

Body/equipment mounting directives

CANTER



Revision A: includes FG4X4/FGB72S

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1 Introduction

Mitsubishi Fuso Truck and Bus Corp., 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 and Bus Corp. 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 and Bus Corp. 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 and Bus Corp. 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 and Bus Corp. 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

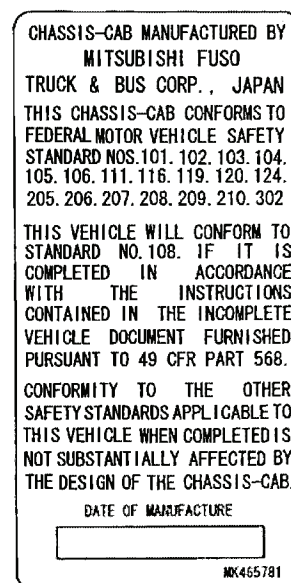
List of FMVSS and CMVSS applicable to MFTBC trucks with GVWR of more than 10,000 lbs. manufactured after Jan. 1, 2007 is shown below.

<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.

<p style="text-align: center;">VEHICLE NOISE EMISSION CONTROL INFORMATION</p> <p style="text-align: center;"> MITSUBISHI FUSO TRUCK & BUS CORPORATION</p> <p style="text-align: center;">DATE OF MANUFACTURE <input type="text"/></p> <p>THIS VEHICLE CONFORMS TO U.S. EPA REGULATIONS FOR NOISE EMISSION APPLICABLE TO MEDIUM AND HEAVY TRUCKS. THE FOLLOWING ACTS OR THE CAUSING THEREOF BY ANY PERSON ARE PROHIBITED BY THE NOISE CONTROL ACT OF 1972:</p> <p>A. THE REMOVAL OR RENDERING INOPERATIVE, OTHER THAN FOR PURPOSES OF MAINTENANCE, REPAIR, OR REPLACEMENT OF ANY NOISE CONTROL DEVICE OR ELEMENT OF DESIGN (LISTED IN THE OWNER'S MANUAL) INCORPORATED INTO THIS VEHICLE IN COMPLIANCE WITH THE NOISE CONTROL ACT.</p> <p>B. THE USE OF THIS VEHICLE AFTER SUCH DEVICE OR ELEMENT OF DESIGN HAS BEEN REMOVED OR RENDERED INOPERATIVE.</p>

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 for modification to other make bodies and major assemblies. These directives are divided into 9 interlinked chapters to help you find the information you require more quickly:

- 1 Introduction
 - 2 General
 - 3 Planning of bodies
 - 4 Technical threshold values for planning
 - 5 Damage prevention
 - 6 Modifications to the basic vehicle
 - 7 Construction of bodies
 - 8 Calculations
 - 9 Technical data
- Appendix
Index



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" (▷ page 81) and Section 7 "Construction of bodies" (▷ page 111) 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.

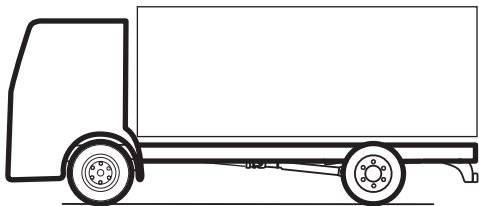
Additional information is available from any

Mitsubishi Fuso Service Center

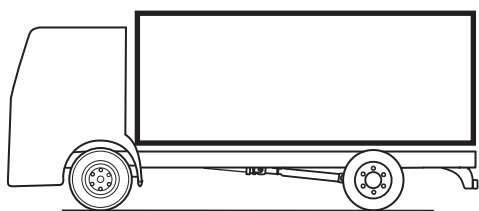
Your

Mitsubishi Fuso Truck and Bus Corp.

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:



Warning

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.



A note draws your attention to possible hazards to your vehicle.



A tip contains advice or further information you may find useful.

▷ 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



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

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.

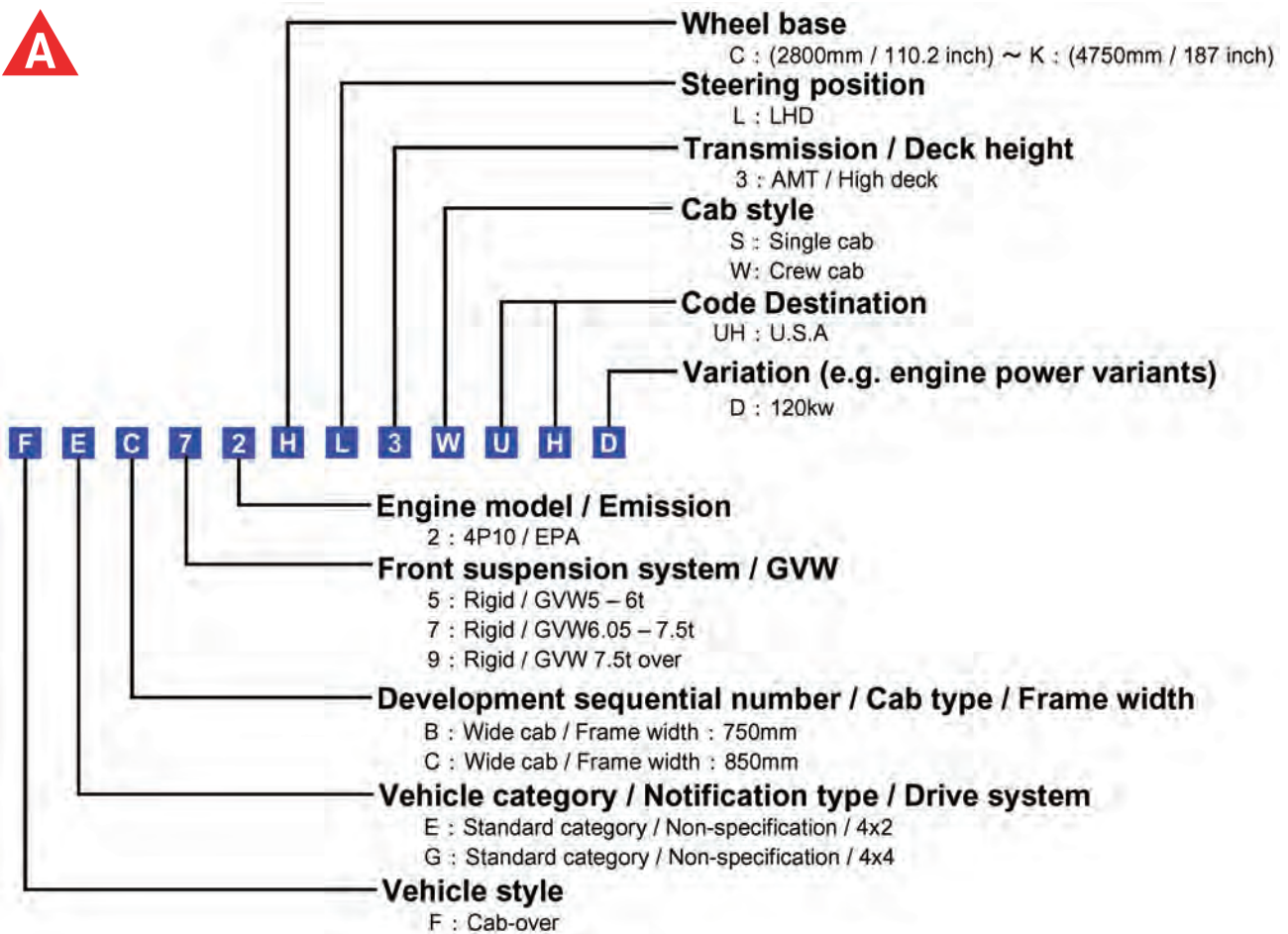
All technical means shall be used to avoid operating conditions that may be unsafe or liable to cause an accident.

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.

2.1 Vehicle and model designations

2.1.1 Model coding system



2 General

2.1 Vehicle and model designations

2.1.2 Vehicle and model designation



			FEC5	FEC7	FEC7	FEC9	FGB7
Engine Type			4P10T5	4P10T5	4P10T5	4P10T5	4P10T5
Number of Cylinders			L4	L4	L4	L4	L4
Output	(kW)		120	120	120	120	120
	(rpm)		3400	3400	3400	3400	3400
Maximum torque	(Nm)		400	400	400	400	400
	(rpm)		1300	1300	1300	1300	1300
Cab		Single Crew	●	●	●	●	●
Transmission			Wet dual clutch	Wet dual clutch	Wet dual clutch	Wet dual clutch	Wet dual clutch
Wheelbase	(mm/inch)	2800 / 110.2	●	●		●	
		3400 / 133.9	●	●		●	
		3415 / 134.4					●
		3850 / 151.6	●	●		●	
		4300 / 169.3		●	●	●	
		4750 / 187.0		●	●	●	
Permissible axle load and weight	(kg/lbs)	Front	2430 / 5360	2900 / 6390	2900 / 6390	2900 / 6390	2600 / 5730
		Rear	4480 / 9880	5760 / 12700	5760 / 12700	5760 / 12700	4300 / 9480
		Total	5670 / 12500	7255 / 15995	7255 / 15995	8160 / 17995	6375 / 14050



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



2.3 Required documents

In individual cases, the body drawings may be submitted to the department responsible before the start of work ▷ page 15. The drawings shall contain the following information:

- All deviations from Mitsubishi Fuso body/equipment mounting directives.
- Complete data on dimensions, weights and center of gravity (weight certificates)
- Attachment of body to the chassis
- Vehicle operating conditions, e.g.
 - on poor roads
 - in very dusty conditions
 - at high altitude
 - at extremely high or low ambient temperatures

2.4 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, gearbox linkage, etc.) even in the case of diagonal torsion between the chassis and the bodies

2.4.1 Guarantee of traceability

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

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

2.5 Mitsubishi three diamonds and Fuso emblem

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 ▷ page 215

Overall appearance of the overall vehicle

If the vehicle fails to comply with the appearance, quality, specifications, and safety standards as required by Mitsubishi Fuso Truck and Bus Corp., 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 Canter FE and FG chassis. Mitsubishi Fuso Truck and Bus Corp. 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 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.



2.7 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 described above, Mitsubishi Fuso Truck and Bus Corp. urgently advises body and equipment 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 labeling materials/parts?
- Are quality assurance measures carried out at suppliers?

3.1 Selecting the chassis



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/gearbox
- 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.



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.



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

3.2 Vehicle modifications



Risk of accident

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

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

The vehicles must still comply with federal, state, and local regulations and codes after modifications have been carried out.

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

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



3 Planning of bodies

3.3 Dimensions, weights, vehicle overall length, height, and width

3.3 Dimensions, weights, vehicle overall length, height, and width



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.



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		

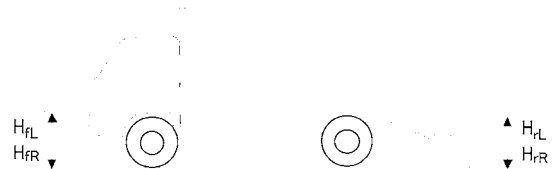
- The following are target reference values for tilting the body of an assembled vehicle.
 - Left-right weight difference
 - $|H_{fL} - H_{fR}| \leq 10\text{mm} \{0.39\text{in.}\}$
 - $|H_{rL} - H_{rR}| \leq 10\text{mm} \{0.39\text{in.}\}$
 - Front-back deviation
 - $|(H_{fL} - H_{fR}) - (H_{rL} - H_{rR})| \leq 10\text{mm} \{0.39\text{in.}\}$

H_{fL}: Center height of headlamp (left side)

H_{fR}: Center height of headlamp (right side)

H_{rL}: Lower height of rear end of body outer panel (left side)

H_{rR}: Lower height of rear end of body outer panel (right side)



3.5 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. NAFTA does not offer optional tire sizes for any model.



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.



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



3.6 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.



Further information on bolted and welded connections can be found in Section 5 "Damage prevention" ▷ page 65 and Section 6 "Modifications to the basic vehicle" ▷ page 81.

3.6.1 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.



3.6.2 Welded connections

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



Parts which must not be welded:

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



Further information on bolted and welded connections can be found in Section 5 "Damage prevention" ▷ page 65 and Section 6 "Modifications to the basic vehicle" ▷ page 81.

3.7 Soundproofing

If modifications are carried out on any parts whose operation produces noise, e.g.

- engine
- exhaust system
- air intake system
- tires
- Noise absorbing cover, etc.

sound level measurements must be made.

To prevent modifications from changing the vehicle's sound levels, it must be ensured that interior sound levels are reduced when planning bodies.

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



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

3.8 Duonic

3.8.1 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 contamination 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 harnesses maintain at least 25 mm (1 in.) of clear space to other parts. If this is impractical with parts installed on the same plane, clamp them at proper point(s) to hold them securely.

3.8.2 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.

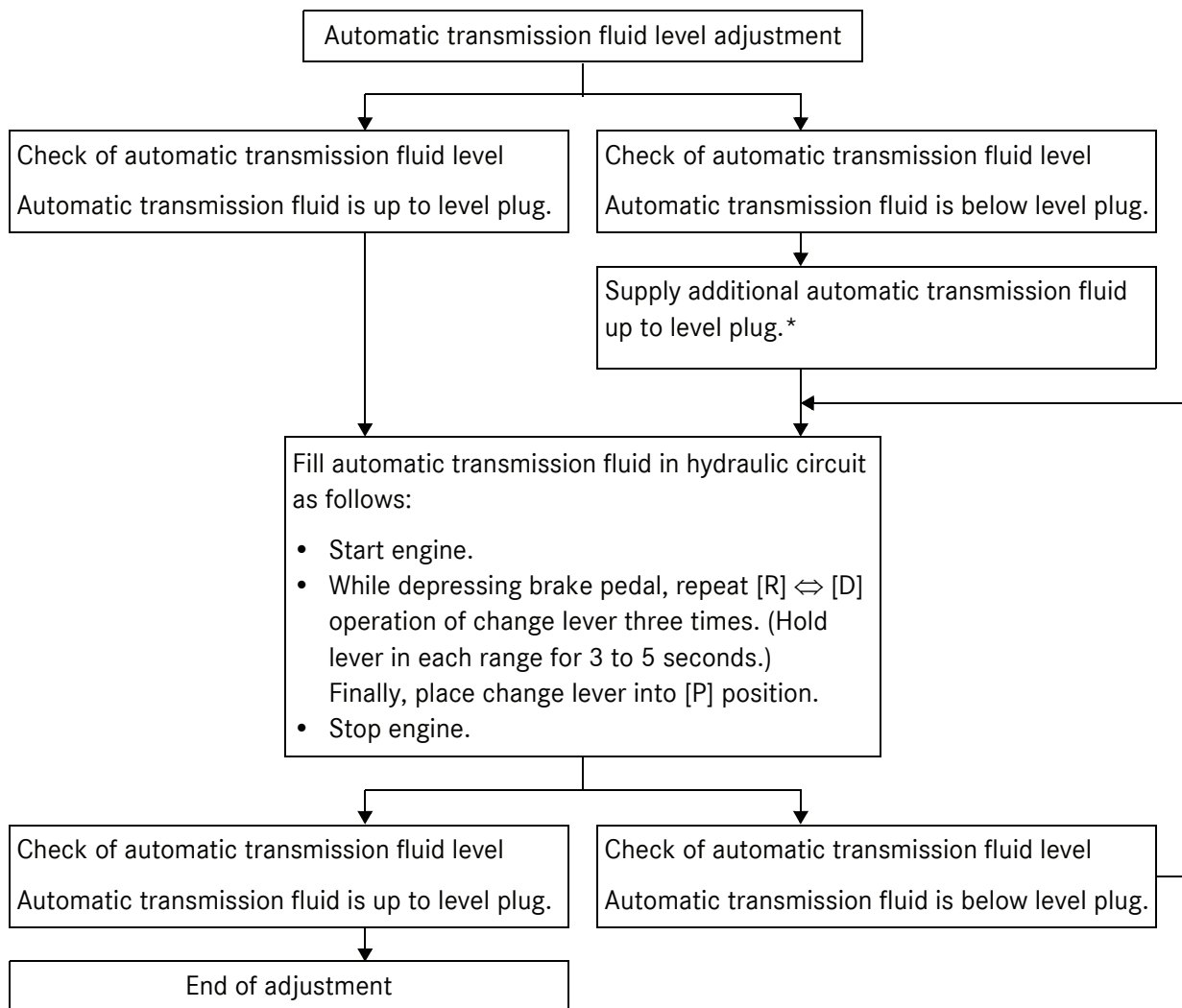


Fig. 1 Left view of transmission



Automatic transmission fluid level plug Transmission gear oil fluid level plug

Fig. 2 Top view of transmission



Clutch housing breather Transmission breather

3.8.3 Initialization of DUONIC system

Initializing the DUONIC system stores the GSU (gear shift unit) gear position, road surface grade zero point correction value, clutch fill time learning value and clutch torque learning value in the memory of the TCU. It must be performed after ANY type of transmission-related service.

If any abnormality occurs during normal running, it may be cleared by initialization. Some kinds of body equipment work to the vehicle can cause an error in road surface grade recognition. To prevent this, be sure to initialize the DUONIC system under the following conditions after body equipment work.

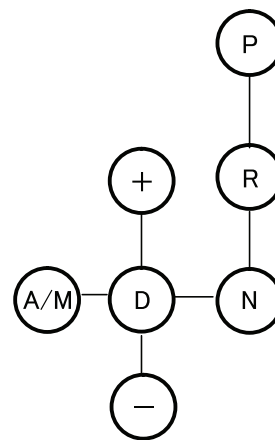
Conditions for initialization

Check the following before initialization.

- (a) The engine electronic control unit and DUONIC electronic control unit (TCU) are finished with flashing (programming) and coding (in case of a change in tire size or final ratio). For details, contact a Mitsubishi Fuso service center.
- (b) To compute the road grade zero point correction value, make sure that the vehicle is in the following state:
 - Standing still, brake released, on a flat surface such that the vehicle remains stationary without drifting forward or backward
 - Equipped with specified wheels with the tires filled to correct pressures.
 - Cab tilt locked (a G sensor is provided in the cab.)
- (c) For learning the clutch torque, units powered by the engine, such as the following, must be stopped:
 - Air conditioner
 - Load for equipment (compressor for refrigerator, etc.)

- Exhaust brake

Change lever pattern



Initialization procedure

Operation	Resultant status	Remarks
<ul style="list-style-type: none"> Hold vehicle on flat surface. (3.8.3 (b)) Turn key ON. Stop engine. Switch off air conditioner, equipment load and exhaust brake. (3.8.3 (c)) Accelerator ON (50% or more) Foot brake ON Change lever D → (hold for approx. 1 second) → Hold A/M Parking brake ON → (hold for approx. 1 second) → OFF → (hold for approx. 1 second) → ON (pull a little hard) 	[Initialize mode standby status] is established and indicator shows [1] blinking.	[To clear initialize mode standby status to return to normal mode], release parking brake or turn key OFF and hold it OFF for 1 second.
From initialize mode standby status, <ul style="list-style-type: none"> Turn accelerator OFF Place change lever to [P]. Then, start engine.	<ul style="list-style-type: none"> With progress of initialization, indicator shows [2-3-4-5-N] blinking in that order. If initialization goes wrong, [R] is shown blinking. 	Even if foot brake is released after engine is started, initialize mode remains, but for safety, foot brake should be kept ON.
	(Status by indication) [2] Detection of GSU gear position in progress [3] Clutch warming up + road grade zero point compensation in progress [4] Clutch fill time learning in progress [5] Clutch torque learning in progress [N] Initialize completed [R] Initialize failed	
Release parking brake or turn key OFF and hold it in that state for 1 second. Mode is returned to normal.		

(a) In case of failure of initialization

- Repeat the initialization procedure from the start.
- If initialization still goes wrong, there may be a problem with the hardware. Check the transmission (including gears, clutch, associated parts, valve body and GSU) and their connections.
- If the indicator shows from [2] to [R] blinking, move the vehicle once, then perform the initialization procedure. The problem may be resolved.



3.8.4 Resetting of initial DUONIC settings

The DUONIC system has a reset function for restoring the initially set GSU gear position, road grade zero point compensation value, clutch fill time learning value and clutch torque learning value to the pre-initialization status. (This is a back-up function used in case any initial settings are found to be abnormal and affect the vehicle operation; it is not normally used.)

Resetting procedure

Operation	Status	Remarks
<ul style="list-style-type: none"> • Turn key ON. • Stop engine. • Accelerator ON (50% or more) • Foot brake ON • Change lever D → (hold approx. 1 second) → Hold A/M • Parking brake ON → (hold approx. 1 second) → OFF → (hold approx. 1 second) → ON 	[Initialize mode standby status] is established and indicator shows [1] blinking.	[To clear initialize mode standby status to return to normal mode], release parking brake or turn key OFF and hold it OFF for 1 second.
From initialize mode standby status, place change lever to [-].	With resetting completed, indicator [6] blinks.	
Release parking brake, or hold key OFF for 1 second.		
Mode returns to normal.		

3.8.5 Cautions during body equipment work on DUONIC vehicle

The DUONIC transmission and control system 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 with 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 vehicle.
- Be sure not to alter DUONIC-associated devices, sensors, harnesses and connectors in any way.

- Before disconnecting DUONIC-associated connectors, set the starter switch of the vehicle to OFF. Before turning the starter switch ON, reconnect the disconnected connectors. If DUONIC-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.






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

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.

3.9 Exhaust system

The exhaust system must not be modified.



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

3.9.1 Clearance between exhaust system parts and other parts

- The exhaust pipe and exhaust gas purification devices (BlueTec[®] system) become so hot that if they are too close to or interfere 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 120. If this is impracticable, provide a heat shield plate to ensure safety.
- Do not install the tail pipe under the fuel pipe, fuel hose joint or fuel filter drain plug.
Wooden and rubber body parts should be more than 100 mm (3.94 in.) apart from the diesel particulate filter (DPF) integrated muffler, SCR muffler and exhaust pipe. If this is impracticable, provide a heat shielding plate against to ensure safety.



Risk of accident and injury

The tail pipe 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.

3.9.2 Exhaust gas purification devices (BlueTec[®] system) and sensors

- Exhaust gas purification devices (BlueTec[®] system) may be damaged by tool or equipment impact, or if dropped. 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 or 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 tightly. Also, securely clip hose joints and confirm that there are no exhaust gas leaks.
- Exhaust gas purification devices and sensors are periodically removed for maintenance. Install any nearby equipment so that removal and reinstallation work can be carried out without any problems.



3.9.3 BlueTec[®] exhaust gas aftertreatment

BlueTec[®] exhaust gas aftertreatment removes NOx in the exhaust gas.

Do not modify or relocate any of the following parts because the performance of the system is may become compromised.

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



Don't 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.



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 specified service intervals. If this is not done, malfunctions or failures may occur in systems that could be relevant to safety. This could cause an operator to have an accident, which could result in injury or death.

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 39.

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



3.10.2 Preparation for storing the vehicle



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 gearbox housing and light-alloy wheels.

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/cm²} 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.



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.

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. NAFTA 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.



Further details are available from any Mitsubishi Fuso Service Center.

3.11 Special 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.



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 45.
- 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

Van body: Body that fully encloses payload and does not permit payload to protrude at the rear of vehicle

Example: Van body, lorry, etc.



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



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. NAFTA 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, overweight 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: 62" (1575mm)
FGB72: 60" (1524mm)



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.



The permissible front axle load must not be exceeded.

Observe the notes on product liability ▷ page 17.



4 Technical threshold values for planning

4.4 Clearance for assemblies and cab

4.4 Clearance for assemblies and cab

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

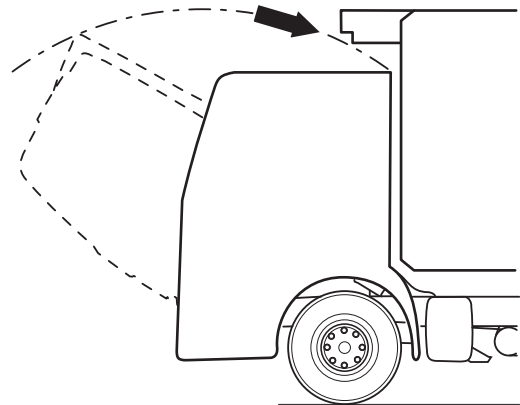
Dimensional data in the body builder's drawings must be observed.



Read and comply with the relevant sections of the Body Builder's Manual.

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.
▷ page 173.



N60.80-2157-00

Cab tilting range clearance



4 Technical threshold values for planning

4.4 Clearance for assemblies and cab

4.4.2 Cab

- The distance between the cab and the body must be kept per layout drawings.



Reference body builder's drawings and technical data. ▷ page 173.



4.5 Air deflectors

4.5.1 Attaching the roof deck

Roof

- When attaching externally mounted parts such as an air deflector onto the roof, use only the threaded factory mounting holes provided on the roof.
- The total weight of externally mounted parts attached to the roof cannot exceed 50 kg {110 lb}. (See Figs. 1, 2 and 4.)

Cautions

- 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 packing made of EPDM rubber to prevent ozone cracking.
- After attaching externally mounted parts, coat the entire periphery of the mounting bolts with sealer.
- A top coat of paint must be applied to externally mounted parts before attaching to the roof. (See Fig. 3.)

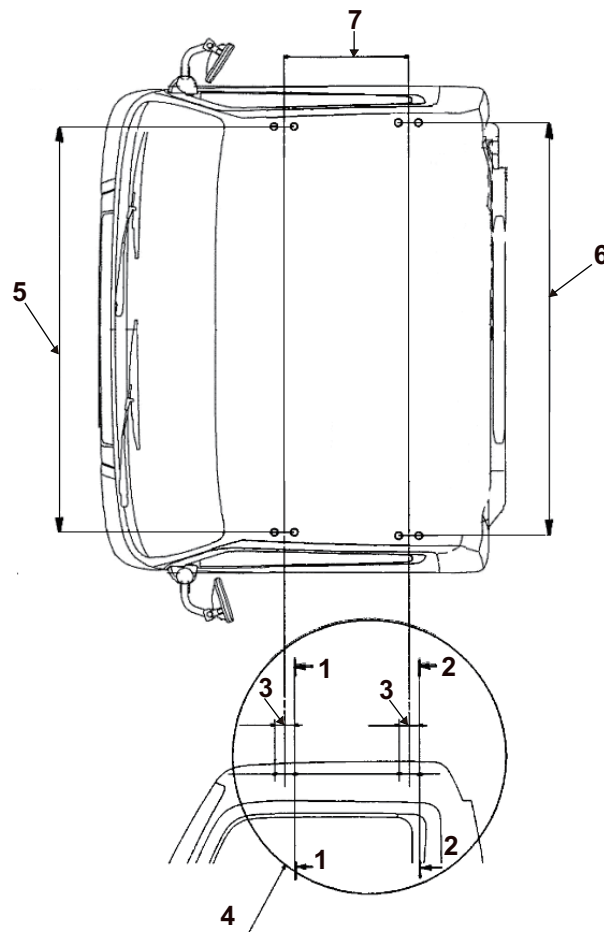


Fig. 1

- 1 Section A-A
 2 Section B-B
 3 80 mm {3.15 in.}
 4 Detail C

- 5 1664 mm {65.5 in.}
 6 1694 mm {66.7 in.}
 7 500 mm {19.7 in.}

4 Technical threshold values for planning

4.5 Air deflectors

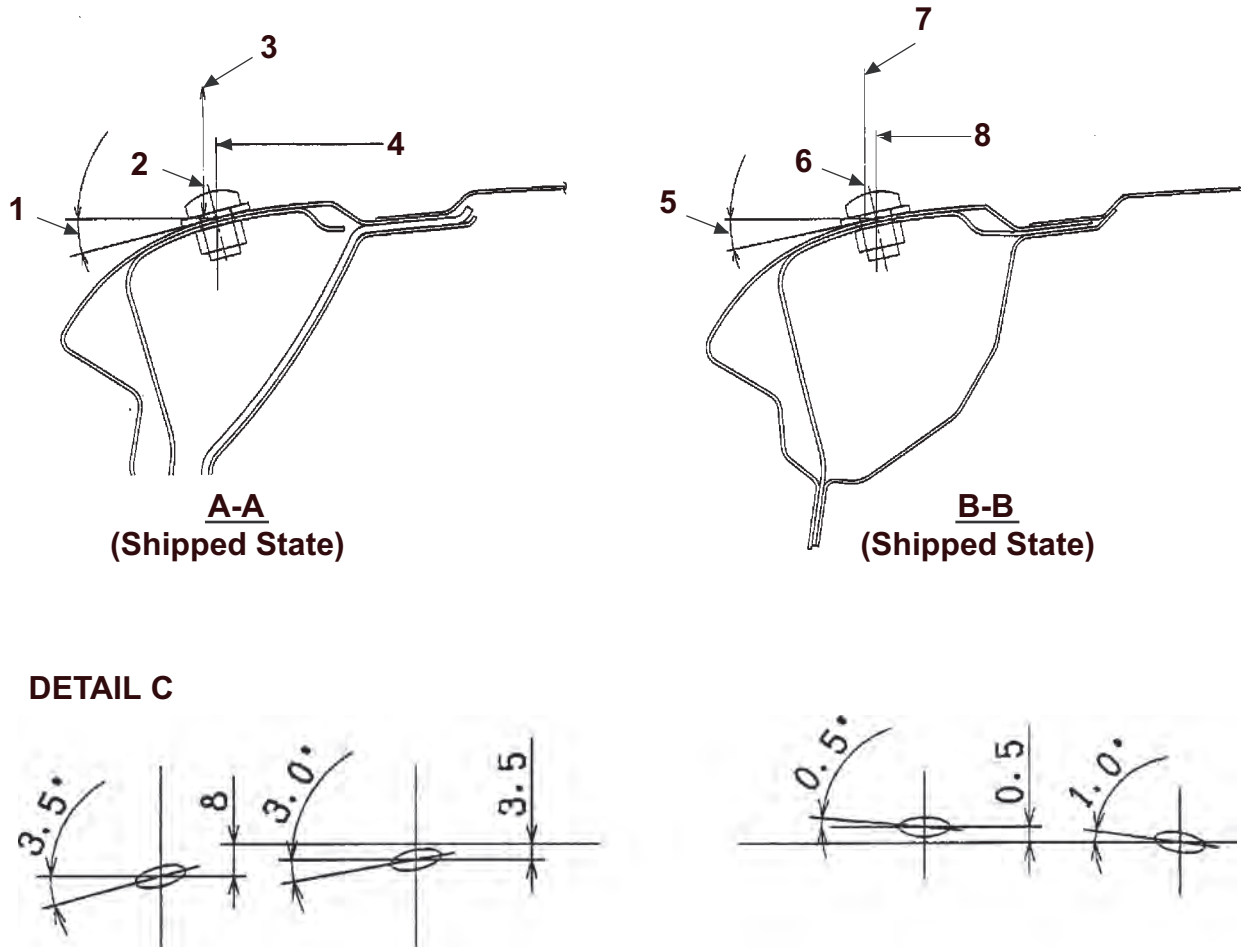


Fig. 2

- 1 16.5°
- 2 31.0 mm {1.22 in.}
- 3 roof top
- 4 1664 mm {65.5 in.}

- 5 14.5°
- 6 34.5 mm {1.36 in.}
- 7 roof top
- 8 1694 mm {66.7 in.}

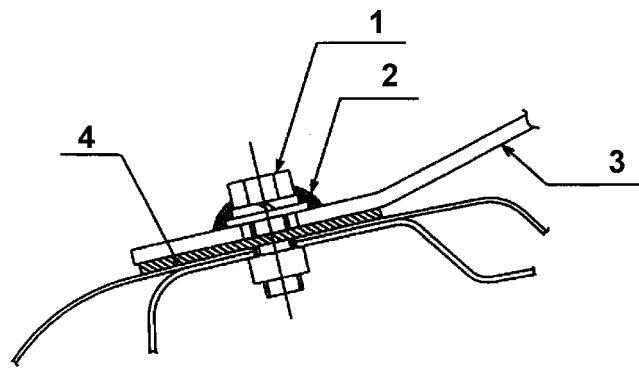


Fig. 3

- 1 Use washer and bolt with plain washer
- 2 Coat periphery with sealer
- 3 Air deflector mounting bracket
- 4 Rubber packing

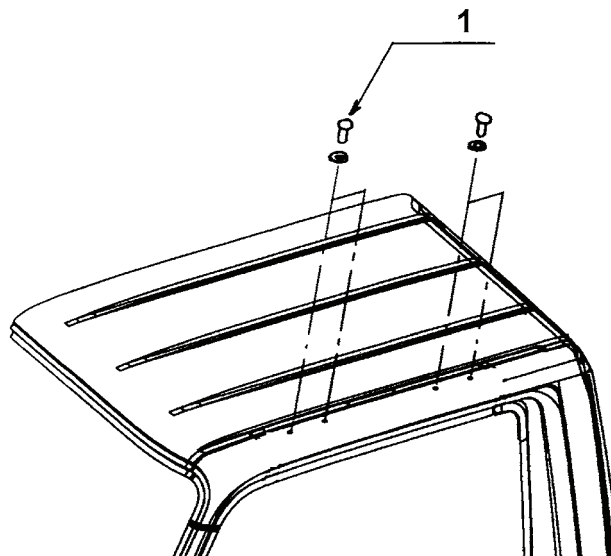


Fig. 4

- 1 Bolt and washer: Left/right total 8 places
(Air deflector)

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4.7 Non standard power take-off

When non standard power take-off is used, see the dimensions listed on ▷ page 206 for the lead-out port diameter and transmission-related dimensions.

5.1 Electrical system



Risk of fire

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.

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

Comply with all national regulations and laws.



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.



Observe the notes on operating safety and vehicle safety in Section 1 "Introduction" ▷ page 10 and ▷ page 11.

5.1.1 Signal detection and actuation module-related parts

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

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

- (a) Before disconnecting the connected cables of the signal detection and actuation module control unit, set the starter switch of the vehicle to OFF.
- (b) Before performing welding to the chassis and body, be sure to disconnect the signal detection and actuation module control unit cables and connectors. Use 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.



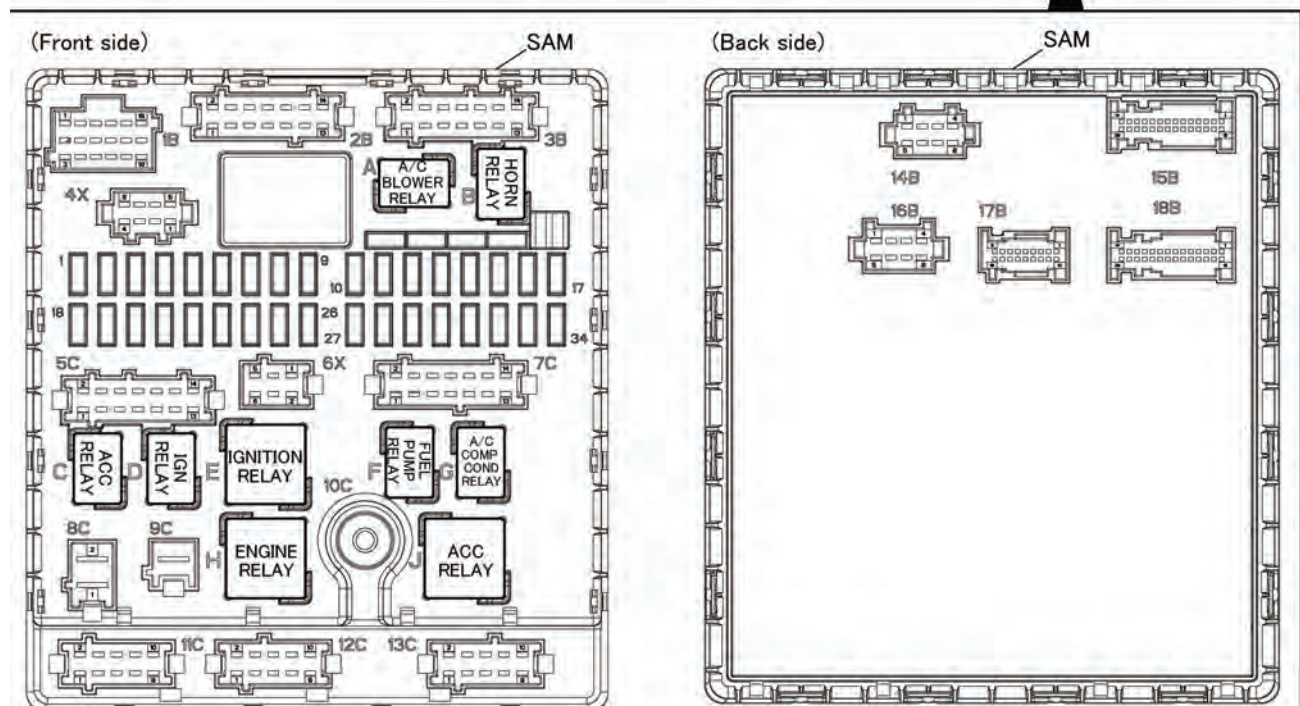
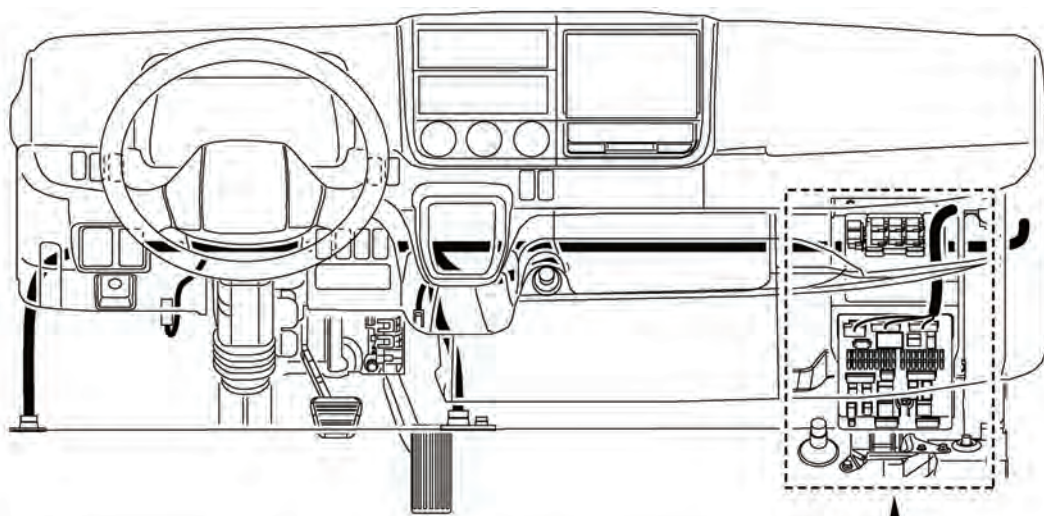
5 Damage prevention

5.1 Electrical system

Unit: N • m {ft. lbs, kgf • m}

Nut type	Torque	Use
M6	4 to 6 {3 to 4.4, 0.4 to 0.6} nominal value: 5.4 {4, 0.55}	To mount the control unit to the 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 103.

Other precautions

When the following parts are mounted, it is necessary to change data for the SAM. For details, ask the contact person ▷ page 15.

- Switch for mirror with heater: Momentary type (MK645411 or equivalent)
- Heated mirror: Operation current: 6 A (Type: 12 V)
- Designated LED rear lamp

5.1.2 Starter switch

- The starter switch uses precision current contacts. Do not add any wiring to the line connected to the starter switch.
- Regarding the output terminals for additional wiring provided on the SAM control unit, see "5.1.1 Signal detection and actuation module-related parts" (▷ page 53).

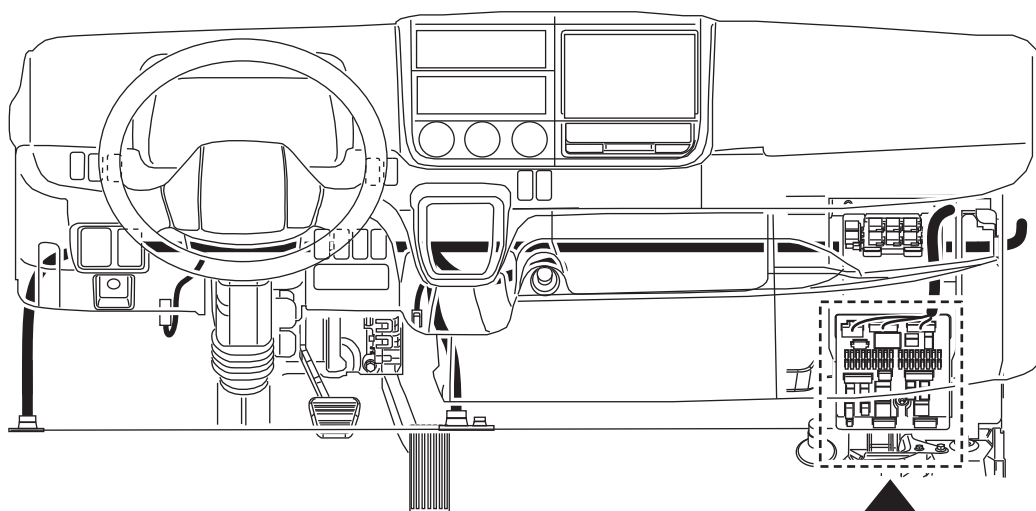
5.1.3 Fuse

- (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.

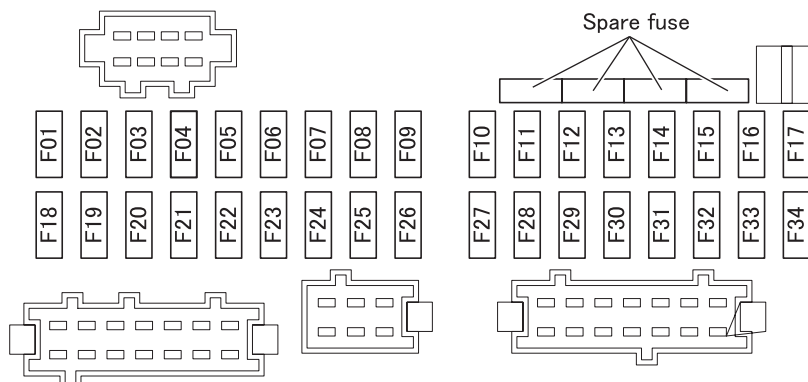
Be sure to lead out power for body equipment-related apparatus and lamps via designated appropriate connectors. For further details, see "Mounting Location of Optional Terminal Inside Cab" (▷ page 103).

Fuses in the cab are provided on the signal detection and actuation module control SAM unit. When removing and reinstalling them, do

- so securely one by one. For other precautions on the SAM, see "5.1.1 Signal detection and actuation module-related parts" (▷ page 53).
- (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.
- (c) Arrangement of power fuses, relay in the instrument panel, sensors and ECU
- Fuse layout drawing



<Inside of SAM>



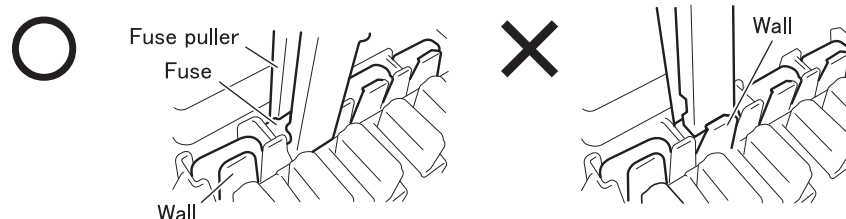
5 Damage prevention

5.1 Electrical system

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	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 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 [®] system	20A
F30	BlueTec [®] 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.

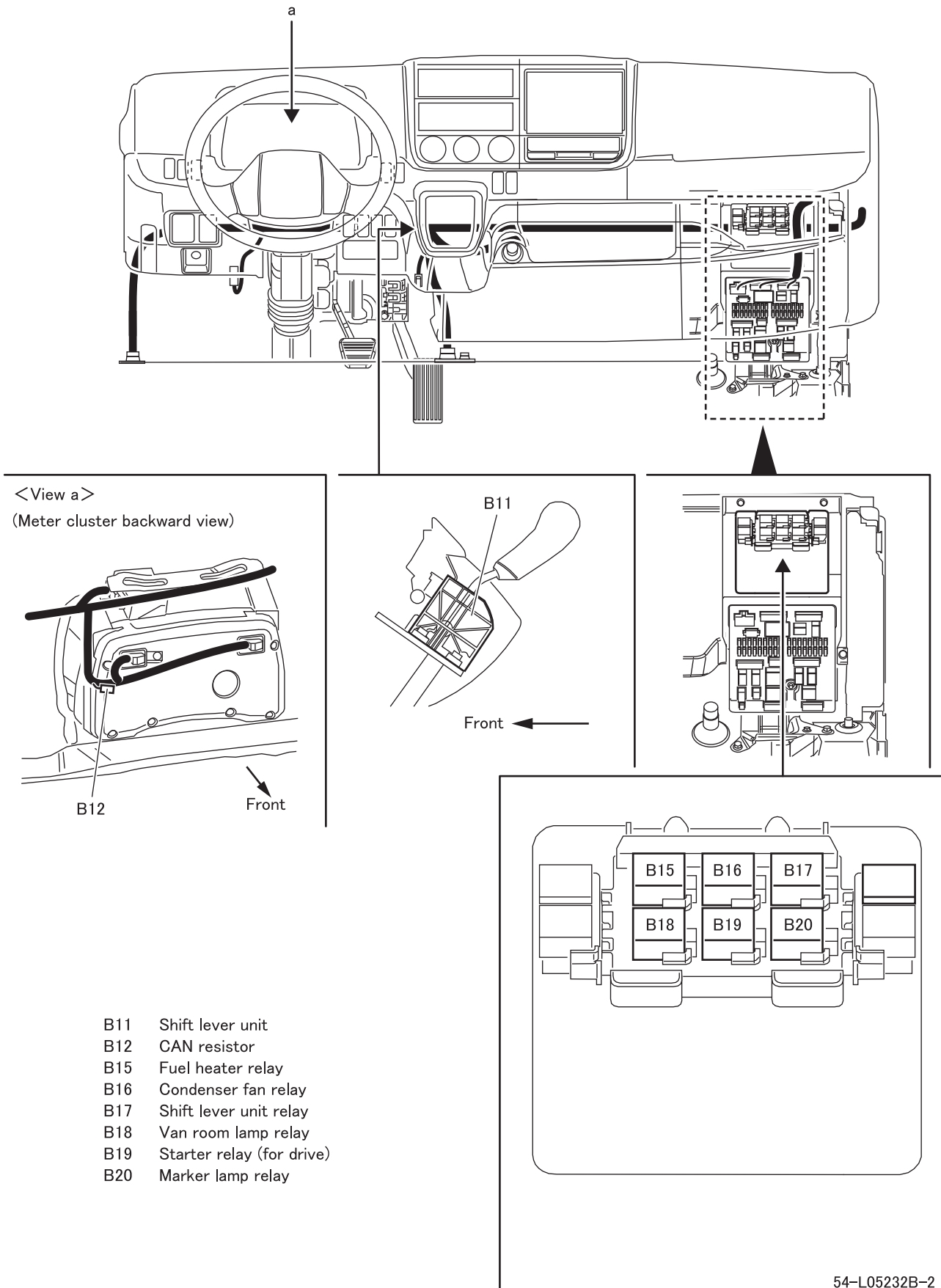
Do not insert the puller from inside the wall, as doing so could damage the fuse holder and cause electrical failure or fire.



5 Damage prevention

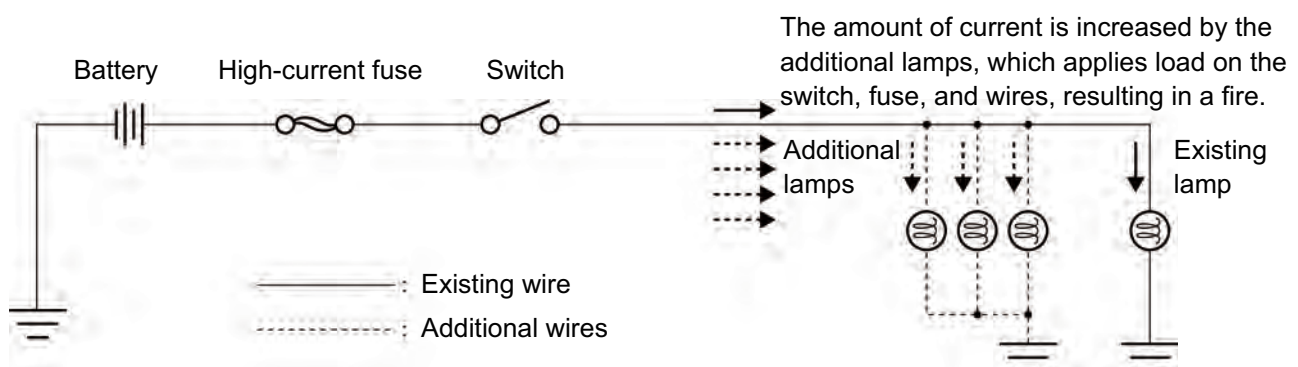
5.1 Electrical system

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



5.1.4 Connecting additional power wiring

- 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

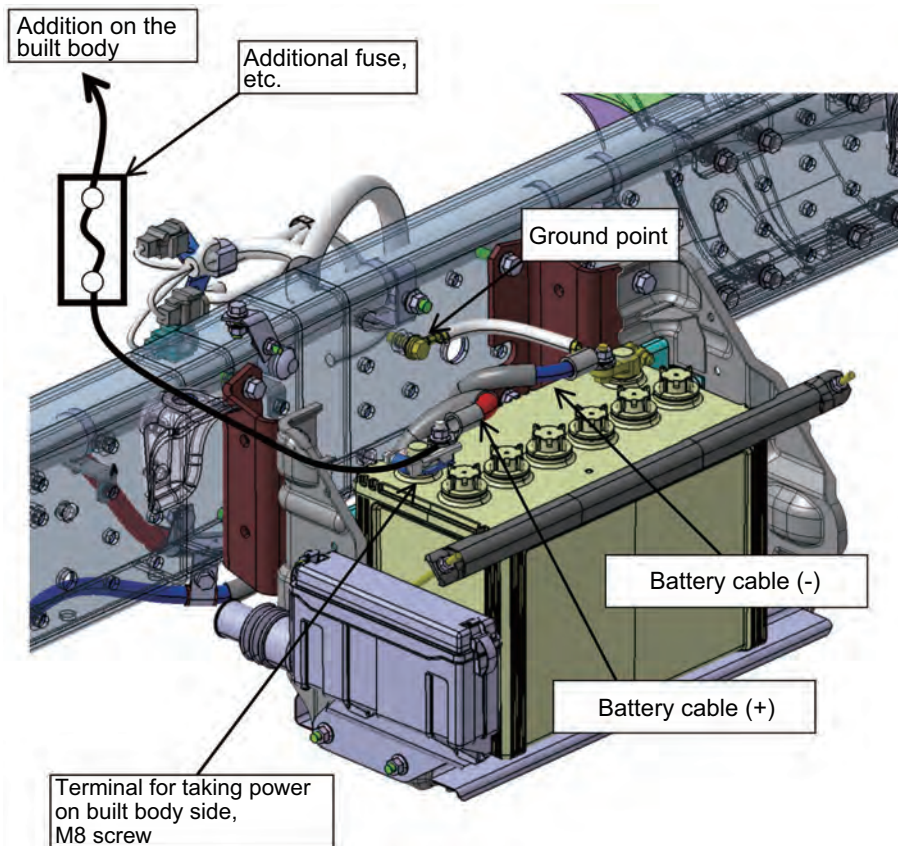


- Taking power via the onboard battery terminal

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

 - (a) Add a fuse of a correct type to any additional wire to thereby protect the circuit.
 - (b) Use a wire of 5.0 mm^2 (0.2 in.^2) or more for the additional wire ("between battery terminal and fuse" of the next figure (▷ page 60)). Set the wire as short as possible and make sure that its jacket is not damaged to result in a short.
 - (c) For the combination of the capacity of the additional fuse and the wire size between the fuse and the additional load, study those marked with ○ in "List of recommended combinations of fuse capacity and wire size" (▷ page 60).
 - (d) Install the additional fuse in a waterproof cover (e.g. electric cover) or take an equivalent waterproofing measure for the additional fuse. Do not add wires or fuses to the existing high-current fuse box.
 - (e) Use of a directly connected power supply causes the onboard battery to tend to run down quickly. Make sure that the customer understands and observes the following handling precautions:
 - It is prohibited to use the onboard battery for a long time with the engine stationary. Do not use the onboard battery as a service power supply (for the clock, memory, etc.).

Between battery terminal and fuse



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

List of recommended combinations of fuse capacity and wire size

○ : Usable × : Not usable

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

Note: Keep the continuous permissible current within 70 % of the fuse specifications value.

(E.g.) If the fuse used is 10 A:

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

R A load of up to 7 A can be used.

Notes:

1. ×: Not usable; – : 50 m (165 ft) max
2. AV/AVS wires: general wires; AVX wires: heat-resistant wires

5.1.5 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.



Installing additional electrical consumers
▷ page 100.

5.1.6 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.

5 Damage prevention

5.2 Brake hoses/cables and lines

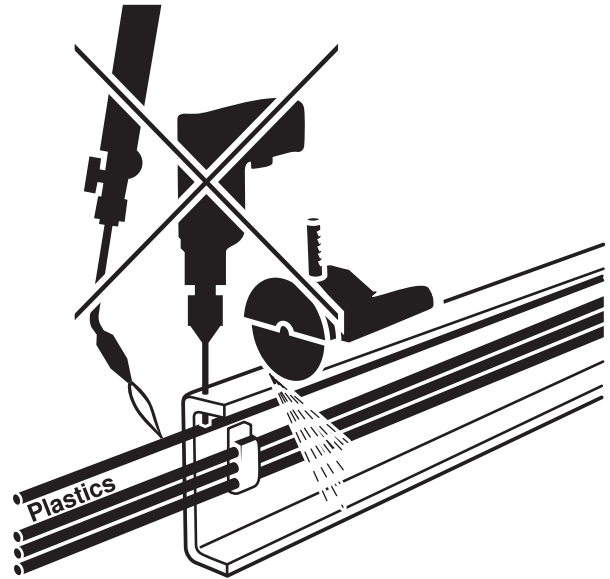
5.2 Brake hoses/cables and lines

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 potentially affected 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 pressure loss.

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



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5.3 Mobile communications systems

United States Federal Communication Commission and Canadian National & Provincial communication regulations as well as the equipment manufacturer's information and installation specifications 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 meet FCC regulations for power, operating frequency, and interference.
- 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 103.
- 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.



The notes on operating safety and vehicle safety in Section 1 "Introduction" ▷ page 10 and ▷ page 11 must be complied with.

5.4 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:



The notes on operating safety and vehicle safety in Section 1 "Introduction" ▷ page 10 and ▷ page 11 must be complied with.



5.5 Welding work

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 springs 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.}.



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

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

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



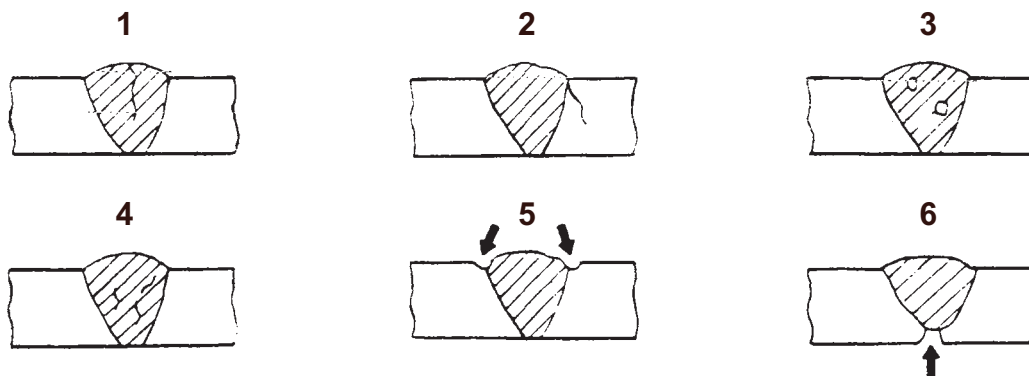


Fig. 1

- 7 Deposited metal cracking
- 8 Toe crack
- 9 Blow hole

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

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.

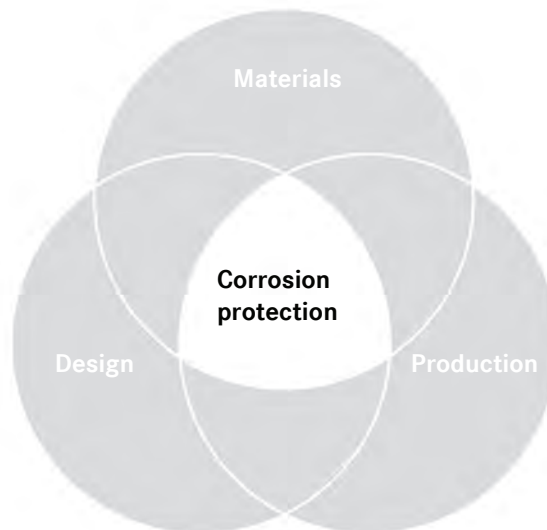
5.6 Corrosion protection measures

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

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.

5.6 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

5.7 Corrosion prevention in welding work

5.7 Corrosion prevention in welding work

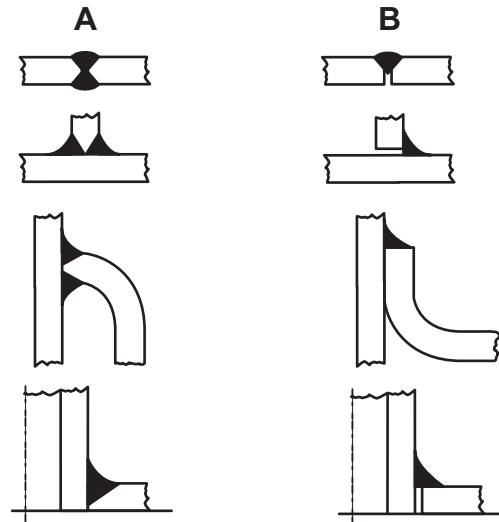
In order to avoid crevice corrosion at weld seams, the welds should be made in accordance with the examples shown.

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



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.



5.8 Bolted connections

Finish-painted components

If painted parts are to be bolted together, the coats of paint must not cause settling in the bolted connections. In such cases, hard, high-density coatings such as cathaphoretic immersion primers or powder coatings should be used. The coat thicknesses should be kept as small as possible (cathaphoretic immersion primer approx. 20 µm (66 µft), powder coatings approx. 100 µm (330 µft)).

- If using bolts with serrations under the head, an additional top coat must be applied to touch up any paint damage.
- The use of hexagon socket or Torx socket bolts with the bolt heads in a horizontal position is to be avoided, as moisture can accumulate in the bolt head under certain conditions, leading to corrosion.

Fasteners

In areas susceptible to corrosion always use bolts, nuts, etc. with corrosion resistance (>480 h saline fog test according to ISO 9227) regardless of the required strength class. This standard is satisfied, e.g. by bolts with electroplating and additional thick-coat sealing and zinc platelet coatings with sealer (e.g. Dacromet or Deltaseal).

Information on identifying suitable coatings can be obtained from your local bolt supplier.

For details on bolted connections see Section 3
▷ page 27.

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

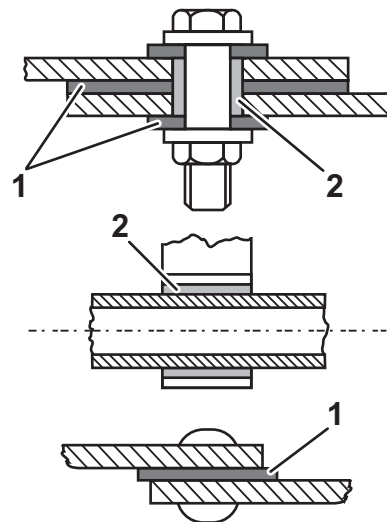
Insulation by coating

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.



- 1 Insulating washer
2 Insulating sleeve

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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 minimized by selecting suitable materials.

