mpa
Tensile strength	305Mpa
Yield point	



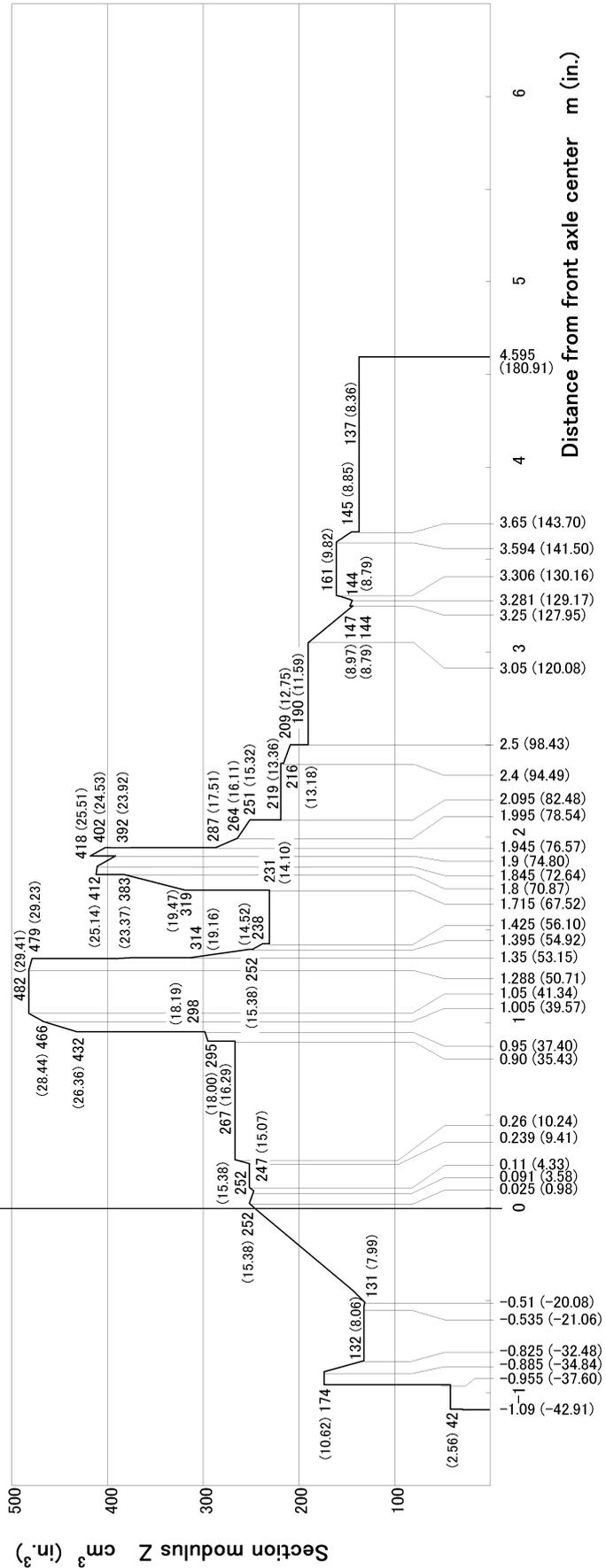


**Model FGB□2E Chassis frame section modulus**



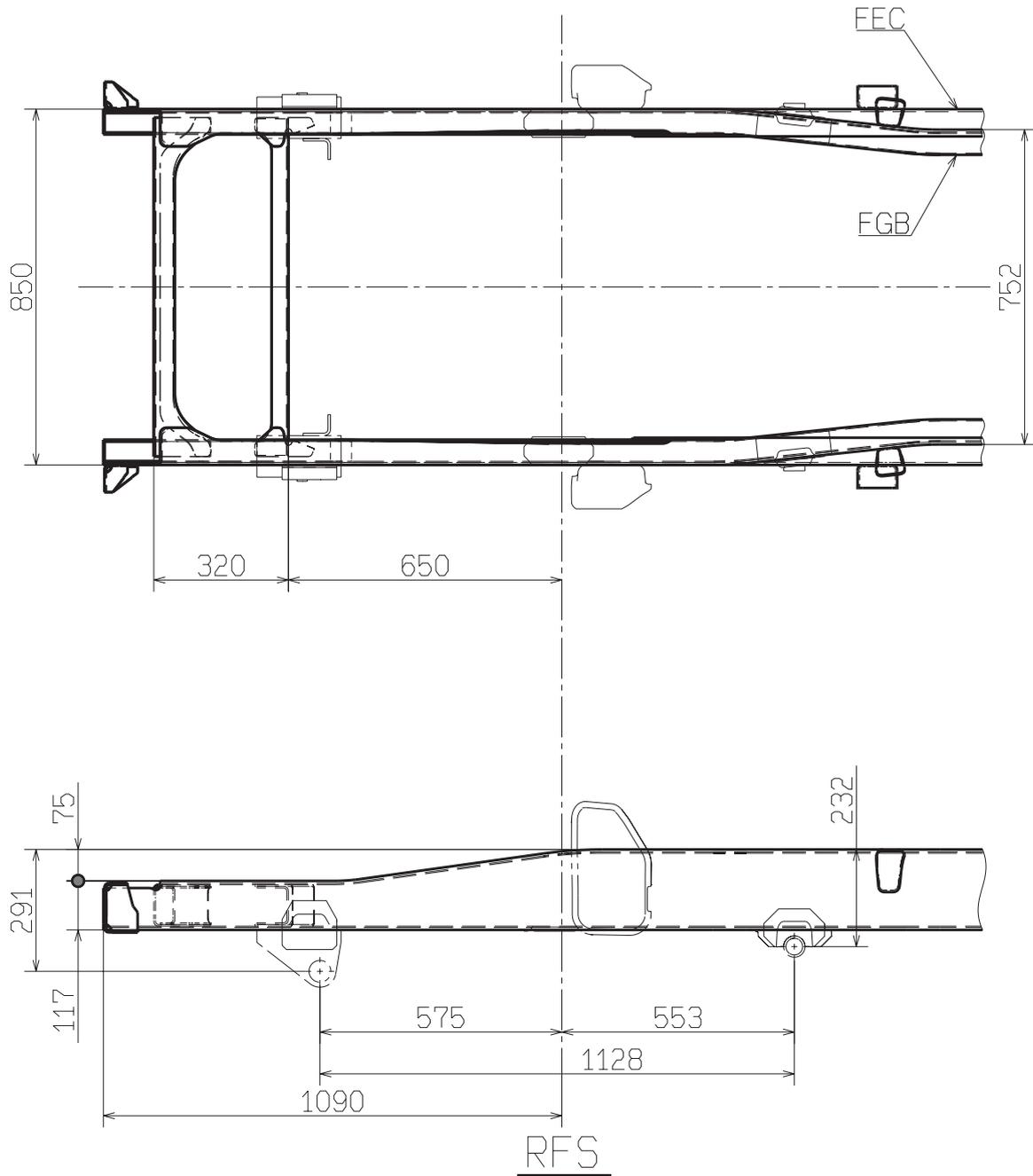
Side-member Stiffener ①, ②  
Kickdown  
Material MJSH440  
Tensile strength 440Mpa  
Yield point 305Mpa

Stiffener ③  
Material HTP540  
Tensile strength 540Mpa  
Yield point 390Mpa



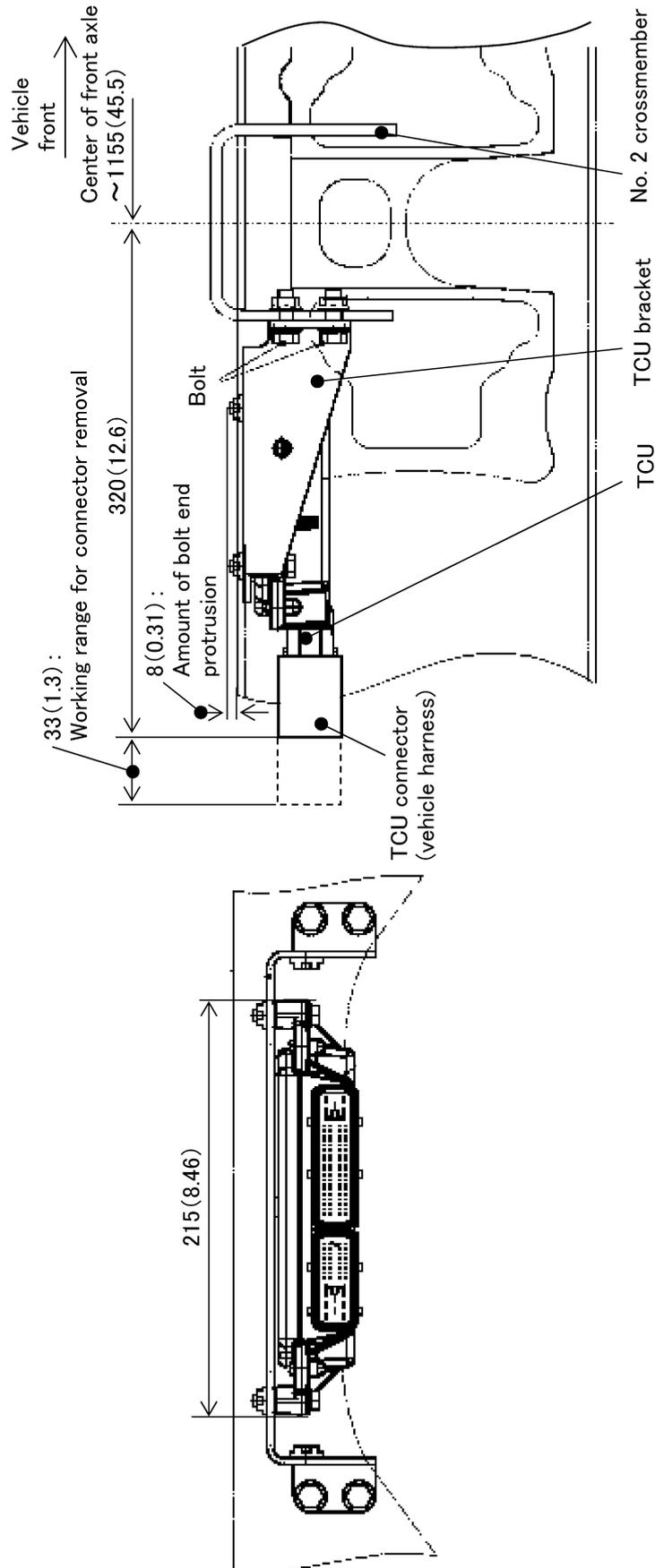
#### 10.6.3 Frame front drawings

Front suspension type	Model	Frame width	Page	Down Load
Rigid	FEC5, 7, 9	850	270	.dxf
	FGB7	750		



10.6.4 TCU installation drawing

Auxiliary equipment installation drawing



UNIT : mm (in)



### 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 (in)		CoG. HEIGHT mm (in)
		Front Wf	Rear Wr	Total W	Front	Rear	Front ±10 Hf	Rear ±25 Hr	
FEC52CL3SUHD	120 (161)	1535 (3385)	835 (1840)	2370 (5225)	277 (610)	478 (1055)	695 (27.4)	790 (31.1)	610 (24.0)
FEC52EL3SUHD	120 (161)	1565 (3450)	840 (1850)	2405 (5300)	277 (610)	478 (1055)	694 (27.3)	790 (31.1)	610 (24.0)
FEC52GL3SUHD	120 (161)	1580 (3485)	840 (1850)	2420 (5335)	277 (610)	478 (1055)	693 (27.3)	790 (31.1)	610 (24.0)
FEC52HL3SUHD	120 (161)	1600 (3530)	850 (1875)	2450 (5405)	277 (610)	478 (1055)	692 (27.2)	790 (31.1)	610 (24.0)
FEC72CL3SUHD	120 (161)	1575 (3475)	920 (2030)	2495 (5505)	310 (685)	562 (1240)	715 (28.1)	796 (31.3)	610 (24.0)
FEC72EL3SUHD	120 (161)	1605 (3540)	925 (2040)	2530 (5580)	310 (685)	562 (1240)	714 (28.1)	796 (31.3)	610 (24.0)
FEC72GL3SUHD	120 (161)	1620 (3570)	925 (2040)	2545 (5610)	310 (685)	562 (1240)	713 (28.1)	796 (31.3)	610 (24.0)
FEC72HL3SUHD	120 (161)	1640 (3615)	935 (2060)	2575 (5675)	310 (685)	562 (1240)	713 (28.1)	795 (31.3)	610 (24.0)
FEC72HL3WUHD	120 (161)	1795 (3960)	1000 (2205)	2795 (6165)	310 (685)	562 (1240)	776 (30.6)	844 (33.2)	715 (28.1)
FEC72KL3SUHD	120 (161)	1650 (3640)	945 (2085)	2595 (5725)	310 (685)	562 (1240)	712 (28.0)	795 (31.3)	610 (24.0)
FEC72KL3WUHD	120 (161)	1815 (4000)	995 (2195)	2810 (6195)	310 (685)	562 (1240)	776 (30.6)	844 (33.2)	715 (28.1)
FEC92CL3SUHD	120 (161)	1575 (3475)	920 (2030)	2495 (5505)	310 (685)	562 (1240)	715 (28.1)	796 (31.3)	610 (24.0)
FEC92EL3SUHD	120 (161)	1605 (3540)	925 (2040)	2530 (5580)	310 (685)	562 (1240)	714 (28.1)	796 (31.3)	610 (24.0)
FEC92GL3SUHD	120 (161)	1620 (3570)	925 (2040)	2545 (5610)	310 (685)	562 (1240)	713 (28.1)	796 (31.3)	610 (24.0)
FEC92HL3SUHD	120 (161)	1640 (3615)	935 (2060)	2575 (5675)	310 (685)	562 (1240)	713 (28.1)	795 (31.3)	610 (24.0)
FEC92KL3SUHD	120 (161)	1650 (3640)	945 (2085)	2595 (5725)	310 (685)	562 (1240)	712 (28.0)	795 (31.3)	610 (24.0)
FGB72EL3SUHD	120 (161)	1835 (4045)	885 (1950)	2720 (5995)	403 (890)	550 (1215)	978 (38.5)	881 (34.7)	610 (24.0)

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 275.)

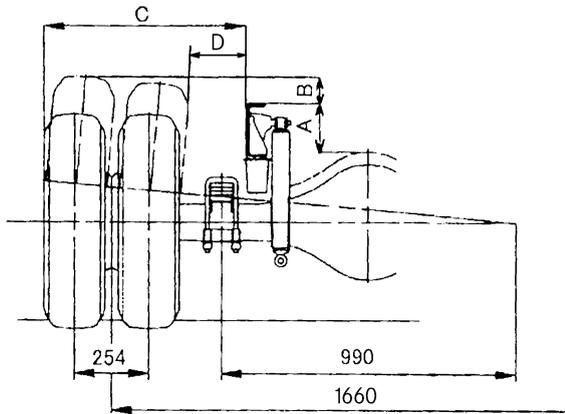
hr : Distance from frame top to rear wheel center (See drawings or following page 280.)

Rf, Rr : Tire radius (See drawings or following page 285.)

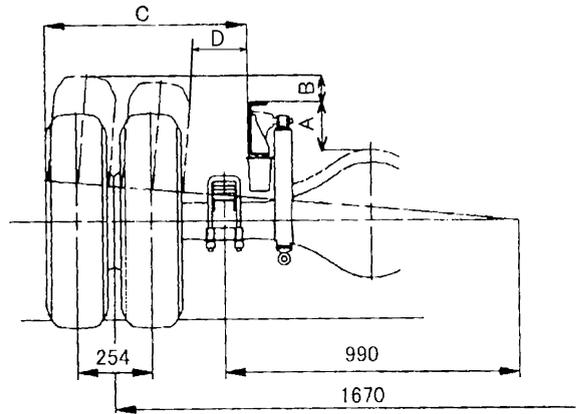
### 10.7.2 Differential and tire bound height

Model	Tire size	A mm (in)	B mm (in)	C mm (in)	D mm (in)
FEC52CL3SUHD	215/85R16	130 (5.1)	129 (5.1)	644.5 (25.4)	148 (5.8)
FEC52EL3SUHD	215/85R16	130 (5.1)	128 (5.0)	644.5 (25.4)	149 (5.9)
FEC52GL3SUHD	215/85R16	130 (5.1)	127 (5.0)	644.5 (25.4)	149 (5.9)
FEC52HL3SUHD	215/85R16	130 (5.1)	127 (5.0)	644.5 (25.4)	149 (5.9)
FEC72CL3SUHD	215/75R17.5	125 (4.9)	131 (5.2)	647 (25.5)	152 (6.0)
FEC72EL3SUHD	215/75R17.5	125 (4.9)	130 (5.1)	647 (25.5)	152 (6.0)
FEC72GL3SUHD	215/75R17.5	125 (4.9)	129 (5.1)	647 (25.5)	152 (6.0)
FEC72HL3SUHD	215/75R17.5	125 (4.9)	129 (5.1)	647 (25.5)	153 (6.0)
FEC72HL3WUHD	215/75R17.5	125 (4.9)	129 (5.1)	647 (25.5)	158 (6.2)
FEC72KL3SUHD	215/75R17.5	175 (6.9)	78 (3.1)	647 (25.5)	153 (6.0)
FEC72KL3WUHD	215/75R17.5	175 (6.9)	78 (3.1)	647 (25.5)	158 (6.2)
FEC92CL3SUHD	215/75R17.5	125 (4.9)	131 (5.2)	647 (25.5)	152 (6.0)
FEC92EL3SUHD	215/75R17.5	125 (4.9)	130 (5.1)	647 (25.5)	152 (6.0)
FEC92GL3SUHD	215/75R17.5	125 (4.9)	129 (5.1)	647 (25.5)	152 (6.0)
FEC92HL3SUHD	215/75R17.5	125 (4.9)	129 (5.1)	647 (25.5)	153 (6.0)
FEC92KL3SUHD	215/75R17.5	125 (4.9)	129 (5.1)	647 (25.5)	153 (6.0)
FGB72EL3SUHD	235/85R16	182 (7.2)	102 (4.0)	653 (25.7)	139 (5.5)

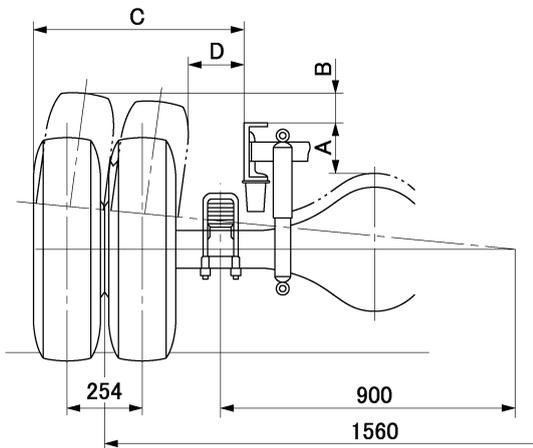
10.7 Spring characteristic



FEC5

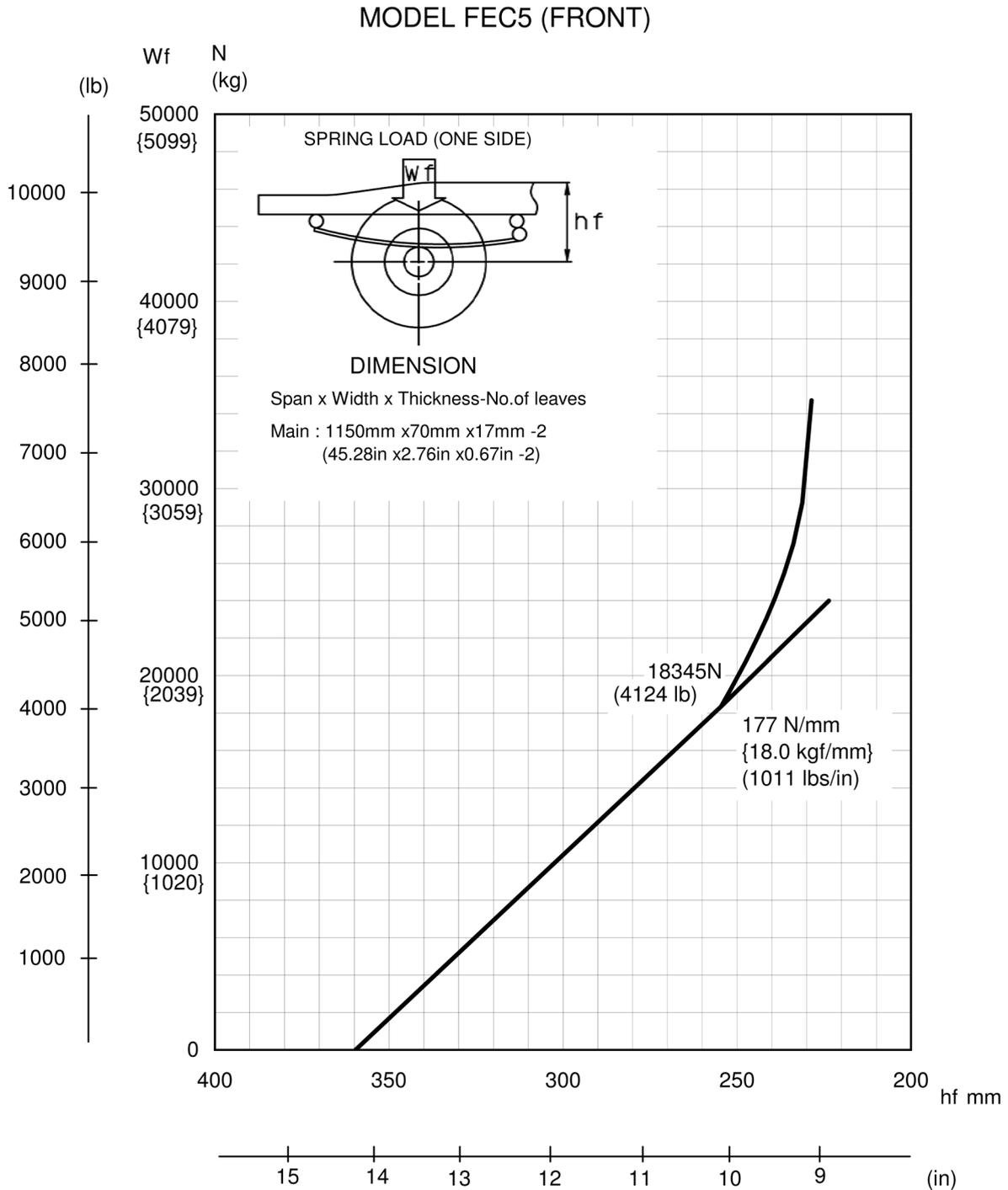


FEC7  
FEC9



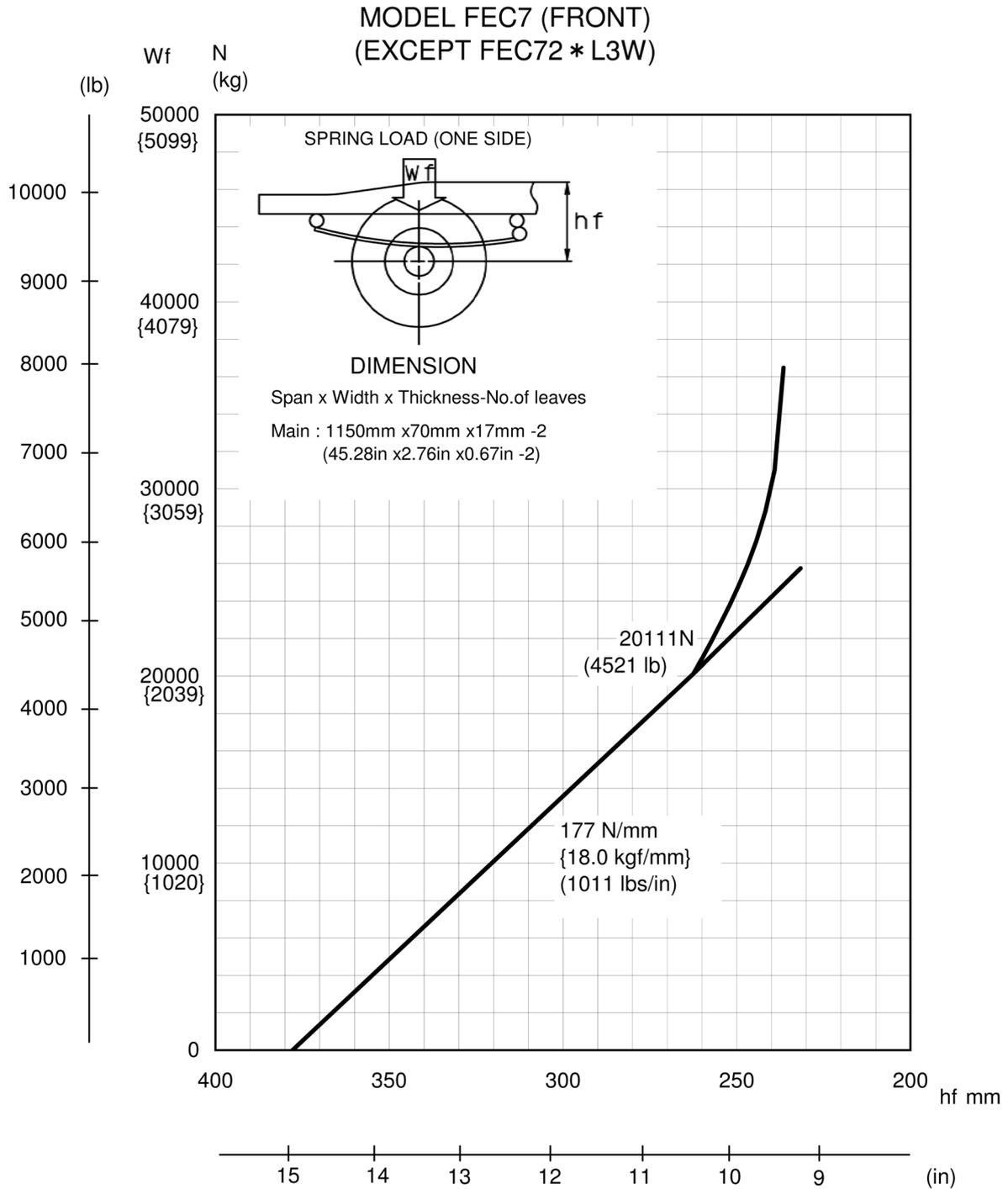
FGB7

10.7.3 Front spring diagram



hf: Distance from front wheel center to upper surface of frame

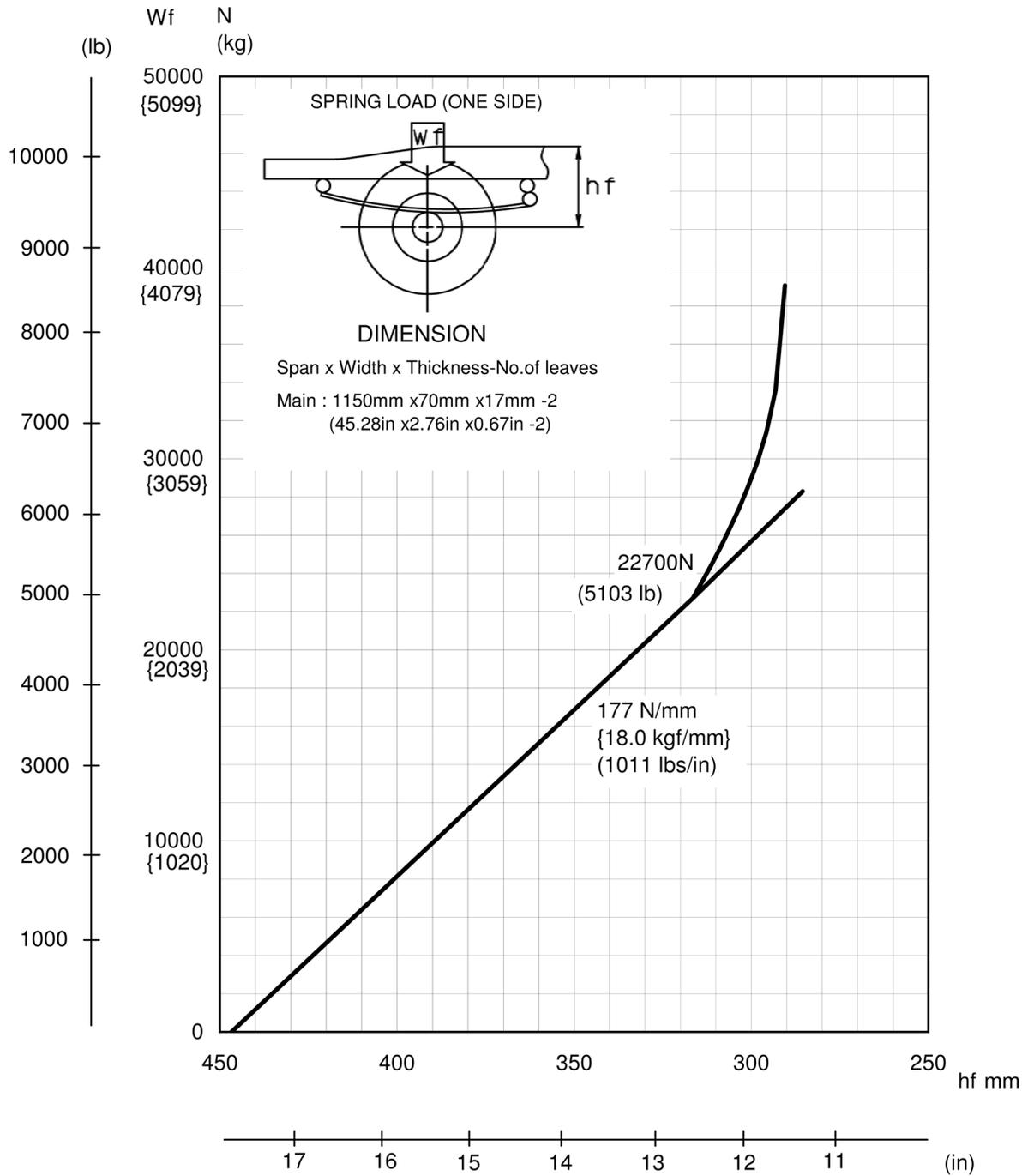




hf: Distance from front wheel center to upper surface of frame



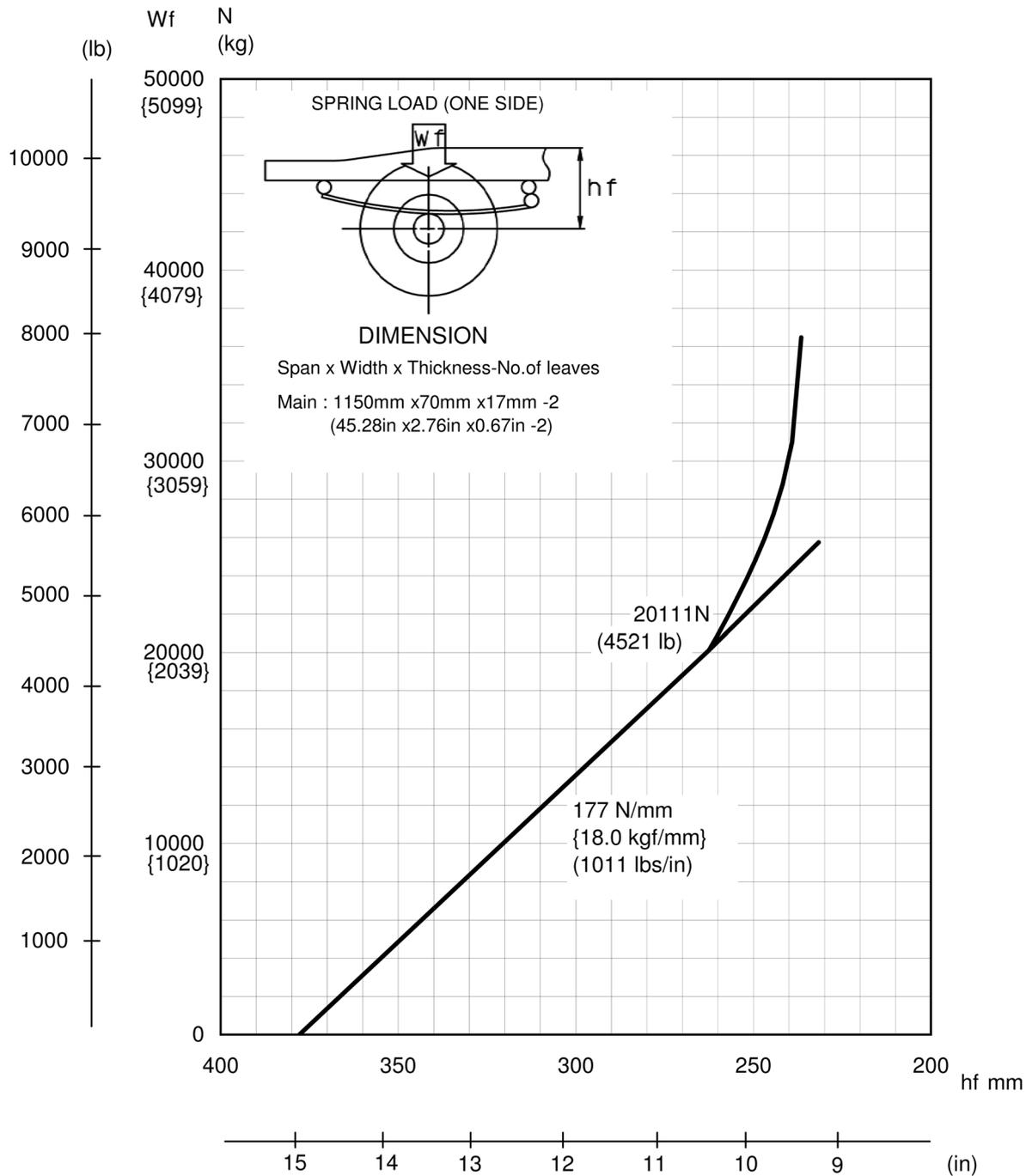
MODEL FEC72 \* L3W (FRONT)



hf: Distance from front wheel center to upper surface of frame



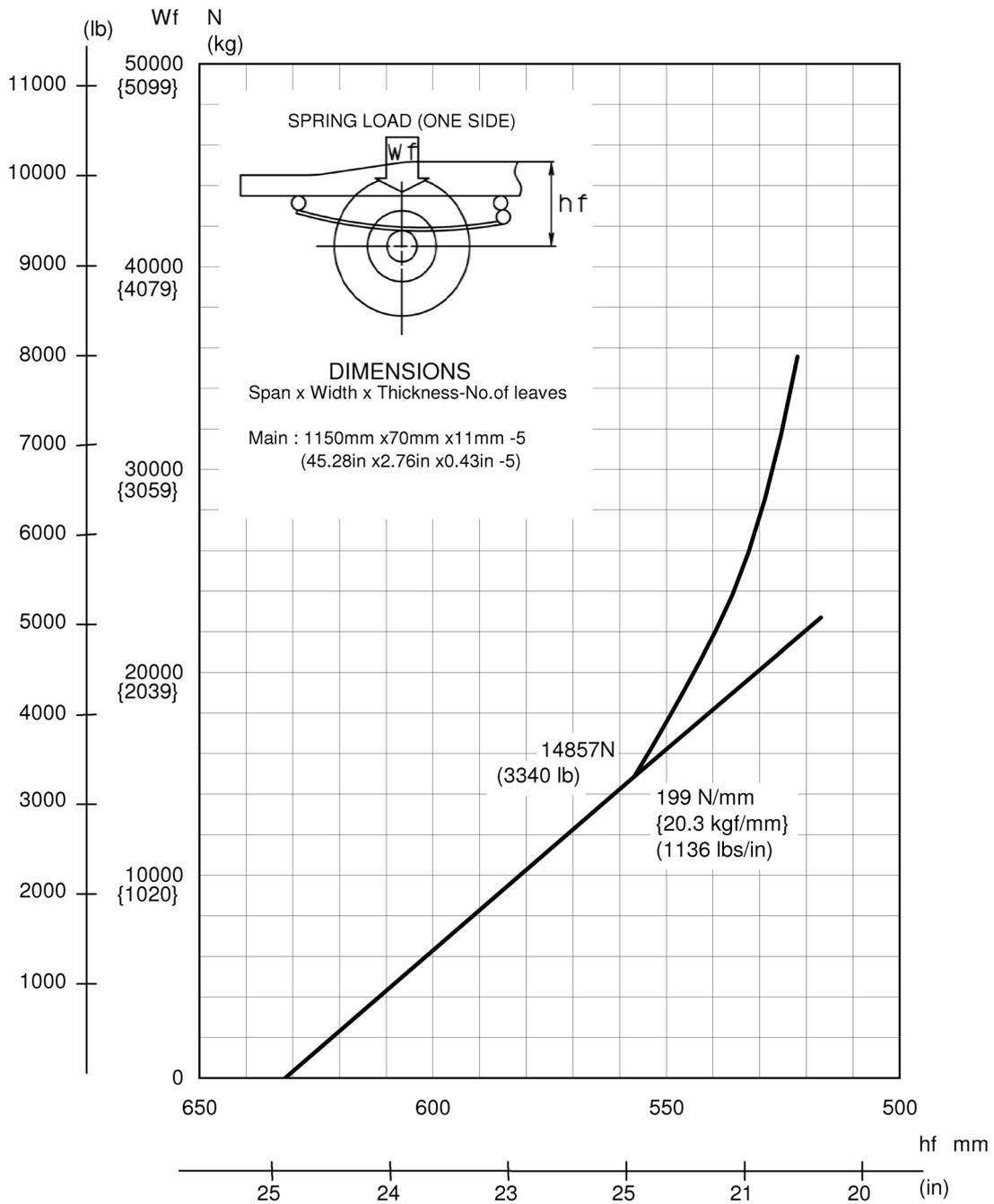
MODEL FEC9 (FRONT)



hf: Distance from front wheel center to upper surface of frame



MODEL FGB7 (FRONT)

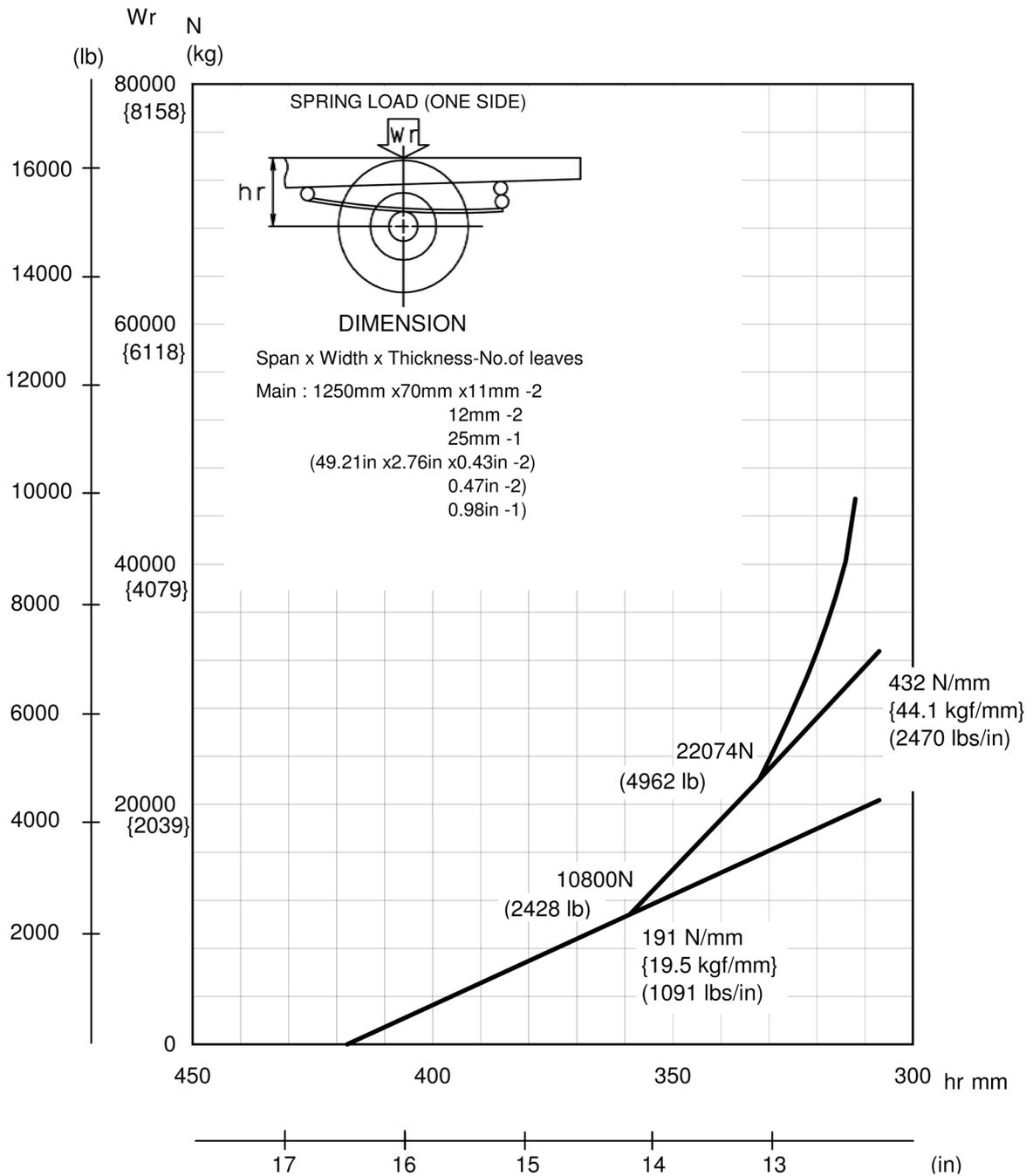


$h_f$ : Distance from front wheel center to upper surface of frame



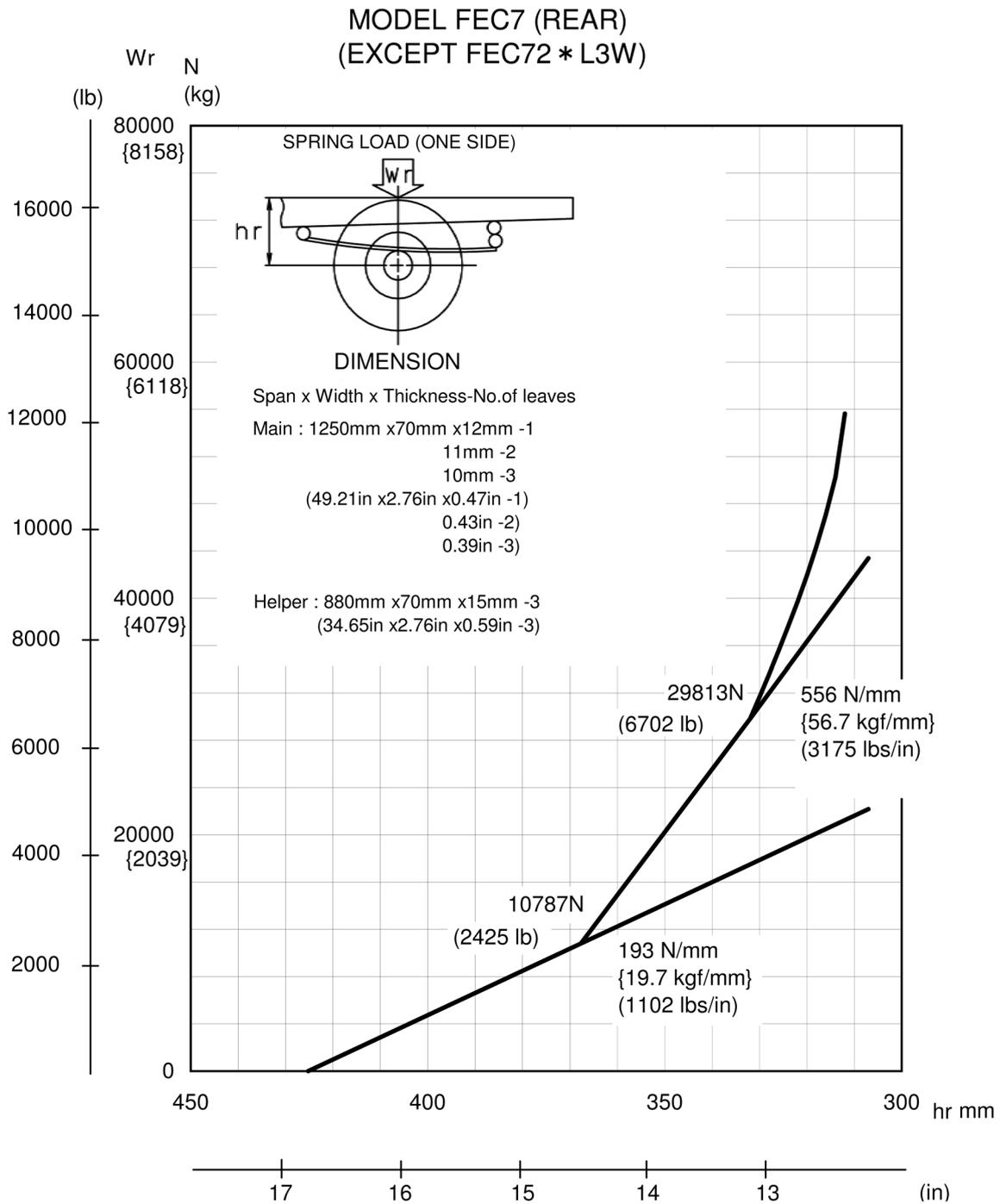
10.7.4 Rear spring diagram

MODEL FEC5 (REAR)



hr: Distance from rear wheel center to upper surface of frame

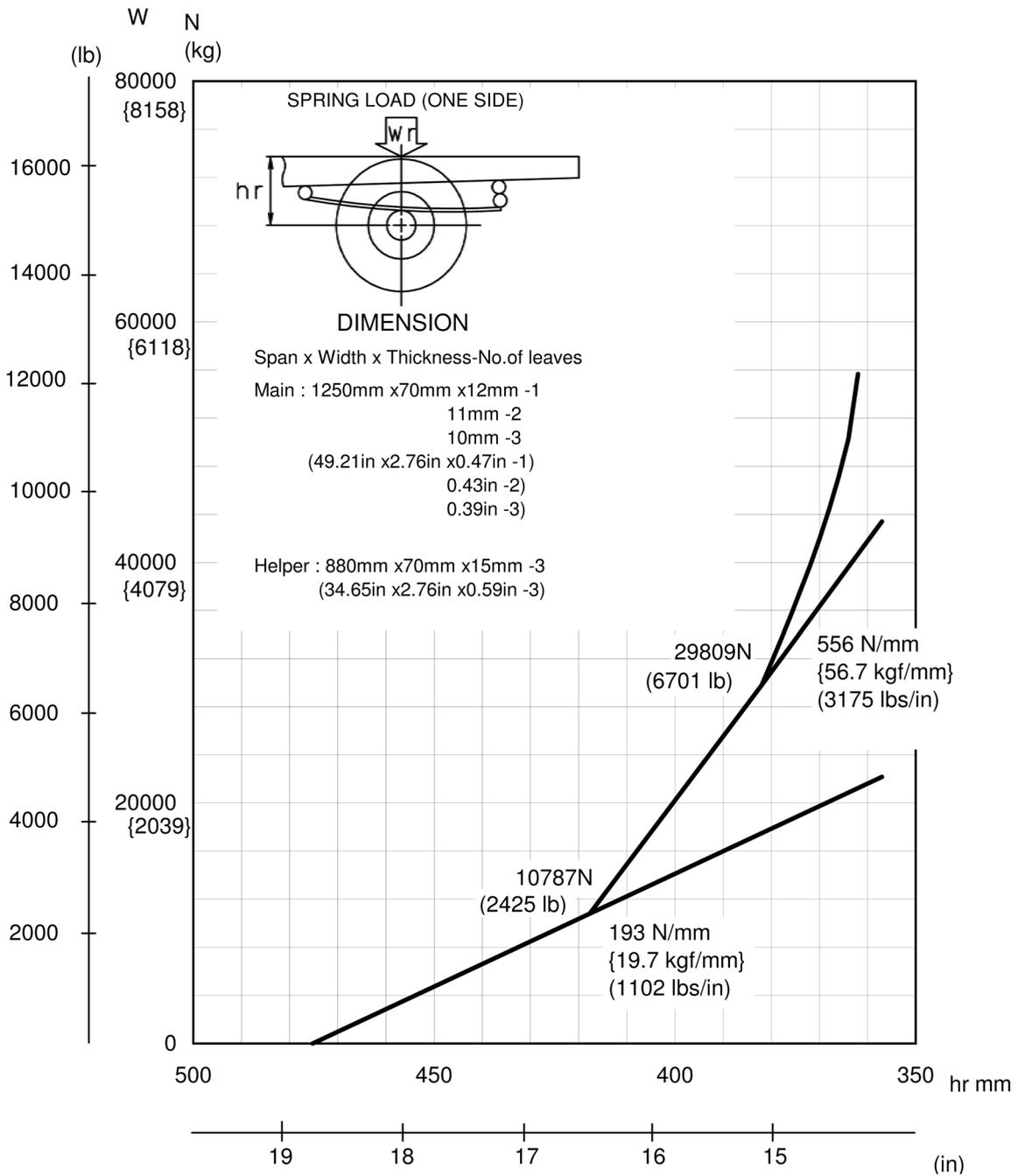




hr: Distance from rear wheel center to upper surface of frame



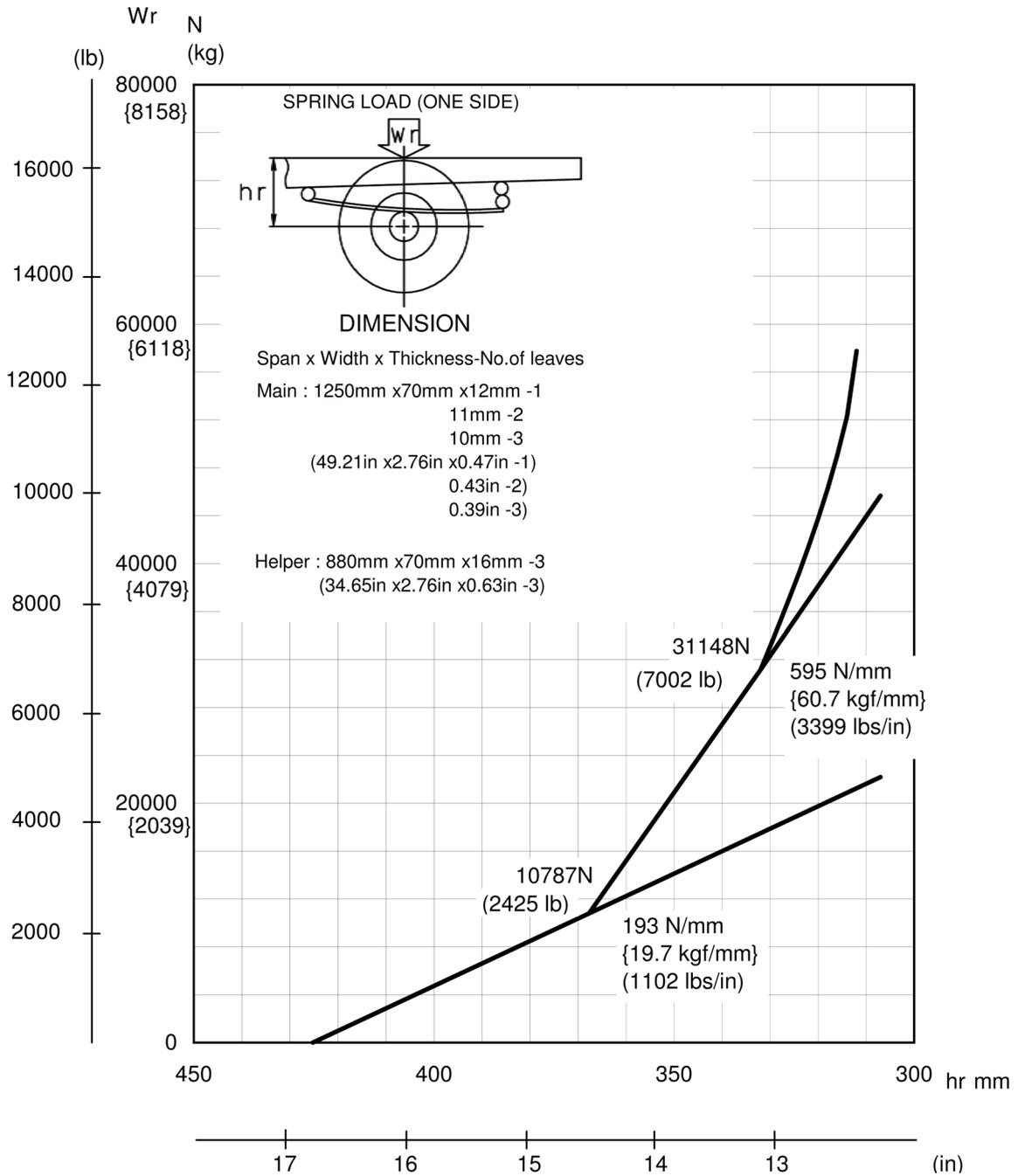
MODEL FEC72 \* L3W (REAR)