5.9 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.

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. Information on the primers used at the factory and on Mitsubishi Fuso color numbers can be obtained from the relevant department ▷ page 15.

Mask the following areas before painting:

- Sealing surfaces
- Windows
- Contact areas between the wheels and wheel hubs
- Contact areas for wheel nuts
- Breathers on gearboxes, axles, etc.
- Disk brakes and disk rotors
- Door locks
- Door retainers in the rear door hinges
- Coupling flanges of drive shafts and power take-offs
- Spring mounting area
- Rubber hoses
- Electric control unit
TCU (Transmission Control Unit)
- Lavel (Caution and name)
- Inner parts of drum brakes <FG>
- Inner surface of brake drums <FG>
- Contact areas between hubs and brake drums <FG>

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

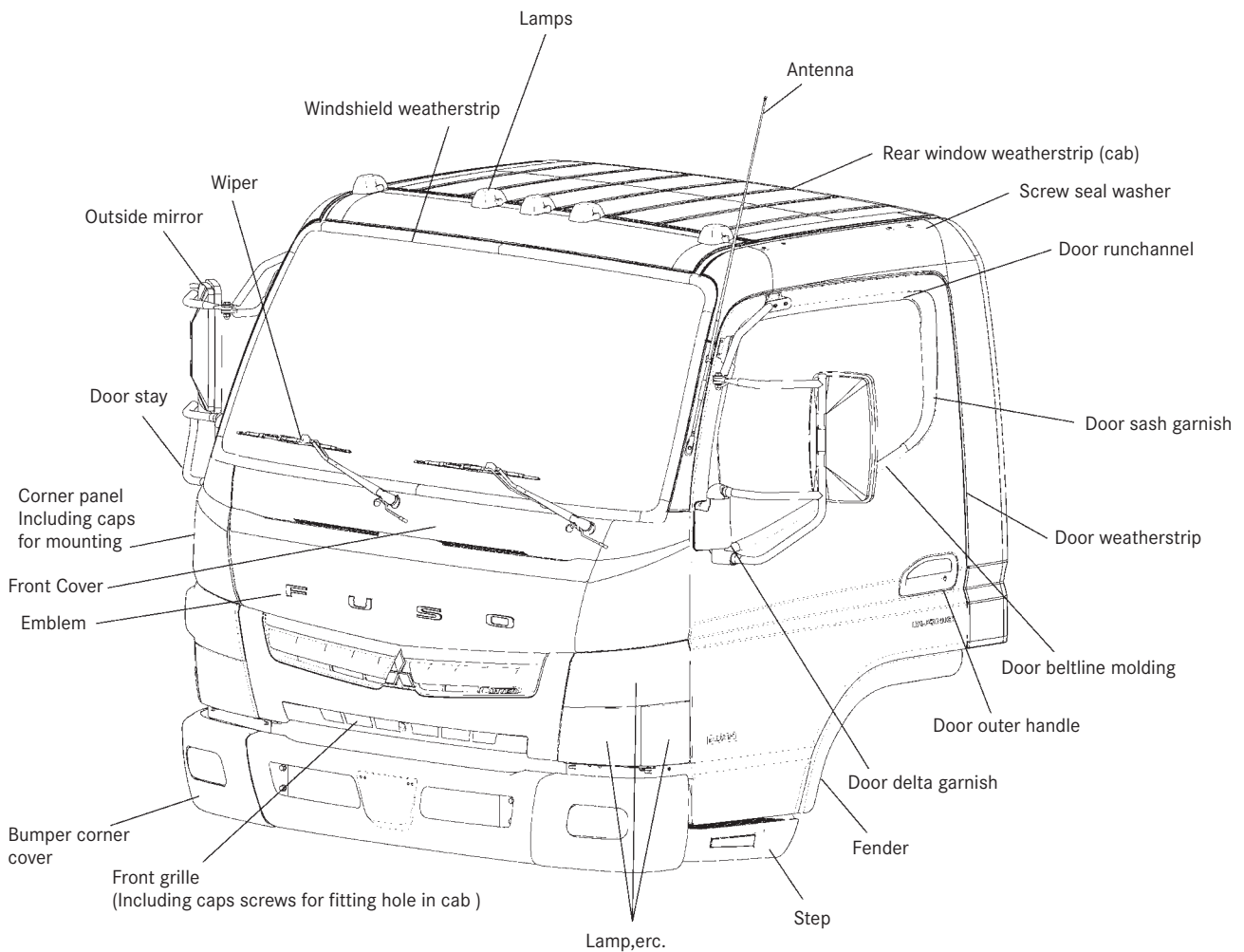
^{*1} The caps covering the holes in the cab for mounting the radiator grille and corner panels cannot be reused once removed. Replace them with new ones.

Part name	Part No.
Clip	MK676916 (Mitsubishi Fuso part number)

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

Part name	Part No.
Clip	MK402586 (Mitsubishi Fuso part number)

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



- Do not leave any plastic parts mounted on the cab during the painting, baking and drying processes. They must be removed prior to painting.

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.

- Parts that must not be repainted
The following parts are made of polypropylene (PP). Do not repaint them.
 - 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 glip 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

5.9.2 Laminated glass

- When a repainted cab body is heat-dried, the temperature should not exceed 100 °C {212 °F} and the process must be completed within 60 minutes. When using a temperature above 100 °C {212 °F}, cover the glass surfaces with shields to prevent them from being heated beyond 100 °C {212 °F} or remove the glass.
- Laminated glass is marked by a double slash (//) in the lower left corner.

5.10 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.

5.11 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.



5.12 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.



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



5.13 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, gearbox, exhaust system, turbocharger, etc.

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



5.14 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 39.

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 40.

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.



Further information on bolted and welded connections can be found in Section 3 "Planning of bodies" ▷ page 27 and Section 5 "Damage prevention" ▷ page 53.



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

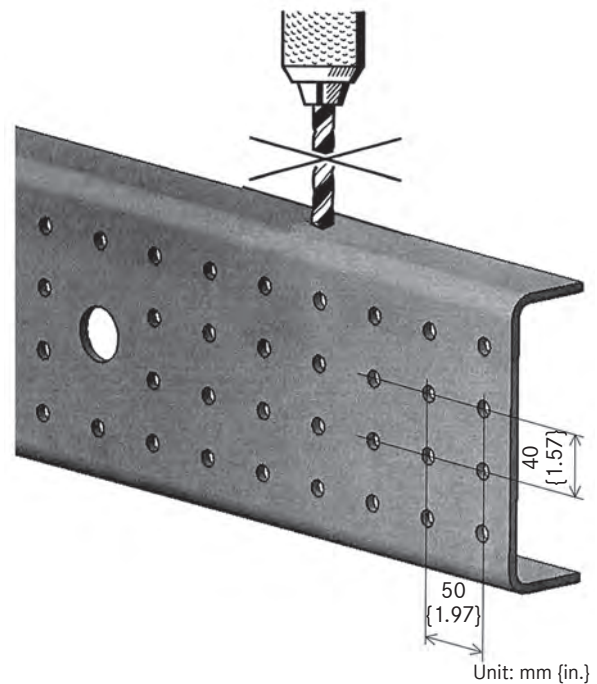
6.3 Drilling work on the vehicle frame

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"> Alligator type (see Fig. 1) Channel type (see Fig. 2) 	9 mm {0.35 in.} max.	30 mm {1.18 in.}* min.

Note*: Maintain the dimensions of previously drilled holes.

Alligator type

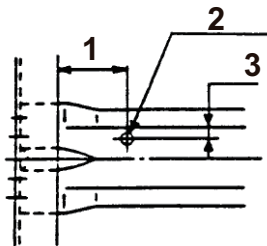


Fig. 1

- 1 100 mm {3.94 in.} min
- 2 DIA 9 mm {0.35 in.} max
- 3 25 mm {0.98 in.} min

Channel type

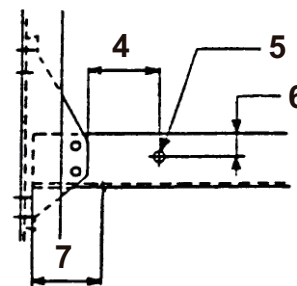


Fig. 2

- 4 100 mm {3.94 in.} min
- 5 DIA 9 mm {0.35 in.} max
- 6 25 mm {0.98 in.} min
- 7 50 mm {1.97 in.} min (Web surface)

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 112.



Further information on welded connections can be found in Section 5 "Damage prevention"
▷ page 65.





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.

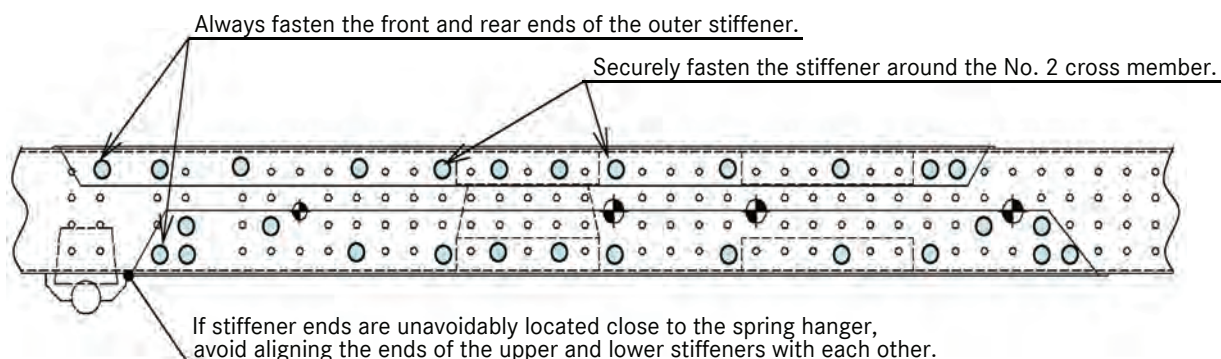
Tightening torque

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.



6.5.1 Others

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

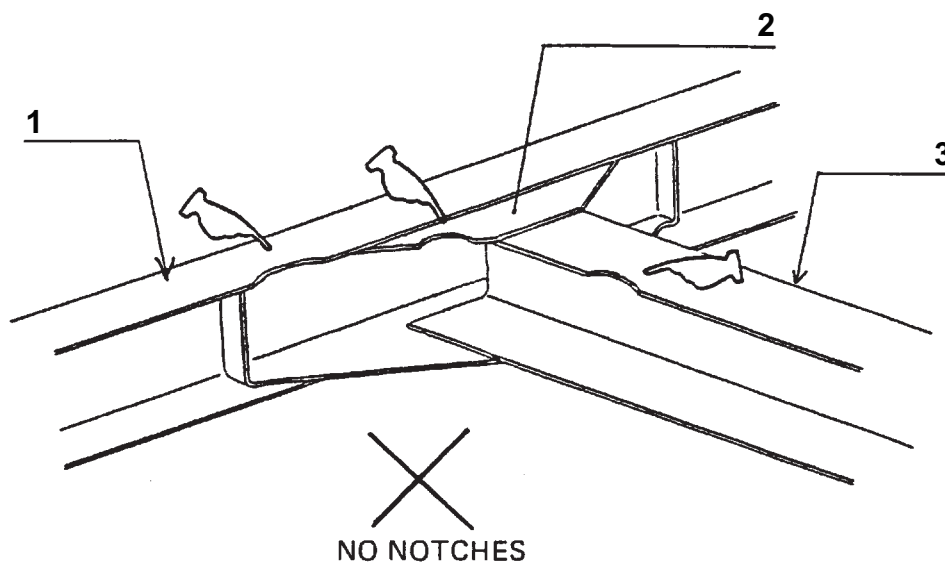


Fig. 1

- 1 Side rail
- 2 Crossmember gusset
- 3 Crossmember

6.6 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.



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 62.

Disk brake



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

6.6 Brake systems

6.6.1 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 $\sqrt[3]{\lambda r0.8}$

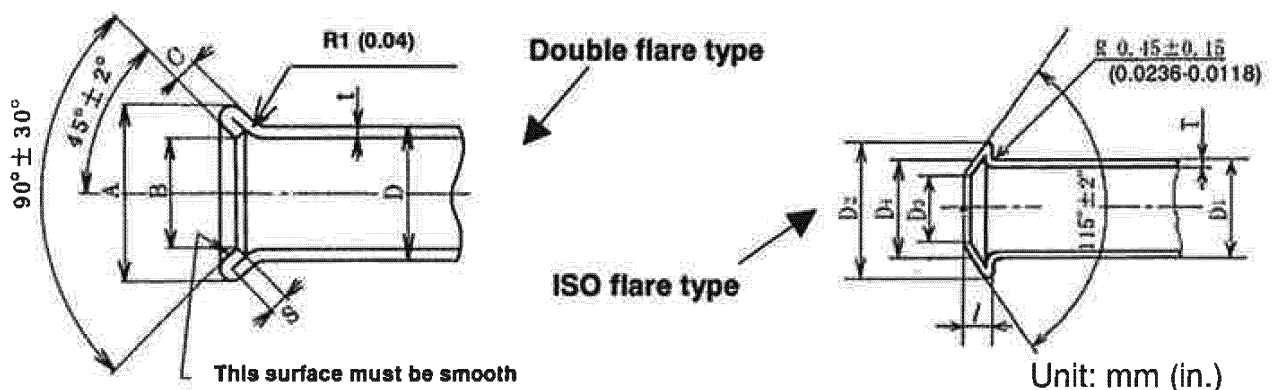


Fig. 1

6 Modifications to the basic vehicle

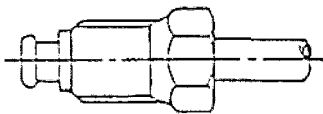
6.6 Brake systems

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 25 {13.7 to 18.8, 190 to 260}

6.6.2 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}	MF651001 (Double flare type) MK678335 (ISO flare type)
6.35 {0.25}	MF651002 (Double flare type) MK678336 (ISO flare type)

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

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



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

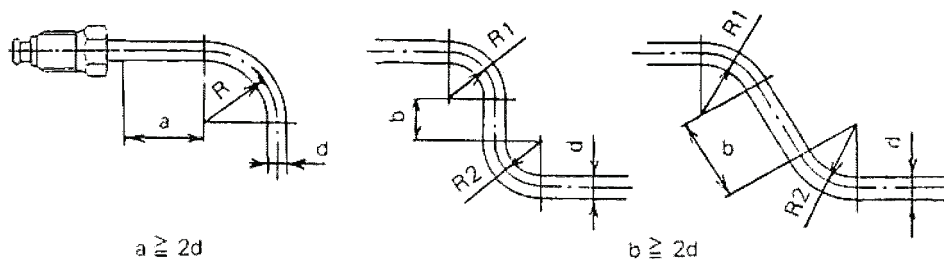


Fig. 3

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

6.6.3 Running additional lines

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

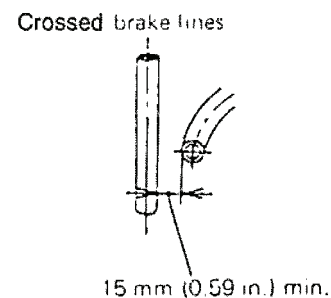


Fig. 4

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

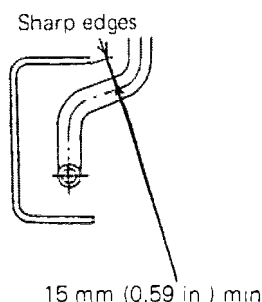


Fig. 5

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

Unit: mm {in.}

	Tube dia	Clamp intervals
Straight tube	4.75-10 {0.19-0.39}	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 7 "Clearance between chassis parts and bodies" ▷ page 119.
- The clearance between the brake lines and exhaust system components should conform to the specifications in Section 7 "Clearance between chassis parts and bodies" ▷ page 119.
- Position the connection nut in a location where it can be completely tightened without difficulty.

- Tighten the flare nuts to torque specified in ▷ page 90. 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

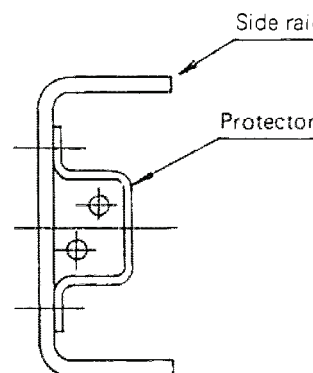


Fig. 6

6.7 Modifications to the wheelbase

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

If this is unavoidable, contact the department responsible ▷ page 15.

6.7.1 Prohibition on modifying the propeller shaft



Risk of accident

It is strictly prohibited to modify a 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 injury, or death.



6.8 Frame modifications

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

6.8.1 Extension and shortening

Procedure for extending the frame's rear overhang

Extend the frame's rear overhang as follows.

- Materials

Unit: mm {in}

Extension member		Reinforcement		Electrode	
Material	Thickness	Material	Thickness	Shielded metal arc welding	CO ₂ gas shielded arc welding
SAPH440 HTP540	Same as side rail	SAPH440	3.2 to 4.5 {0.13 to 0.18}	Ilmenite type covered electrode for 540 MPa conforming to D4301 under JIS Z3211 or equivalent	Conforming to YGW11 under JIS Z3312 or equivalent

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.

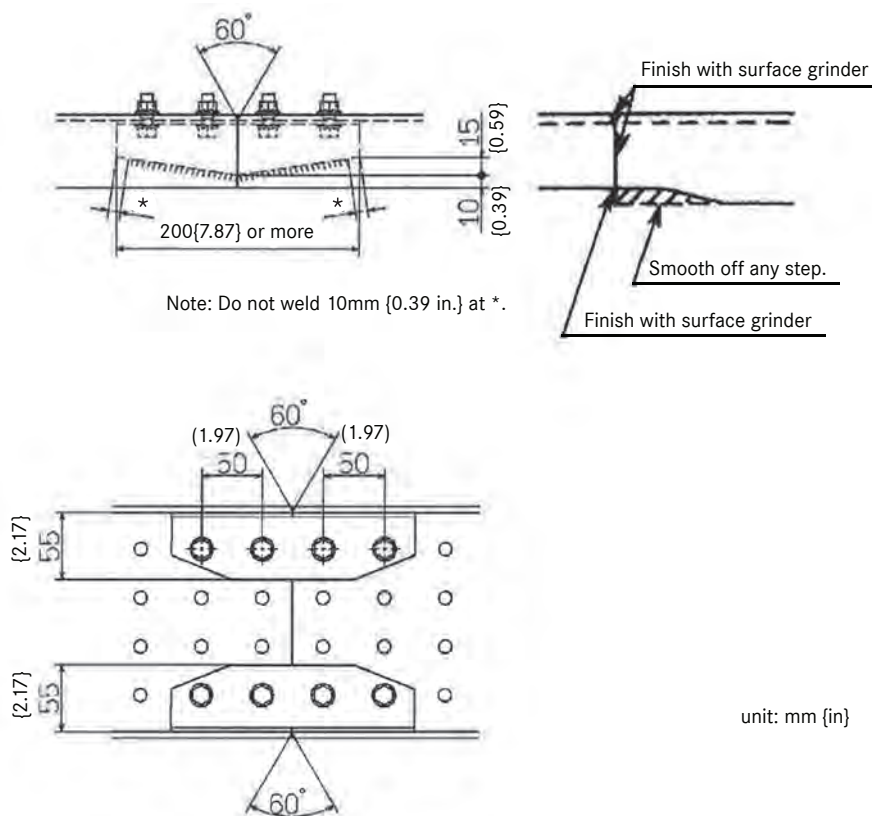
6 Modifications to the basic vehicle

6.8 Frame modifications

- Extension/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.



6 Modifications to the basic vehicle

6.9 Mounting equipment on the side rail

6.9 Mounting equipment on the side rail

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.

6.9.1 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:

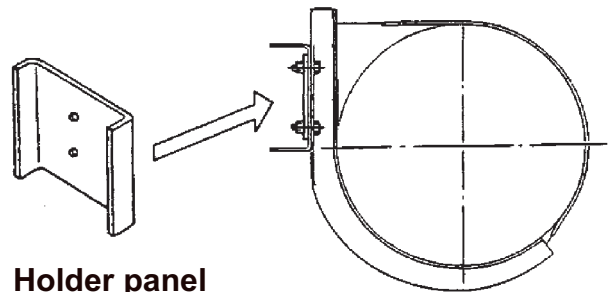


Fig. 1

- 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.

6 Modifications to the basic vehicle

6.9 Mounting equipment on the side rail

6.9.2 Wheel chocks

Mounting

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

6.9.3 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 body/equipment mounting directives must be observed.
- On chassis with standard bore holes for mudguard brackets, use these bore holes to secure the brackets.



6.10 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.

6.11 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.



6.12 Electrics/electronics



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 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.

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.

Electrical Wiring

The electrical circuits have been designed in particular with the emphasis on safety. In this respect, a high-current fuse box is provided at the side of the battery in order to prevent fires caused by shorting during accidents. Therefore, follow the procedures below when making changes to the electrical circuits.

- Additional Wiring
 - (a) Use wires of the same gauge and color as the original wires when making wiring extensions.
 - (b) Connect wires securely by soldering or crimping terminals and then insulate them completely with tape or other weatherproof material. Never attempt to connect wires by just twisting the stripped ends together.
 - (c) Do not use sulfuric acid for soldering.
 - (d) Do not extend or shorten the battery cables. If battery cable length must be adjusted due to the transfer of the battery, replace the cable(s) with one(s) of appropriate gauge and length.
 - (e) Be especially careful not to modify the type of clamps, location, or slack of wiring connected to movable components between the starter and the frame.
 - (f) Wiring should be made along the rear body parts, the frame, etc., fully supported, and never extended individually in midair.
 - (g) Clamp all wires securely in locations away from moving parts or sharp corners on the chassis and body. Use grommets where routing wires through metal plates in order to prevent electrical short circuits due to installation damage or chafing. (Fig. 1)

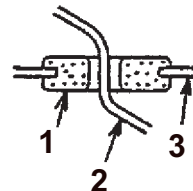


Fig. 1

- 1 Grommet
- 2 Wire
- 3 Metal plate



6 Modifications to the basic vehicle

6.12 Electrics/electronics

- (h) Wires should never pass along brake tubes or fuel lines. Observe the following clearances.

Wiring	Clearance mm {in.}
Parallel	10 {0.39} or more
Crossed	20 {0.79} or more

- (i) Position wires more than 200 mm {7.87 in.} away from parts which become extremely hot such as the exhaust pipe or muffler. Install a heat insulator if heat protection is necessary.
- (j) Road debris which is thrown up by the wheels can damage wiring. Install metal covers to protect the wiring.
- (k) Tape wires together with the nearest chassis wiring harnesses if possible.
- (l) Route wires along the chassis harnesses that are already installed. Wires should be clamped with vinyl tape, and wrapped up widely with thin metal sleeves (rubber or vinyl coated, or wiring loom). Do not use weak vinyl tape that could fall off soon due to engine heat.
- (m) Wires connecting engine and transmission components should run along previously installed harnesses to allow them to absorb motion. Also allow adequate slack to prevent them from contacting other components.
- (n) When connecting plugs, place the female end in the power source side to prevent a short circuit to the body even if the terminal comes off.

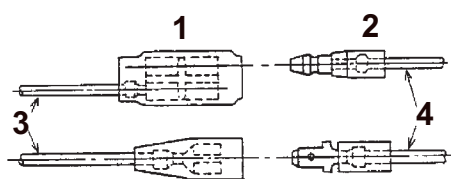


Fig. 2

- 1 Socket (female)
 2 Plug (male)
 3 Power source side
 4 Ground side

- (o) Use coated or vinyl clamps when clamping wires.

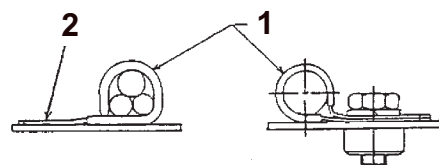


Fig. 3

- 1 PVC covering
 2 Spot welding

- (p) Bonding or temporary clamps should be used only for additional support.
- (q) Use standard wiring clamp intervals as shown below:

Harness diameter	Clamp intervals mm {in.}
5 {0.20} max	300 {11.81} max
5-10 {0.20-39}	approx. 400 {15.75}
10-20 {0.39-0.79}	approx. 500 {19.69}

- (r) Wires may come in contact with edges of metal parts; increase the number of clamps and cover the edges with protectors to prevent damages due to vibrations.

- (s) When passing electrical wiring through the cab floor, use the grommets in the area A and B shown in Fig. 4.

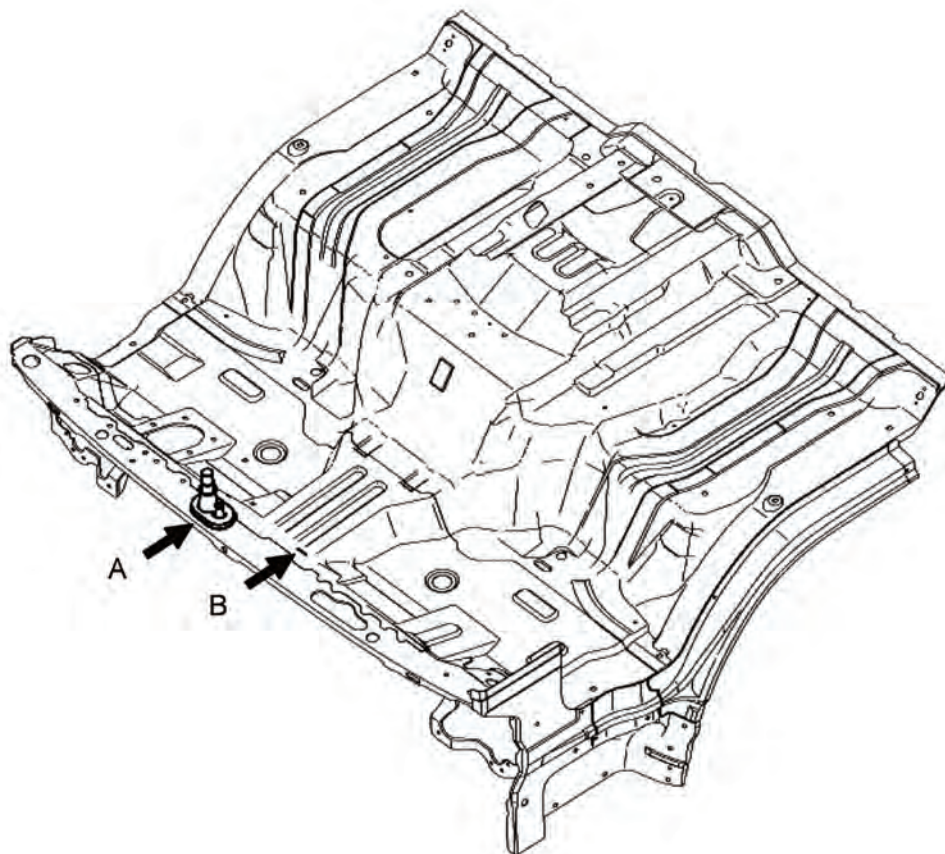
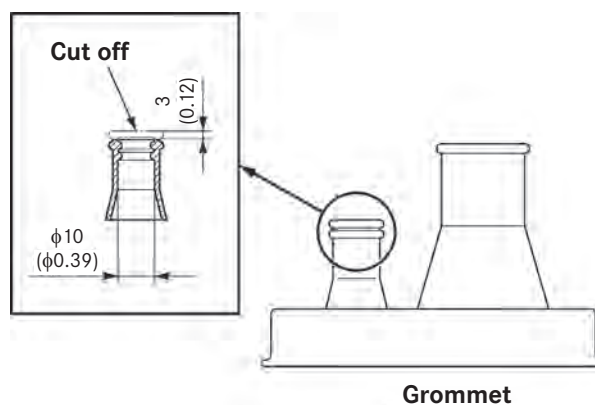


Fig. 4

Let harness pass through the grommet cut as shown in Fig. 5 and then tape them.



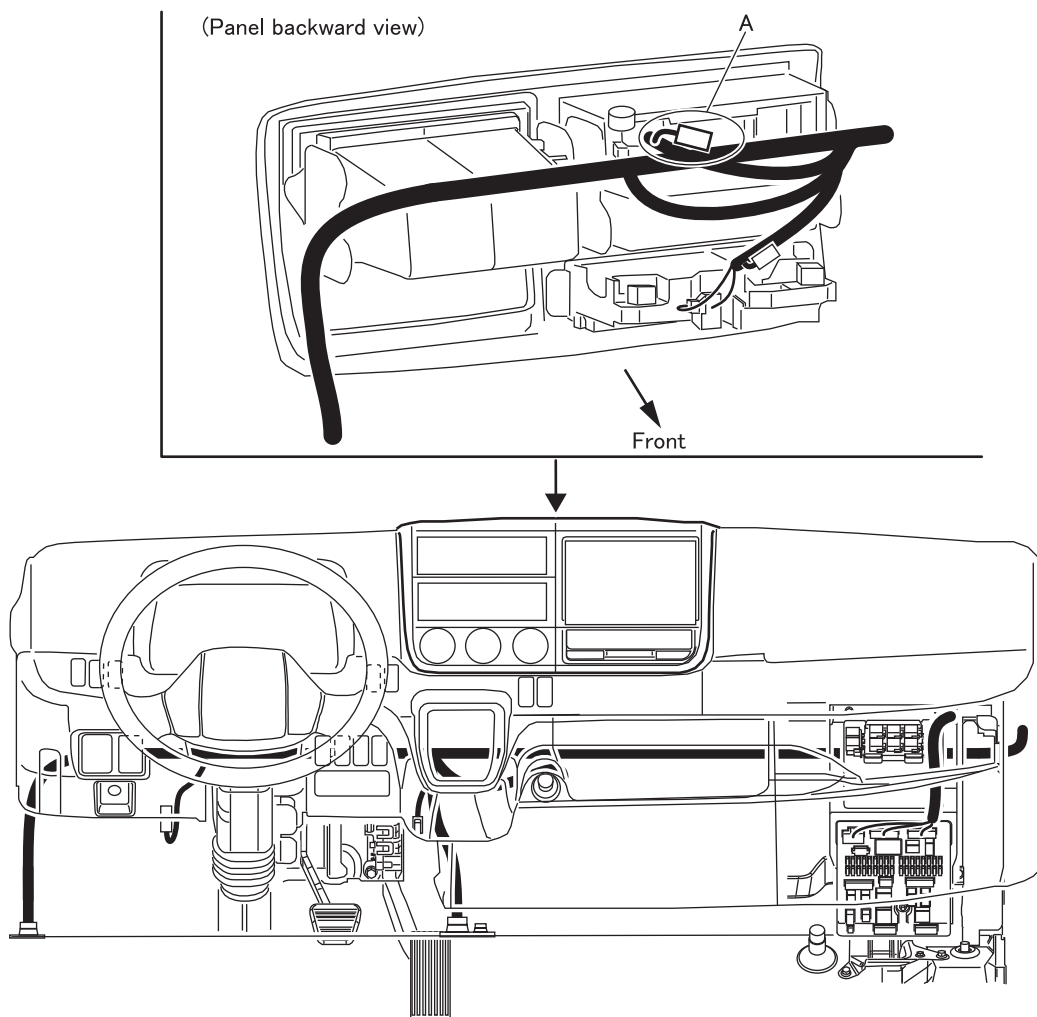
Unit: mm (in.)

Fig. 5

6 Modifications to the basic vehicle

6.12 Electrics/electronics

- Mounting Location of Optional Terminal Inside Cab

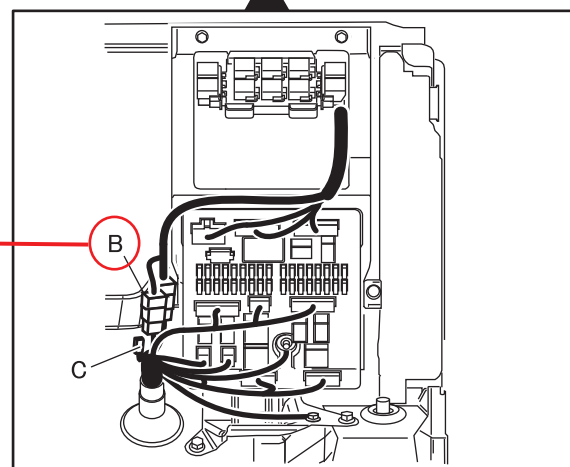
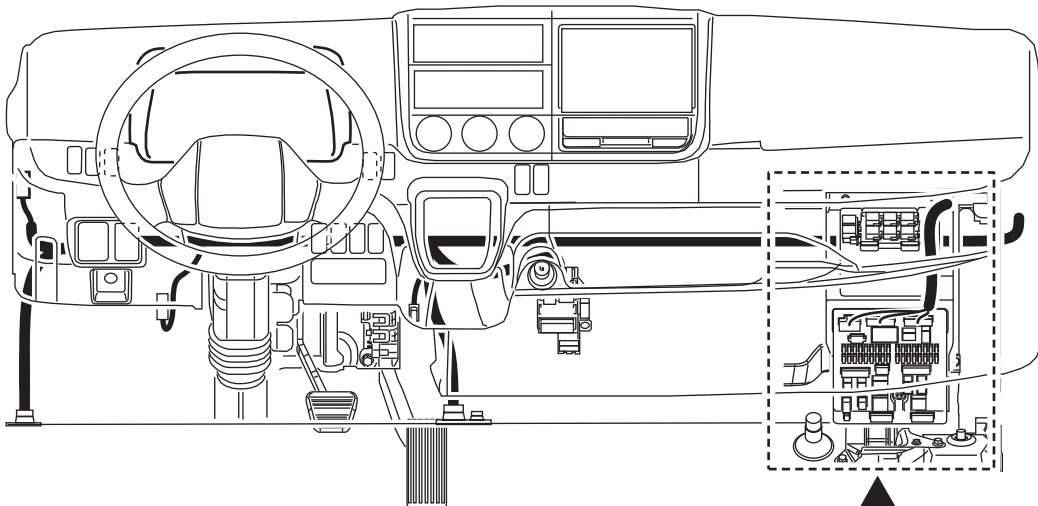


No.	Part Name	Connector No.	Circuit Description				Mating Connector
			No.	Circuit	Line color	Load	
A	OPTION CONNECTOR (Tachograph navigation)		01	MAIN (12V)	Y-G	-	
			02				
			03				
			04				
			05	SPEEDSIG(25P)	Lg	-	
			06	SPEEDSIG(8P)	O-L	-	


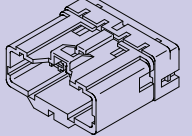

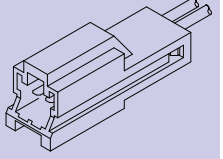
-: The connector marked with - is used for signal cabling only, not used to connect the loads.

6 Modifications to the basic vehicle

6.12 Electrics/electronics



option connector B and harness
are not installed/available

No.	Part Name	Connector No.	Circuit Description				Mating Connector
			No.	Circuit	Line color	Load	
B	OPTION CONNECTOR (Only When sub harness (MK649751) is arranged) not available		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)			

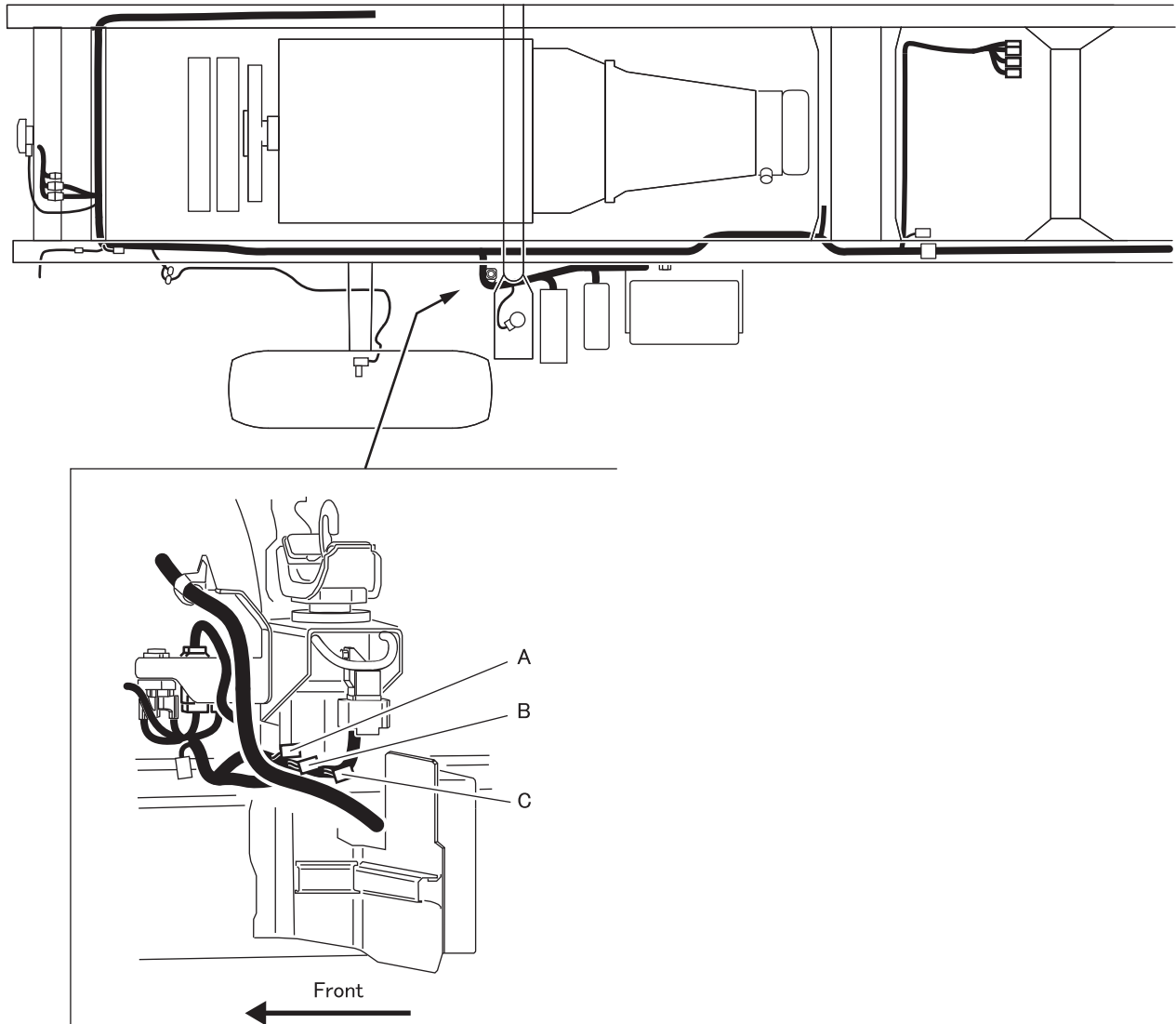
-: The connector marked with - is used for signal cabling only, not used to connect the loads.

* 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.

6 Modifications to the basic vehicle


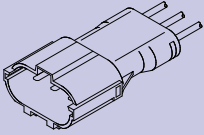

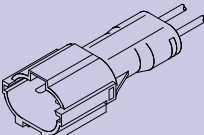

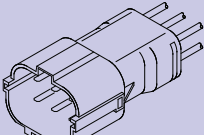
6.12 Electrics/electronics

- Mounting Location of Optional Terminal Outside Cab



6 Modifications to the basic vehicle

6.12 Electrics/electronics

No.	Part Name	Connector No.	Circuit Description				Mating Connector
			No.	Circuit	Line color	Load	
A	OPTION CONNECTOR (van room lamp & ID lamp)	MH056453 	01	VAN ID LAMP	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	-	
			06	GND	B	-	

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

*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.

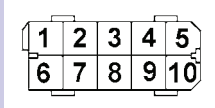
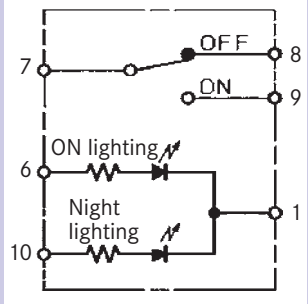
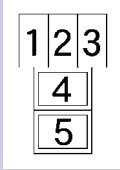
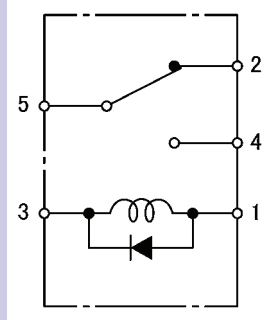
*2: Loads to be connected to the connector marked with *2 should be arranged so that the total value of the connector output in each of the cab and chassis side shall not exceed the permissible current.

- Cautions when Grounding the Frame
When moving the battery or when grounding a new rear body on the frame, remove masked or painted areas then reliably ground the connection terminal.
- About Charging/Discharging Balance
The charging/discharging balance may become unequalized in the following operating conditions. For this reason, reduce the electrical load during work referring to the Engine Alternator Performance Curves on page ▷ page 109.
 - When there is a lot of night work
 - When working for a long time with the engine idling
 - When many electrical load capacities are placed on installation items.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.

6 Modifications to the basic vehicle

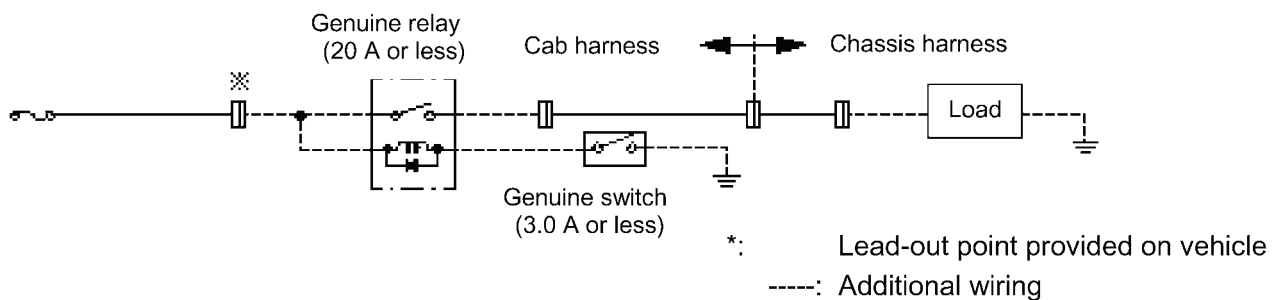
6.12 Electrics/electronics

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 mm²) A0135457626KZ (wire diameter: 0.5 to 0.85 mm²)</p>	
Relay	MK420480 For 12 V	<p>Between (5) and (4) (normal open side): 20 A or less</p> <p>Between (5) and (2) (normal close side): 10 A or less</p>	 <p>Connector type EQ5A (MH059820)</p>	 <p>3: Power supply side 1: Ground side</p>

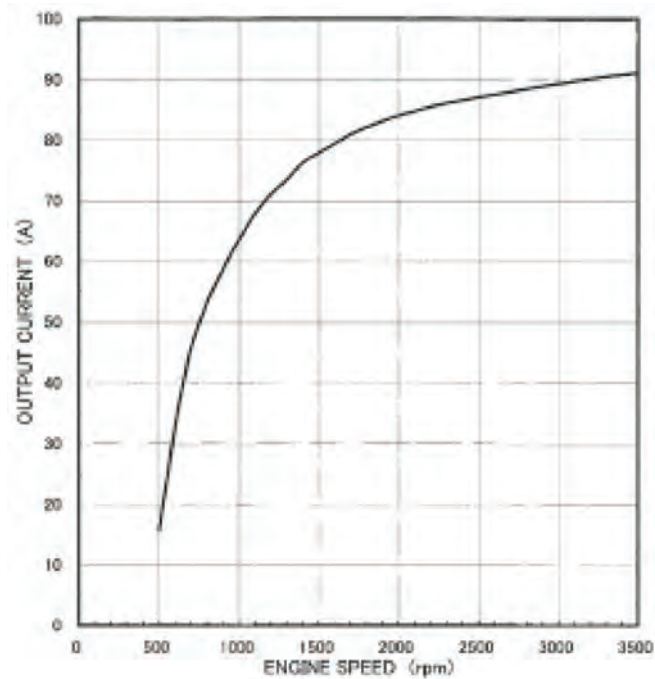
Notes:

- 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

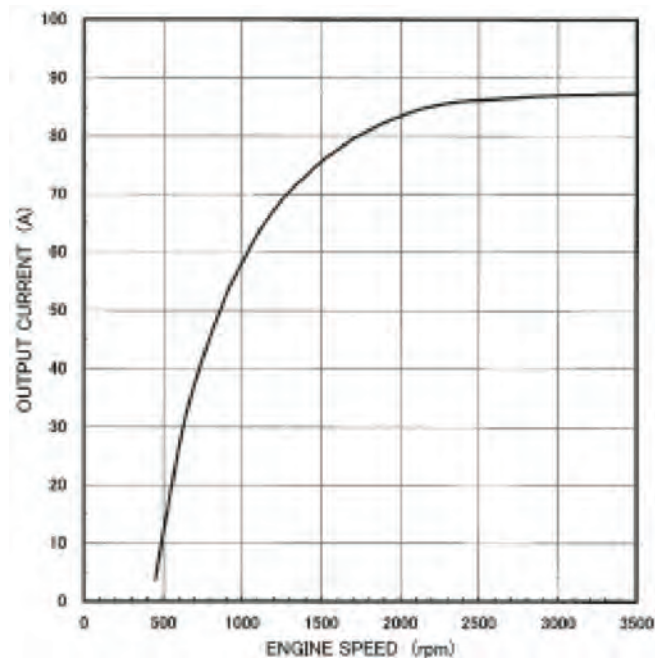


- Engine Alternator Performance Curves

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



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



140-Ampere alternator is standard equipment

6 Modifications to the basic vehicle

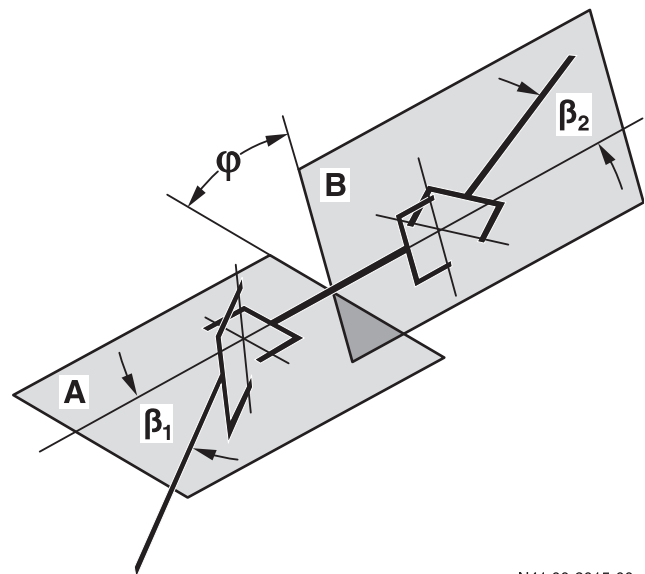
6.13 Installation of propeller shafts

6.13 Installation of propeller shafts

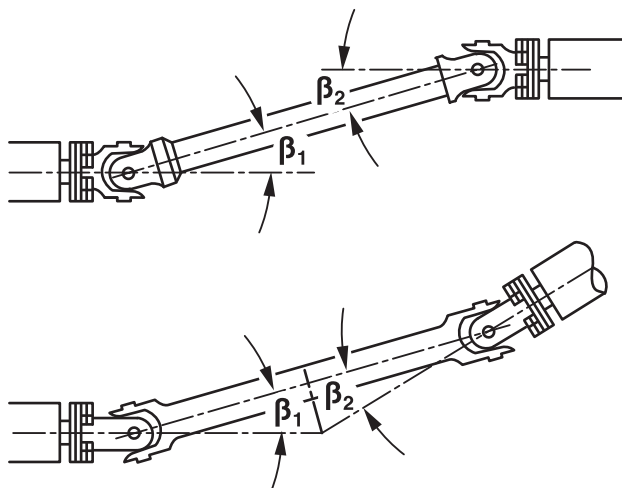
Observe the following when installing propeller shafts:

- 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° or less than 1° .
- Balancing plates must not be removed.
- Make sure that the marks are aligned on the propeller shafts during installation.
- Eliminate any vibrations, e.g. by optimising the propeller shaft angles.

6.13.1 Types of angular offset



N41.00-2015-00



N41.00-2014-00

Angle in one plane (two-dimensional offset)

$$\beta_1 = \beta_2$$

Upper = Z-type offset

Lower = W-type offset

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.



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

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, gearbox, exhaust system, turbocharger, etc.

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



Bodies on which the gearbox 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 gearbox (gearbox guard) which will prevent abrupt cooling as well as water ingestion via the gearbox breather.



Further information on bolted and welded connections can be found in Section 3 "Planning of bodies" ▷ page 27 and Section 5 "Damage prevention" ▷ page 53.



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.



If more than one body or equipment item 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.

Sub-frame

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

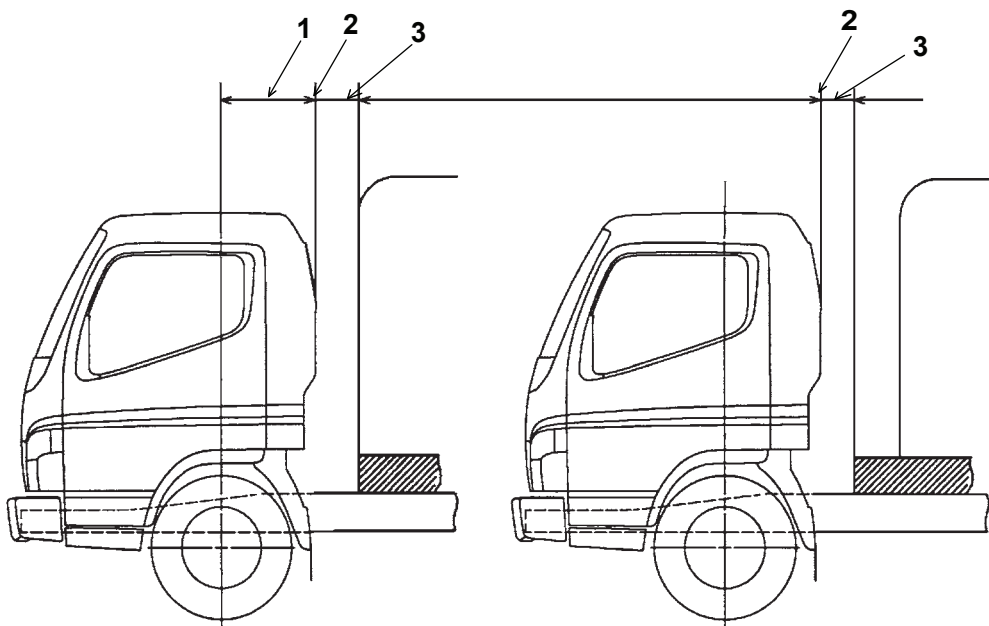


Fig. 1

- 1 525 mm {20.7 in.}
- 2 CAB BACK
- 3 Extend the front end of the sub-frame as far forward as possible; less than 300 mm {11.81 in.}

- Examples of front-end shape of sub-frames

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

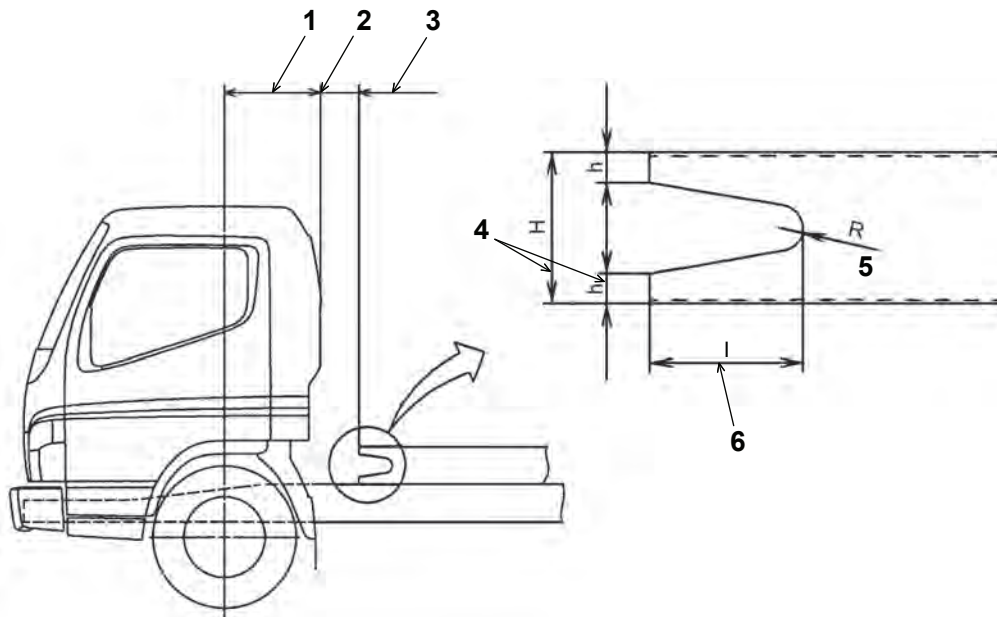


Fig. 2

1 525 mm {20.7 in.}

2 CAB BACK

3 Extend the front end of the sub-frame as far forward as possible; less than 115 mm {4.53 in.}

4 "h" should be between a fourth and a fifth of "H"

5 DRILLING

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

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

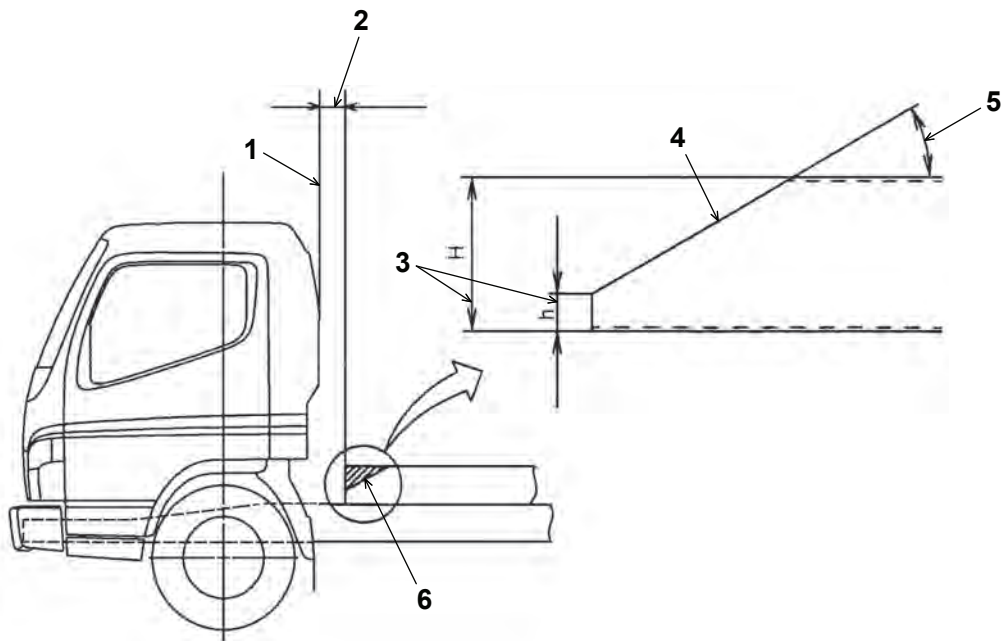


Fig. 3

- | | | | |
|---|---|---|-------------------|
| 1 | CAB BACK | 5 | Less than 30° |
| 2 | Less than 300 mm {11.81 in.} | 6 | Cut off Obliquely |
| 3 | "h" should be between a fourth and a fifth of "H" | | |
| 4 | Left open | | |

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

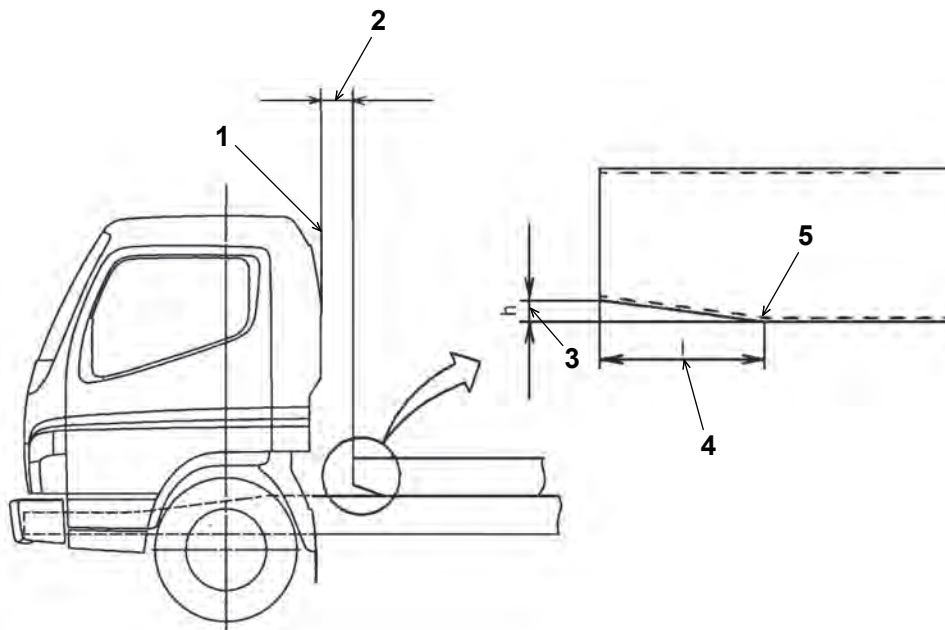


Fig. 4

- 1 CAB BACK
- 2 Less than 300 mm {11.81 in.}
- 3 "h" should be 2 to 3 mm {0.079 to 0.12 in.}
- 4 "l" should be 200 mm {7.874 in.}
- 5 This corner should be ground smoothly

- A** (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).

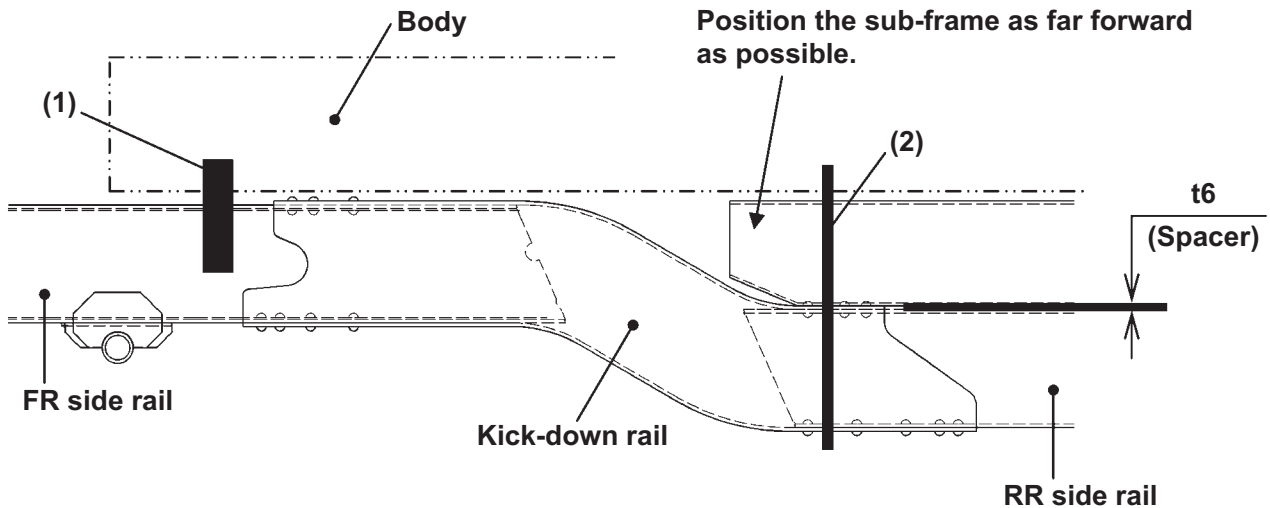


Fig. 5

- 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.

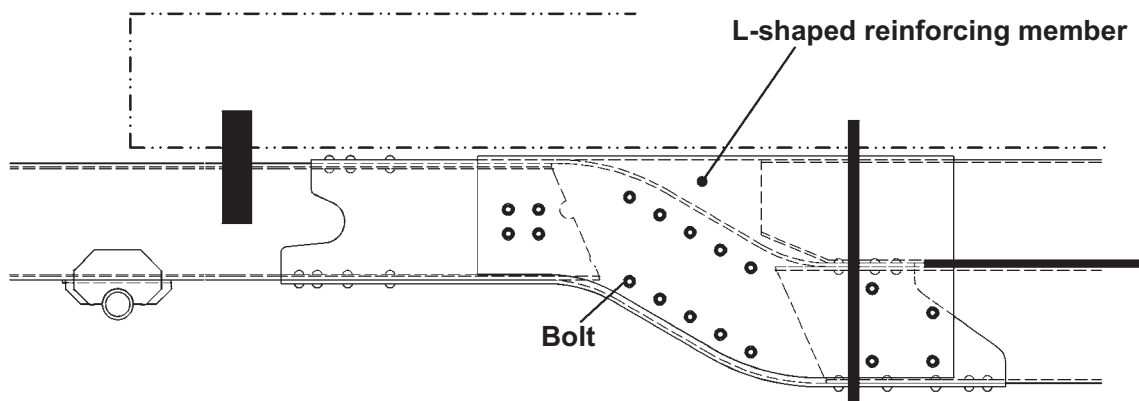


Fig. 6

7 Construction of bodies

7.3 Mounting frame attachment

7.3 Mounting frame attachment

Attaching with U-bolts

- Allow sufficient clearance so that the U-bolts for tightening sub-frames or main bolsters do not come in contact with pipes, hoses, wires and harnesses.
- Do not install U-bolts at the taper-cut position of the sub-frames or main bolster.

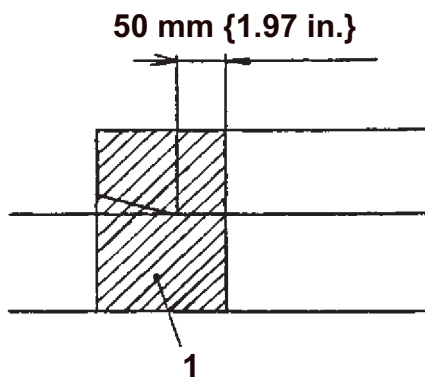


Fig. 1

1 Do not install U-bolts in the shaded area.

- Place a wooden spacer inside the flange of the side rail to avoid bending when tightening the U-bolts.
- Use metal spacers in locations subject to heat, such as near the muffler, or other place where it is difficult to place wooden spacers.

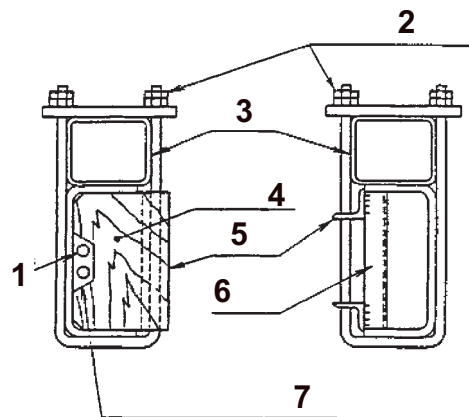
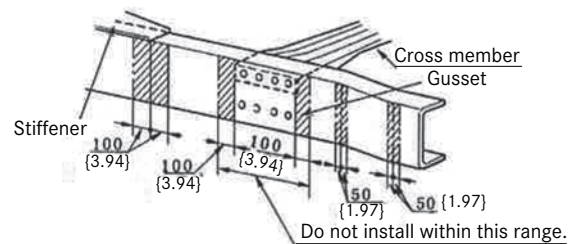


Fig. 2

- 1 Pipes and other parts
- 2 Use double nuts
- 3 Main bolster
- 4 Spacer (Wood)
- 5 Slip Stopper
- 6 Spacer (Steel plate or pipe)
- 7 Make a notch to secure clearance from pipes or tubes.

- Stress in the chassis frame tends to concentrate in the areas where the cross member, stiffener and gussets are fitted and near the side rail bends. Do not install U-bolts and opposed brackets in such areas.

Installing U-bolts and brackets in the hatched areas is prohibited.



Unit: mm (in.)

Mounting Bracket

When U-bolts cannot be used with a particular body, use mounting brackets in those positions to attach it to the sub-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.

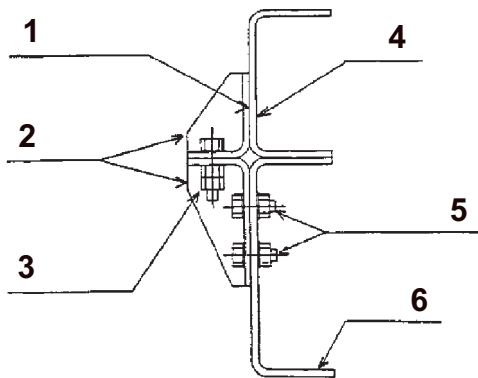
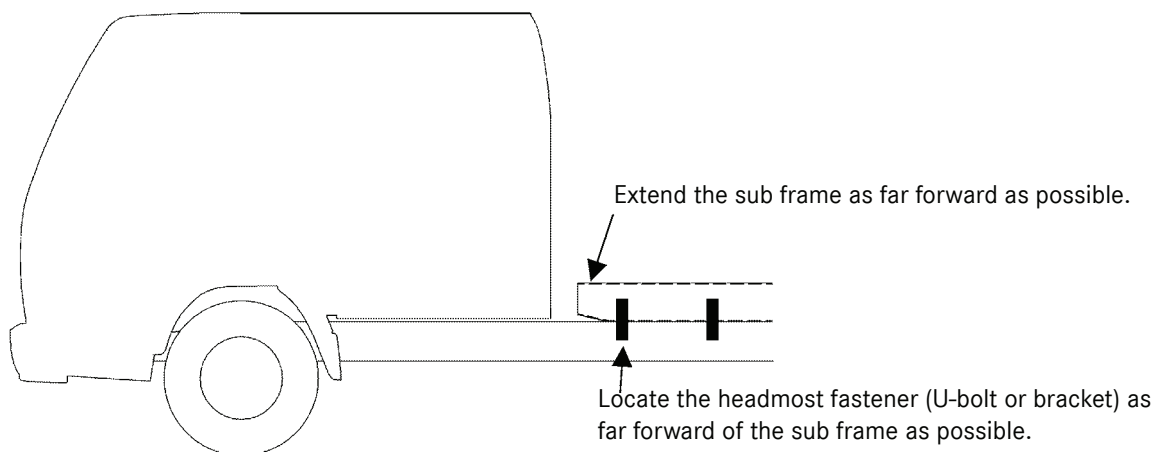


Fig. 1

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

<Crew-Cab>

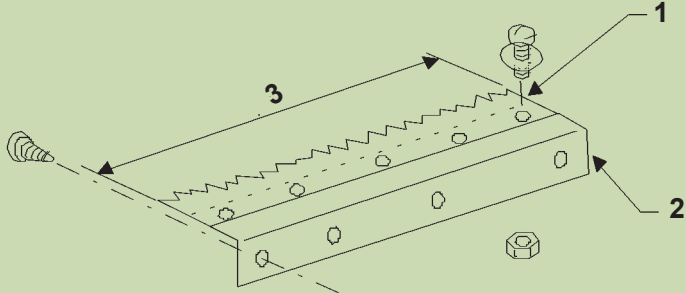


7 Construction of bodies

7.4 Clearance between chassis parts and bodies

7.4 Clearance between chassis parts and bodies

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

Part	Minimum Clearance and Notes
1. The Surrounding part of T/M	25 mm {0.98 in.} at surrounding part of transmission except rear part.
2. Clutch and Transmission Assembly	Do not install any rear body part in the area of 100 mm {3.94 in.} of the rear of the clutch and transmission ass'y, as the ass'y must be moved backward in the same inclination line of engine, to pull out the clutch spline shaft, when the transmission ass'y is removed from engine for service.
3. Upper part of Transmission	Keep more than 100 mm {3.94 in.} 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.
4. The surrounding part of the Propeller shaft and the Rear axle	Min. 25 mm {0.98 in.} of the surrounding part.
5. The brake hose (which connects to the front and rear wheel)	Maintain a minimum of 50 mm {1.97 in.} of clearance. This brake hose is considered to move when vehicle is driven.
6. The cab back and the surrounding part of the engine	<p>No equipment must be mounted within 100 mm {3.94 in.} in the cab back, except the subframe and the side members. If any equipment inevitably comes within this range, install it in such a position which is more than 300 mm {11.8 in.} from both sides of engine rear part and not over the engine. Also take care that all equipment must not stand in the way of air flow which is discharged rearward, downward, or sideward from the engine compartment. If air flow is restricted, engine compartment temperature will excessively rise, resulting in poor engine performance, and fuel pipe and electric wiring overheating. Install a protector as shown below on the cab back or the front of the fixed rear body as high as possible with regard to exhaust so as to block foreign matter, which may come between cab and rear body, from high temperature areas of the engine. When a protector is installed on the cab back, use the specialized mounting holes provided.</p>  <p>1 Rubber strip 2 Sheet metal 3 675 mm {26.6 in.}</p>

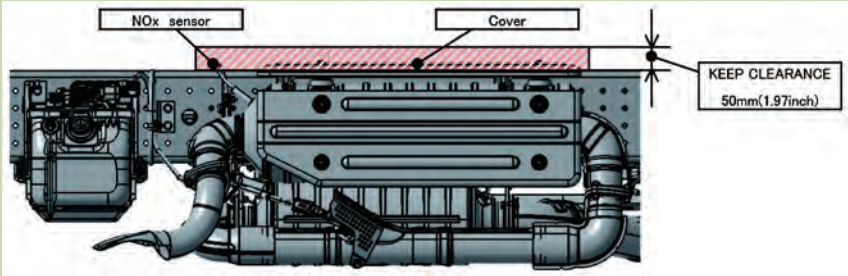
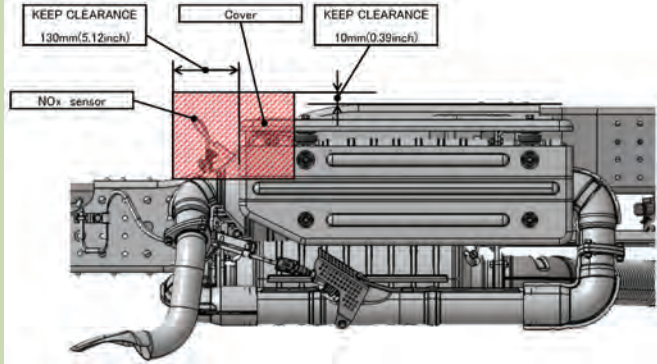
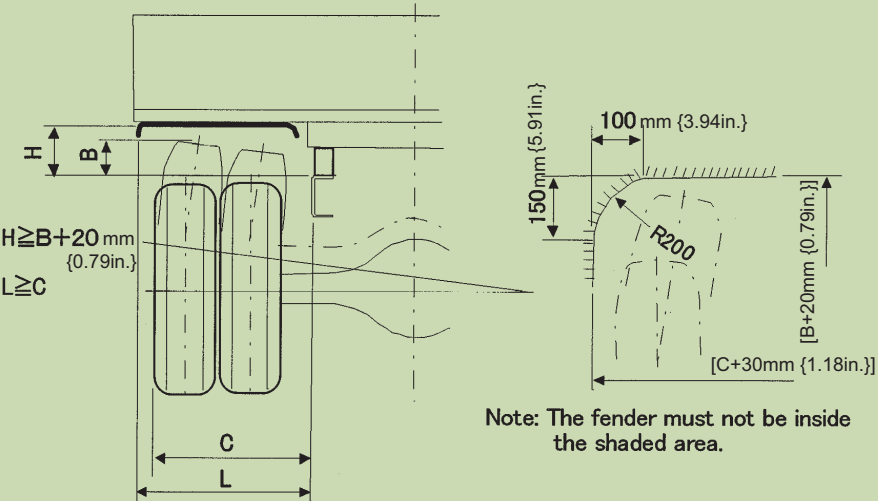
7 Construction of bodies

7.4 Clearance between chassis parts and bodies

Part	Minimum Clearance and Notes																																										
7. The Exhaust system	<p>The heat generated within and around the exhaust system can be very high, and the required clearance of components near it is an important factor in the safety of the vehicle. Keep the clearance between the rear body parts and these parts per the following figures on the table.</p> <table border="1" data-bbox="571 477 1433 1585"> <thead> <tr> <th data-bbox="571 477 1011 533">Parts</th> <th data-bbox="1011 477 1433 533">Minimum Clearance (mm {in.})</th> </tr> </thead> <tbody> <tr> <td data-bbox="571 533 1011 589">Wiring harness</td> <td data-bbox="1011 533 1433 589">150 (*100) {5.91 (*3.94)}</td> </tr> <tr> <td data-bbox="571 589 1011 645">Fuel hose and pipe</td> <td data-bbox="1011 589 1433 645">200 {7.87}</td> </tr> <tr> <td data-bbox="571 645 1011 701">Fuel tank</td> <td data-bbox="1011 645 1433 701">150 {5.91}</td> </tr> <tr> <td data-bbox="571 701 1011 757">Rear body floor</td> <td data-bbox="1011 701 1433 757">100 {3.94}</td> </tr> <tr> <td data-bbox="571 757 1011 813">Subframe, additional member etc.</td> <td data-bbox="1011 757 1433 813">20 {0.79}</td> </tr> <tr> <td data-bbox="571 813 1011 869">Spring, axle</td> <td data-bbox="1011 813 1433 869">20 {0.79}</td> </tr> <tr> <td data-bbox="571 869 1011 925">Shock absorber</td> <td data-bbox="1011 869 1433 925">30 {1.18}</td> </tr> <tr> <td data-bbox="571 925 1011 981">Tire</td> <td data-bbox="1011 925 1433 981">100 {3.94}</td> </tr> <tr> <td data-bbox="571 981 1011 1037">Propeller shaft</td> <td data-bbox="1011 981 1433 1037">50 {1.97}</td> </tr> <tr> <td data-bbox="571 1037 1011 1093">Differential</td> <td data-bbox="1011 1037 1433 1093">50 {1.97}</td> </tr> <tr> <td data-bbox="571 1093 1011 1149">Brake hose and pipe</td> <td data-bbox="1011 1093 1433 1149">100 {3.94}</td> </tr> <tr> <td data-bbox="571 1149 1011 1205">Parking brake cable</td> <td data-bbox="1011 1149 1433 1205">50 {1.97}</td> </tr> <tr> <td data-bbox="571 1205 1011 1261">Oil pan</td> <td data-bbox="1011 1205 1433 1261">100 {3.94}</td> </tr> <tr> <td data-bbox="571 1261 1011 1317">Rear mud guard</td> <td data-bbox="1011 1261 1433 1317">50 {1.97}</td> </tr> <tr> <td data-bbox="571 1317 1011 1373">Battery cable</td> <td data-bbox="1011 1317 1433 1373">150 {5.91}</td> </tr> <tr> <td data-bbox="571 1373 1011 1429">Rubber parts</td> <td data-bbox="1011 1373 1433 1429">150 {5.91}</td> </tr> <tr> <td data-bbox="571 1429 1011 1485">Plastic parts</td> <td data-bbox="1011 1429 1433 1485">150 {5.91}</td> </tr> <tr> <td data-bbox="571 1485 1011 1541">Oil pipe</td> <td data-bbox="1011 1485 1433 1541">100 {3.94}</td> </tr> <tr> <td data-bbox="571 1541 1011 1597">Brake booster</td> <td data-bbox="1011 1541 1433 1597">100 {3.94}</td> </tr> <tr> <td data-bbox="571 1597 1011 1653">Vacuum tank</td> <td data-bbox="1011 1597 1433 1653">80 {3.15}</td> </tr> </tbody> </table> <p data-bbox="571 1597 1433 1700">Note*: When wire harness is covered by heatproof conduit or protection.</p>	Parts	Minimum Clearance (mm {in.})	Wiring harness	150 (*100) {5.91 (*3.94)}	Fuel hose and pipe	200 {7.87}	Fuel tank	150 {5.91}	Rear body floor	100 {3.94}	Subframe, additional member etc.	20 {0.79}	Spring, axle	20 {0.79}	Shock absorber	30 {1.18}	Tire	100 {3.94}	Propeller shaft	50 {1.97}	Differential	50 {1.97}	Brake hose and pipe	100 {3.94}	Parking brake cable	50 {1.97}	Oil pan	100 {3.94}	Rear mud guard	50 {1.97}	Battery cable	150 {5.91}	Rubber parts	150 {5.91}	Plastic parts	150 {5.91}	Oil pipe	100 {3.94}	Brake booster	100 {3.94}	Vacuum tank	80 {3.15}
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7 Construction of bodies

7.4 Clearance between chassis parts and bodies

Part	Minimum Clearance and Notes
<div data-bbox="60 685 140 757" style="color: red; font-weight: bold; font-size: 2em;">A</div>	<p>NOx sensor <FE></p>  <p>KEEP CLEARANCE 50mm(1.97inch)</p> <p><FG></p>  <p>KEEP CLEARANCE 130mm(5.12inch)</p> <p>KEEP CLEARANCE 10mm(0.39inch)</p>
<p>8. Cab tilt area</p>	<p>Cabs other than double cabs can be tilted. Make sure that installation items do not enter the tilt path of the cab. For details on space requirements, refer to Chapter 9 "Layout Drawings: Cab Side View (Cab Tilt Area)" (▷ page 173).</p>
<p>9. Attaching the rear fender</p>	<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 9.9 "Differential and tire bound height" ▷ page 202.</p>  <p>Note: The fender must not be inside the shaded area.</p>

7.5 Fuel tank

7.5.1 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.

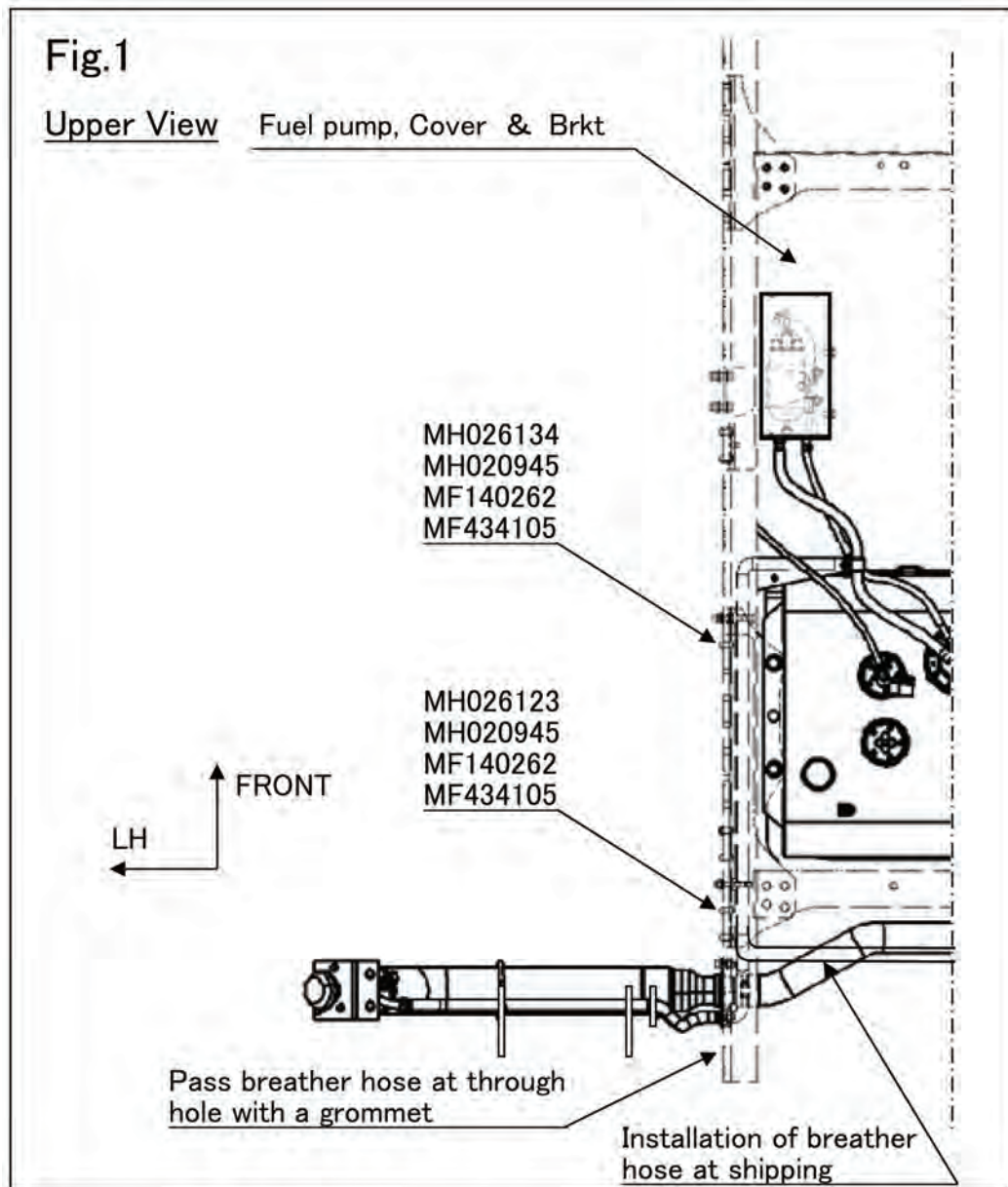
The fuel filler pipe MUST be located at least 171.5 mm {6.75 in.} above the height of the upper truck frame flange. This will allow satisfactory fill speed.

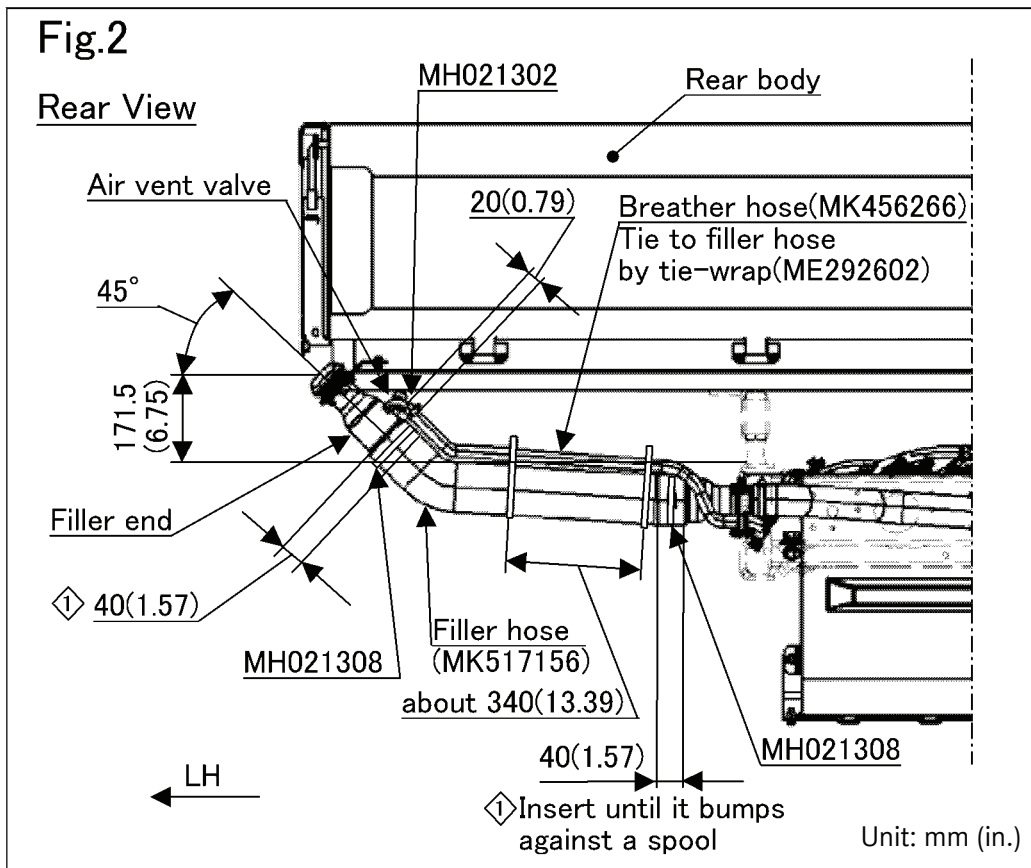
Attach the fuel cap tether. See Section 9.13 Fuel tank mounting layout.

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.





Unit: N·m {ft.lbs, kgf·m}

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

7.5.2 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 NAFTA.
 - 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.

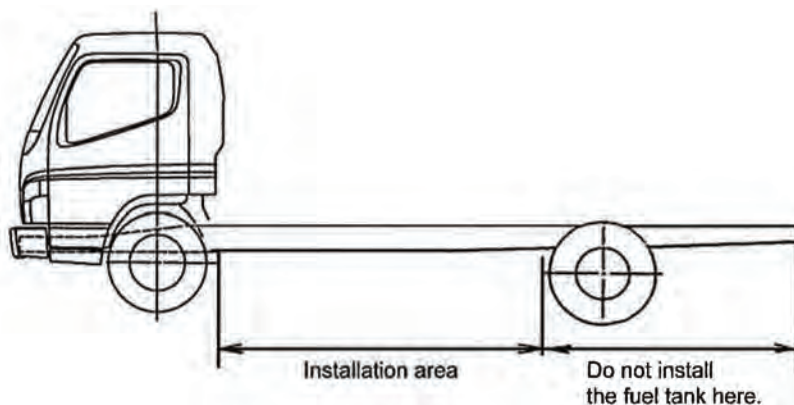
Unit: N·m {ft.lbs, kgf·m}

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



7.5.3 Moving the fuel tank

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



7.5.4 Fuel tubes

- Use rubber or metal tubes specified below when changing the fuel lines.

(a) Fuel hose

Fuel hoses of poor quality may cause a fire. Always use the standard MFTBC products described below.

	Inside dia. mm {in.}	MFTBC Part No.	Length mm {in.}
Supply tube	11.5 {0.45}	MH030***	120 to 20000 (4.72 to 787.4)
Return tube	9.5 {0.37}	MH030***	80 to 6500 (3.15 to 225.9)
	6.2 {0.24}	MS602***	40 to 10000 (1.57 to 393.7)

Note: Check with NAFTA for corresponding details regarding the part numbers and length.

(b) Metal tube

	Outside dia. mm {in.}	Thickness mm {in.}	Material
Supply tube	8 {0.31}	0.7 {0.028}	SPCC (JIS) (ASTM A109 or A366) Single rolled steel pipe
Return tube	10 {0.39}	0.7 {0.028}	

(c) Fuel Nylon tube

Outside dia. mm {in.}	MFTBC Part No.	Length mm {in.}	Application Part
8 {0.31}	MK629953	1,000 {39.4}	Fuel Tank - Fuel Filter
8 {0.31}	MK629955	1,500 {59.1}	Fuel Tank - Fuel Filter
8 {0.31}	MK629957	2,000 {78.7}	Fuel Tank - Fuel Filter
8 {0.31}	MK629959	3,000 {118.1}	Fuel Tank - Fuel Filter
8 {0.31}	MK629961	1,000 {39.4}	Fuel Filter - Supply Pipe
8 {0.31}	MK629963	1,500 {59.1}	Fuel Filter - Supply Pipe
8 {0.31}	MK629965	2,000 {78.7}	Fuel Filter - Supply Pipe
8 {0.31}	MK629967	3,000 {118.1}	Fuel Filter - Supply Pipe
10 {0.39}	MK629969	1,000 {39.4}	Return Pipe - Fuel Tank
10 {0.39}	MK629971	1,500 {59.1}	Return Pipe - Fuel Tank
10 {0.39}	MK629973	2,000 {78.7}	Return Pipe - Fuel Tank
10 {0.39}	MK629975	3,000 {118.1}	Return Pipe - Fuel Tank

- Never extend the fuel lines.
- Use metal tubing for the fuel line inside the engine compartment.
- Never modify the clips or move the location of clamps for components in the engine compartment which can be moved.
- Never install tubes together with electrical wires.
- Follow the procedures described in Section 9 "EXHAUST SYSTEM" when modifying exhaust system components. Install a Heat insulation panel if the specified clearances cannot be maintained.
- Be sure to position the fuel lines so that if a fuel leak should somehow occur, the fuel will not drip onto the muffler or exhaust pipe. Never connect the fuel lines above the exhaust system.
- Use the nylon hose and the metal tube for connection with the fuel tank of the supply piping and the return piping.
The end shape of the metal tube must be conformed by SAE J2044 standard.
Otherwise it may cause fuel leakage.
Please be sure to use the specified nylon hose and metal tube.
- Never use the rubber hose to the supply line (From the fuel pump to the engine)

7.5.5 Others

- Observe the procedures described in Section 6 "ELECTRICAL WIRING" when modifying the wires connected with the fuel tank.
- Place the filler port of the fuel tank to allow easy fueling. ▷ page 122.

7.6 BlueTec[®] system

7.6.1 Installing a side guard and other parts around the DEF tank

- Care is required when installing a side guard around the DEF tank. Do not let the side guard and its mounting bracket(s) hide the filler cap of the tank and interfere with refilling the tank with DEF. Be sure to open up sufficient space around the cap to allow a filler nozzle of DEF 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 DEF tank and the following parts of the DEF tank: front end, rear end, and outer side.
- Avoid directly attaching parts to any of the DEF tank brackets.
- Maintain sufficient free space to insert DEF filler nozzle. (shaded area)

<FE>

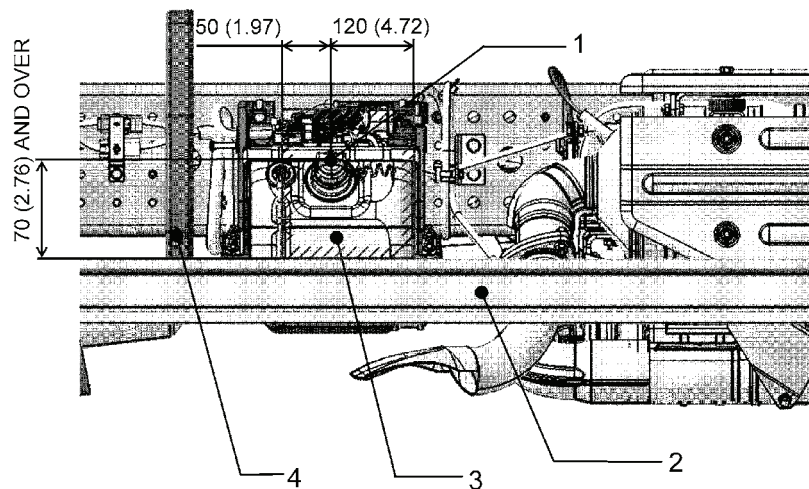


Fig.1



<FG>

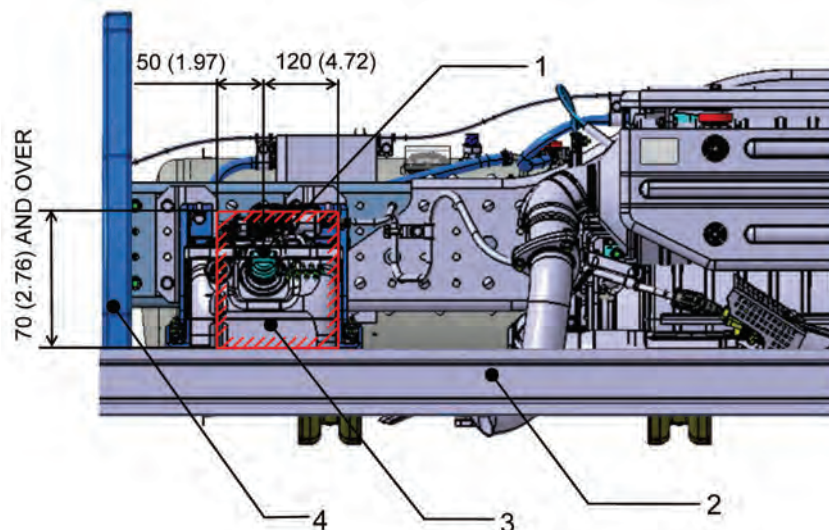


Fig.2

- 1 Cap
- 2 Side guard
- 3 DEF tank
- 4 Side guard mounting stay

DEF filler nozzle - Examples

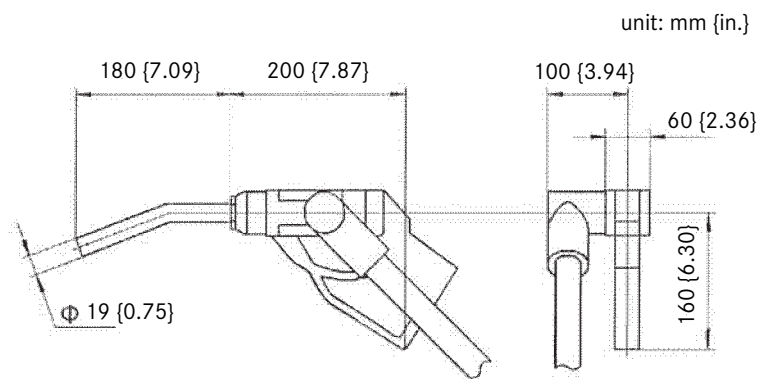


Fig. 3

7.6.2 DEF tank and connection piping

The DEF tank with a DEF 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.

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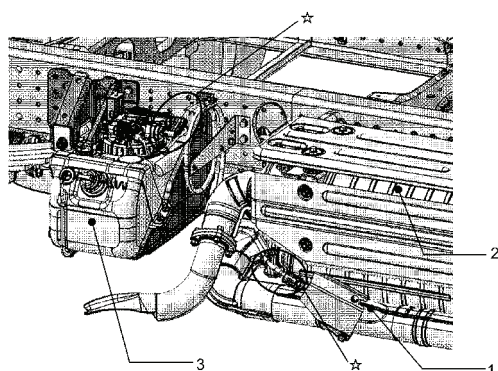


Fig. 1

- 1 Dosing module
- 2 SCR muffler
- 3 DEF tank

There are 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 are fully closed regardless of whether you touch the piping or not.



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

<FG>

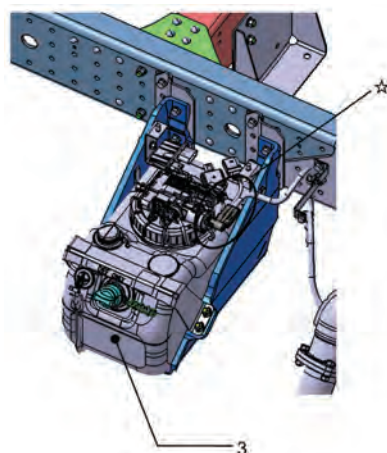


Fig. 2

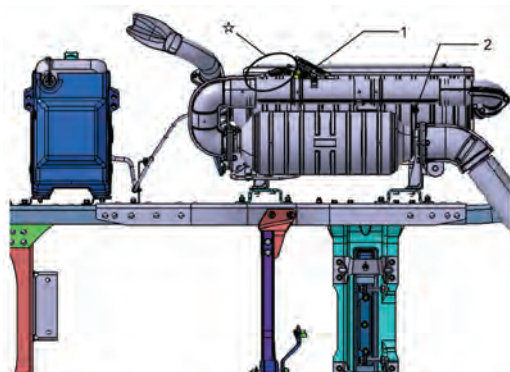


Fig. 3



7.6.3 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 the after-running 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 welding, confirm that the starter switch is in the "OFF" position.



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.

8.1 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:

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

ΔG_{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.})

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

ΔG_{VA} = Change in weight on front axle in (kg {lb})

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

ΔG_{HA} = Change in weight on rear axle in (kg {lb})

8 Calculations

8.1 Axle load calculation

Axle and Tire Load Carrying Capacity



Vehicle Model	Max. Output	Tire Size			Axle Capacity (kg {lb})	
		LT215/85R16	LT235/85R16	215/75R17.5	Front	Rear
FEC52CL3SUHD	120kW {161 hp}	X			2430 {5360}	4480 {9880}
FEC52EL3SUHD		X				
FEC52GL3SUHD		X				
FGB72EL3SUHD			X		2600 {5730}	4300 {9480}
FEC72CL3SUHD				X	2900 {6390}	5760 {12700}
FEC72EL3SUHD				X		
FEC72GL3SUHD				X		
FEC72HL3SUHD				X		
FEC72KL3SUHD				X		
FEC72HL3WUHD				X		
FEC72KL3WUHD				X		
FEC92CL3SUHD				X		
FEC92EL3SUHD				X		
FEC92GL3SUHD				X		
FEC92HL3SUHD				X		
FEC92KL3SUHD				X		
Tire Capacity (kg {lb})* 1	Front	1215x2=2430 {2680x2=5360}	1380x2=2760 {3040x2=6080}	1600x2=3200 {3530x2=7050}		
	Rear	1120x4=4480 {2470x4=9880}	1260x4=5040 {2780x4=11110}	1550x4=6200 {3420x4=13670}		

* 1: At Maximum information pressure (kPa {psi, kgf/cm²} cold:Fr/Re)

LT215/85R16 LOAD RANGE E 550 {80, 5.6}/550 {80, 5.6}

LT235/85R16 LOAD RANGE E 550 {80, 5.6}/550 {80, 5.6}

215/75R17.5 LOAD RANGE F 690 {100, 7.0}/690 {100, 7.0}



9.1 Vehicle performance list

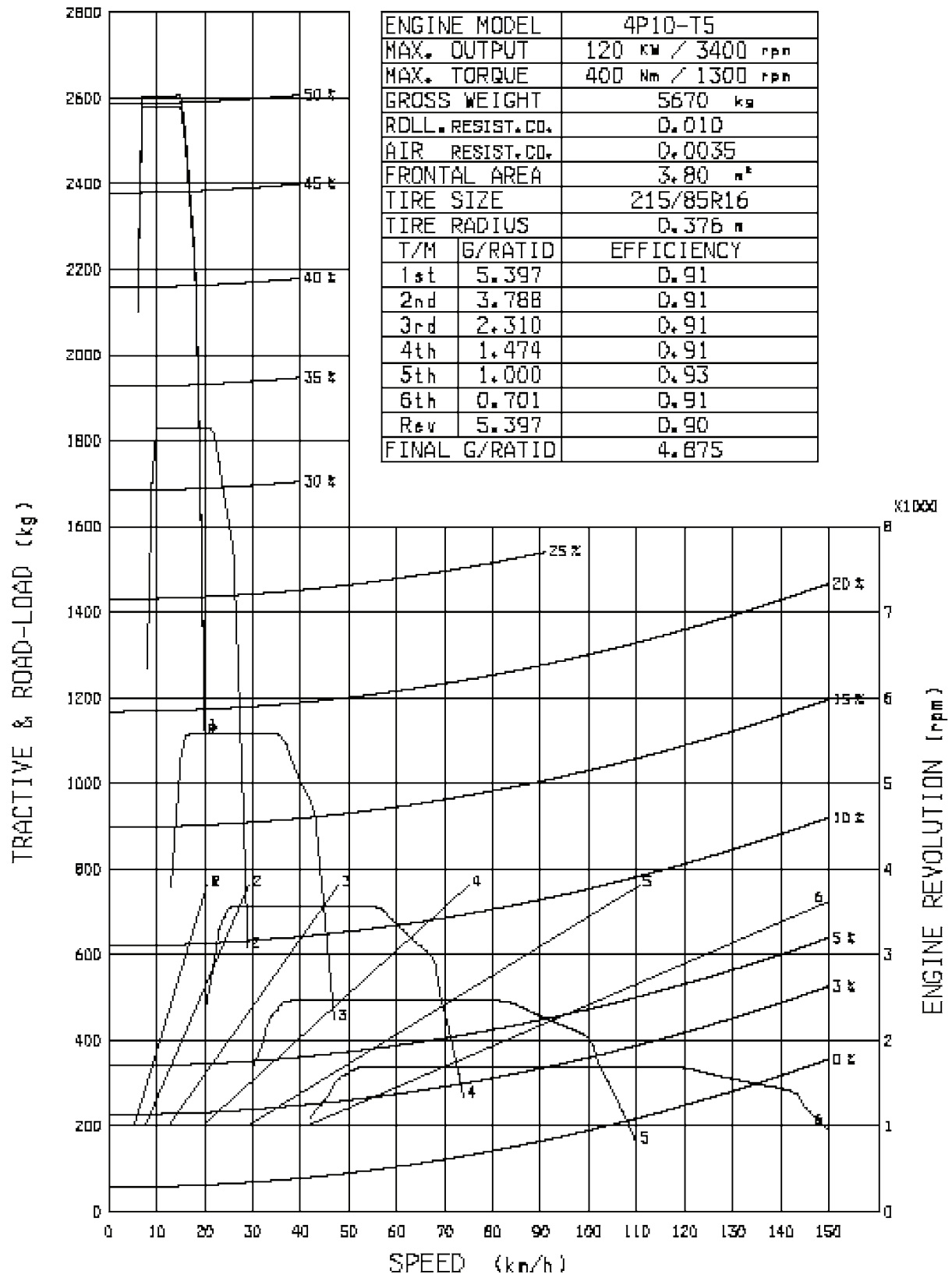
Model	Engine Output (kW/rpm) Torque (Nm/rpm)	Clutch	T/M			GVW (kg/lbs)	Tire	Radius (mm)	Final gear ratio (S:Std, P:Opt)				Model						
			Model	Position	Ratio				4.875	5.285	5.714	6.166							
4P10T5	120/3400 400/1300	Wet dual clutch	M038S6	1	5.397	5670/12500	215/85R16	376	S	P			FEC52CL3SUHD						
				2	3.788				S	P			FEC52EL3SUHD						
				3	2.310				S	P			FEC52GL3SUHD						
				4	1.474					S	P		FEC72CL3SUHD						
				5	1.000					S	P		FEC72EL3SUHD						
				6	0.701					S	P		FEC72GL3SUHD						
				R	5.397					S	P		FEC72HL3WUHD						
																			FEC92CL3SUHD
																			FEC92EL3SUHD
																			FEC92GL3SUHD
																			FEC92HL3SUHD
												8160/17995							FEC92KL3SUHD
					6375/14050	235/85R16	389		S	P		FG872EL3SUHD							



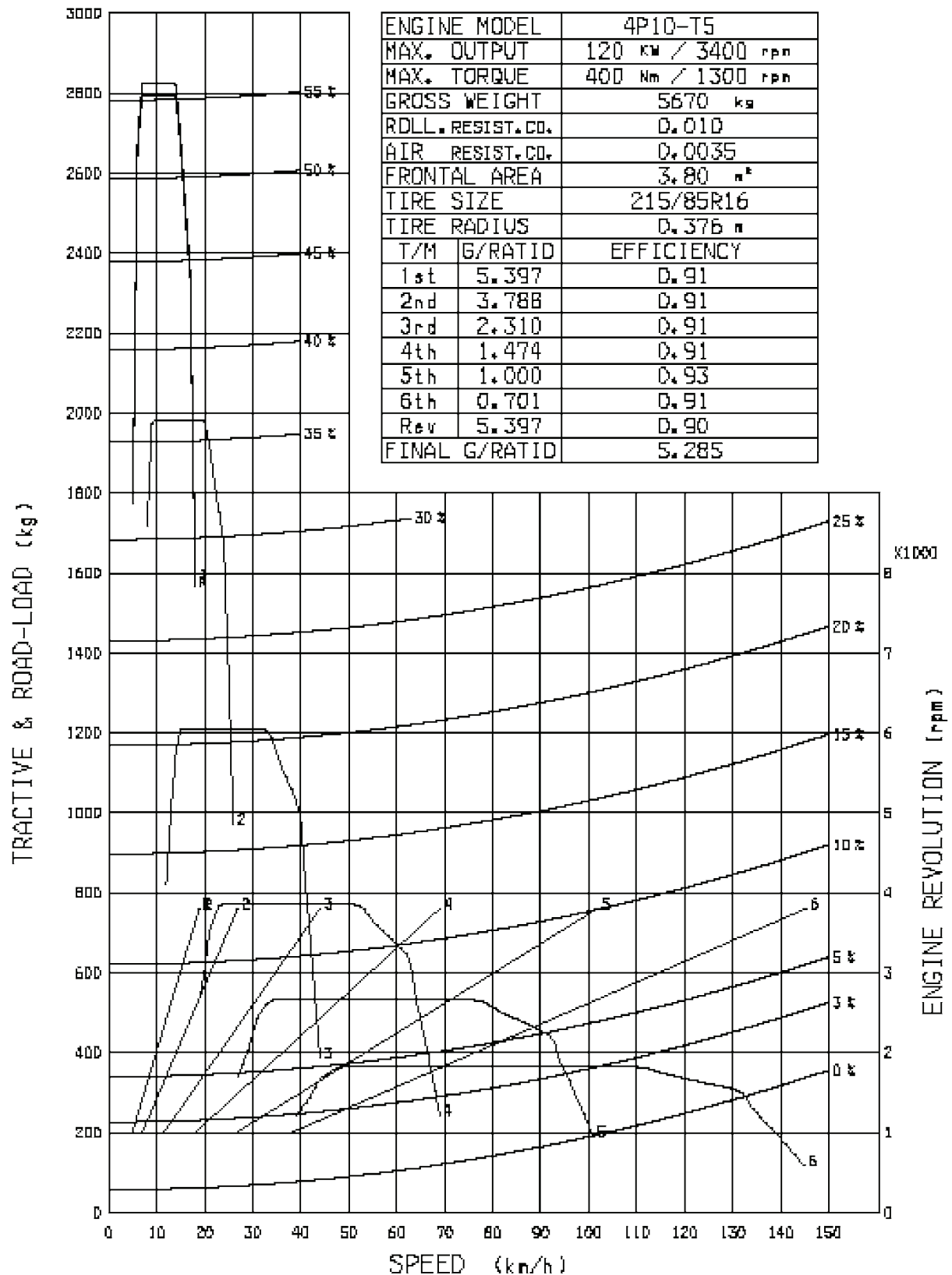
9.2 Performance curve

9.2.1 Vehicle performance curve

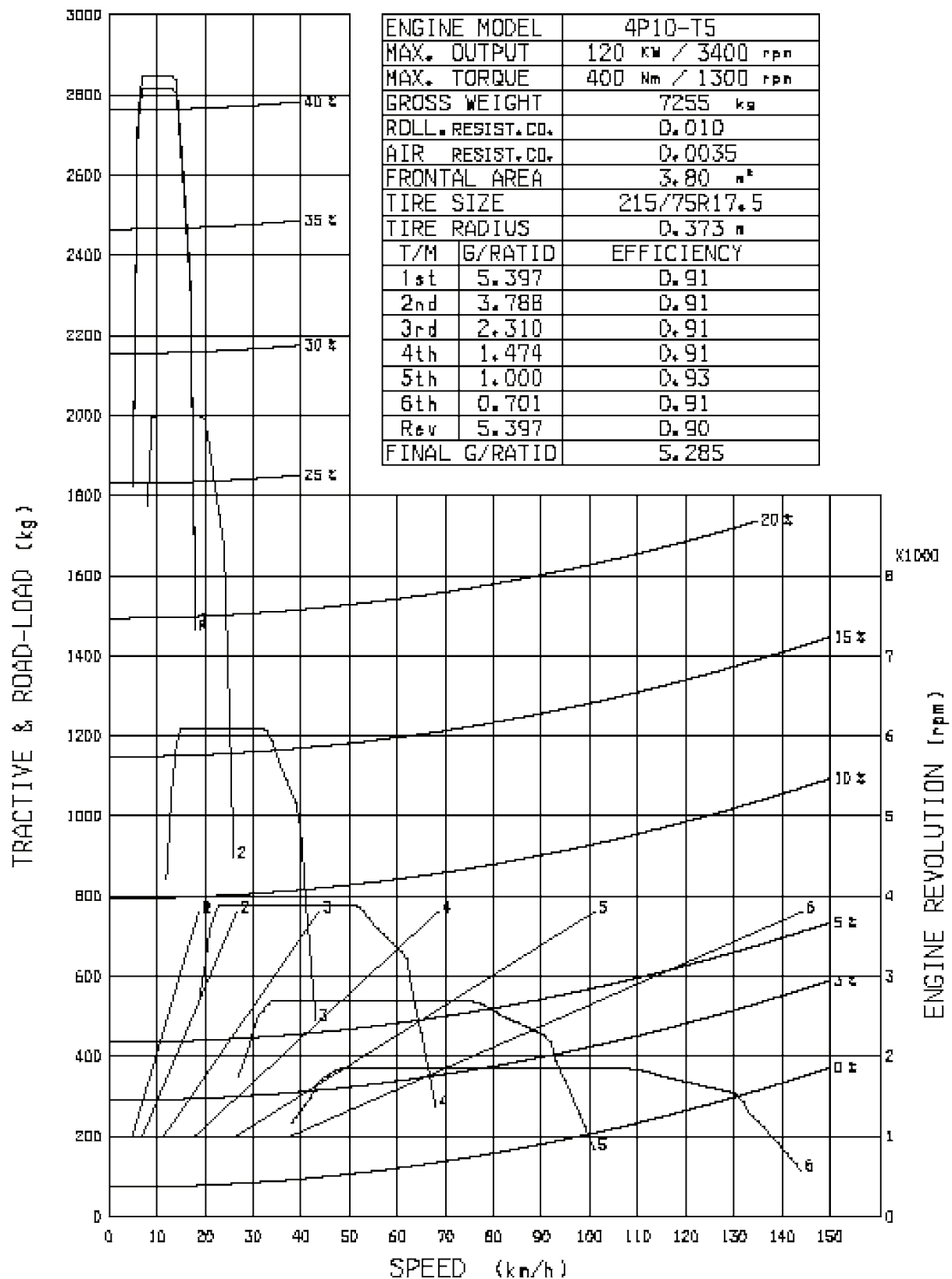
FEC52 4P10-T5



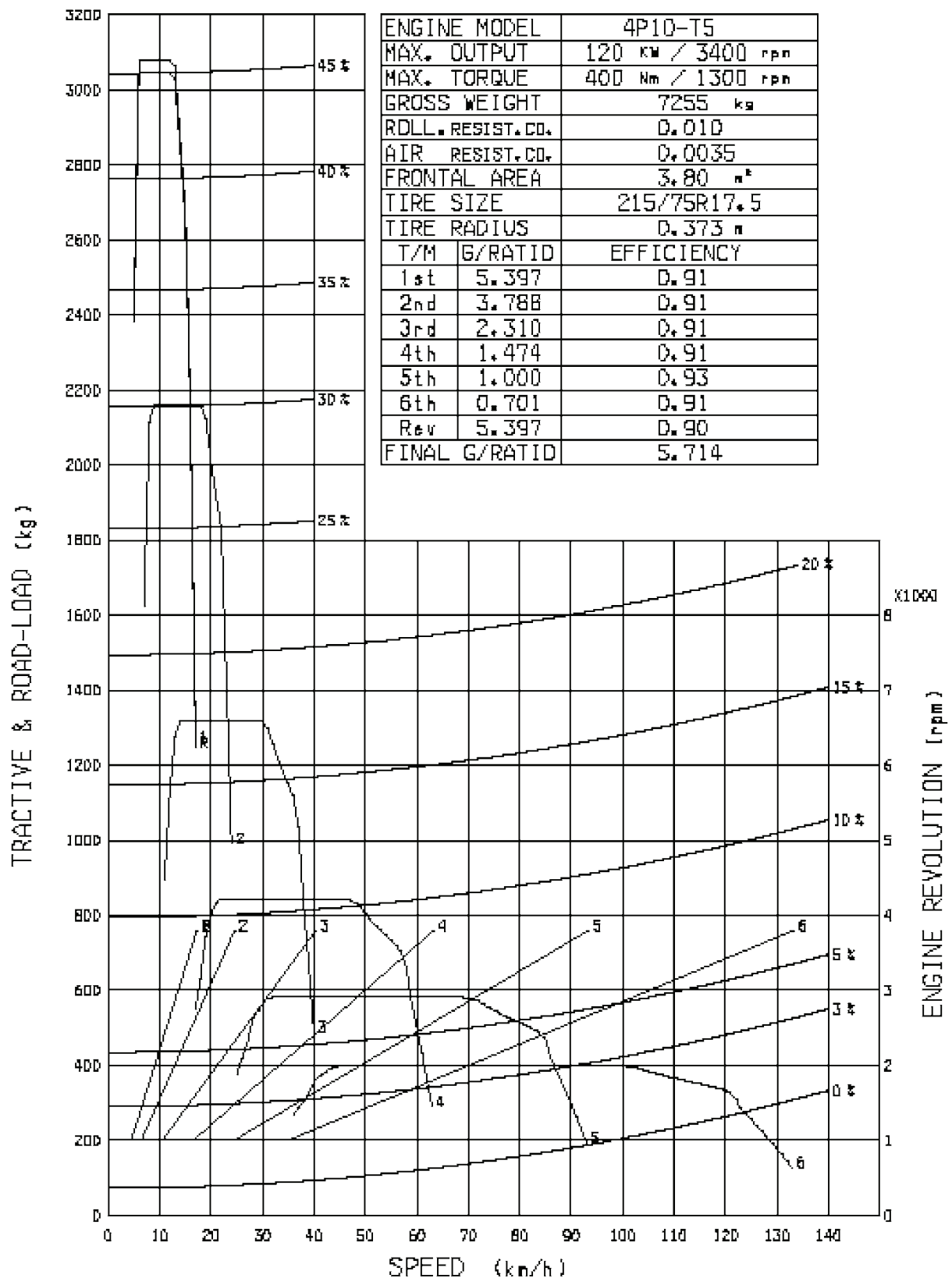
FEC52 4P10-T5



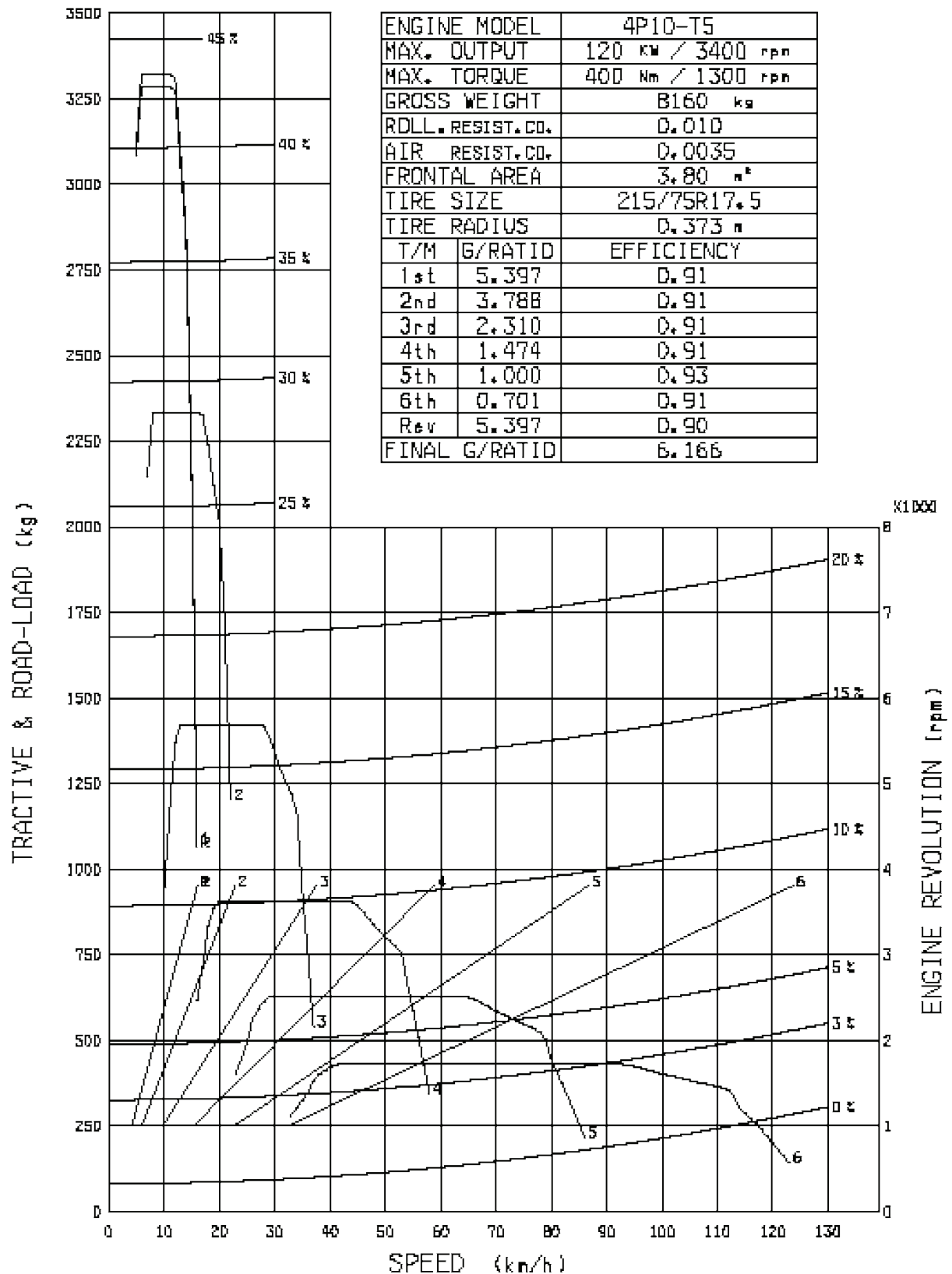
FEC72 4P10-T5



FEC72 4P10-T5

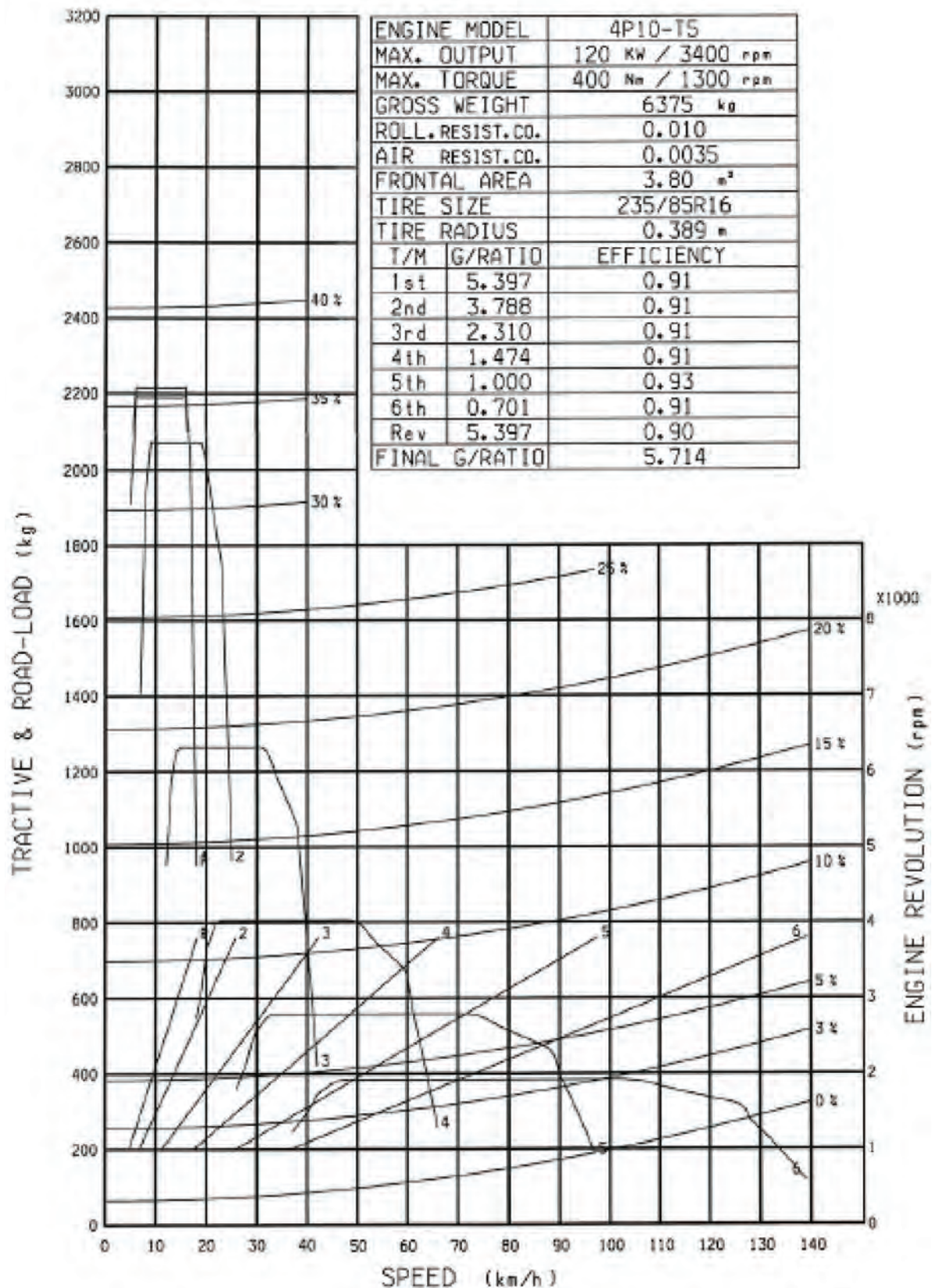


FEC92 4P10-T5



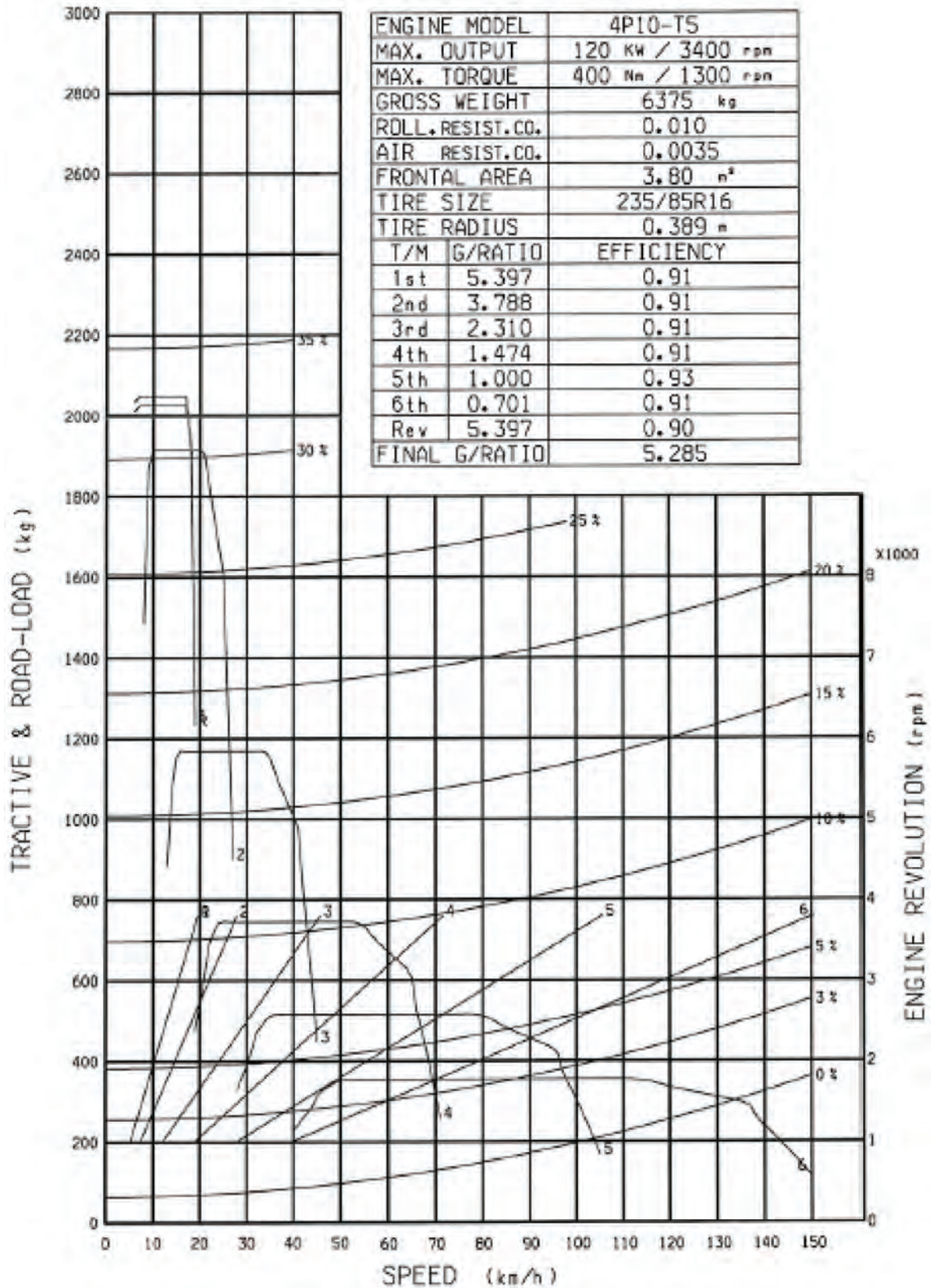


FGB72 4P10-T5

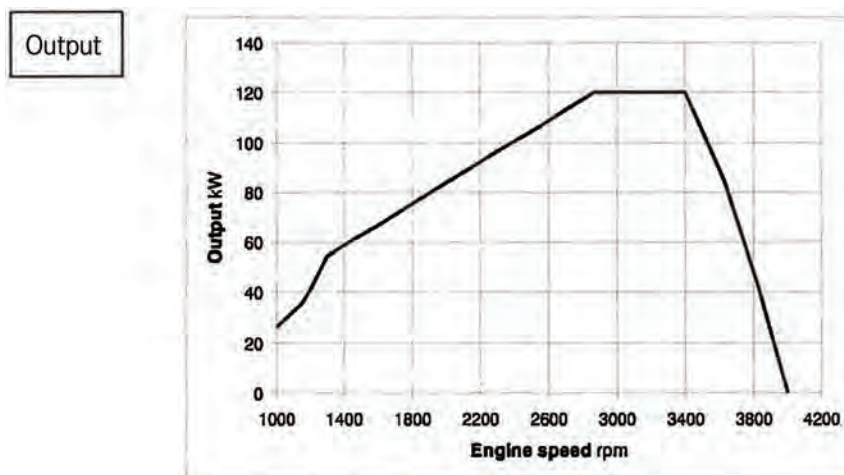
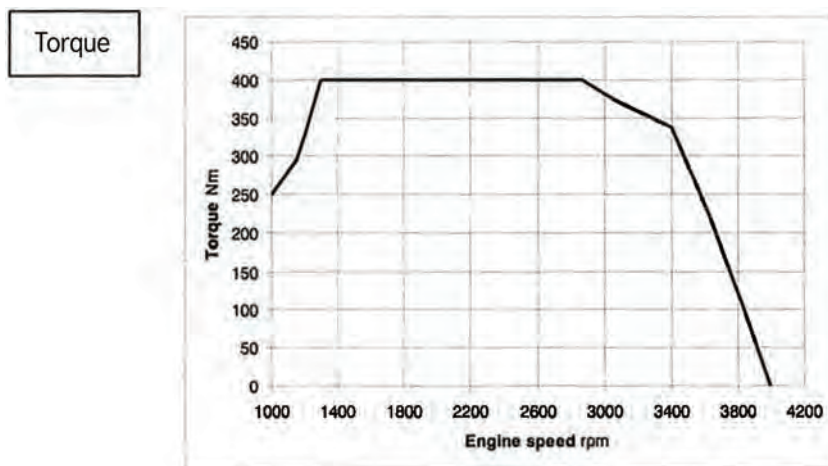