hr: Distance from rear wheel center to upper surface of frame



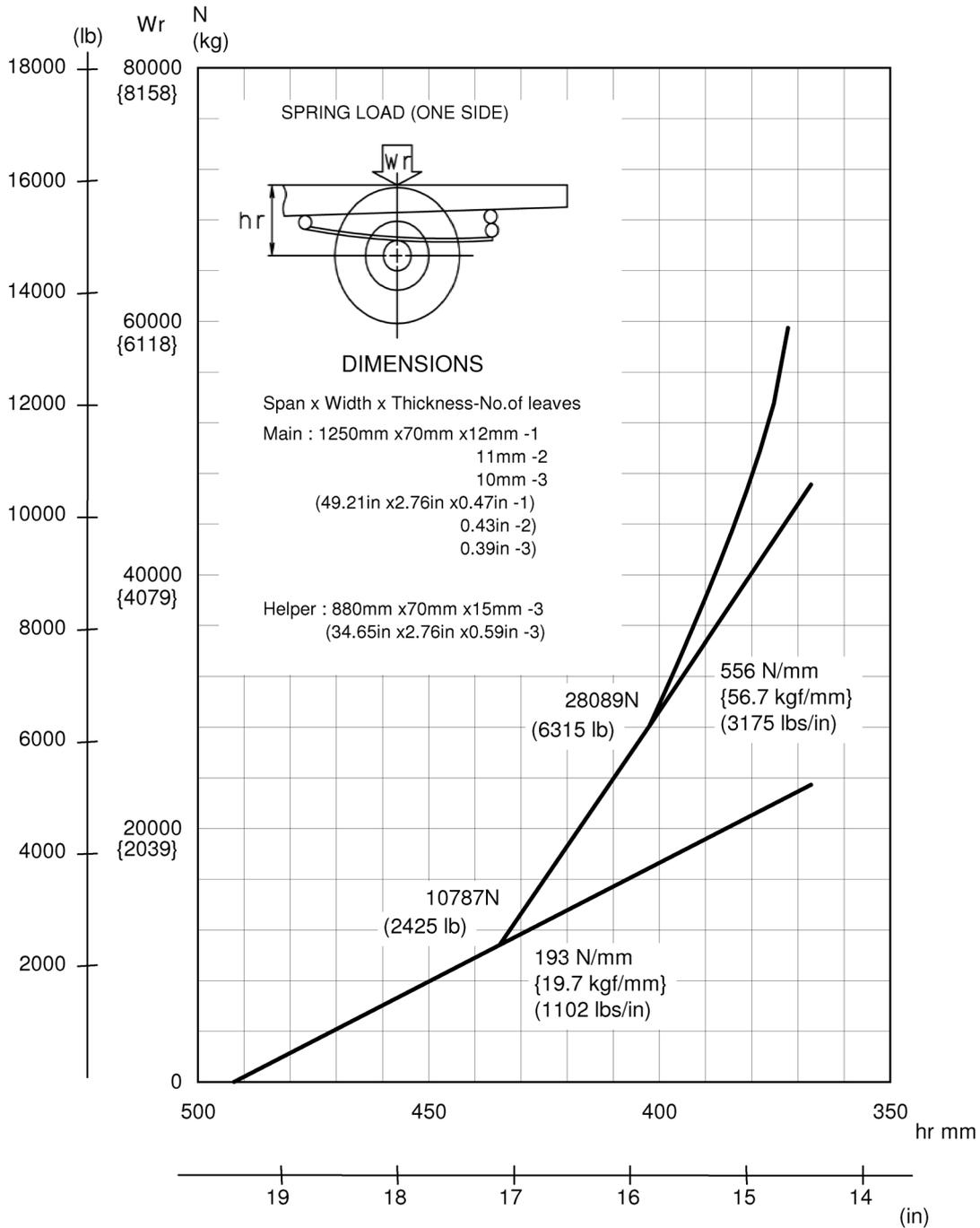
MODEL FEC9 (REAR)



hr: Distance from rear wheel center to upper surface of frame



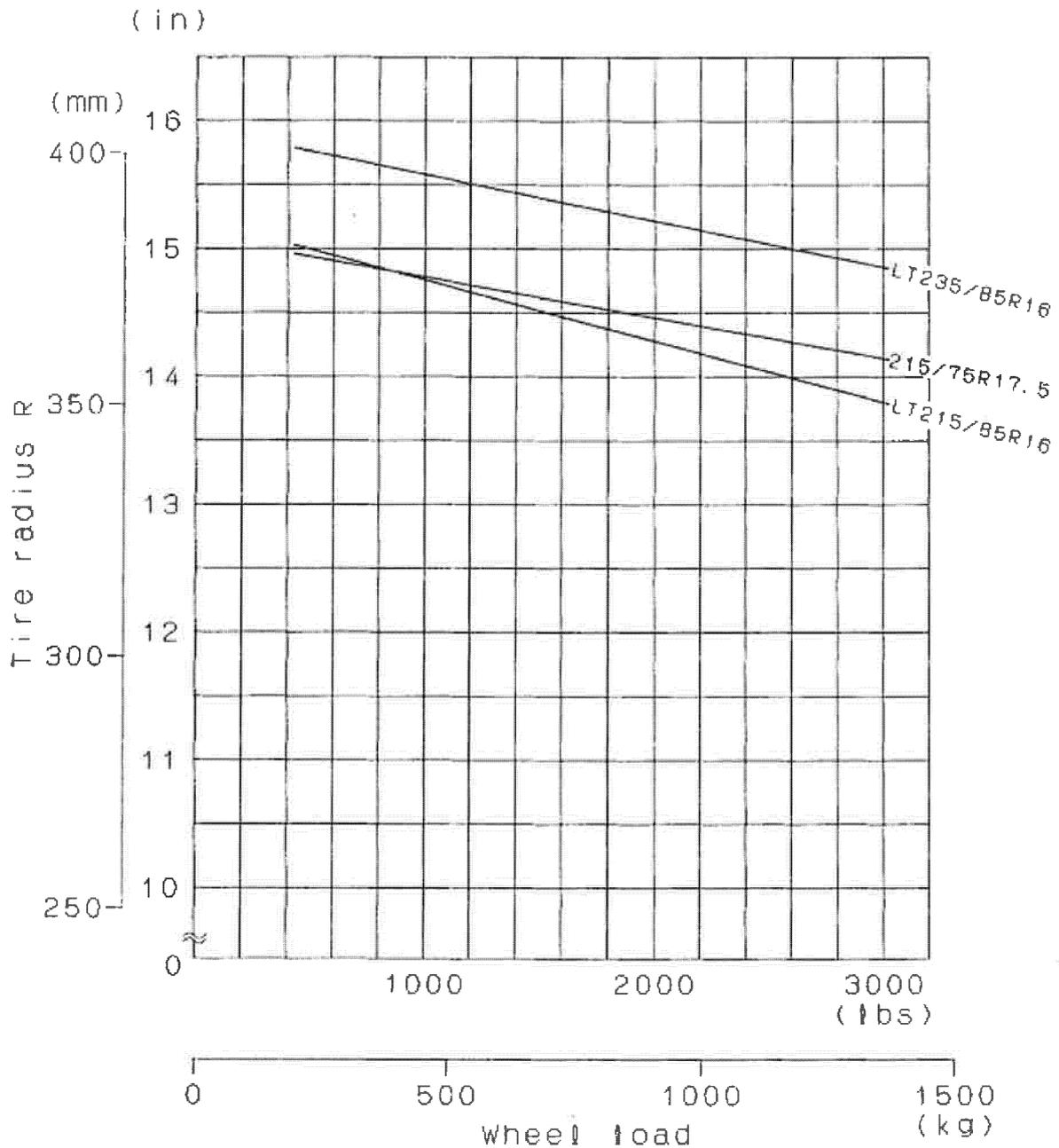
MODEL FGB7 (REAR)



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

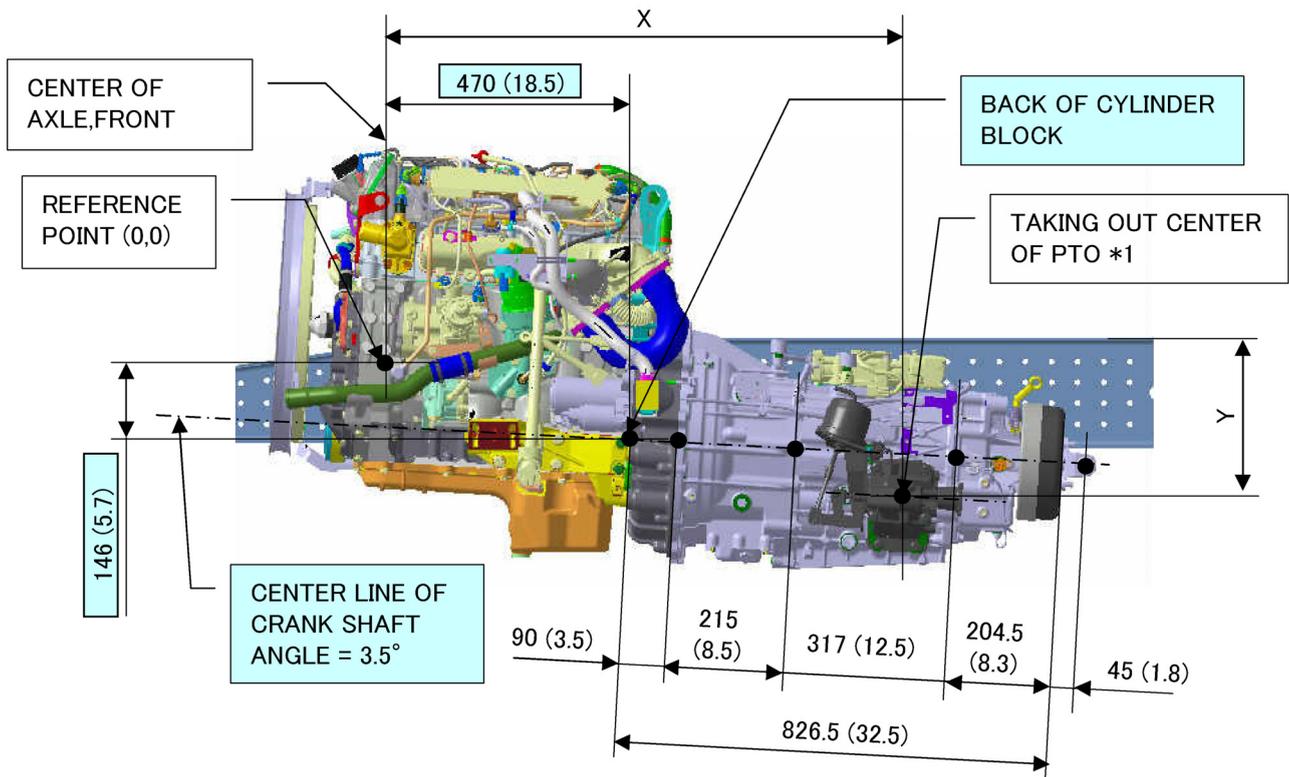


## 10.8 Engine transmission assembly

### 10.8 Engine transmission assembly

<FE>

Unit : mm (in)



- ENG CENTER Unit : mm (in.)

ENG	CENTER OF CHASSIS TO CENTER OF ENG OFFSET
4P10	-10 (0.4) (TO THE LEFT SIDE)

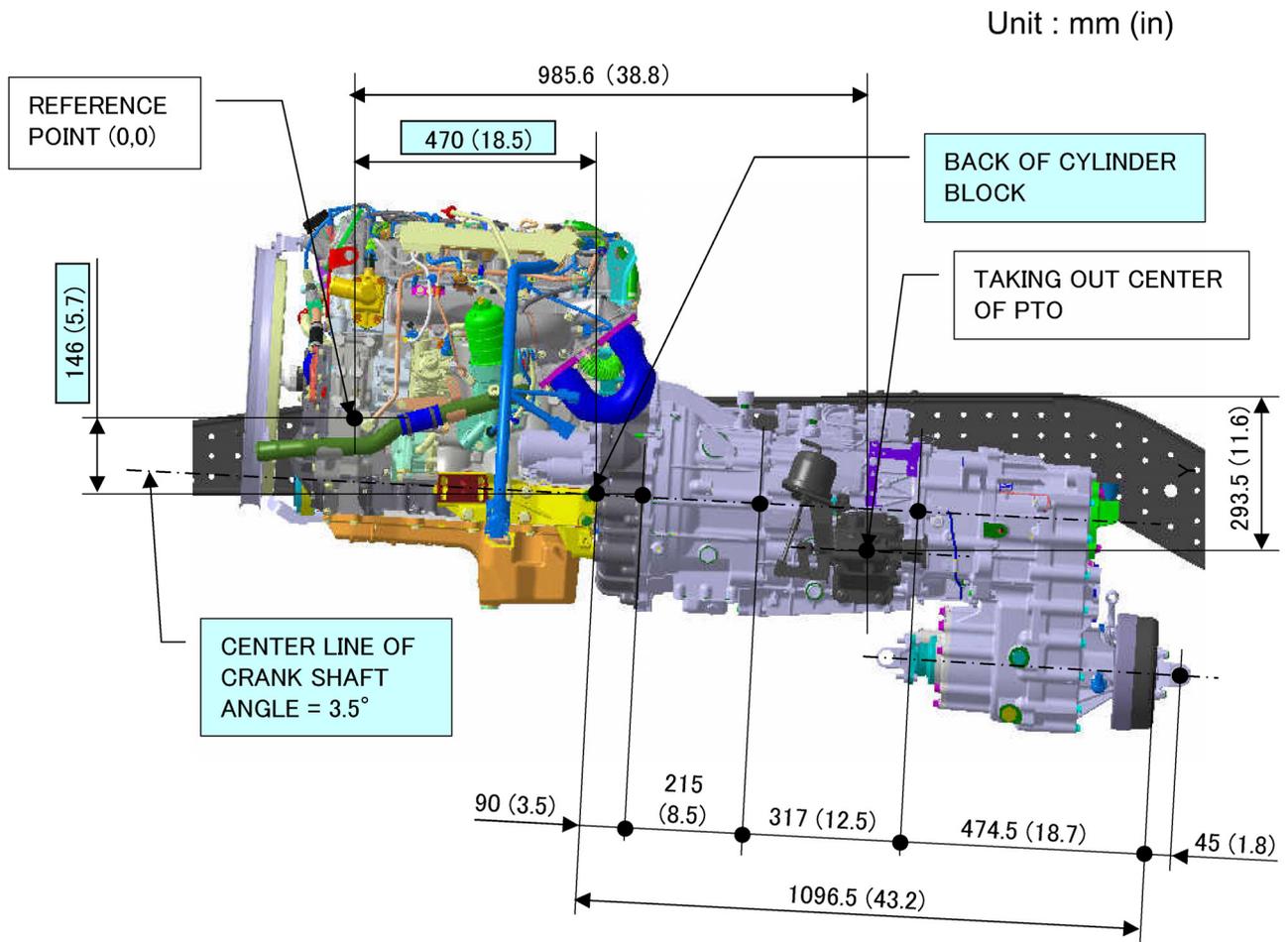
- TAKING OUT CENTER OF PTO \*1 Unit : mm (in.)

MODEL	T/M	147 N·m [110 lbs.ft, 15 kgf·m] 196 N·m [145 lbs.ft, 20 kgf·m]		392 N·m [290 lbs.ft, 40 kgf·m]	
		X	Y	X	Y
6AMT	M038S6	985.6 (38.8)	302.5 (11.9)	870.7 (34.3)	313.7 (12.4)



## 10.8 Engine transmission assembly

<FG>



- ENG CENTER (Unit : mm (in))

ENG	CENTER OF CHASSIS TO CENTER OF ENG OFFSET
4P10	-10 (0.4) (TO THE LEFT SIDE)

- TM & PTO

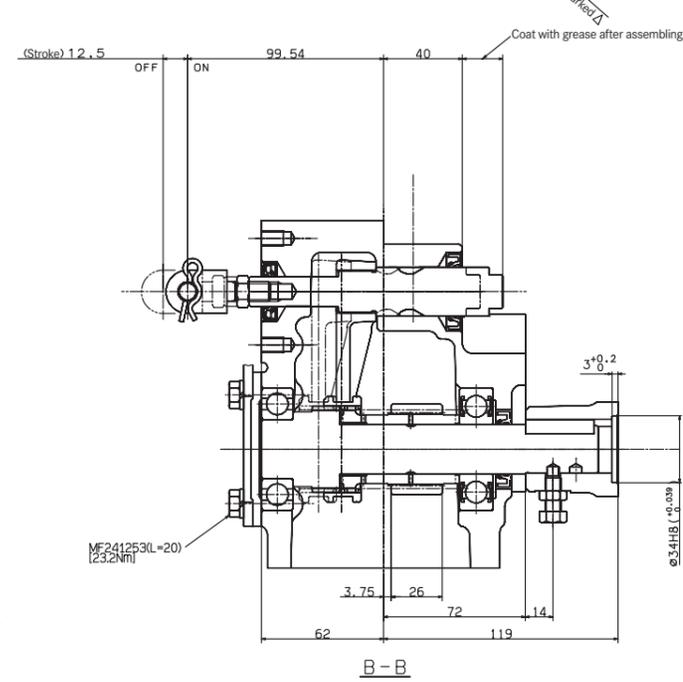
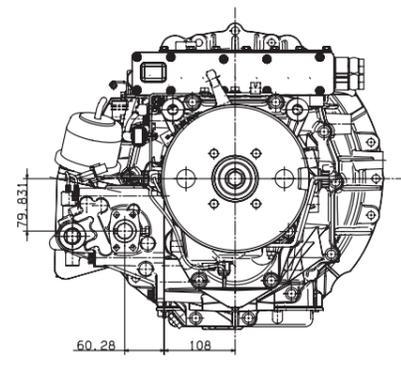
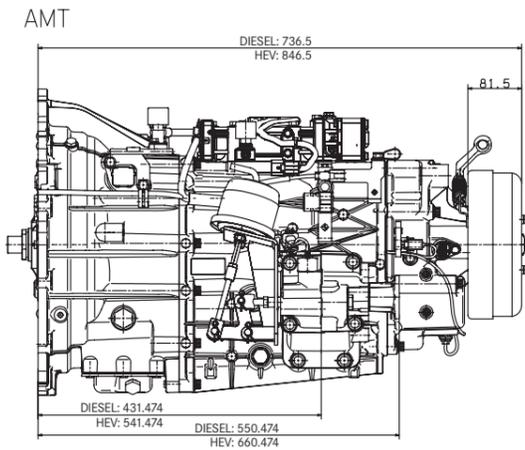
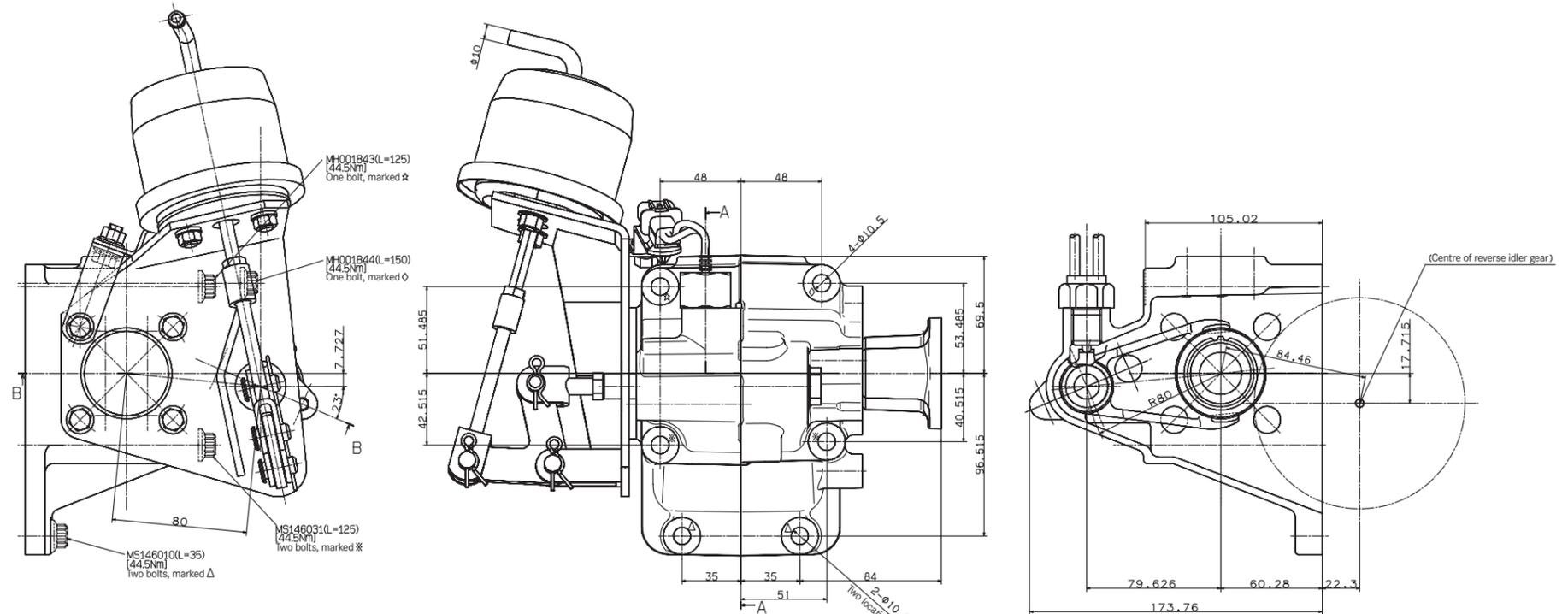
MODEL	T/M	PTO
6AMT	M038S6	196 N·m [145 ft.lbs, 20 kgf·m]



10.9 Power take-offs

10.9 Power take-offs

10.9.1 Transmission driven power take-offs

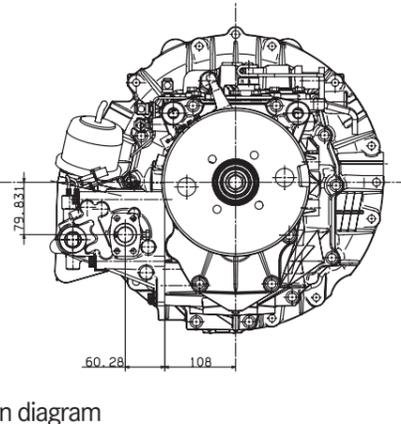
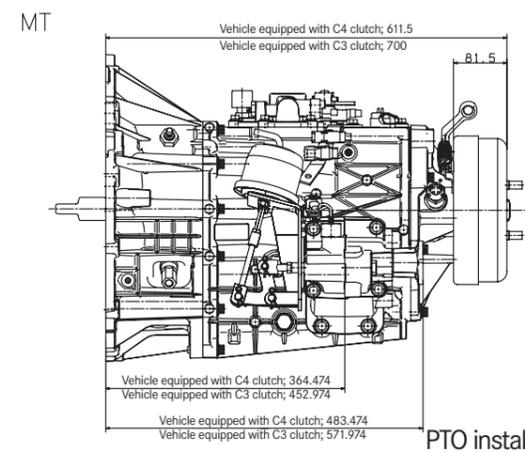


A-A

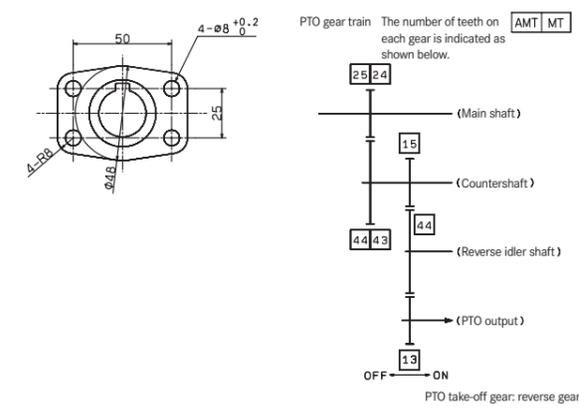
- The value inside [ ] indicates the tightening torque.
- Use the following kinds of liquid packing.  
Mating faces of the case: ThreeBond 1215  
F cover: ThreeBond 1104J  
Screw plug: ThreeBond 1105D
- Shift force on the shift rail: 76N ±10% (static)
- When assembling the oil seal, inject bearing grease between the lips of the oil seal.
- The PTO gear ratio and the gear layout are as shown below.

PTO gear ratio

Transmission mode	Gear ratio i	Reduction ratio 1/i	Applicable vehicle
M038	1.525	0.655	AMT
	1.552	0.644	MT (vehicles equipped with C3 clutch or C4 clutch)



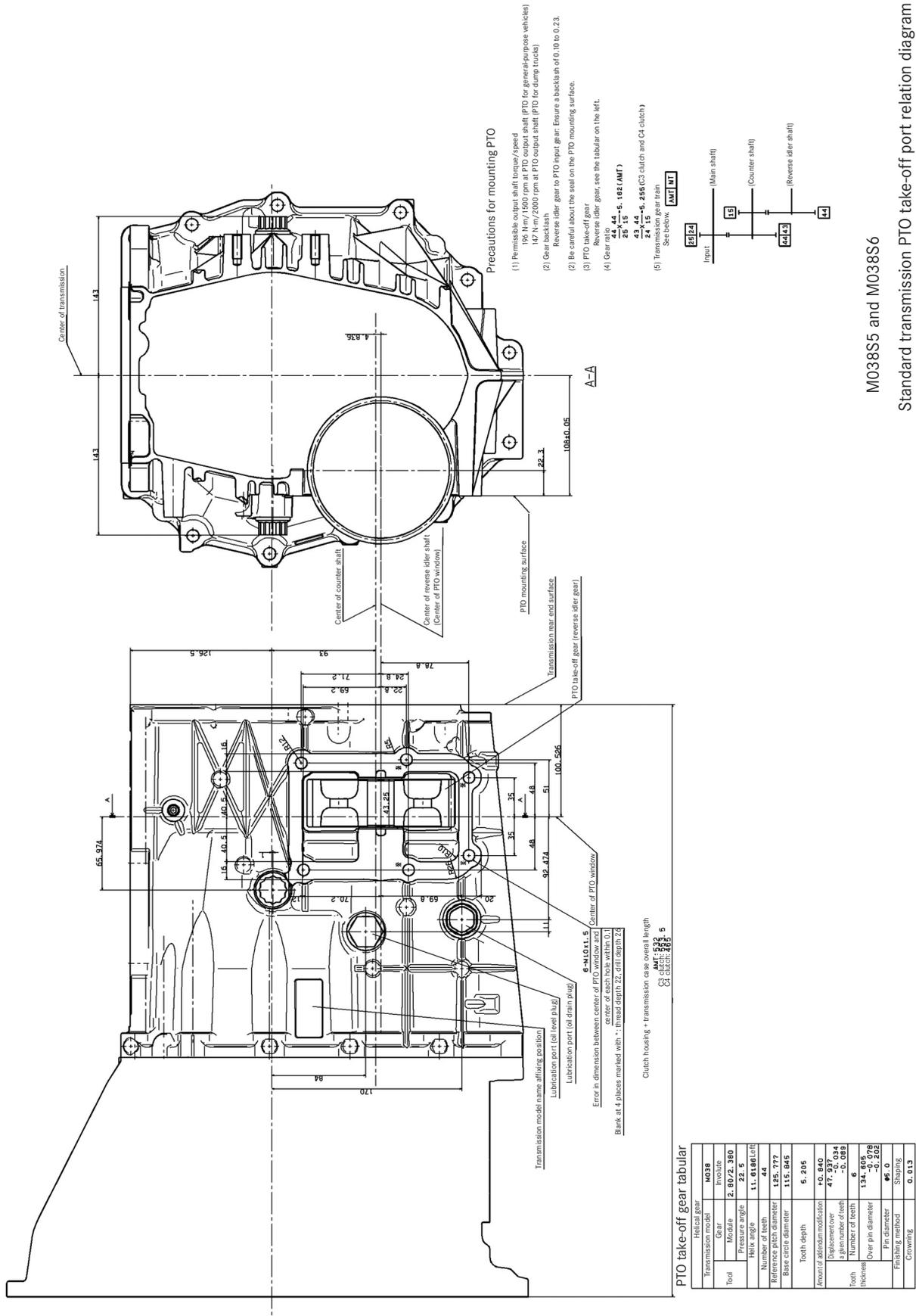
PTO installation diagram



Note 1. Allowable output torque: M038: 196 N·m (20 kgf-m)/1500 r.p.m.

Transmission PTO assembly diagram  
General purpose vacuum flange type

10.9.2 Transmission power-take-off layout



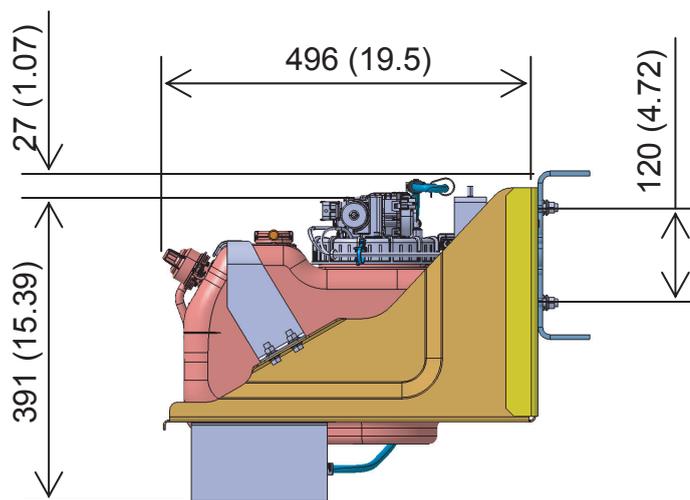
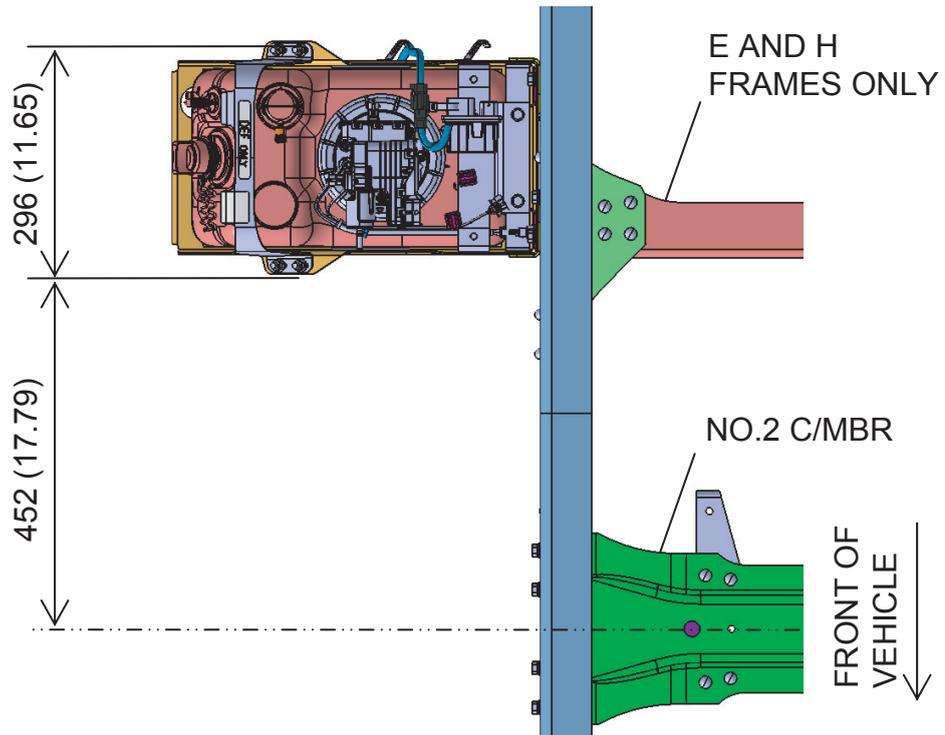
M038S5 and M038S6

Standard transmission PTO take-off port relation diagram

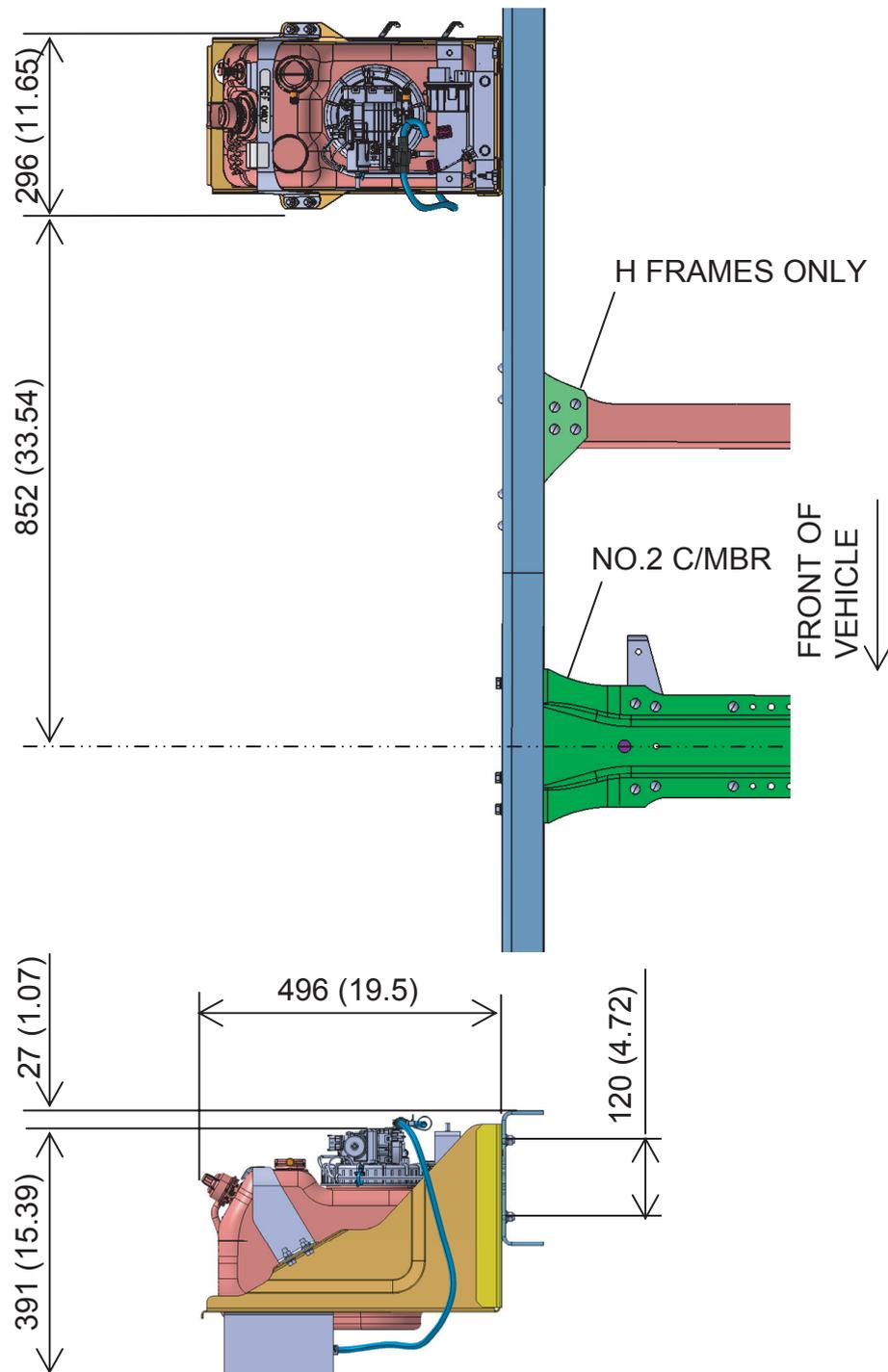


10.10 Exhaust system layout

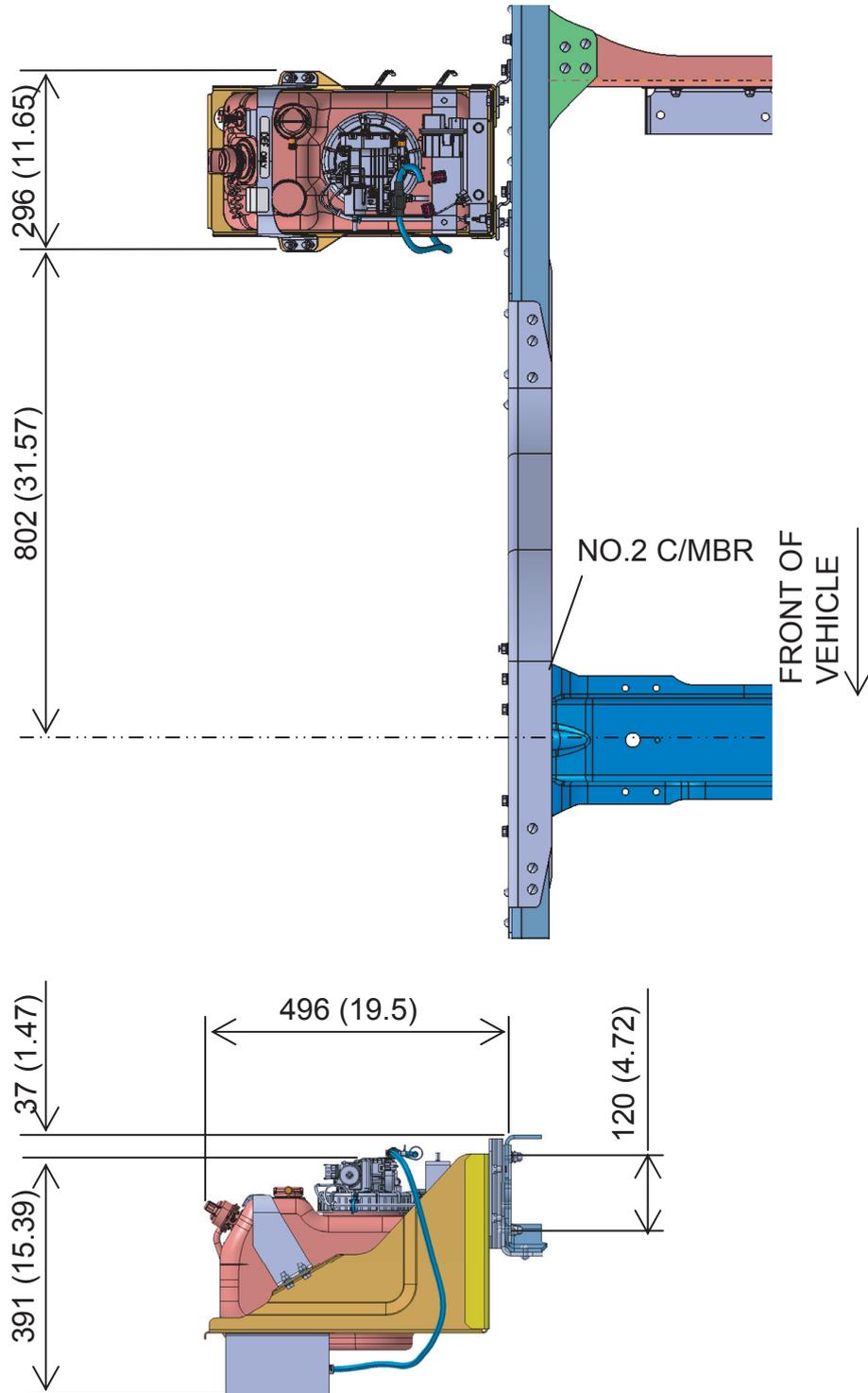
- FEC C, E, G, H, K



▪FEC H, K Crea cab

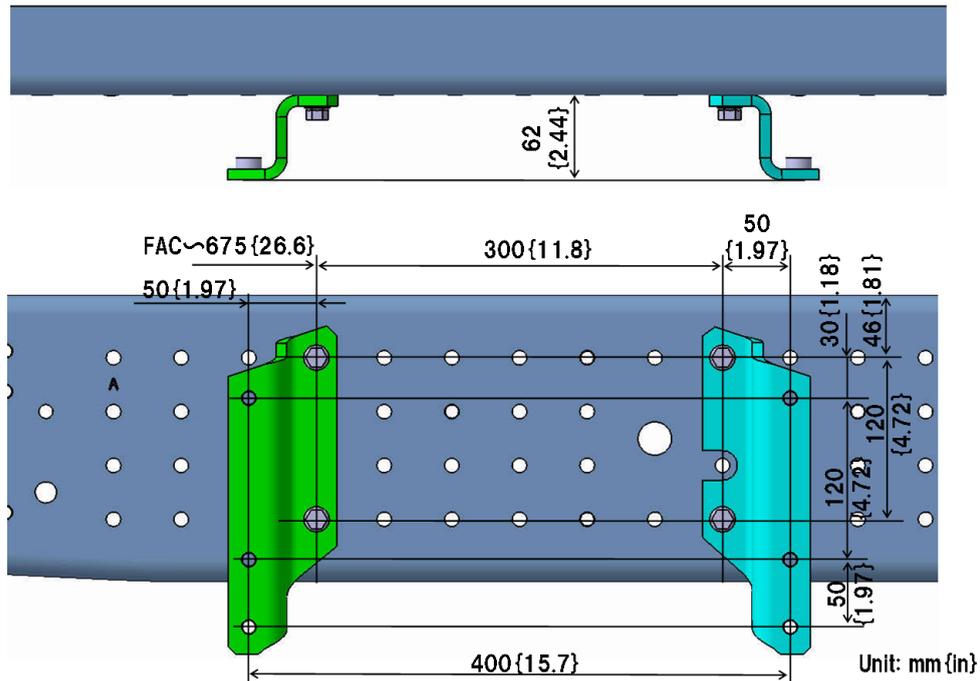


▪ FGB

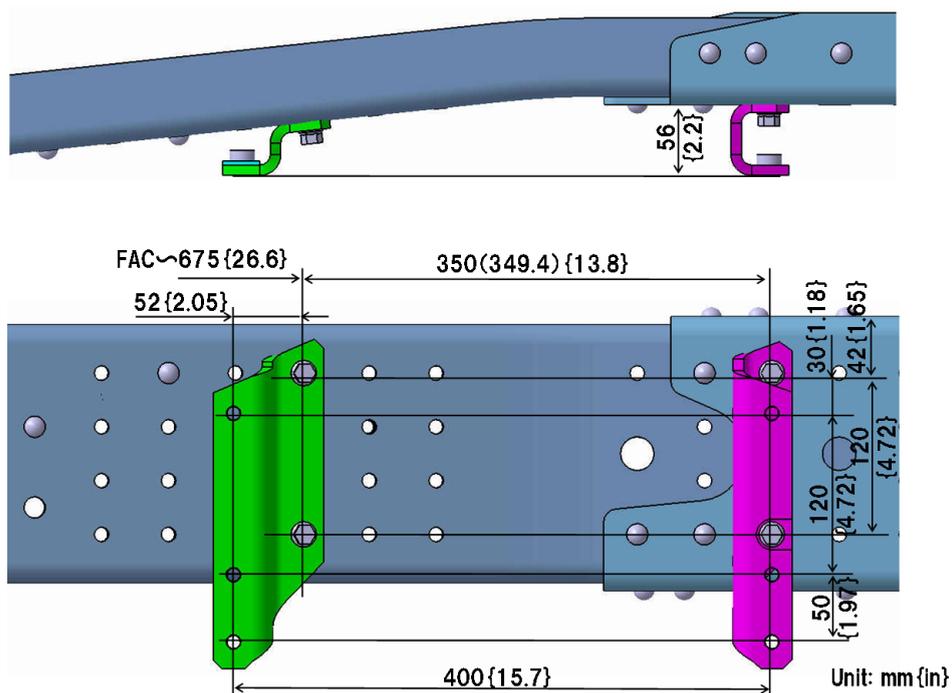


### 10.11 Battery mounting layout

<FE>



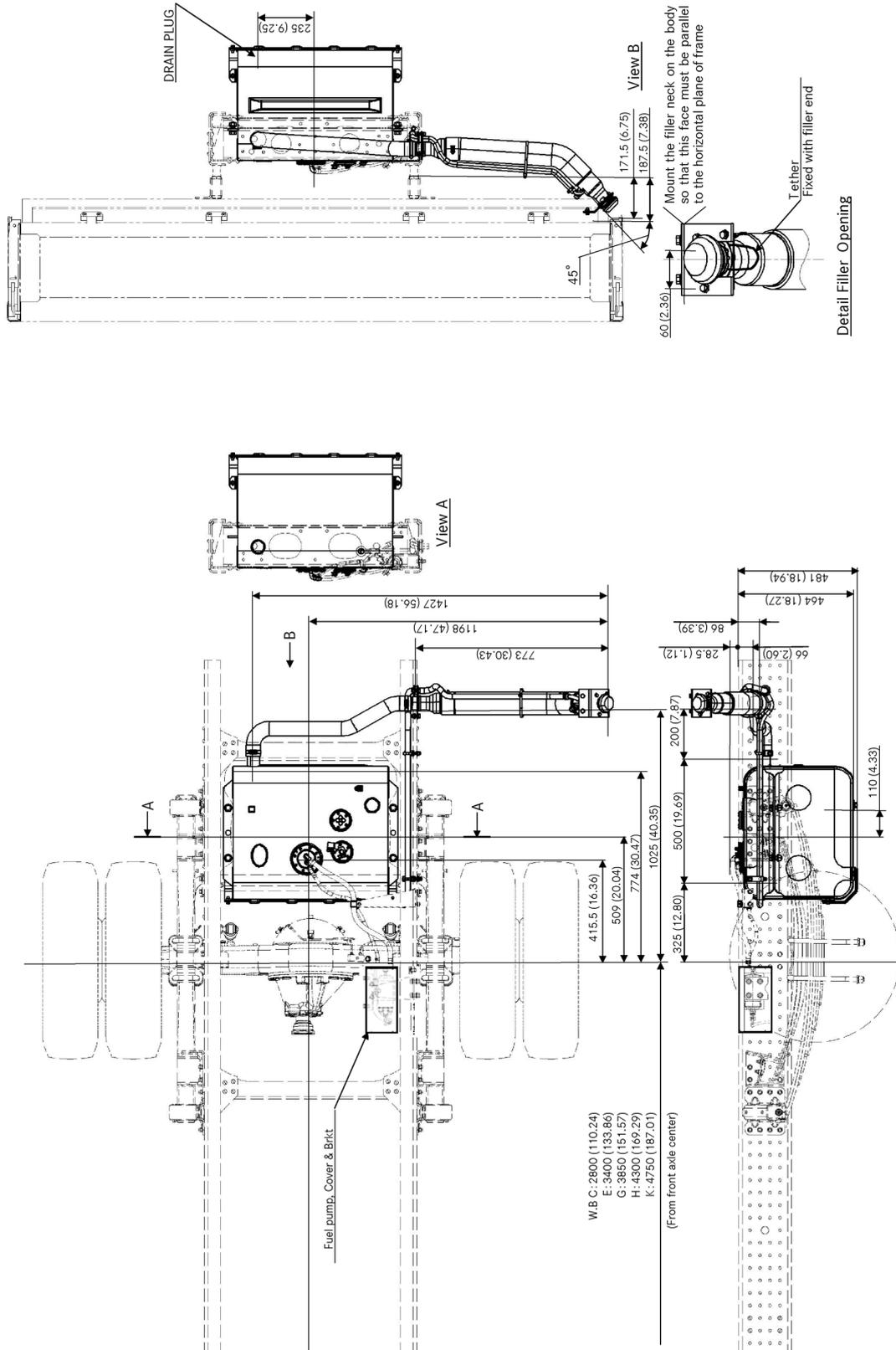
<FG>



### 10.12 Fuel tank mounting layout

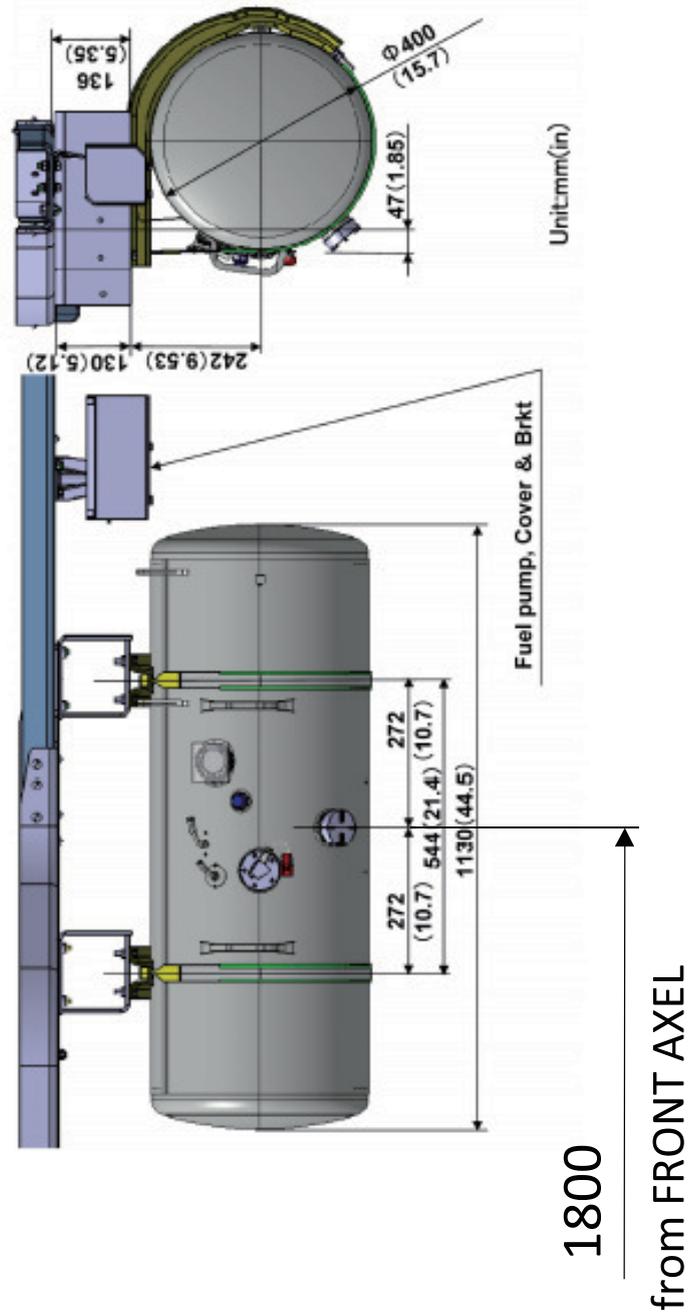
#### 10.12.1 Fuel tank

<FE>



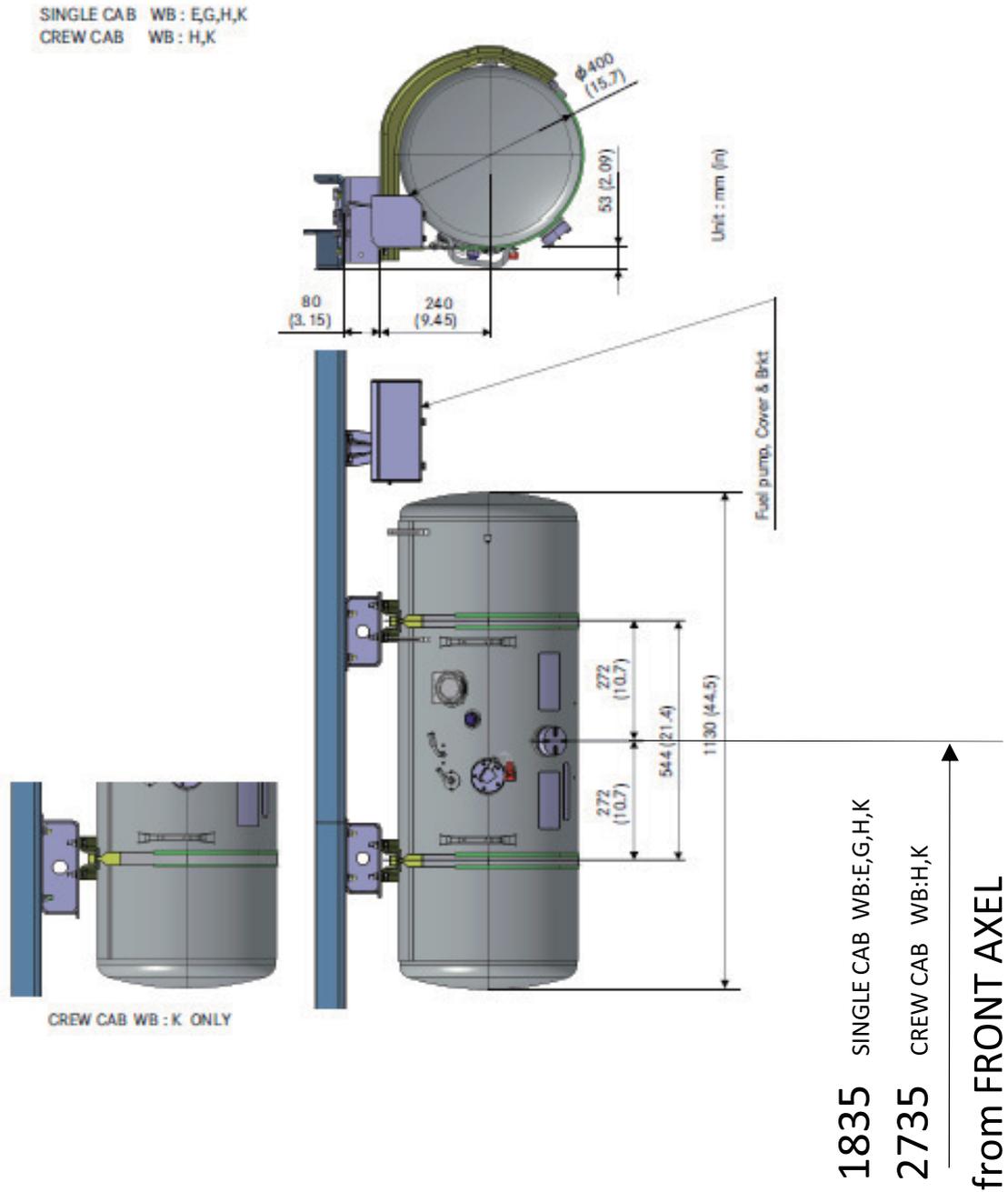
10.12 Fuel tank mounting layout

<FG>

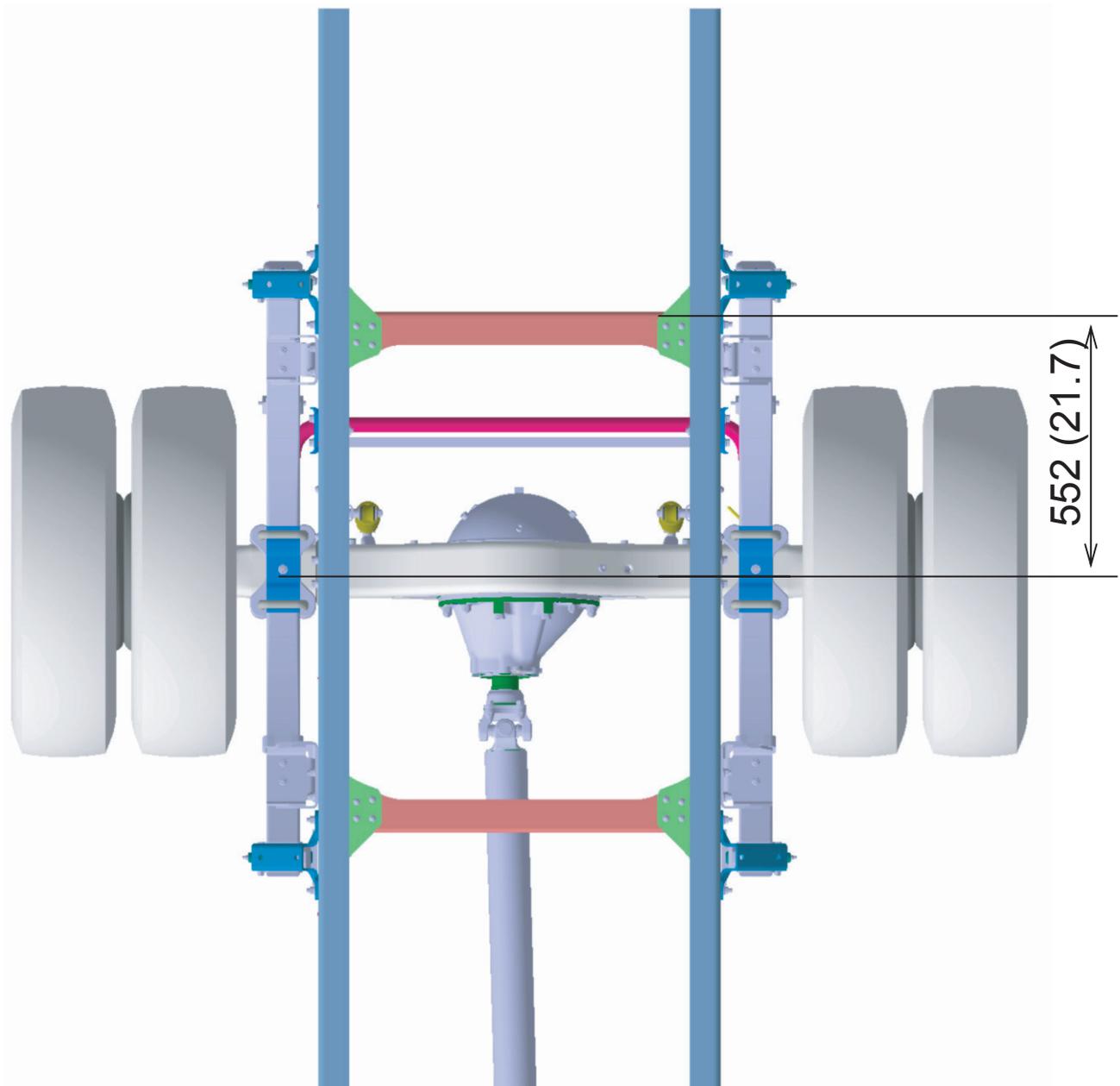


## 10.12 Fuel tank mounting layout

<Option 125L Fuel tank>

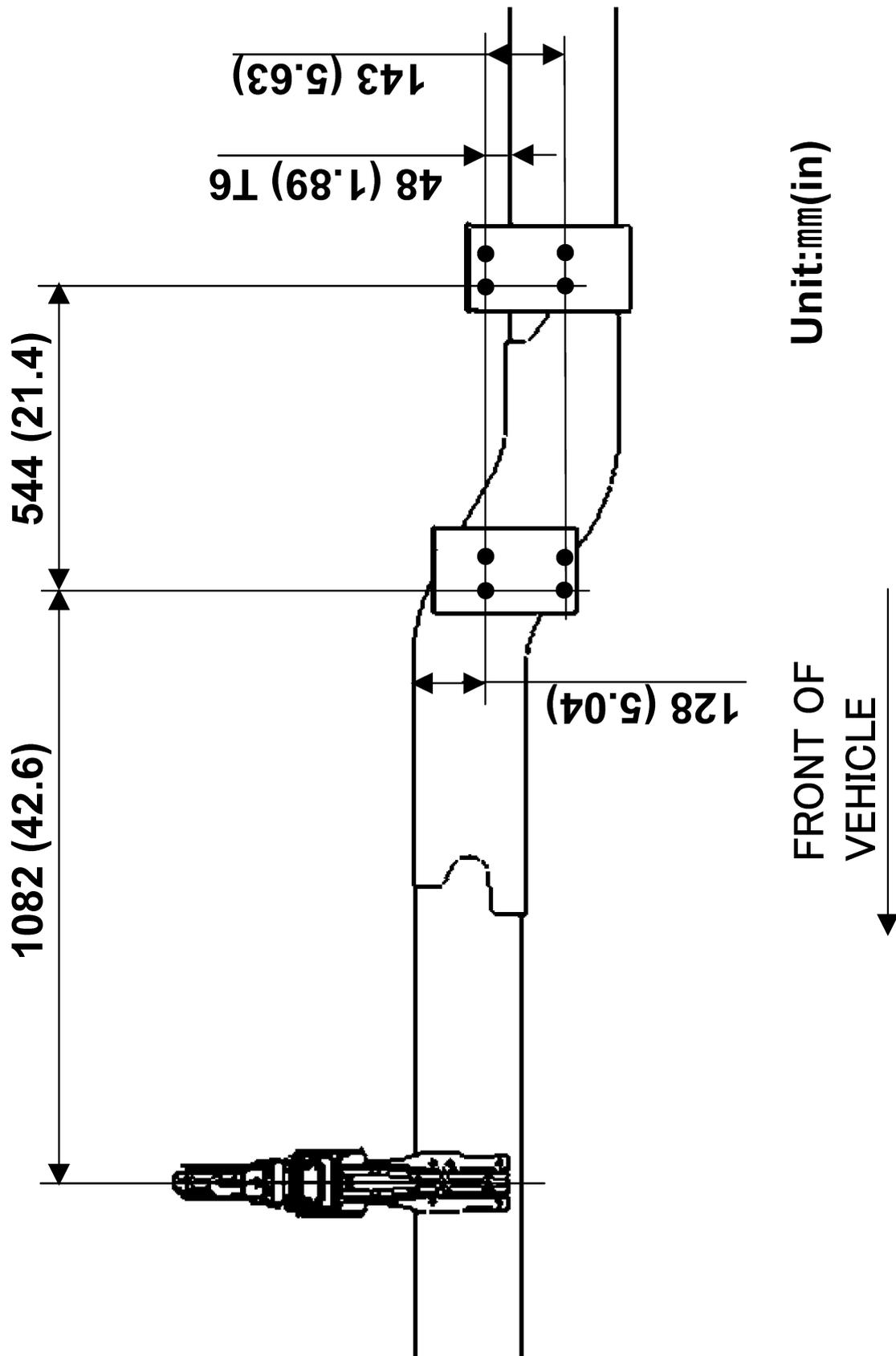


<Option 125L Fuel tank - Crossmember>



10.12.2 Fuel tank bracket (option)

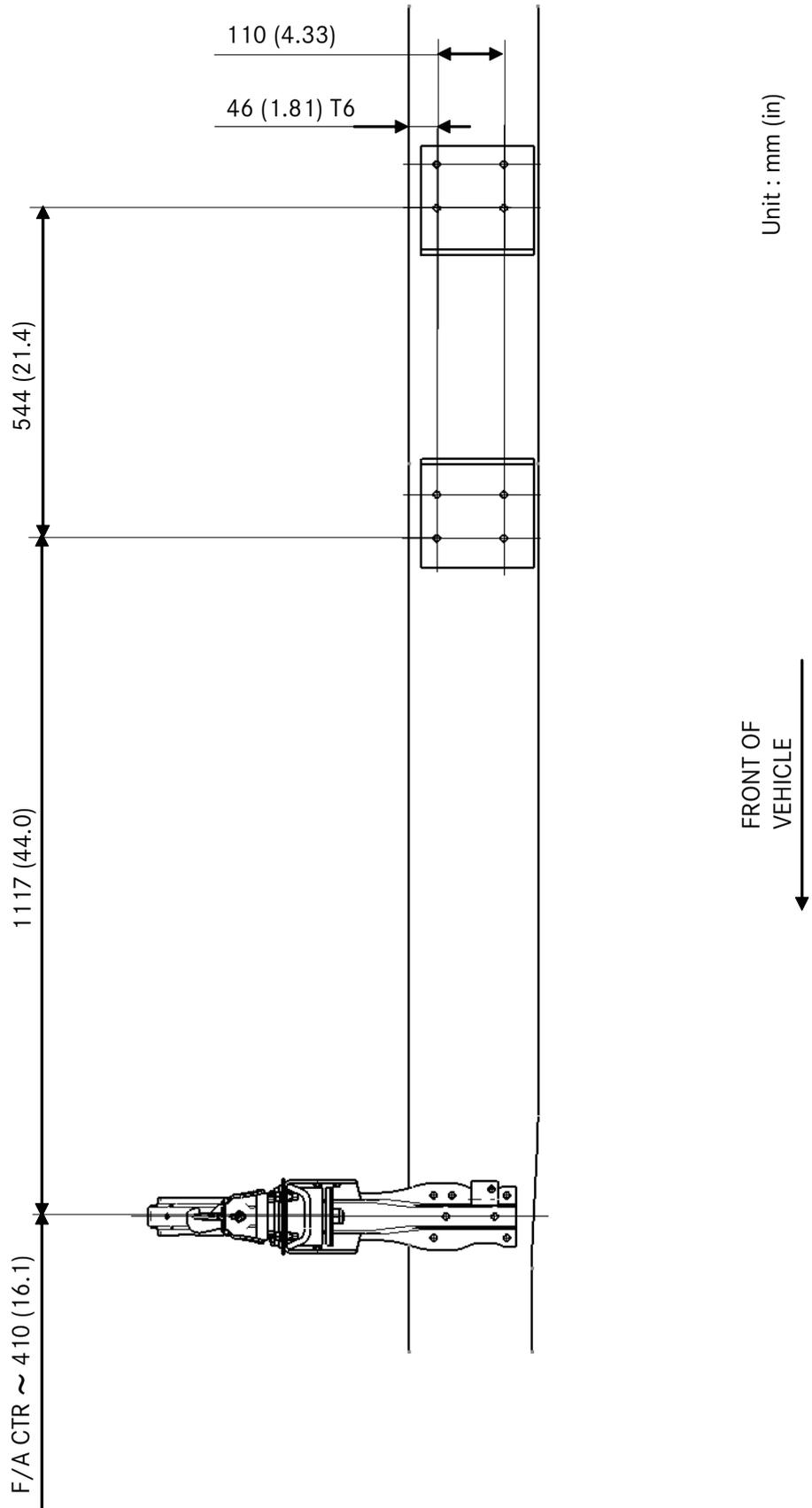
<FG>



## 10.12 Fuel tank mounting layout

<Option 125L Fuel tank>

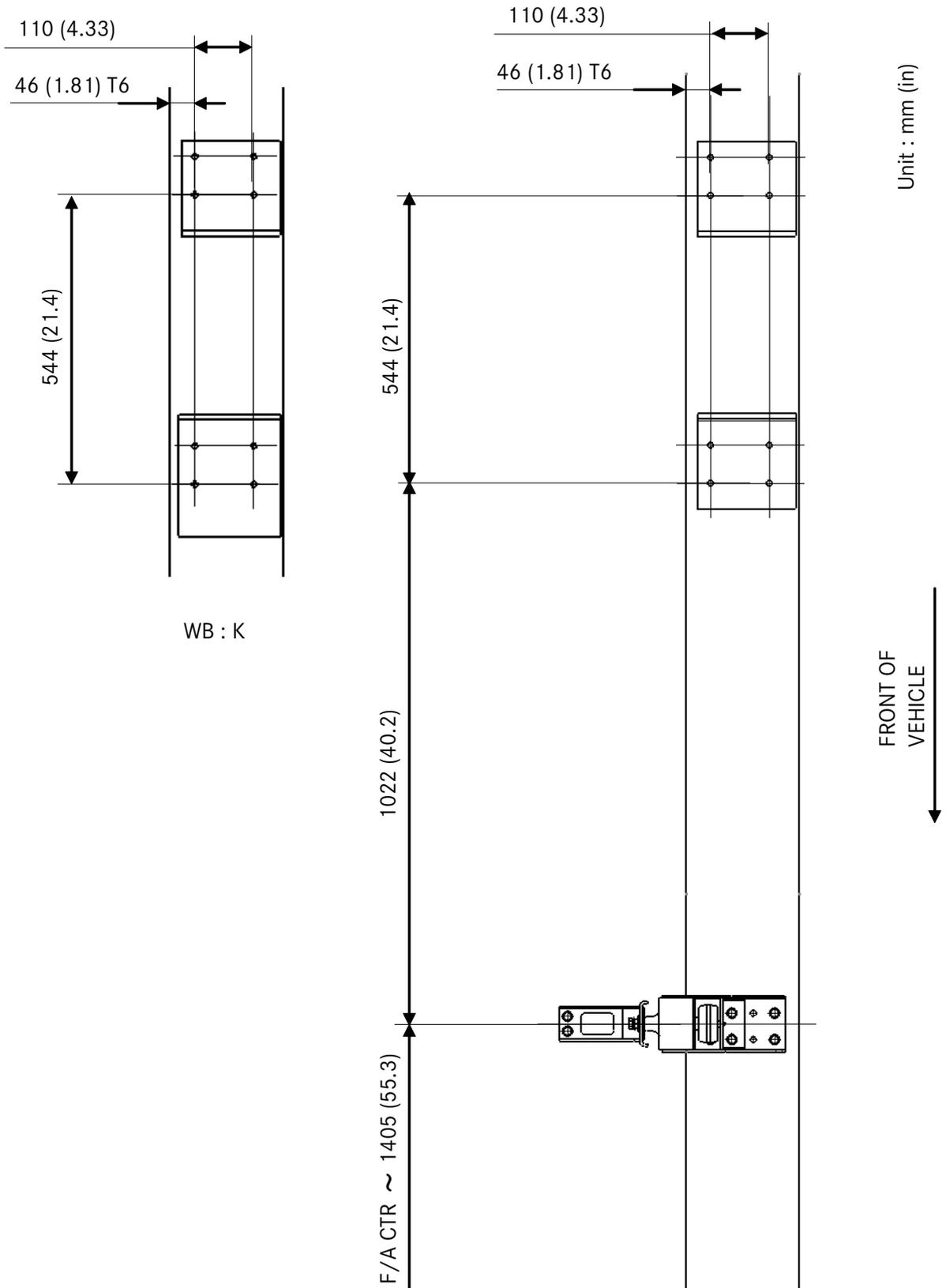
SINGLE CAB WB : E,G,H,K



## 10.12 Fuel tank mounting layout

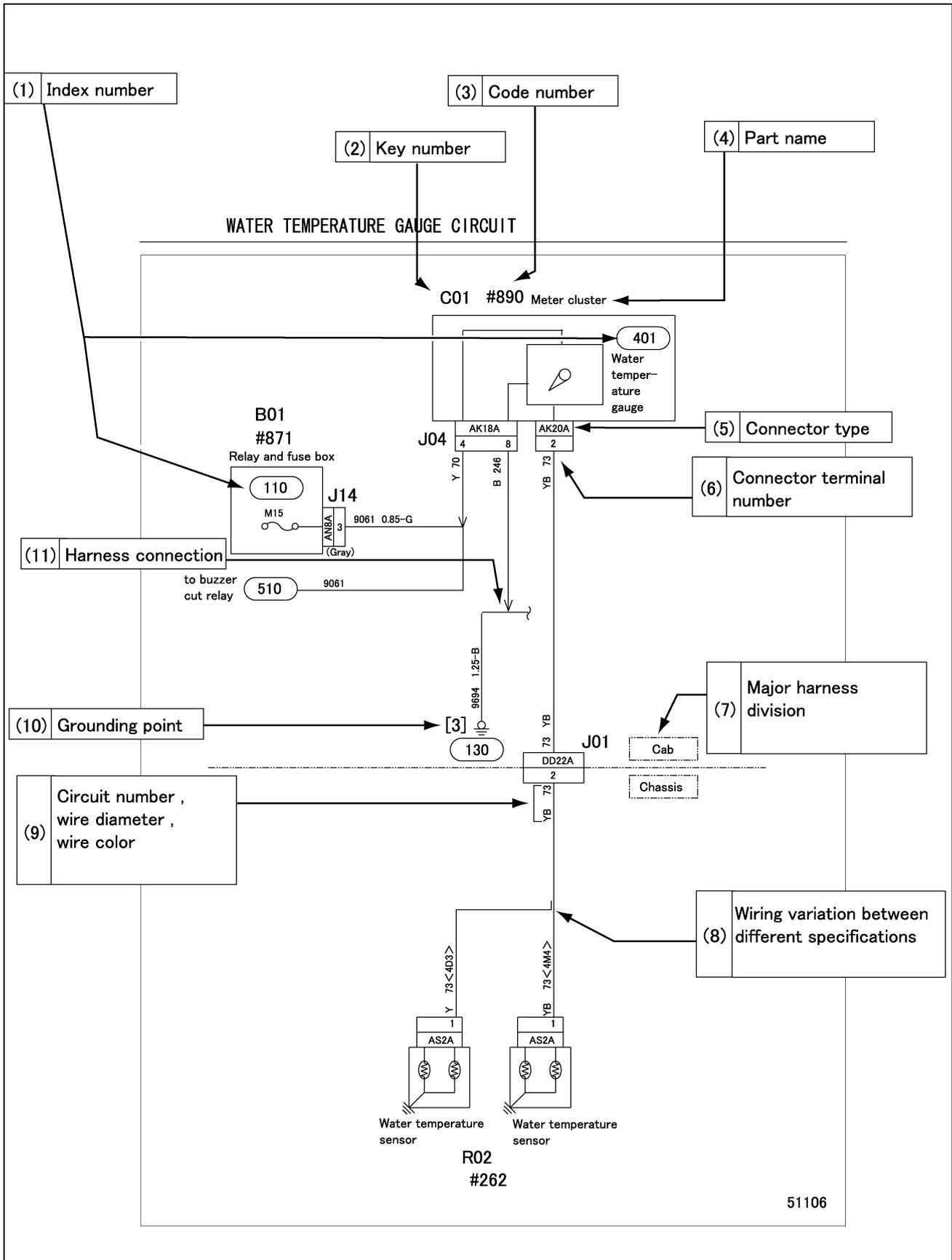
<Option 125L Fuel tank>

CREW CAB WB : H,K



10.13 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.

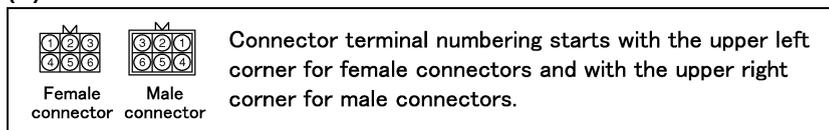
### (3) Code number: #001 - #999

- 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



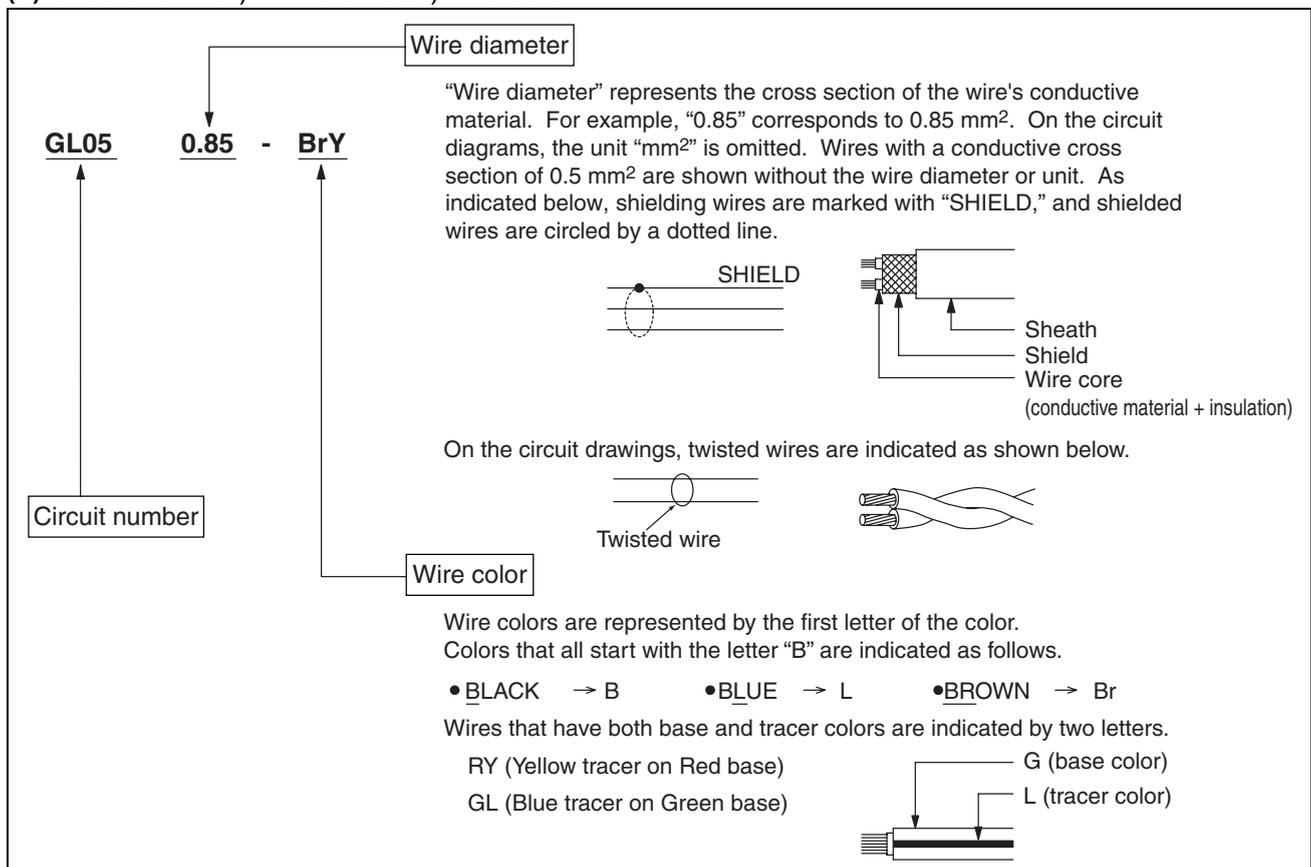
### (7) Major harness division

- 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 harnesses 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				



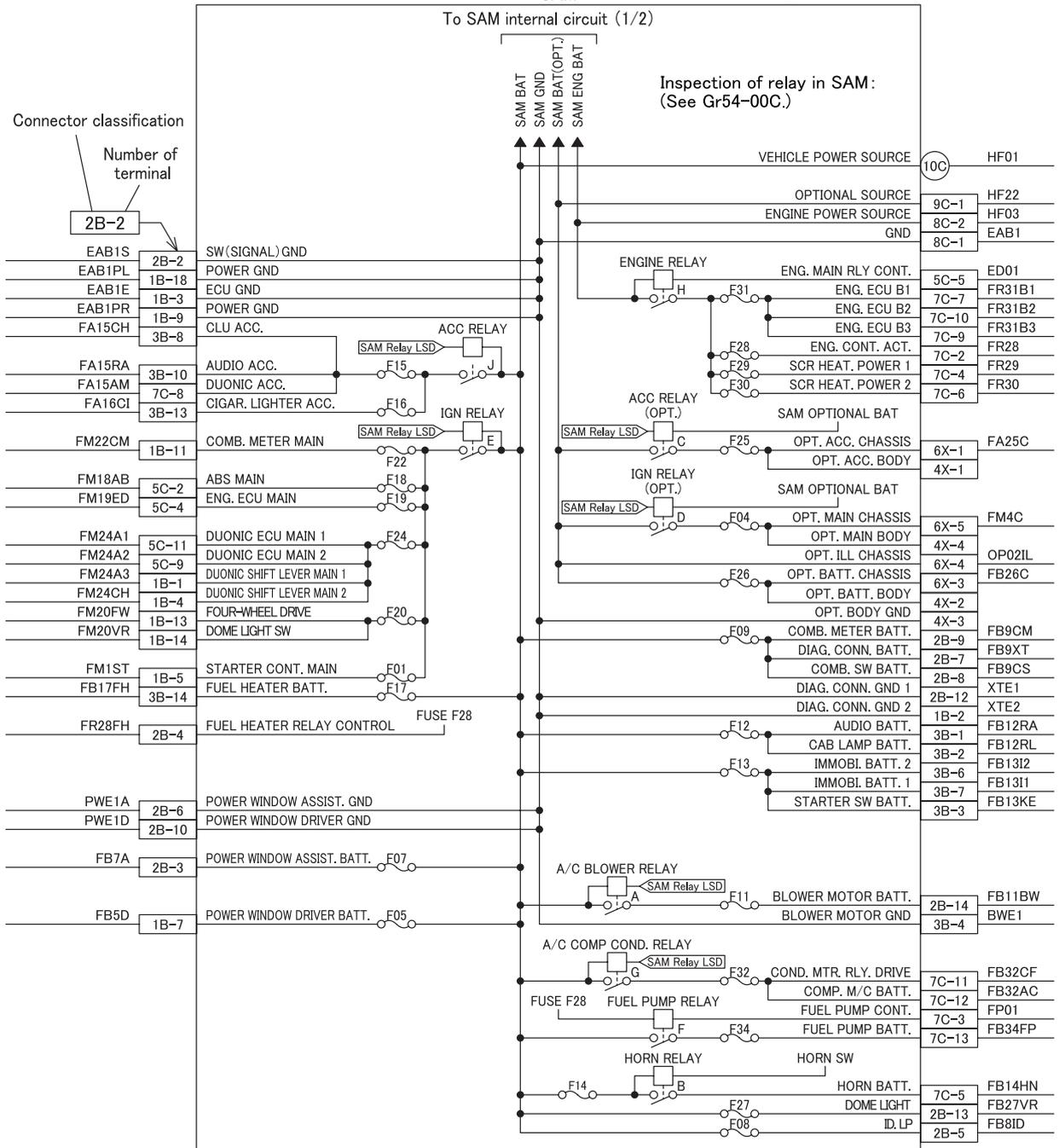
SAM INTERNAL CIRCUIT

(2/2)

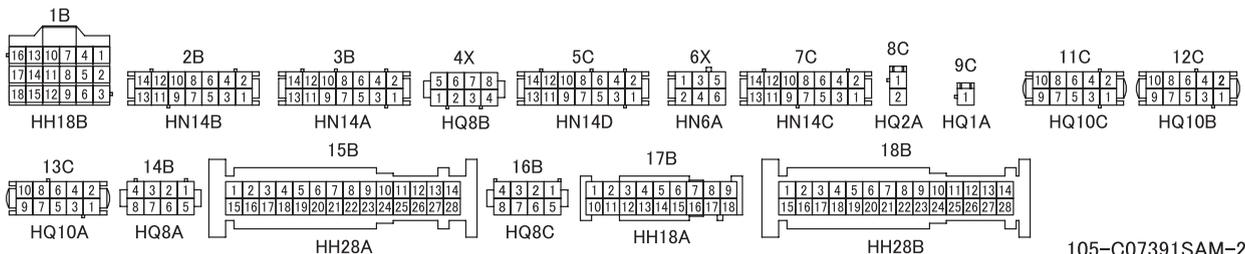
A part of this circuit is omitted.

B40  
SAM

SAM: Signal detect and actuation modules



SAM connector (harness side)



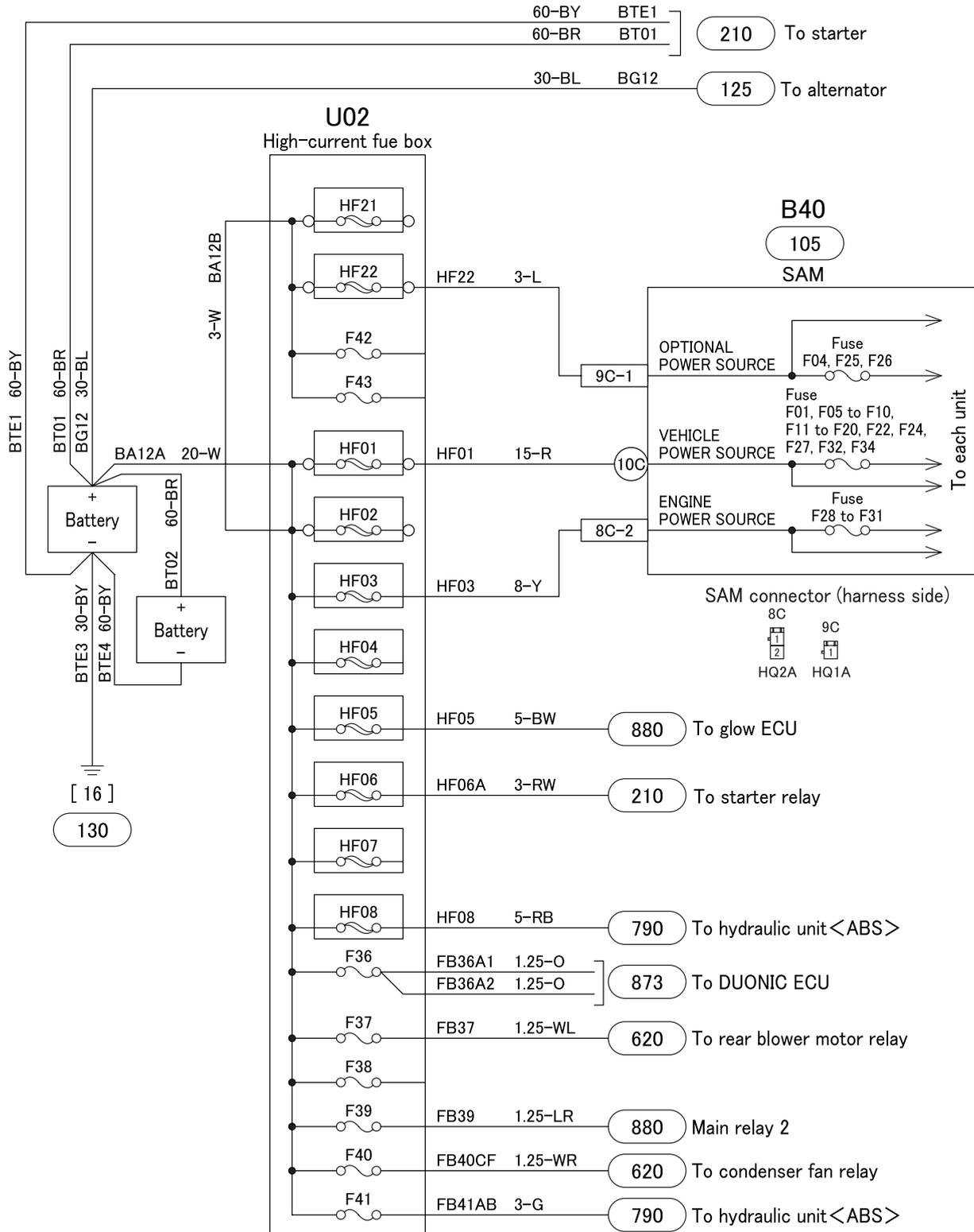
105-C07391SAM-2



POWER CIRCUIT (1)

Battery → high-current fuse → SAM

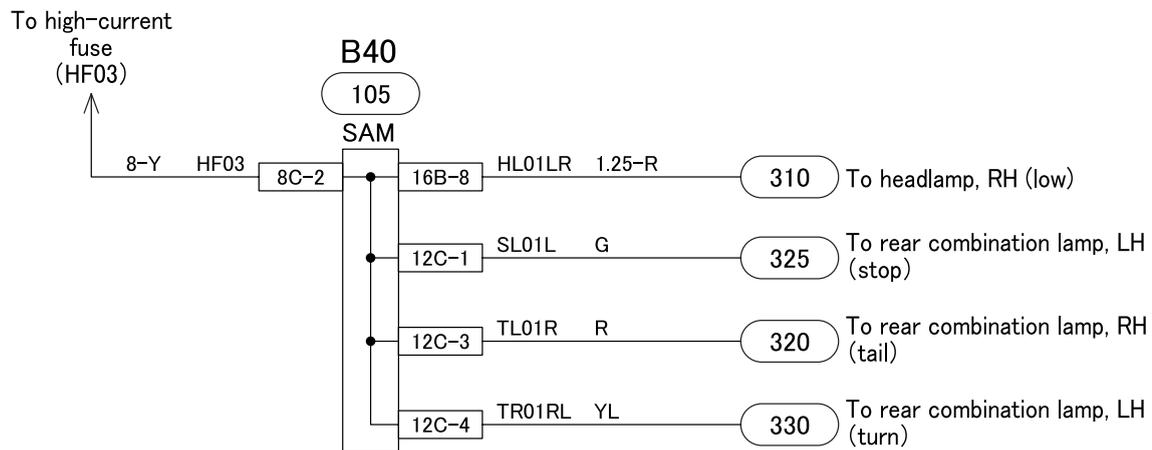
ECU : Electronic control unit  
 SAM : Signal detect and modules  
 ABS : Anti-lock brake system



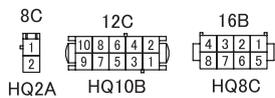
110-C07391ALL

### POWER CIRCUIT (2)

SAM  
(ENG BAT)



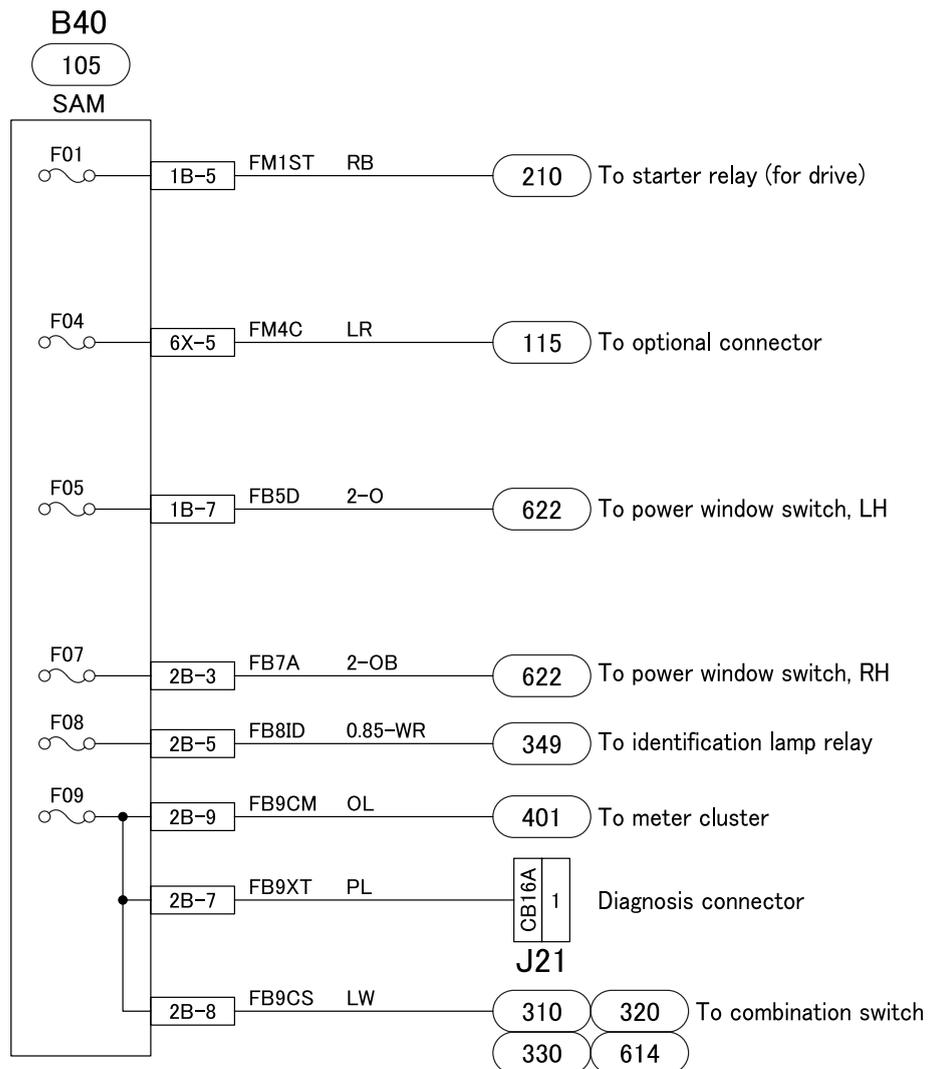
SAM connector (harness side)



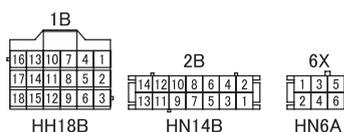
110-C07391EB

### POWER CIRCUIT (3)

SAM  
(Fuse F01 to F09)



SAM connector (harness side)



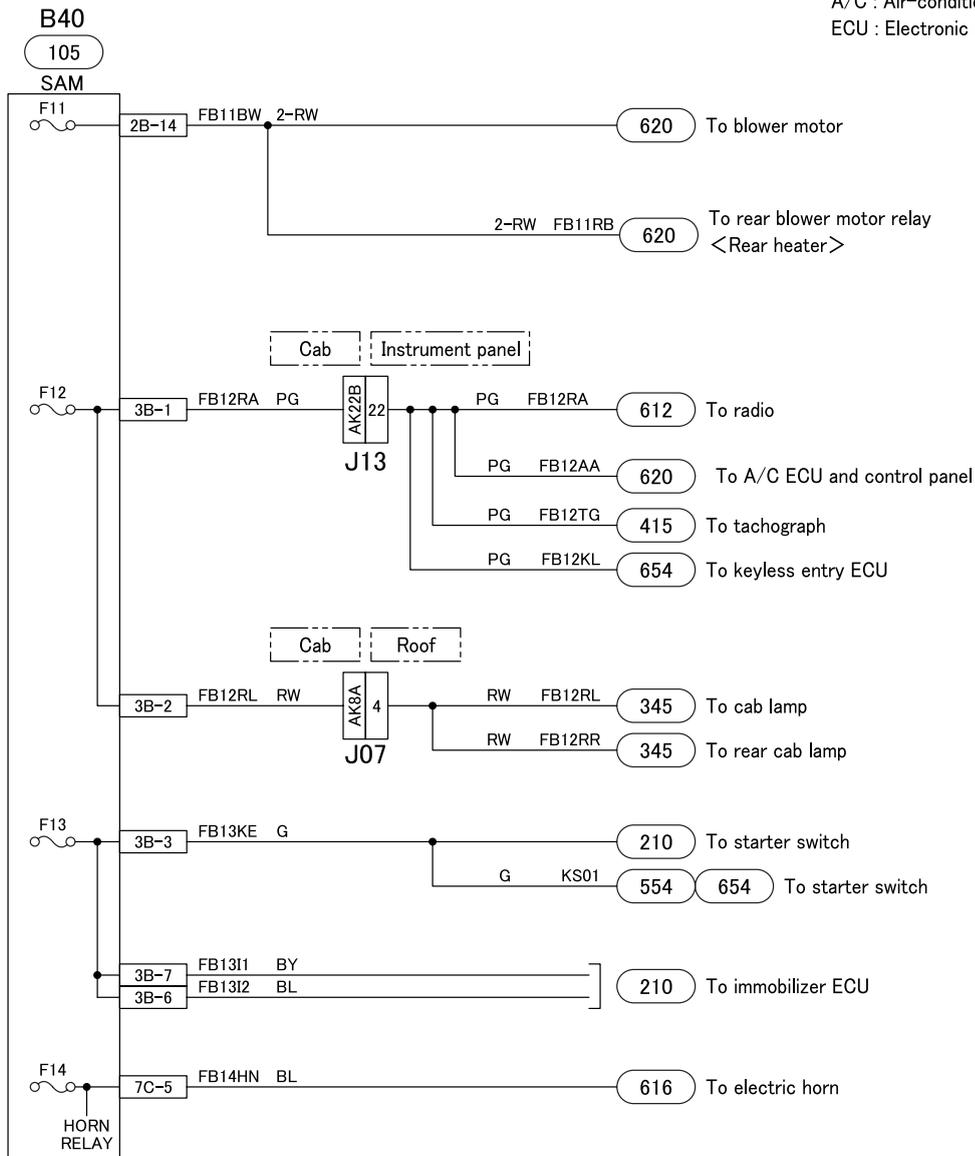
110-C07391F01



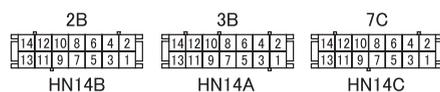
### POWER CIRCUIT (4)

SAM  
(Fuse F11 to F14)

A/C : Air-conditioner  
ECU : Electronic control unit



SAM connector (harness side)

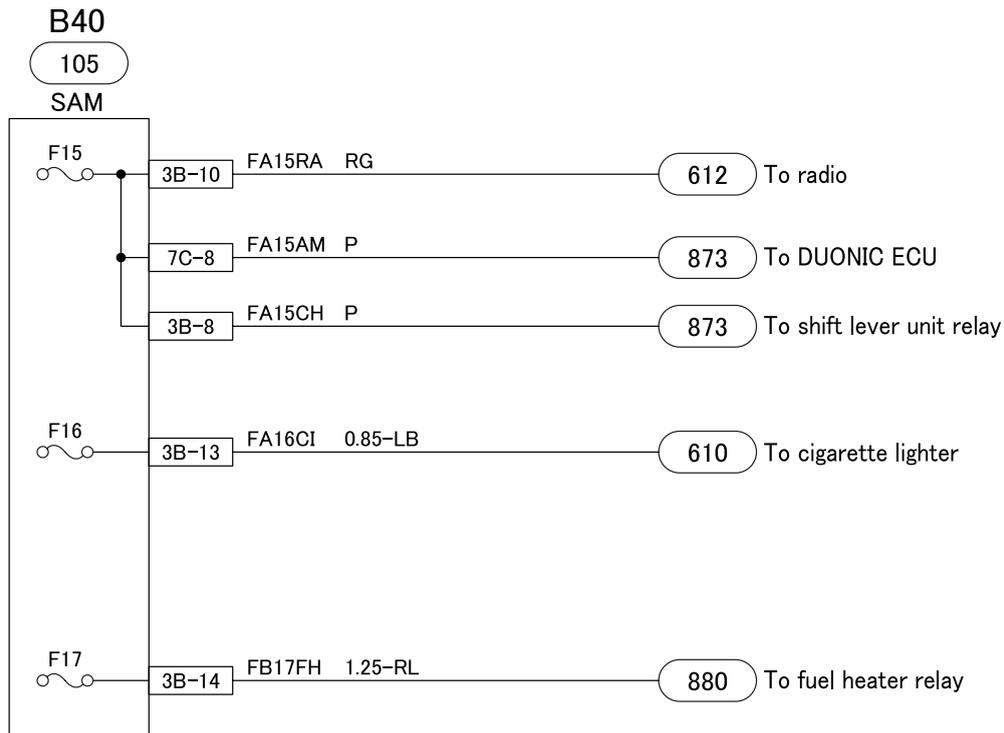


110-C07391F11

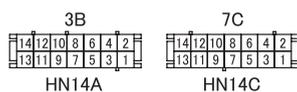
### POWER CIRCUIT (5)

SAM  
(Fuse F15 to F17)

ECU : Electronic control unit



SAM connector (harness side)