FGB72 4P10-T5



9.2.2 Engine performance curve



9 Technical data

9.3 Weight distribution table

9.3 Weight distribution table

Model: FEC52CL3SUHD (120kW)

Wheelbase (m) : 2.800

Parts name	Weight (Kg)	Distance * 1 to center of gravity (m)	Front axle load (Kg)	Rear axle load (Kg)
Front bumper	10.6	-1.012	14.4	-3.8
Steering system	39.9	-0.719	50.1	-10.2
Engine control system	0.7	-1.000	1.0	-0.3
Brake, clutch control system	22.3	-1.000	30.3	-8.0
Air intake system	24.4	0.524	19.8	4.6
Parking brake system	5.2	0.826	3.7	1.5
Remote control system	9.0	-0.180	9.6	-0.6
Cab assembly, Front cab mounting	355.0	-0.300	393.0	-38.0
Cooling system	25.0	-0.320	27.9	-2.9
Engine, Transmission assembly	429.9	0.401	368.3	61.6
Rear cab mounting	44.0	-0.223	47.5	-3.5
Battery	28.0	0.889	19.1	8.9
Fuel system	133.6	3.230	-20.5	154.1
Exhaust system	68.9	1.420	34.0	34.9
Propeller shaft assembly	11.5	1.882	3.8	7.7
Electric system	10.0	1.600	4.3	5.7
Frame and others	262.1	1.470	124.5	137.6
Engine and T/M cover	2.7	0.401	2.3	0.4
A/C unit	27.0	-0.780	34.5	-7.5
Electric others	38.7	-0.800	49.8	-11.1
ECU	3.1	-0.896	4.1	-1.0
SCR tank	17.4	1.975	5.1	12.3
Sprung weight	1569		1226.6 1227	342.4 342
Unsprung weight	770		278	492
Chassis Cab weight *2	2339 2340		1505 1505	834 835

* 1: From front axle center

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



9 Technical data

9.3 Weight distribution table

Model: FEC52EL3SUHD (120kW)

Wheelbase (m) : 3.400

Parts name	Weight (Kg)	Distance * 1 to center of gravity (m)	Front axle load (Kg)	Rear axle load (Kg)
Front bumper	10.6	-1.012	13.8	-3.2
Steering system	39.9	-0.719	48.3	-8.4
Engine control system	0.7	-1.000	0.9	-0.2
Brake, clutch control system	22.3	-1.000	28.9	-6.6
Air intake system	24.4	0.524	20.6	3.8
Parking brake system	5.2	0.826	3.9	1.3
Remote control system	9.0	-0.180	9.5	-0.5
Cab assembly, Front cab mounting	355.0	-0.300	386.3	-31.3
Cooling system	25.0	-0.320	27.4	-2.4
Engine, Transmission assembly	429.9	0.401	379.2	50.7
Rear cab mounting	44.0	-0.223	46.9	-2.9
Battery	28.0	0.889	20.7	7.3
Fuel system	133.6	3.830	-16.9	150.5
Exhaust system	68.9	1.420	40.1	28.8
Propeller shaft assembly	22.1	2.190	7.9	14.2
Electric system	10.0	1.700	5.0	5.0
Frame and others	289.4	1.756	139.9	149.5
Engine and T/M cover	2.7	0.401	2.4	0.3
A/C unit	27.0	-0.780	33.2	-6.2
Electric others	38.7	-0.800	47.8	-9.1
ECU	3.1	-0.896	3.9	-0.8
SCR tank	17.4	1.975	7.3	10.1
			1257.0	349.9
Sprung weight	1607		1257	350
Unsprung weight	770		278	492
Chassis Cab weight	*2 2377		1535	842
	2375		1535	840

* 1: From front axle center

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



9 Technical data

9.3 Weight distribution table

Model: FEC52GL3SUHD (120kW)

Wheelbase (m) : 3.850

Parts name	Weight (Kg)	Distance * 1 to center of gravity (m)	Front axle load (Kg)	Rear axle load (Kg)
Front bumper	10.6	-1.012	13.4	-2.8
Steering system	39.9	-0.719	47.4	-7.5
Engine control system	0.7	-1.000	0.9	-0.2
Brake, clutch control system	22.3	-1.000	28.1	-5.8
Air intake system	24.4	0.524	21.1	3.3
Parking brake system	5.2	0.826	4.1	1.1
Remote control system	9.0	-0.180	9.4	-0.4
Cab assembly, Front cab mounting	355.0	-0.300	382.7	-27.7
Cooling system	25.0	-0.320	27.1	-2.1
Engine, Transmission assembly	429.9	0.401	385.1	44.8
Rear cab mounting	44.0	-0.223	46.5	-2.5
Battery	28.0	0.889	21.5	6.5
Fuel system	133.6	4.280	-14.9	148.5
Exhaust system	68.9	1.420	43.5	25.4
Propeller shaft assembly	22.8	2.416	8.5	14.3
Electric system	10.0	1.920	5.0	5.0
Frame and others	302.6	1.990	146.2	156.4
Engine and T/M cover	2.7	0.401	2.4	0.3
A/C unit	27.0	-0.780	32.5	-5.5
Electric others	38.7	-0.800	46.7	-8.0
ECU	3.1	-0.896	3.8	-0.7
SCR tank	17.4	1.975	8.5	8.9
			1269.5	351.3
Sprung weight	1621		1270	351
Unsprung weight	770		278	492
Chassis Cab weight	*2 2391		1548	843
	2390		1550	840

* 1: From front axle center

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



9 Technical data

9.3 Weight distribution table

Model: FEC72CL3SUHD (120kW)

Wheelbase (m) : 2.800

Parts name	Weight (Kg)	Distance * 1 to center of gravity (m)	Front axle load (Kg)	Rear axle load (Kg)
Front bumper	10.6	-1.012	14.4	-3.8
Steering system	39.9	-0.719	50.1	-10.2
Engine control system	0.7	-1.000	1.0	-0.3
Brake, clutch control system	22.3	-1.000	30.3	-8.0
Air intake system	24.4	0.524	19.8	4.6
Parking brake system	5.2	0.826	3.7	1.5
Remote control system	9.0	-0.180	9.6	-0.6
Cab assembly, Front cab mounting	355.0	-0.300	393.0	-38.0
Cooling system	25.0	-0.320	27.9	-2.9
Engine, Transmission assembly	429.9	0.401	368.3	61.6
Rear cab mounting	44.0	-0.223	47.5	-3.5
Battery	28.0	0.889	19.1	8.9
Fuel system	133.6	3.230	-20.5	154.1
Exhaust system	68.9	1.420	34.0	34.9
Propeller shaft assembly	11.5	1.882	3.8	7.7
Electric system	10.0	1.600	4.3	5.7
Frame and others	270.8	1.470	128.6	142.2
Engine and T/M cover	2.7	0.401	2.3	0.4
A/C unit	27.0	-0.780	34.5	-7.5
Electric others	38.7	-0.800	49.8	-11.1
ECU	3.1	-0.896	4.1	-1.0
SCR tank	17.4	1.975	5.1	12.3
			1230.7	347.0
Sprung weight	1578		1231	347
Unsprung weight	898		310	588
Chassis Cab weight	*2 2476		1541	935
	2475		1540	935

* 1: From front axle center

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



9 Technical data

9.3 Weight distribution table

Model: FEC72EL3SUHD (120kW)

Wheelbase (m) : 3.400

Parts name	Weight (Kg)	Distance * 1 to center of gravity (m)	Front axle load (Kg)	Rear axle load (Kg)
Front bumper	10.6	-1.012	13.8	-3.2
Steering system	39.9	-0.719	48.3	-8.4
Engine control system	0.7	-1.000	0.9	-0.2
Brake, clutch control system	22.3	-1.000	28.9	-6.6
Air intake system	24.4	0.524	20.6	3.8
Parking brake system	5.2	0.826	3.9	1.3
Remote control system	9.0	-0.180	9.5	-0.5
Cab assembly, Front cab mounting	355.0	-0.300	386.3	-31.3
Cooling system	25.0	-0.320	27.4	-2.4
Engine, Transmission assembly	429.9	0.401	379.2	50.7
Rear cab mounting	44.0	-0.223	46.9	-2.9
Battery	28.0	0.889	20.7	7.3
Fuel system	133.6	3.830	-16.9	150.5
Exhaust system	68.9	1.420	40.1	28.8
Propeller shaft assembly	22.1	2.190	7.9	14.2
Electric system	10.0	1.700	5.0	5.0
Frame and others	298.1	1.756	144.1	154.0
Engine and T/M cover	2.7	0.401	2.4	0.3
A/C unit	27.0	-0.780	33.2	-6.2
Electric others	38.7	-0.800	47.8	-9.1
ECU	3.1	-0.896	3.9	-0.8
SCR tank	17.4	1.975	7.3	10.1
			1261.2	354.4
Sprung weight	1616		1261	354
Unsprung weight	898		310	588
Chassis Cab weight	*2 2514		1571	942
	2515		1570	945

* 1: From front axle center

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



9 Technical data

9.3 Weight distribution table

Model: FEC72GL3SUHD (120kW)

Wheelbase (m) : 3.850

Parts name	Weight (Kg)	Distance * 1 to center of gravity (m)	Front axle load (Kg)	Rear axle load (Kg)
Front bumper	10.6	-1.012	13.4	-2.8
Steering system	39.9	-0.719	47.4	-7.5
Engine control system	0.7	-1.000	0.9	-0.2
Brake, clutch control system	22.3	-1.000	28.1	-5.8
Air intake system	24.4	0.524	21.1	3.3
Parking brake system	5.2	0.826	4.1	1.1
Remote control system	9.0	-0.180	9.4	-0.4
Cab assembly, Front cab mounting	355.0	-0.300	382.7	-27.7
Cooling system	25.0	-0.320	27.1	-2.1
Engine, Transmission assembly	429.9	0.401	385.1	44.8
Rear cab mounting	44.0	-0.223	46.5	-2.5
Battery	28.0	0.889	21.5	6.5
Fuel system	133.6	4.280	-14.9	148.5
Exhaust system	68.9	1.420	43.5	25.4
Propeller shaft assembly	22.8	2.416	8.5	14.3
Electric system	10.0	1.920	5.0	5.0
Frame and others	311.3	1.990	150.4	160.9
Engine and T/M cover	2.7	0.401	2.4	0.3
A/C unit	27.0	-0.780	32.5	-5.5
Electric others	38.7	-0.800	46.7	-8.0
ECU	3.1	-0.896	3.8	-0.7
SCR tank	17.4	1.975	8.5	8.9
			1273.7	355.8
Sprung weight	1630		1274	356
Unsprung weight	898		310	588
Chassis Cab weight	*2 2528		1584	944
	2530		1585	945

* 1: From front axle center

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

9 Technical data

9.3 Weight distribution table

Model: FEC72HL3SUHD (120kW)

Wheelbase (m) : 4.300

Parts name	Weight (Kg)	Distance * 1 to center of gravity (m)	Front axle load (Kg)	Rear axle load (Kg)
Front bumper	10.6	-1.012	13.1	-2.5
Steering system	39.9	-0.719	46.6	-6.7
Engine control system	0.7	-1.000	0.9	-0.2
Brake, clutch control system	22.3	-1.000	27.5	-5.2
Air intake system	24.4	0.524	21.4	3.0
Parking brake system	5.2	0.826	4.2	1.0
Remote control system	9.0	-0.180	9.4	-0.4
Cab assembly, Front cab mounting	355.0	-0.300	379.8	-24.8
Cooling system	25.0	-0.320	26.9	-1.9
Engine, Transmission assembly	429.9	0.401	389.8	40.1
Rear cab mounting	44.0	-0.223	46.3	-2.3
Battery	28.0	0.889	22.2	5.8
Fuel system	133.6	4.730	-13.4	147.0
Exhaust system	68.9	1.420	46.1	22.8
Propeller shaft assembly	30.1	2.653	11.5	18.6
Electric system	10.0	2.020	5.3	4.7
Frame and others	334.1	2.205	162.8	171.3
Engine and T/M cover	2.7	0.401	2.4	0.3
A/C unit	27.0	-0.780	31.9	-4.9
Electric others	38.7	-0.800	45.9	-7.2
ECU	3.1	-0.896	3.7	-0.6
SCR tank	17.4	1.975	9.4	8.0
			1293.7	365.9
Sprung weight	1660		1294	366
Unsprung weight	898		310	588
Chassis Cab weight	*2 2558		1604	954
	2560		1605	955

* 1: From front axle center

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



9 Technical data

9.3 Weight distribution table

Model: FEC72KL3SUHD (120kW)

Wheelbase (m) : 4.750

Parts name	Weight (Kg)	Distance * 1 to center of gravity (m)	Front axle load (Kg)	Rear axle load (Kg)
Front bumper	10.6	-1.012	12.9	-2.3
Steering system	39.9	-0.719	45.9	-6.0
Engine control system	0.7	-1.000	0.8	-0.1
Brake, clutch control system	22.3	-1.000	27.0	-4.7
Air intake system	24.4	0.524	21.7	2.7
Parking brake system	5.2	0.826	4.3	0.9
Remote control system	9.0	-0.180	9.3	-0.3
Cab assembly, Front cab mounting	355.0	-0.300	377.4	-22.4
Cooling system	25.0	-0.320	26.7	-1.7
Engine, Transmission assembly	429.9	0.401	393.6	36.3
Rear cab mounting	44.0	-0.223	46.1	-2.1
Battery	28.0	0.889	22.8	5.2
Fuel system	133.6	5.180	-12.1	145.7
Exhaust system	68.9	1.420	48.3	20.6
Propeller shaft assembly	34.6	2.877	13.6	21.0
Electric system	10.0	2.110	5.6	4.4
Frame and others	347.3	2.435	169.3	178.0
Engine and T/M cover	2.7	0.401	2.5	0.2
A/C unit	27.0	-0.780	31.4	-4.4
Electric others	38.7	-0.800	45.2	-6.5
ECU	3.1	-0.896	3.7	-0.6
SCR tank	17.4	1.975	10.2	7.2
			1306.2	371.1
Sprung weight	1677		1306	371
Unsprung weight	898		310	588
Chassis Cab weight *2	2575		1616	959
	2575		1615	960

* 1: From front axle center

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



9 Technical data

9.3 Weight distribution table

Model: FEC72HL3WUHD (120kW)

Wheelbase (m) : 4.300

Parts name	Weight (Kg)	Distance * 1 to center of gravity (m)	Front axle load (Kg)	Rear axle load (Kg)
Front bumper	10.6	-1.012	13.1	-2.5
Steering system	39.6	-0.719	46.2	-6.6
Engine control system	0.7	-1.000	0.9	-0.2
Brake, clutch control system	22.3	-1.000	27.5	-5.2
Air intake system	27.4	0.524	24.1	3.3
Parking brake system	5.2	0.826	4.2	1.0
Remote control system	9.0	-0.180	9.4	-0.4
Cab assembly, Front cab mounting	565.0	0.240	533.5	31.5
Cooling system	25.0	-0.320	26.9	-1.9
Engine, Transmission assembly	429.9	0.401	389.8	40.1
Rear cab mounting	42.0	0.230	39.8	2.2
Battery	28.0	0.889	22.2	5.8
Fuel system	133.6	4.730	-13.4	147.0
Exhaust system	67.6	1.420	45.3	22.3
Propeller shaft assembly	30.1	2.653	11.5	18.6
Electric system	10.0	2.020	5.3	4.7
Frame and others	333.9	2.205	162.7	171.2
Engine and T/M cover	2.7	0.401	2.4	0.3
A/C unit	36.0	-0.300	38.5	-2.5
Electric others	38.7	-0.800	45.9	-7.2
ECU	3.1	-0.896	3.7	-0.6
SCR tank	17.4	2.225	8.4	9.0
			1447.9	429.9
Sprung weight	1878		1448	430
Unsprung weight	898		310	588
Chassis Cab weight	*2 2776		1758	1018
	2775		1760	1015

* 1: From front axle center

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



9 Technical data

9.3 Weight distribution table

Model: FEC72KL3WUHD (120kW)

Wheelbase (m) : 4.750

Parts name	Weight (Kg)	Distance * 1 to center of gravity (m)	Front axle load (Kg)	Rear axle load (Kg)
Front bumper	10.6	-1.012	12.9	-2.3
Steering system	39.6	-0.719	45.6	-6.0
Engine control system	0.7	-1.000	0.8	-0.1
Brake, clutch control system	22.3	-1.000	27.0	-4.7
Air intake system	27.4	0.524	24.4	3.0
Parking brake system	5.2	0.826	4.3	0.9
Remote control system	9.0	-0.180	9.3	-0.3
Cab assembly, Front cab mounting	565.0	0.240	536.5	28.5
Cooling system	25.0	-0.320	26.7	-1.7
Engine, Transmission assembly	429.9	0.401	393.6	36.3
Rear cab mounting	42.0	0.230	40.0	2.0
Battery	28.0	0.889	22.8	5.2
Fuel system	133.6	5.180	-12.1	145.7
Exhaust system	67.6	1.420	47.4	20.2
Propeller shaft assembly	34.6	2.877	13.6	21.0
Electric system	10.0	2.110	5.6	4.4
Frame and others	347.1	2.435	169.2	177.9
Engine and T/M cover	2.7	0.401	2.5	0.2
A/C unit	36.0	-0.300	38.3	-2.3
Electric others	38.7	-0.800	45.2	-6.5
ECU	3.1	-0.896	3.7	-0.6
SCR tank	17.4	2.225	9.2	8.2
			1466.5	429.0
Sprung weight	1896		1467	429
Unsprung weight	898		310	588
Chassis Cab weight	*2 2794		1777	1017
	2795		1780	1015

* 1: From front axle center

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



9 Technical data

9.3 Weight distribution table

Model: FEC92CL3SUHD (120kW)

Wheelbase (m) : 2.800

Parts name	Weight (Kg)	Distance * 1 to center of gravity (m)	Front axle load (Kg)	Rear axle load (Kg)
Front bumper	10.6	-1.012	14.4	-3.8
Steering system	39.9	-0.719	50.1	-10.2
Engine control system	0.7	-1.000	1.0	-0.3
Brake, clutch control system	22.3	-1.000	30.3	-8.0
Air intake system	24.4	0.524	19.8	4.6
Parking brake system	5.2	0.826	3.7	1.5
Remote control system	9.0	-0.180	9.6	-0.6
Cab assembly, Front cab mounting	355.0	-0.300	393.0	-38.0
Cooling system	25.0	-0.320	27.9	-2.9
Engine, Transmission assembly	429.9	0.401	368.3	61.6
Rear cab mounting	44.0	-0.223	47.5	-3.5
Battery	28.0	0.889	19.1	8.9
Fuel system	133.6	3.230	-20.5	154.1
Exhaust system	68.9	1.420	34.0	34.9
Propeller shaft assembly	11.5	1.882	3.8	7.7
Electric system	10.0	1.600	4.3	5.7
Frame and others	270.8	1.470	128.6	142.2
Engine and T/M cover	2.7	0.401	2.3	0.4
A/C unit	27.0	-0.780	34.5	-7.5
Electric others	38.7	-0.800	49.8	-11.1
ECU	3.1	-0.896	4.1	-1.0
SCR tank	17.4	1.975	5.1	12.3
			1230.7	347.0
Sprung weight	1578		1231	347
Unsprung weight	898		310	588
Chassis Cab weight *2	2476		1541	935
	2475		1540	935

* 1: From front axle center

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



9 Technical data

9.3 Weight distribution table

Model: FEC92EL3SUHD (120kW)

Wheelbase (m) : 3.400

Parts name	Weight (Kg)	Distance * 1 to center of gravity (m)	Front axle load (Kg)	Rear axle load (Kg)
Front bumper	10.6	-1.012	13.8	-3.2
Steering system	39.9	-0.719	48.3	-8.4
Engine control system	0.7	-1.000	0.9	-0.2
Brake, clutch control system	22.3	-1.000	28.9	-6.6
Air intake system	24.4	0.524	20.6	3.8
Parking brake system	5.2	0.826	3.9	1.3
Remote control system	9.0	-0.180	9.5	-0.5
Cab assembly, Front cab mounting	355.0	-0.300	386.3	-31.3
Cooling system	25.0	-0.320	27.4	-2.4
Engine, Transmission assembly	429.9	0.401	379.2	50.7
Rear cab mounting	44.0	-0.223	46.9	-2.9
Battery	28.0	0.889	20.7	7.3
Fuel system	133.6	3.830	-16.9	150.5
Exhaust system	68.9	1.420	40.1	28.8
Propeller shaft assembly	22.1	2.190	7.9	14.2
Electric system	10.0	1.700	5.0	5.0
Frame and others	298.1	1.756	144.1	154.0
Engine and T/M cover	2.7	0.401	2.4	0.3
A/C unit	27.0	-0.780	33.2	-6.2
Electric others	38.7	-0.800	47.8	-9.1
ECU	3.1	-0.896	3.9	-0.8
SCR tank	17.4	1.975	7.3	10.1
			1261.2	354.4
Sprung weight	1616		1261	354
Unsprung weight	898		310	588
Chassis Cab weight	*2 2514		1571	942
	2515		1570	945

* 1: From front axle center

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



9 Technical data

9.3 Weight distribution table

Model: FEC92GL3SUHD (120kW)

Wheelbase (m) : 3.850

Parts name	Weight (Kg)	Distance * 1 to center of gravity (m)	Front axle load (Kg)	Rear axle load (Kg)
Front bumper	10.6	-1.012	13.4	-2.8
Steering system	39.9	-0.719	47.4	-7.5
Engine control system	0.7	-1.000	0.9	-0.2
Brake, clutch control system	22.3	-1.000	28.1	-5.8
Air intake system	24.4	0.524	21.1	3.3
Parking brake system	5.2	0.826	4.1	1.1
Remote control system	9.0	-0.180	9.4	-0.4
Cab assembly, Front cab mounting	355.0	-0.300	382.7	-27.7
Cooling system	25.0	-0.320	27.1	-2.1
Engine, Transmission assembly	429.9	0.401	385.1	44.8
Rear cab mounting	44.0	-0.223	46.5	-2.5
Battery	28.0	0.889	21.5	6.5
Fuel system	133.6	4.280	-14.9	148.5
Exhaust system	68.9	1.420	43.5	25.4
Propeller shaft assembly	22.8	2.416	8.5	14.3
Electric system	10.0	1.920	5.0	5.0
Frame and others	311.3	1.990	150.4	160.9
Engine and T/M cover	2.7	0.401	2.4	0.3
A/C unit	27.0	-0.780	32.5	-5.5
Electric others	38.7	-0.800	46.7	-8.0
ECU	3.1	-0.896	3.8	-0.7
SCR tank	17.4	1.975	8.5	8.9
			1273.7	355.8
Sprung weight	1630		1274	356
Unsprung weight	898		310	588
Chassis Cab weight	*2 2528		1584	944
	2530		1585	945

* 1: From front axle center

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



9 Technical data

9.3 Weight distribution table

Model: FEC92HL3SUHD (120kW)

Wheelbase (m) : 4.300

Parts name	Weight (Kg)	Distance * 1 to center of gravity (m)	Front axle load (Kg)	Rear axle load (Kg)
Front bumper	10.6	-1.012	13.1	-2.5
Steering system	39.9	-0.719	46.6	-6.7
Engine control system	0.7	-1.000	0.9	-0.2
Brake, clutch control system	22.3	-1.000	27.5	-5.2
Air intake system	24.4	0.524	21.4	3.0
Parking brake system	5.2	0.826	4.2	1.0
Remote control system	9.0	-0.180	9.4	-0.4
Cab assembly, Front cab mounting	355.0	-0.300	379.8	-24.8
Cooling system	25.0	-0.320	26.9	-1.9
Engine, Transmission assembly	429.9	0.401	389.8	40.1
Rear cab mounting	44.0	-0.223	46.3	-2.3
Battery	28.0	0.889	22.2	5.8
Fuel system	133.6	4.730	-13.4	147.0
Exhaust system	68.9	1.420	46.1	22.8
Propeller shaft assembly	30.1	2.653	11.5	18.6
Electric system	10.0	2.020	5.3	4.7
Frame and others	334.1	2.205	162.8	171.3
Engine and T/M cover	2.7	0.401	2.4	0.3
A/C unit	27.0	-0.780	31.9	-4.9
Electric others	38.7	-0.800	45.9	-7.2
ECU	3.1	-0.896	3.7	-0.6
SCR tank	17.4	1.975	9.4	8.0
			1293.7	365.9
Sprung weight	1660		1294	366
Unsprung weight	898		310	588
Chassis Cab weight	*2 2558		1604	954
	2560		1605	955

* 1: From front axle center

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



9 Technical data

9.3 Weight distribution table

Model: FEC92KL3SUHD (120kW)

Wheelbase (m) : 4.750

Parts name	Weight (Kg)	Distance * 1 to center of gravity (m)	Front axle load (Kg)	Rear axle load (Kg)
Front bumper	10.6	-1.012	12.9	-2.3
Steering system	39.9	-0.719	45.9	-6.0
Engine control system	0.7	-1.000	0.8	-0.1
Brake, clutch control system	22.3	-1.000	27.0	-4.7
Air intake system	24.4	0.524	21.7	2.7
Parking brake system	5.2	0.826	4.3	0.9
Remote control system	9.0	-0.180	9.3	-0.3
Cab assembly, Front cab mounting	355.0	-0.300	377.4	-22.4
Cooling system	25.0	-0.320	26.7	-1.7
Engine, Transmission assembly	429.9	0.401	393.6	36.3
Rear cab mounting	44.0	-0.223	46.1	-2.1
Battery	28.0	0.889	22.8	5.2
Fuel system	133.6	5.180	-12.1	145.7
Exhaust system	68.9	1.420	48.3	20.6
Propeller shaft assembly	34.6	2.877	13.6	21.0
Electric system	10.0	2.110	5.6	4.4
Frame and others	347.3	2.435	169.3	178.0
Engine and T/M cover	2.7	0.401	2.5	0.2
A/C unit	27.0	-0.780	31.4	-4.4
Electric others	38.7	-0.800	45.2	-6.5
ECU	3.1	-0.896	3.7	-0.6
SCR tank	17.4	1.975	10.2	7.2
			1306.2	371.1
Sprung weight	1677		1306	371
Unsprung weight	898		310	588
Chassis Cab weight *2	2575		1616	959
	2575		1615	960

* 1: From front axle center

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



9 Technical data

9.3 Weight distribution table

Model: FGB72EL3SUHD (120kW)

Wheelbase (m) : 3.415

Parts name	Weight (Kg)	Distance * 1 to center of gravity (m)	Front axle load (Kg)	Rear axle load (Kg)
Front bumper	10.6	-1.012	13.8	-3.2
Steering system	38.6	-0.719	46.7	-8.1
Engine control system	0.4	-1.000	0.5	-0.1
Brake, clutch control system	22.0	-1.000	28.4	-6.4
Air intake system	23.5	0.524	19.9	3.6
Parking brake system	6.2	0.826	4.7	1.5
Remote control system	8.7	0.471	7.5	1.2
Cab assembly, Front cab mounting	355.5	-0.300	386.7	-31.2
Cooling system	21.5	-0.320	23.5	-2.0
Engine, Transmission assembly	429.9	0.401	379.4	50.5
Rear cab mounting	44.0	-0.223	46.9	-2.9
Battery	28.0	0.889	20.7	7.3
Fuel system	156.4	1.833	72.5	83.9
Exhaust system	71.1	1.420	41.5	29.6
Propeller shaft assembly	22.0	2.190	7.9	14.1
Electric system	10.0	1.700	5.0	5.0
Frame and others	336.5	1.600	178.8	157.7
Engine and T/M cover	2.9	0.401	2.6	0.3
A/C unit	20.5	-0.780	25.2	-4.7
Electric others	38.7	-0.800	47.8	-9.1
ECU	4.0	-0.896	5.0	-1.0
Transfer	66.5	1.350	40.2	26.3
SCR tank	17.4	1.975	7.3	10.1
			1412.5	322.4
Sprung weight	1735		1413	322
Unsprung weight	947		404	543
Chassis Cab weight	*2 2682		1817	865
	2680		1815	865

* 1: From front axle center

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



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	Double	
Chassis	T/M PTO (20 kgfm, vacuum, separate connected pump, with flange)	+12 (+26)	0.401 (1.3)	0.401 (1.3)	
	T/M PTO (40 kgfm, vacuum, separate connected pump, with flange)	+13 (+29)	0.401 (1.3)	0.401 (1.3)	

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

9.4 Chassis cab drawings

9.4.1 Chassis cab drawings

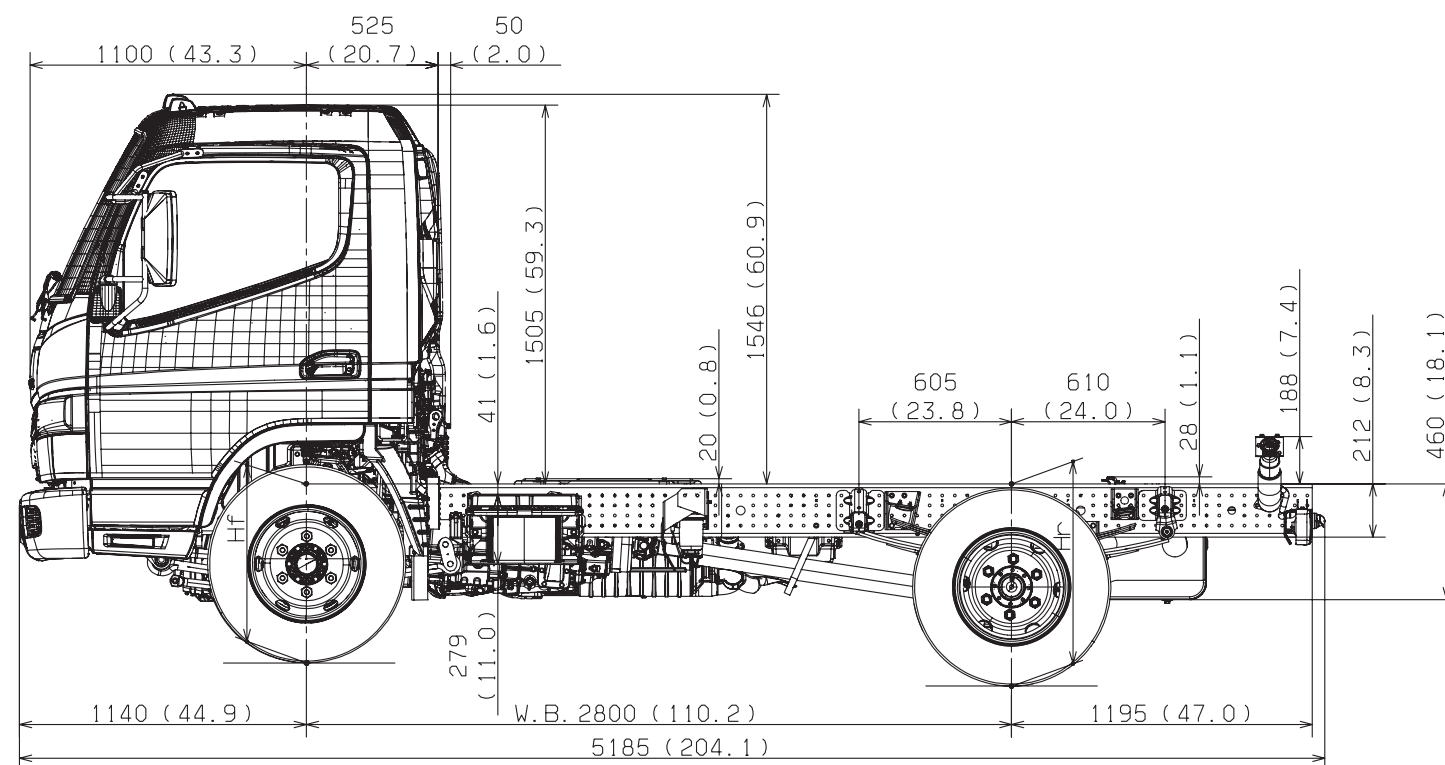
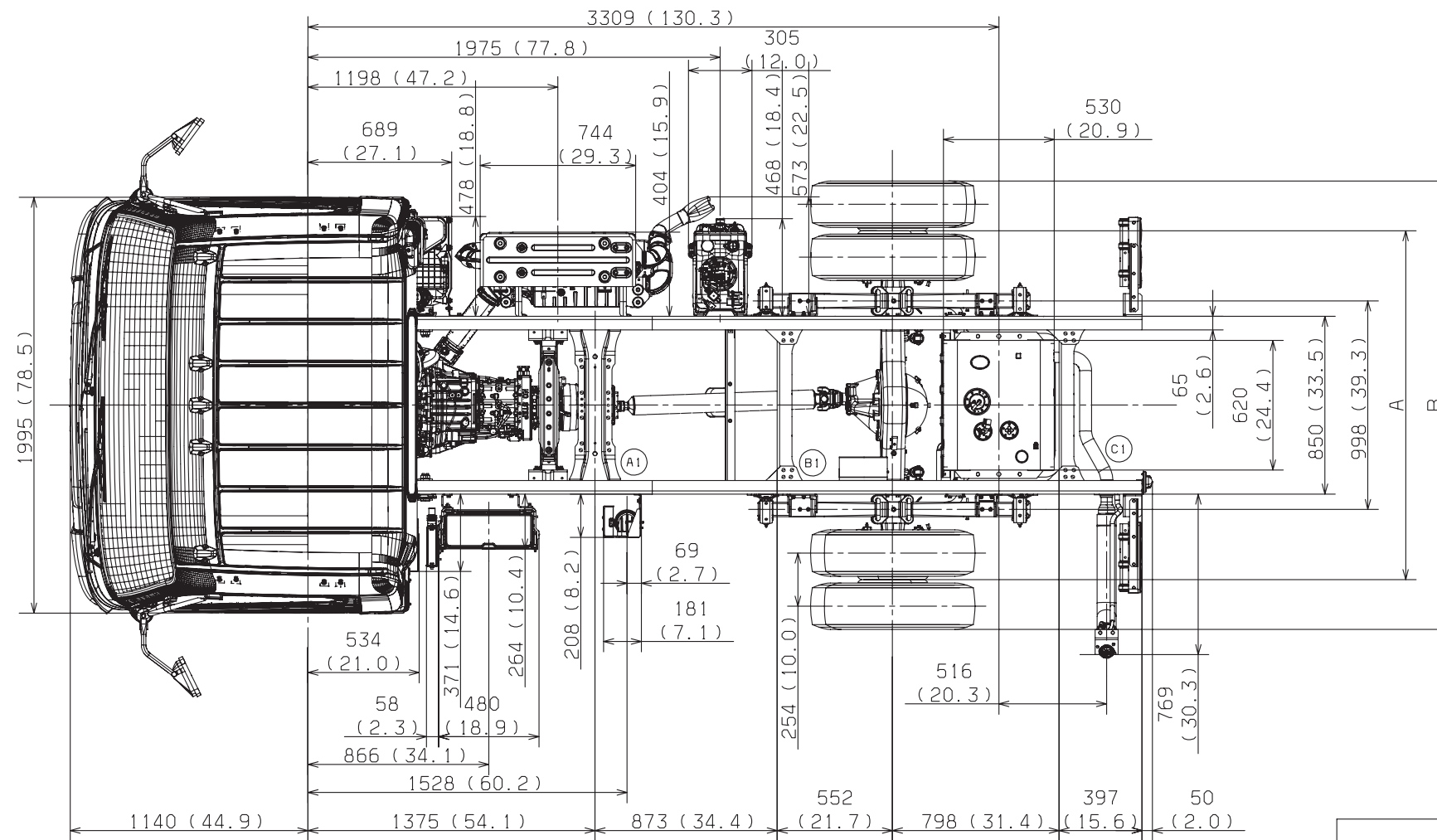
***PDF FILE -view file, unable to edit- ***

PDF files of Chassis cab drawings will be shown on clicking the Model name in left bookmark.

Model	Page	Down Load
FEC52CL3SUHD	161	.dxf
FEC72CL3SUHD		
FEC92CL3SUHD		
FEC52EL3SUHD	162	.dxf
FEC72EL3SUHD		
FEC92EL3SUHD		
FEC52GL3SUHD	163	.dxf
FEC72GL3SUHD		
FEC92GL3SUHD		
FEC72HL3SUHD	164	.dxf
FEC92HL3SUHD		

Model	Page	Down Load
FEC72HL3WUHD	165	.dxf
FEC72KL3SUHD	166	.dxf
FEC92KL3SUHD		
FEC72KL3WUHD	167	.dxf
FGB72EL3SUHD	168	.dxf

9.4 Chassis cab drawings



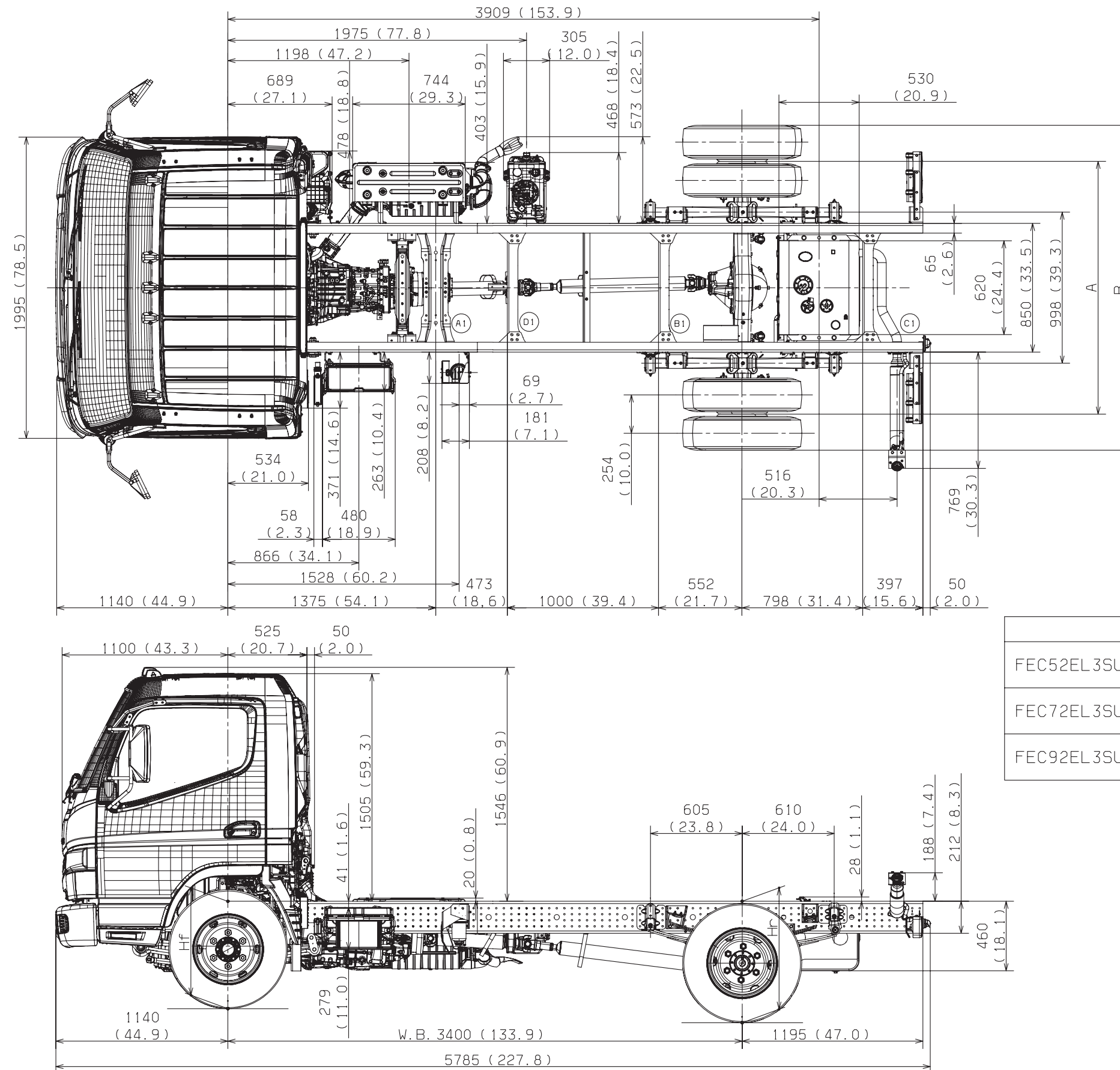
	TIRE SIZE	A	B
FEC52CL3SUHD	215/85R16	1660 (65.4)	2143 (84.4)
FEC72CL3SUHD	215/75R17.5	1670 (65.7)	2144 (84.4)
FEC92CL3SUHD			

CHASSIS CAB
DRAWINGS

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



9.4 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			

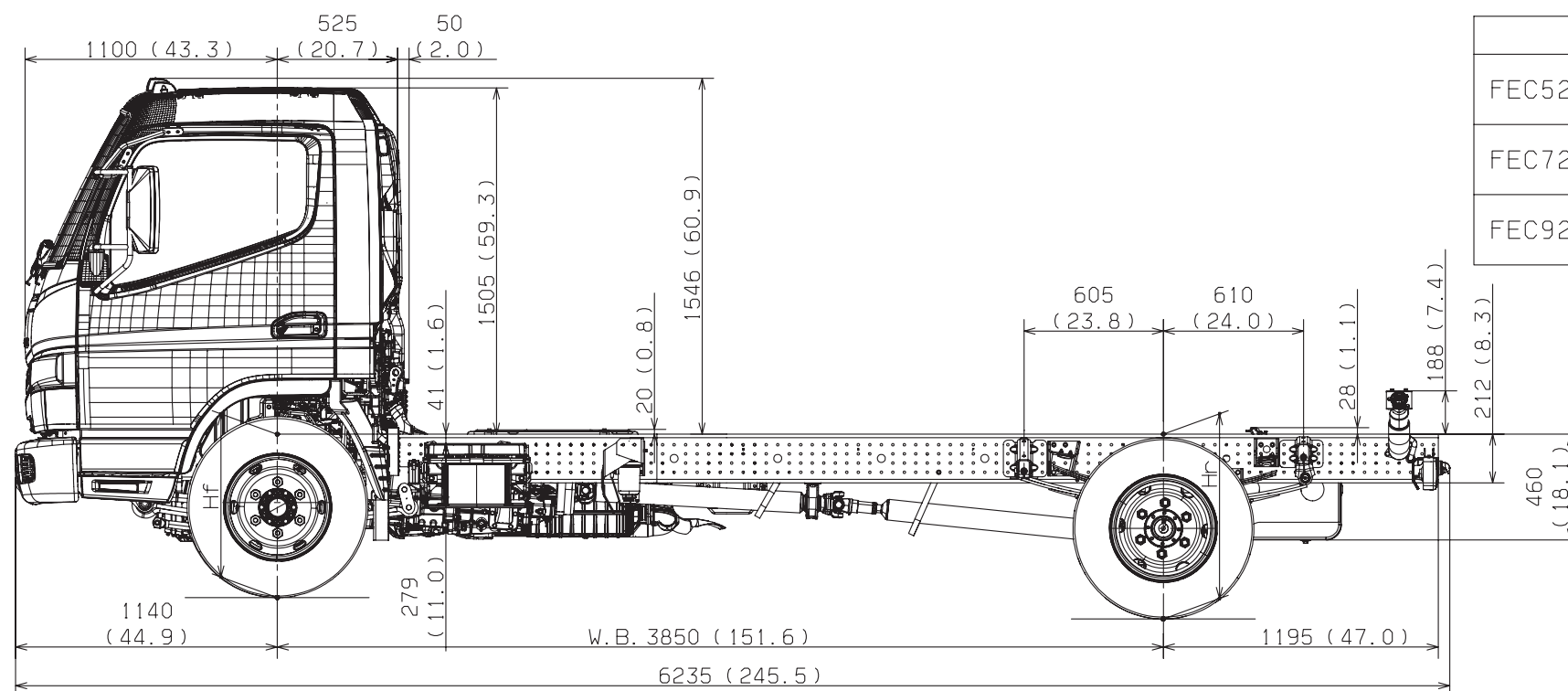
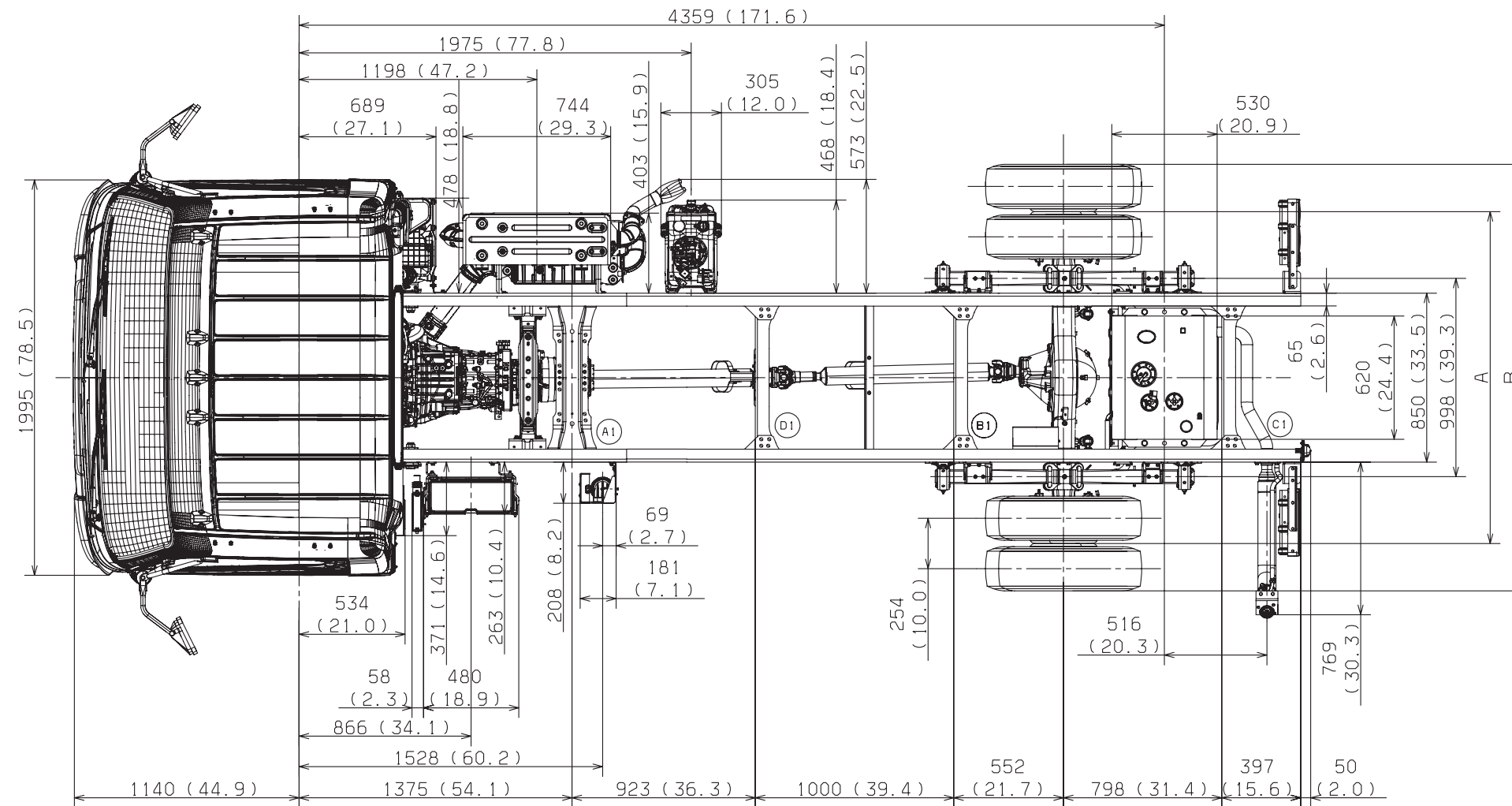
CHASSIS CAB
DRAWINGS

FEC52EL3SUHD
FEC72EL3SUHD
FEC92EL3SUHD

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



9.4 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			

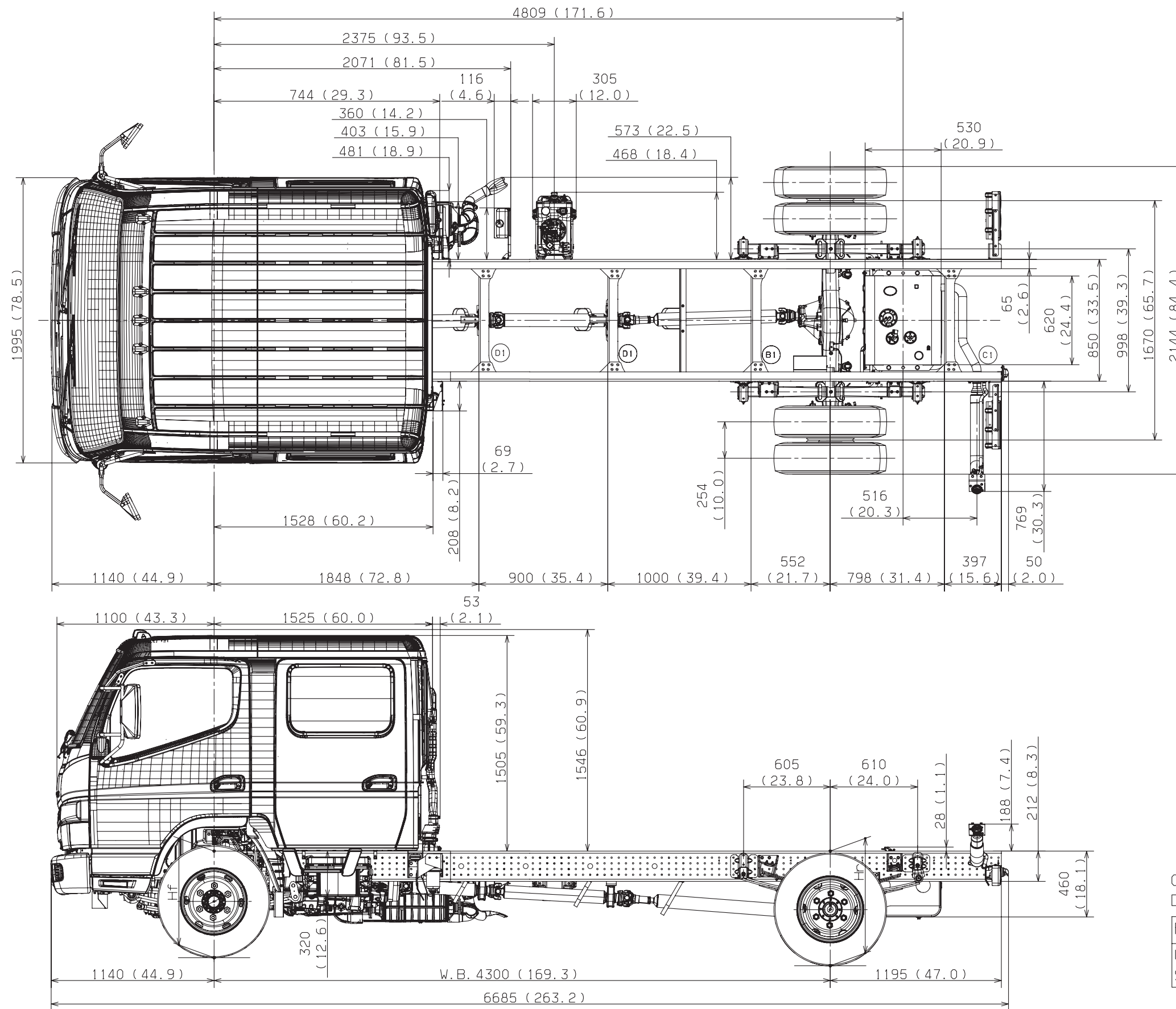
CHASSIS CAB
DRAWINGS

FEC52GL3SUHD
FEC72GL3SUHD
FEC92GL3SUHD

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



9.4 Chassis cab drawings



CHASSIS CAB
DRAWINGS

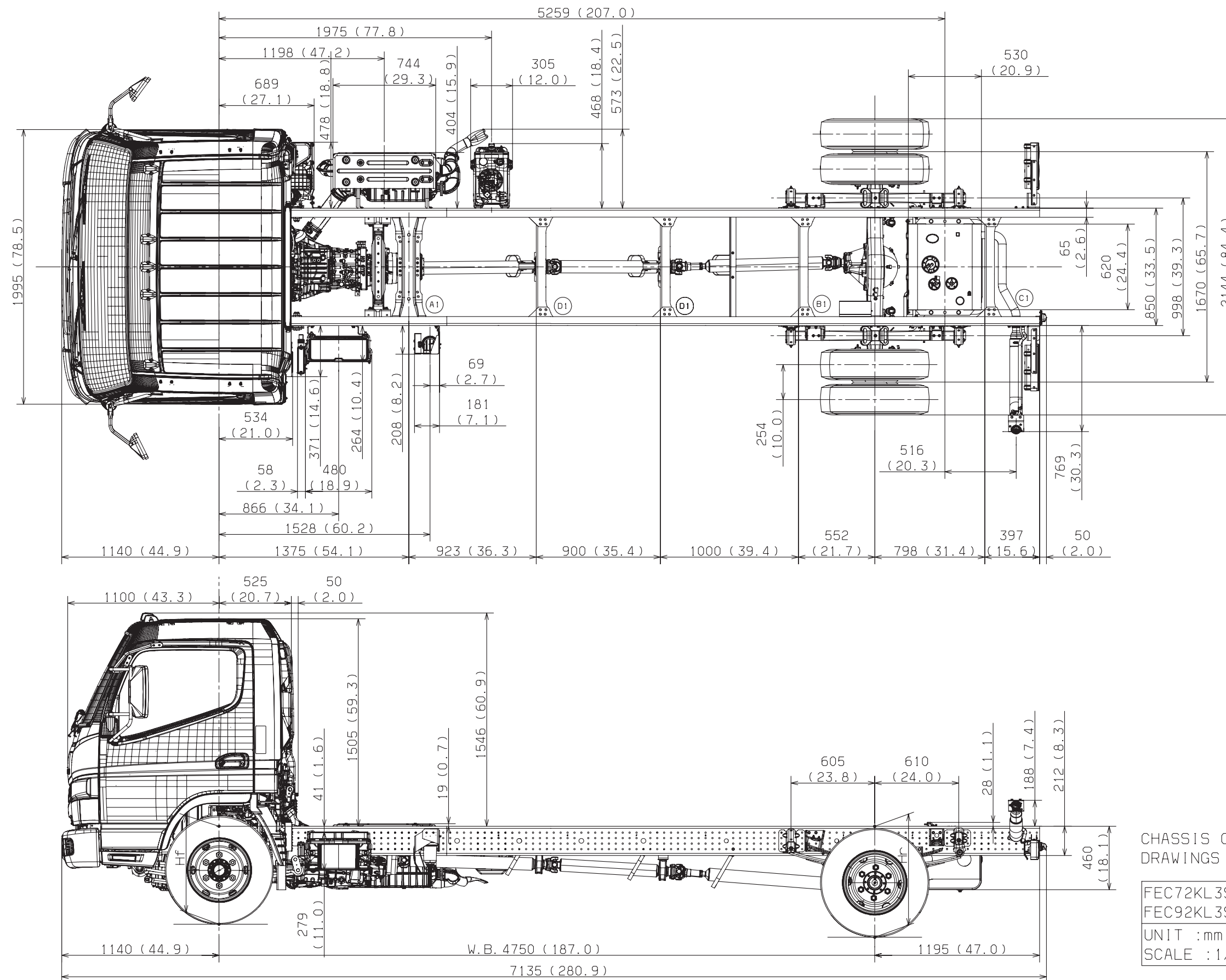
FEC72HL3WUHD

UNIT :mm(in.)