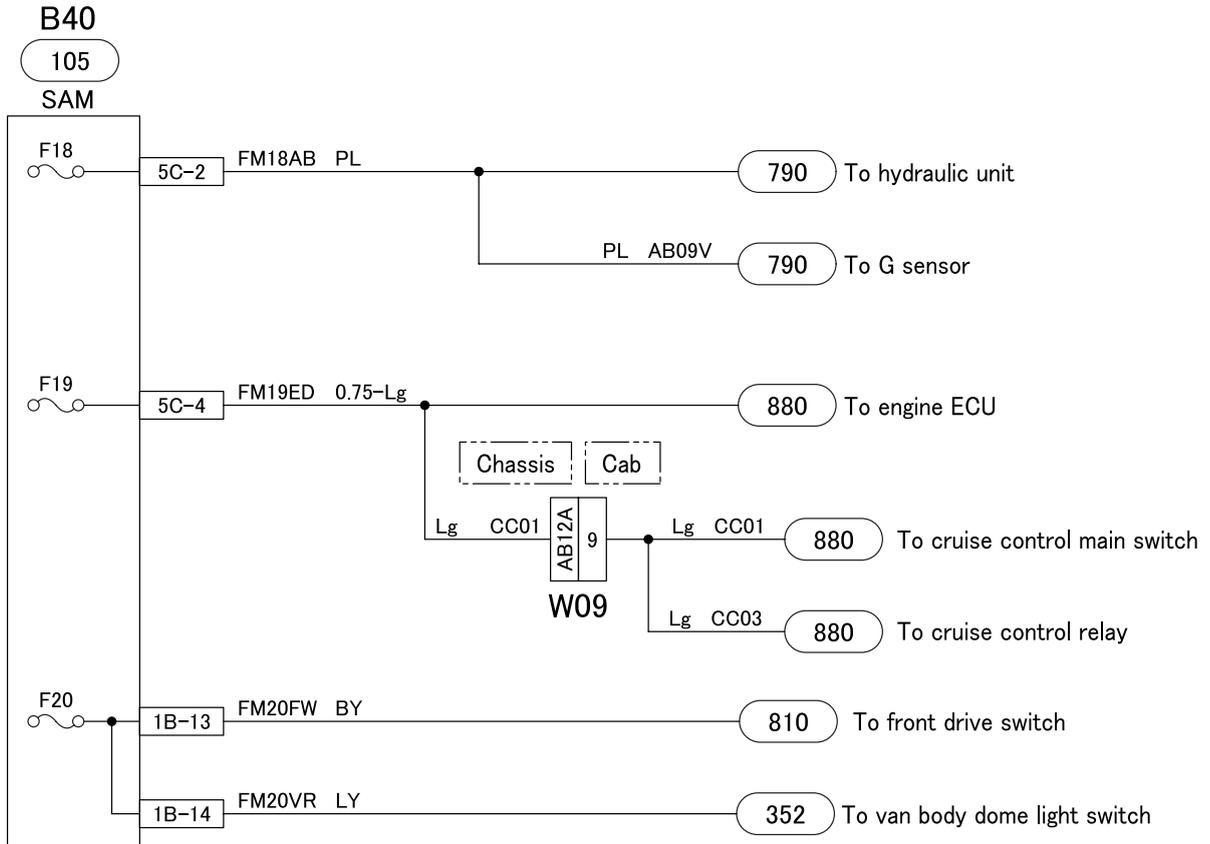
110-C07391F15



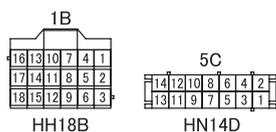
### POWER CIRCUIT (6)

SAM  
(Fuse F18 to F20)

ABS : Anti-lock brake system  
ECU : Electronic control unit



SAM connector (harness side)

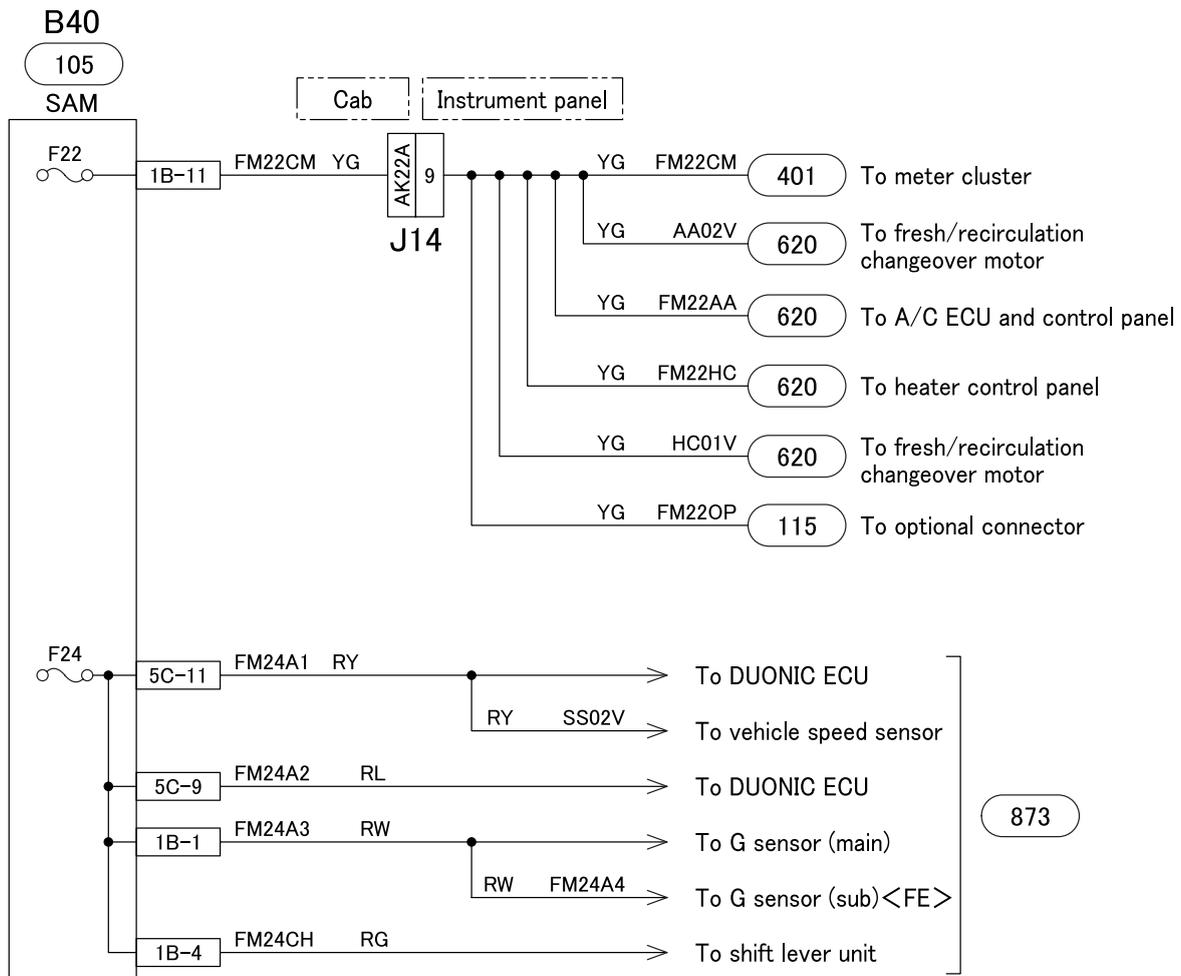


110-C07391F18

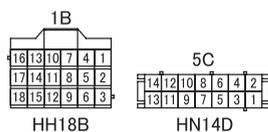
### POWER CIRCUIT (7)

SAM  
(Fuse F22 to F24)

A/C : Air-conditioner  
ECU : Electronic control unit



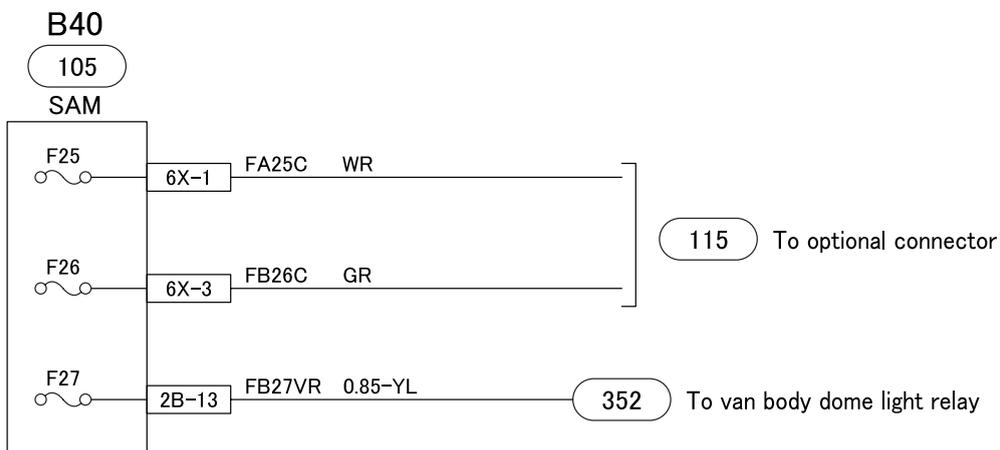
SAM connector (harness side)



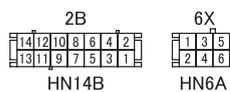
110-C07391F22

### POWER CIRCUIT (8)

SAM  
(Fuse F25 to F27)



SAM connector (harness side)



110-C07391F25



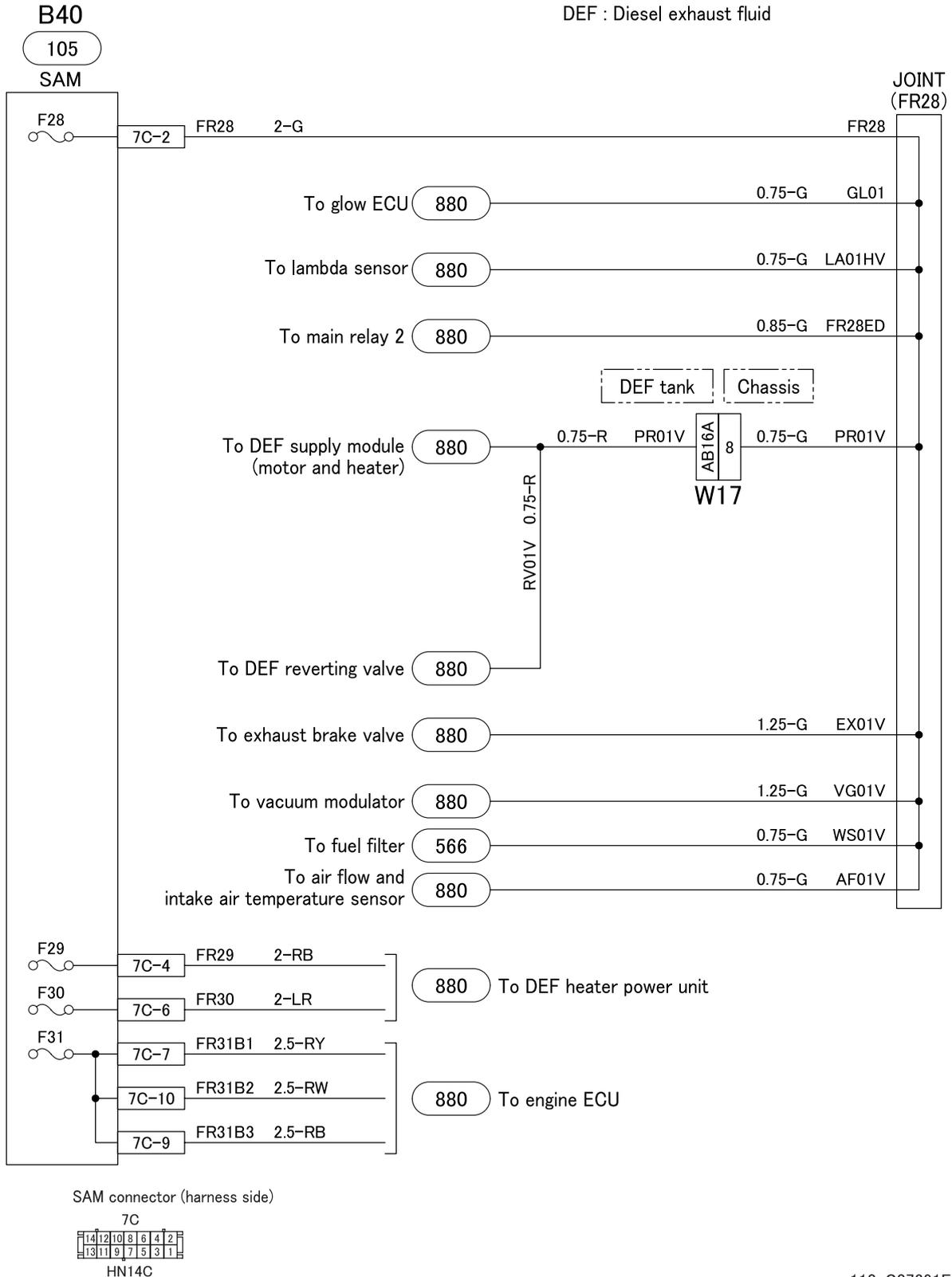
### POWER CIRCUIT (9)

SAM

(Fuse F28 to F31)

ECU : Electronic control unit

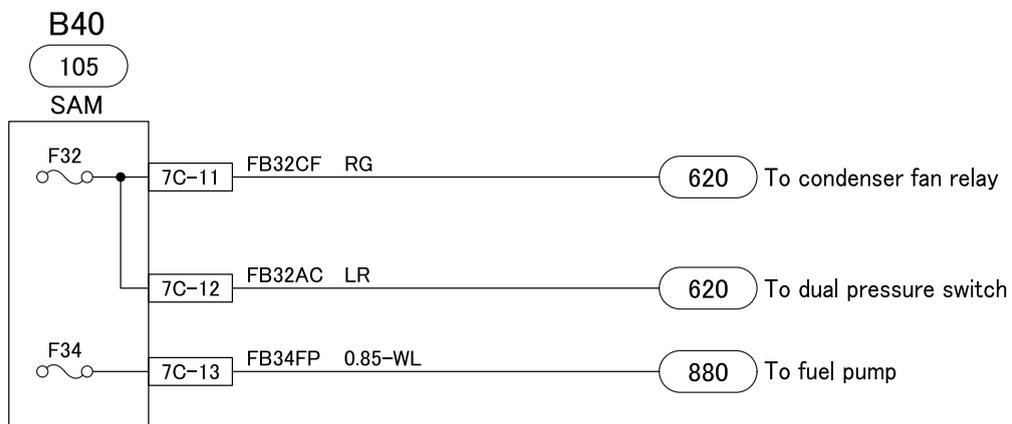
DEF : Diesel exhaust fluid



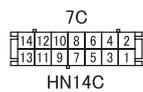
110-C07391F28

### POWER CIRCUIT (10)

SAM  
(Fuse F32 to F34)



SAM connector (harness side)

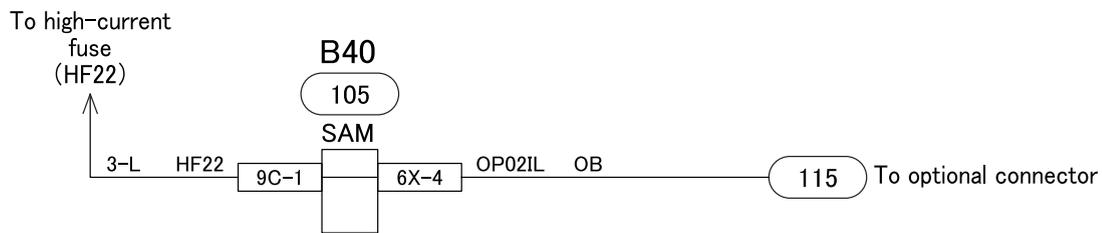


110-C07391F32

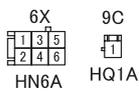


### POWER CIRCUIT (11)

SAM  
(OPTIONAL BAT)



SAM connector (harness side)

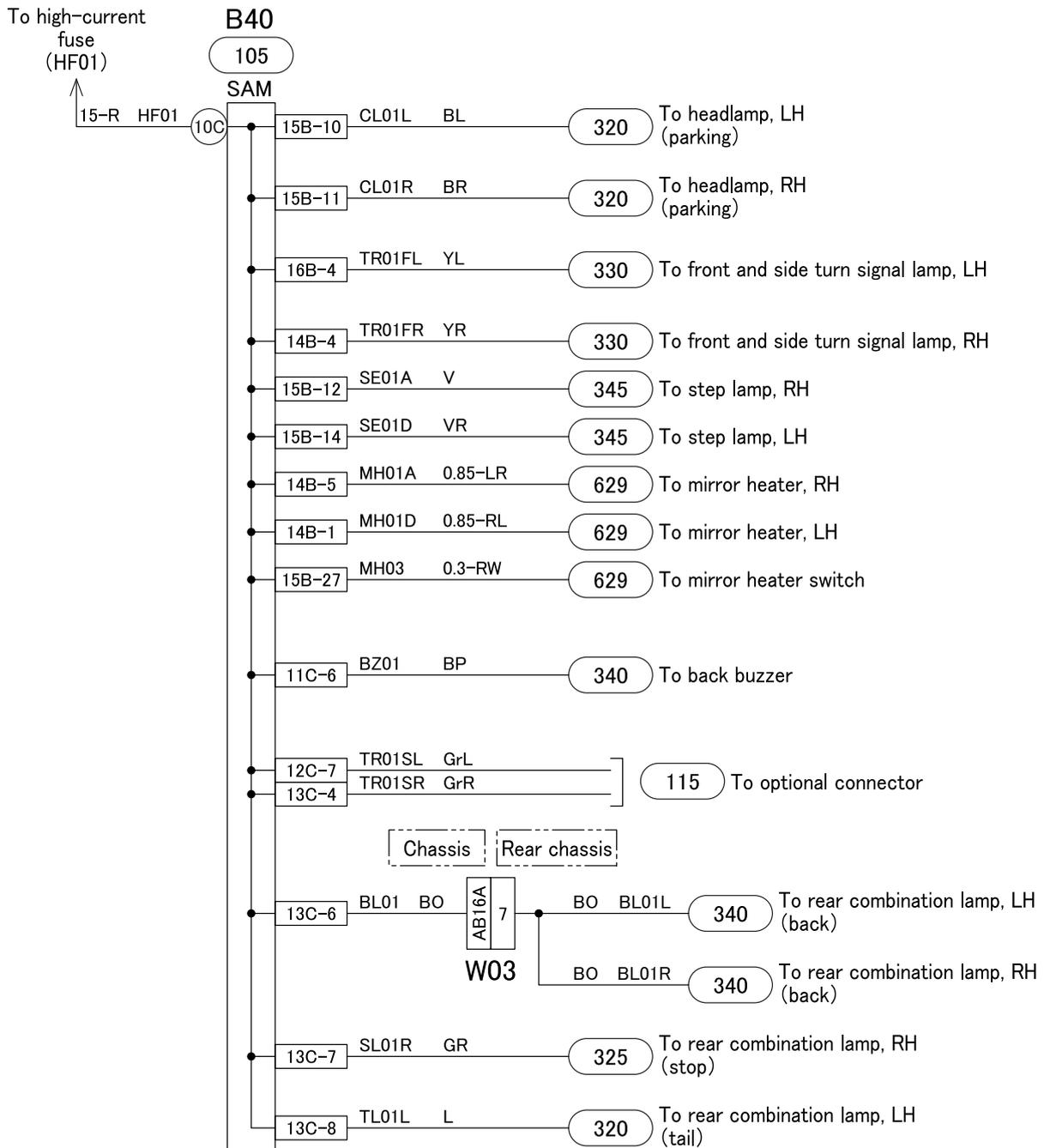


110-C073910B

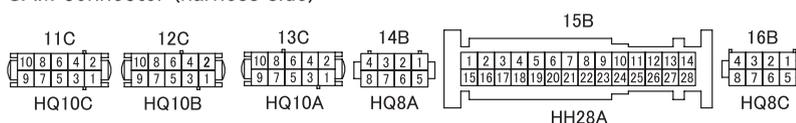


### POWER CIRCUIT (12)

SAM  
(VEHICLE BAT) 1/3



SAM connector (harness side)

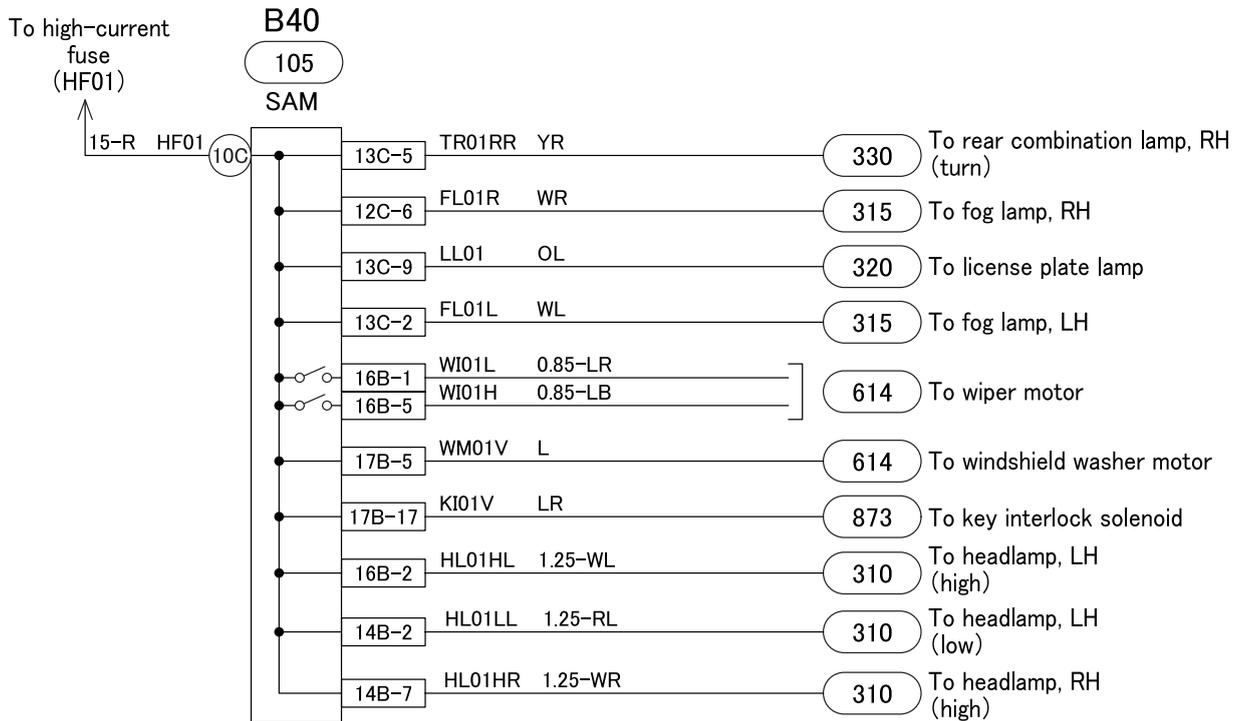


110-C07391VB-1

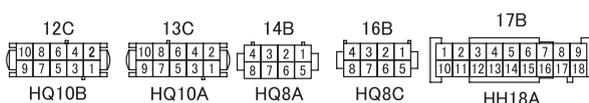


### POWER CIRCUIT (13)

SAM  
(VEHICLE BAT) 2/3



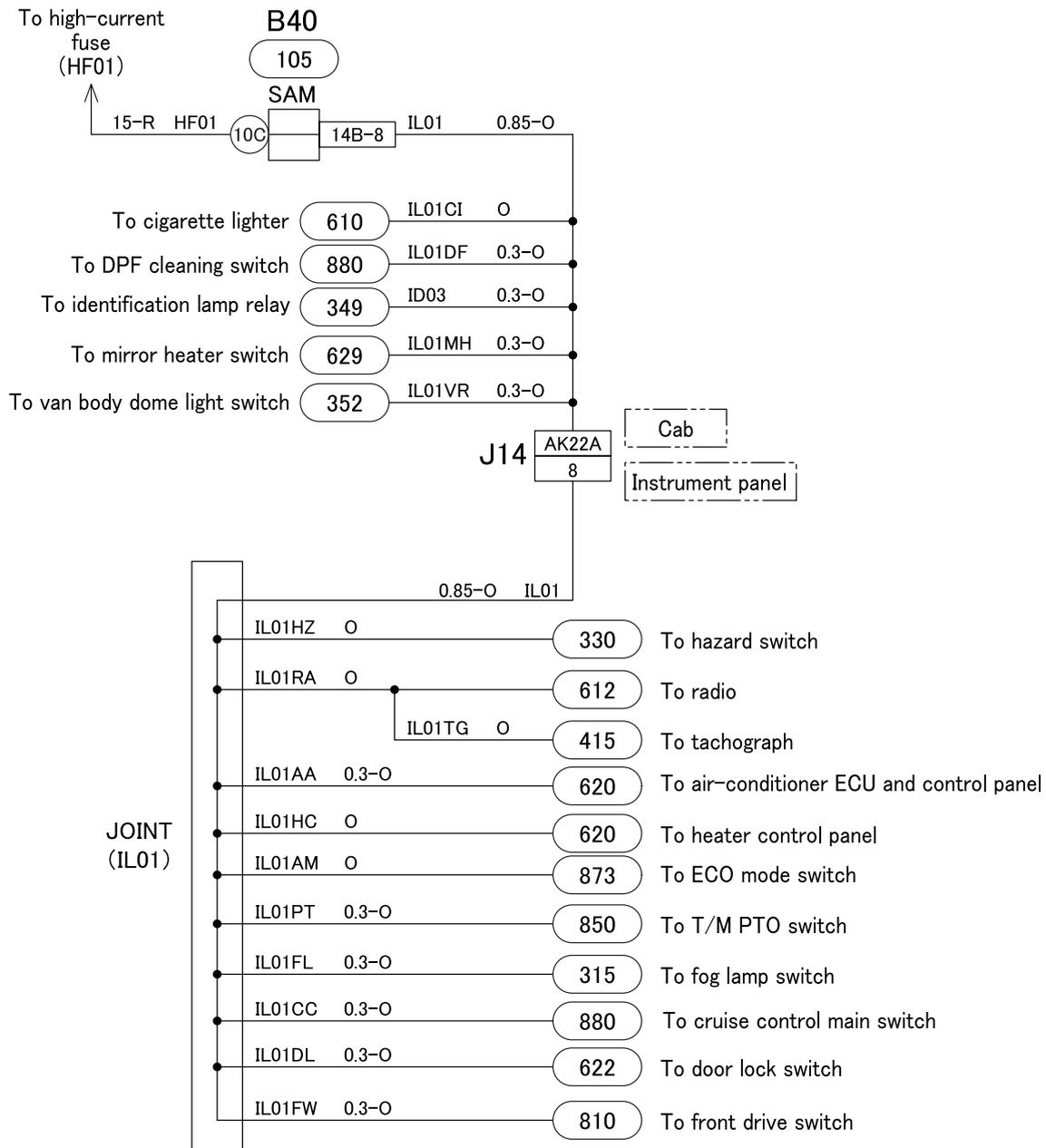
SAM connector (harness side)



110-C07391VB-2

### POWER CIRCUIT (14)

SAM  
(VEHICLE BAT) 3/3



SAM connector (harness side)

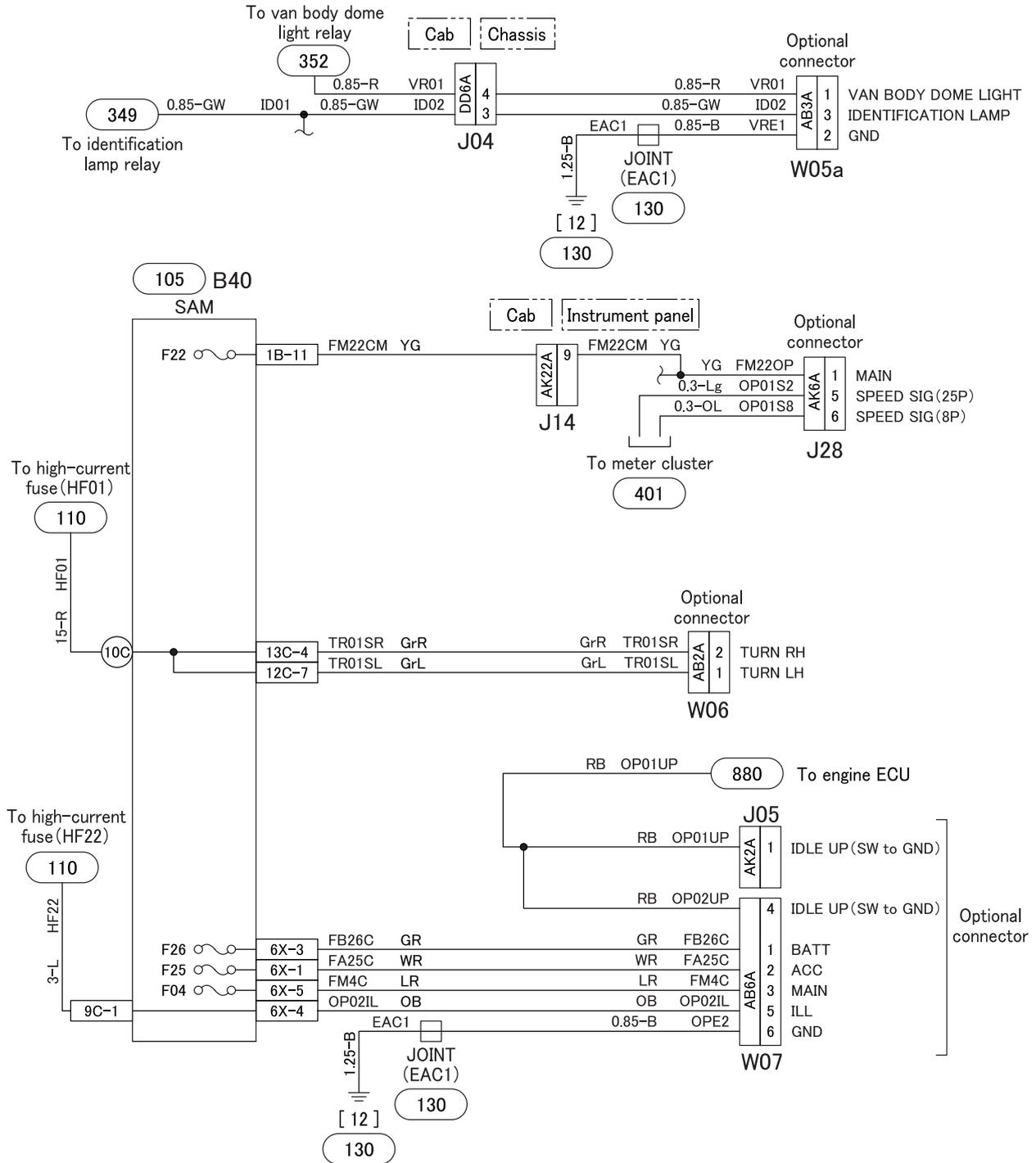


ECU : Electronic control unit  
T/M : Transmission  
PTO : Power take-off  
DPF : Diesel particulate filter

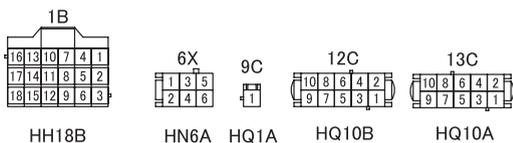
110-C07391VB-3



RESERVE POWER CIRCUIT

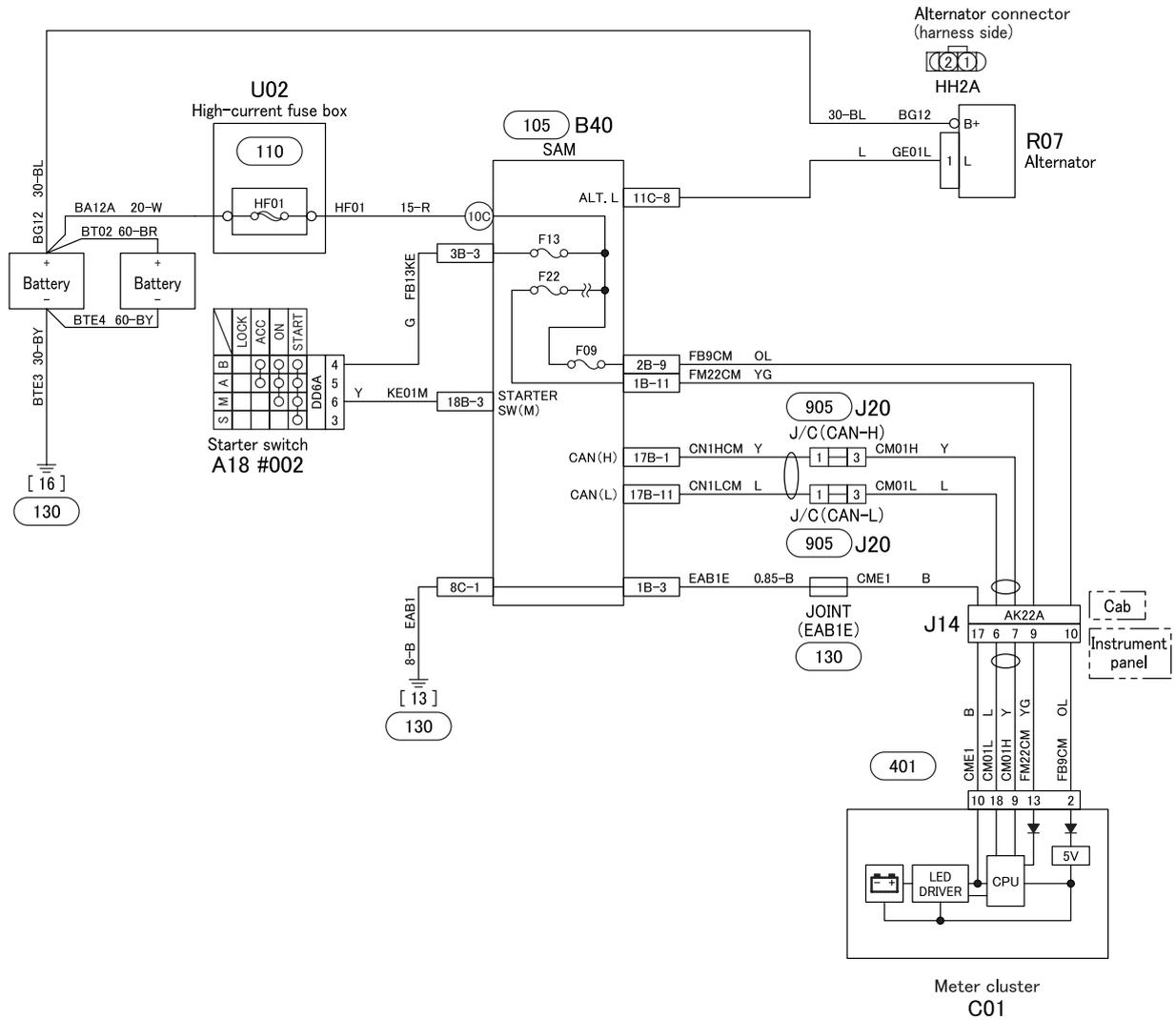


SAM connector (harness side)

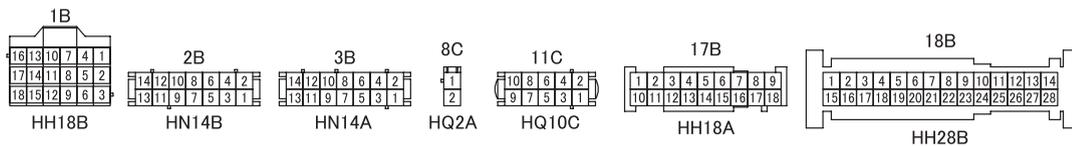


115-C07391

BATTERY CHARGING CIRCUIT



SAM connector (harness side)

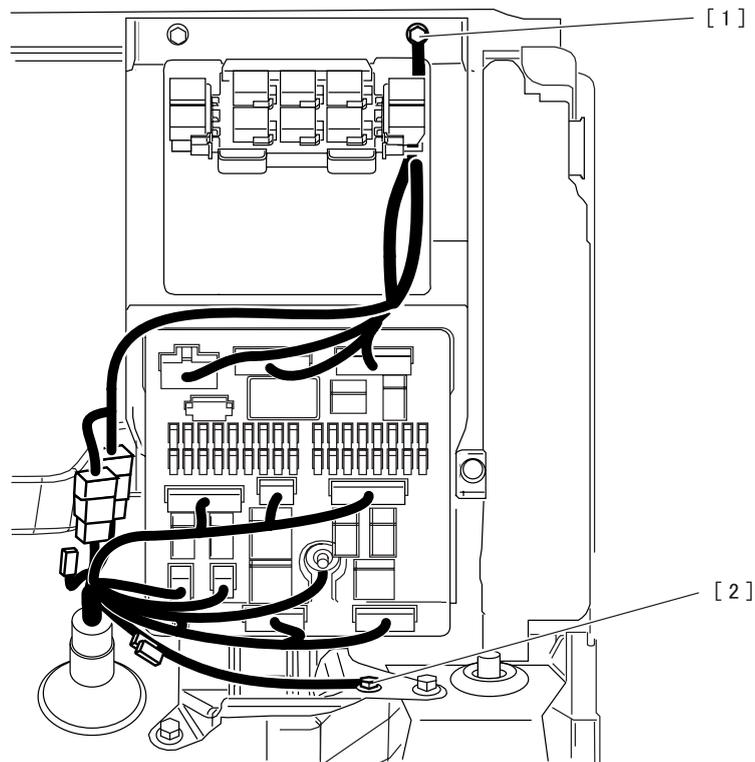
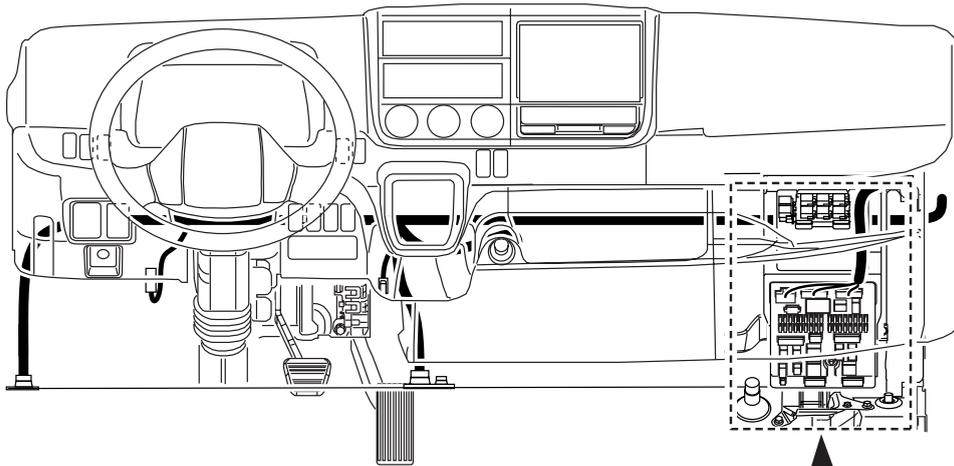


125-C07391

### GROUND (1)

[ 1 ] to [ 2 ]

Cab ground



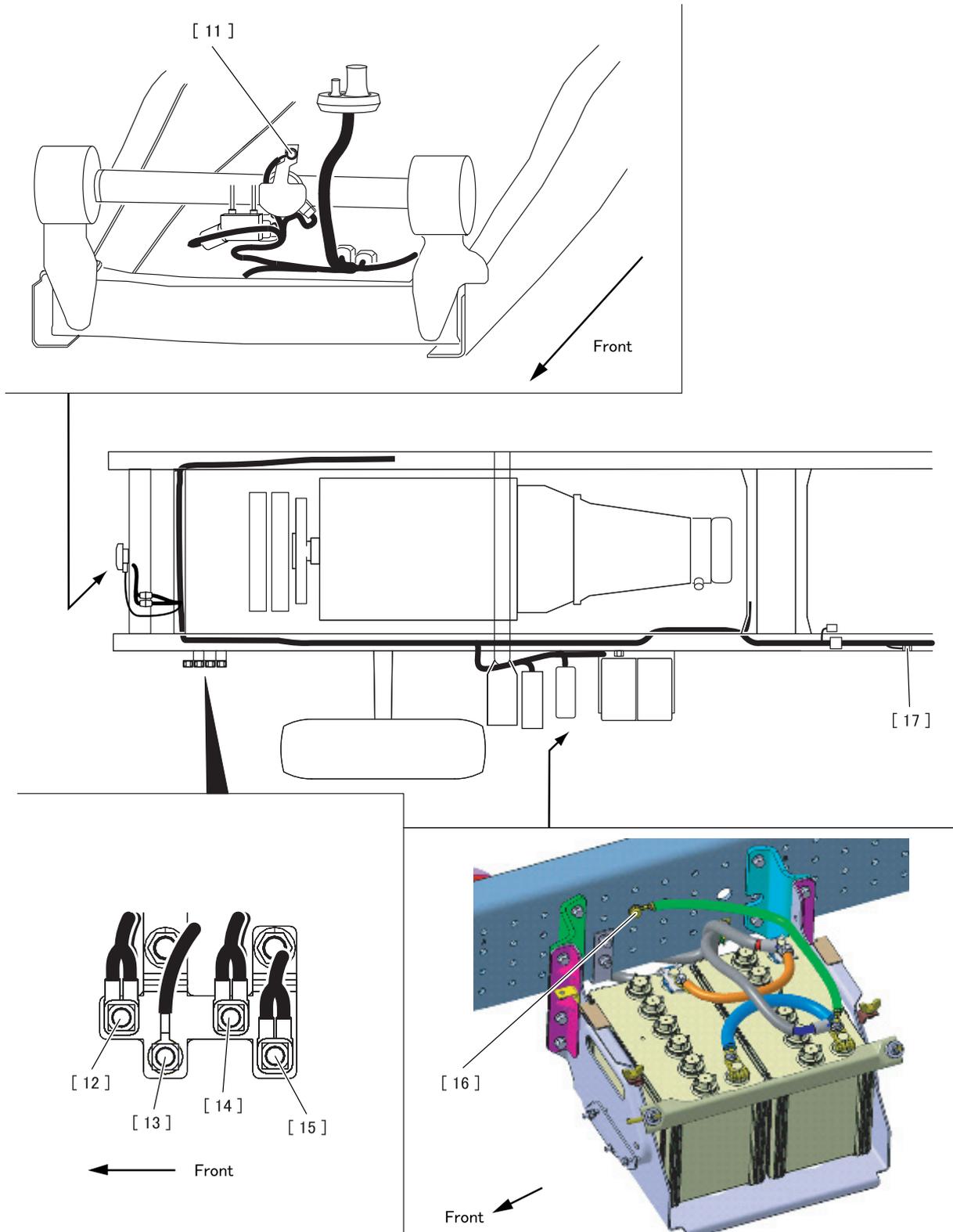
Location	Circuit No.	Wire diameter - wire color	Destination	Remarks
[1]	EAB2	1.25-B	JOINT (EAB2)	
[2]	EAB3	1.25-B	Frame ground ([12])	

54-L05278GND-1



### GROUND (2)

[11] to [17] Chassis ground



54-L05278GND-2

### GROUND (3)

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)	
	FHE1	1.25-B	Fuel filter	
	FHE1S	1.25-B		FG
	FLE1	B	Fog lamp	
	HNE1	1.25-B	Horn ground	
	HSE1	2-B	DEF tank	BlueTec® exhaust gas aftertreatment
	HSE2	2-B		
[13]	EAB1	8-B	SAM	
[14]	ABE1	3-B	Hydraulic unit	ABS
	ABE2	3-B		
	AME1	1.25-B	DUONIC ECU	
	AME2	1.25-B		
	EDE1	2.5-B	Engine ECU	
	EDE2	2.5-B		
	EDE3	2.5-B		
	EXE1	1.25-B		
[15]	CFE1	1.25-B	Condenser fan motor	
	EAR1		JOINT (EAR1)	FG
[16]	BTE3	30-BY	Battery	
[17]	EAR1	1.25-B	JOINT (EAR1)	FE
	FPE1X	0.85-B	Fuel pump	FE

SAM : Signal detect and actuation modules □

ABS : Anti-lock brake system □

ECU : Electronic control unit

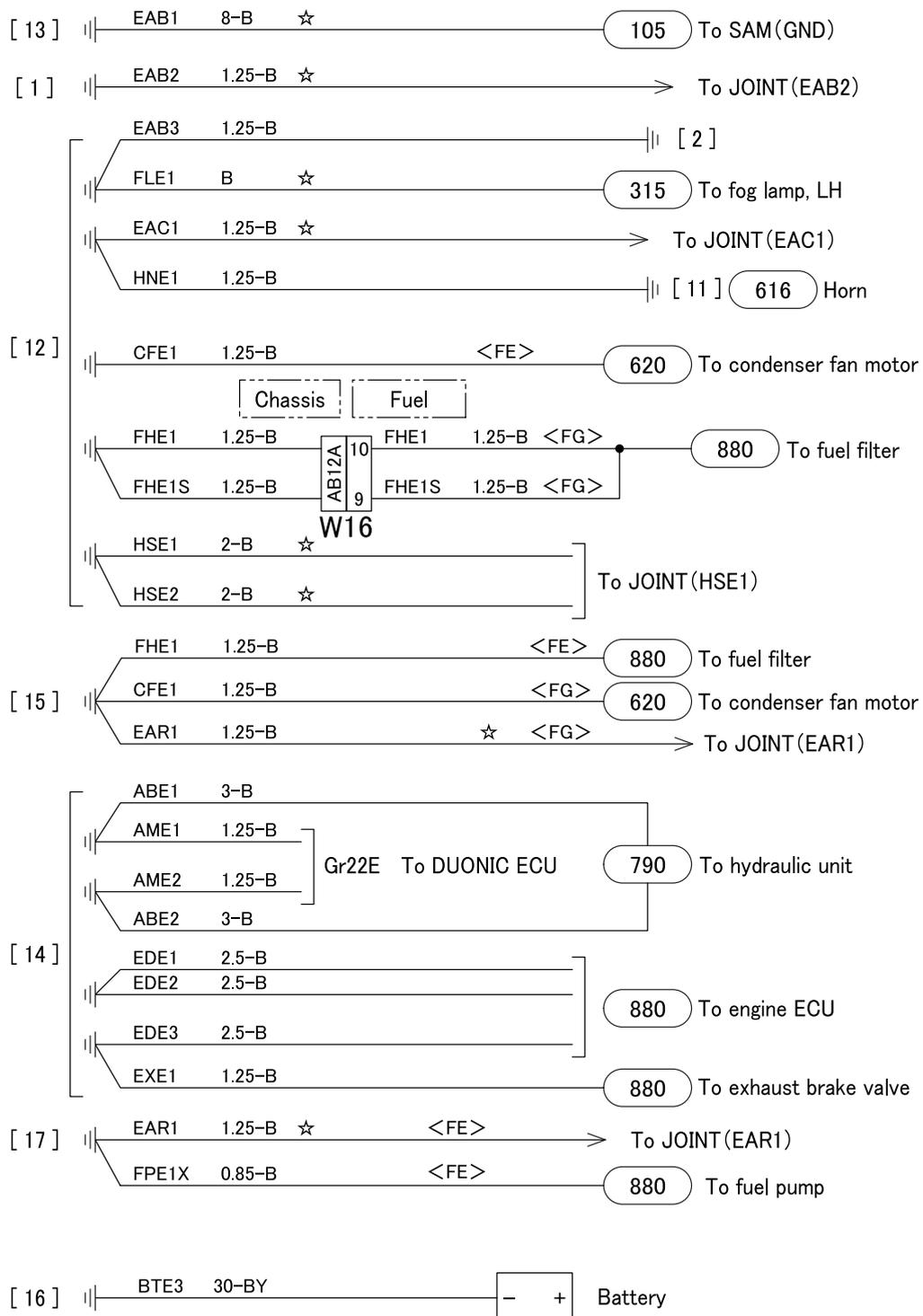
DEF : Diesel exhaust fluid

### GROUND (4)

#### Entire ground

- This diagram indicates grounding points.
- See the following pages for branching of grounding (wiring for ☆).  
(in circuit No. order)

ECU : Electronic control unit

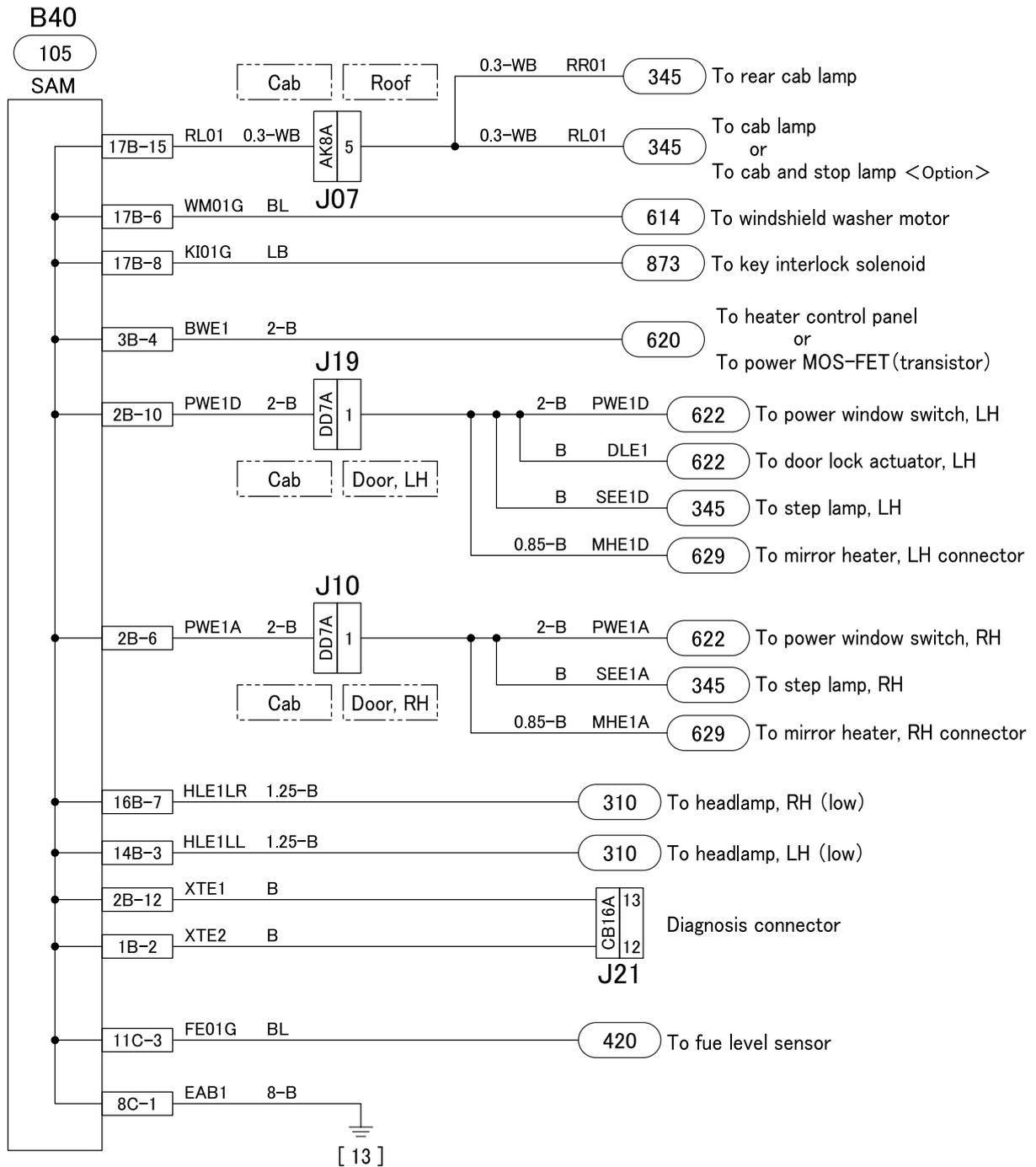


130-C07391ALL

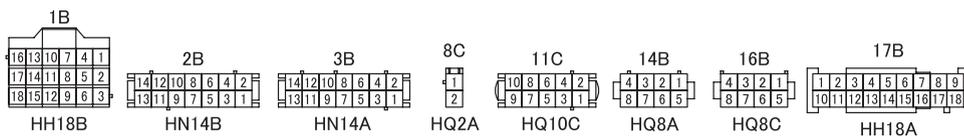


### GROUND (5)

Circuit No. EAB1 ground (1/6)



SAM connector (harness side)

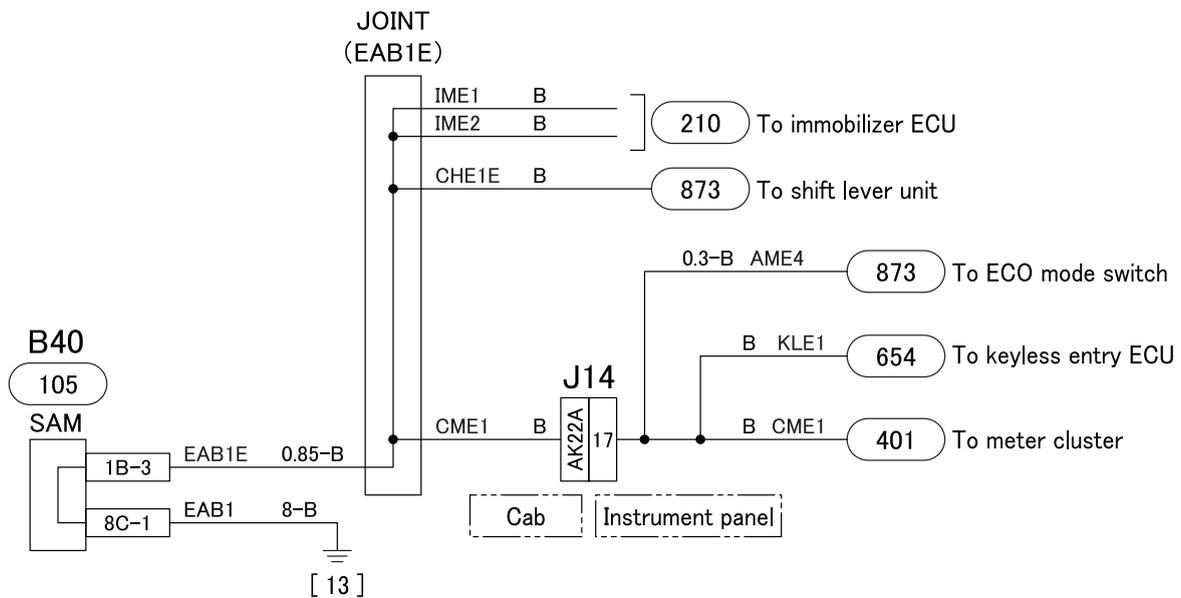


130-C07391EAB1-1

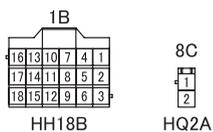
### GROUND (6)

Circuit No. EAB1 ground (2/6)  
 <JOINT(EAB1E)>

ECU : Electronic control unit



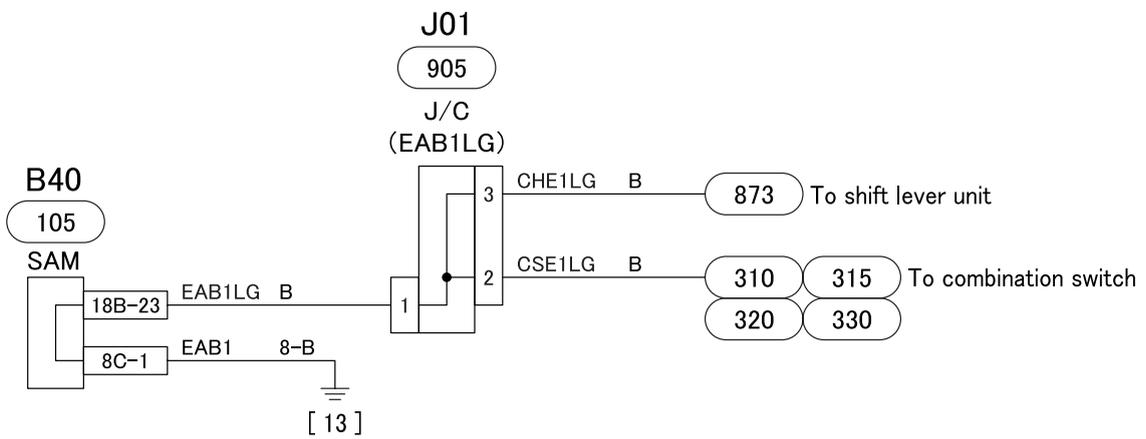
SAM connector (harness side)



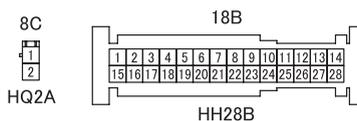
130-C07391EAB1-2

GROUND (7)

Circuit No. EAB1 ground (3/6)  
 <J/C(EAB1LG)>



SAM connector (harness side)

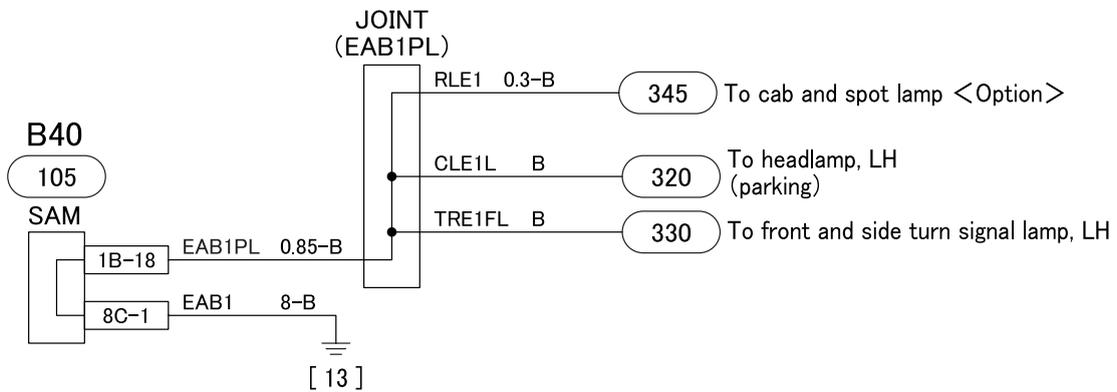


130-C07391EAB1-3

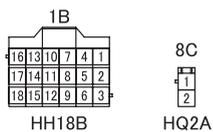


### GROUND (8)

Circuit No. EAB1 ground (4/6)  
 <JOINT(EAB1PL)>



SAM connector (harness side)

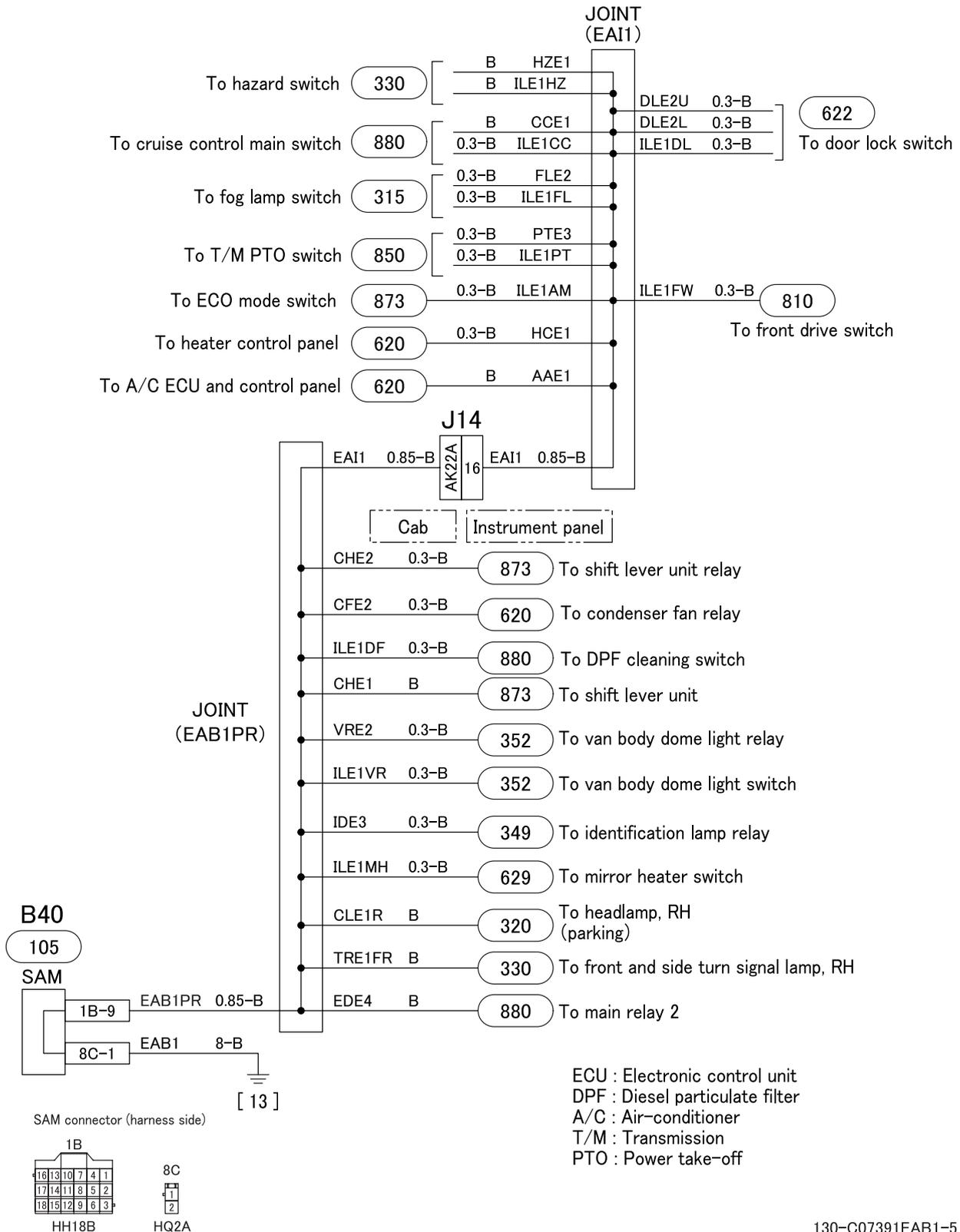


130-C07391EAB1-4



### GROUND (9)

Circuit No. EAB1 ground (5/6)  
 <JOINT(EAB1PR), JOINT(EAI1)>

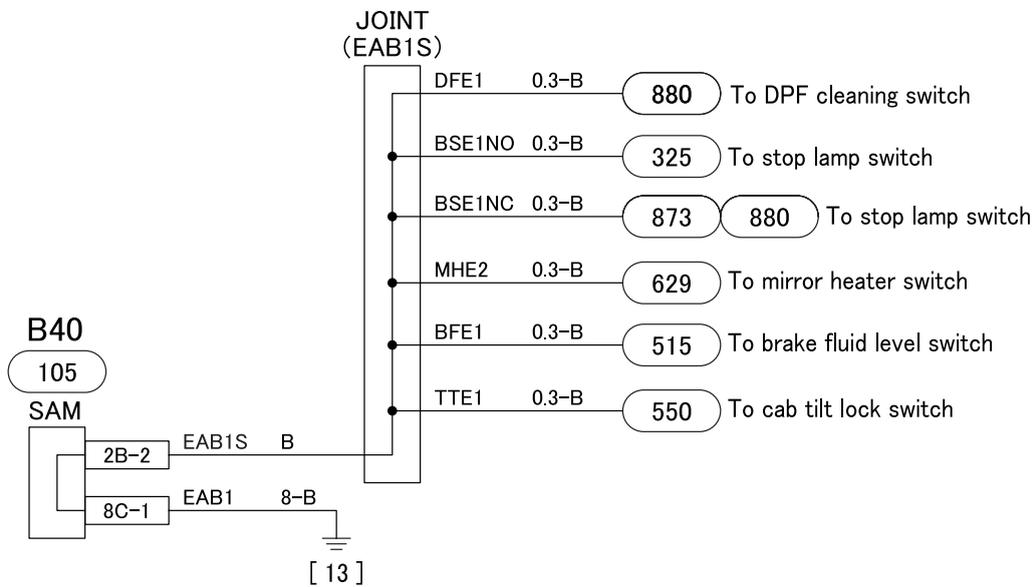


130-C07391EAB1-5

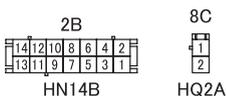
### GROUND (10)

Circuit No. EAB1 ground (6/6)  
 <JOINT(EAB1S)>

DPF : Diesel particulate filter



SAM connector (harness side)

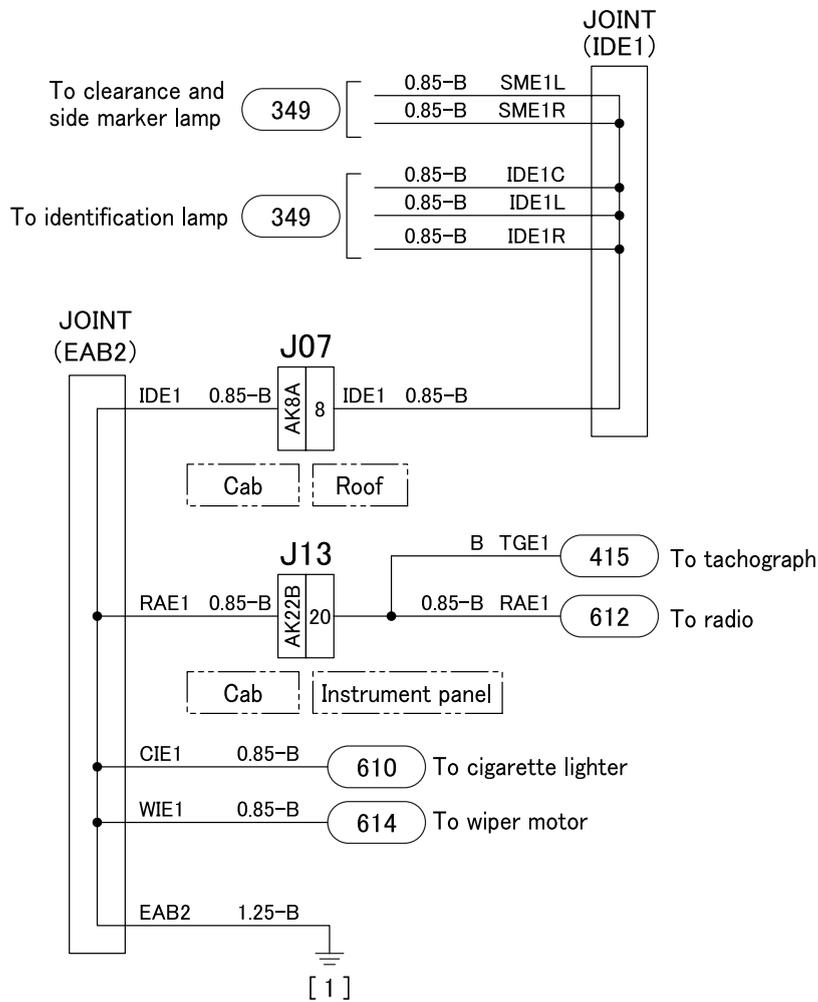


130-C07391EAB1-6



### GROUND (11)

Circuit No. EAB2 ground

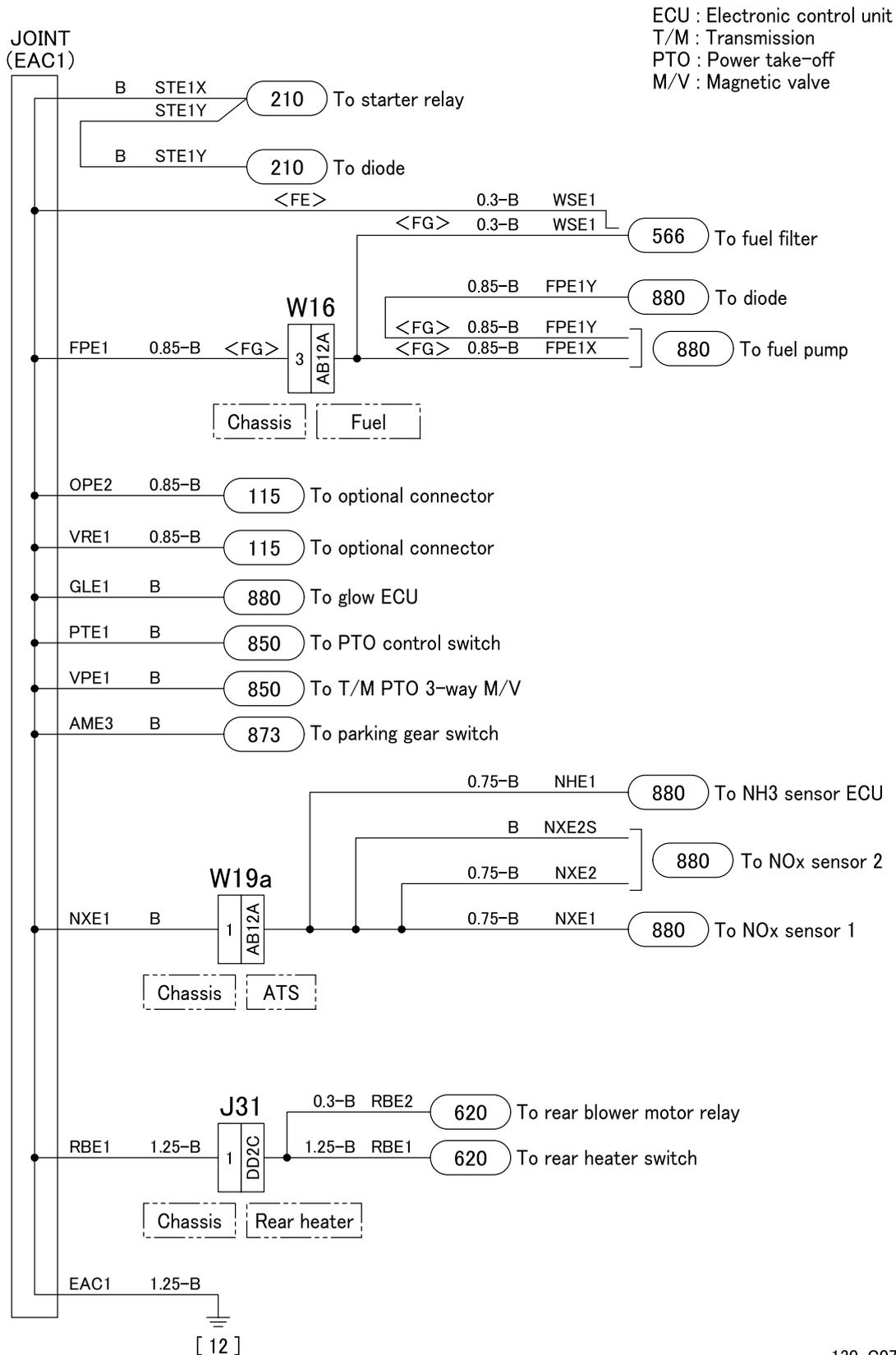


130-C07391EAB2



### GROUND (12)

Circuit No. EAC1 ground



[ 12 ]

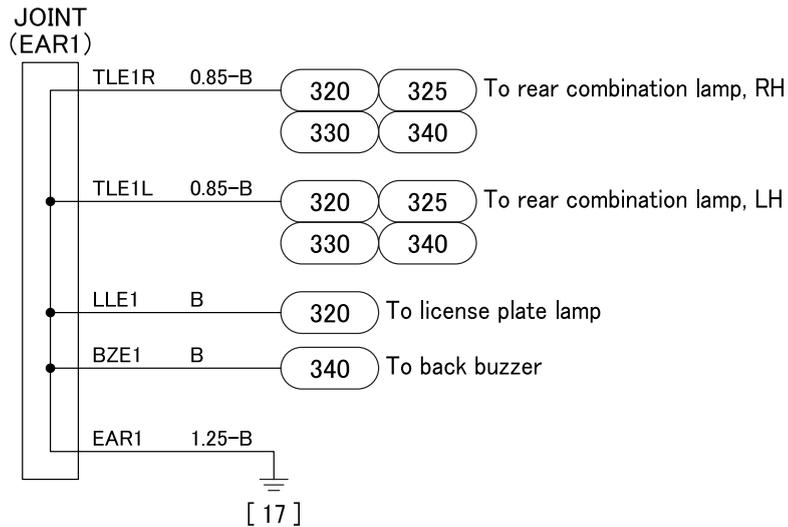
130-C07391EAC1



GROUND (13)

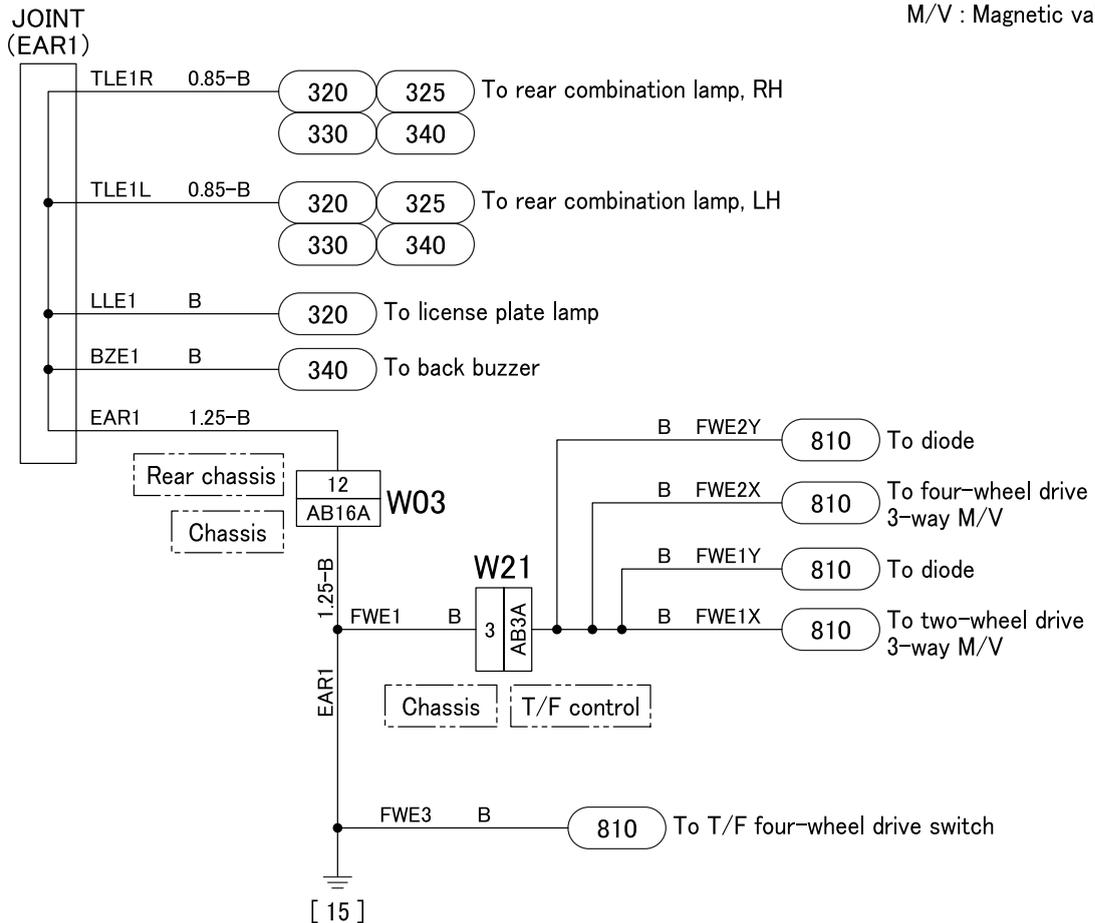
Circuit No. EAR1 ground

<FE>



<FG>

T/F : Transfer  
M/V : Magnetic valve

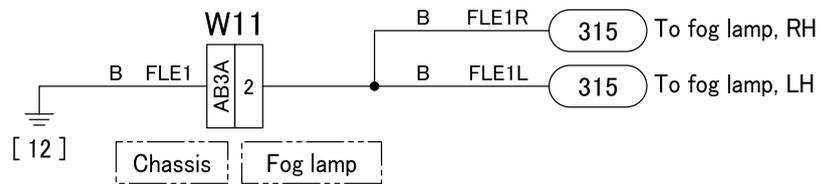


130-C07391EAR1



GROUND (14)

Circuit No. FLE1 ground



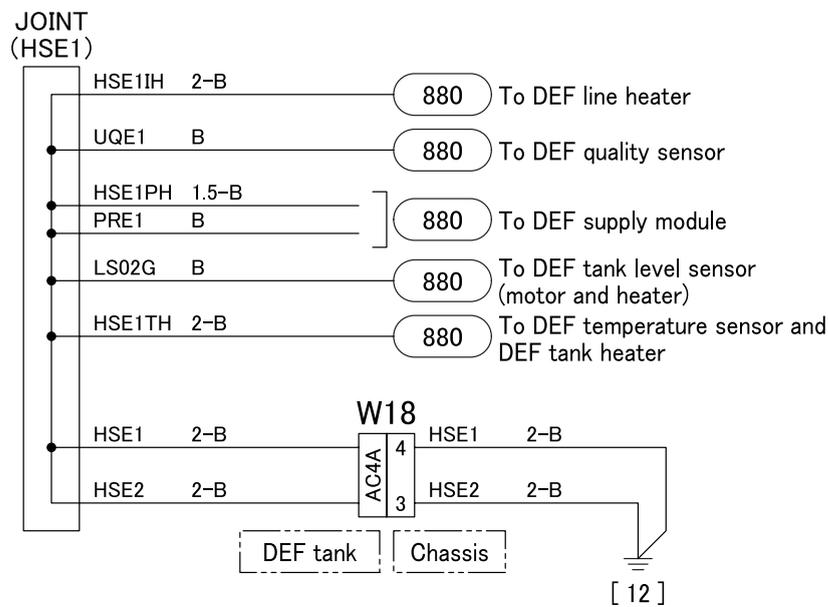
130-C07391FLE1



### GROUND (15)

Circuit No. HSE1, HSE2 ground

DEF : Diesel exhaust fluid

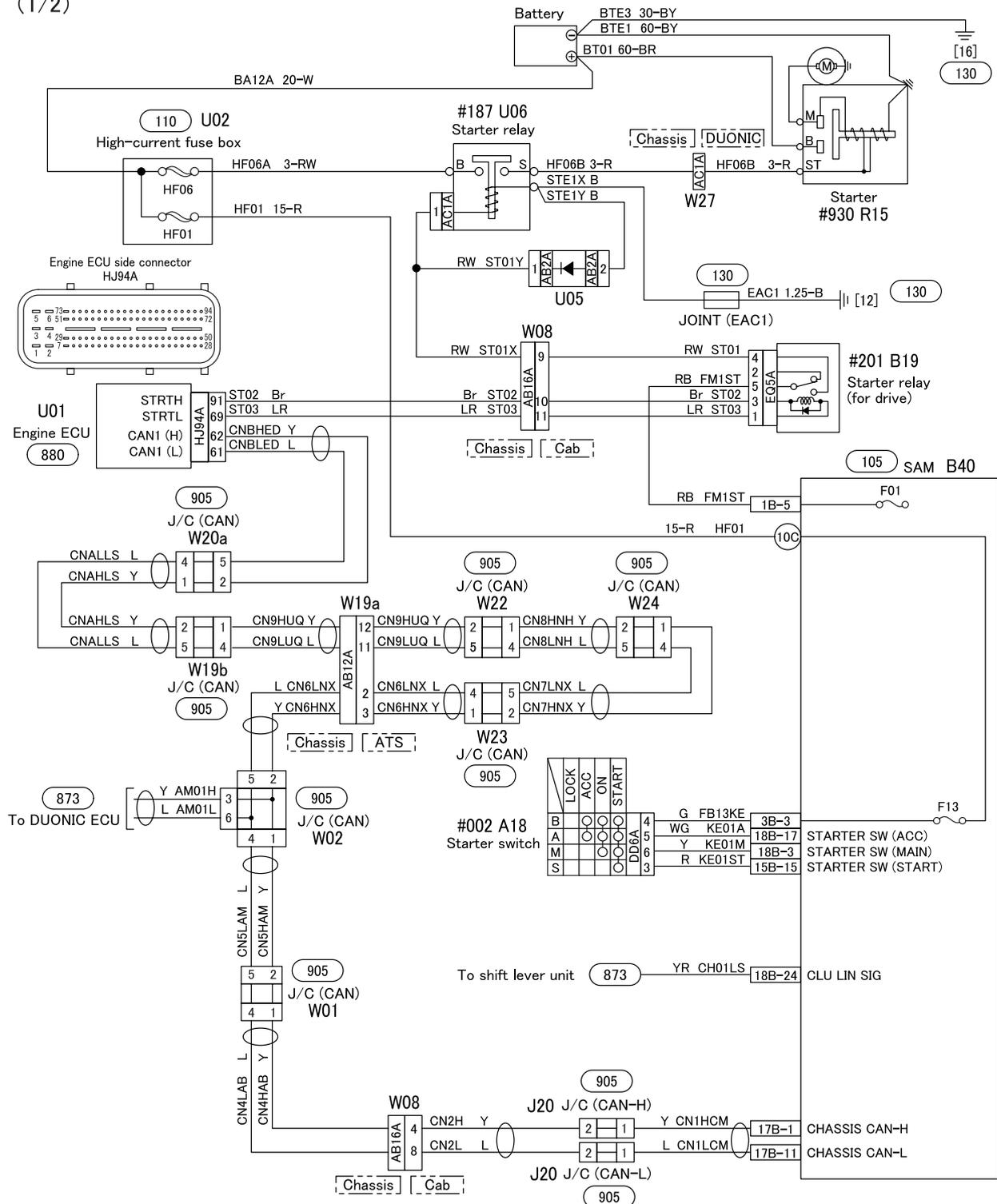


130-C07391HSE1

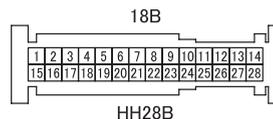
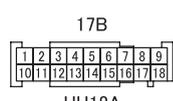
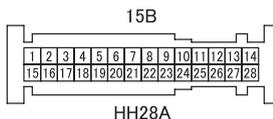
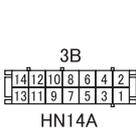
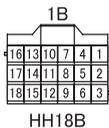


ENGINE STARTING CIRCUIT (1)

(1/2)



SAM connector (harness side)



ECU : Electronic control unit

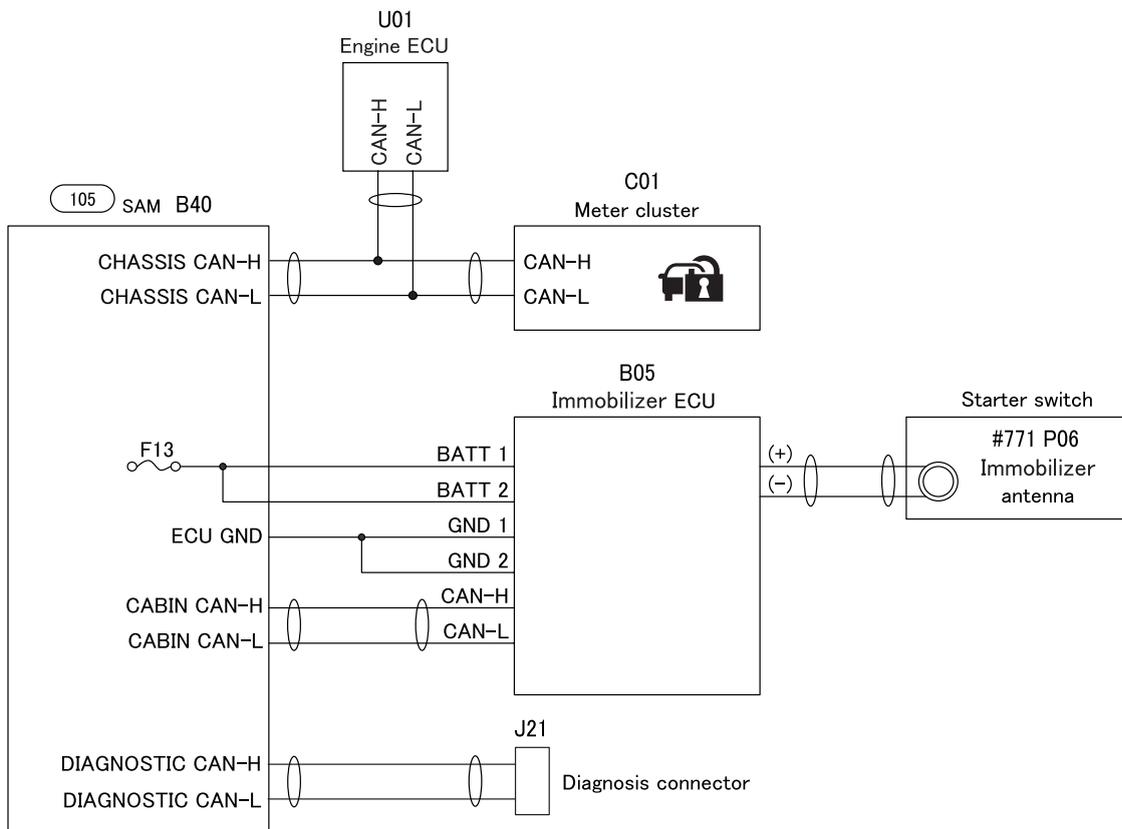
210-C07391-1

ENGINE STARTING CIRCUIT (2)

(2/2)

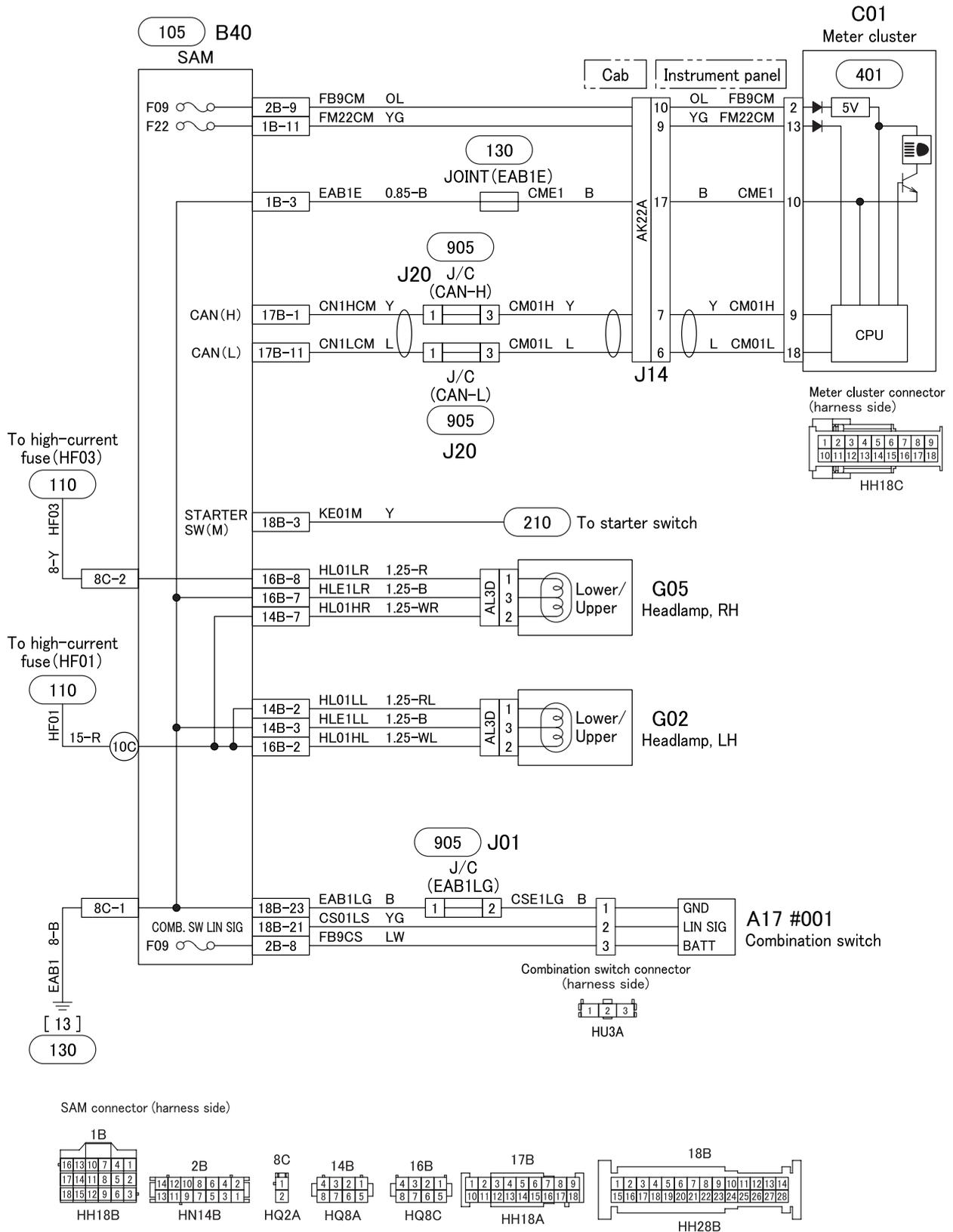
A part of immobilizer circuit is omitted.