SCALE :1/30



9.4 Chassis cab drawings



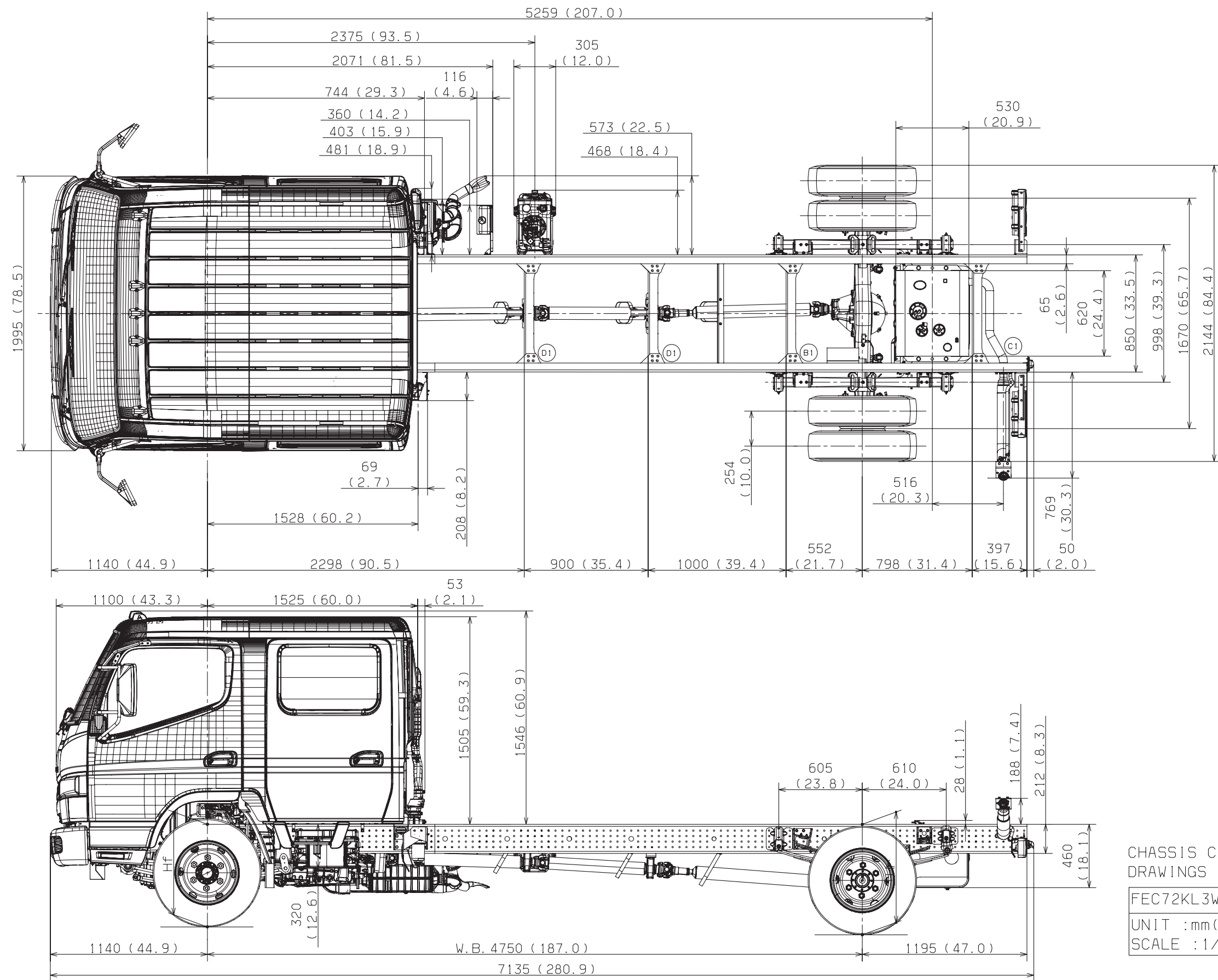
CHASSIS CAB
DRAWINGS

FEC72KL3SUHD
FEC92KL3SUHD

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



9.4 Chassis cab drawings



CHASSIS CAB
DRAWINGS

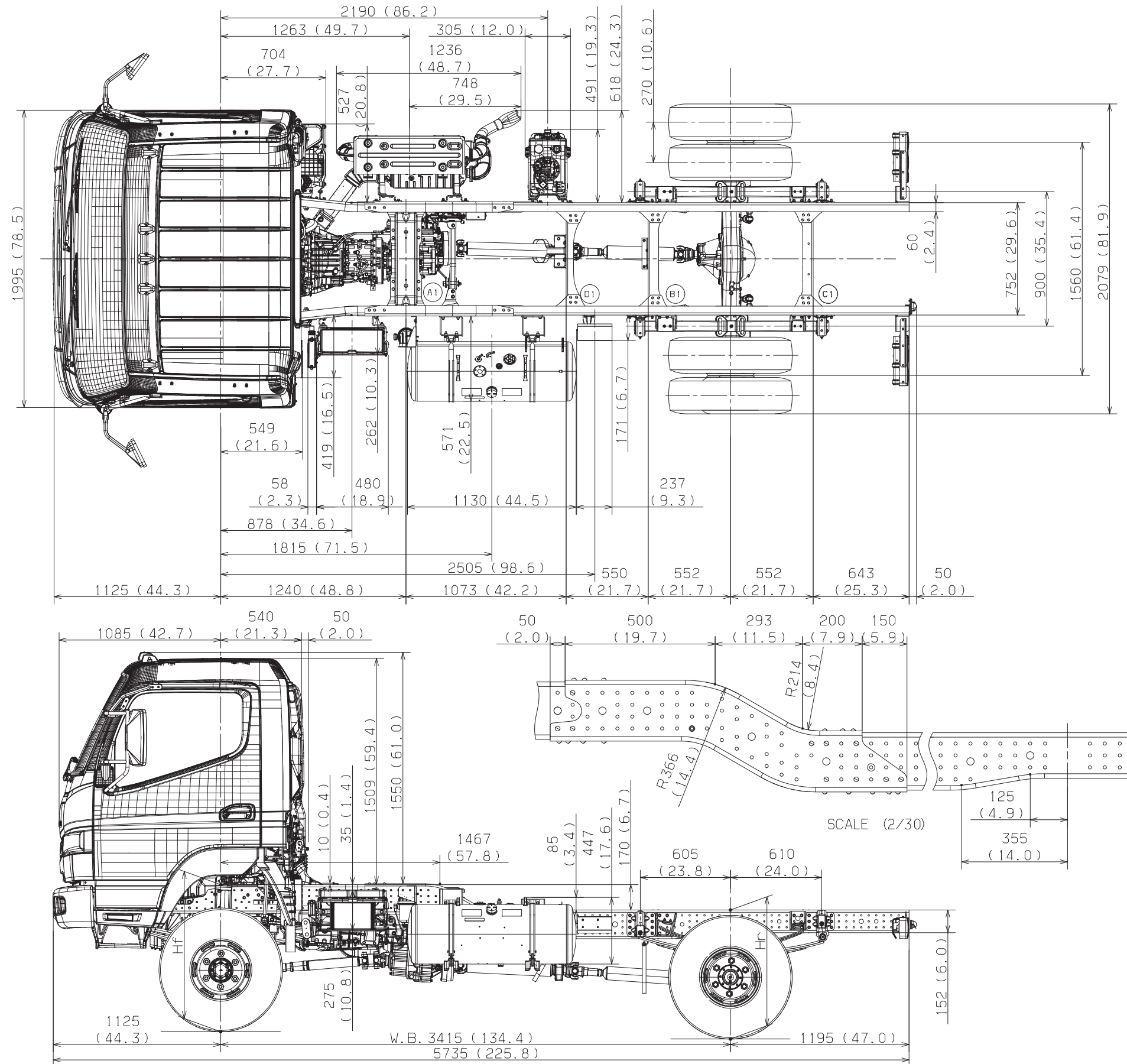
FEC72KL3WUHD

UNIT :mm(in.)

SCALE :1/30



9.4 Chassis cab drawings



CHASSIS CAB
DRAWINGS

FGB72EL3SUHD

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



9.4.2 Cab front & Rear view

***PDF FILE -view file, unable to edit- ***

PDF files of Cab front & Rear view will be shown on clicking the Model name in left bookmark.

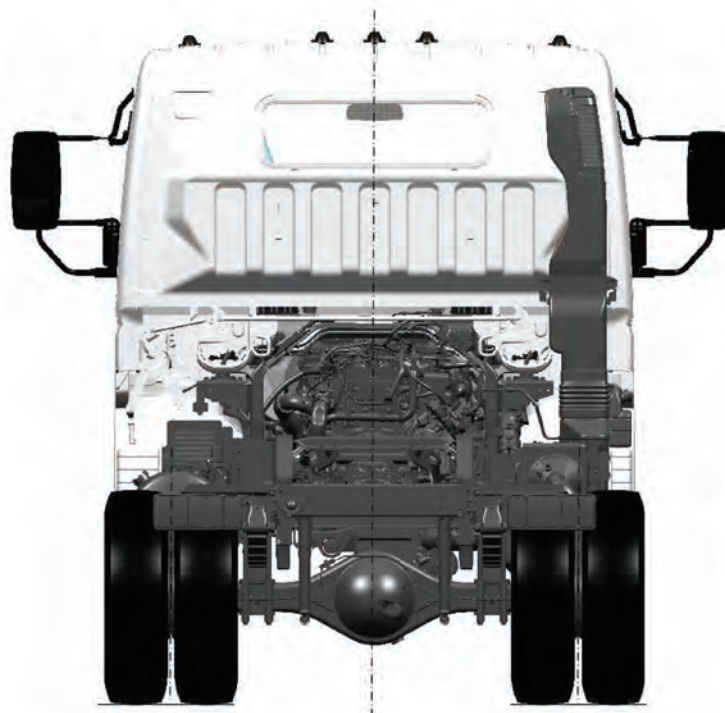
Model	Page
FEC52CL3SUHD	170
FEC52EL3SUHD	
FEC52GL3SUHD	
FEC72CL3SUHD	
FEC72EL3SUHD	
FEC72GL3SUHD	
FEC72HL3SUHD	
FEC72KL3SUHD	
FEC92CL3SUHD	
FEC92EL3SUHD	
FEC92GL3SUHD	
FEC92HL3SUHD	
FEC92KL3SUHD	
FEC72HL3WUHD	
FEC72KL3WUHD	
FGB72EL3SUHD	172



Single cab



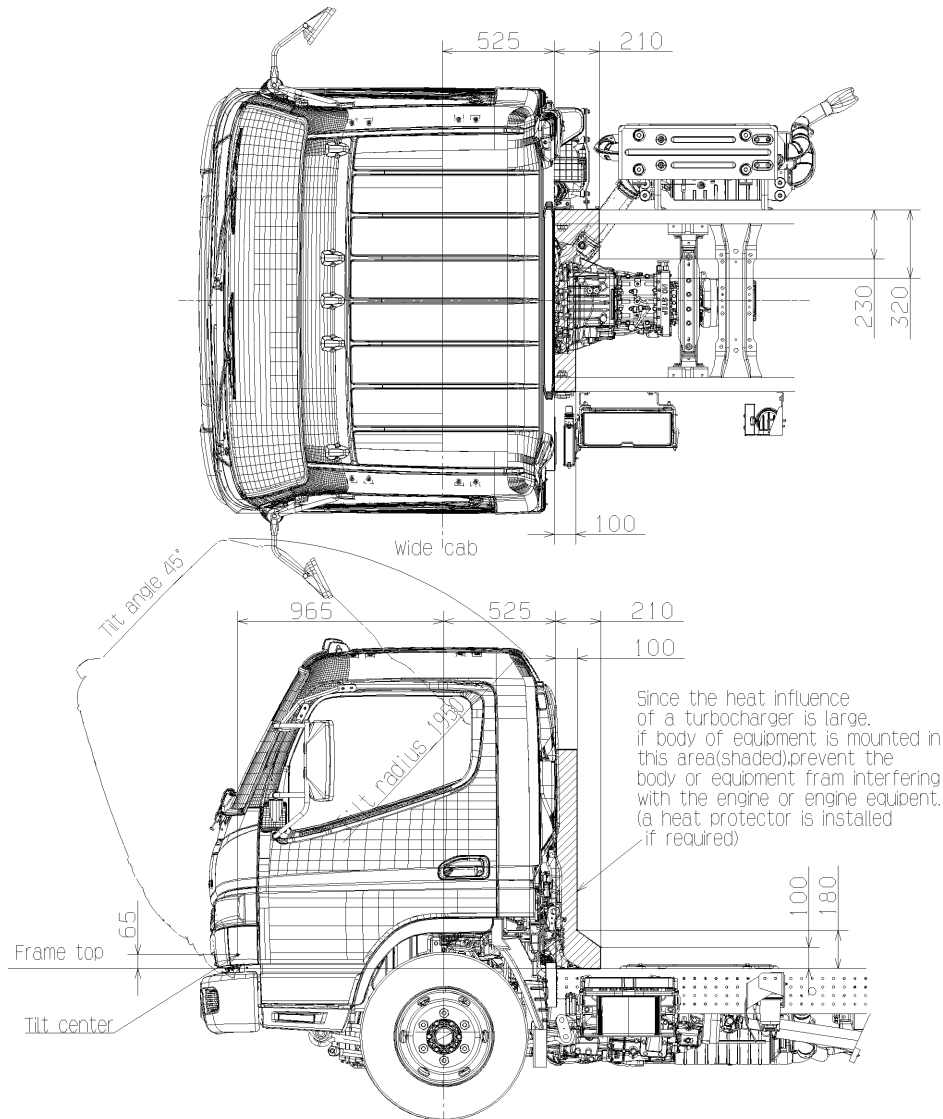
Crew cab

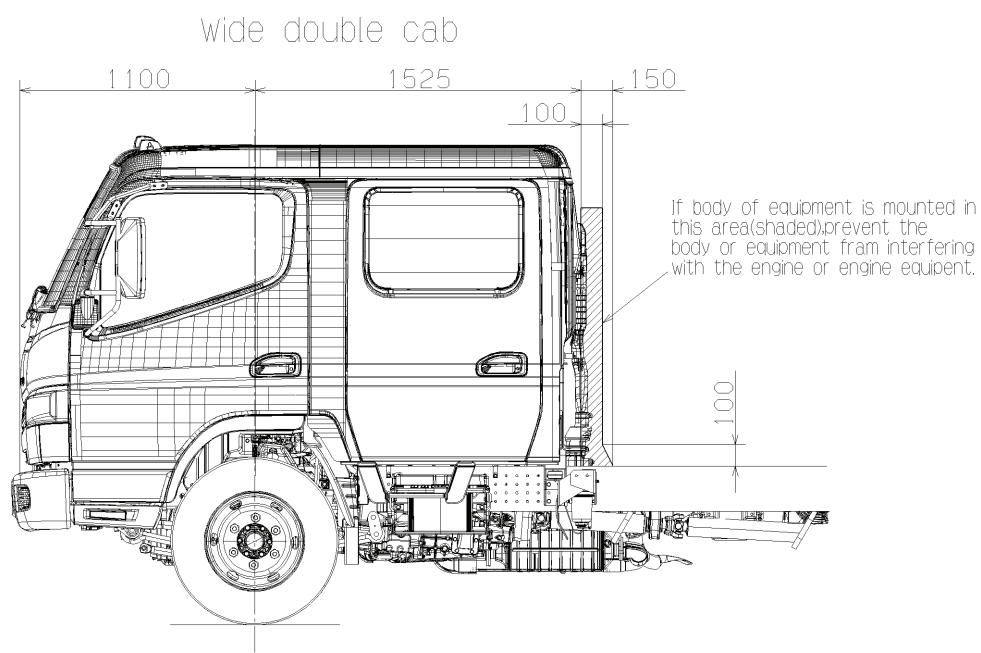


Single cab



9.4.3 Cab side view





9.5 Frame layout

***PDF FILE -view file, unable to edit- ***

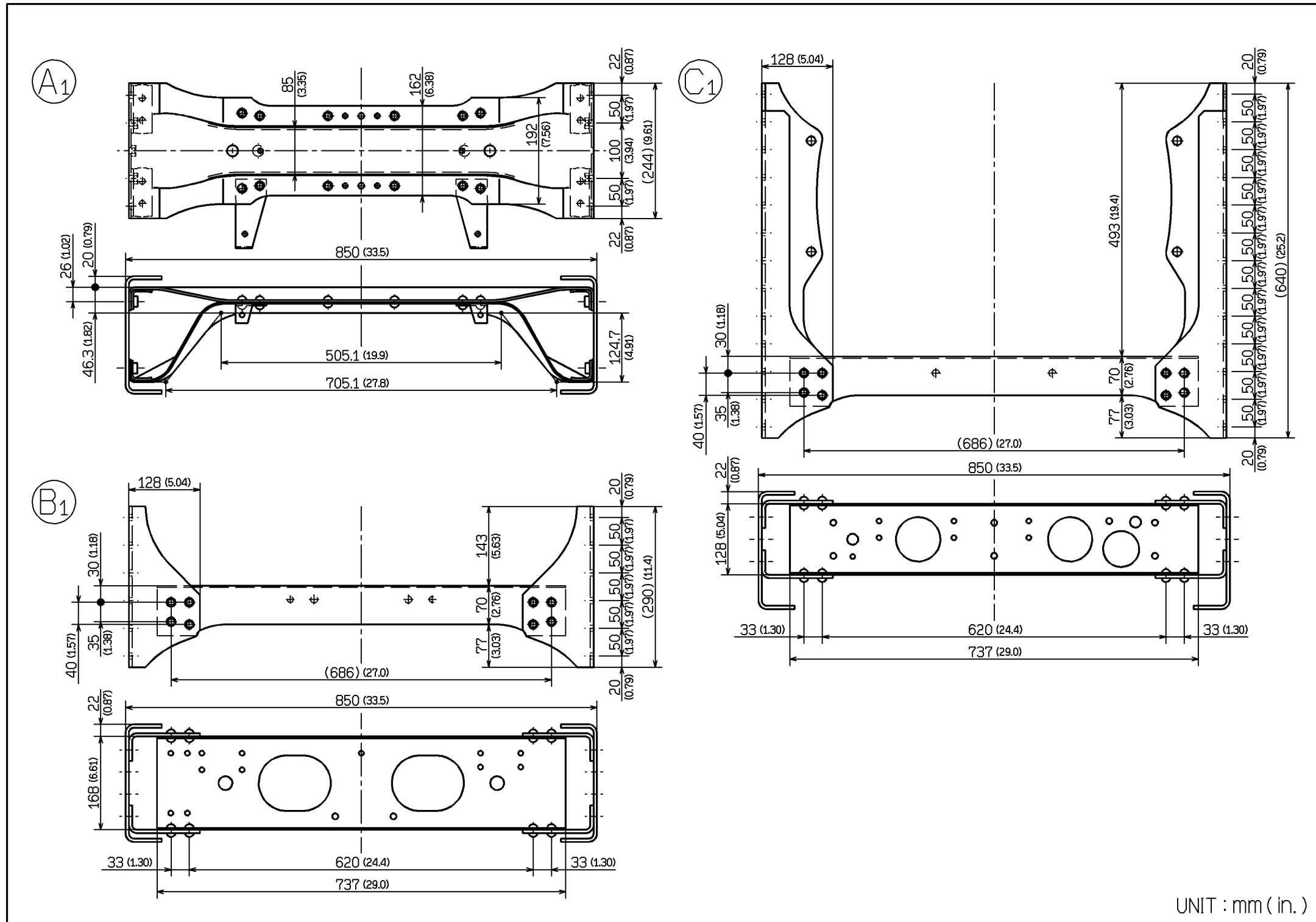
PDF files of Frame Layout & Frame Section Drawing. will be shown on clicking the Model name or Section name in left bookmark.

9.5.1 Frame section drawing

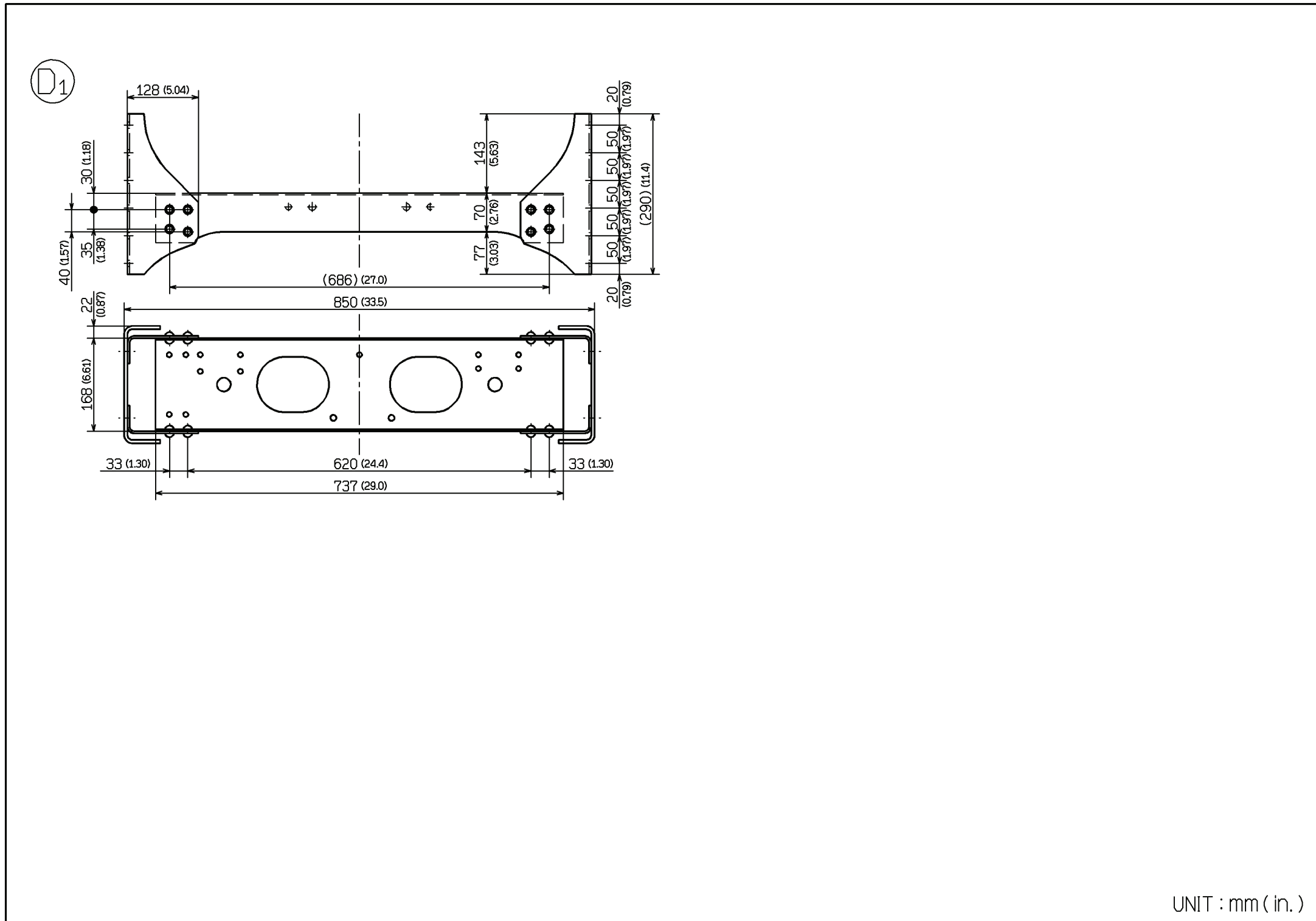
Model	Section	Page	Down Load
FE	A-A, B-B, C-C	176	.dxf
	D-D	177	.dxf
FG	A-A, D-D	178	.dxf



9.5 Frame layout

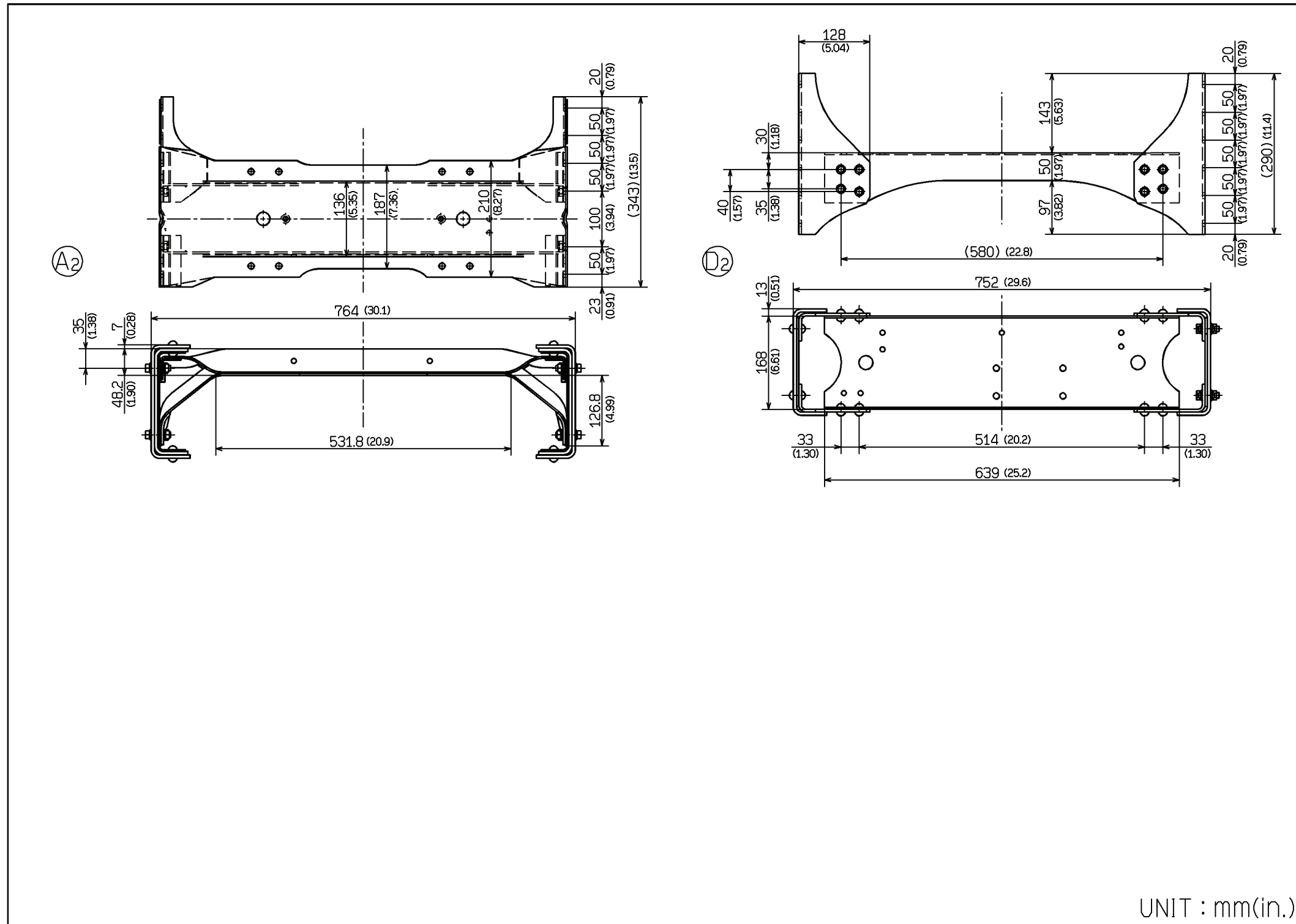


9.5 Frame layout



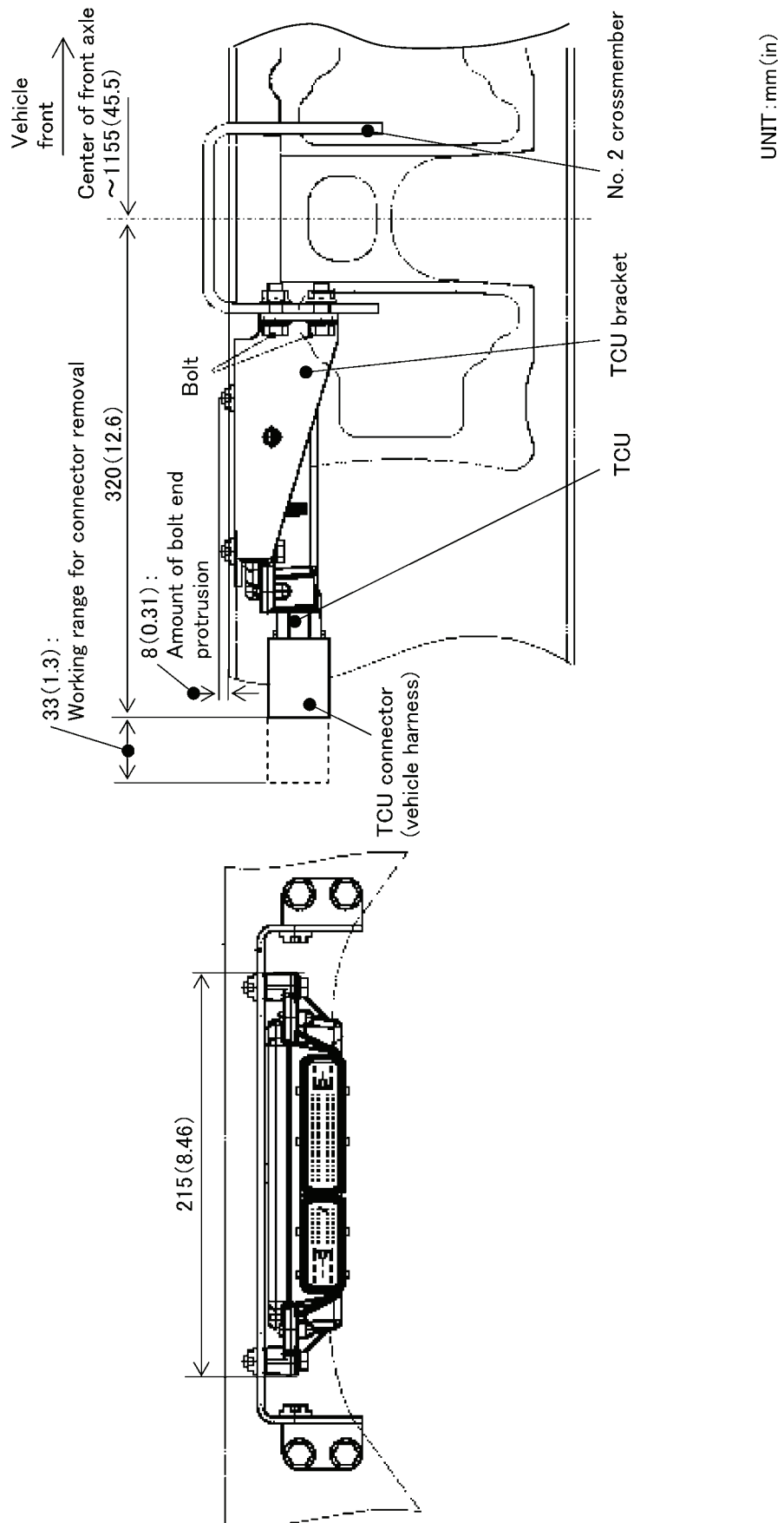
9.5 Frame layout

A



9.5.2 TCU installation drawing

Auxiliary equipment installation drawing

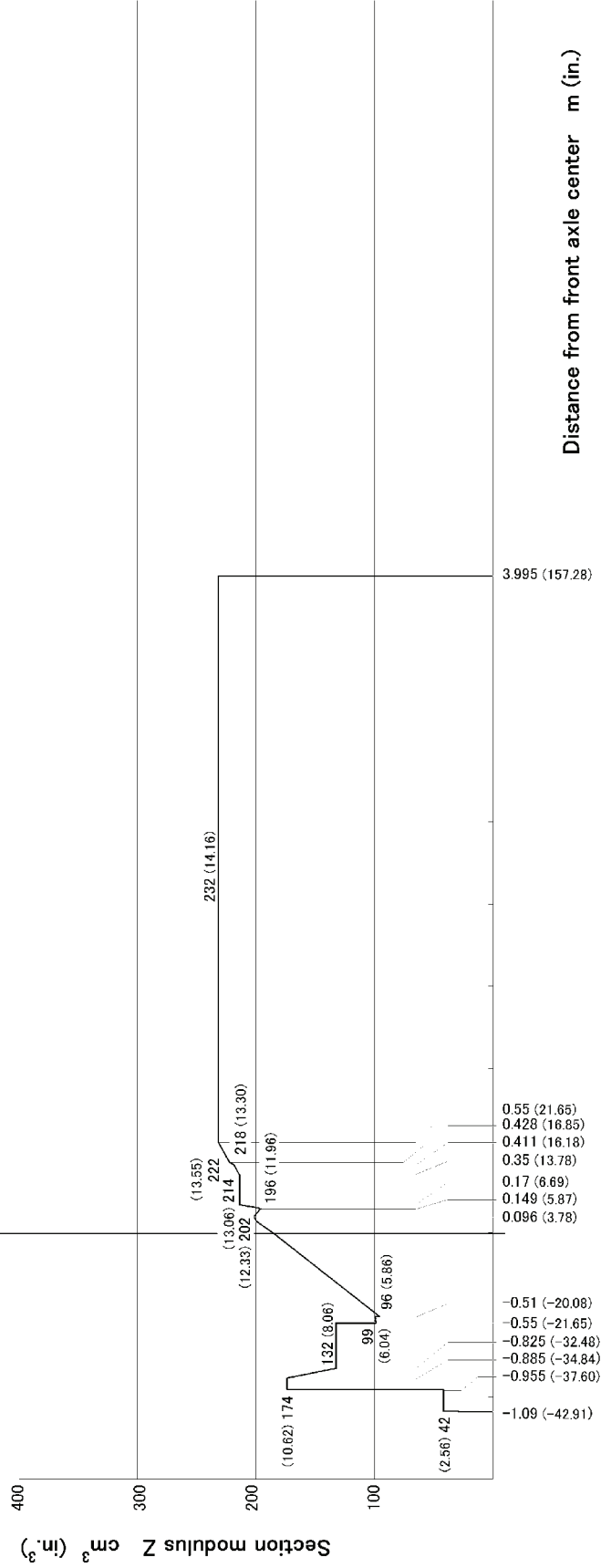
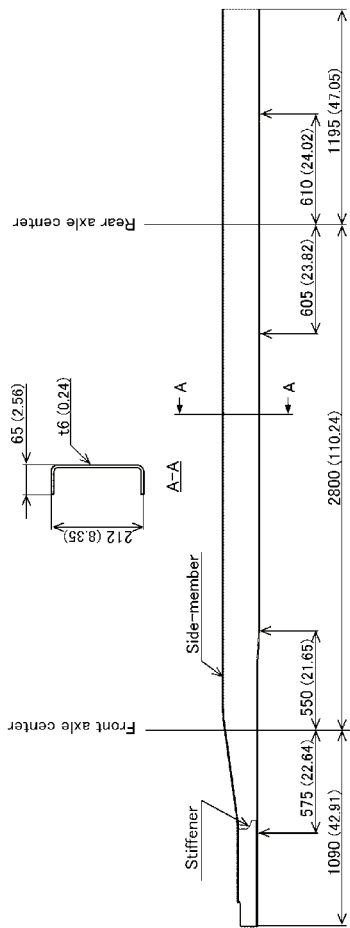


9.5.3 Frame section module

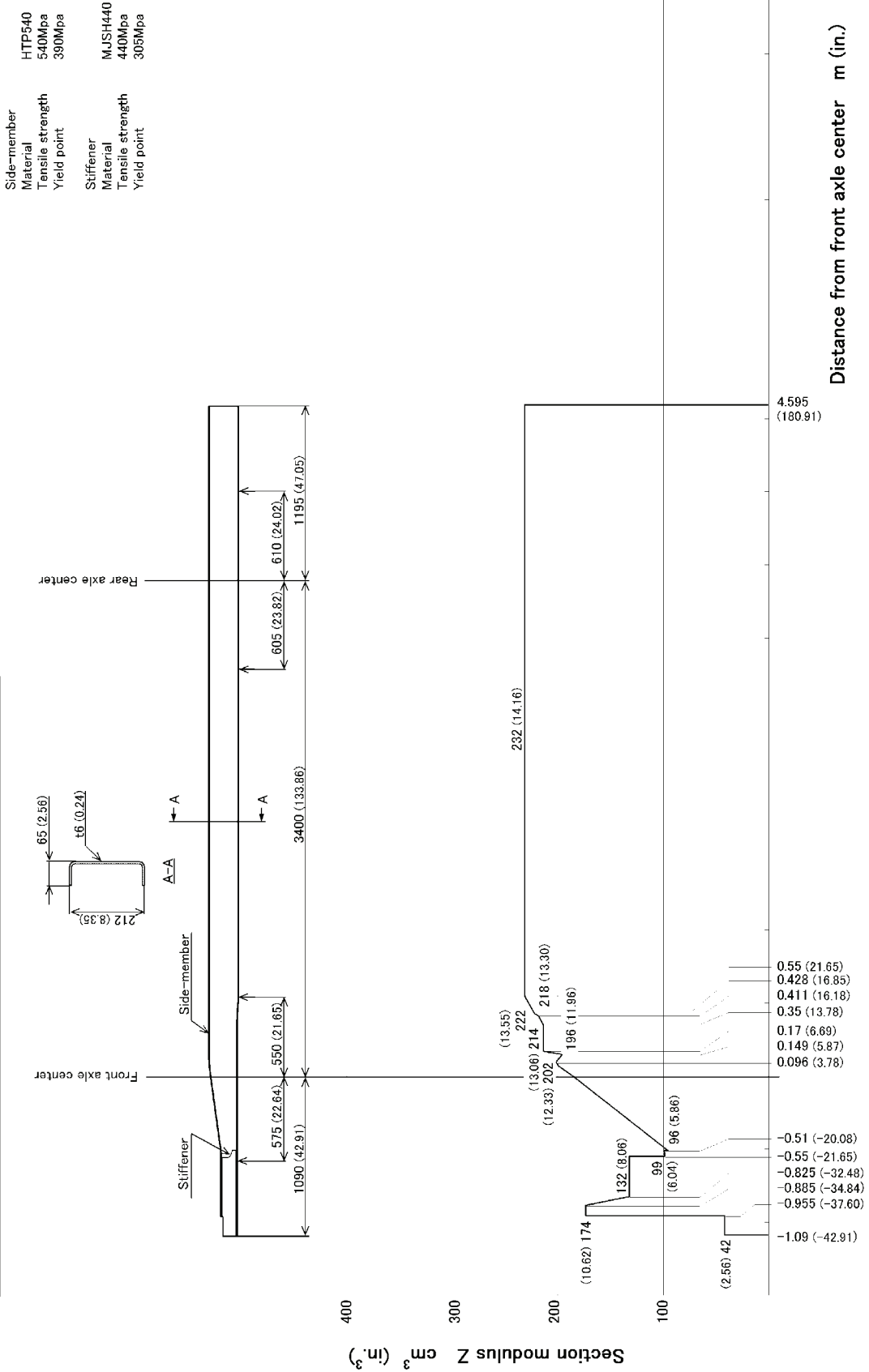
Model	Page
FEC□2C	181
FEC□2E	182
FEC□2G	183
FEC□2H	184
FEC□2K	185
FGB□2E	186

Model FEC□2C Chassis frame section modulus

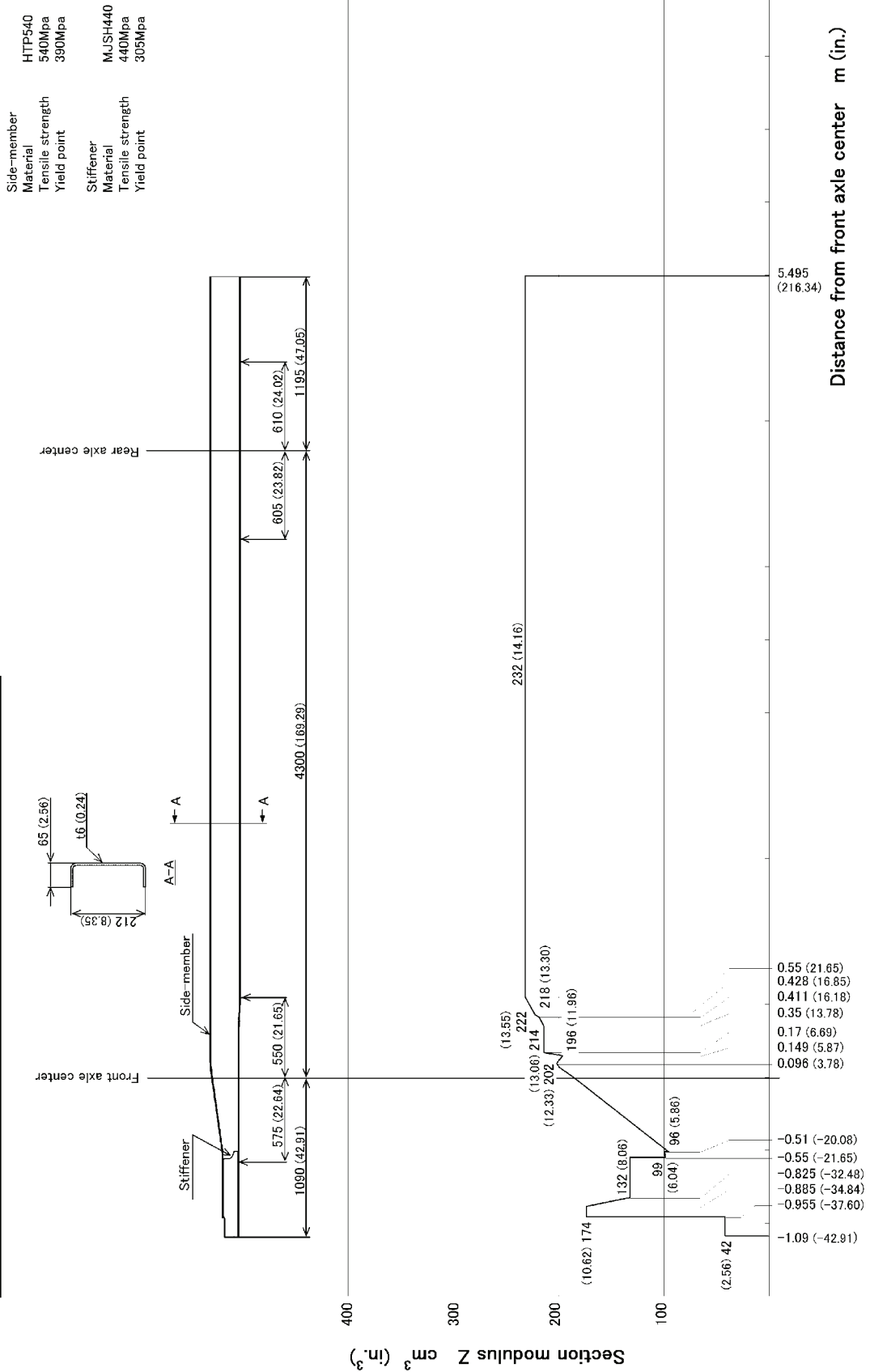
Side-member	HTP540
Material	540Mpa
Tensile strength	390Mpa
Yield point	
Stiffener	MJSH440
Material	440Mpa
Tensile strength	305Mpa
Yield point	



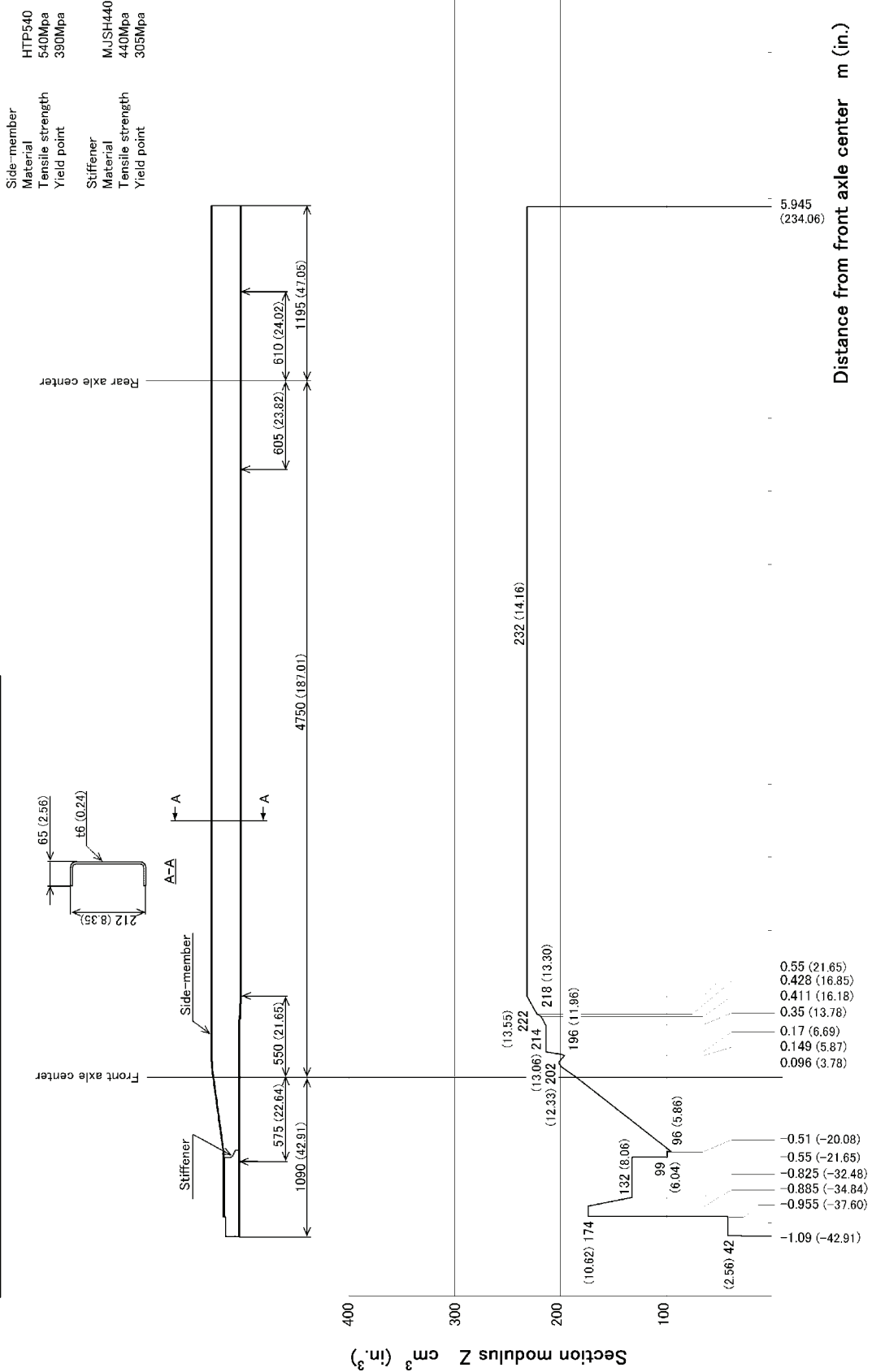
Model FEC□2E Chassis frame section modulus



Model FEC□2H Chassis frame section modulus

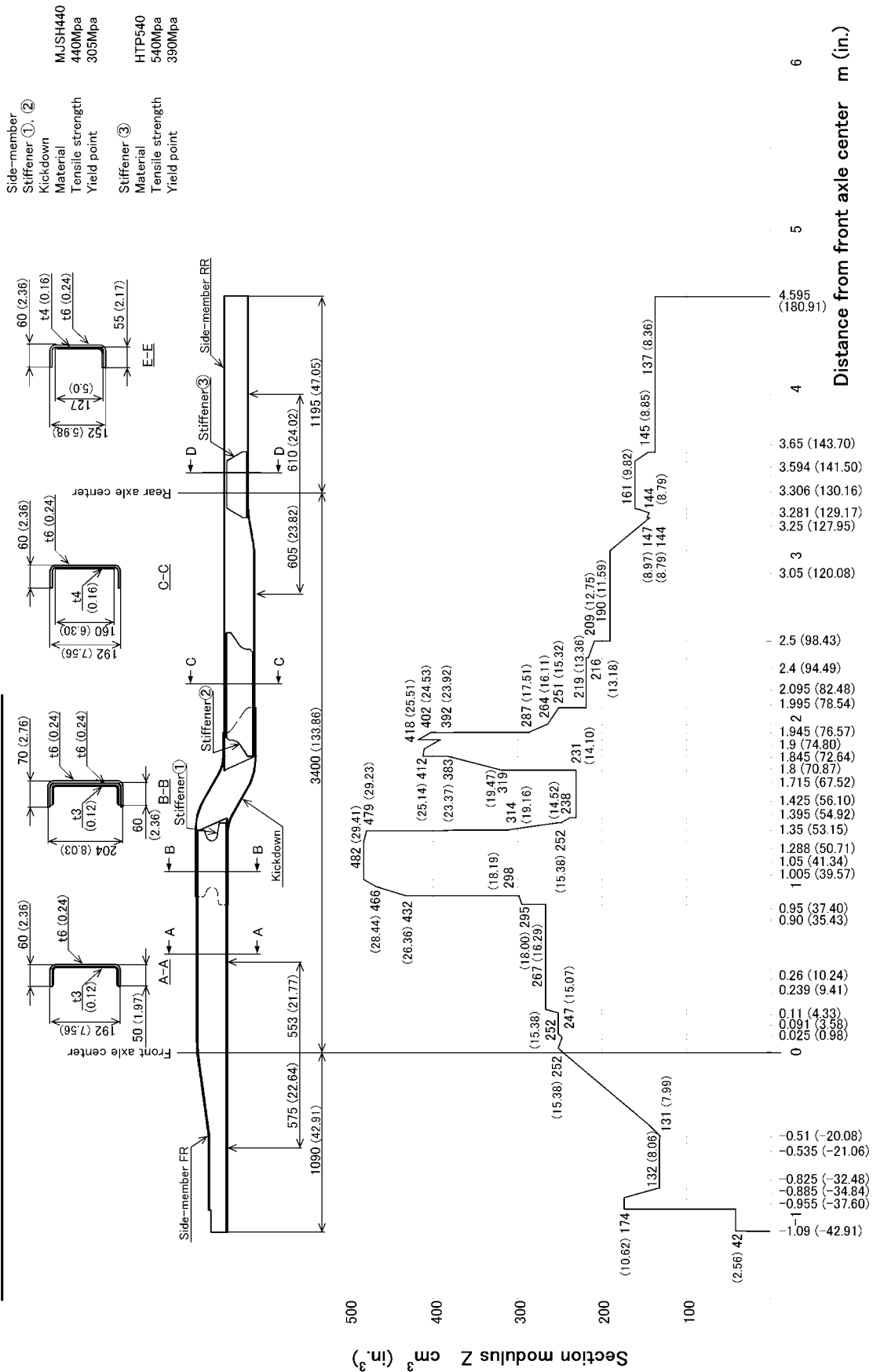


Model FEC□2K Chassis frame section modulus





Model FGB□2E Chassis frame section modulus



Side-member
Stiffener ①, ②
Kickdown
Material
Tensile strength
Yield point

MJSH440
440Mpa
305Mpa

Stiffener ③
Material
Tensile strength
Yield point

HTP540
540Mpa
390Mpa



9.6 Spring diagram

9.6.1 Distance from frame top surface to ground

MODEL	OBJECT ENGINE kW	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	1500 (3305)	840 (1850)	2340 (5155)	280 (620)	475 (1050)	705 (27.8)	798 (31.4)	610 (24.0)
FEC52EL3SUHD	120	1530 (3375)	845 (1865)	2375 (5240)	280 (620)	475 (1050)	704 (27.7)	798 (31.4)	610 (24.0)
FEC52GL3SUHD	120	1545 (3405)	845 (1865)	2390 (5270)	280 (620)	475 (1050)	703 (27.7)	798 (31.4)	610 (24.0)
FEC72CL3SUHD	120	1535 (3385)	940 (2075)	2475 (5460)	310 (685)	575 (1270)	725 (28.5)	804 (31.7)	610 (24.0)
FEC72EL3SUHD	120	1570 (3460)	945 (2085)	2515 (5545)	310 (685)	575 (1270)	723 (28.5)	804 (31.7)	610 (24.0)
FEC72GL3SUHD	120	1580 (3485)	945 (2085)	2525 (5570)	310 (685)	575 (1270)	723 (28.5)	804 (31.7)	610 (24.0)
FEC72HL3SUHD	120	1610 (3550)	945 (2085)	2555 (5635)	310 (685)	575 (1270)	722 (28.4)	804 (31.7)	610 (24.0)
FEC72KL3SUHD	120	1620 (3570)	955 (2105)	2575 (5675)	310 (685)	575 (1270)	722 (28.4)	803 (31.6)	610 (24.0)
FEC72HL3WUHD	120	1765 (3890)	1010 (2225)	2775 (6115)	310 (685)	575 (1270)	785 (30.9)	852 (33.5)	715 (28.1)
FEC72KL3WUHD	120	1780 (3925)	1015 (2240)	2795 (6165)	310 (685)	575 (1270)	785 (30.9)	852 (33.5)	715 (28.1)
FEC92CL3SUHD	120	1535 (3385)	940 (2075)	2475 (5460)	310 (685)	575 (1270)	725 (28.5)	804 (31.7)	610 (24.0)
FEC92EL3SUHD	120	1570 (3460)	945 (2085)	2515 (5545)	310 (685)	575 (1270)	723 (28.5)	804 (31.7)	610 (24.0)
FEC92GL3SUHD	120	1580 (3485)	945 (2085)	2525 (5570)	310 (685)	575 (1270)	723 (28.5)	804 (31.7)	610 (24.0)
FEC92HL3SUHD	120	1610 (3550)	945 (2085)	2555 (5635)	310 (685)	575 (1270)	722 (28.4)	804 (31.7)	610 (24.0)
FEC92KL3SUHD	120	1620 (3570)	955 (2105)	2575 (5675)	310 (685)	575 (1270)	722 (28.4)	803 (31.6)	610 (24.0)
FGB72EL3SUHD	120	1780 (3925)	835 (1840)	2615 (5765)	400 (880)	540 (1190)	990 (39.0)	892 (35.1)	740 (29.1)



Method of calculating Hf, Hr

Hf=hf+Rf : Frame height, Front See Chapter 9.4.1

Hr=hr+Rr : Frame height, Rear

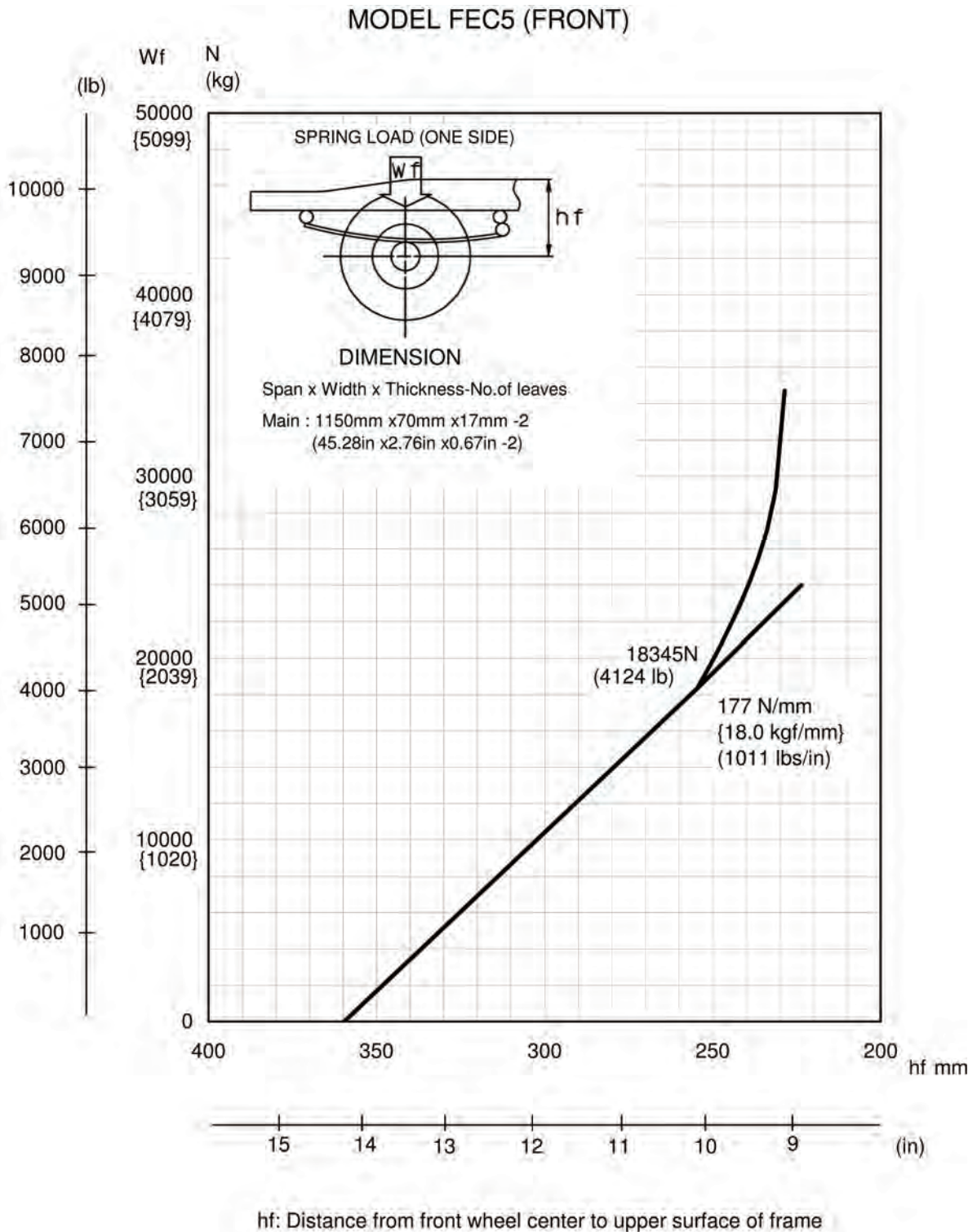
hf : Distance from frame top to front wheel center (See drawings or following page 188.)

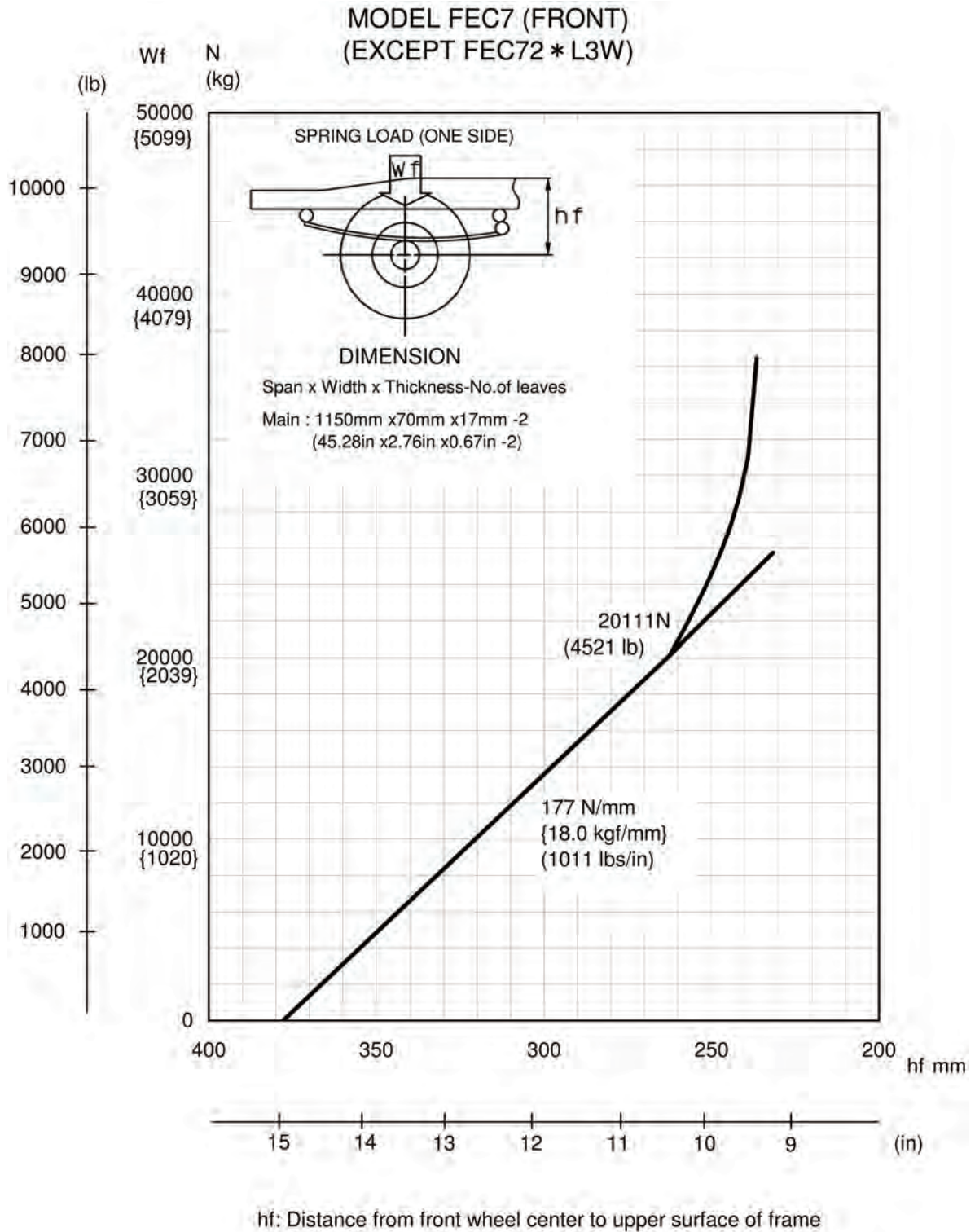
hr : Distance from frame top to rear wheel center (See drawings or following page 193.)

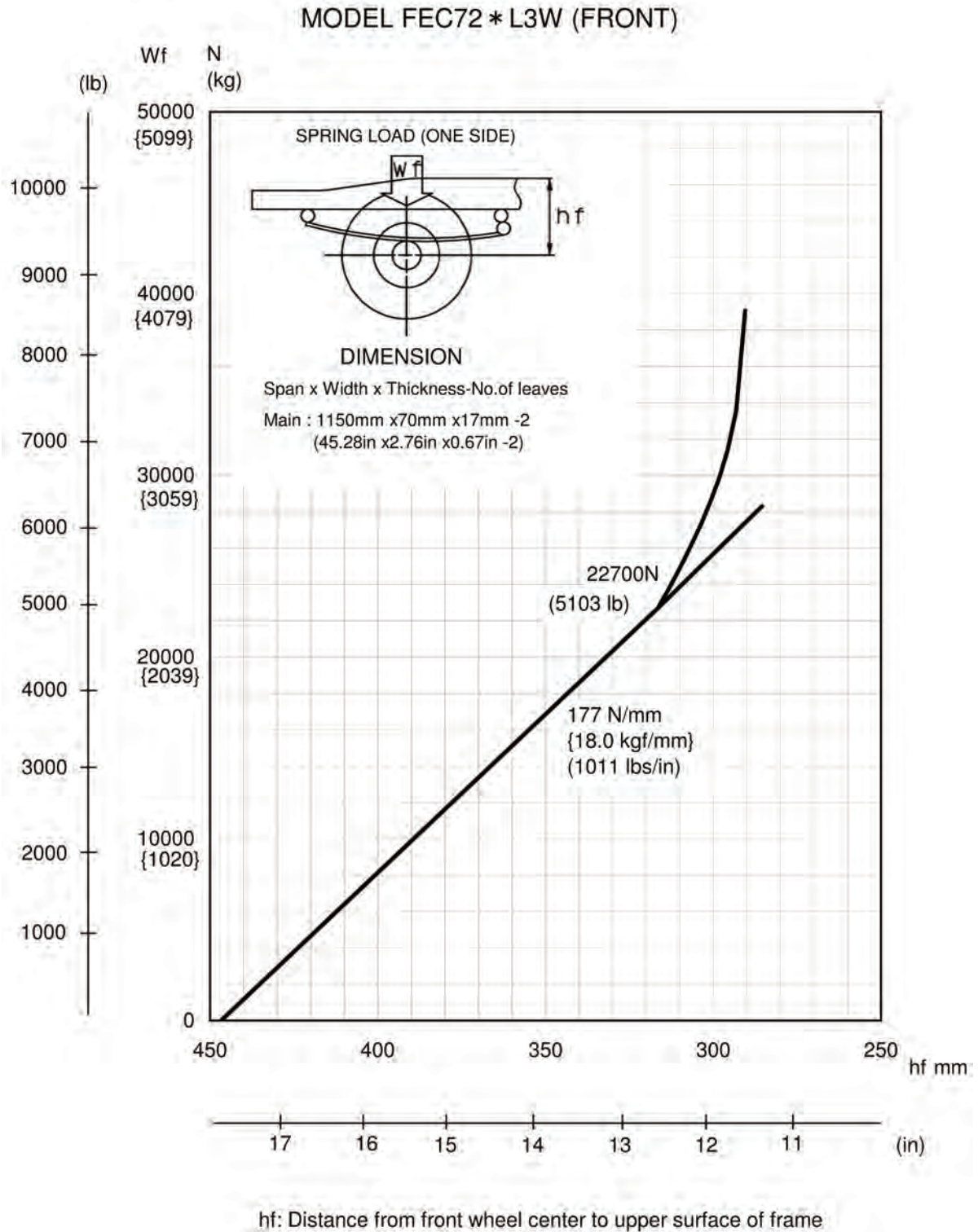
Rf, Rr : Tire radius (See drawings or following page 198.)

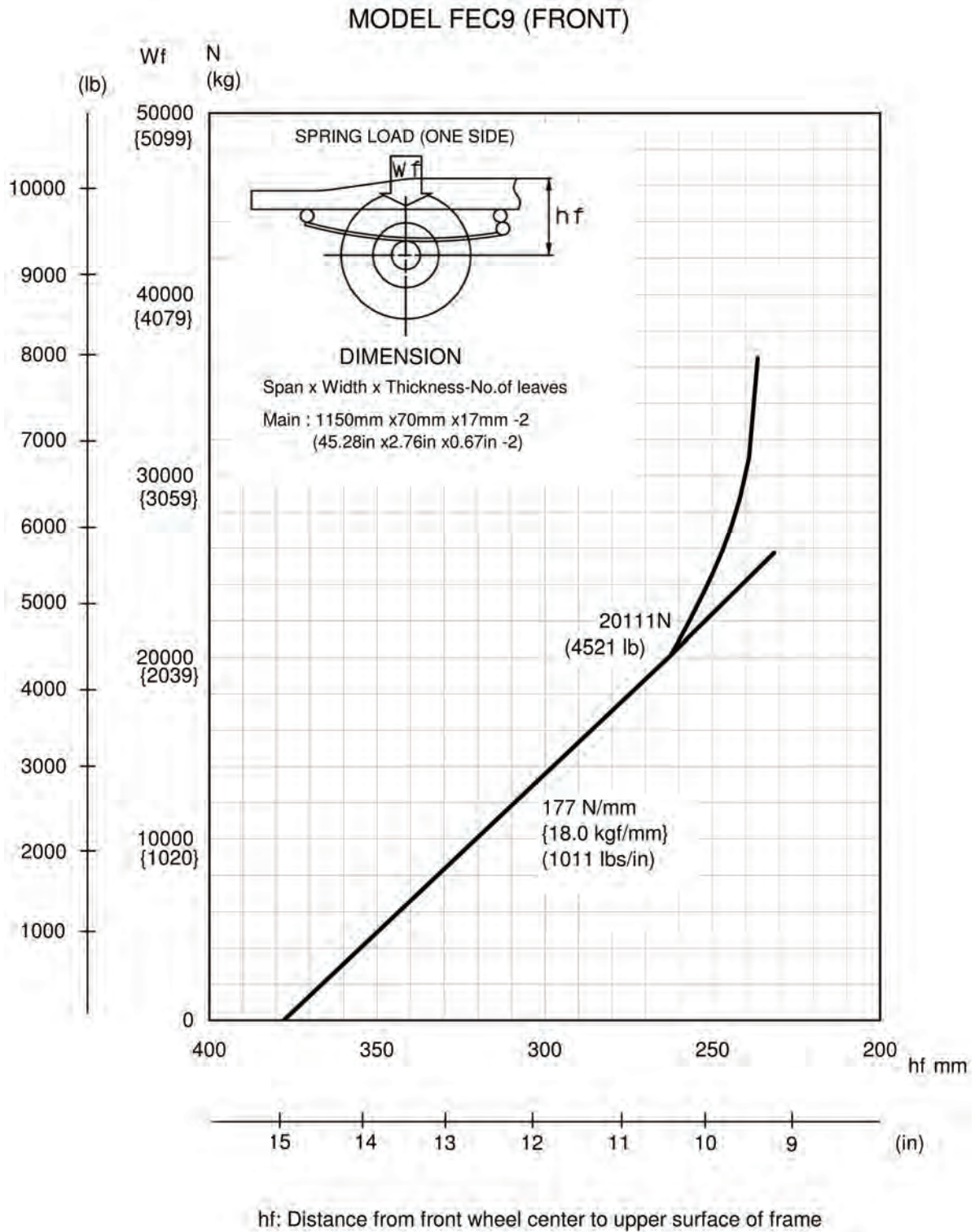


9.6.2 Front spring diagram



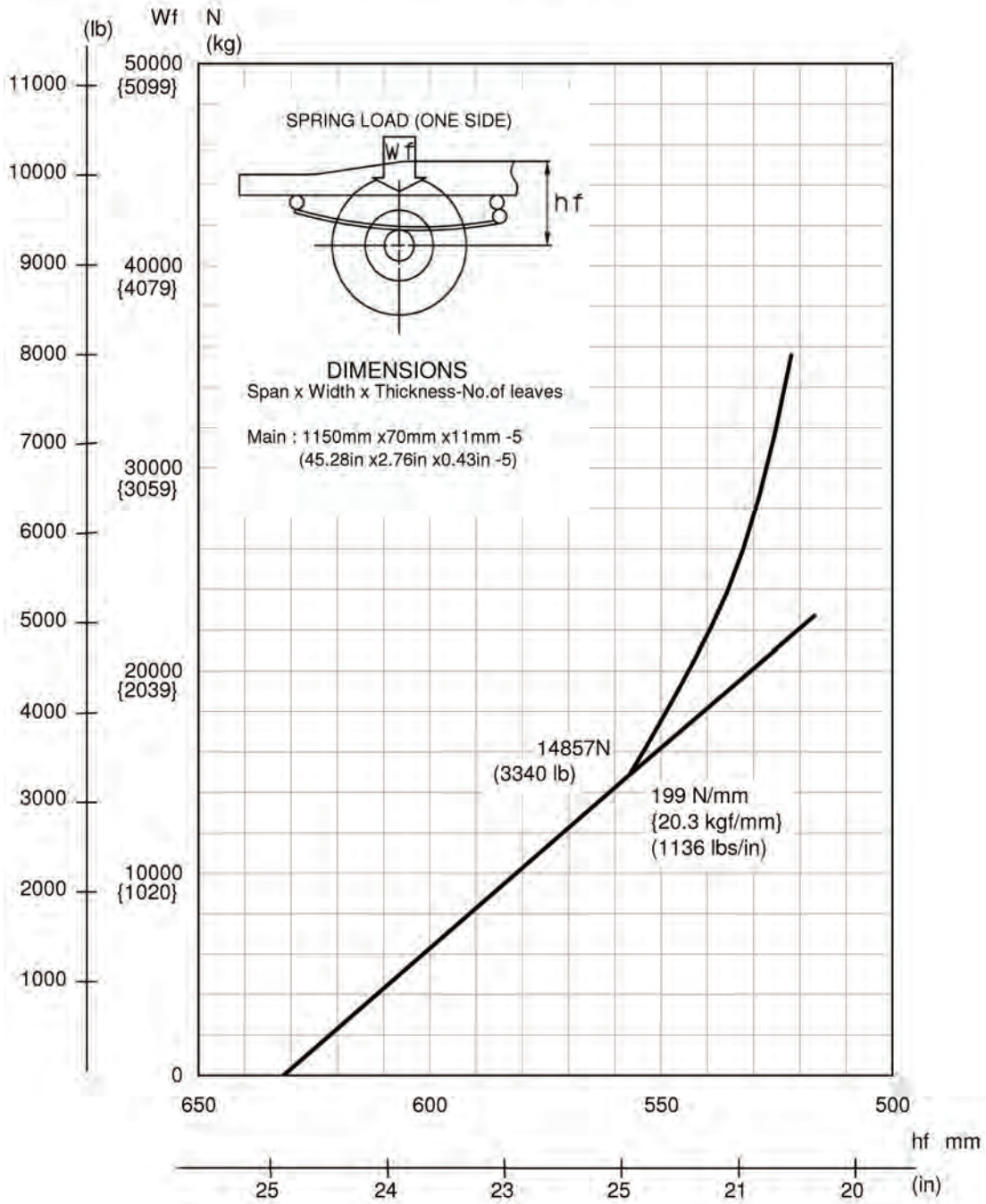








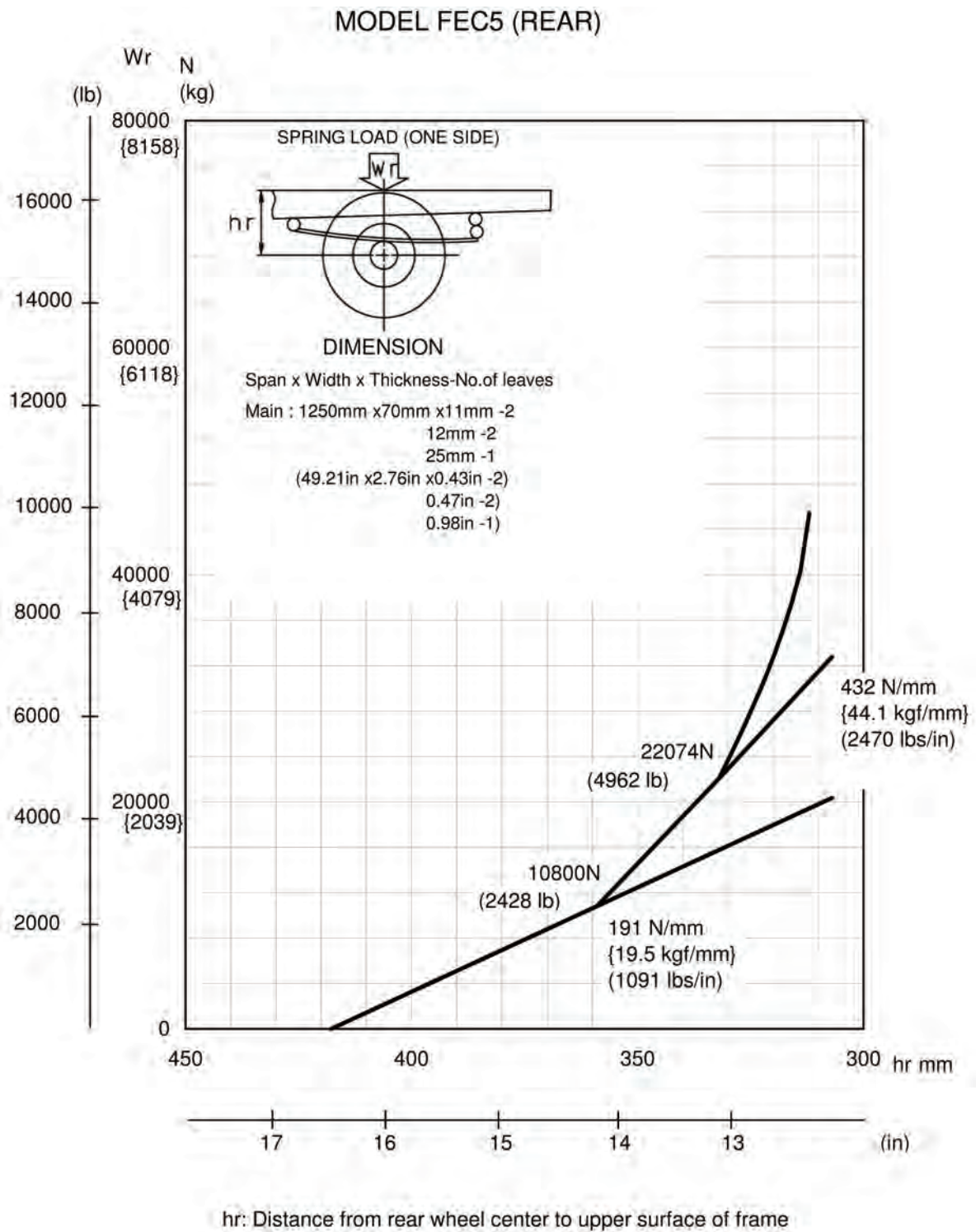
MODEL FGB7 (FRONT)

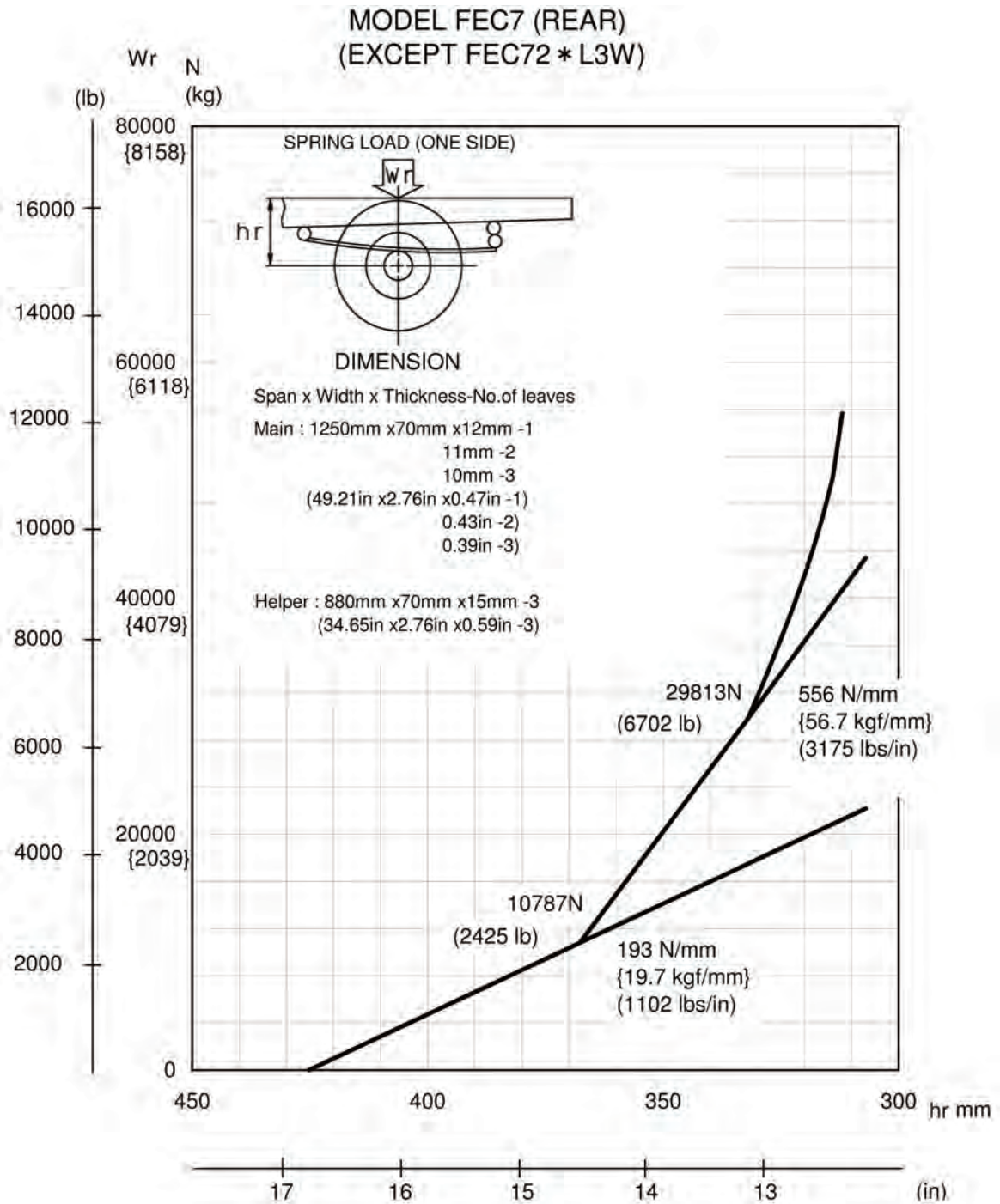


hf: Distance from front wheel center to upper surface of frame



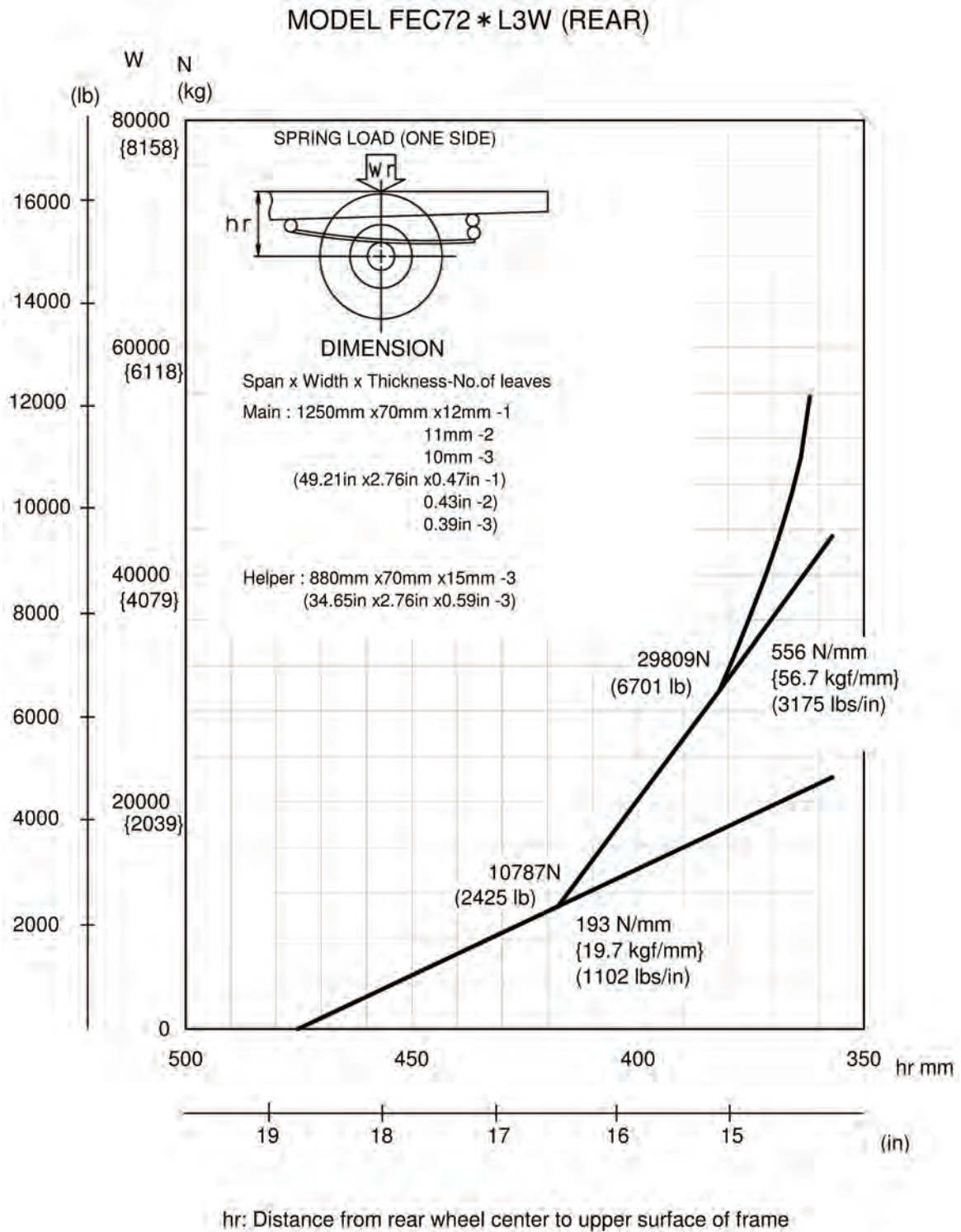
9.6.3 Rear spring diagram

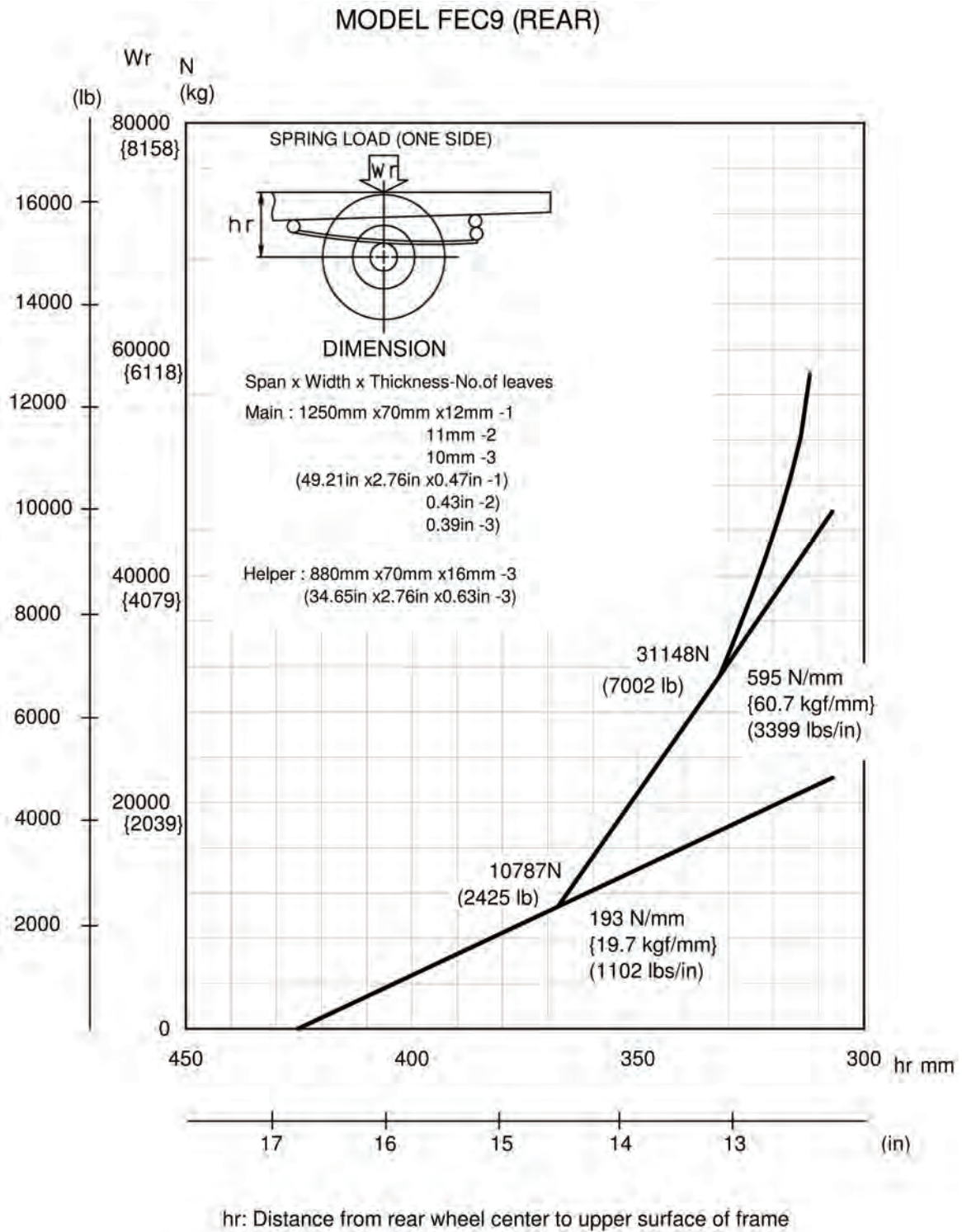




hr: Distance from rear wheel center to upper surface of frame

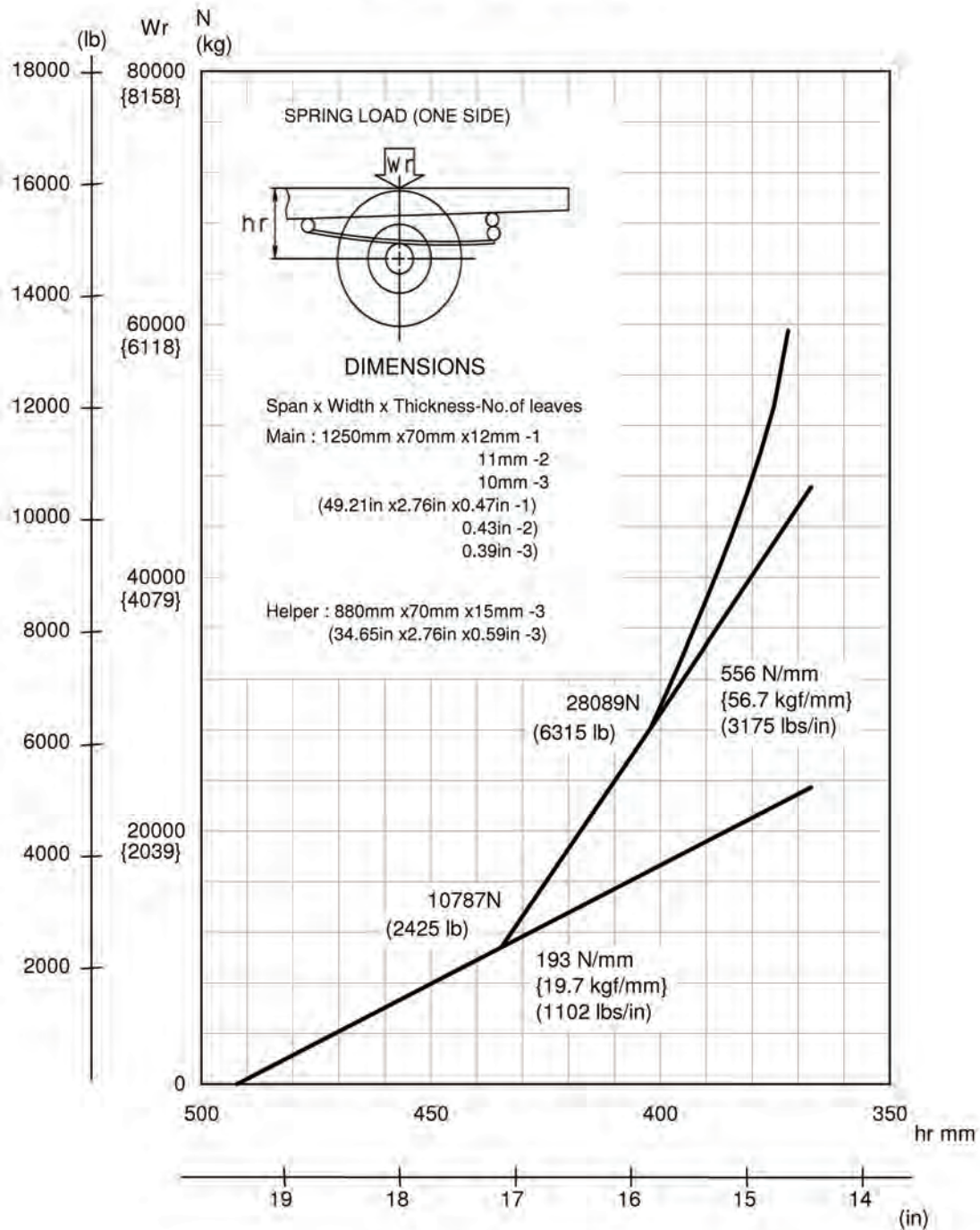








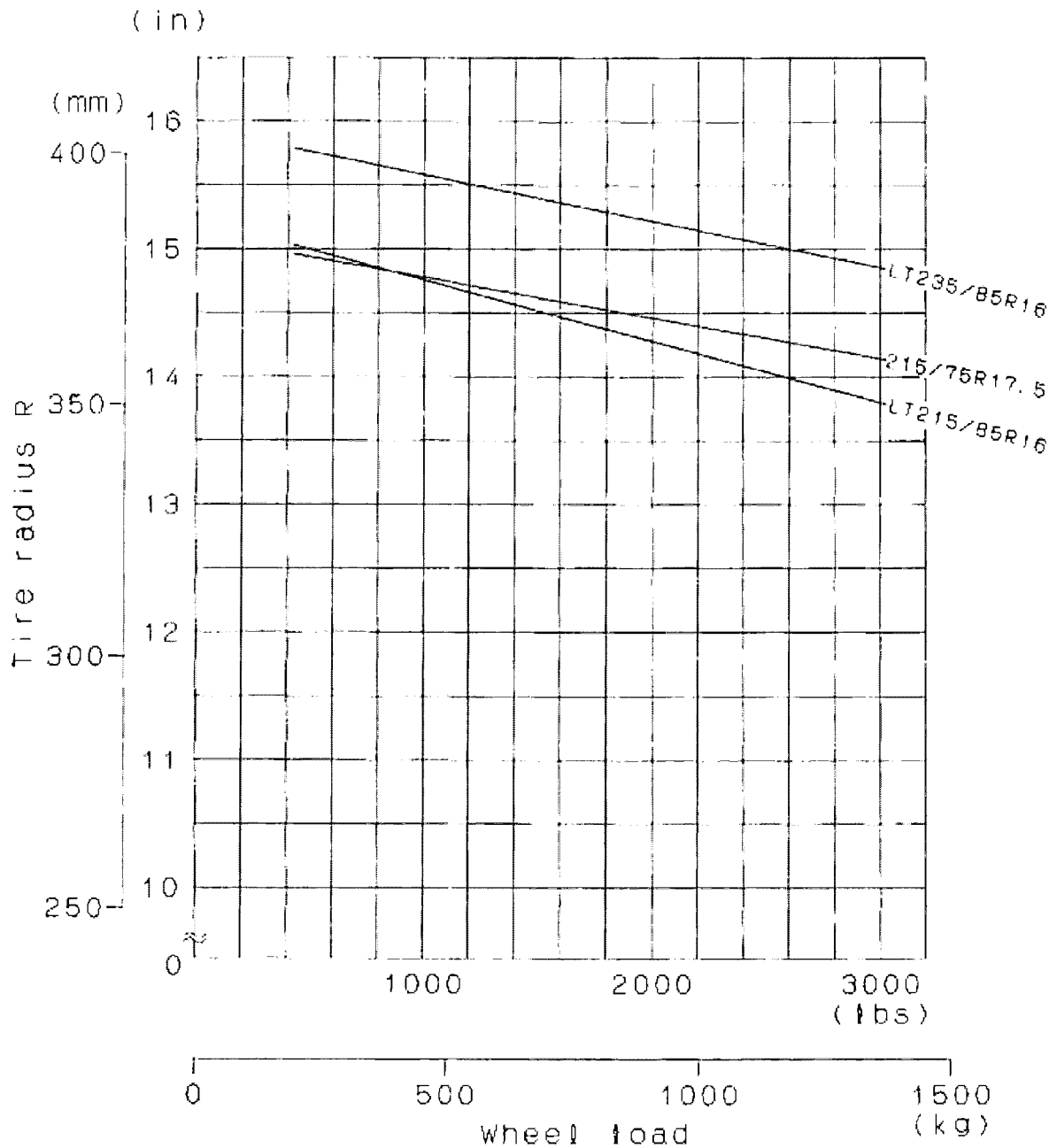
MODEL FGB7 (REAR)



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



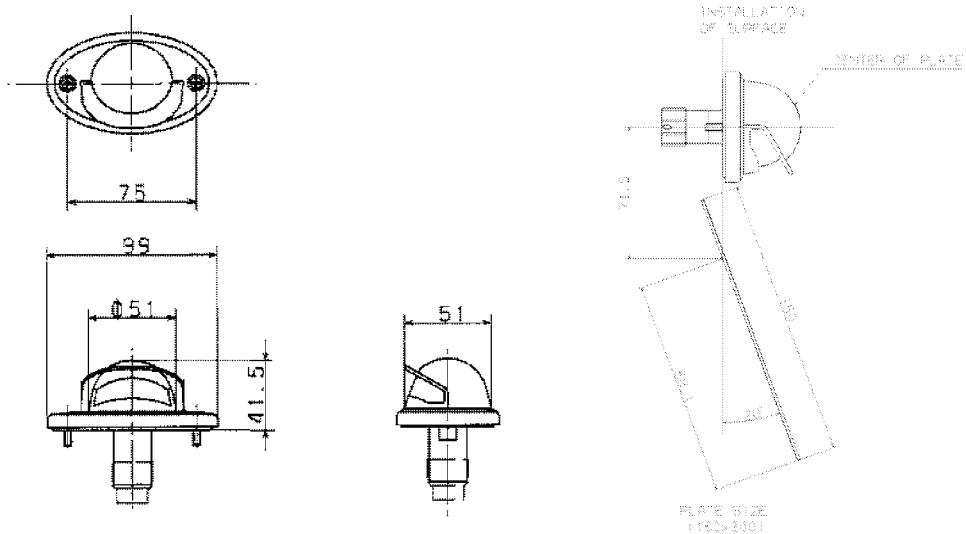
9.6.4 Tire radius calculating diagram



Single tire: Front-tire distributed load/2

Double tire: Rear-tire distributed load/4

9.7.2 License plate lamp



9.8 Power train

9.8.1 Powertrain list

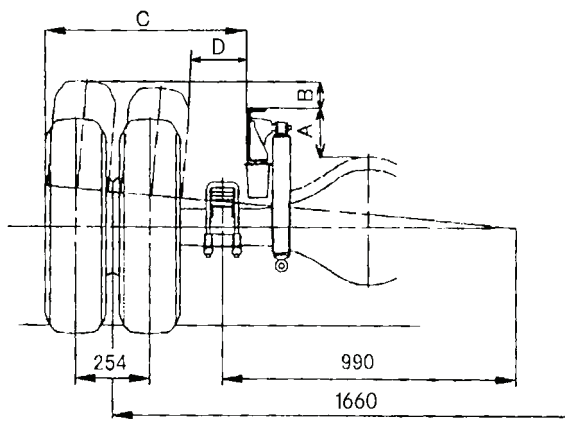
Model	GVW (kg/lbs)	Engine	Clutch	T/M		
		Model		Model	Position	Ratio
FEC52CL3SUHD	5670/12500	4P10T5 120 kW 400 Nm	Wet dual clutch	M038S6	1 2 3 4 5 6 R	5.397 3.788 2.310 1.474 1.000 0.701 5.397
FEC52EL3SUHD						
FEC52GL3SUHD						
FEC72CL3SUHD	7255/15995					
FEC72EL3SUHD						
FEC72GL3SUHD						
FEC72HL3SUHD						
FEC72KL3SUHD						
FEC72HL3WUHD						
FEC72KL3WUHD						
FEC92CL3SUHD	8160/17995					
FEC92EL3SUHD						
FEC92GL3SUHD						
FEC92HL3SUHD						
FEC92KL3SUHD						

9.9 Differential and tire bound height

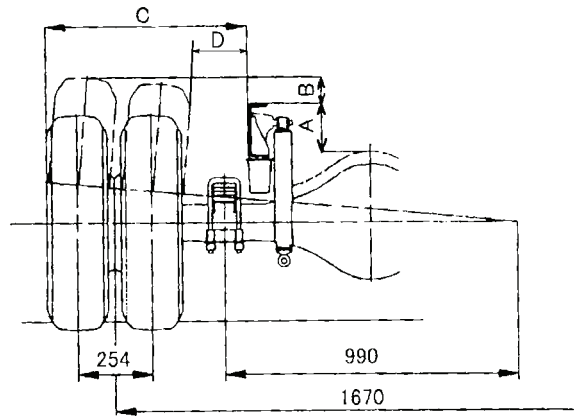
Model	Tire size	A mm (in)	B mm (in)	C mm (in)	D mm (in)
FEC52CL3SUHD	215/85R16	130 (5.1)	139 (5.5)	644.5 (25.4)	145 (5.7)
FEC52EL3SUHD	215/85R16	130 (5.1)	140 (5.5)	644.5 (25.4)	145 (5.7)
FEC52GL3SUHD	215/85R16	130 (5.1)	139 (5.5)	644.5 (25.4)	145 (5.7)
FEC72CL3SUHD	215/75R17.5	125 (4.9)	142 (5.6)	647 (25.5)	151 (5.9)
FEC72EL3SUHD	215/75R17.5	125 (4.9)	141 (5.6)	647 (25.5)	151 (5.9)
FEC72GL3SUHD	215/75R17.5	125 (4.9)	140 (5.5)	647 (25.5)	152 (6.0)
FEC72HL3SUHD	215/75R17.5	125 (4.9)	137 (5.4)	647 (25.5)	153 (6.0)
FEC72KL3SUHD	215/75R17.5	125 (4.9)	137 (5.4)	647 (25.5)	153 (6.0)
FEC72HL3WUHD	215/75R17.5	175 (6.9)	89 (3.5)	647 (25.5)	153 (6.0)
FEC72KL3WUHD	215/75R17.5	175 (6.9)	90 (3.5)	647 (25.5)	152 (6.0)
FEC92CL3SUHD	215/75R17.5	125 (4.9)	142 (5.6)	647 (25.5)	151 (5.9)
FEC92EL3SUHD	215/75R17.5	125 (4.9)	141 (5.6)	647 (25.5)	152 (6.0)
FEC92GL3SUHD	215/75R17.5	125 (4.9)	140 (5.5)	647 (25.5)	152 (6.0)
FEC92HL3SUHD	215/75R17.5	125 (4.9)	138 (5.4)	647 (25.5)	153 (6.0)
FEC92KL3SUHD	215/75R17.5	125 (4.9)	138 (5.4)	647 (25.5)	154 (6.1)
FGB72EL3SUHD	235/85R16	182 (7.2)	102 (4.0)	653 (25.7)	139 (5.5)



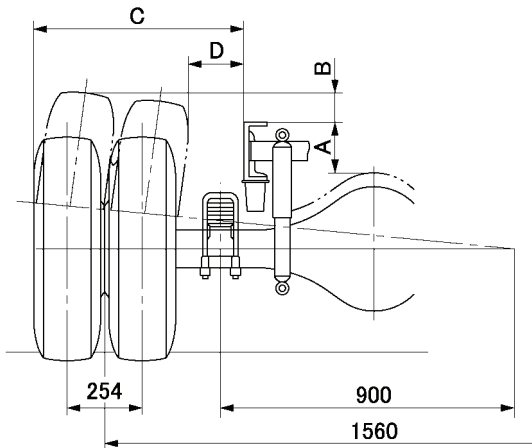
9.9 Differential and tire bound height



FEC5



FEC7
FEC9



FGB7

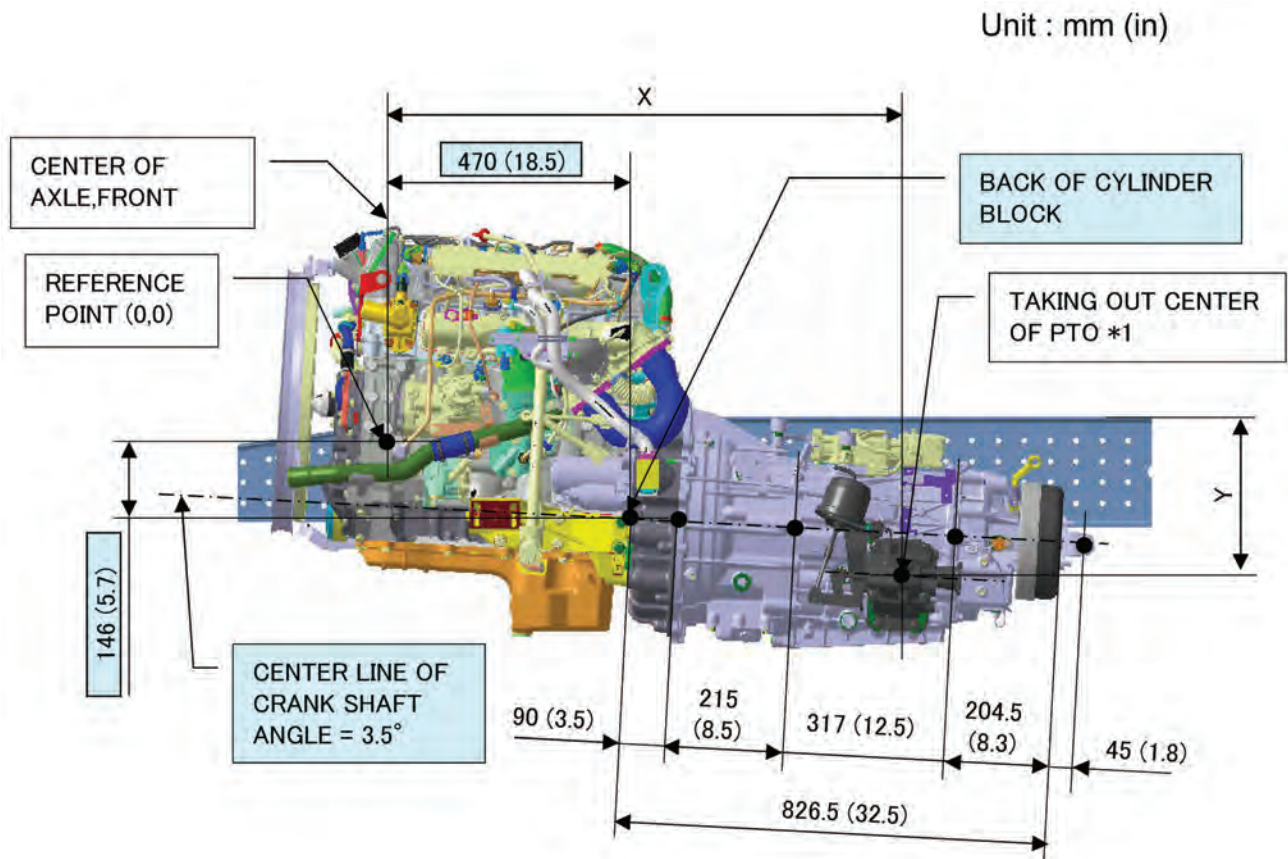


9 Technical data

9.10 Engine transmission assembly

9.10 Engine transmission assembly

<FE>



- ENG CENTER Unit : mm (in.)

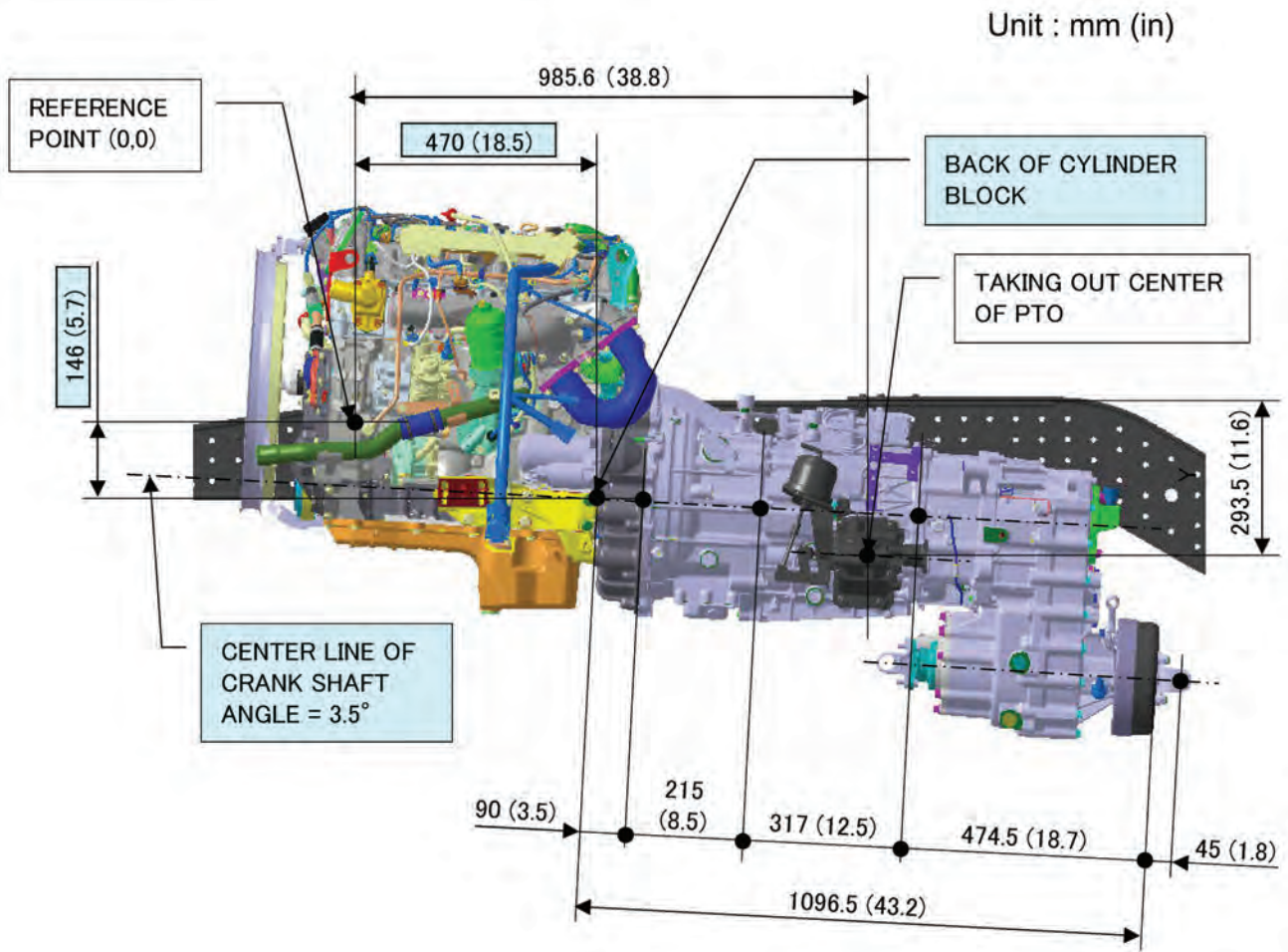
ENG	CENTER OF CHASSIS TO CENTER OF ENG OFFSET
4P10	-10 (0.4) (TO THE LEFT SIDE)

- 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)



<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

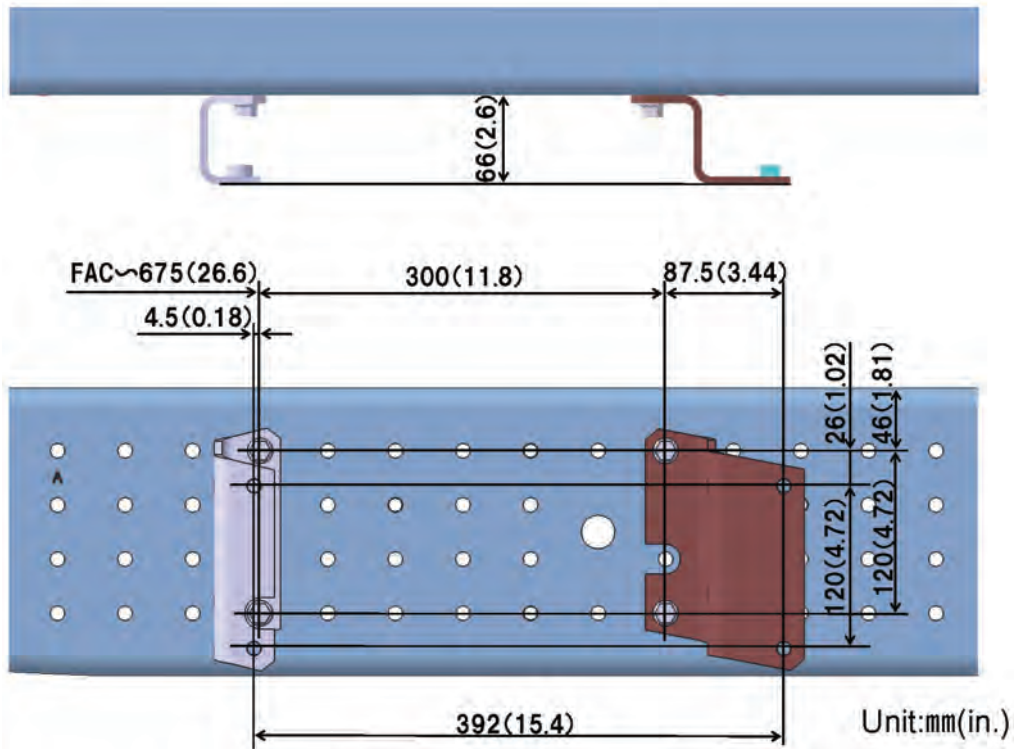
MODEL	T/M	PTO
6AMT	M038S6	196 N•m [145 ft.lbs, 20 kgf•m]