ECU : Electronic control unit



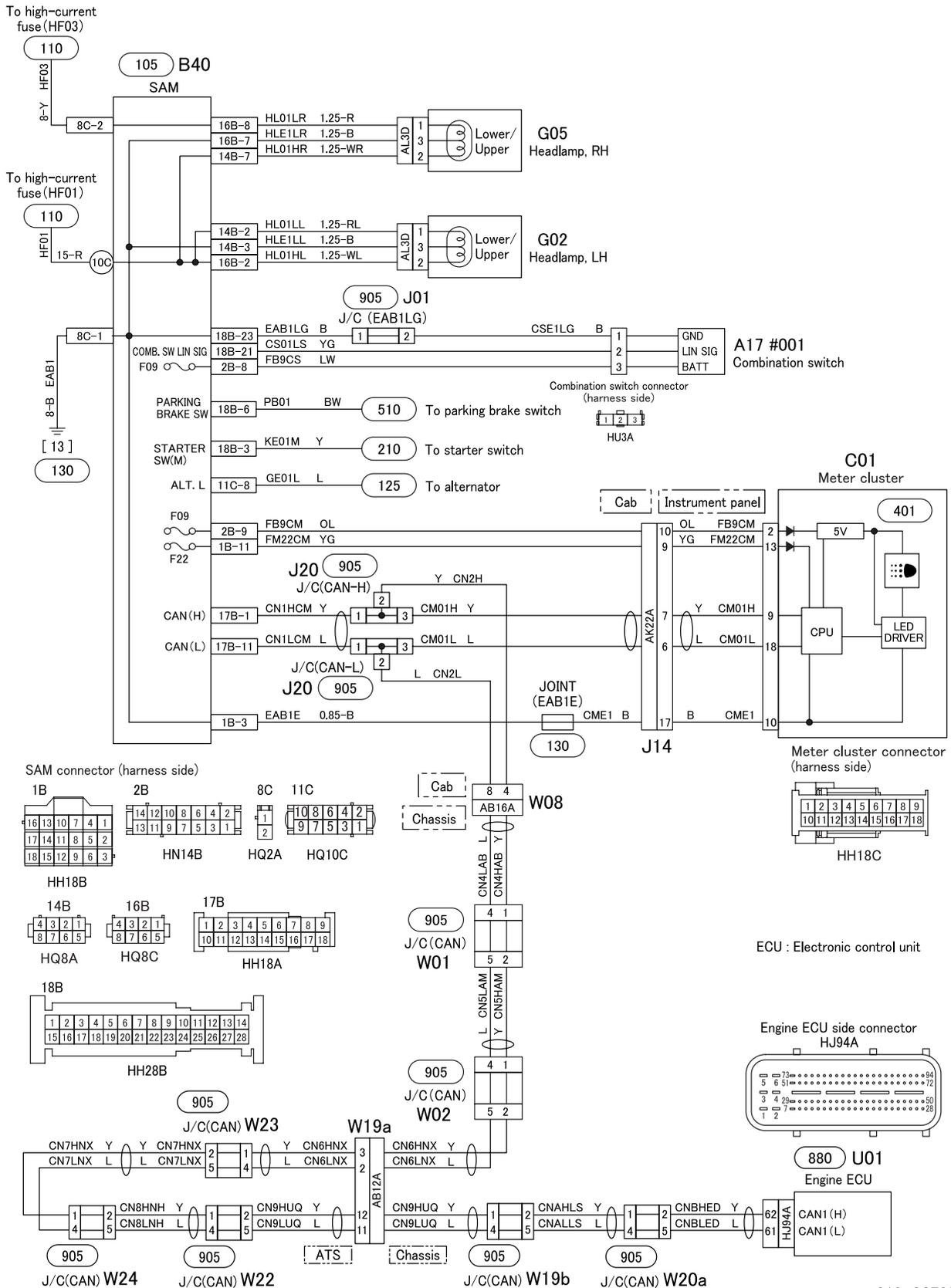
210-C07391-2

HEADLAMP CIRCUIT



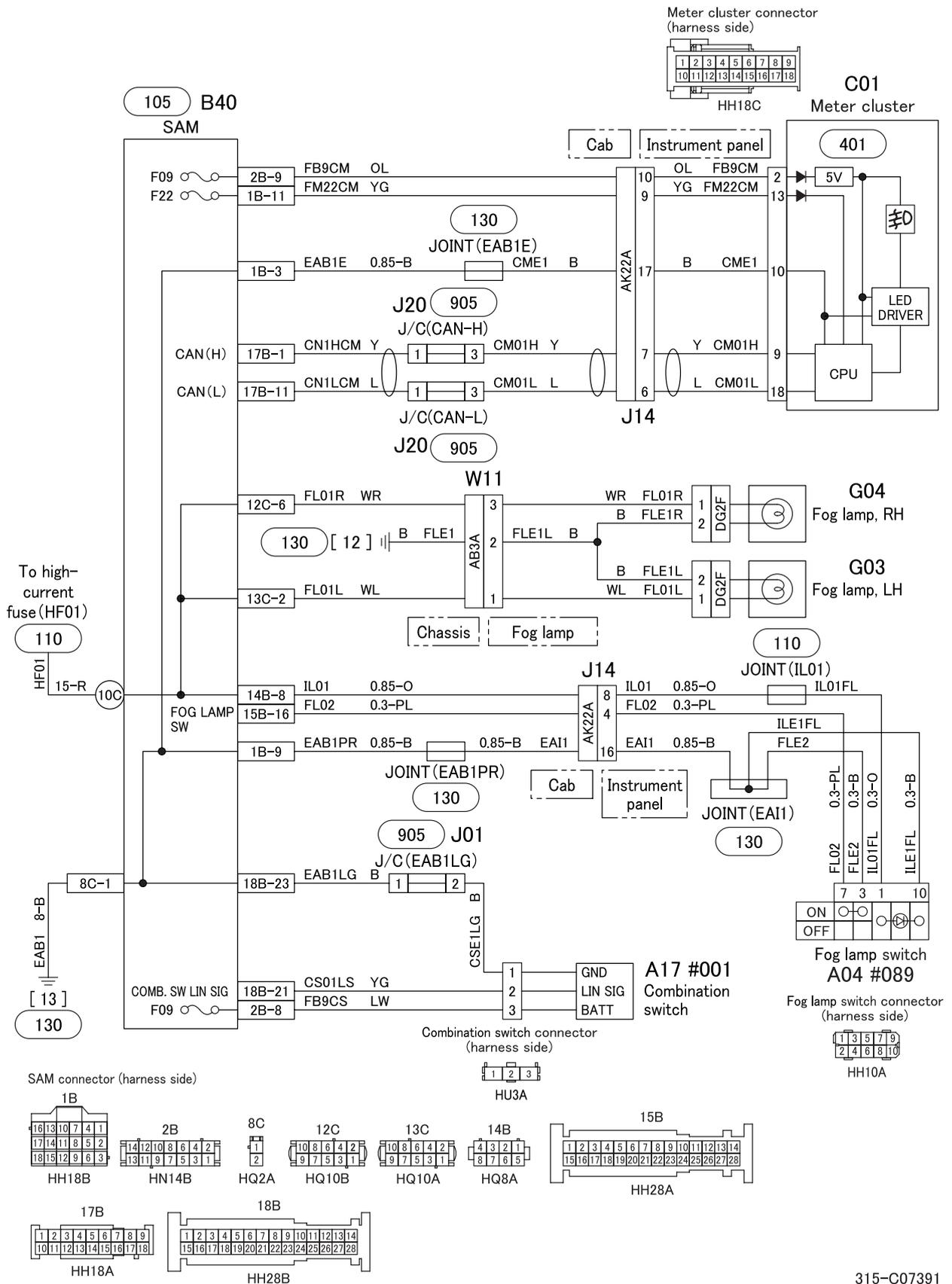
310-C07391

DAYTIME RUNNING LIGHT CIRCUIT



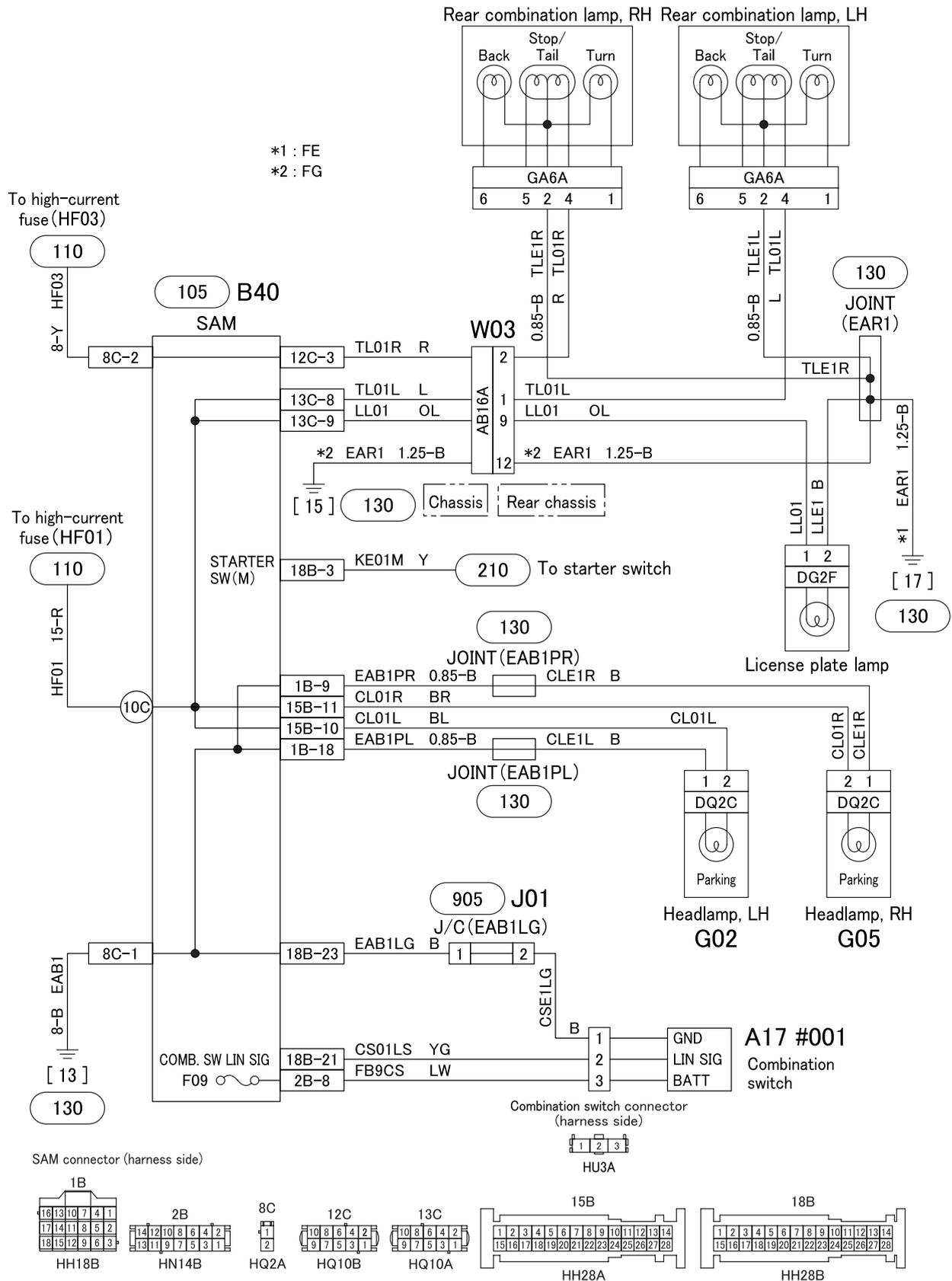
313-C07391

FOG LAMP CIRCUIT



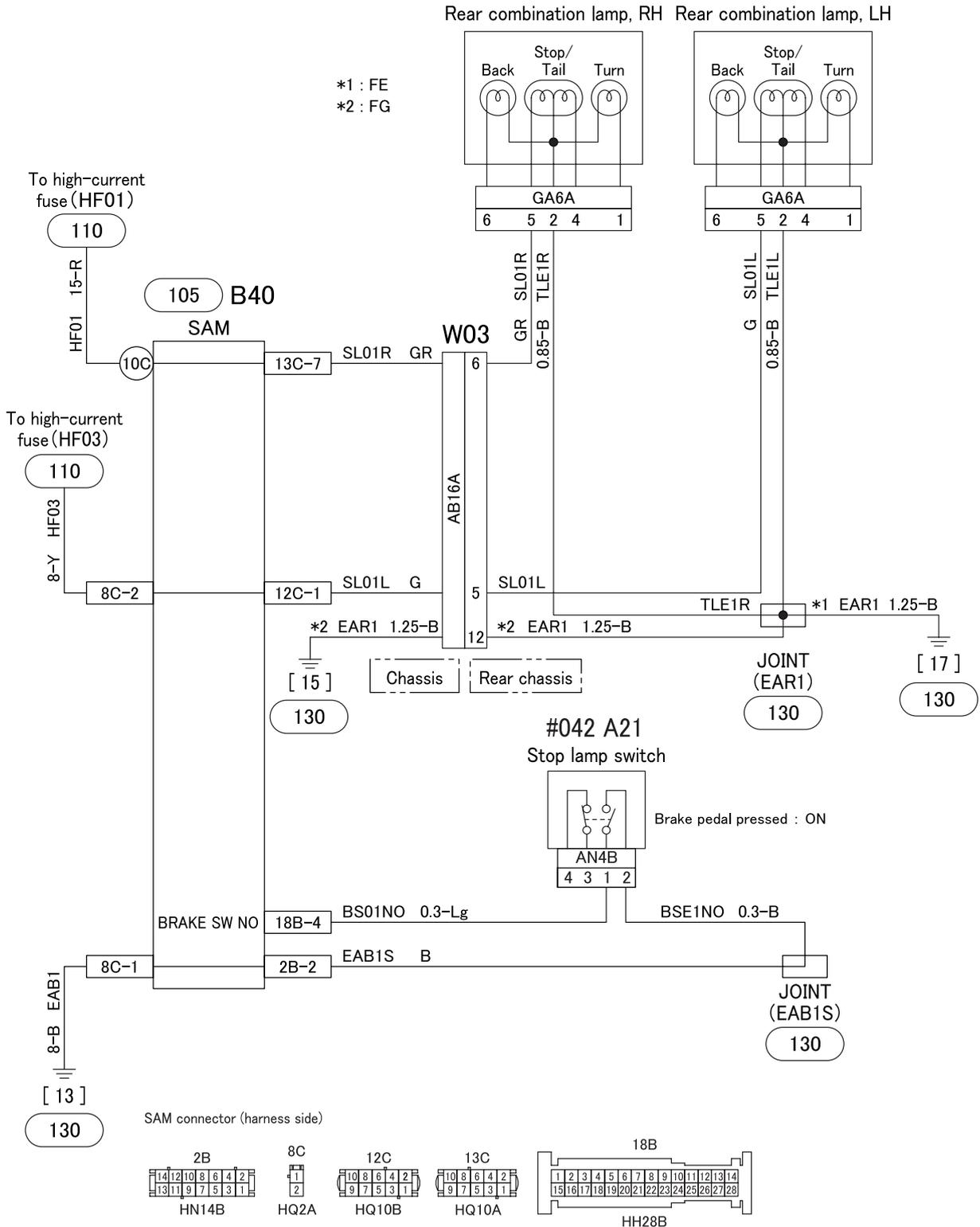
315-C07391

TAIL, POSITION AND LICENSE PLATE LAMPS CIRCUIT



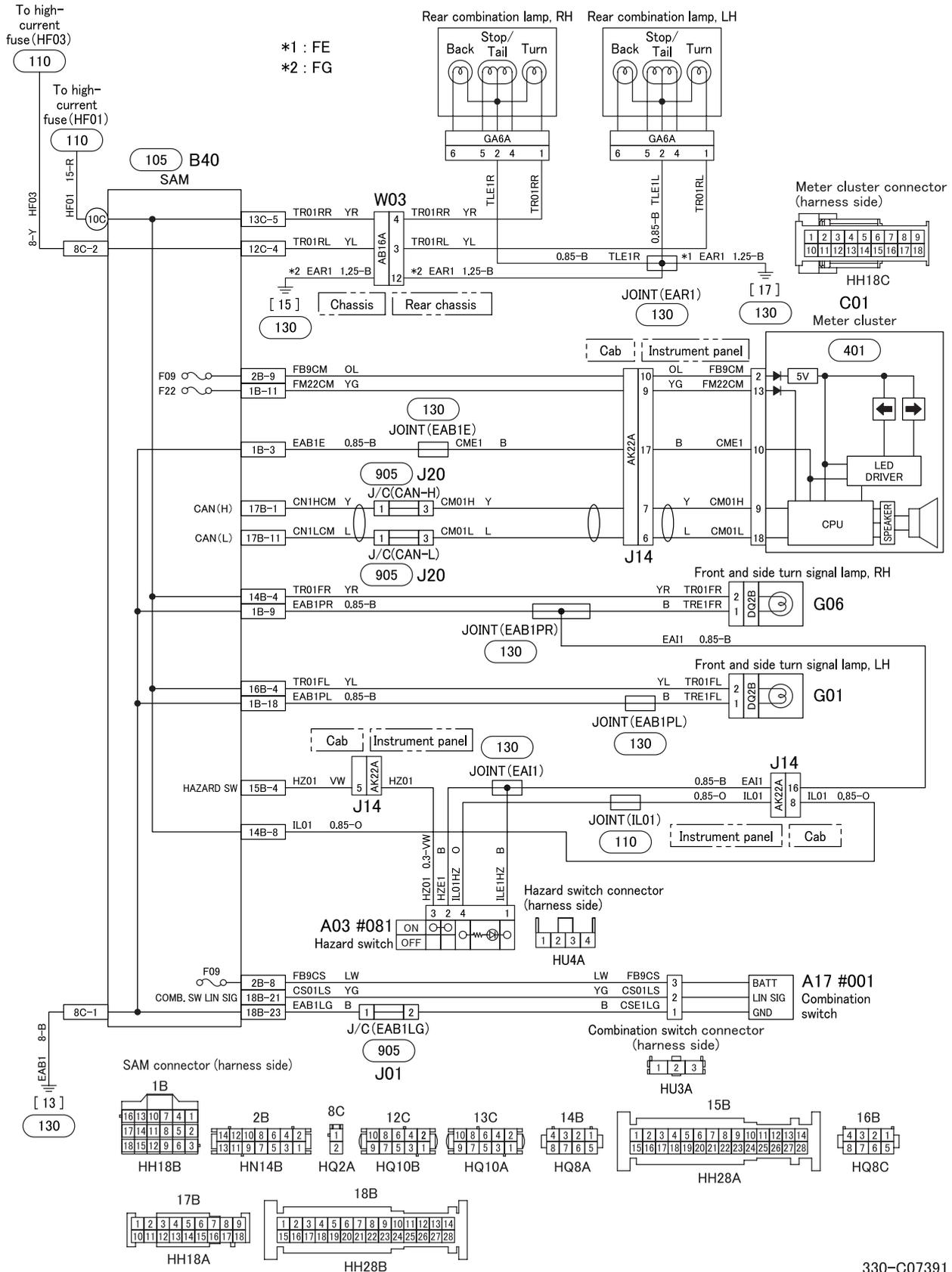
320-C07391

STOP LAMP CIRCUIT



325-C07391

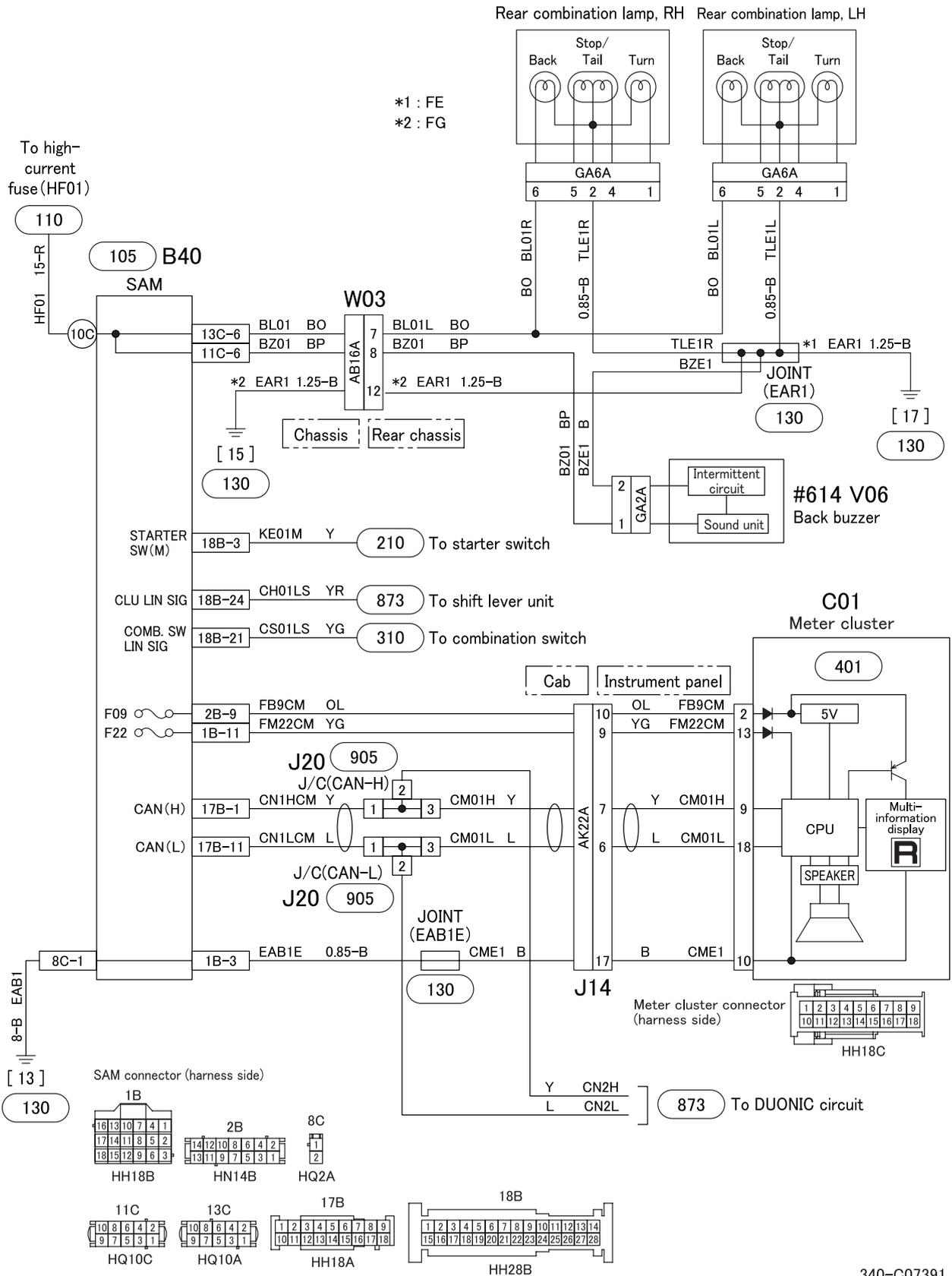
TURN SIGNAL AND HAZARD LAMP CIRCUIT



330-C07391



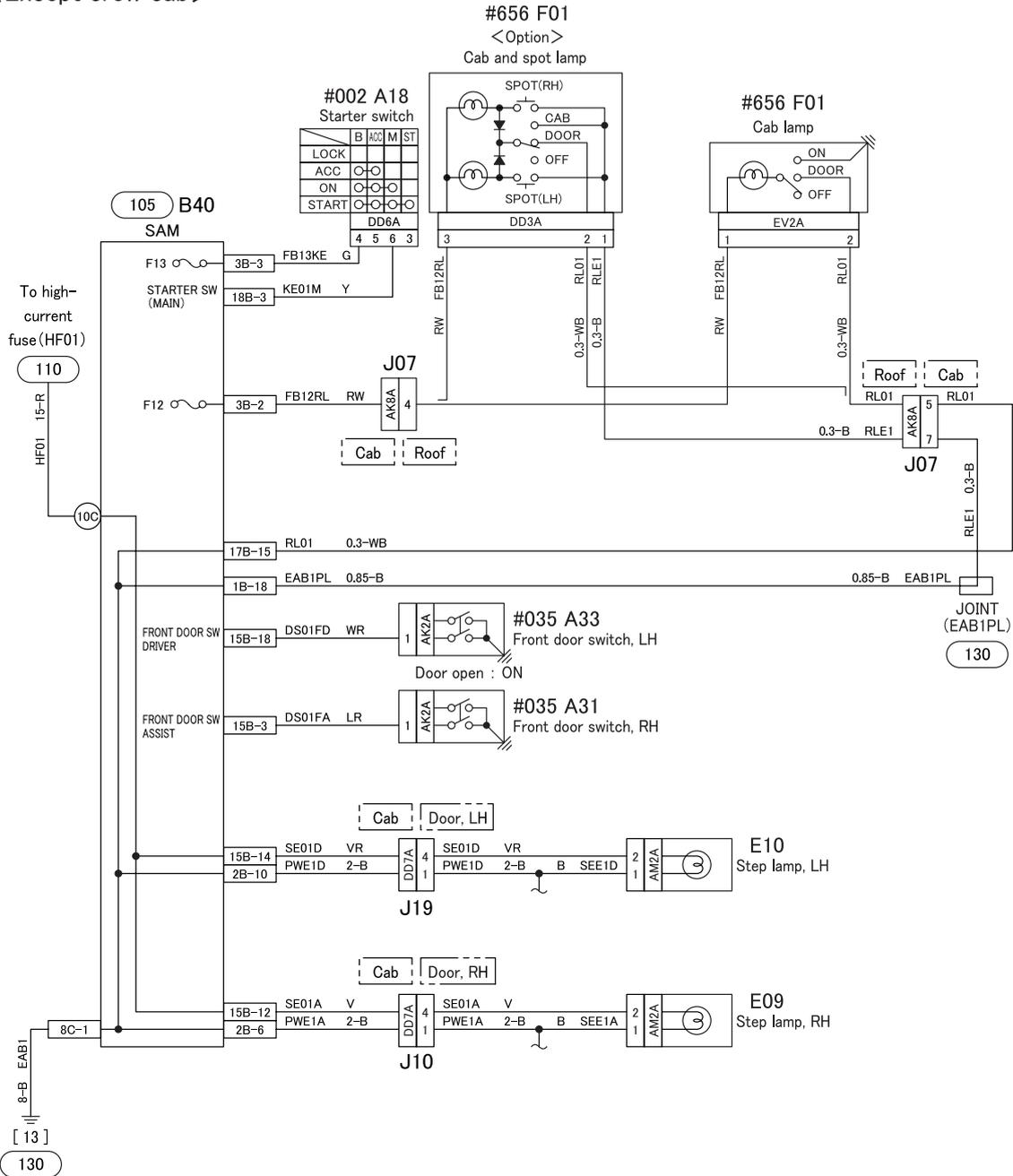
BACKUP LAMP CIRCUIT



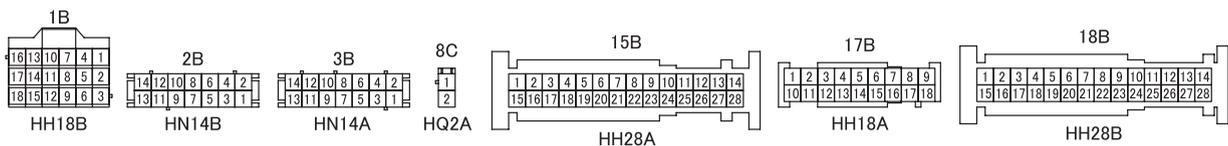
340-C07391

CAB LAMP CIRCUIT

<Except crew cab>



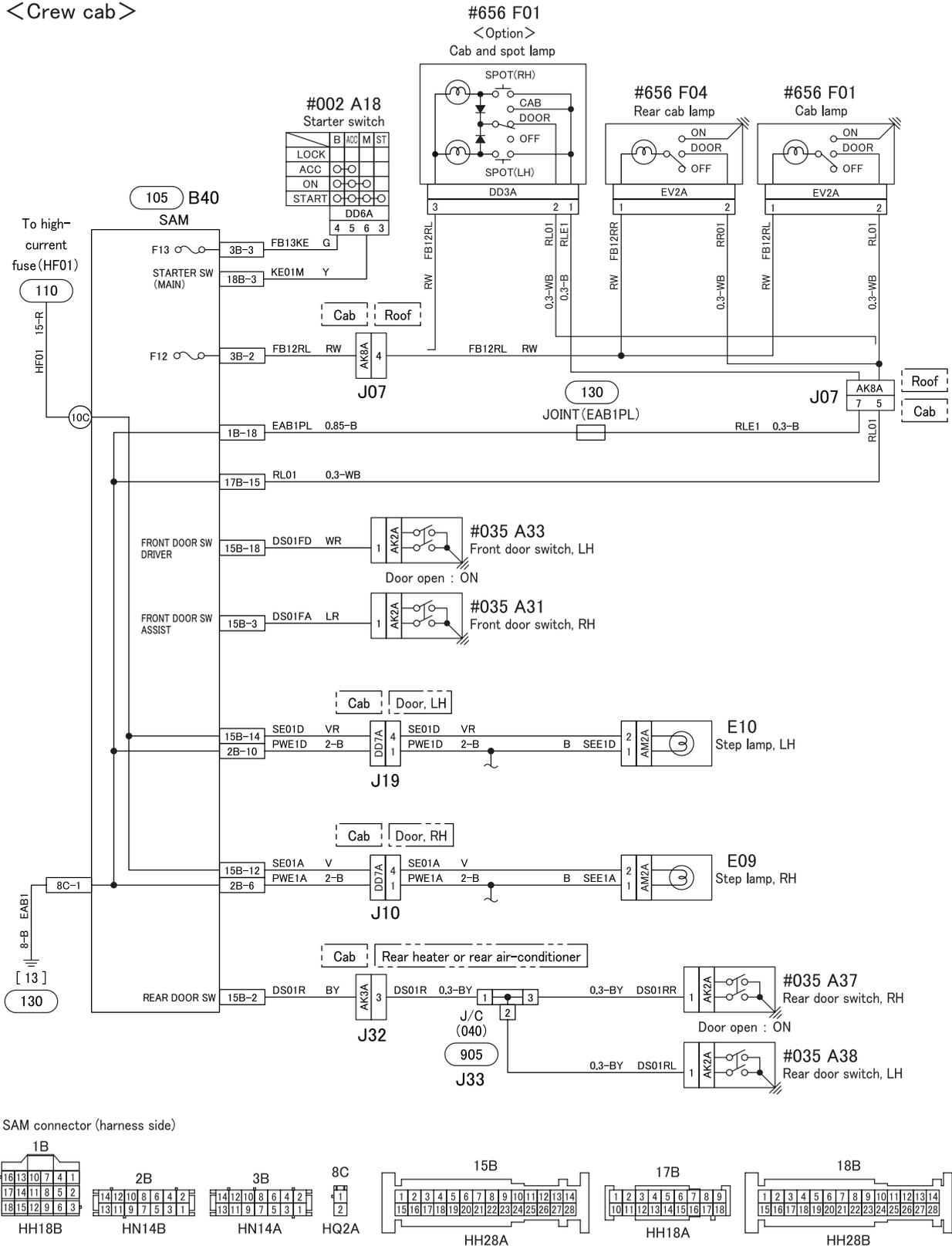
SAM connector (harness side)



345-C07391-1

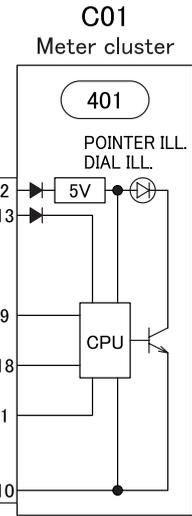
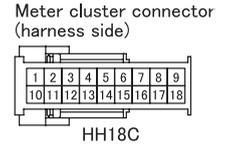
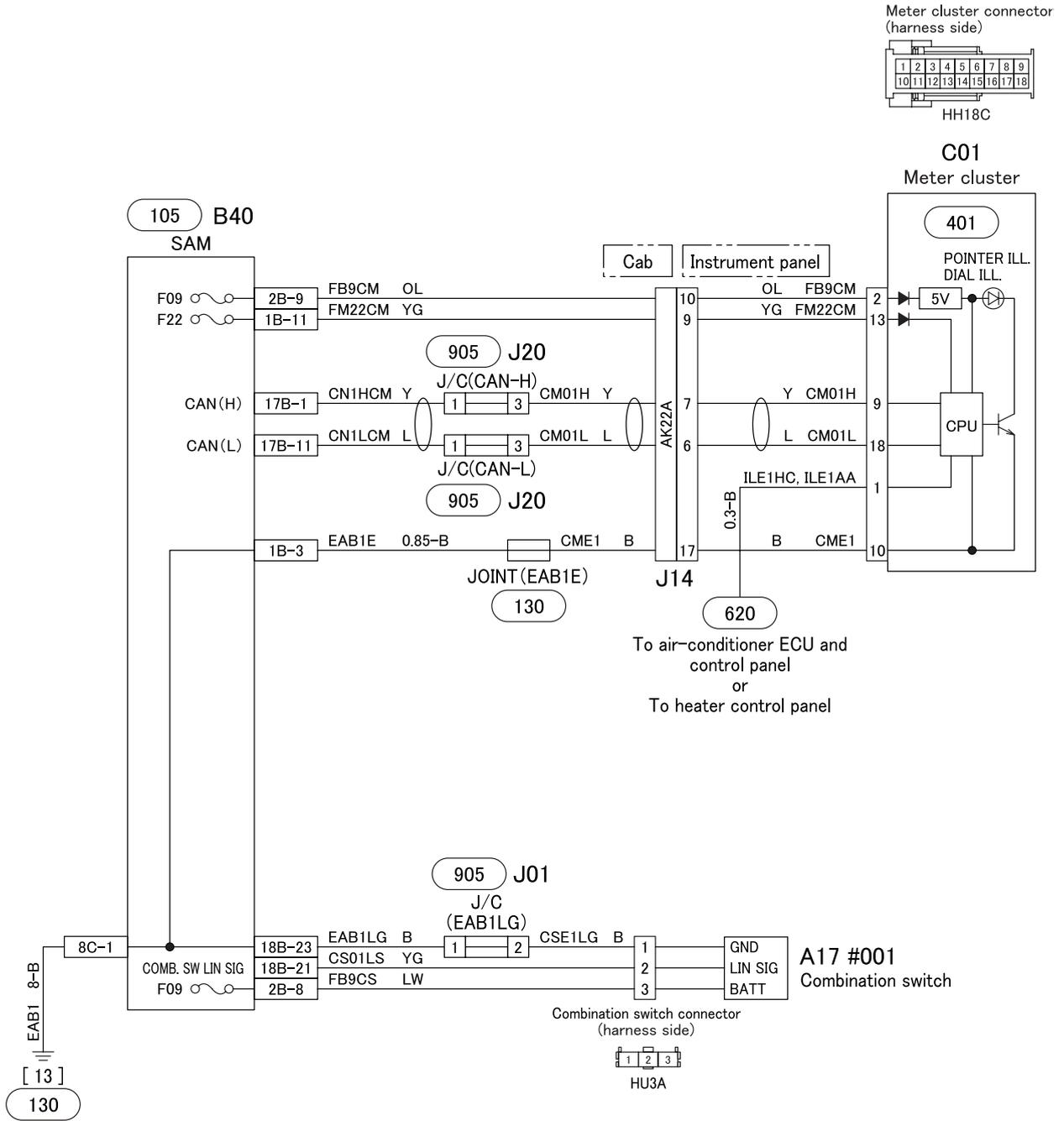
CAB LAMP CIRCUIT

<Crew cab>

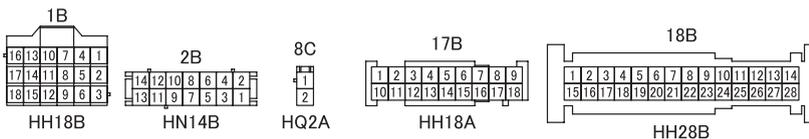


345-C07391-2

ILLUMINATION LAMP CIRCUIT

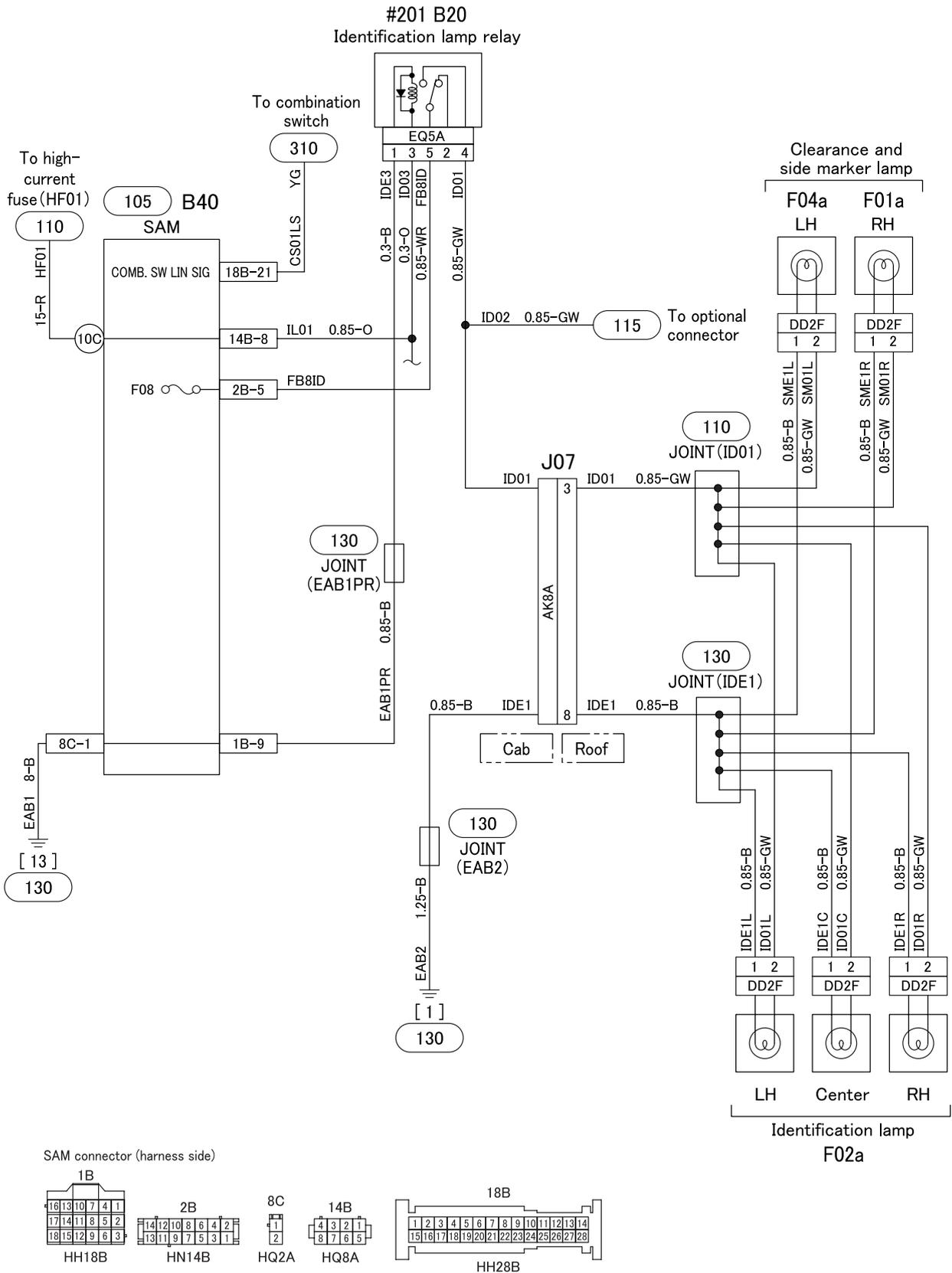


SAM connector (harness side)



348-C07391

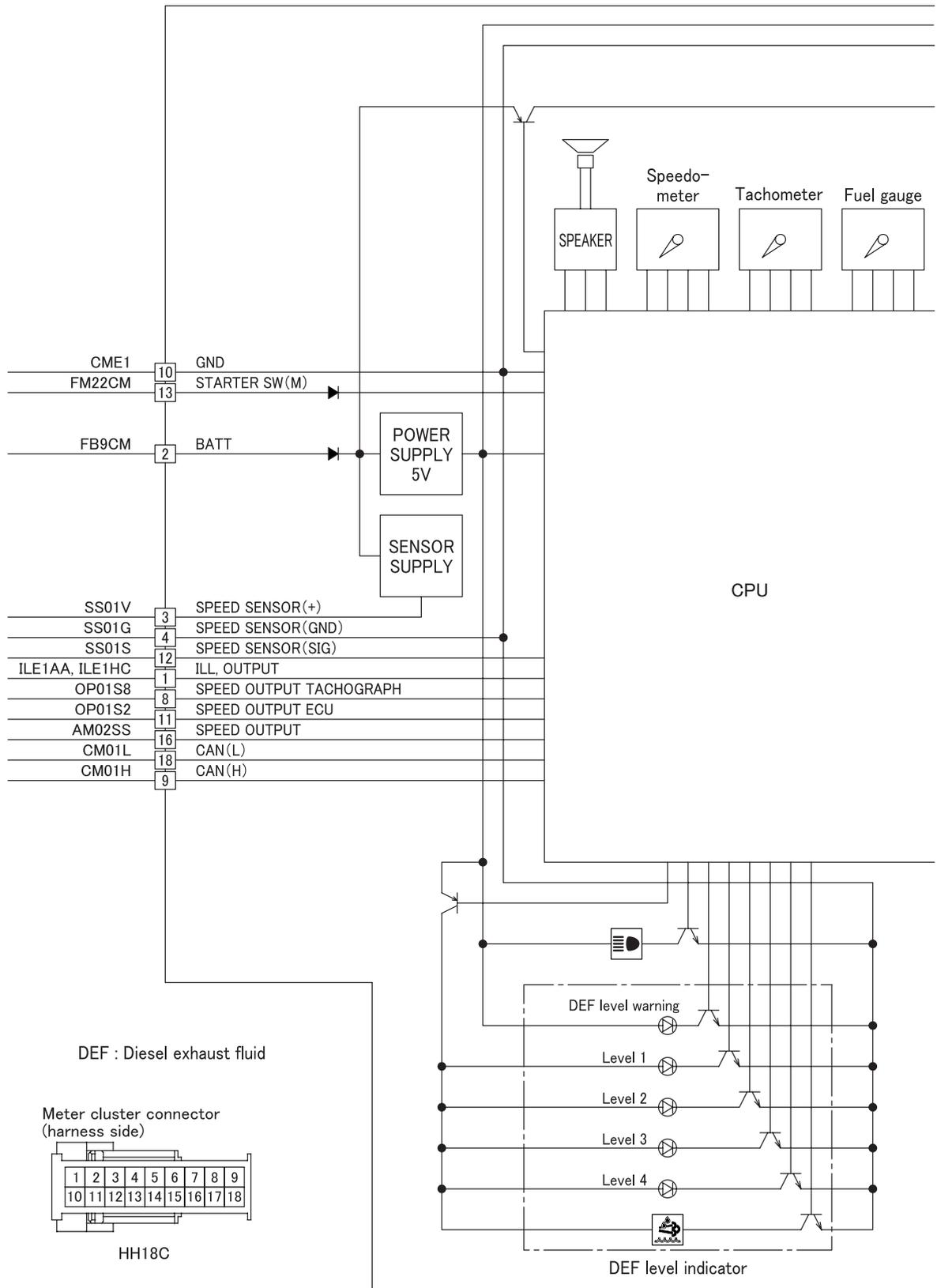
END-OUTLINE MARKER LAMP CIRCUIT



349-C07391

METER CLUSTER INTERNAL CIRCUIT

(1/2)

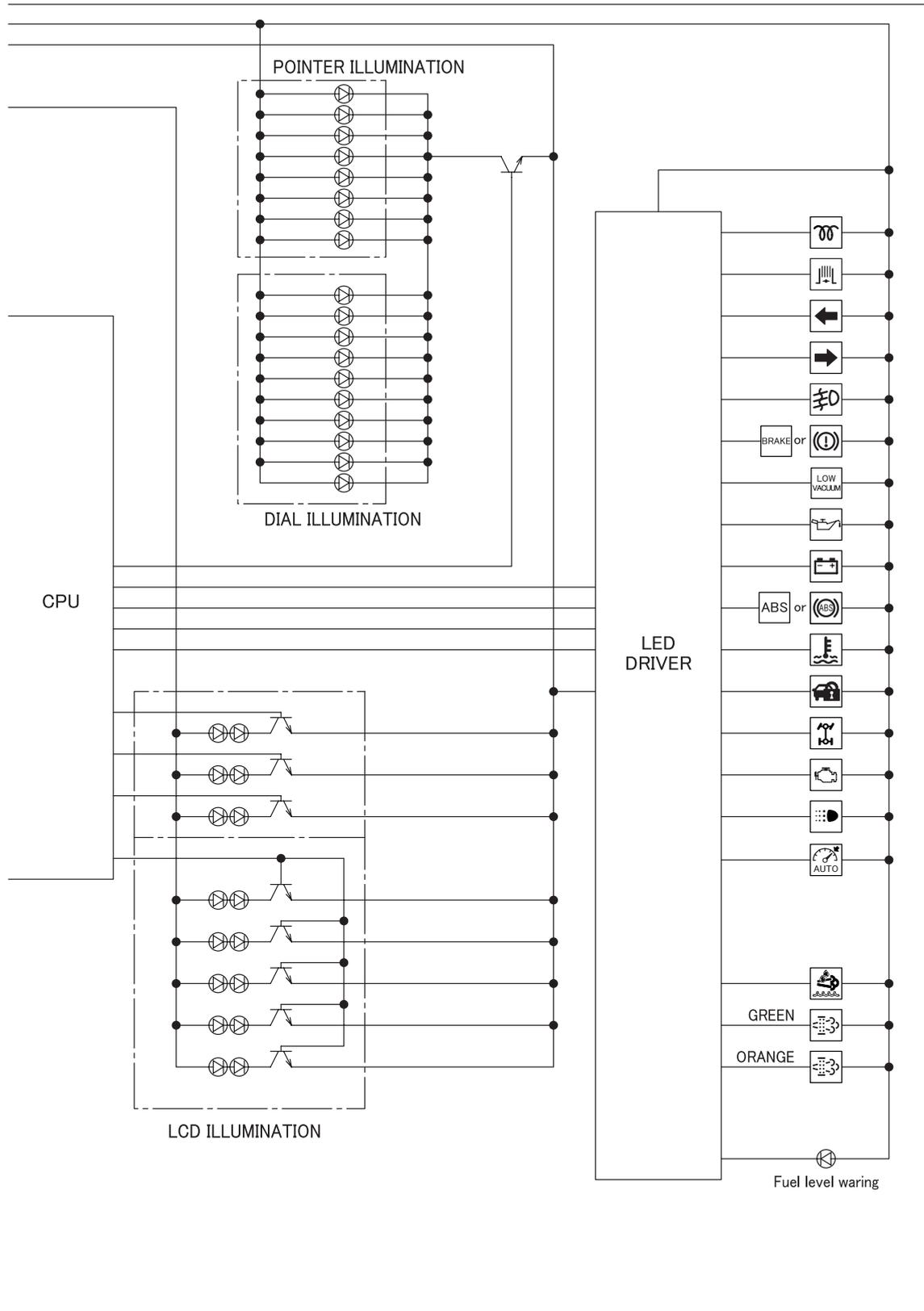


401-C07391-1



METER CLUSTER INTERNAL CIRCUIT

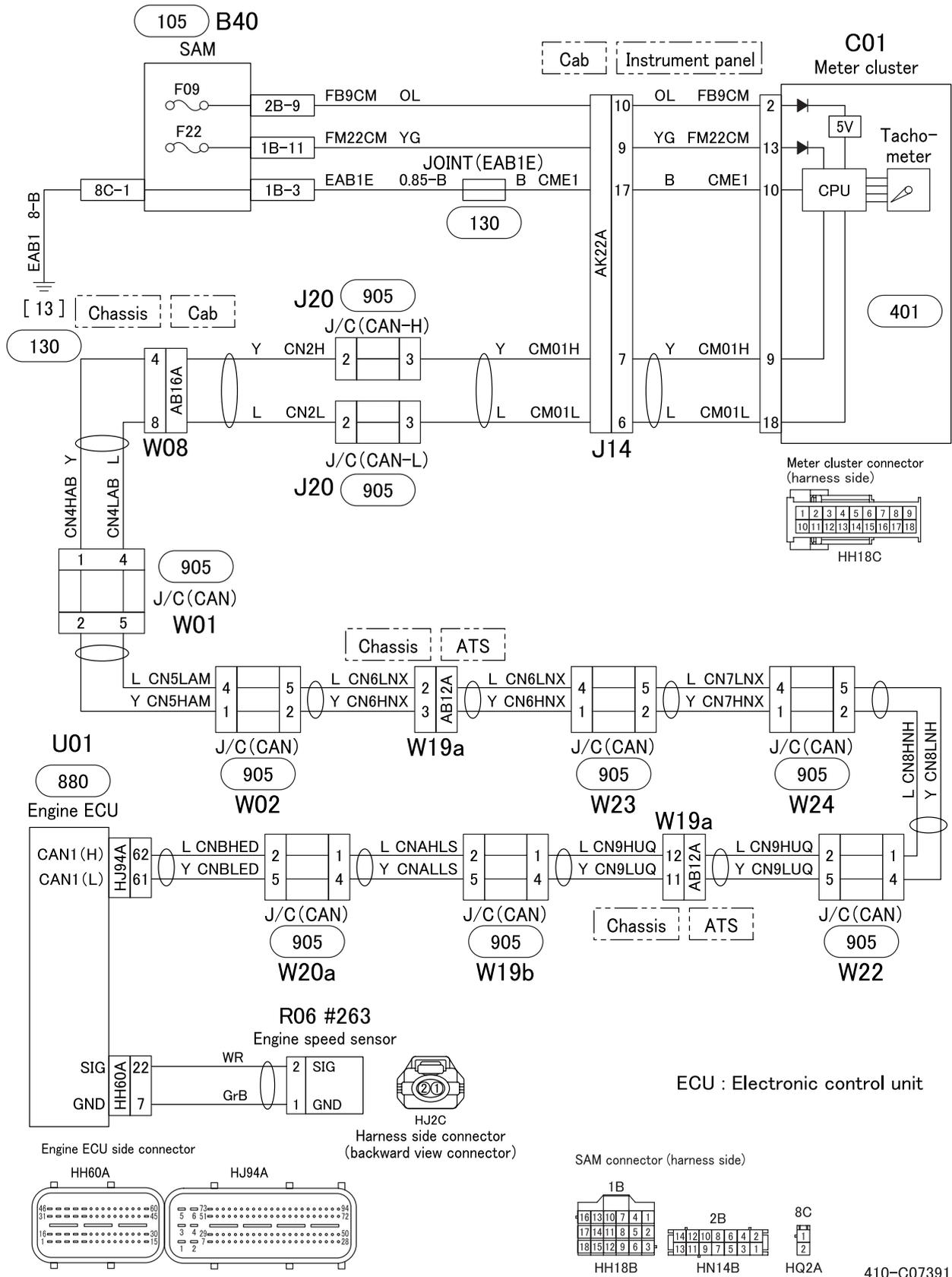
(2/2)



401-C07391-2

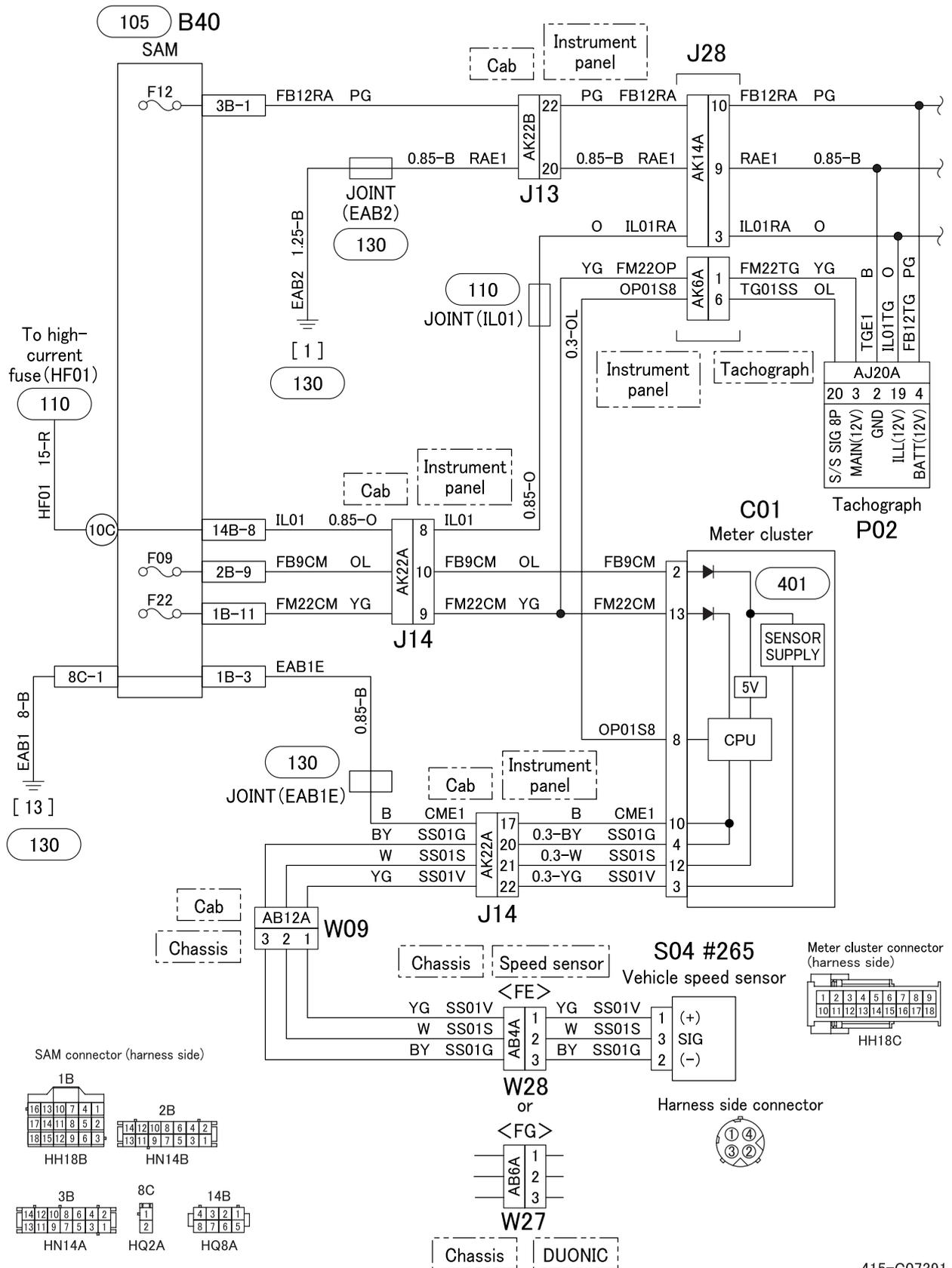


TACHOMETER CIRCUIT



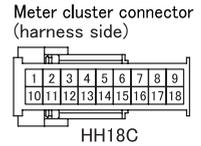
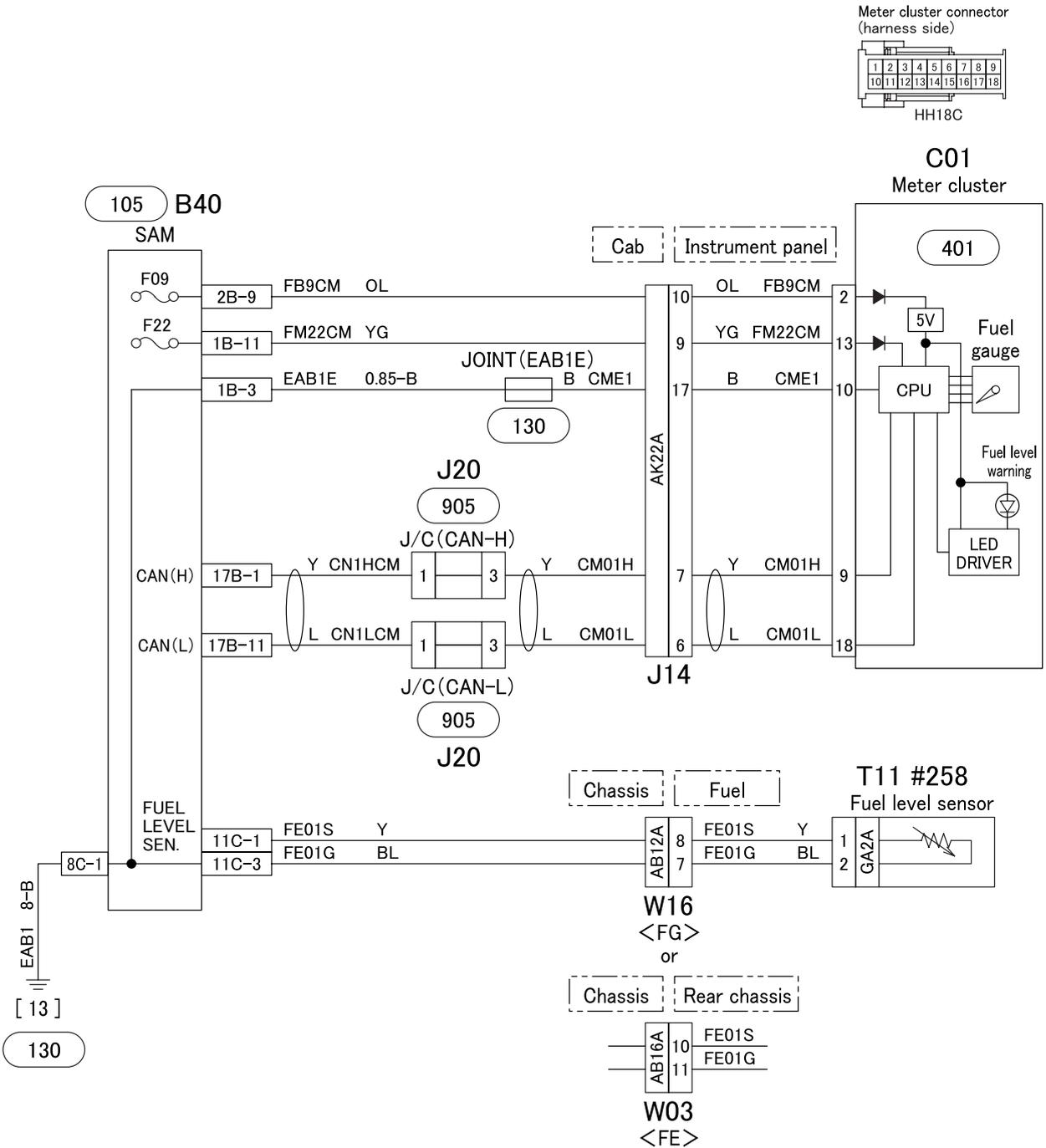


TACHOGRAPH CIRCUIT

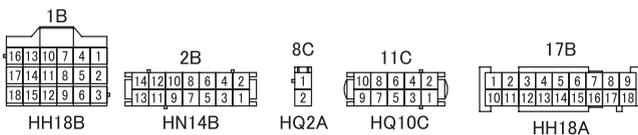


415-C07391

FUEL GAUGE CIRCUIT

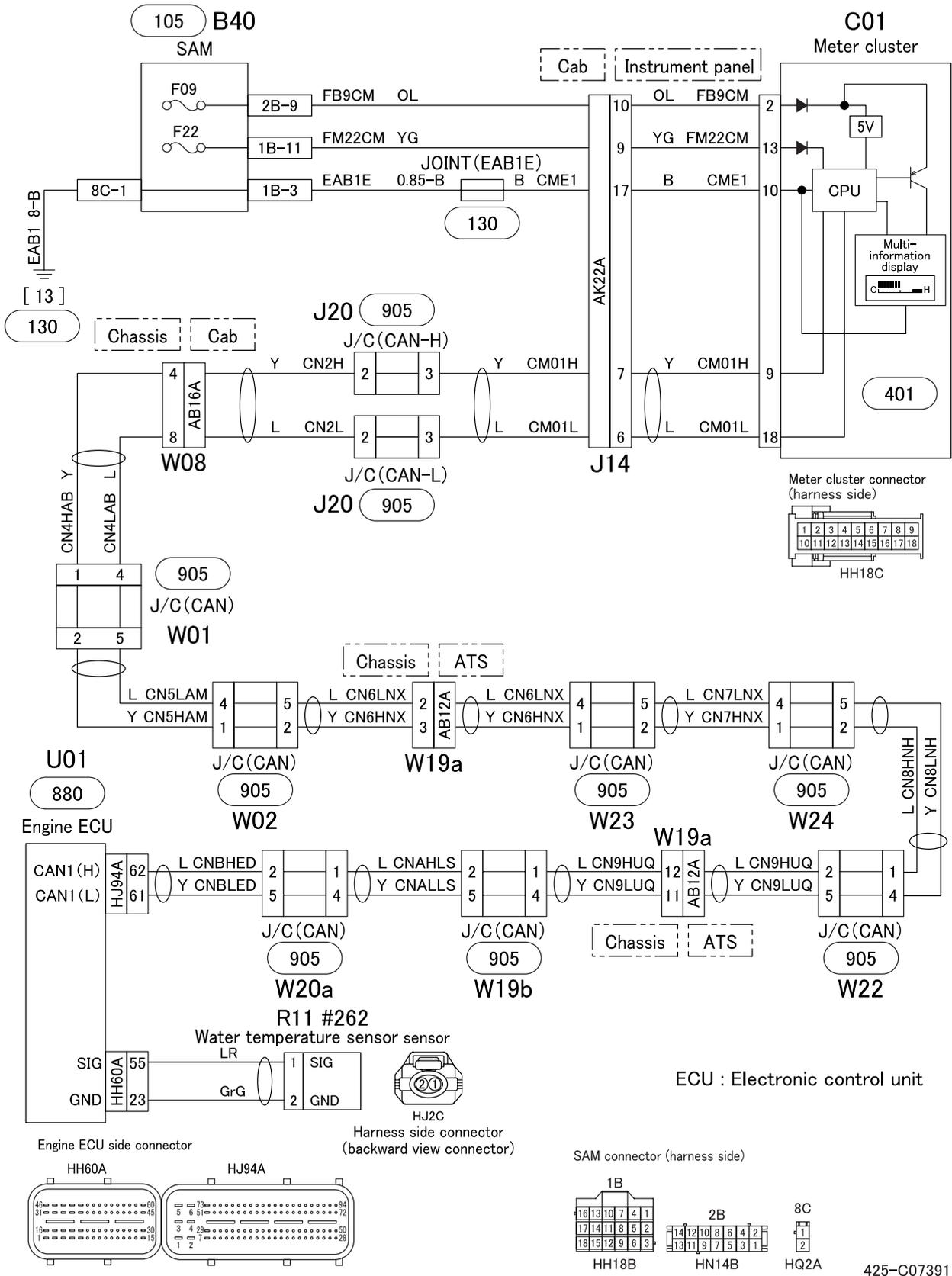


SAM connector (harness side)