**PAGE
INTENTIONALLY
LEFT
BLANK**



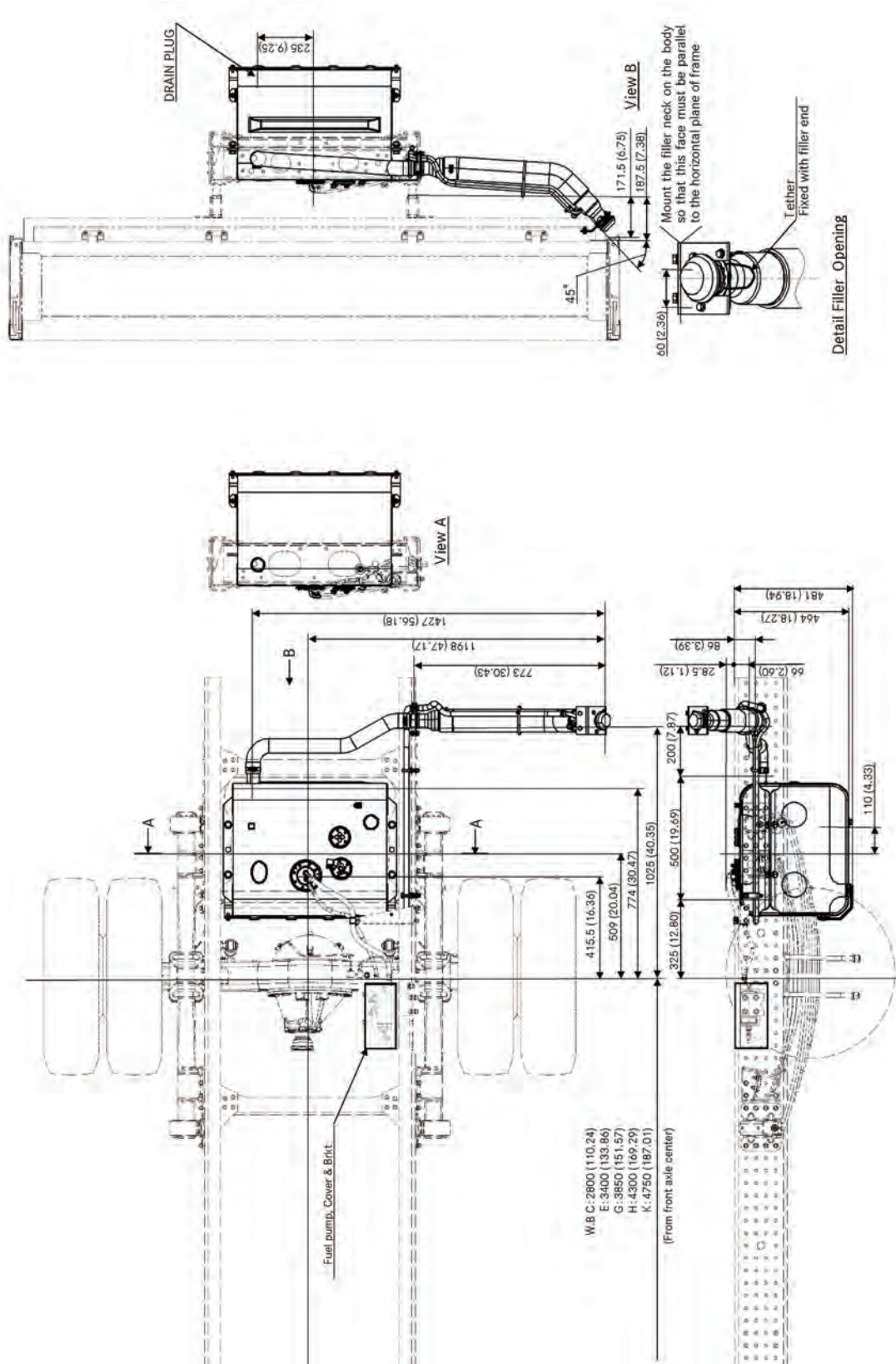
9.12 Battery mounting layout



9.13 Fuel tank mounting layout

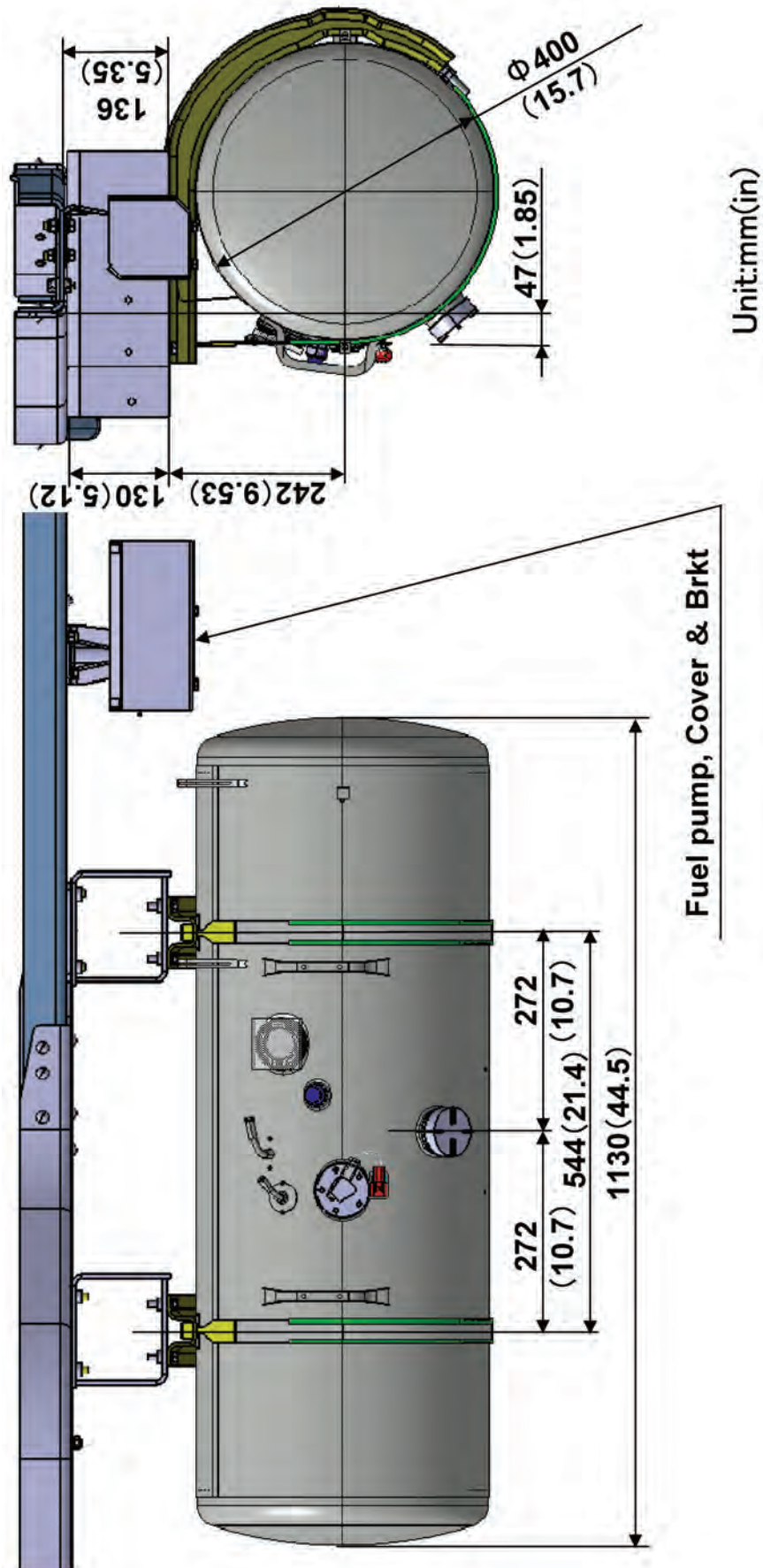
9.13.1 Fuel tank

<FE>



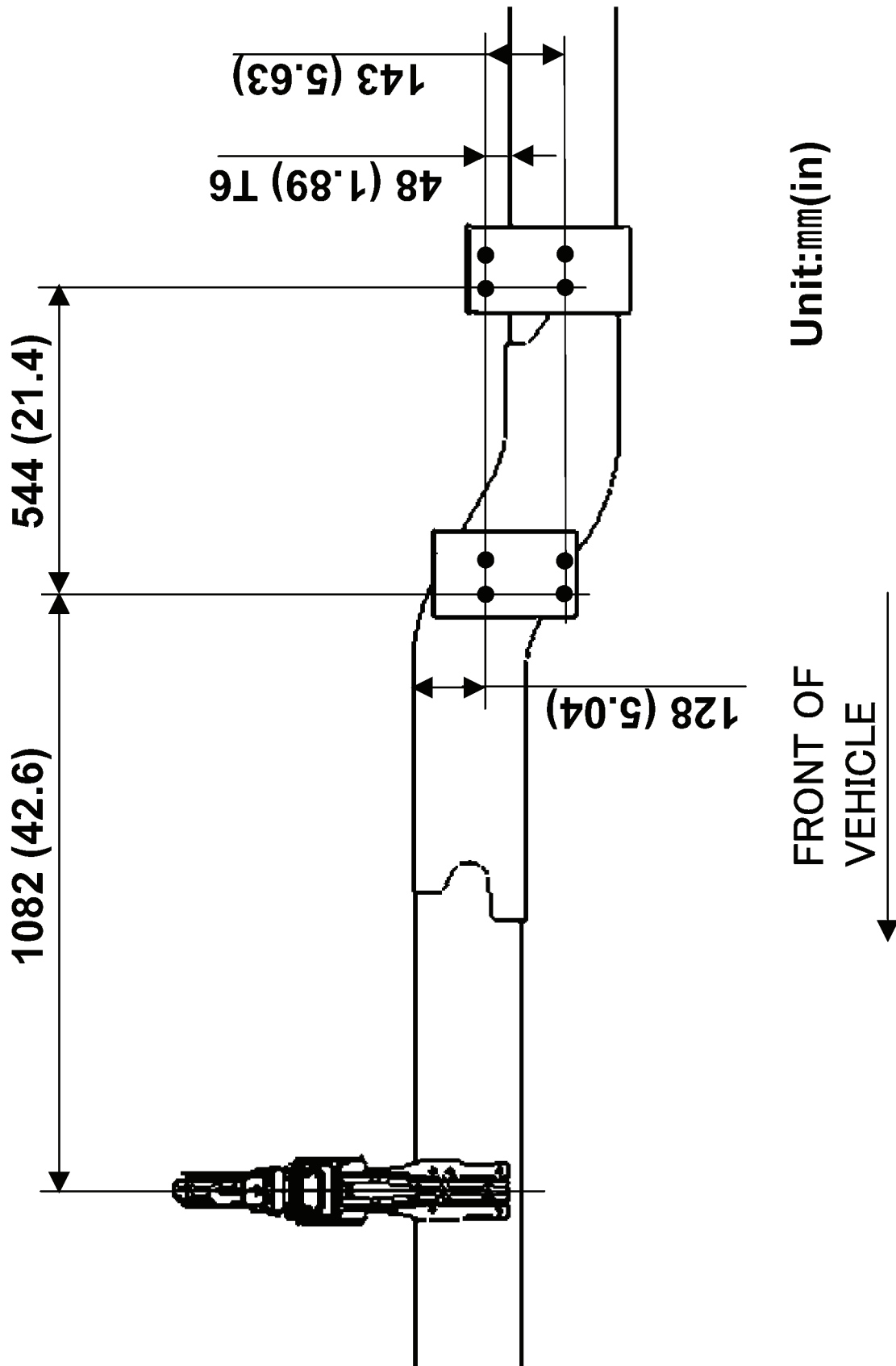


<FG>



9.13.2 Fuel tank bracket (option)

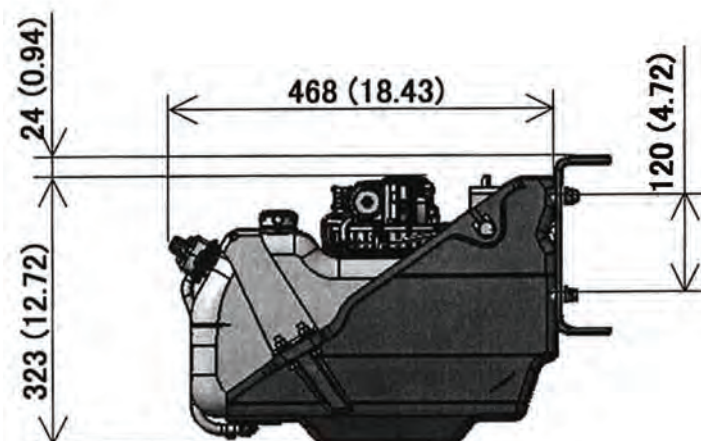
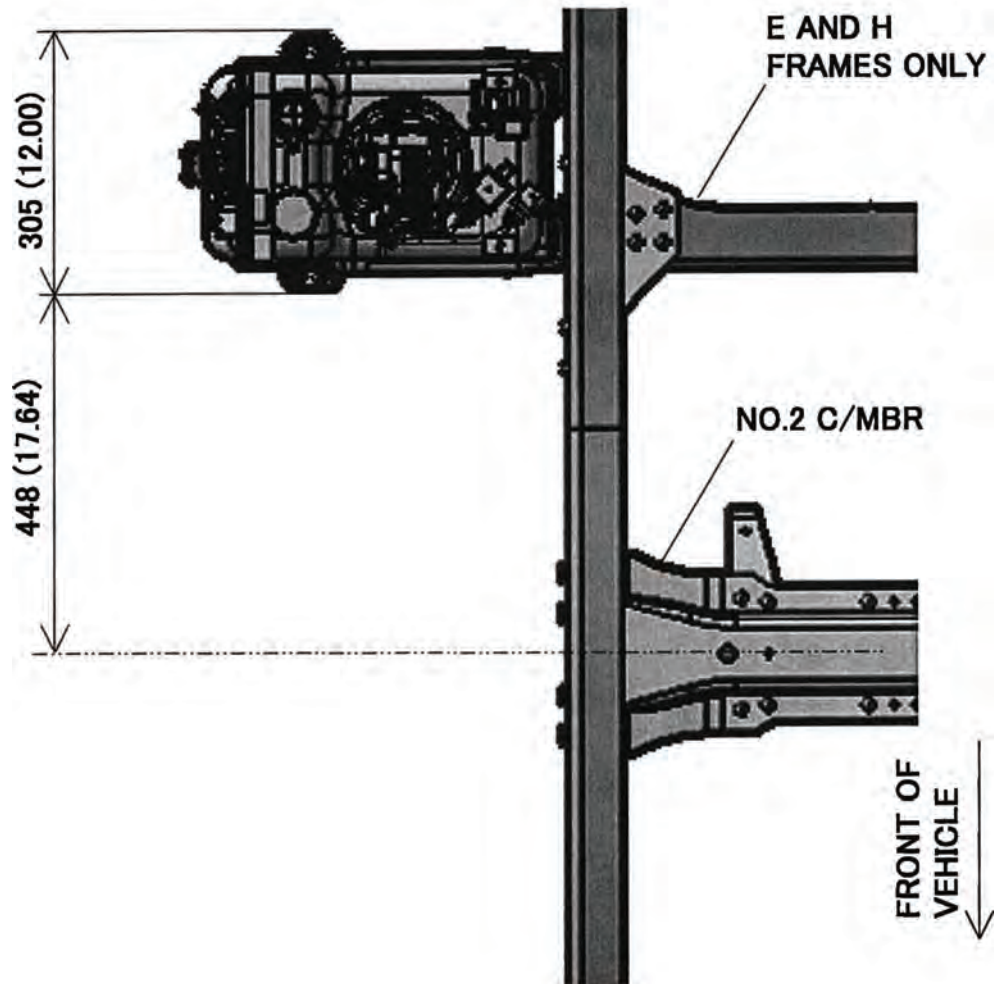
<FG>



9.14 BlueTec[®] exhaust gas aftertreatment

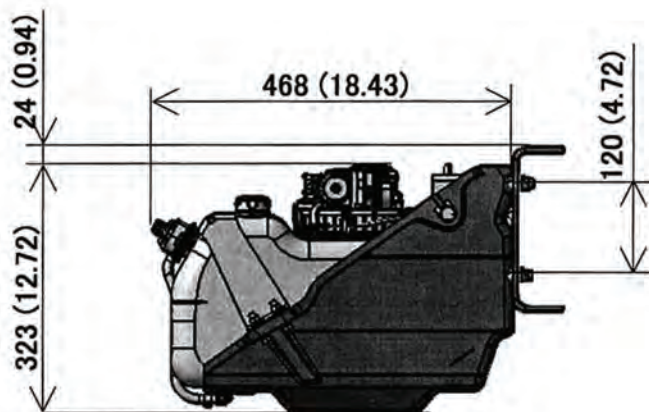
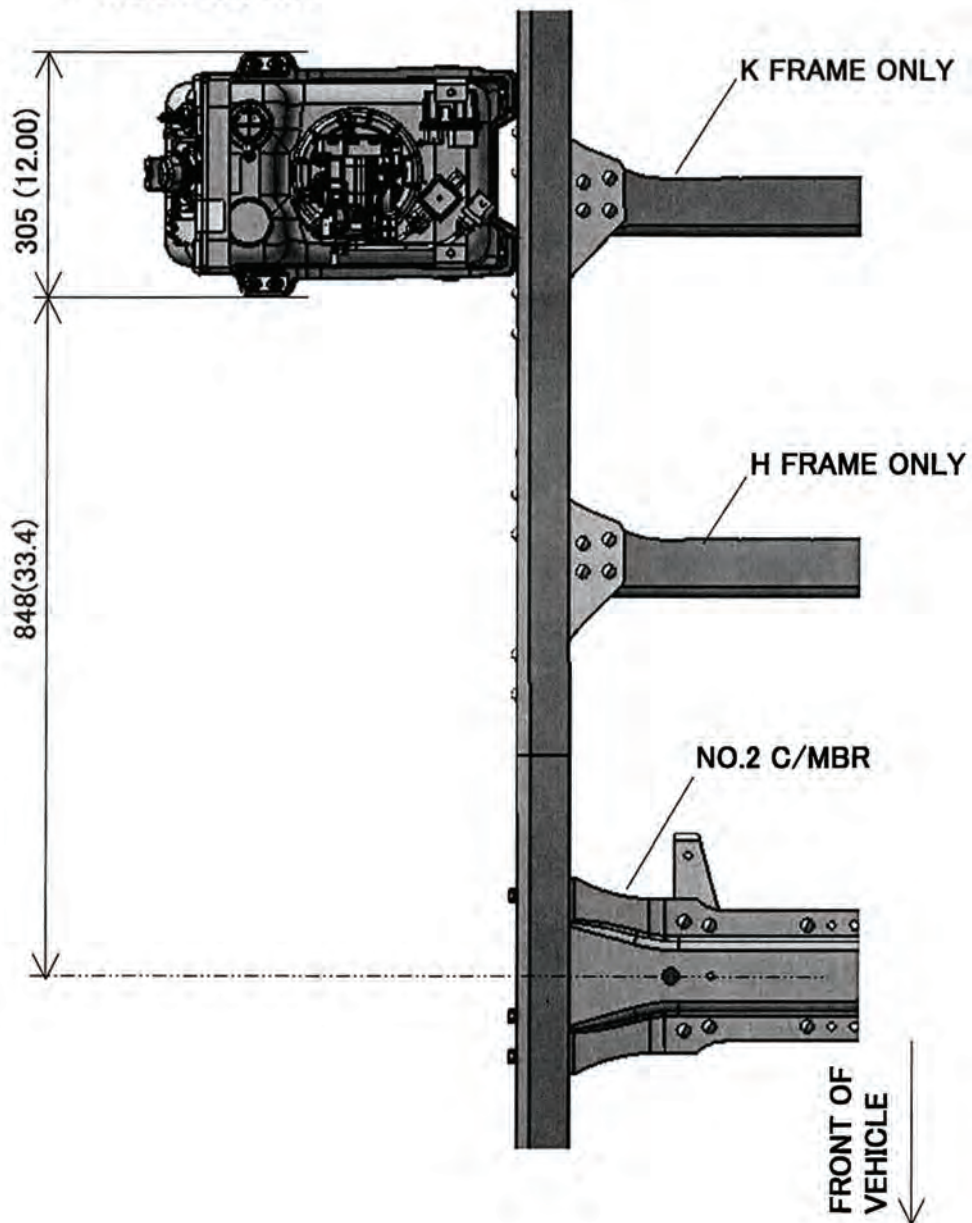
9.14 BlueTec[®] exhaust gas aftertreatment

- FEC C, E, G, H, K

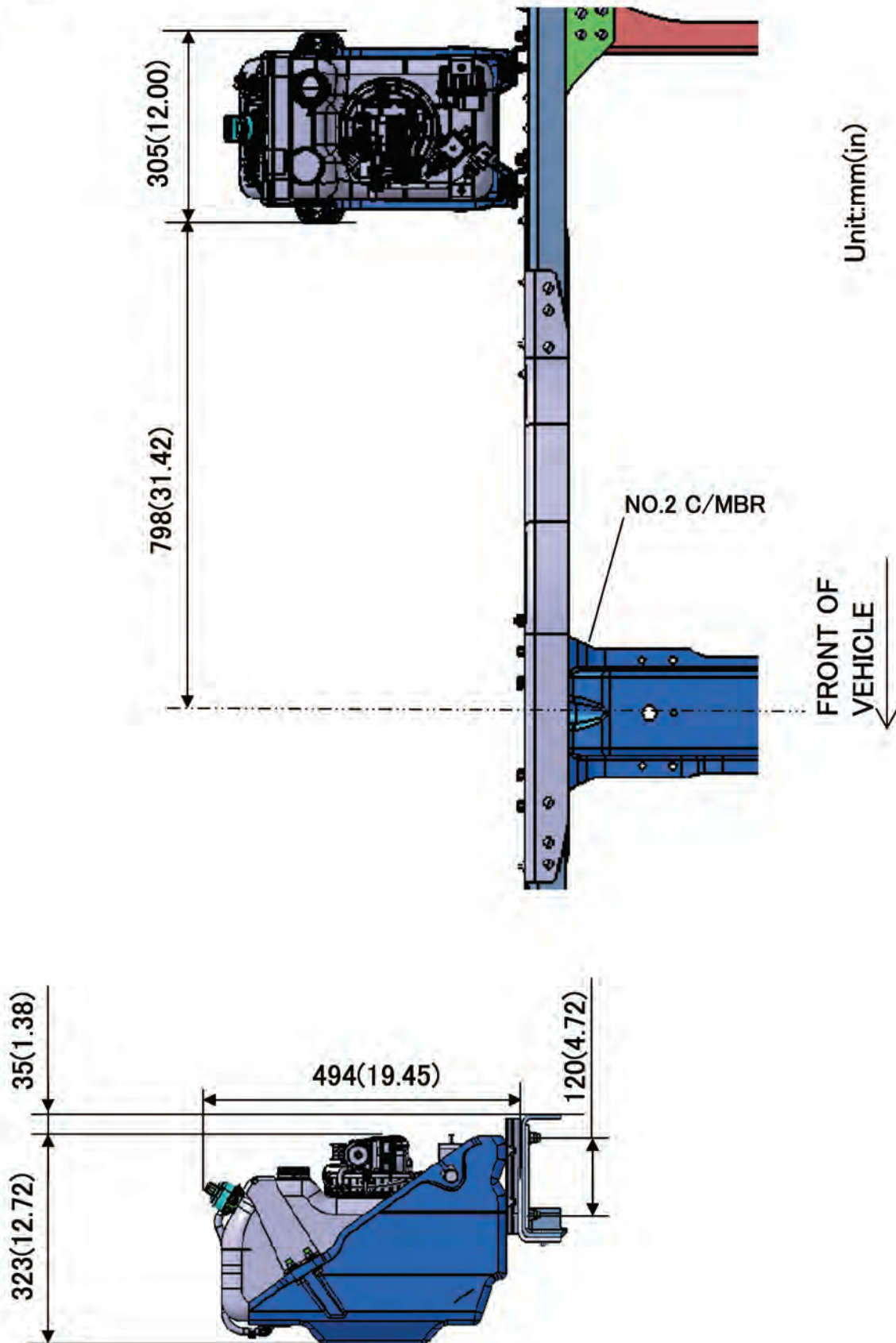


9.14 BlueTec® exhaust gas aftertreatment

• FEC HW, KW



A · FGB



9.15 Labels and marks

- 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 216.

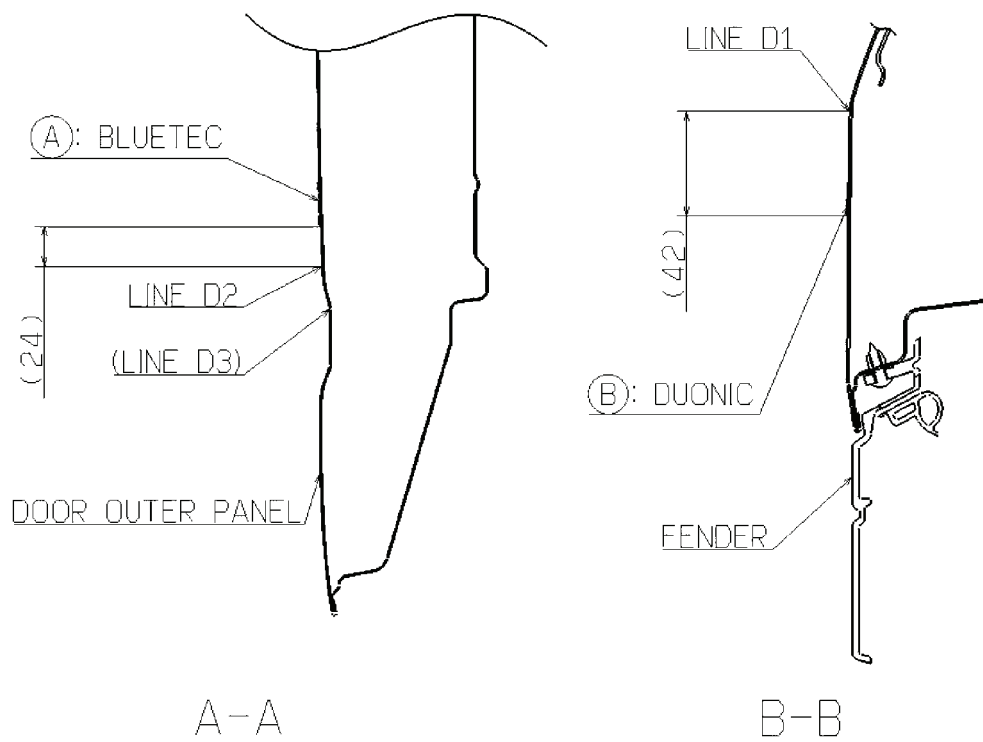
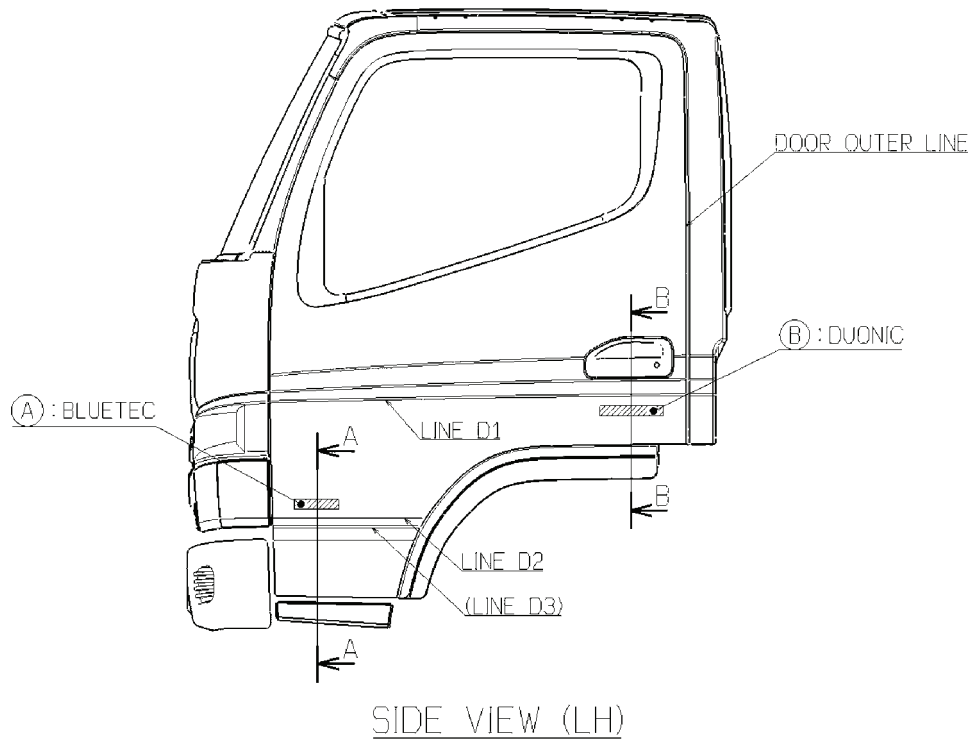
9.15.1 List of the attaching locations of labels and emblems

Locations Description	Front face of cab	RH and LH doors
FUSO	○	–
DUONIC	–	○
BlueTec [®]	–	○

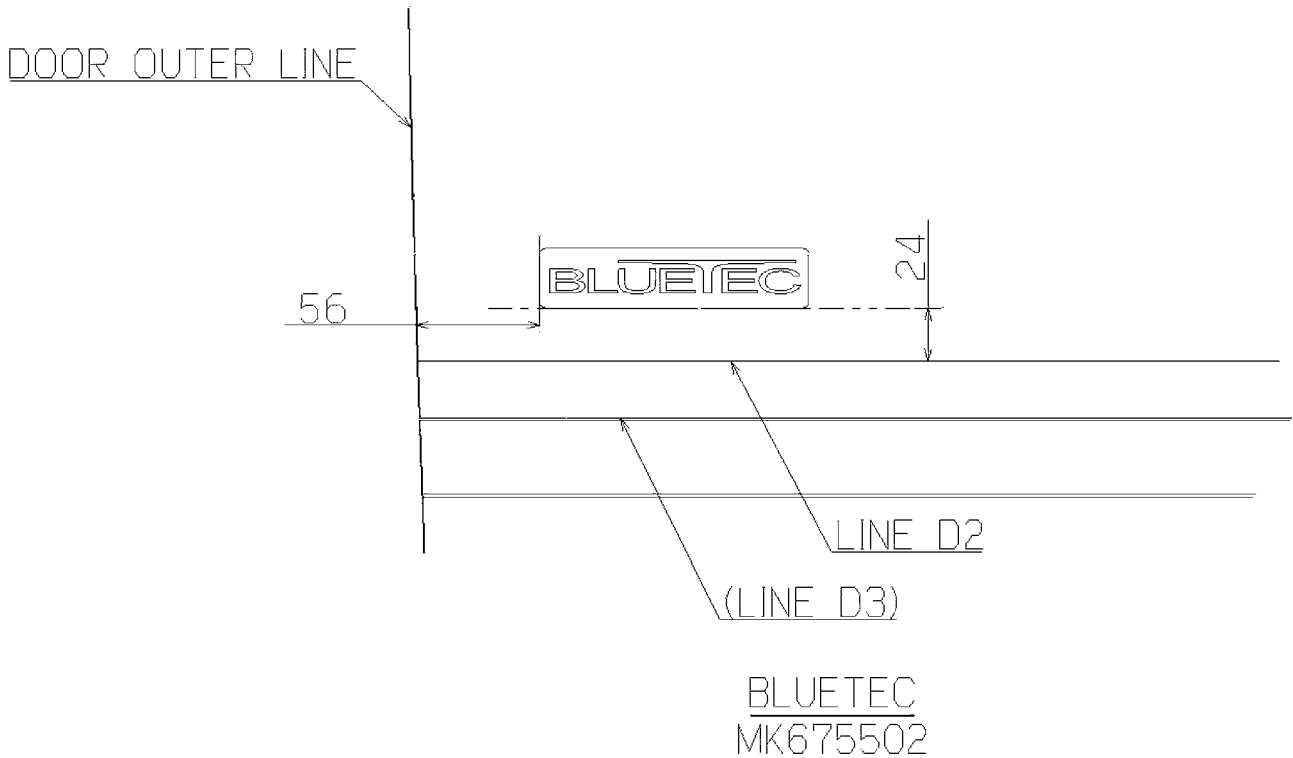
NOTE: Types of the label and emblem attaching on a vehicle differ depending on the vehicle types.

9.15.2 Installation of marks

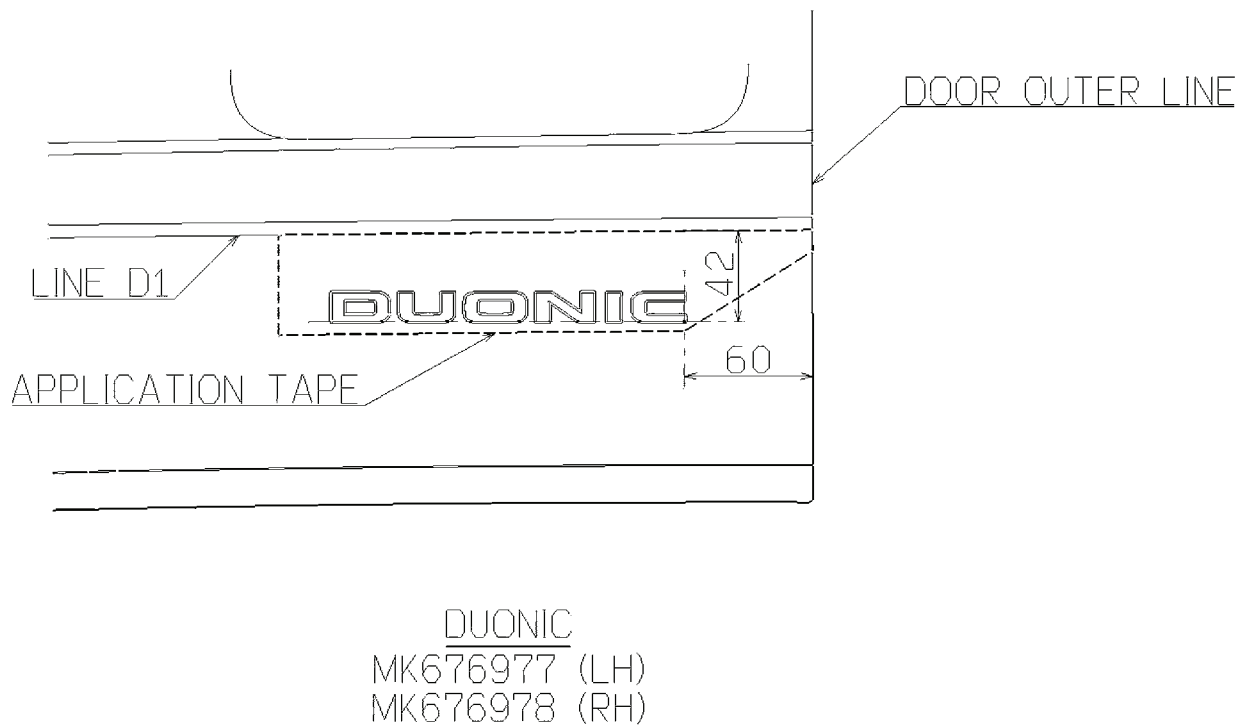
Clean the indicated areas where the CUSTOM mark, BLUETEC mark, and DUONIC mark are to be stuck, peel off the backing paper from each sticker, and affix it in position according to the illustration.



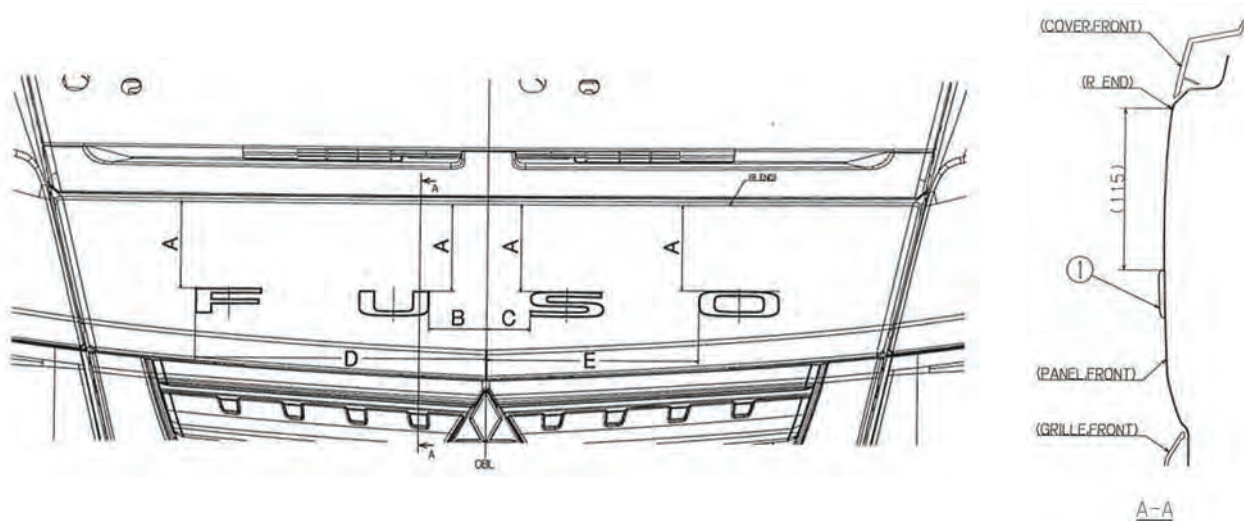
(A)



(B)



Attaching procedure of the labels and emblems

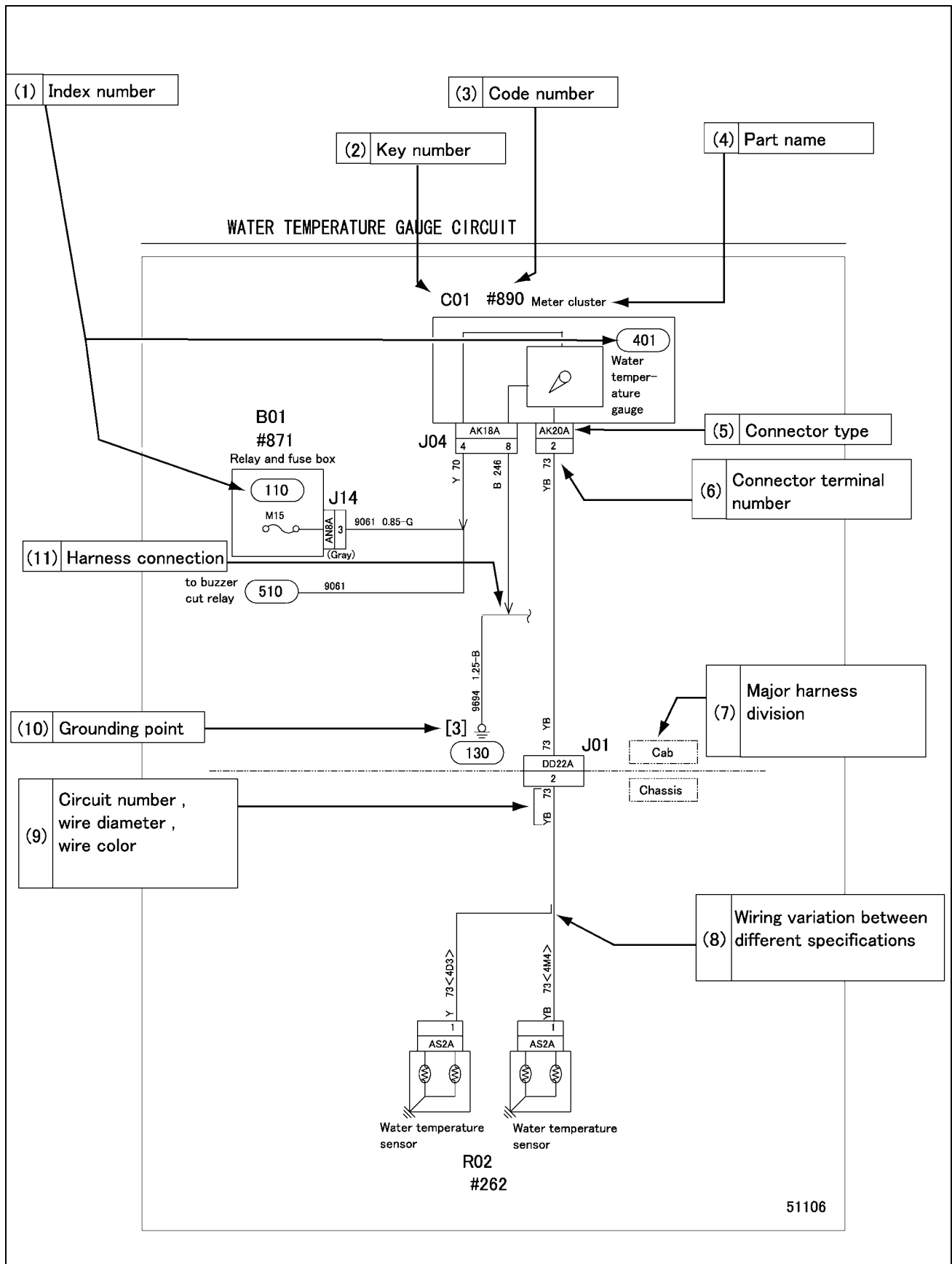


Unit: mm (in.)

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)

9.16 Electrical wiring diagram

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.

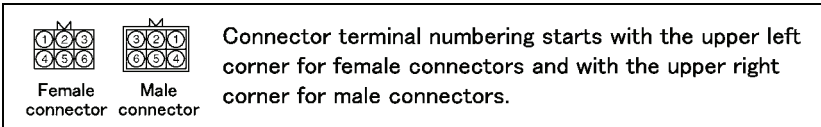
(3) Code number: #001 - #999

- 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



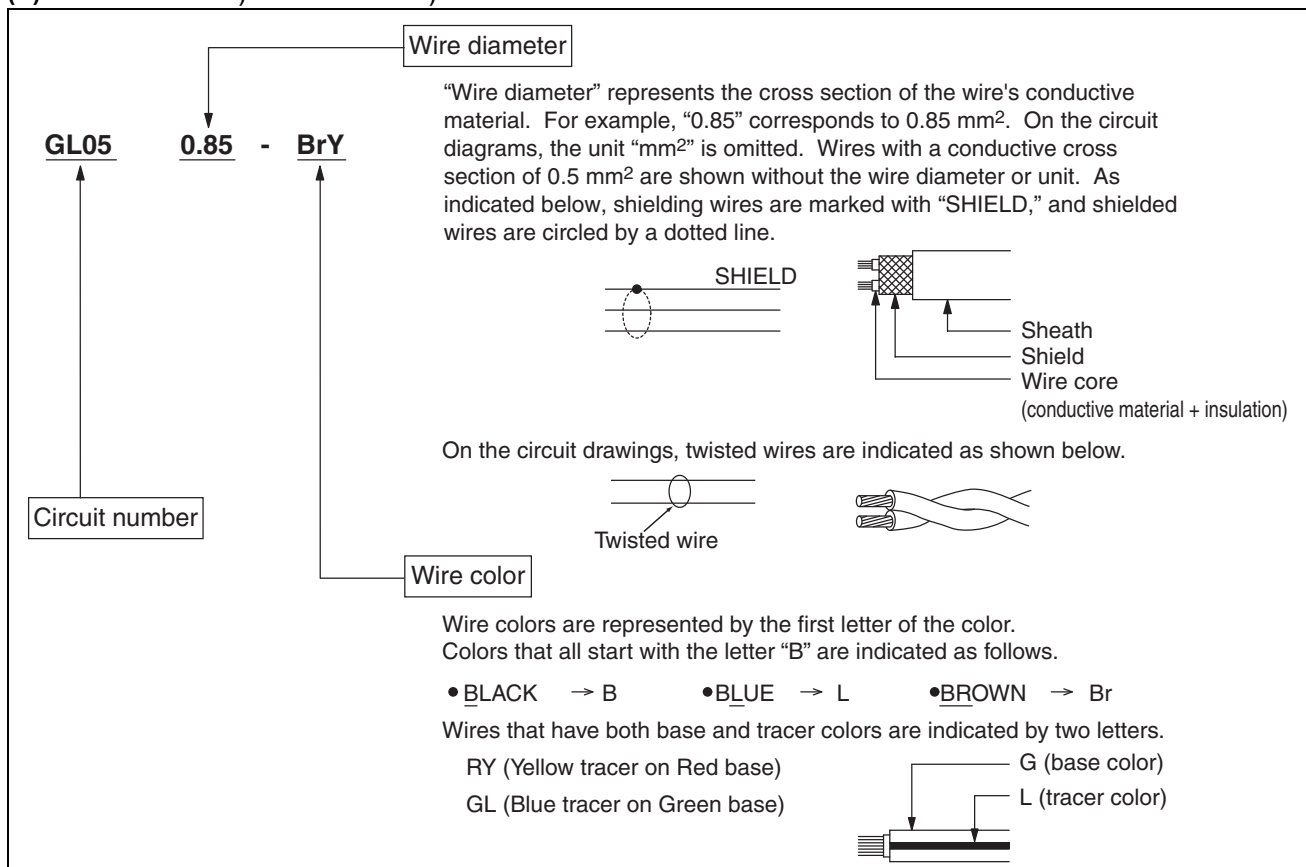
(7) Major harness division

- 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.

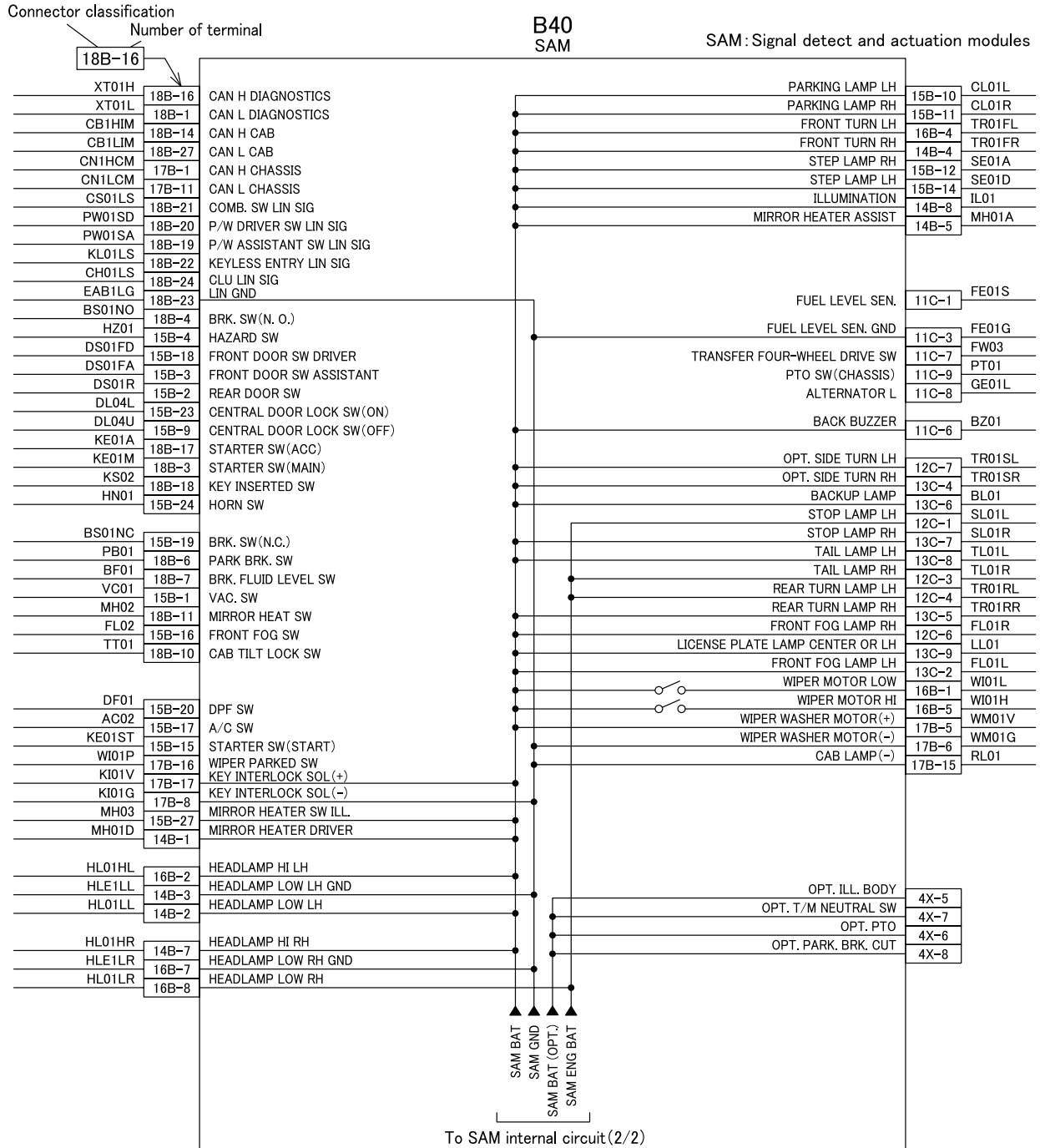
Wire color

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				

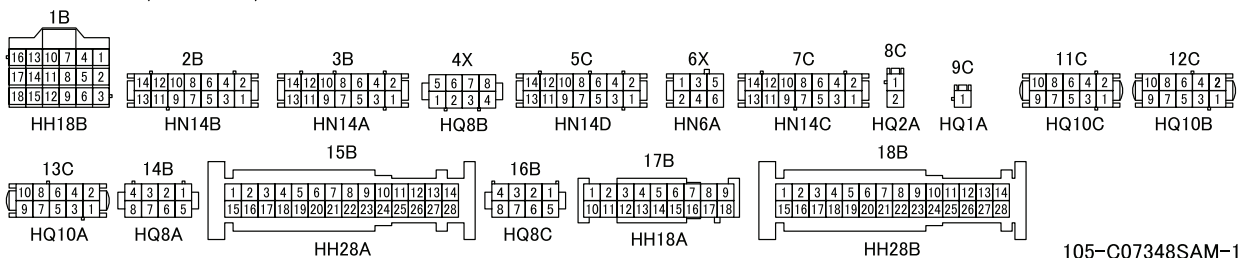
SAM INTERNAL CIRCUIT

(1/2)

A part of this circuit is omitted.



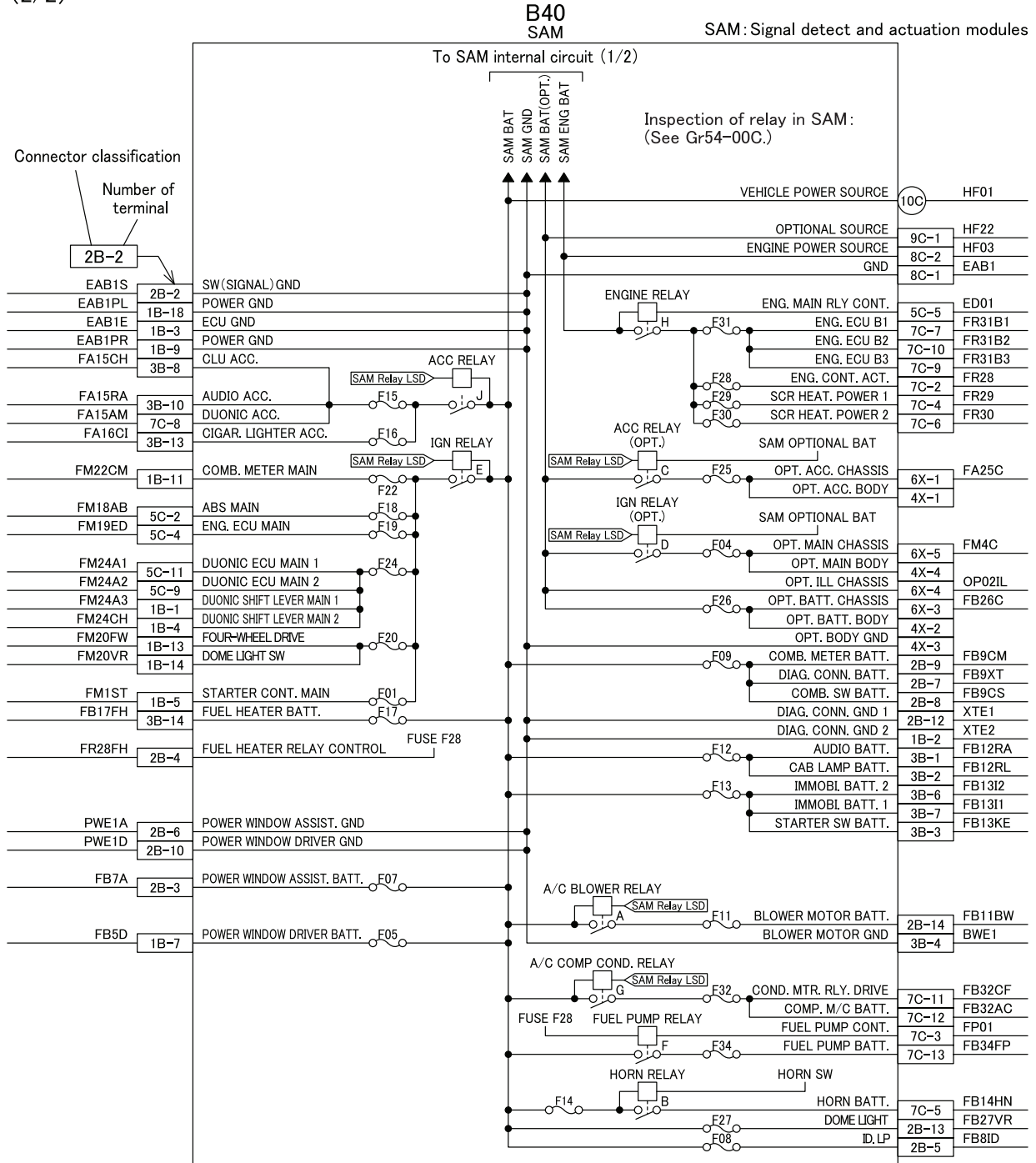
SAM connector (harness side)



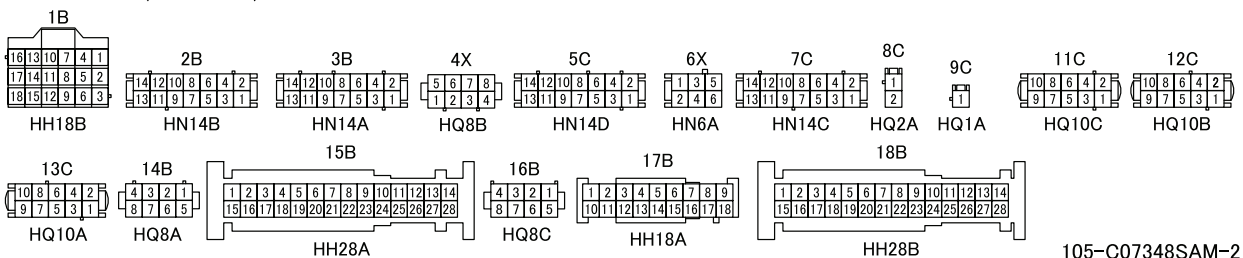
SAM INTERNAL CIRCUIT

(2/2)

A part of this circuit is omitted.