420-C07391

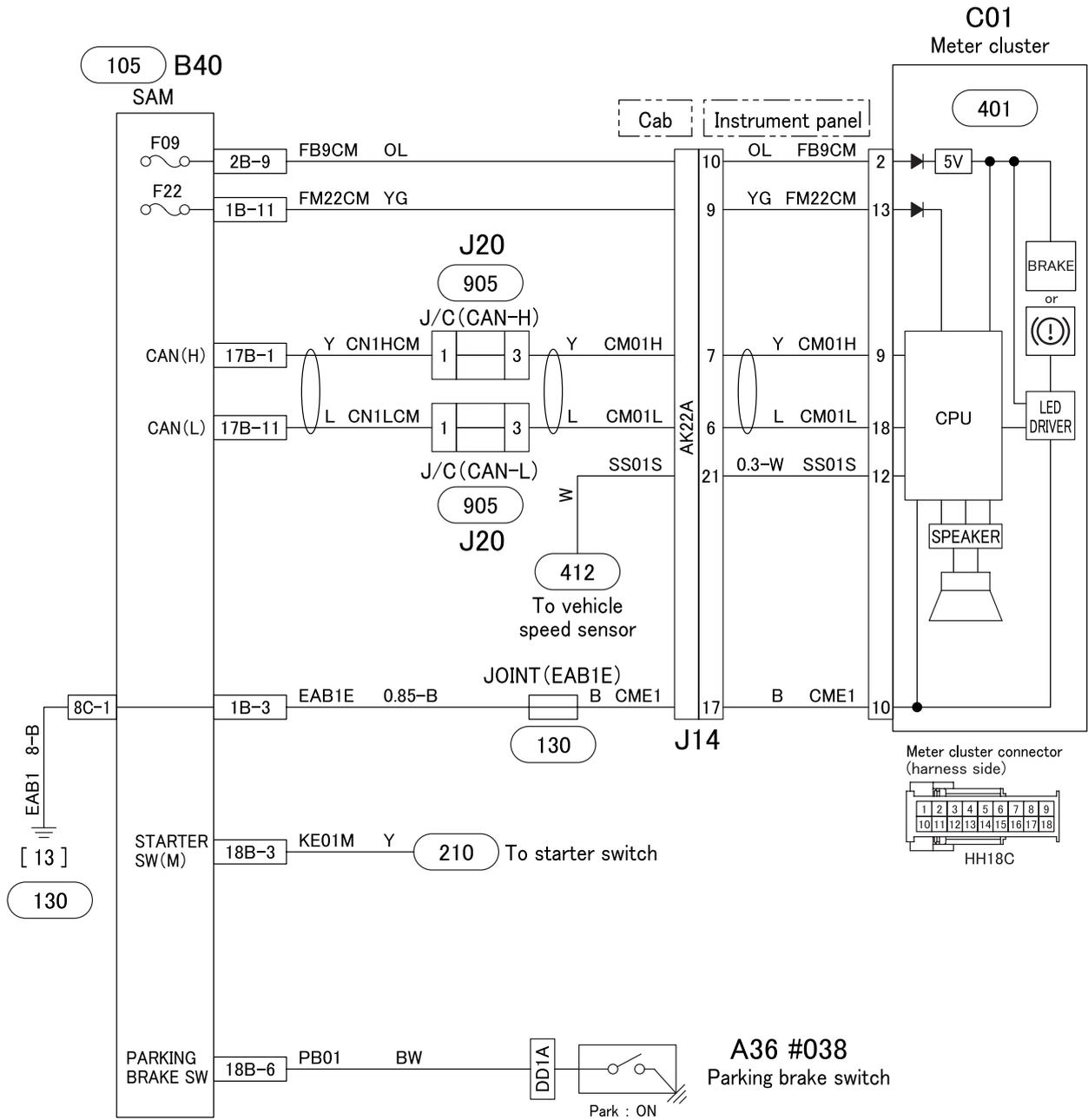
WATER TEMPERATURE GAUGE CIRCUIT



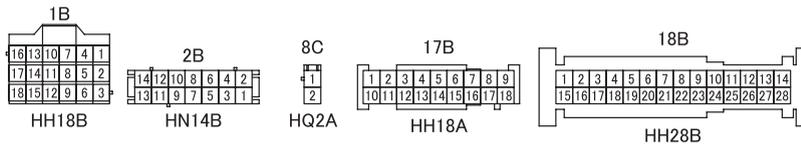
ECU : Electronic control unit

425-C07391

PARKING BRAKE INDICATOR CIRCUIT

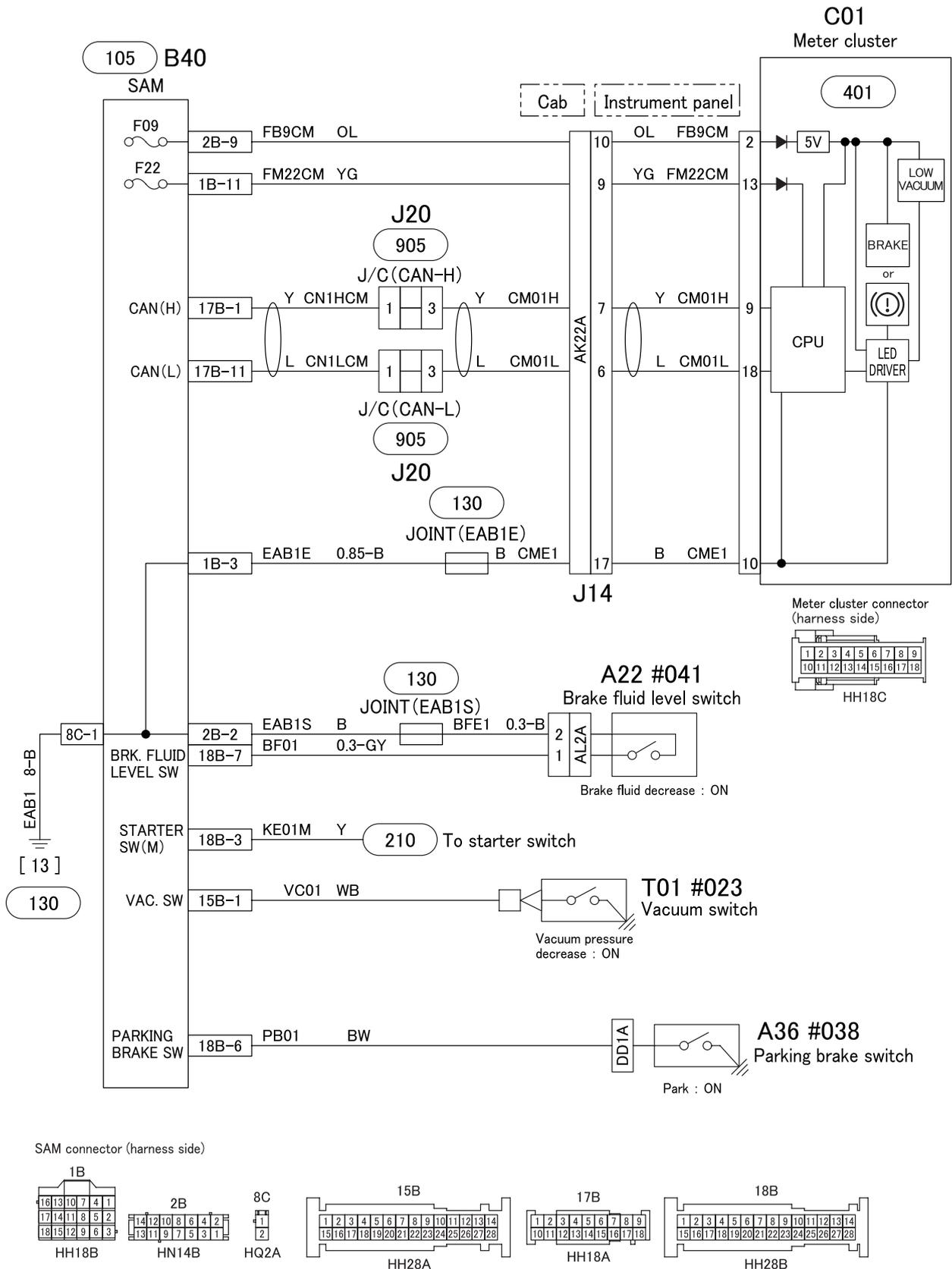


SAM connector (harness side)



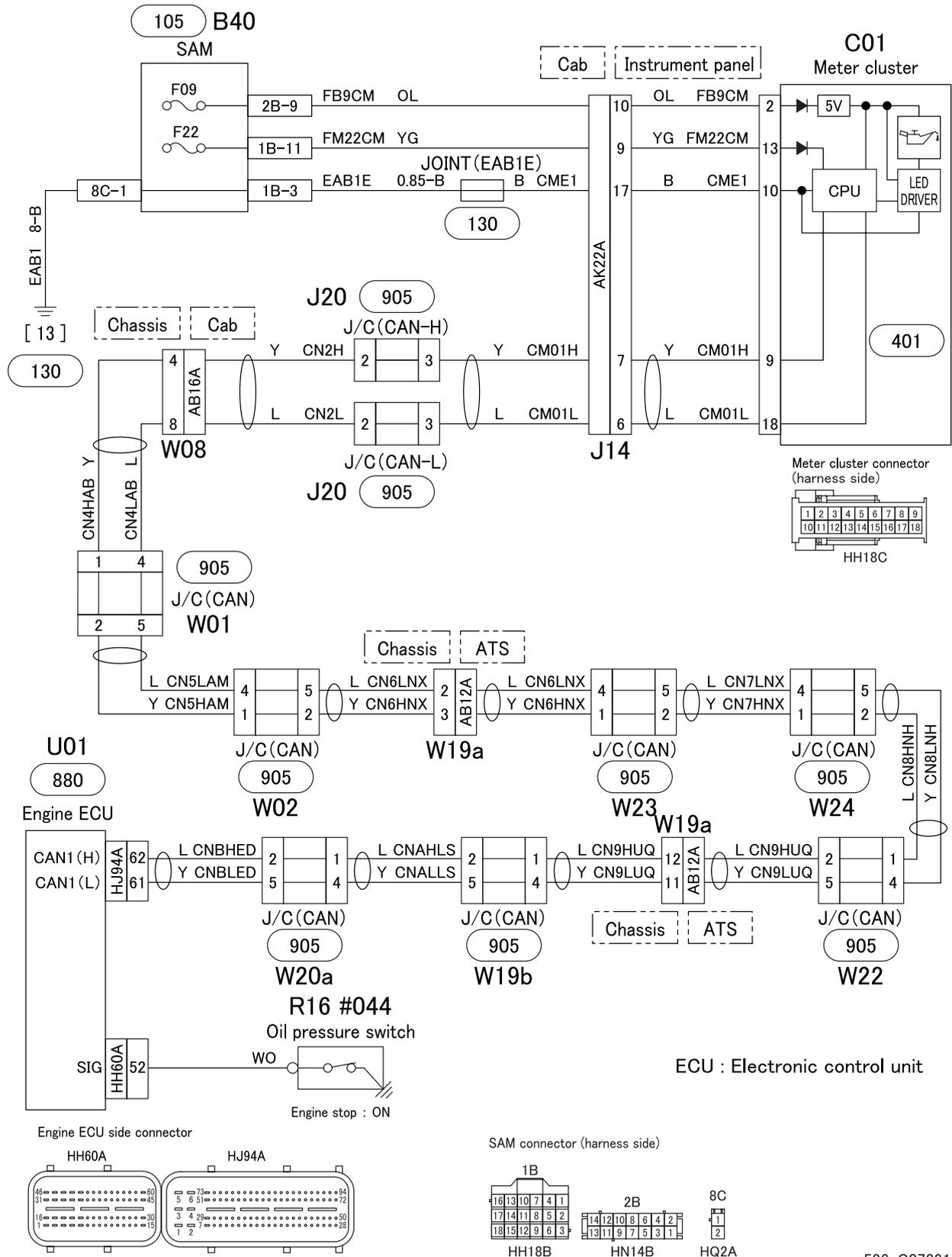
510-C07391

BRAKE WARNING CIRCUIT



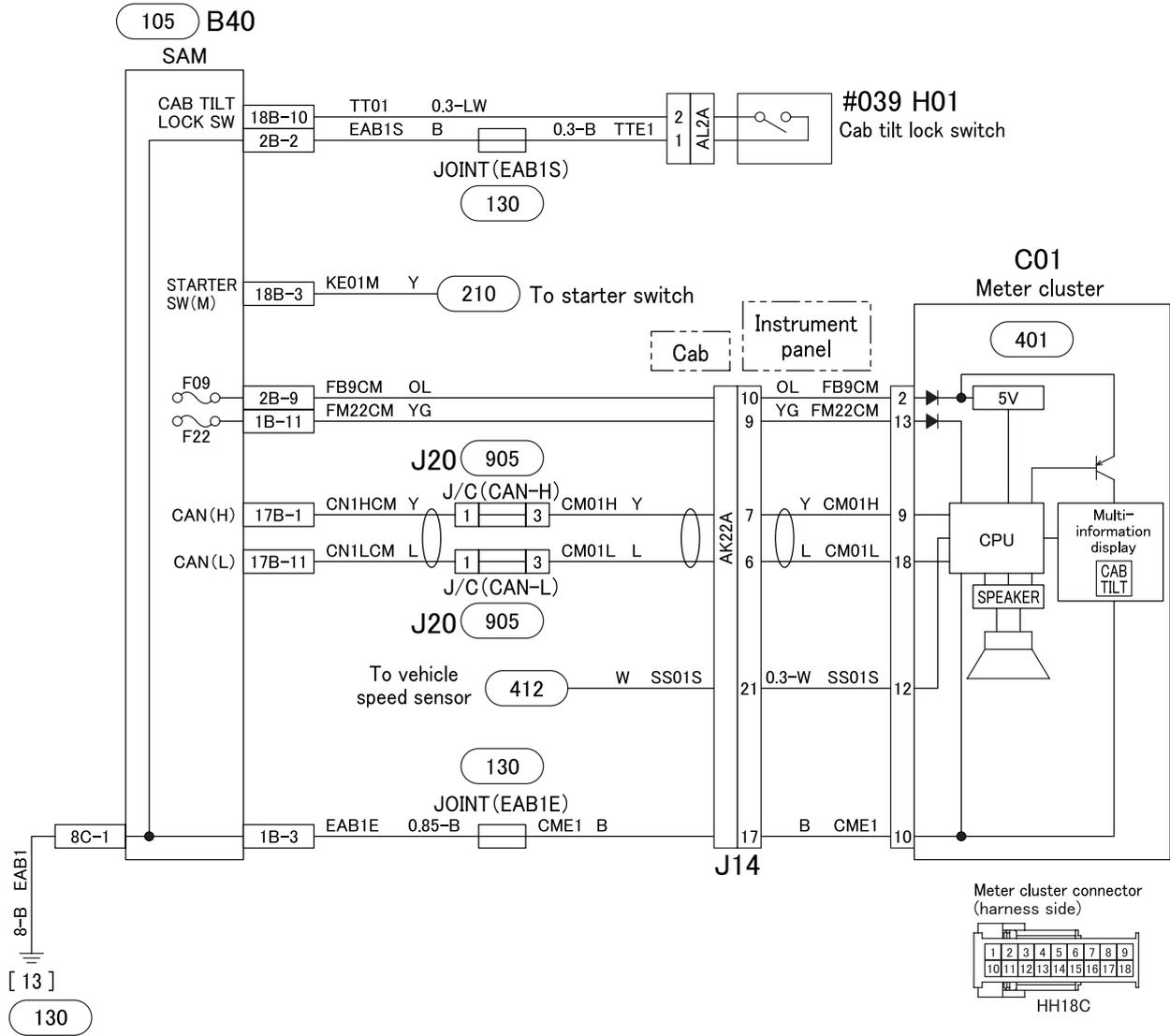
515-C07391

ENGINE OIL PRESSURE WARNING CIRCUIT

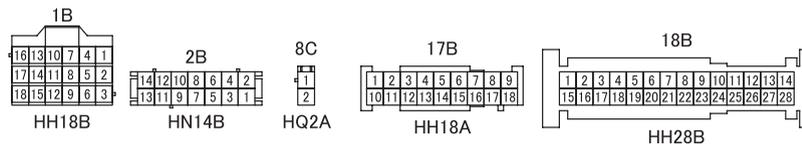


536-C07391

CAB TILT WARNING CIRCUIT



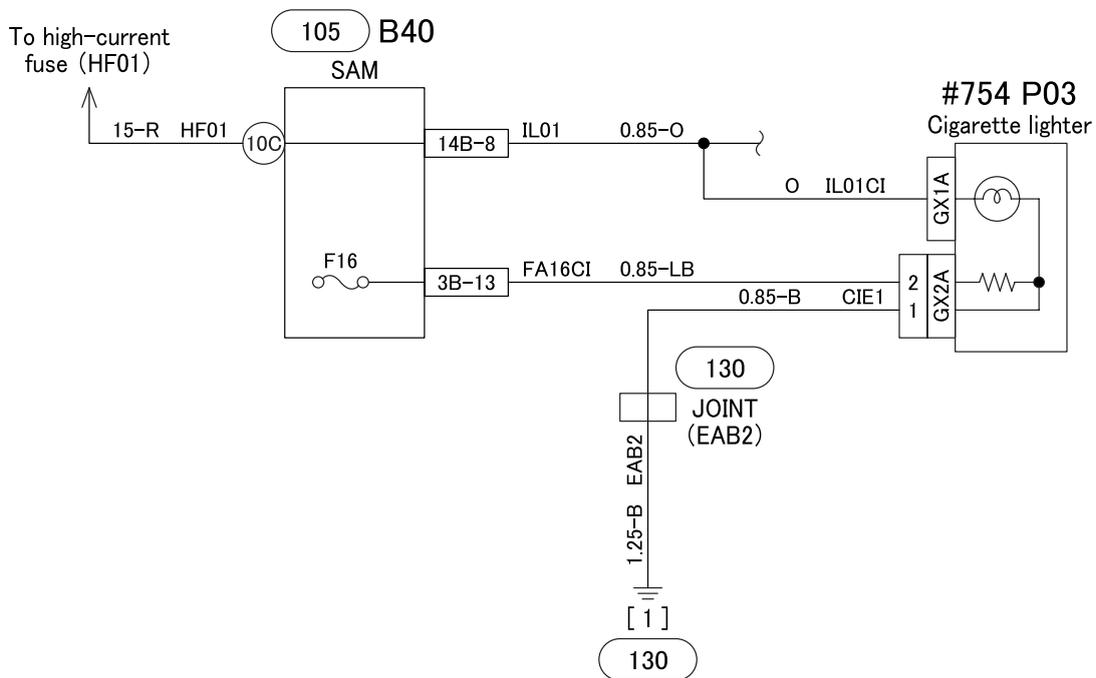
SAM connector (harness side)



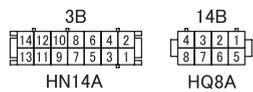
550-C07391



CIGARETTE LIGHTER CIRCUIT



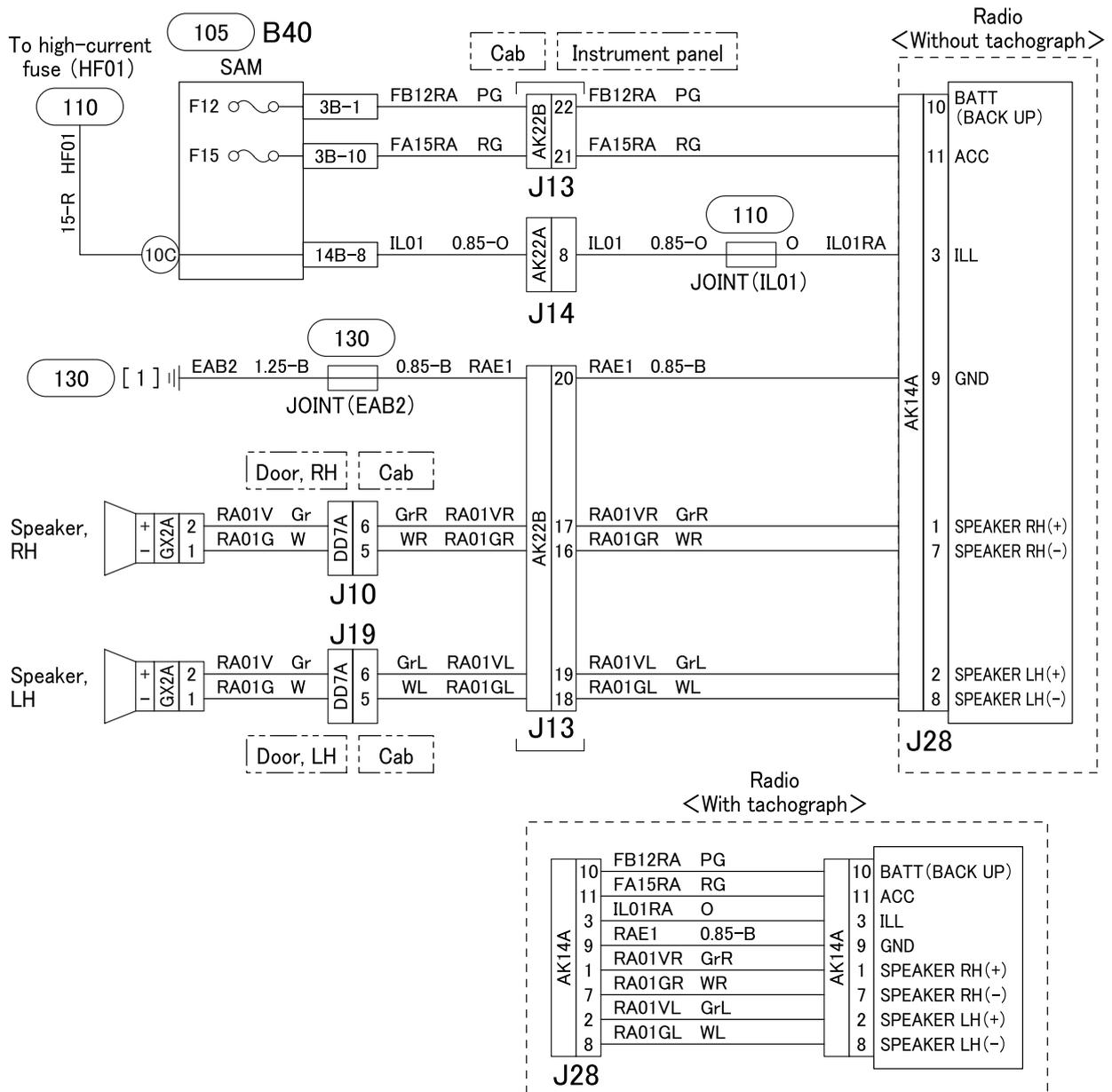
SAM connector (harness side)



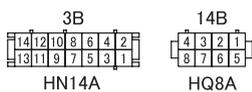
610-C07391



AUDIO CIRCUIT

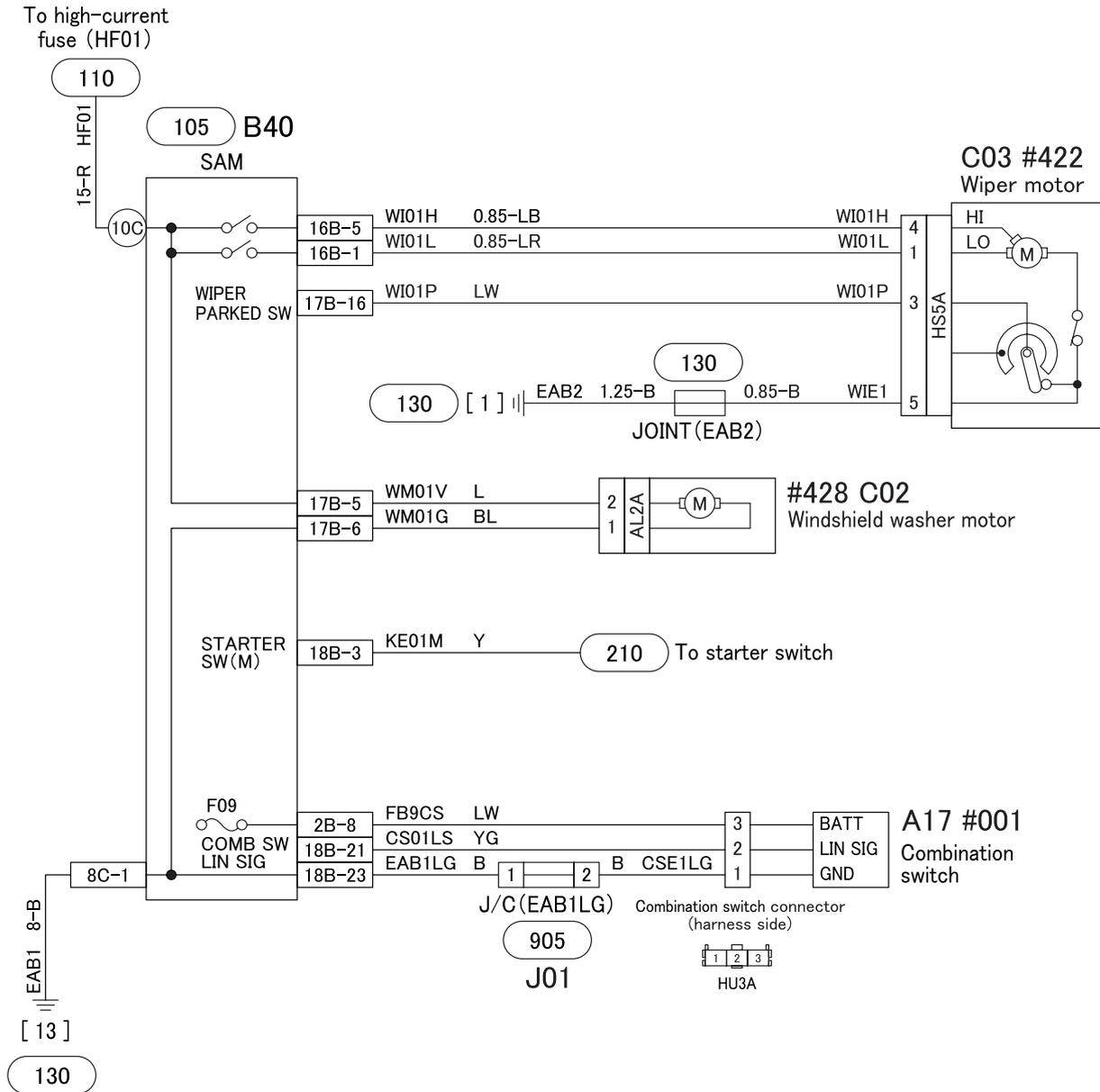


SAM connector (harness side)

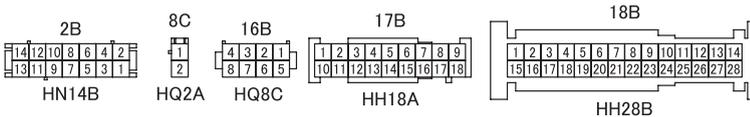


612-C07391

WIPER AND WASHER CIRCUIT

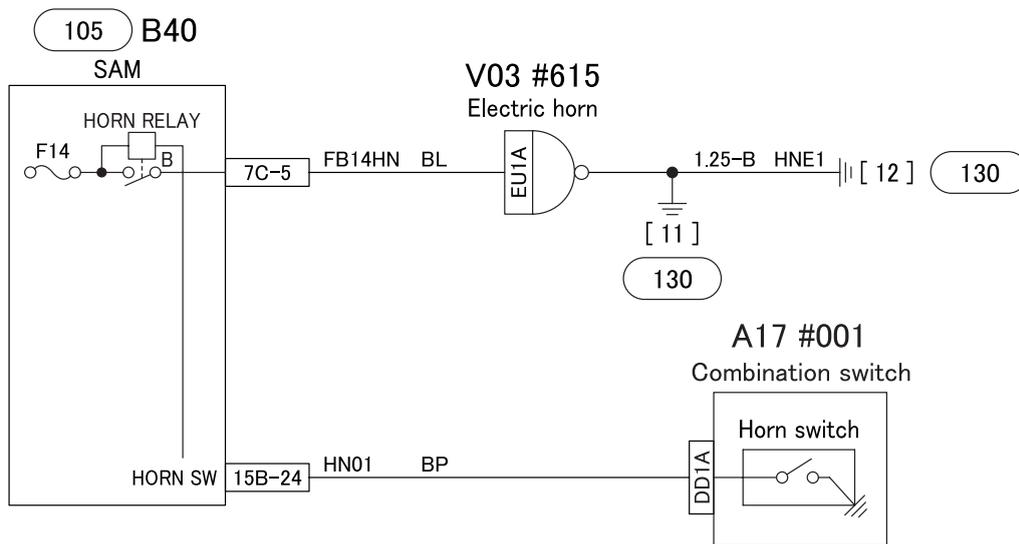


SAM connector (harness side)

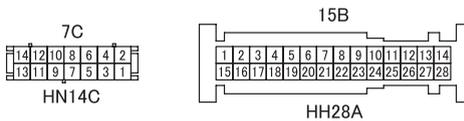


614-C07391

HORN CIRCUIT



SAM connector (harness side)

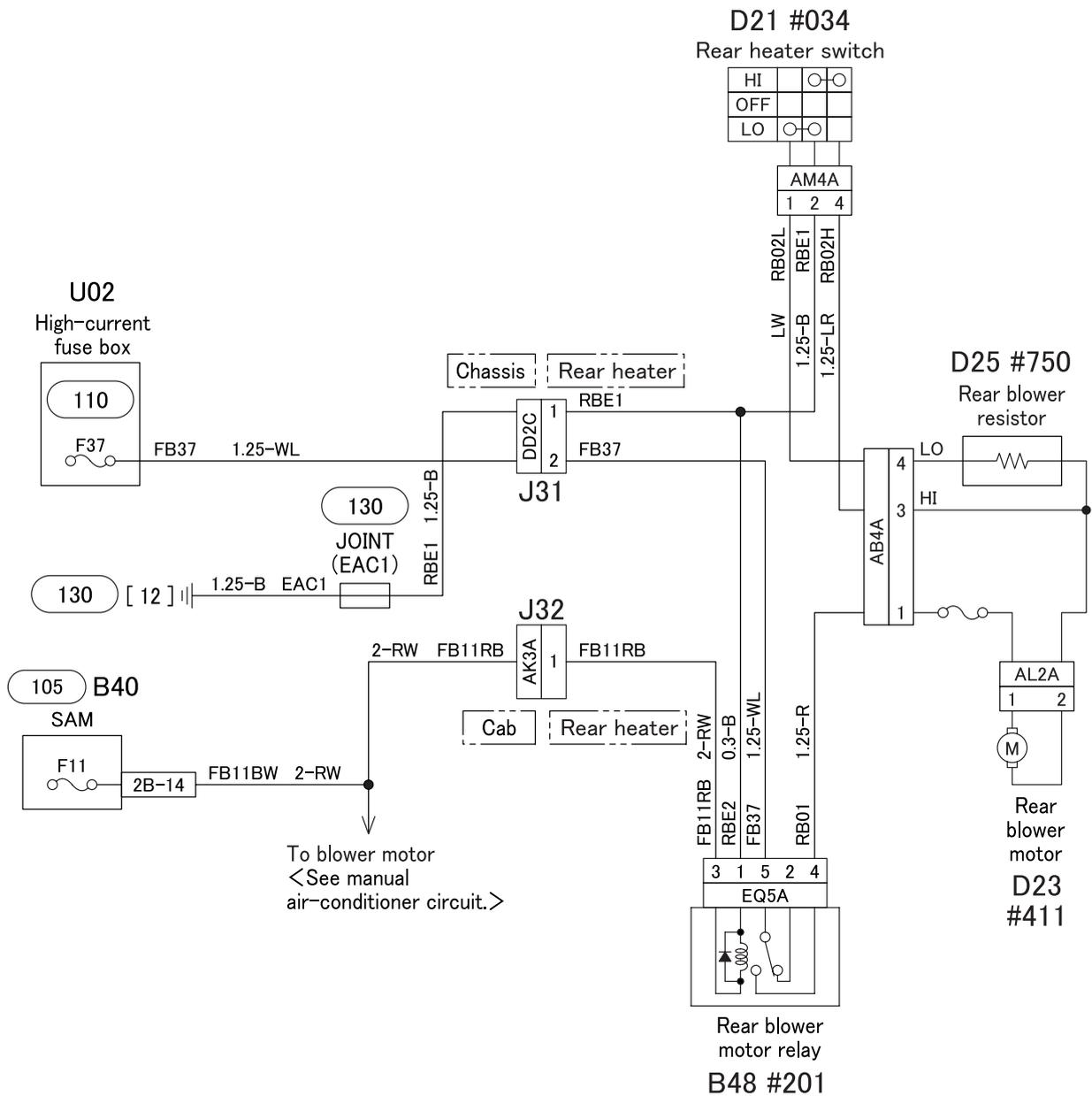


616-C07391

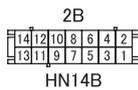


AIR-CONDITIONER CIRCUIT (1)

<Rear heater>



SAM connector (harness side)

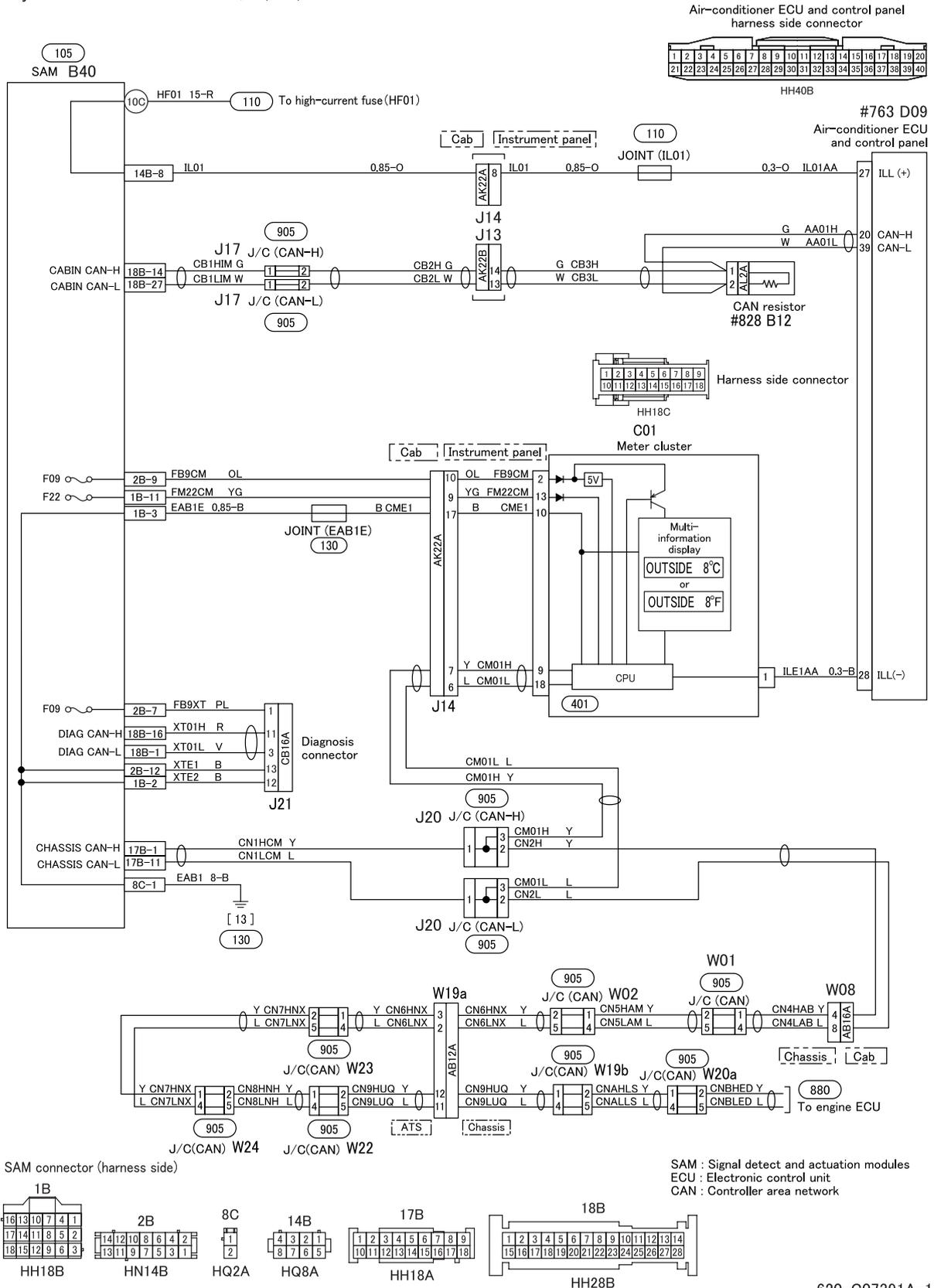


620-C07391H



### AIR-CONDITIONER CIRCUIT (3)

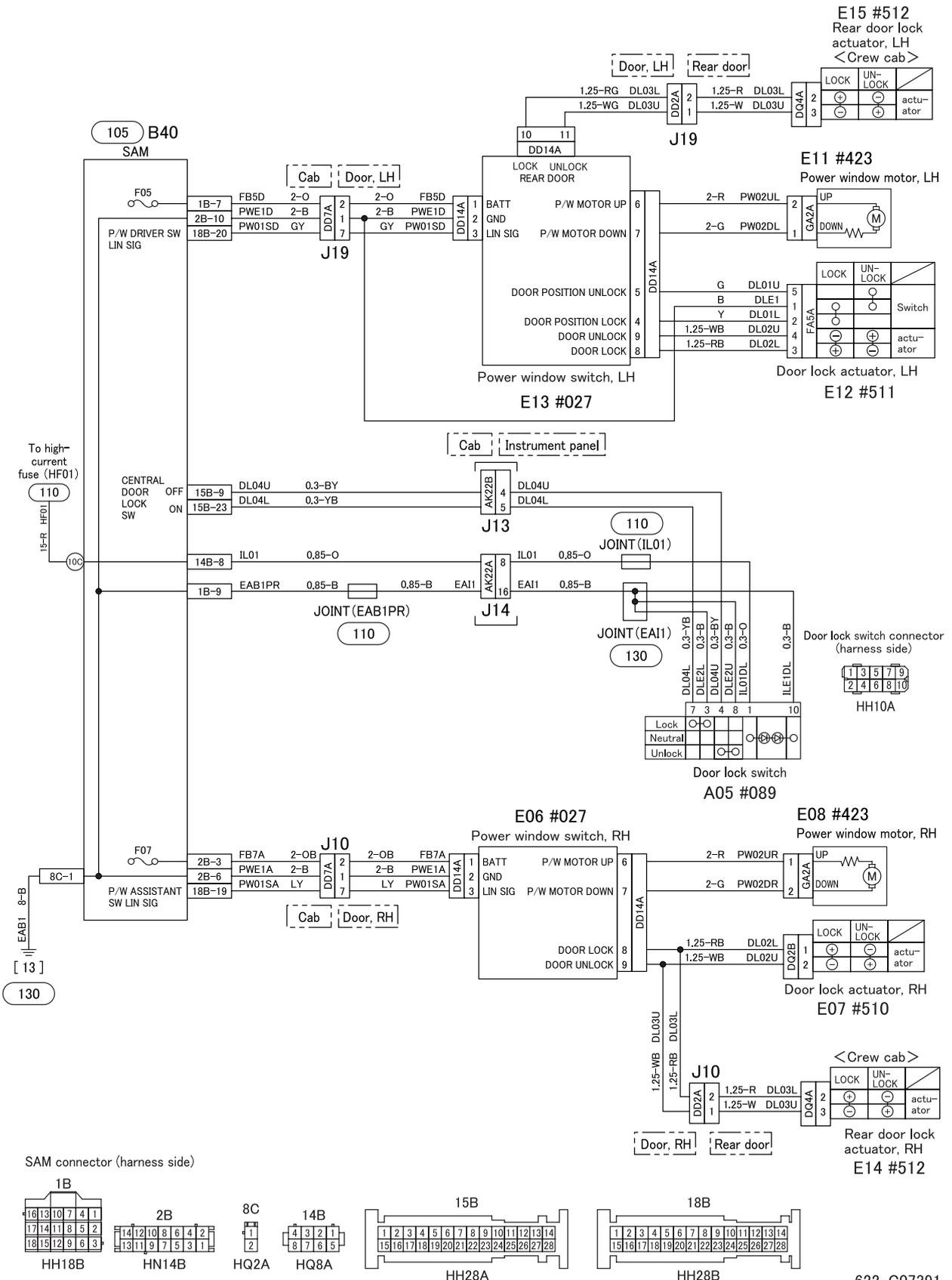
<Fully automatic air-conditioner> (1/2)



620-C07391A-1

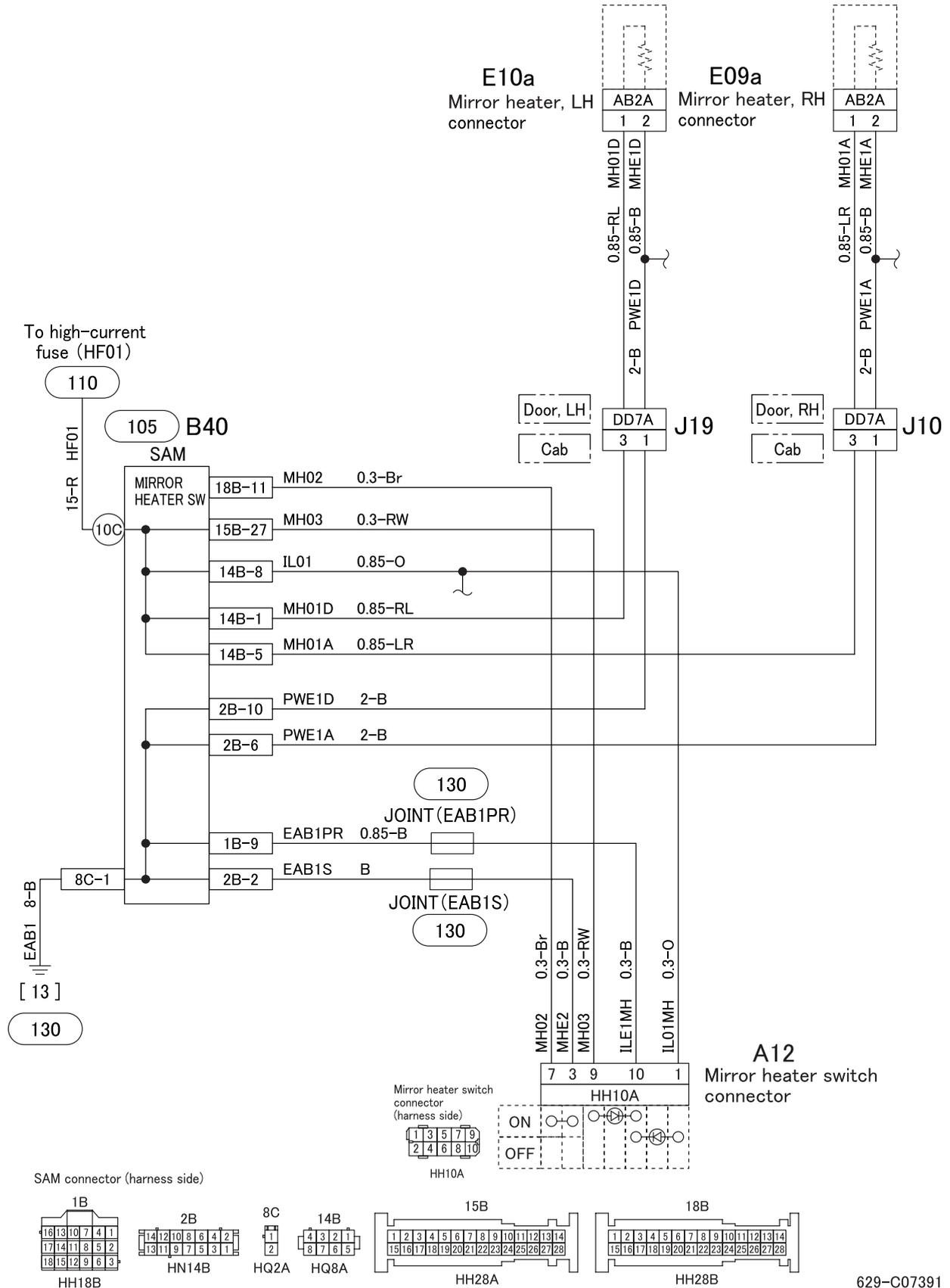


POWER WINDOW AND CENTRAL DOOR LOCK CIRCUIT



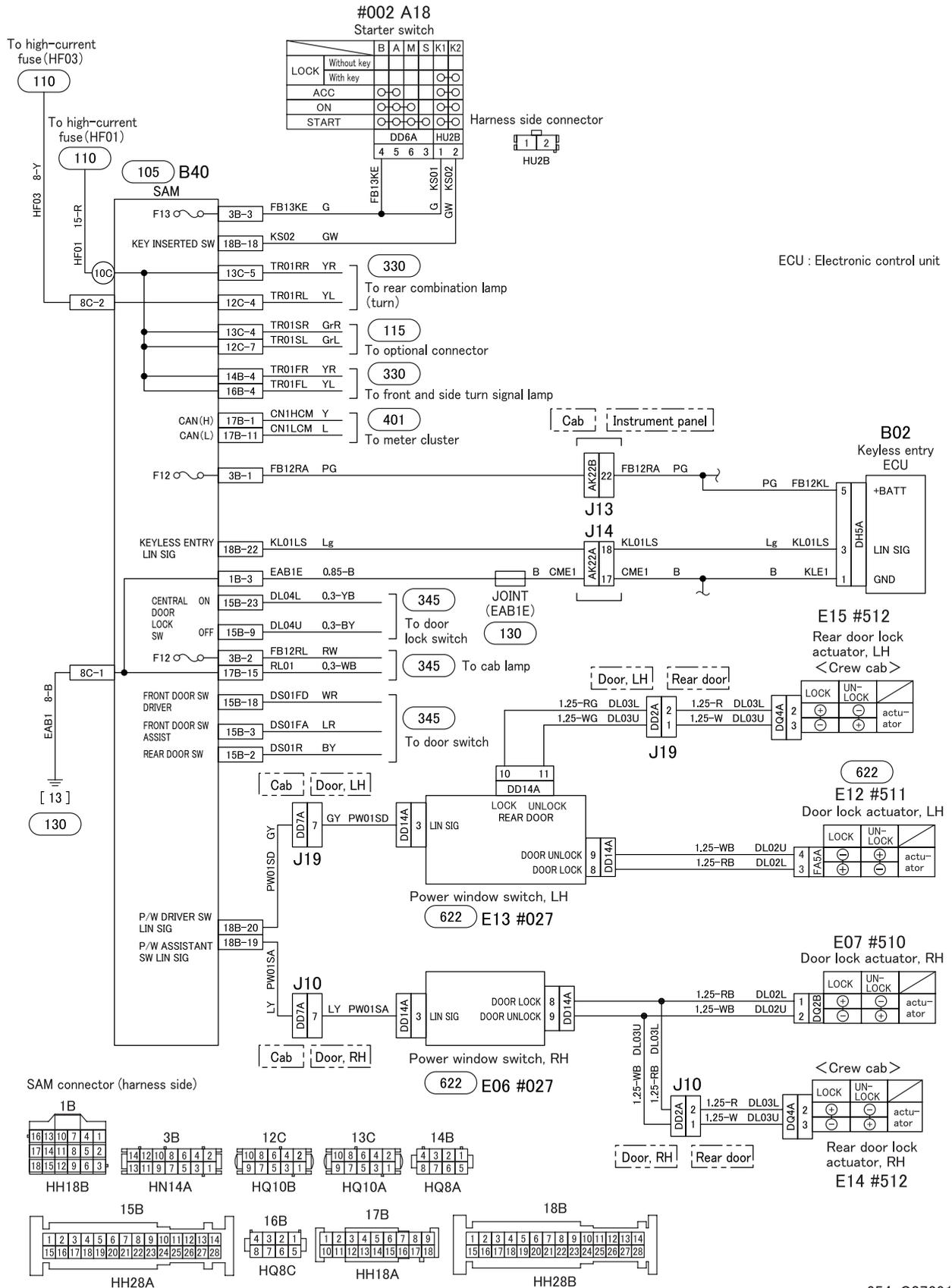
622-C07391

MIRROR HEATER CIRCUIT



629-C07391

### KEYLESS ENTRY CIRCUIT

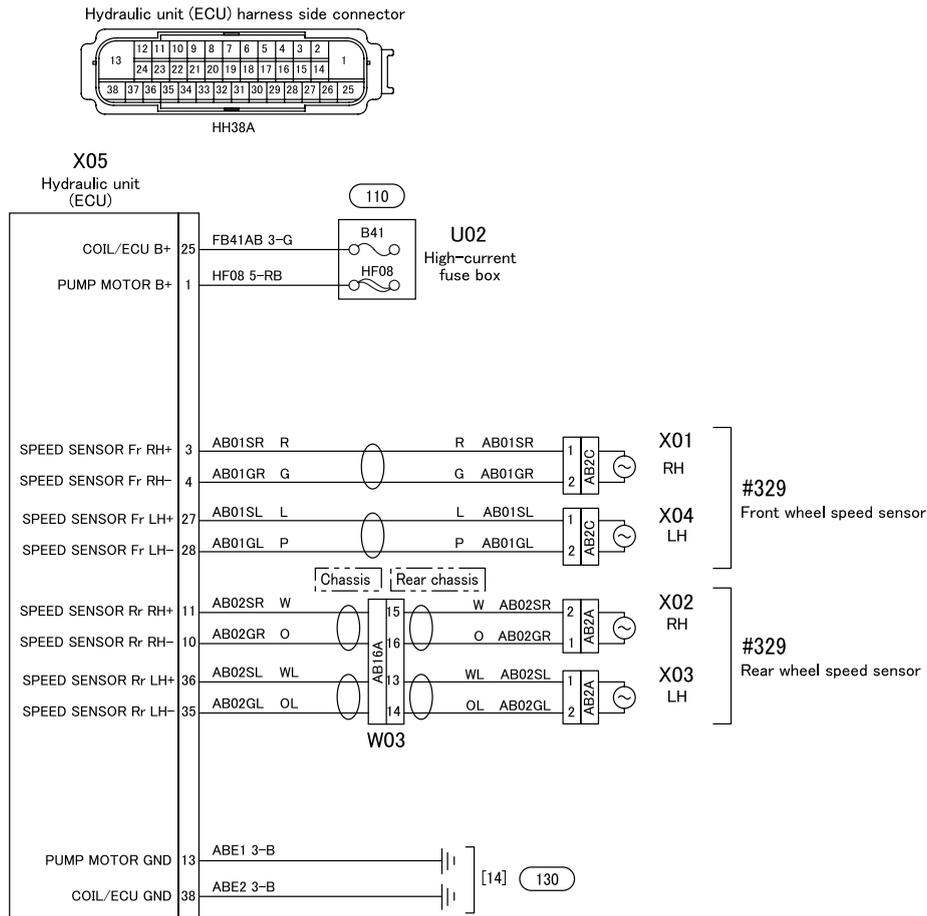


654-C07391



### ANTI-LOCK BRAKE SYSTEM CIRCUIT (2)

(2/2)



ECU : Electronic control unit

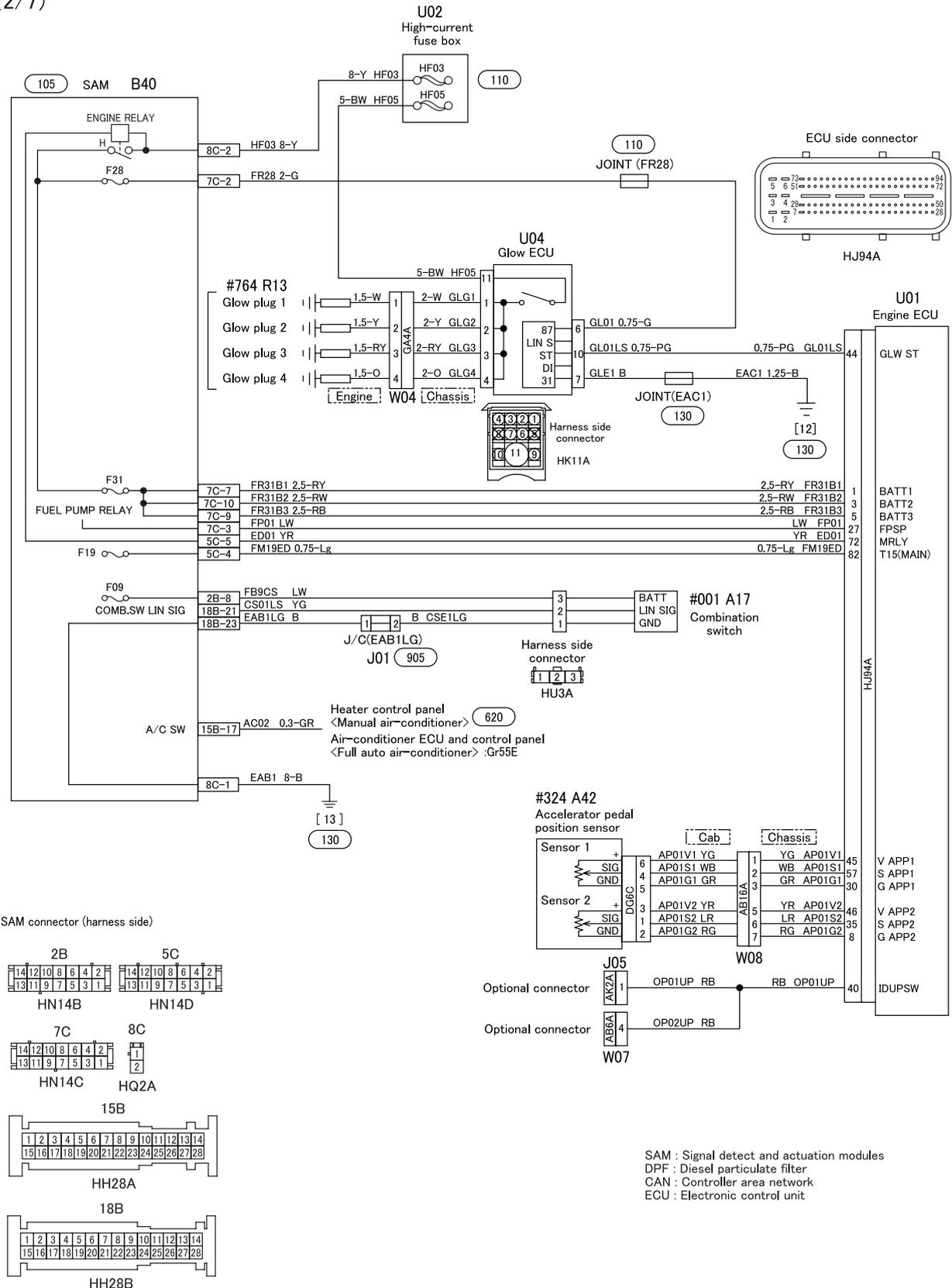
790-C07391-2





ENGINE ELECTRIC CIRCUIT (2/7)

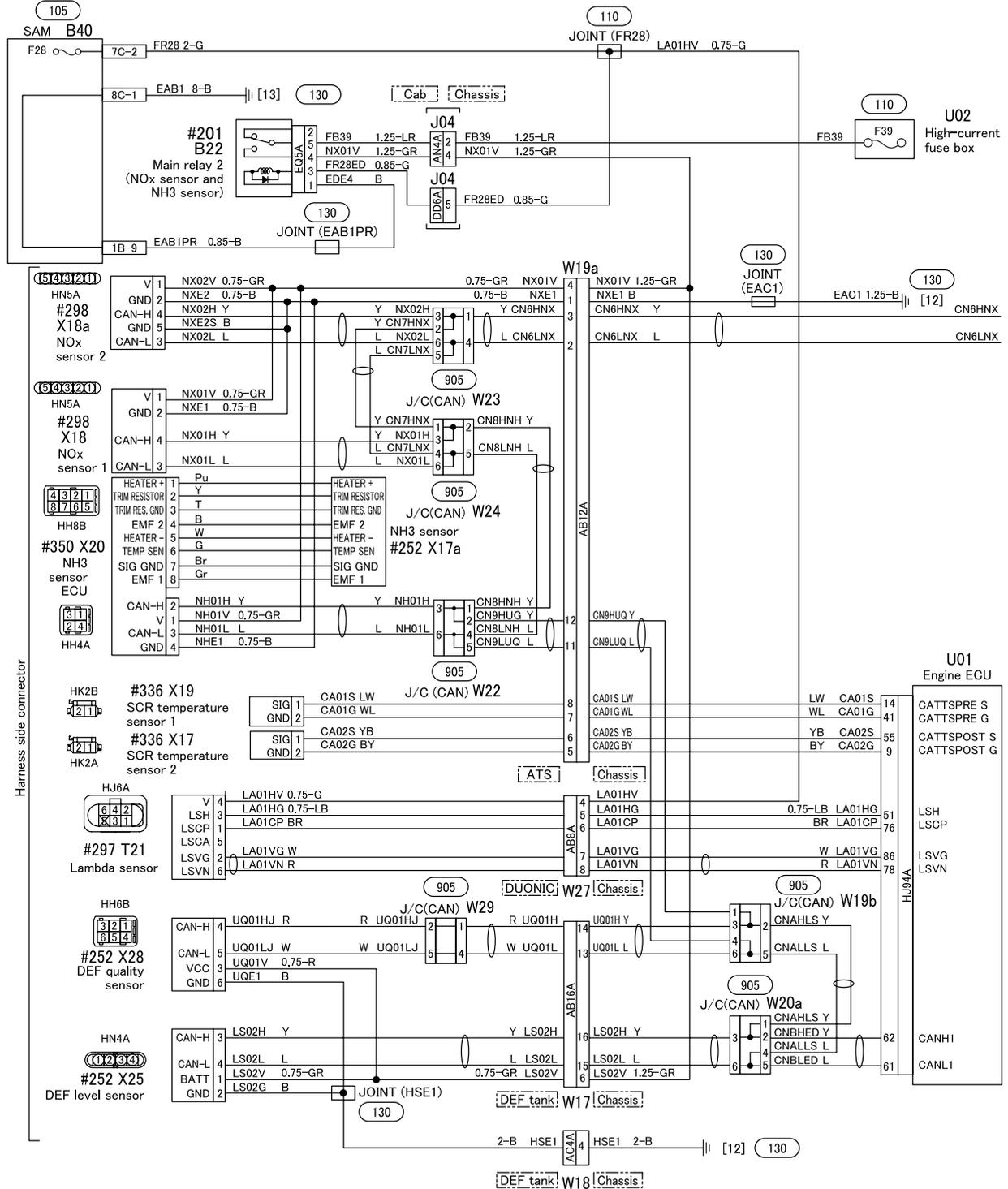
(2/7)



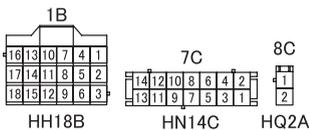
880-C07391-2

### ENGINE ELECTRIC CIRCUIT (3/7)

(3/7)

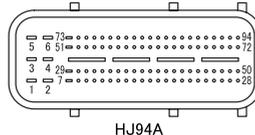


SAM connector (harness side)



SAM : Signal detect and actuation modules  
 CAN : Controller area network  
 ECU : Electronic control unit  
 SCR : Selective catalytic reduction  
 DEF : Diesel exhaust fluid

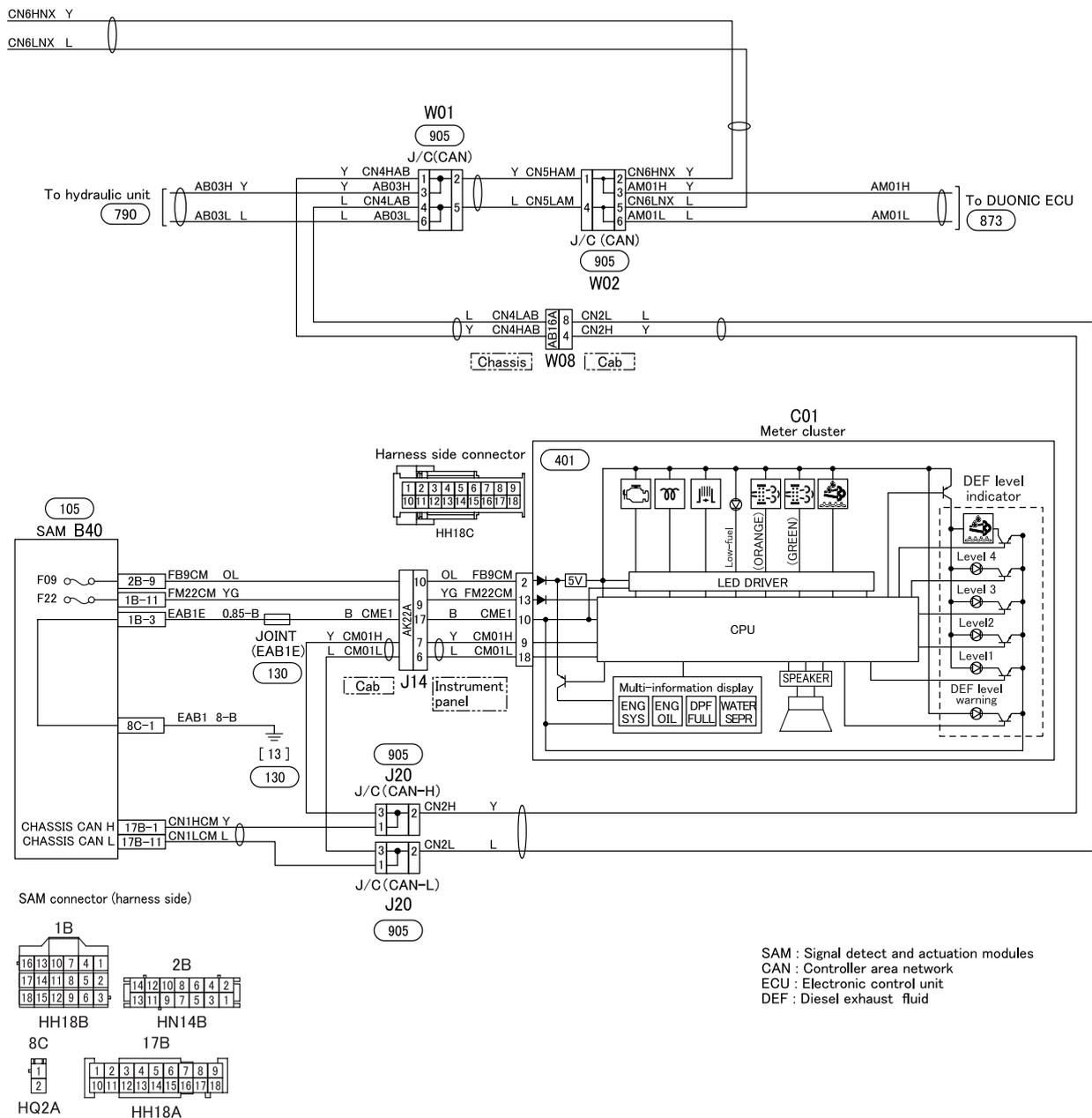
Engine ECU side connector



880-C07391-3

ENGINE ELECTRIC CIRCUIT (4/7)

(4/7)



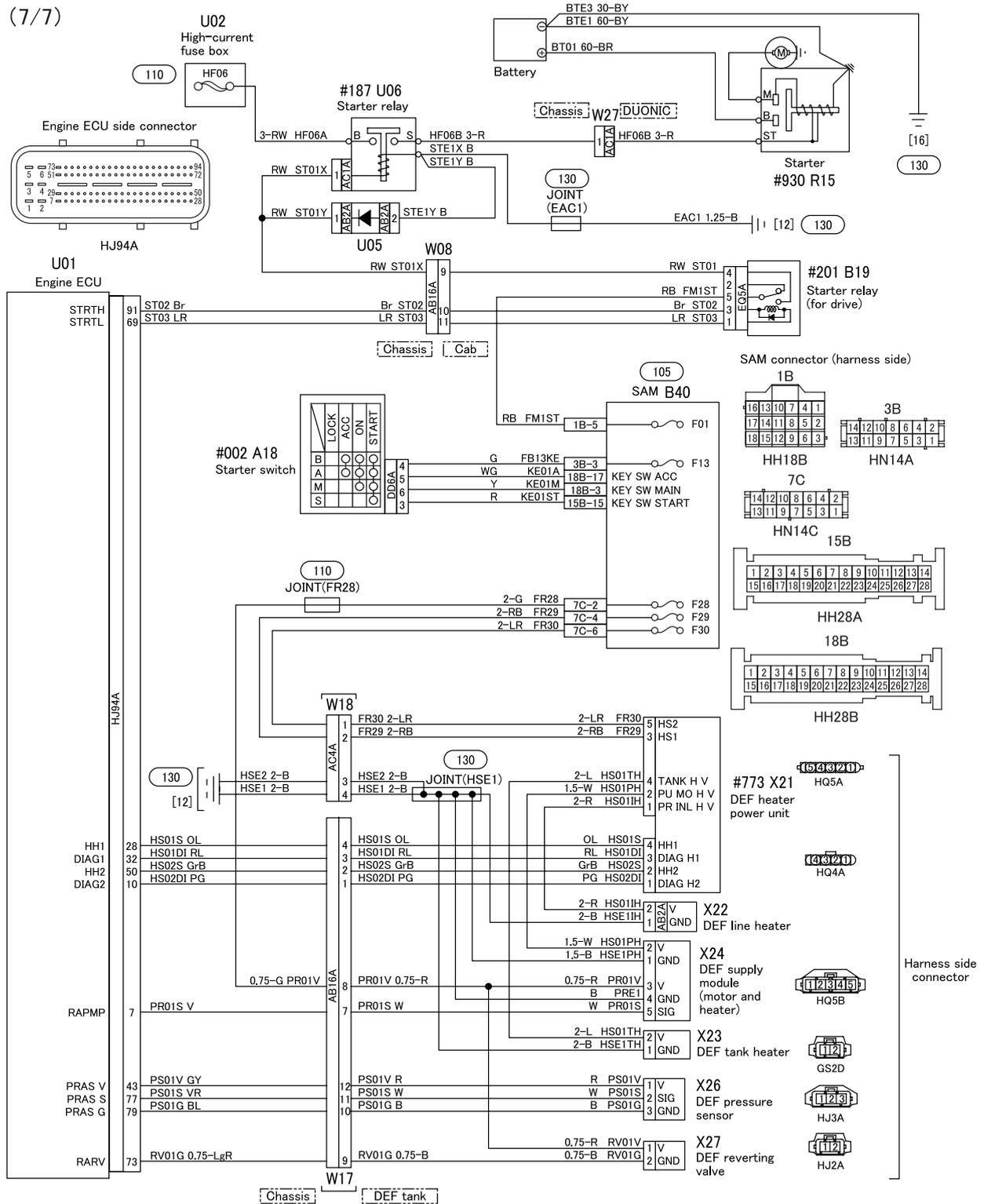
880-C07391-4





ENGINE ELECTRIC CIRCUIT (7/7)

(7/7)



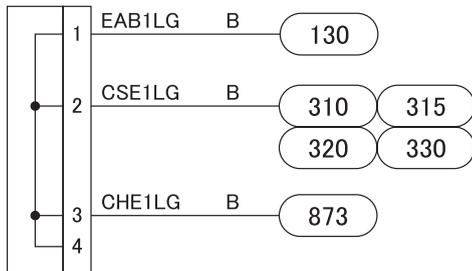
880-C07391-7

### JOINT CONNECTOR

(1/4)

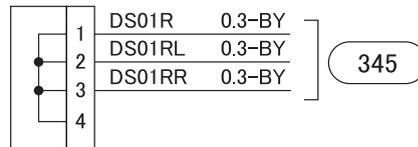
Ground (EAB1LG)

1	2	3	4
EAB1LG	CSE1LG	CHE1LG	-



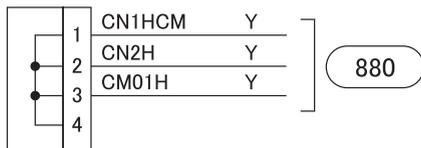
Rear door switch (040)

1	2	3	4
DS01R	DS01RL	DS01RR	-



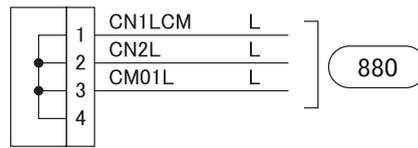
Meter cluster (CAN-H)

1	2	3	4
CN1HCM	CN2H	CM01H	-



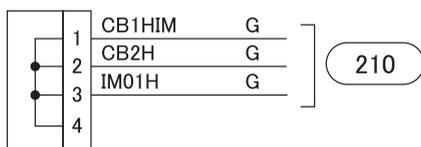
Meter cluster (CAN-L)

1	2	3	4
CN1LCM	CN2L	CM01L	-



Immobilizer (CAN-H)

1	2	3	4
CB1HIM	CB2H	IM01H	-



Immobilizer (CAN-L)

1	2	3	4
CB1LIM	CB2L	IM01L	-



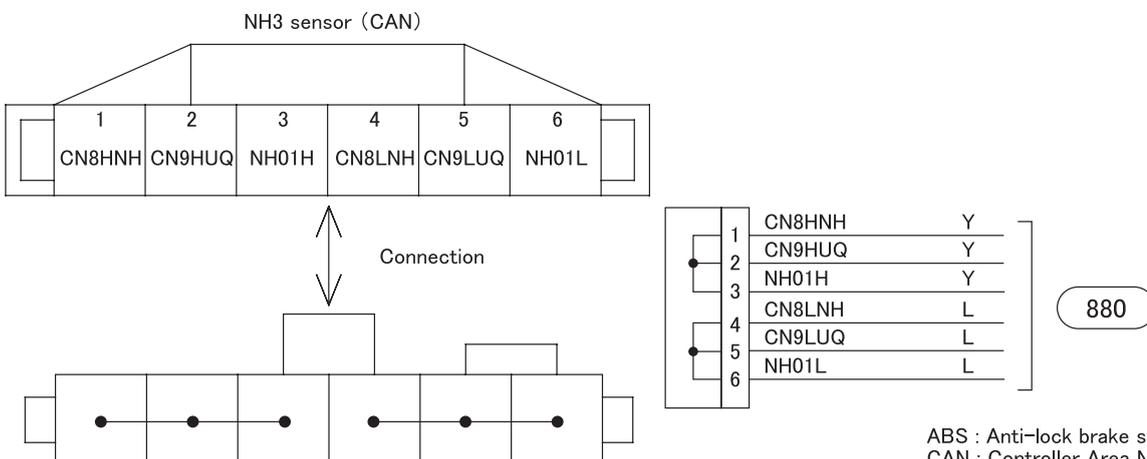
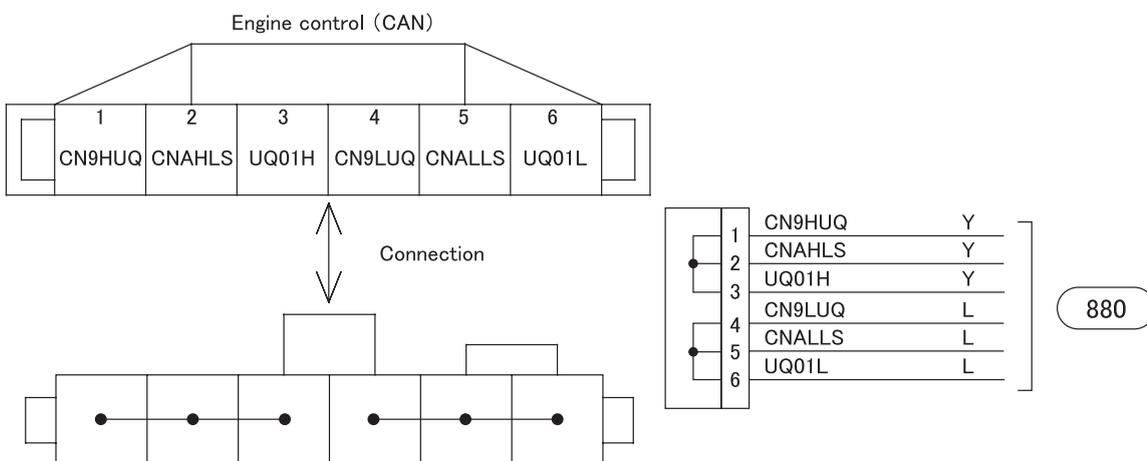
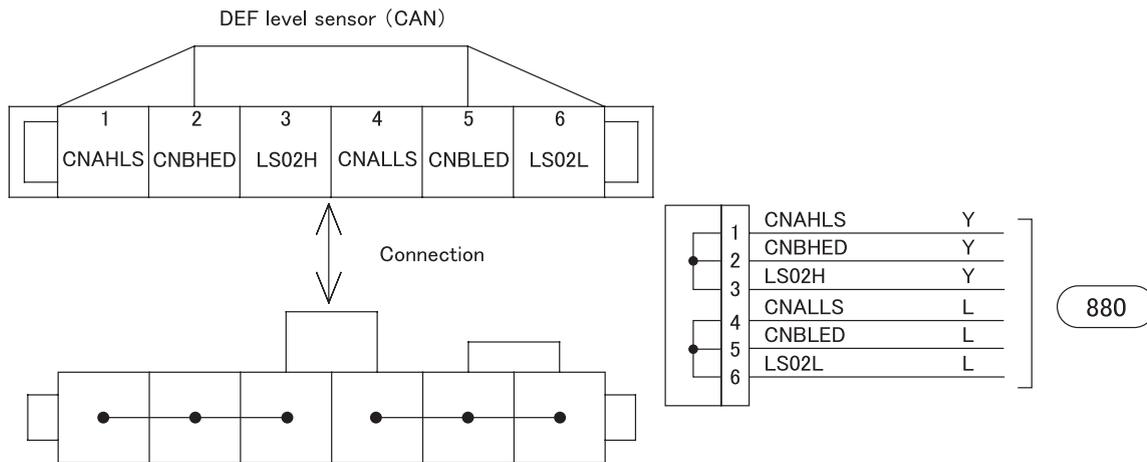
CAN : Controller Area Network

905-C07391-1



### JOINT CONNECTOR

(2/4)



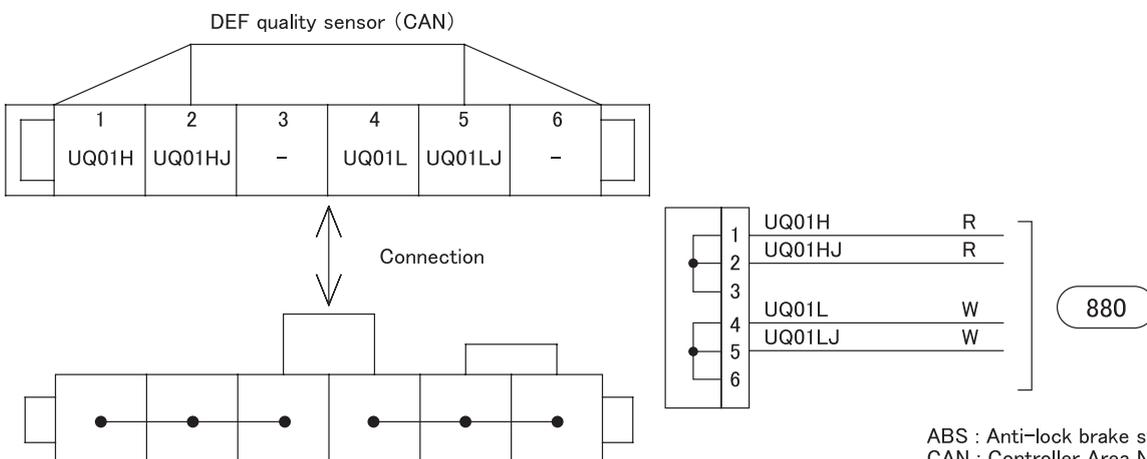
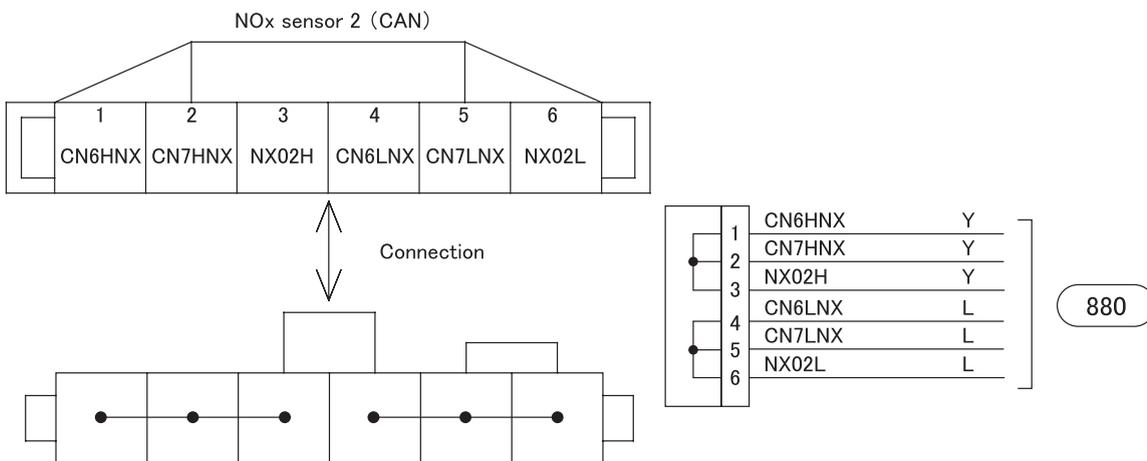
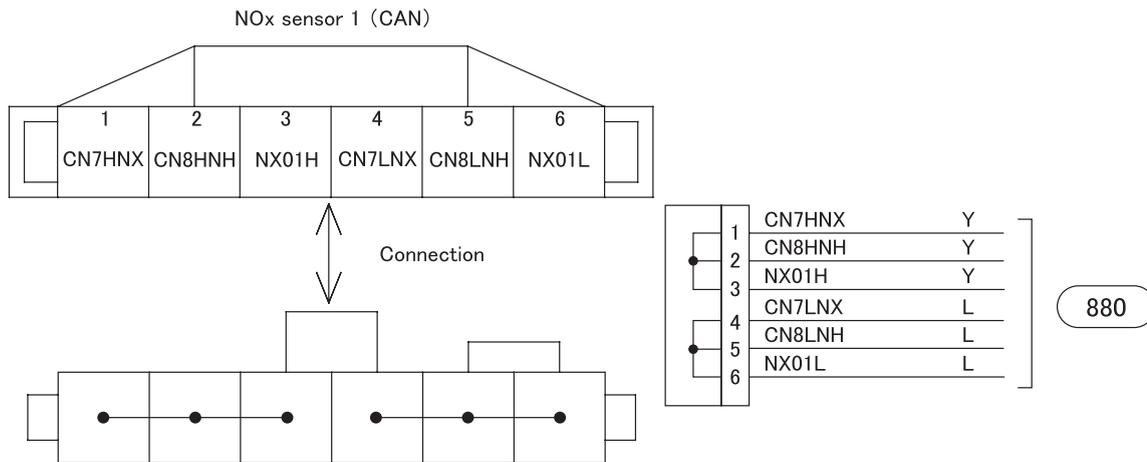
ABS : Anti-lock brake system  
CAN : Controller Area Network

905-C07391-2



### JOINT CONNECTOR

(3/4)



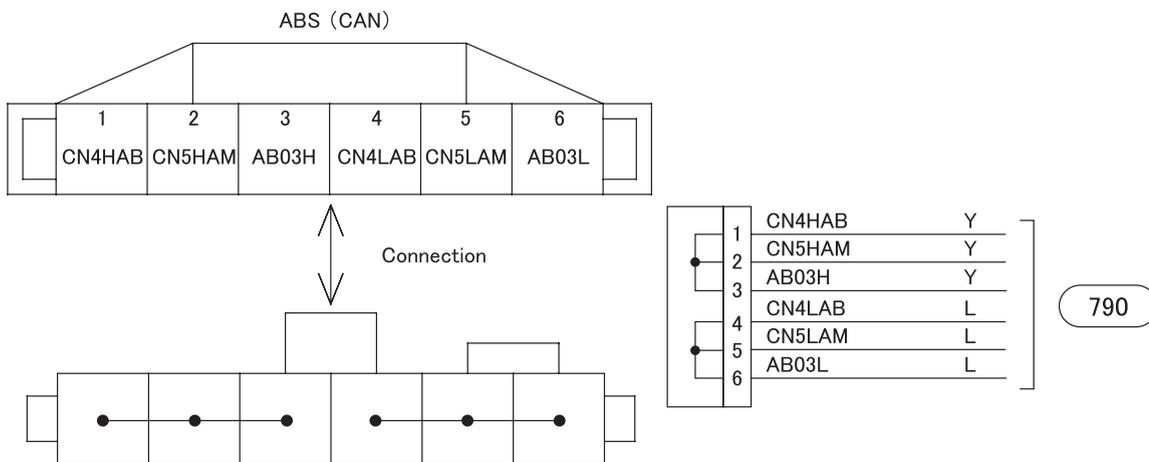
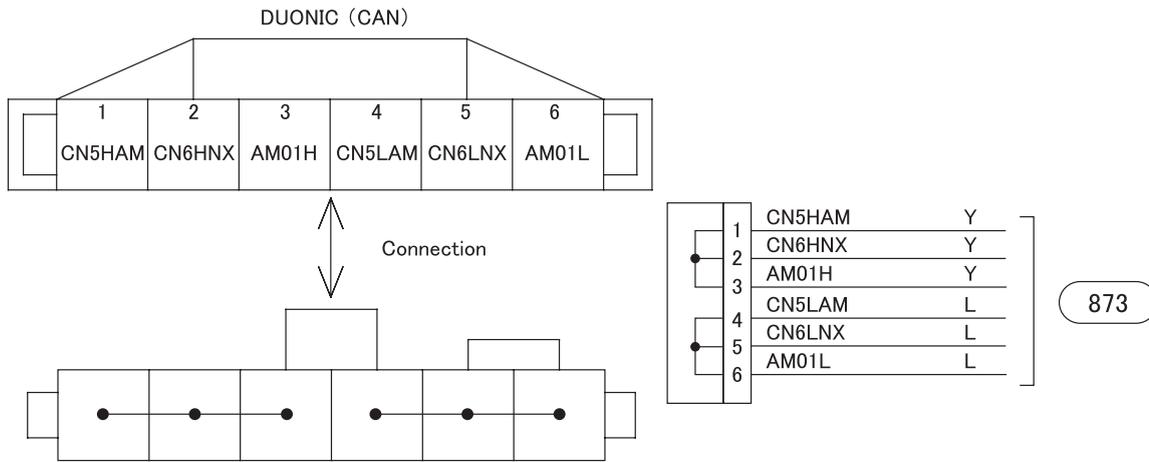
ABS : Anti-lock brake system  
CAN : Controller Area Network

905-C07391-3



JOINT CONNECTOR

(4/4)



ABS : Anti-lock brake system  
CAN : Controller Area Network

905-C07391-4

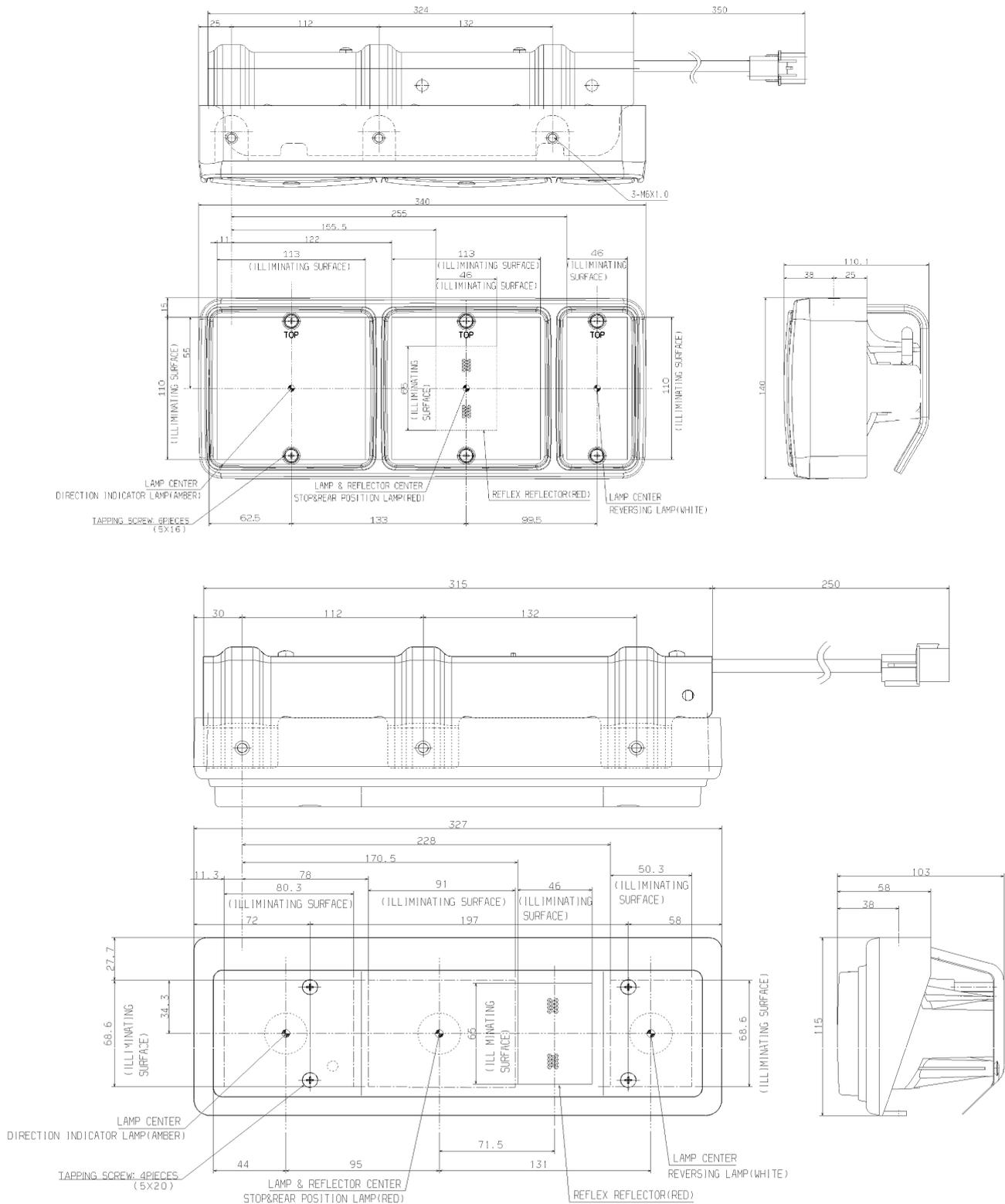


### 10.14 Other equipment

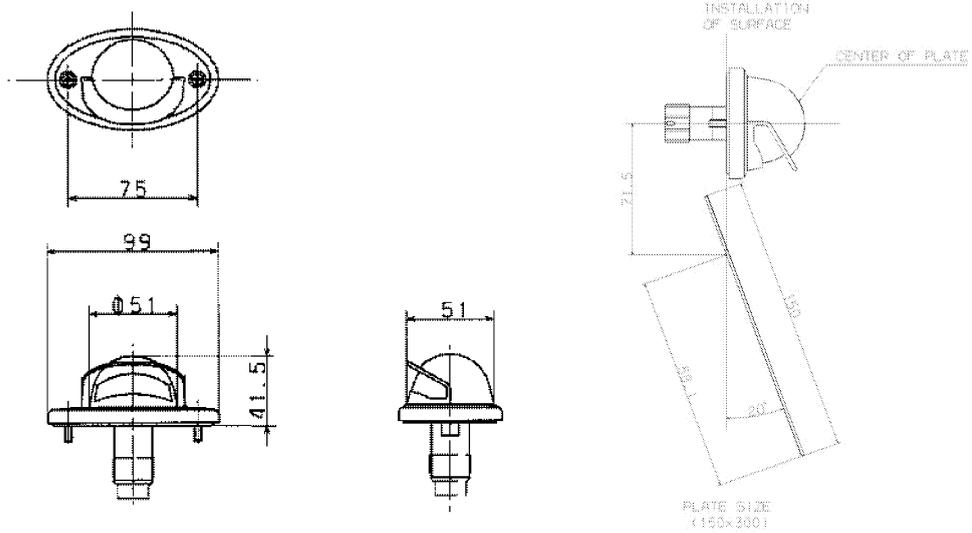
#### 10.14.1 Installing rear lamp

##### (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.



### (2) License plate lamp



### 10.14.2 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 390.

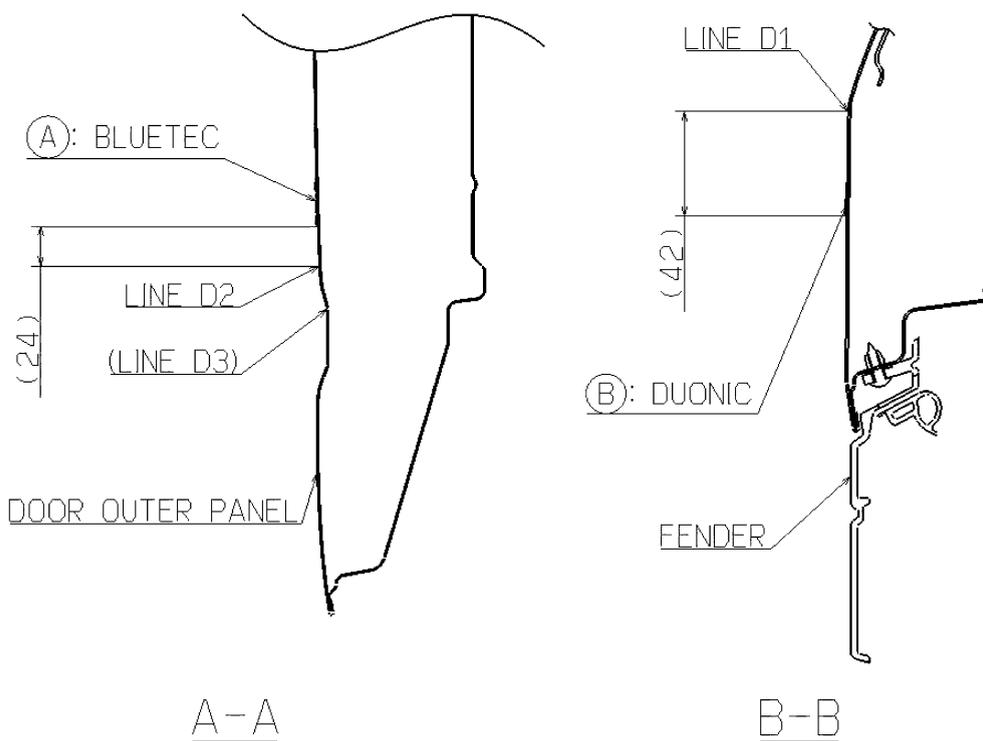
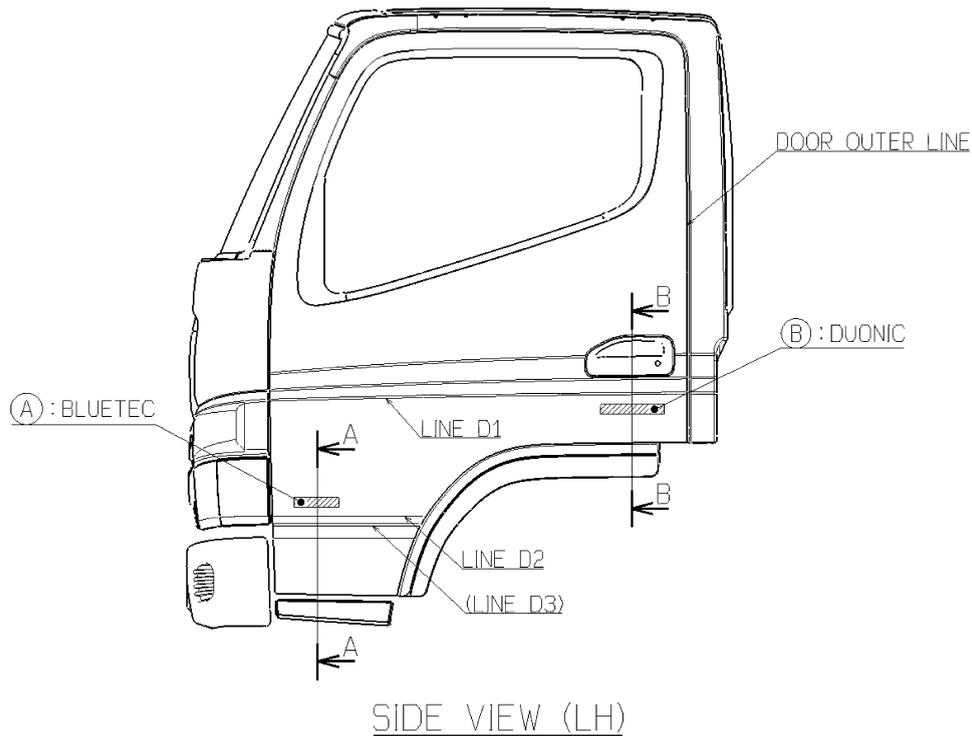
#### (1) List of the attaching locations of labels and emblems

Locations Description	Front face of cab	RH and LH doors
FUSO	○	—
DUONIC	—	○
BlueTec	—	○

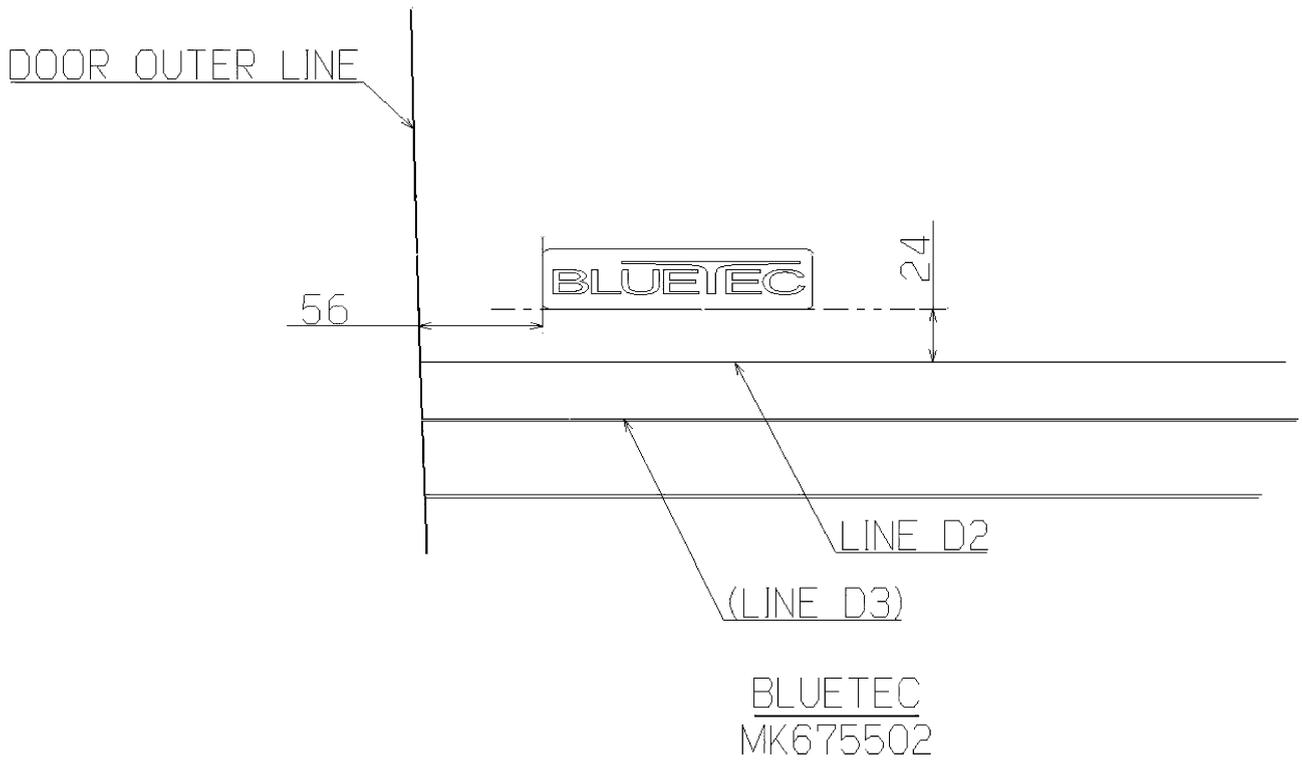
NOTE: Types of the label and emblem attaching on a vehicle differ depending on the vehicle types.

### (2) Installation of marks

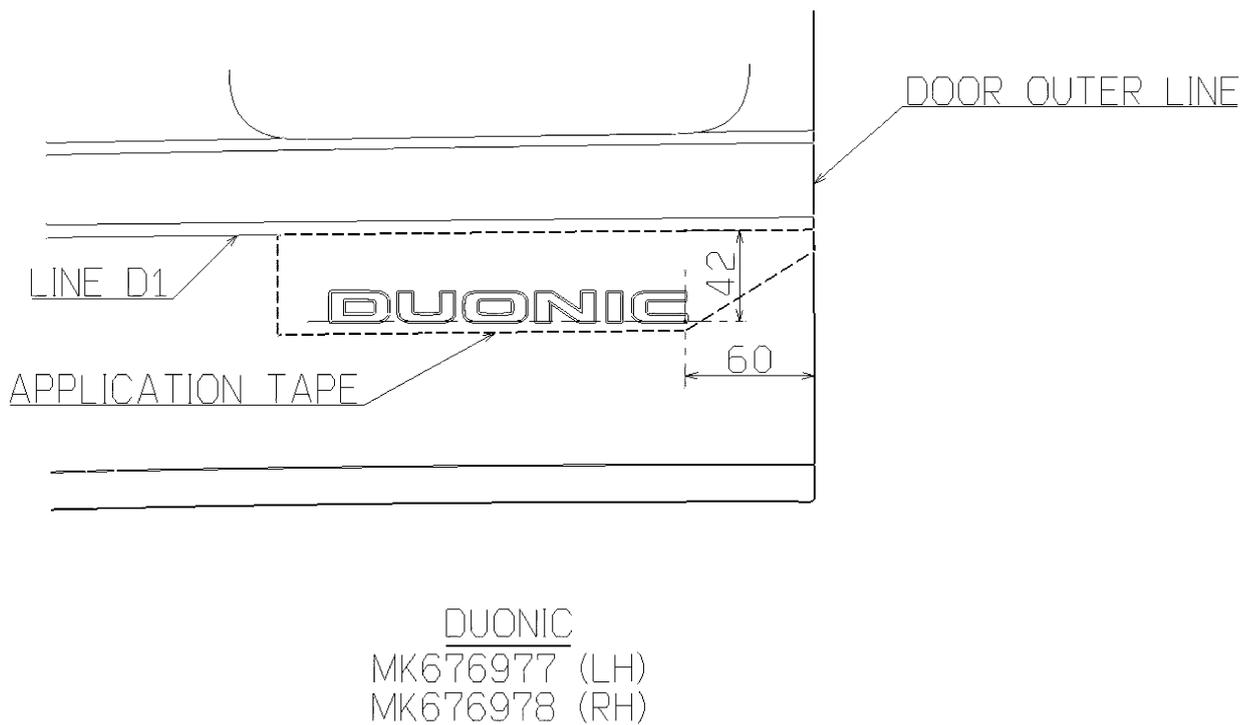
Clean the indicated areas where the CUSTOM mark, BLUETEC mark, and DUONIC mark are to be stuck, peel off the backing paper from each sticker, and affix it in position according to the illustration.



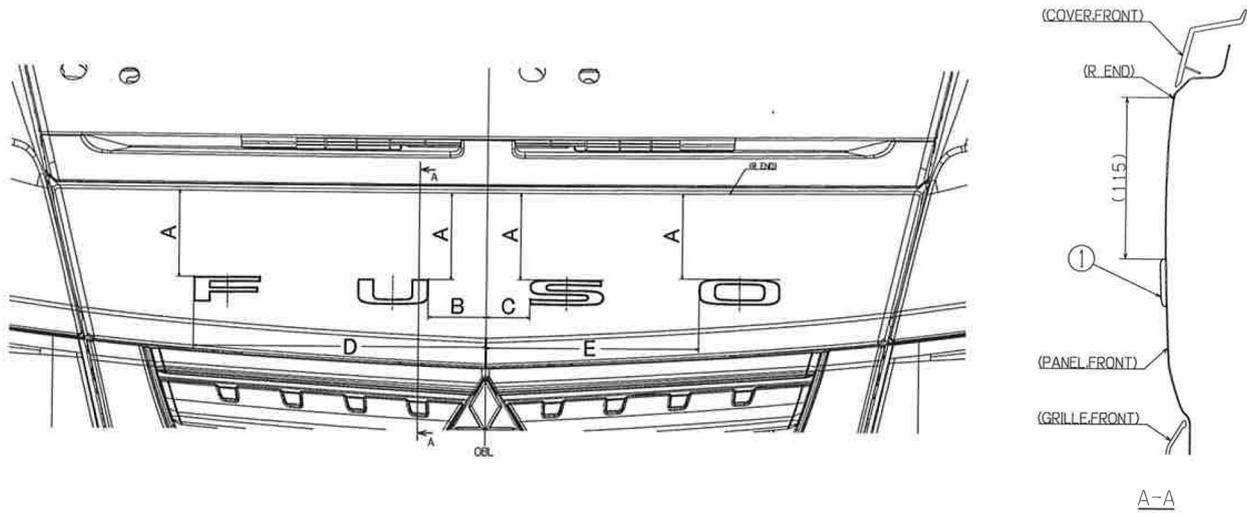
(A)



(B)



### 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)

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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.

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# Body/equipment mounting directives

<Technical data section>



**mitsubishi FUSO TRUCK & BUS CORPORATION**

June 2013 TL2UX

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