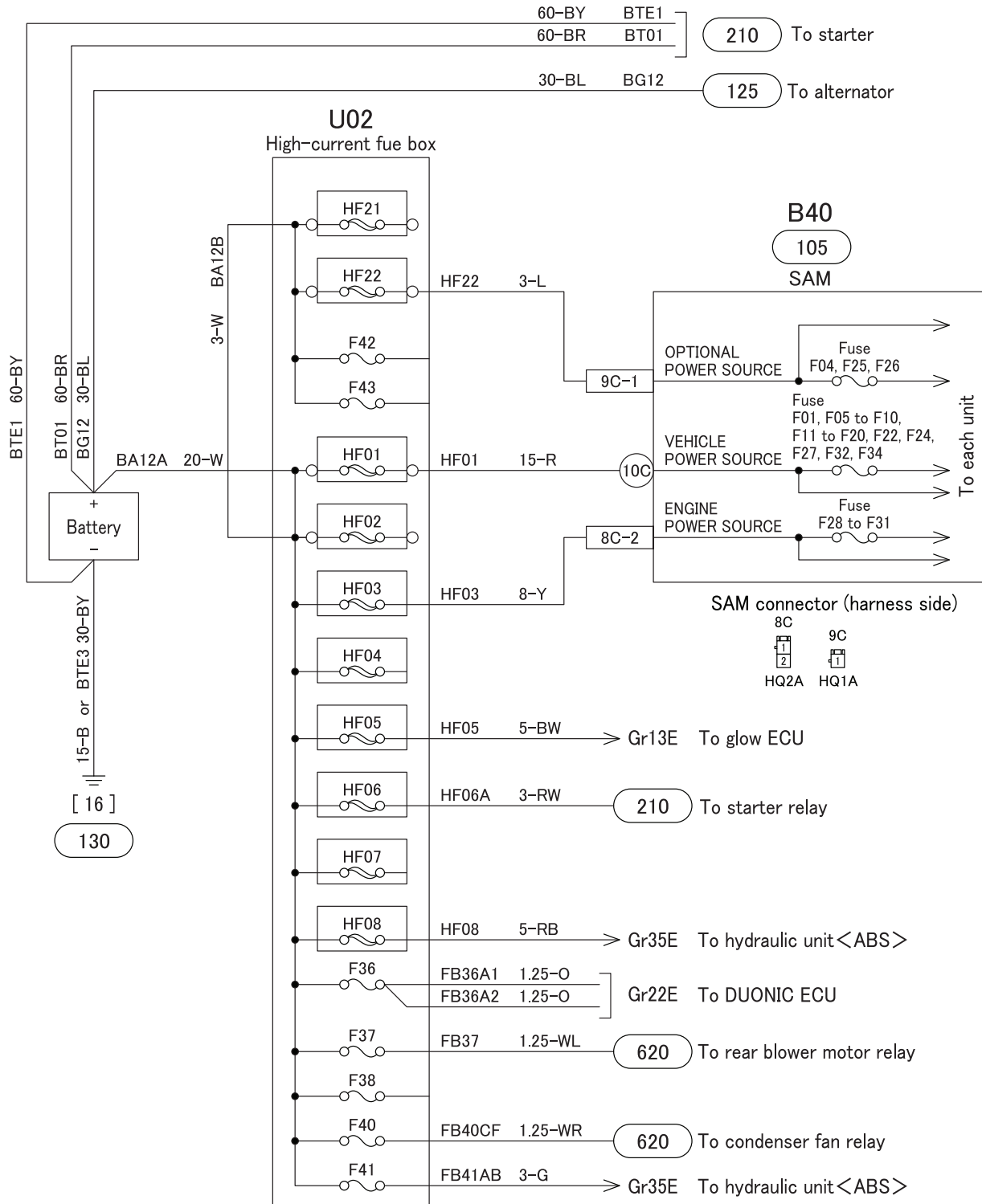
SAM connector (harness side)



POWER CIRCUIT (1)

Battery → high-current fuse → SAM

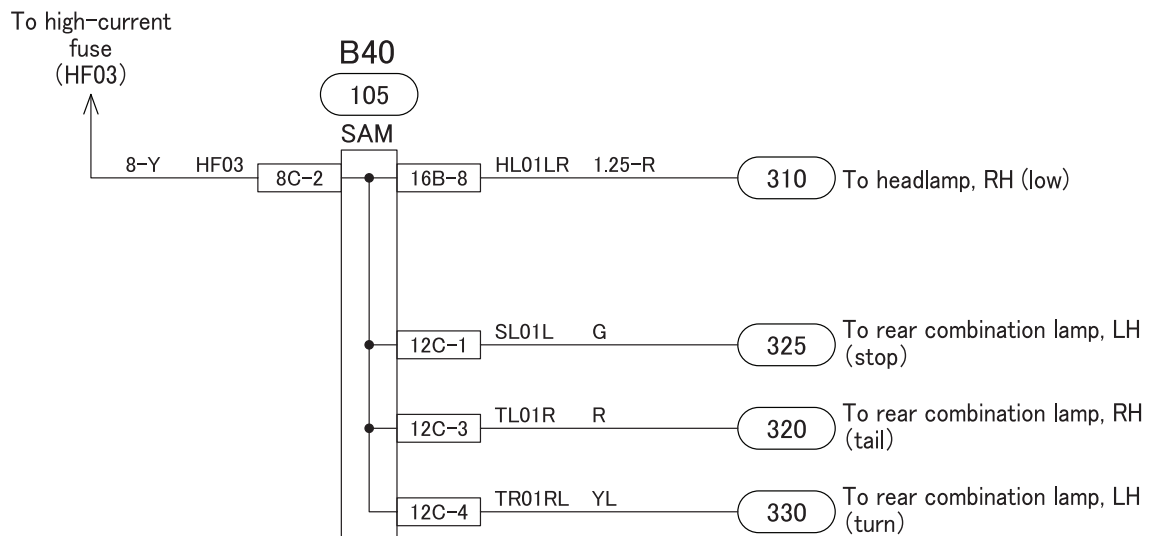
ECU : Electronic control unit
 SAM : Signal detect and modules
 ABS : Anti-lock brake system



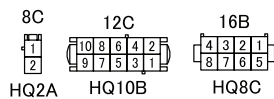
110-C07348ALL

POWER CIRCUIT (2)

SAM
(ENG BAT)



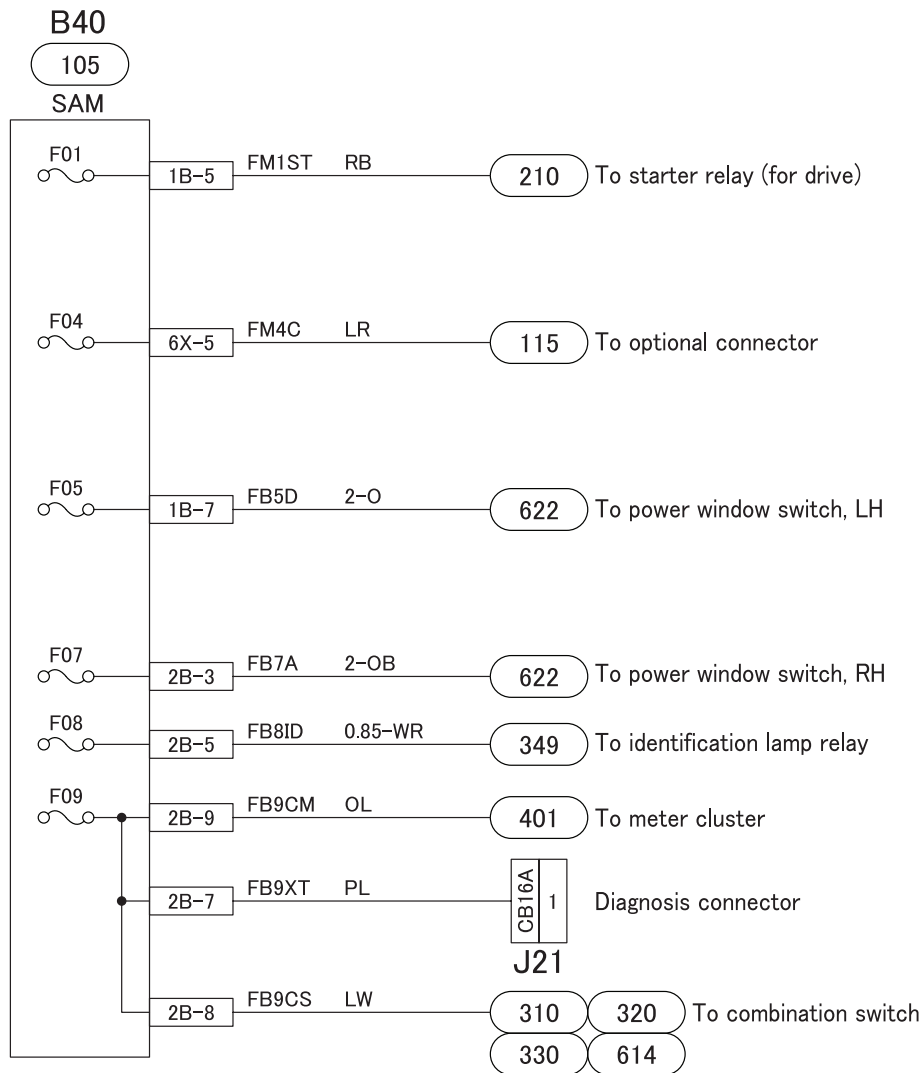
SAM connector (harness side)



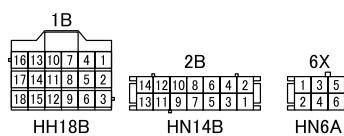
110-C07348EB

POWER CIRCUIT (3)

SAM
(Fuse F01 to F09)



SAM connector (harness side)

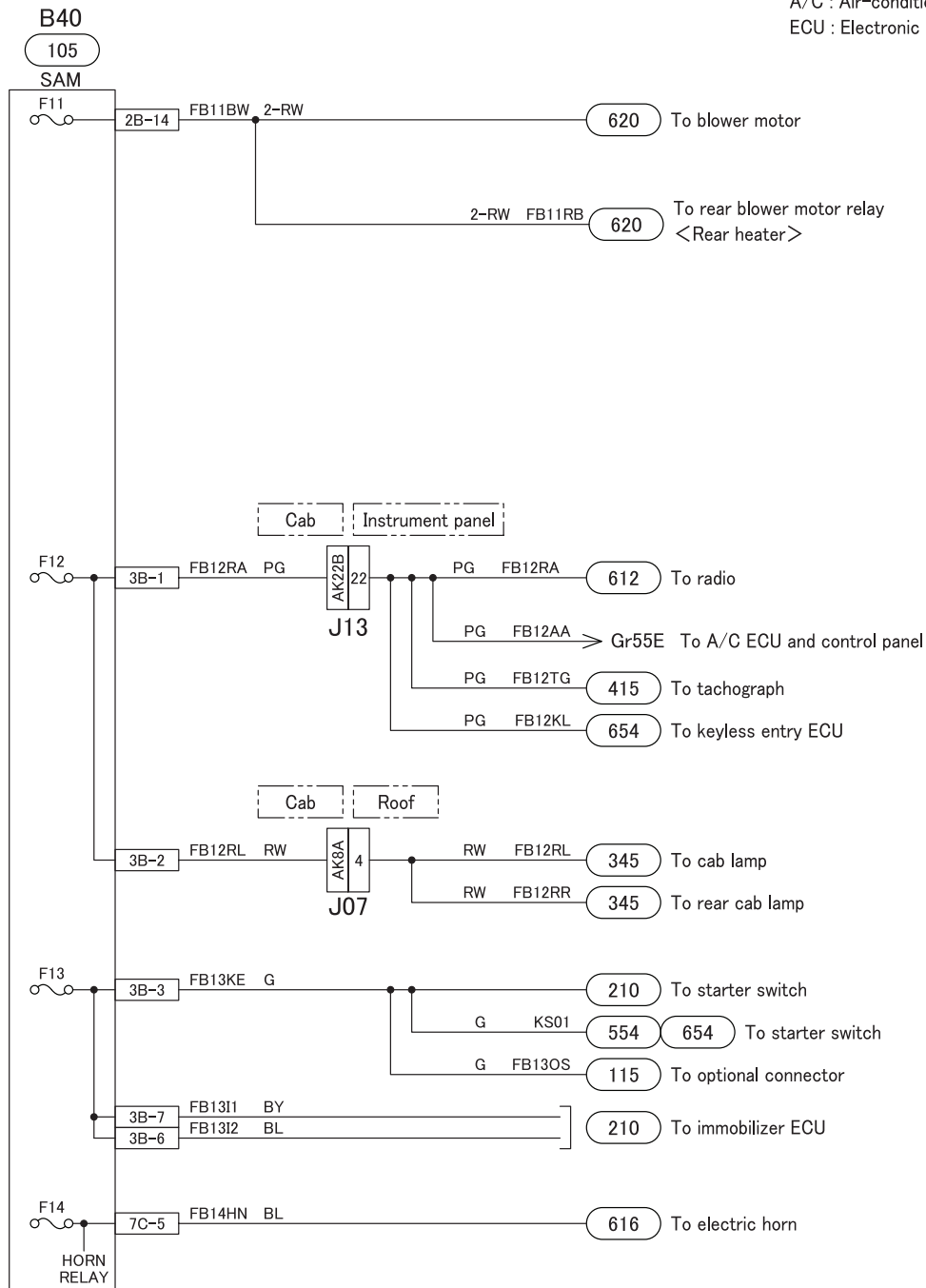


110-C07348F01

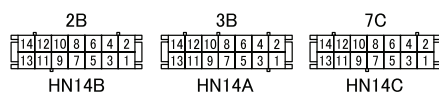
POWER CIRCUIT (4)

SAM
(Fuse F11 to F14)

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



SAM connector (harness side)

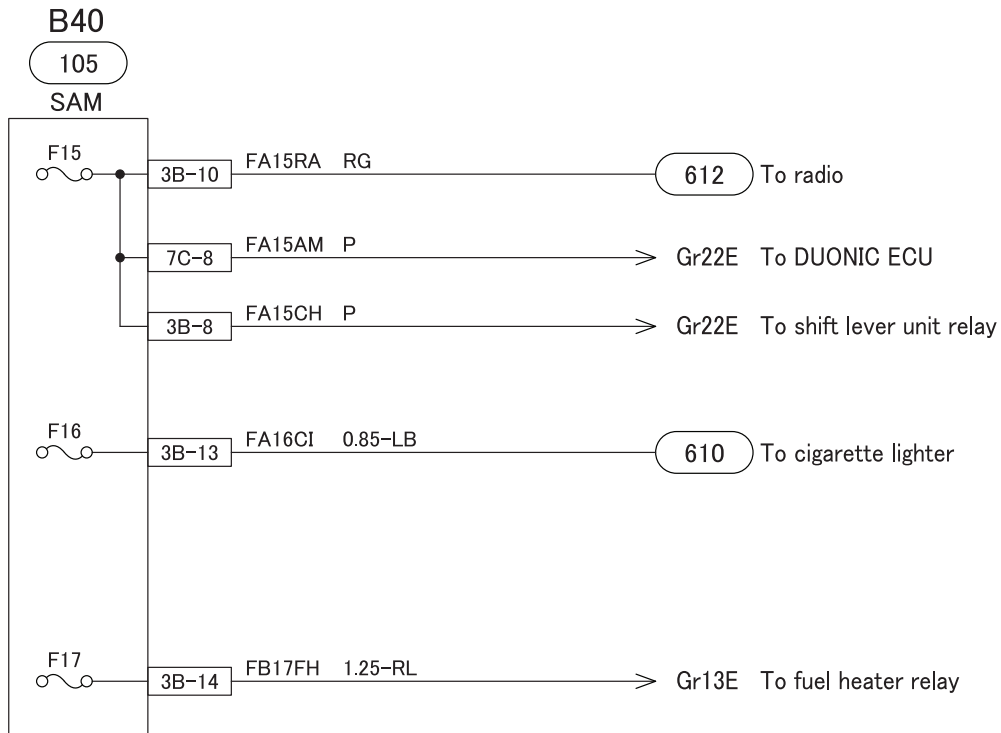


110-C07348F11

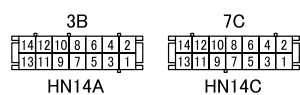
POWER CIRCUIT (5)

SAM
(Fuse F15 to F17)

ECU : Electronic control unit



SAM connector (harness side)



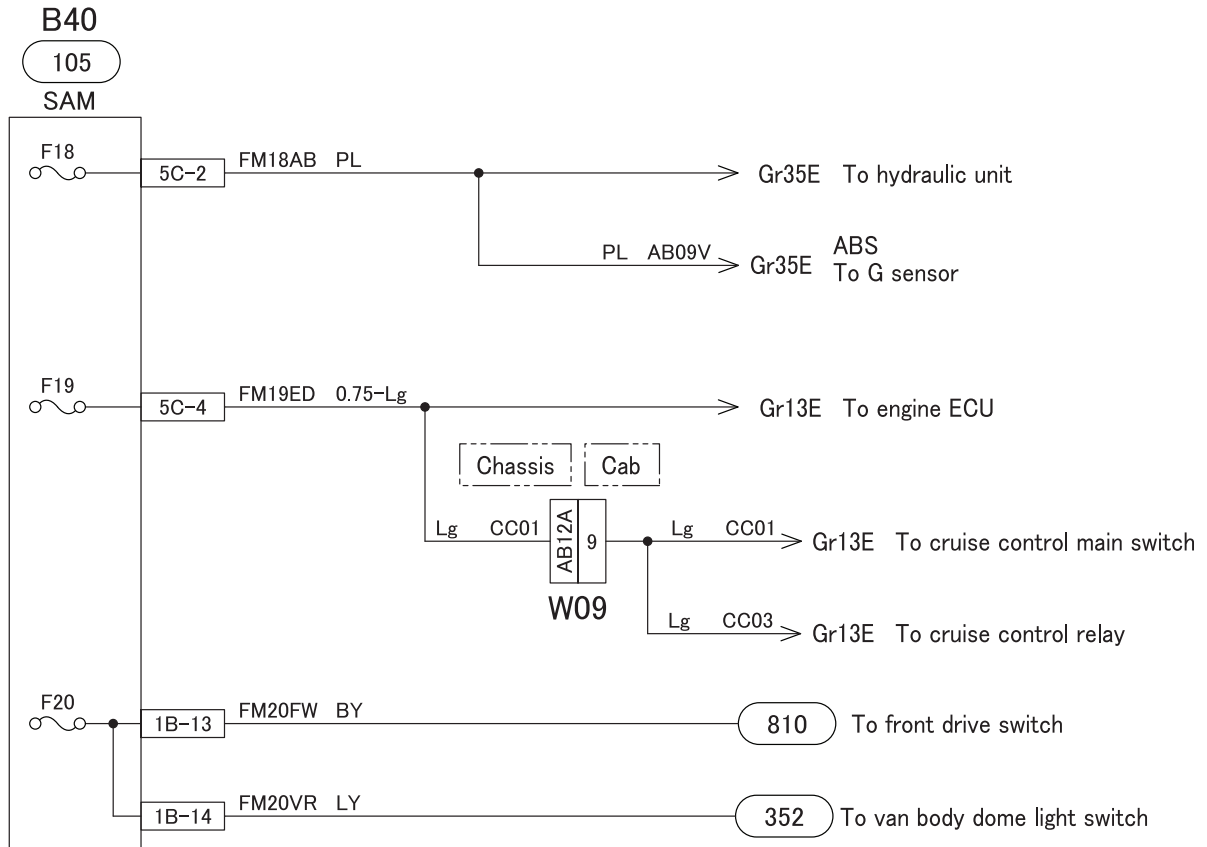
110-C07348F15



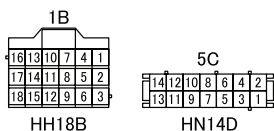
POWER CIRCUIT (6)

SAM
(Fuse F18 to F20)

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



SAM connector (harness side)

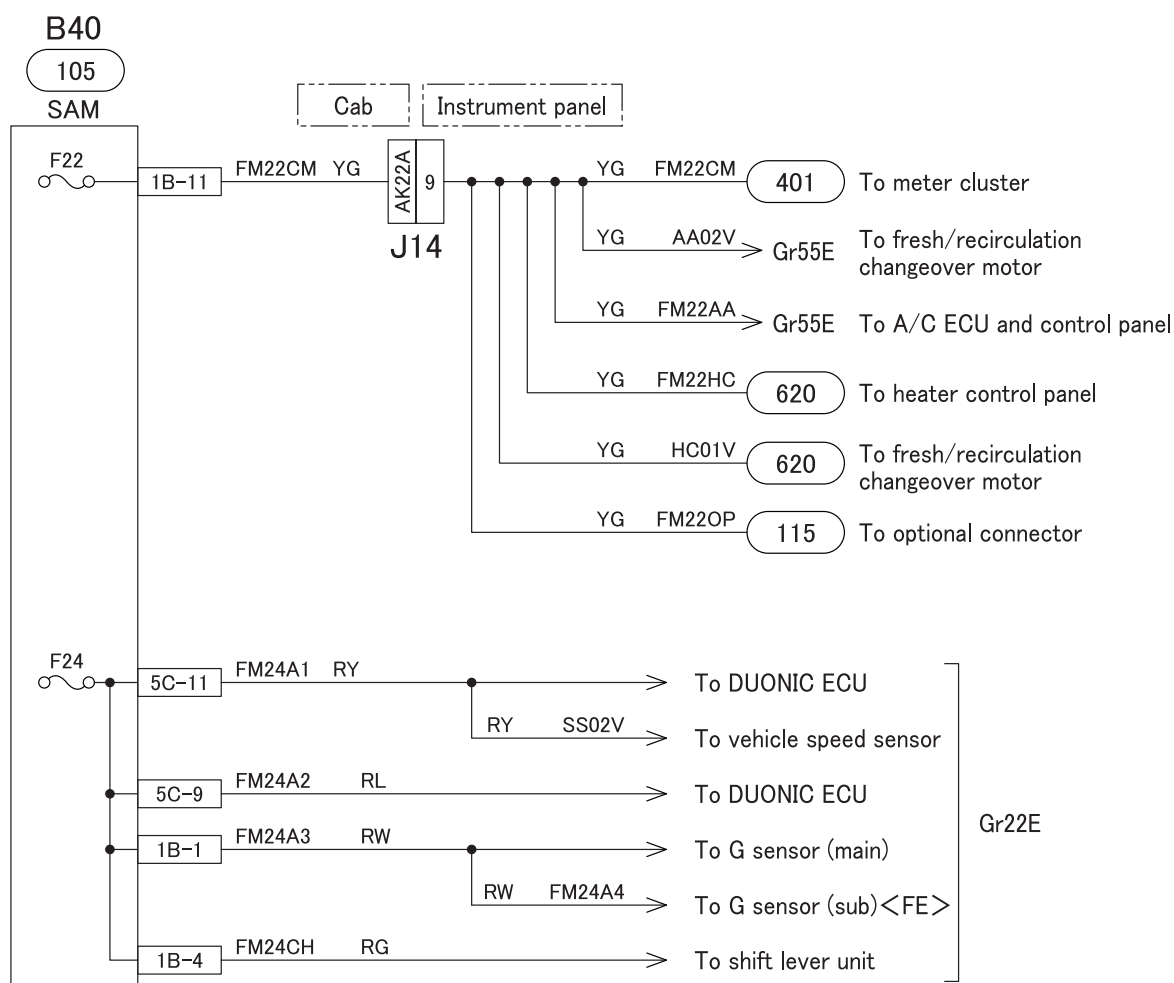


110-C07348F18

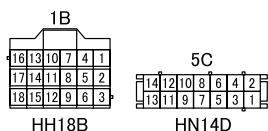
POWER CIRCUIT (7)

SAM
(Fuse F22 to F24)

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



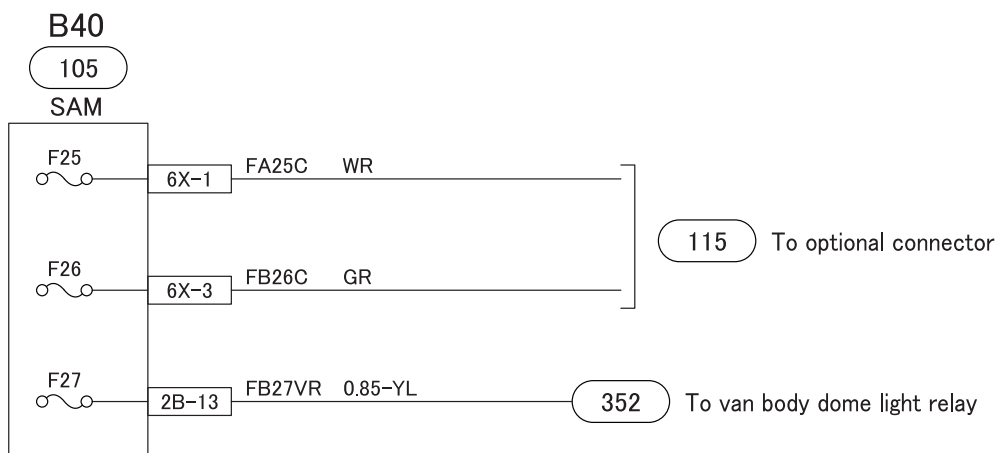
SAM connector (harness side)



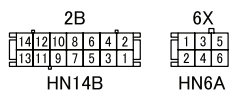
110-C07348F22

POWER CIRCUIT (8)

SAM
(Fuse F25 to F27)



SAM connector (harness side)



110-C07348F25



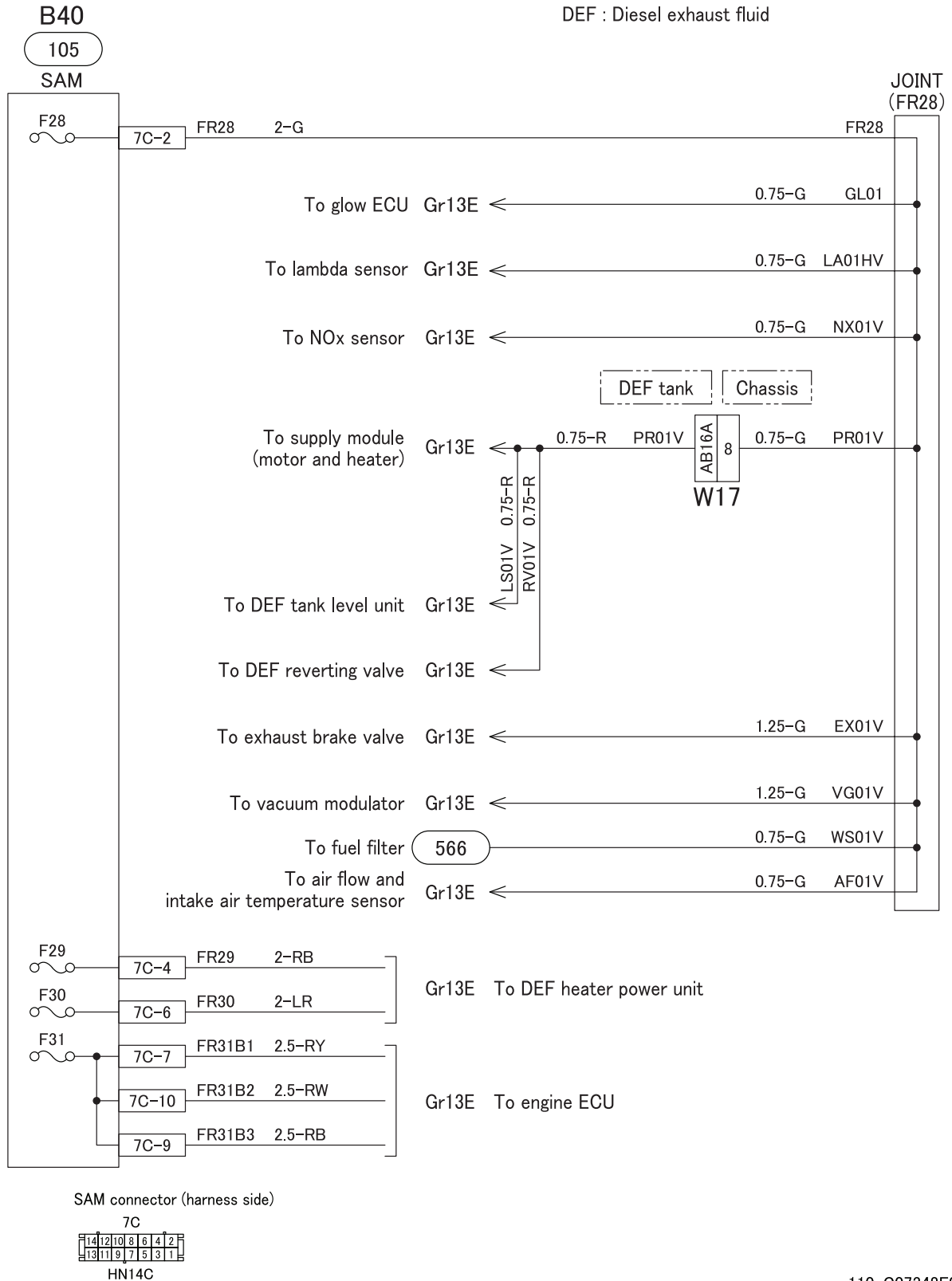
POWER CIRCUIT (9)

SAM

(Fuse F28 to F31)

ECU : Electronic control unit

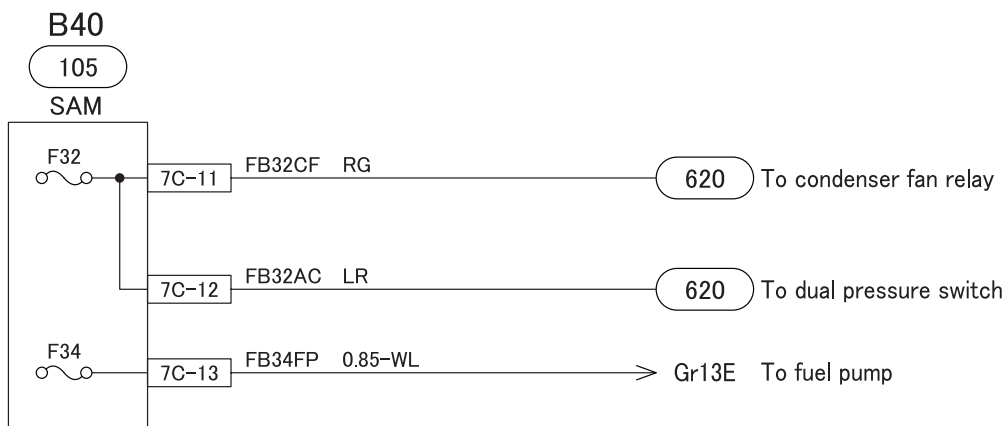
DEF : Diesel exhaust fluid



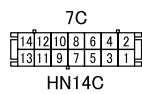
110-C07348F28

POWER CIRCUIT (10)

SAM
(Fuse F32 to F34)



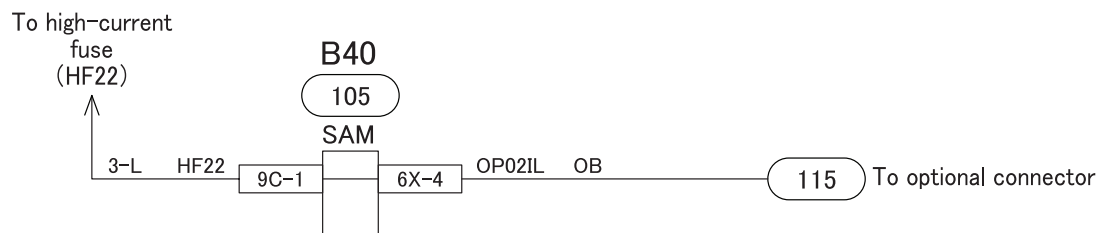
SAM connector (harness side)



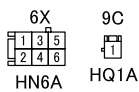
110-C07348F32

POWER CIRCUIT (11)

SAM
(OPTIONAL BAT)



SAM connector (harness side)

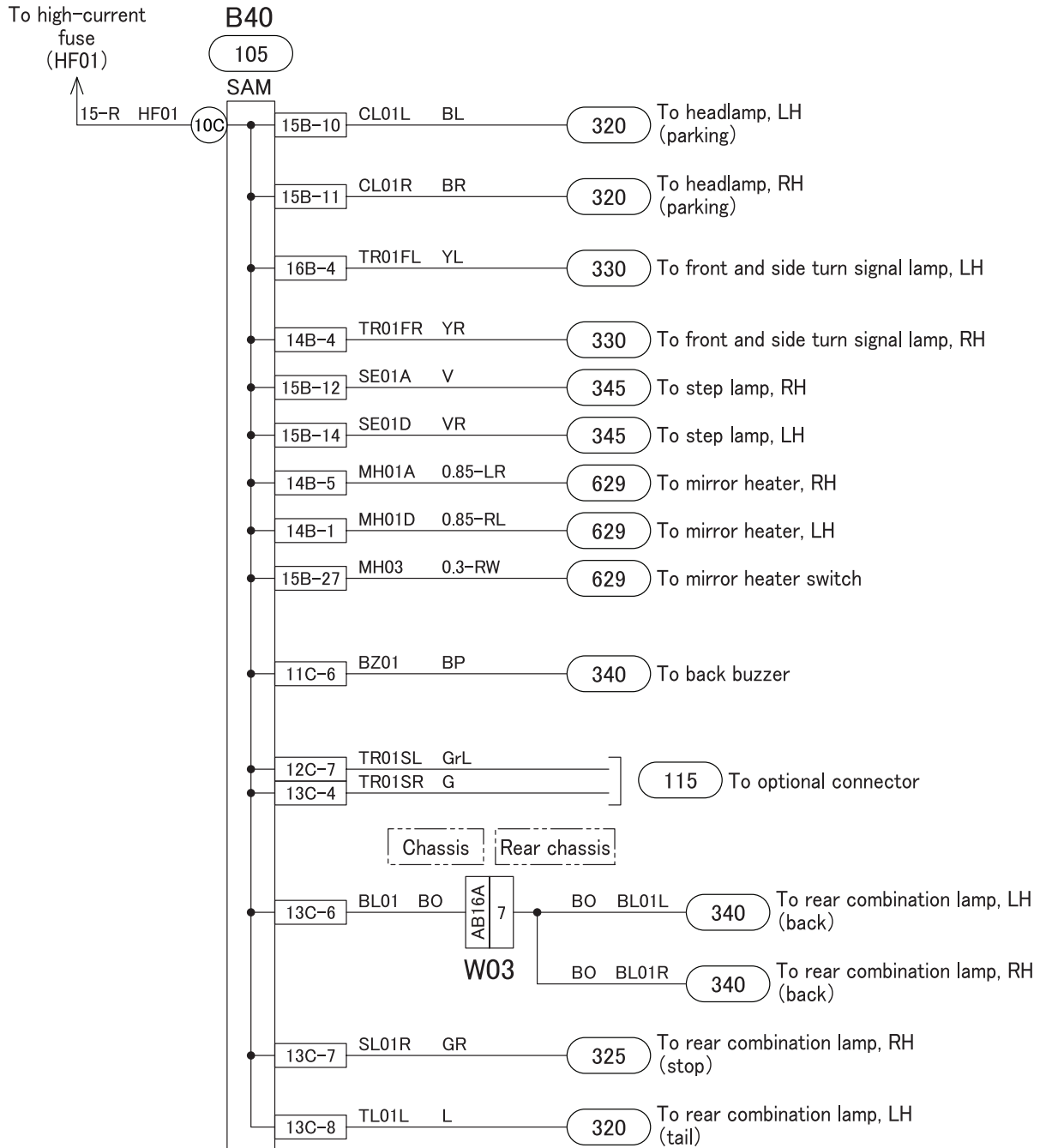


110-C073480B

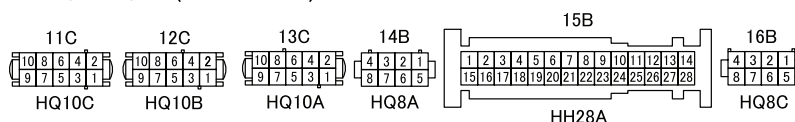


POWER CIRCUIT (12)

SAM
(VEHICLE BAT) 1/3



SAM connector (harness side)

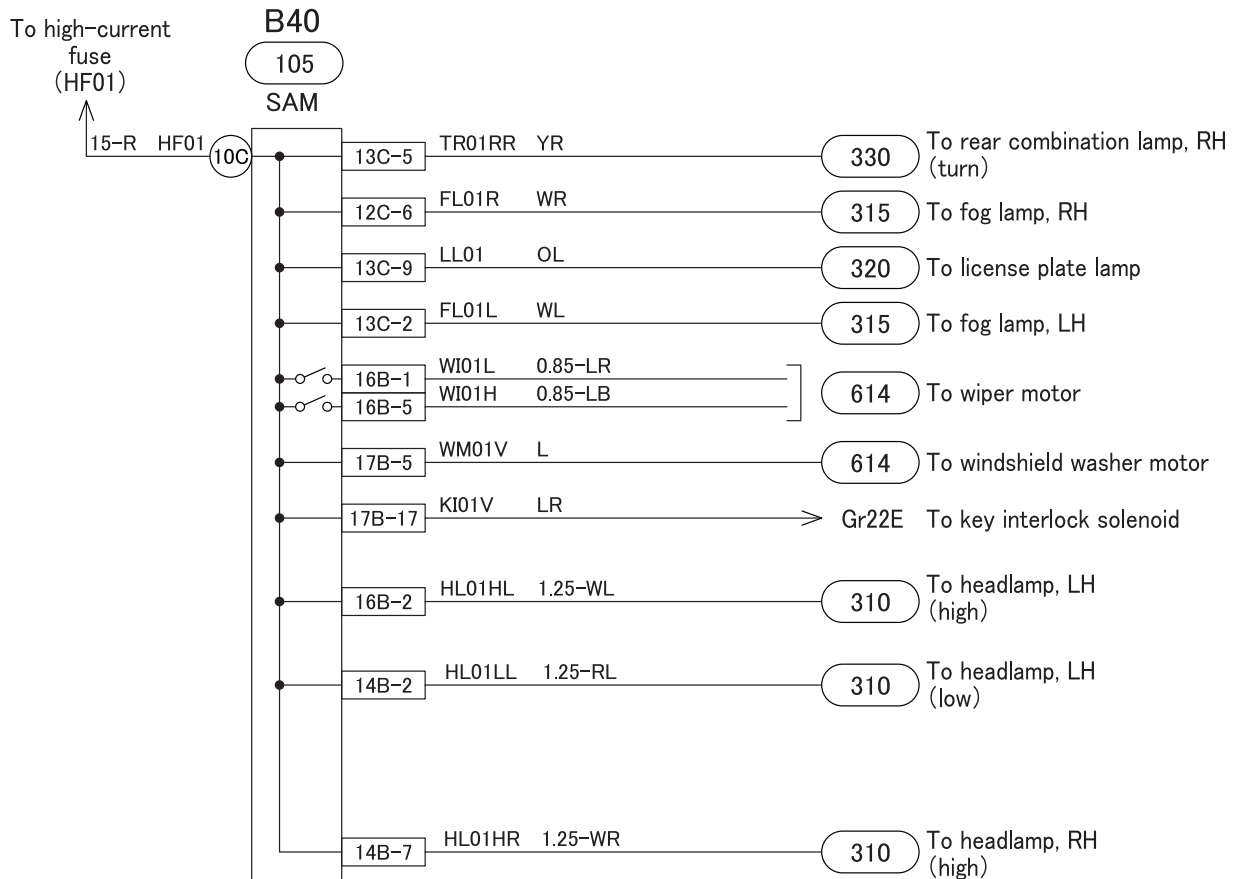


110-C07348VB-1

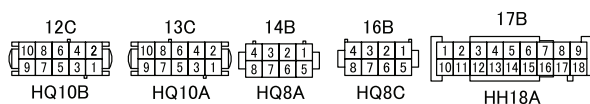


POWER CIRCUIT (13)

SAM
(VEHICLE BAT) 2/3



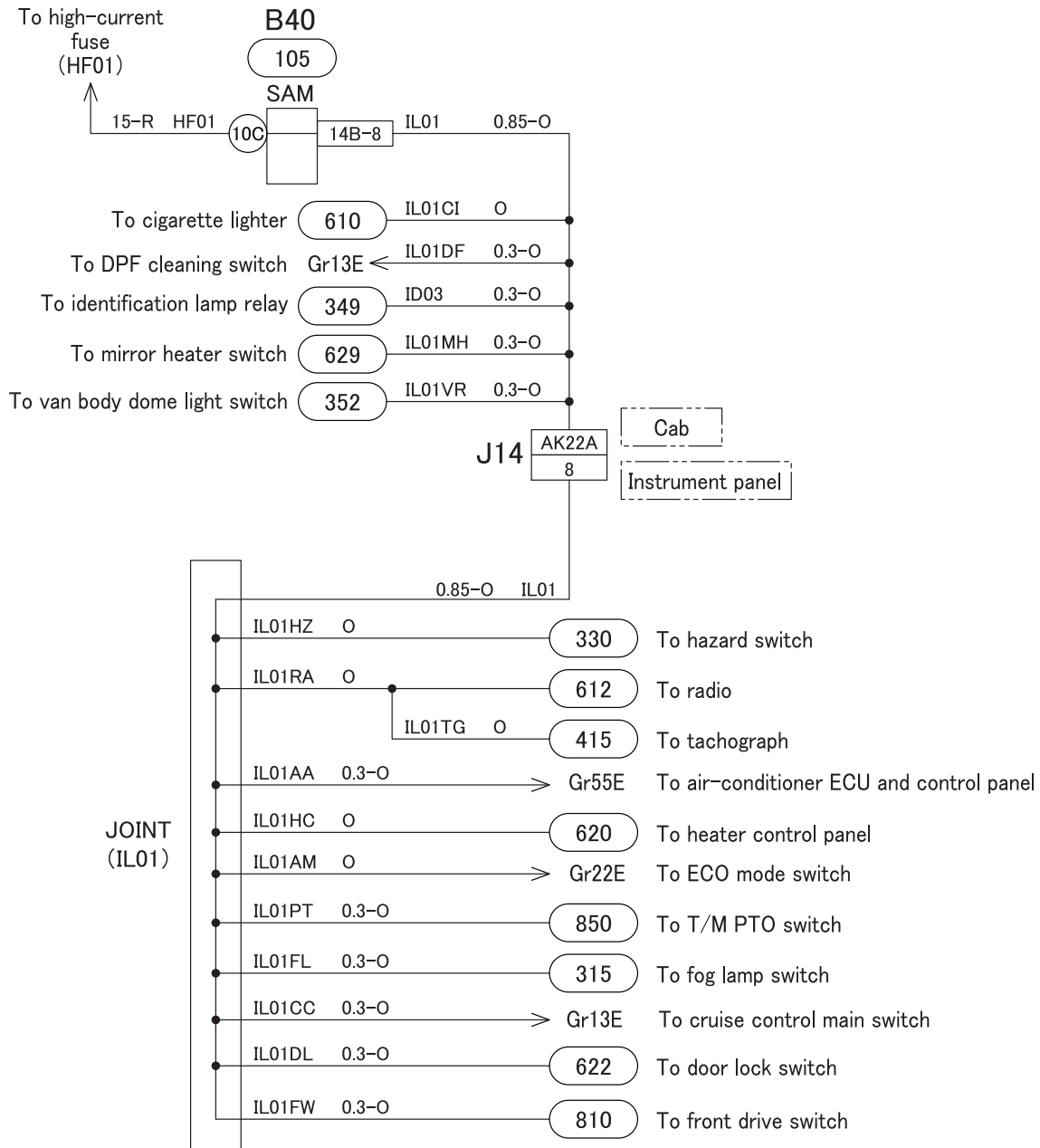
SAM connector (harness side)



110-C07348VB-2

POWER CIRCUIT (14)

SAM
(VEHICLE BAT) 3/3



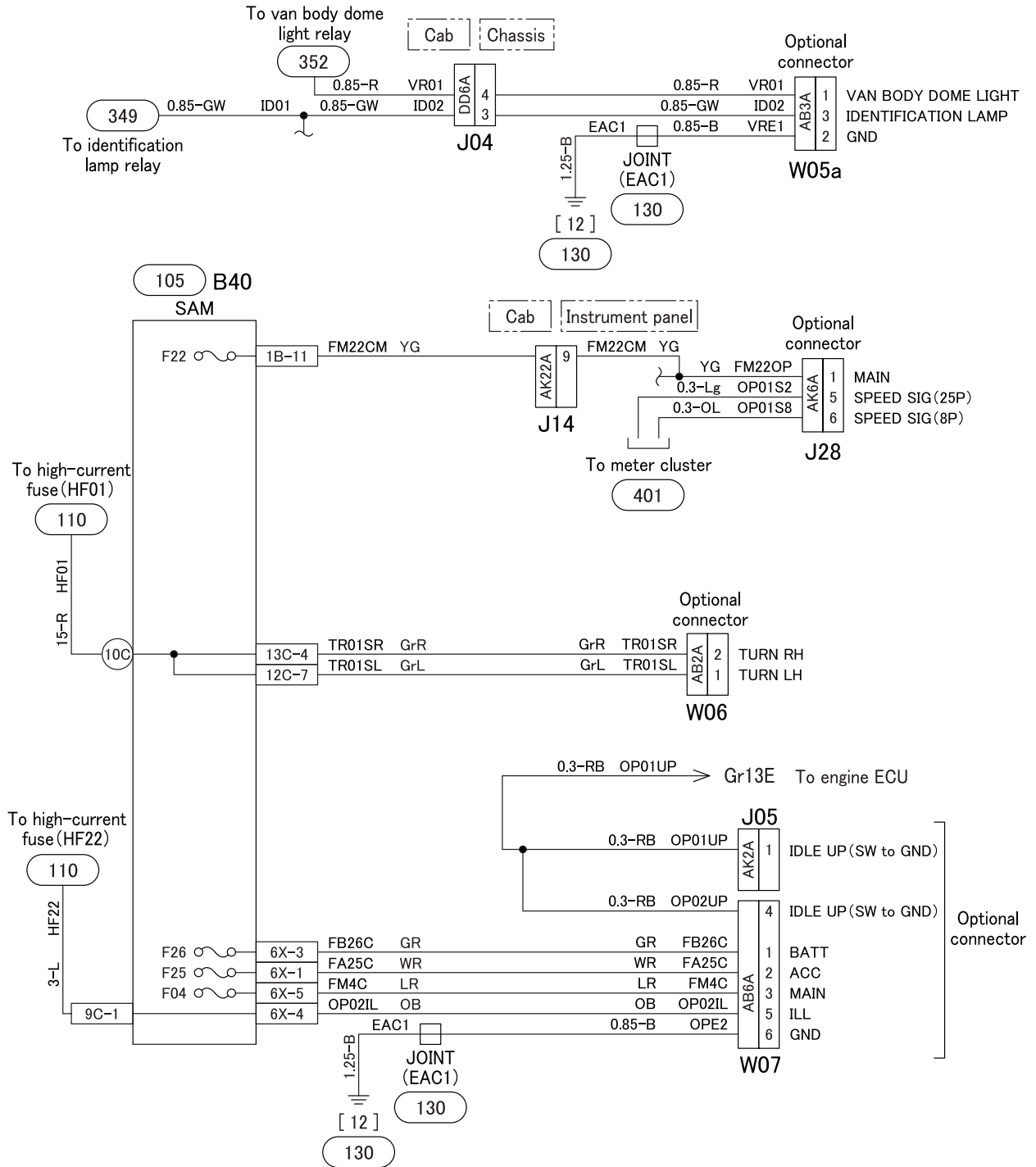
SAM connector (harness side)



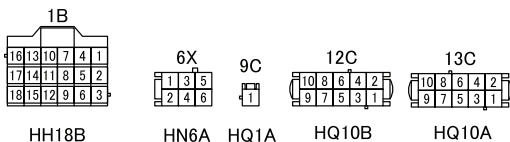
ECU : Electronic control unit
T/M : Transmission
PTO : Power take-off
DPF : Diesel particulate filter

110-C07348VB-3

RESERVE POWER CIRCUIT

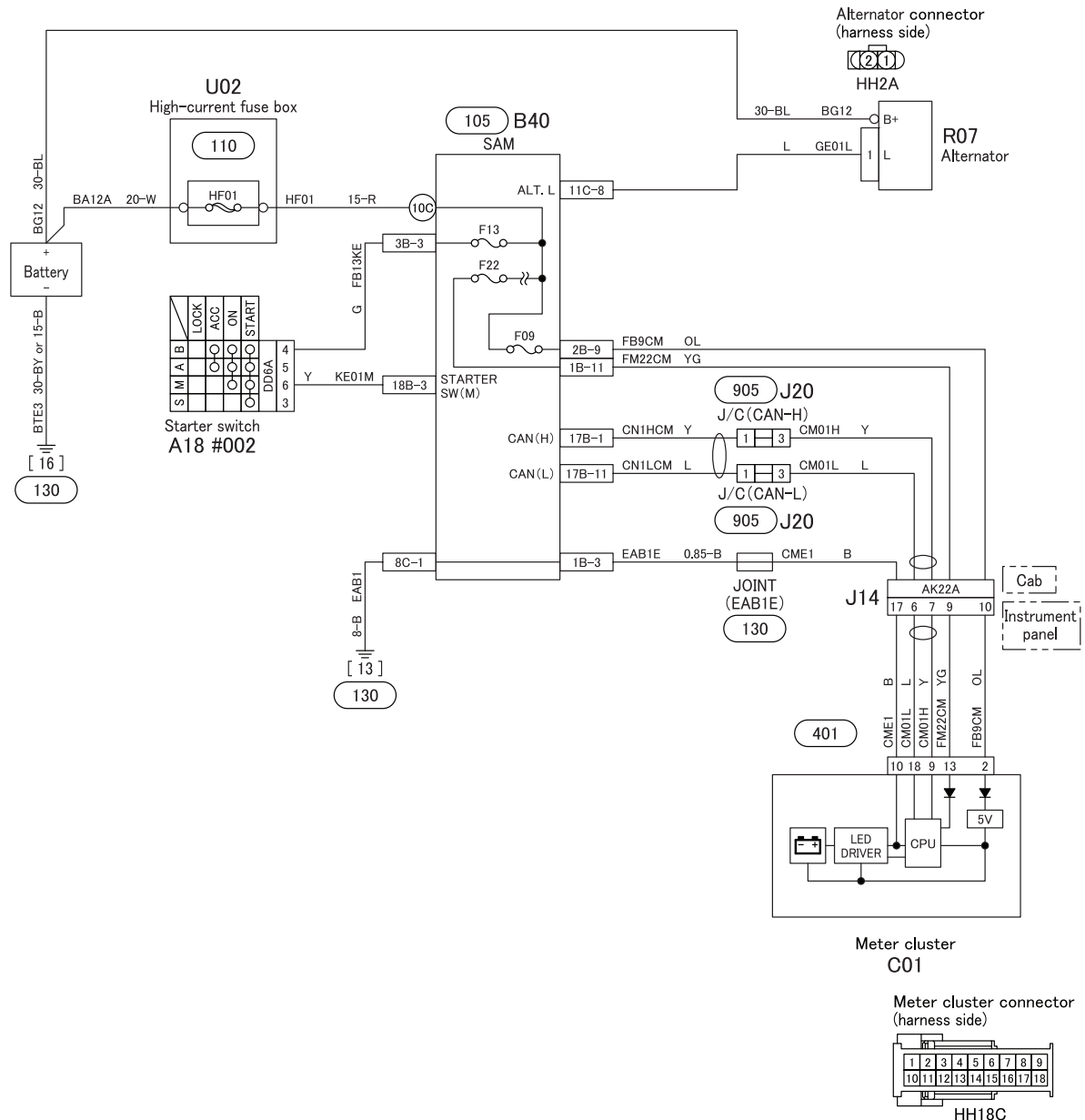


SAM connector (harness side)

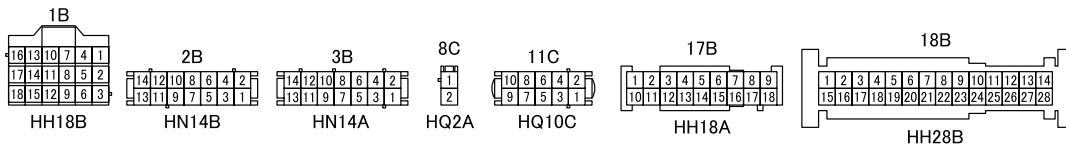


115-C07348

BATTERY CHARGING CIRCUIT



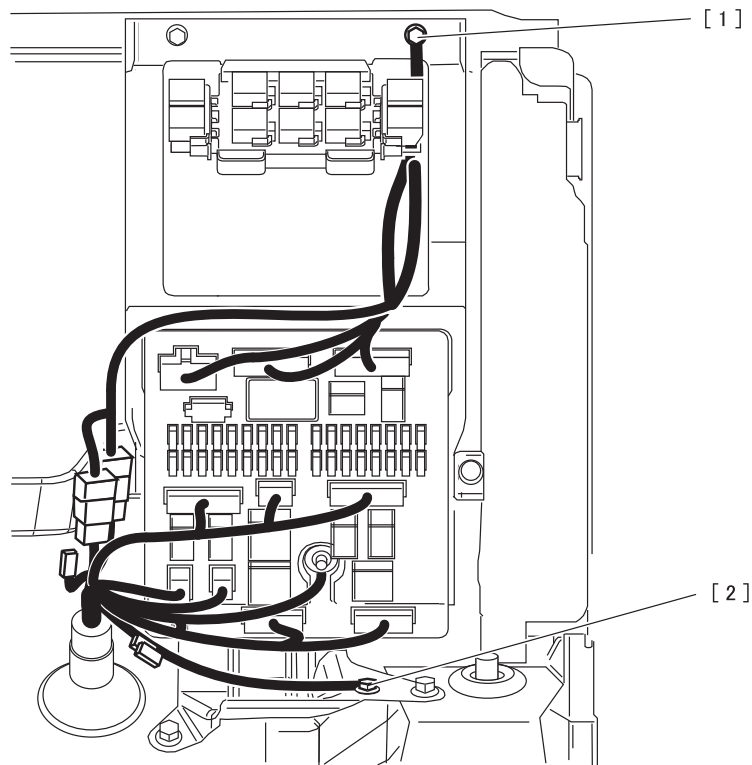
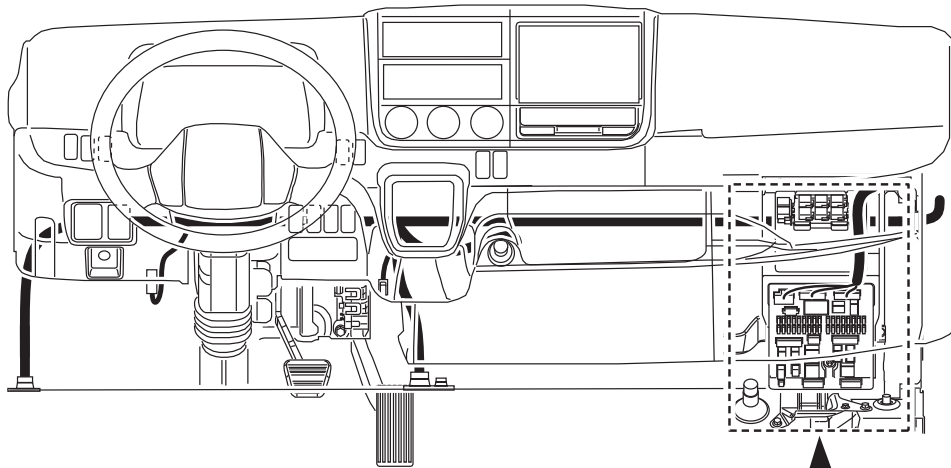
SAM connector (harness side)



125-C07348

GROUND (1)

[1] to [2] Cab ground

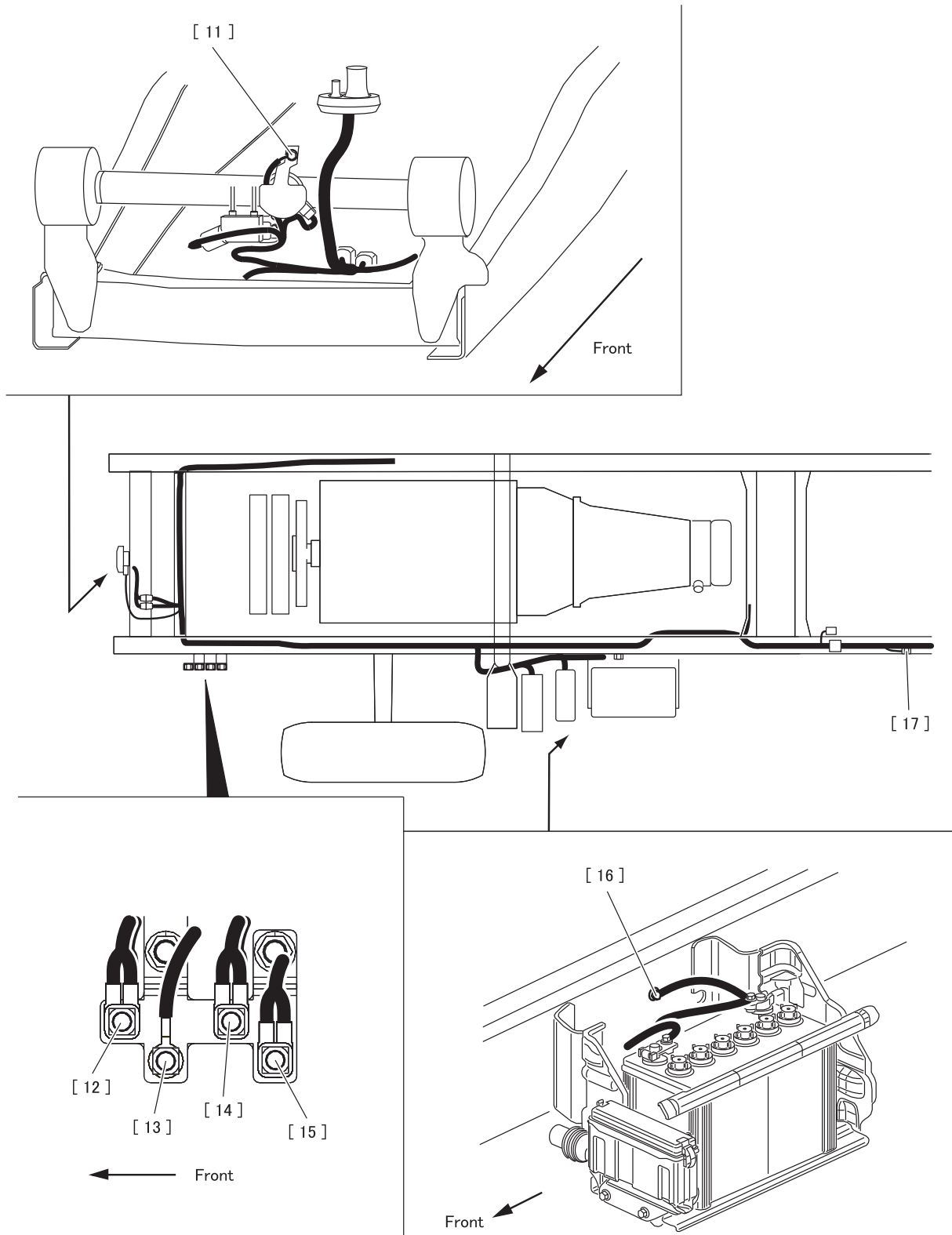


Location	Circuit No.	Wire diameter - wire color	Destination	Remarks
[1]	EAB2	1.25-B	JOINT (EAB2)	
[2]	EAB3	1.25-B	Frame ground ([12])	

54-L05232GND-1

GROUND (2)

[11] to [17] Chassis ground



54-L05232GND-2

GROUND (3)

Location	Circuit No.	Wire diameter - wire color	Destination	Remarks
[11]	HNE1	1.25-B	Frame ground ([12])	Horn
[12]	CFE1	1.25-B	Condenser fan motor	FE
	EAB3	1.25-B	Cab ground ([2])	
	EAC1	1.25-B	JOINT (EAC1)	
	FHE1	1.25-B	Fuel filter	FG
	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	FG
	EAR1		JOINT (EAR1)	FG
	FHE1		Fuel filter	FE
[16]	—	15-B	Battery	FG
	BTE3	30-BY	Battery	FE
[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

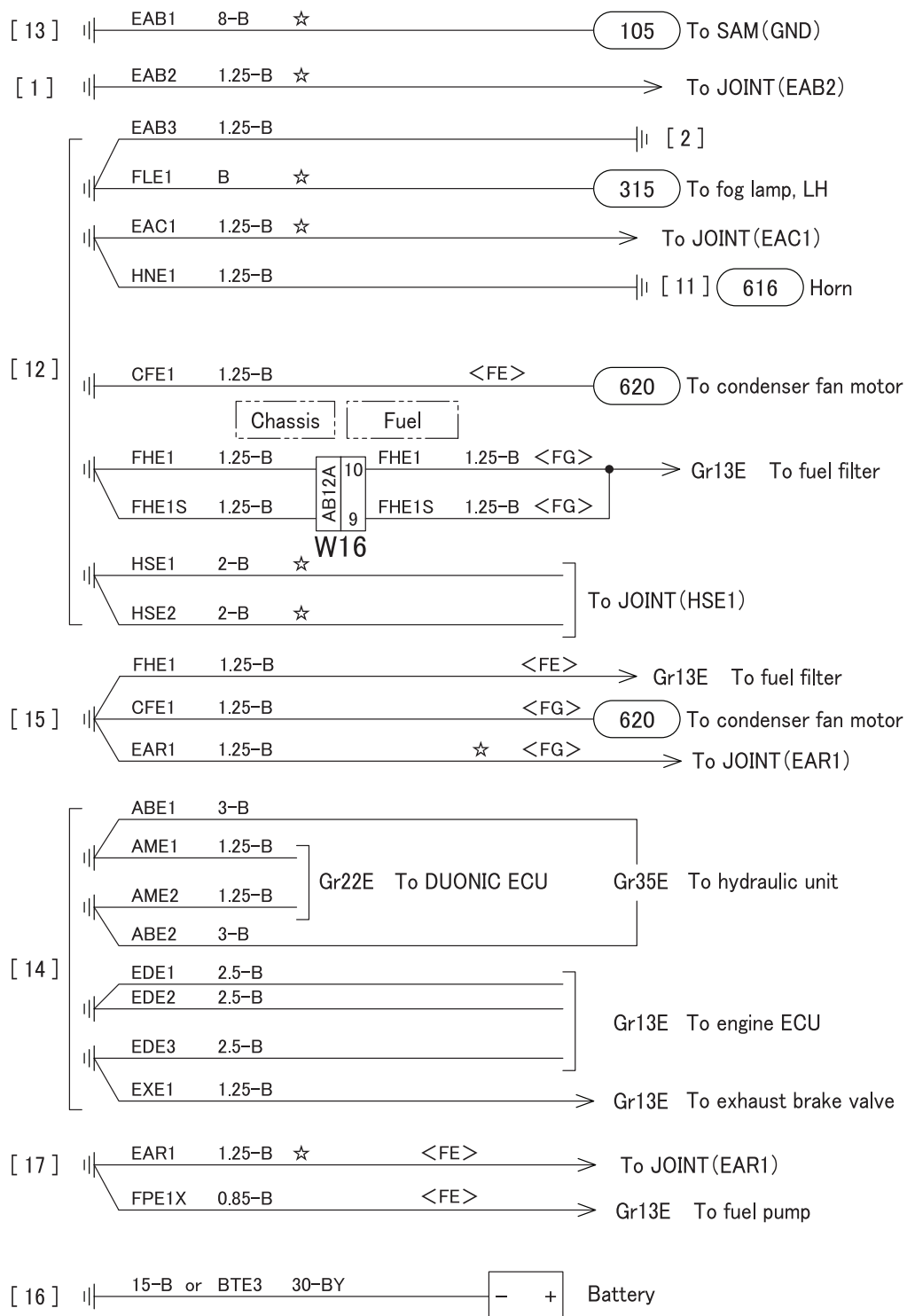
GROUND (4)

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

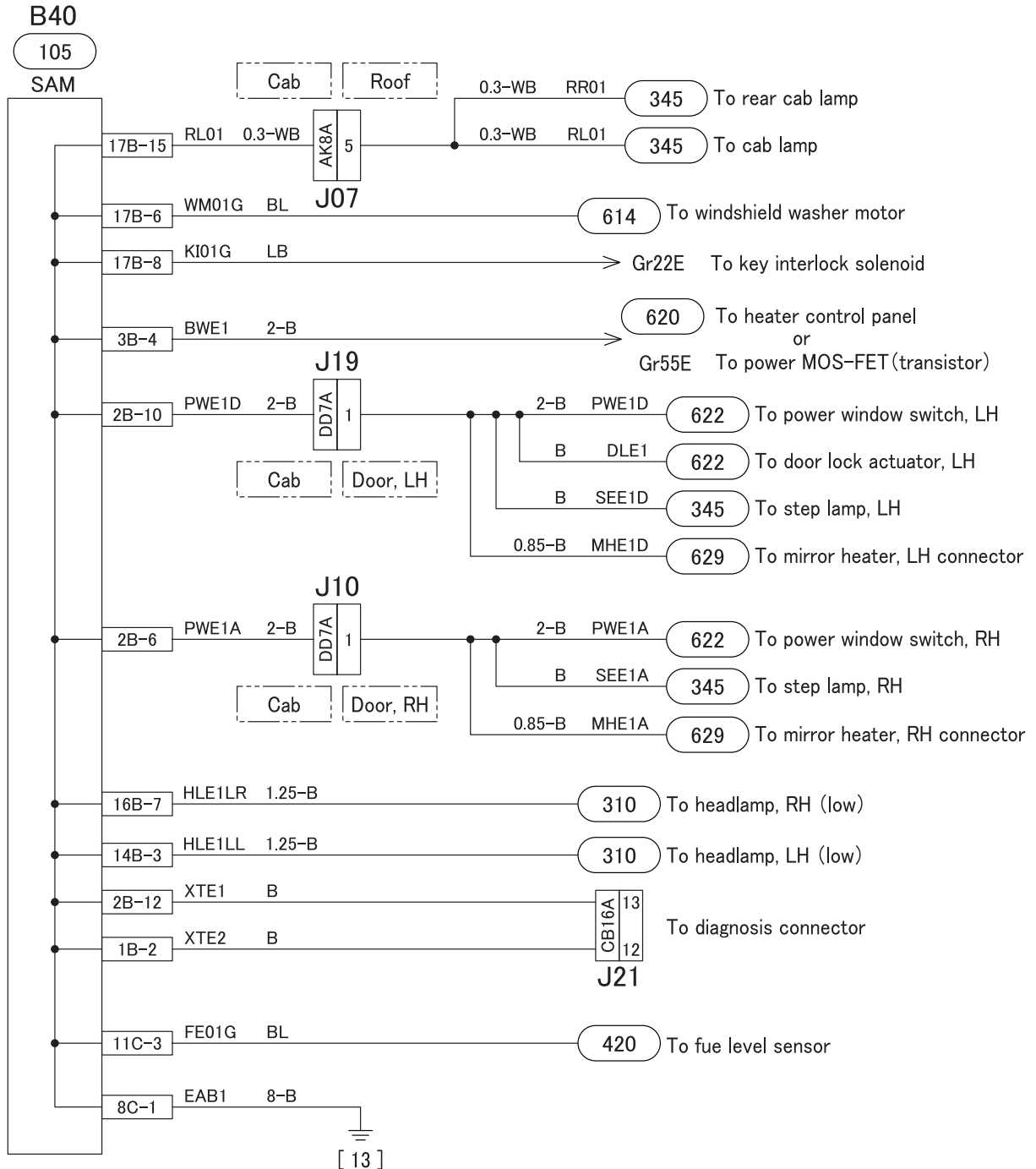


130-C07348ALL

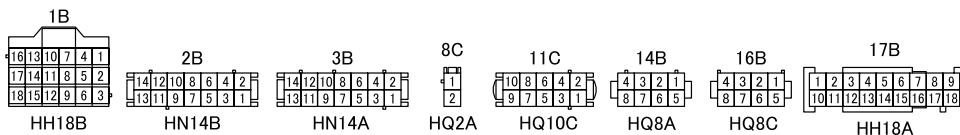


GROUND (5)

Circuit No. EAB1 ground (1/6)



SAM connector (harness side)

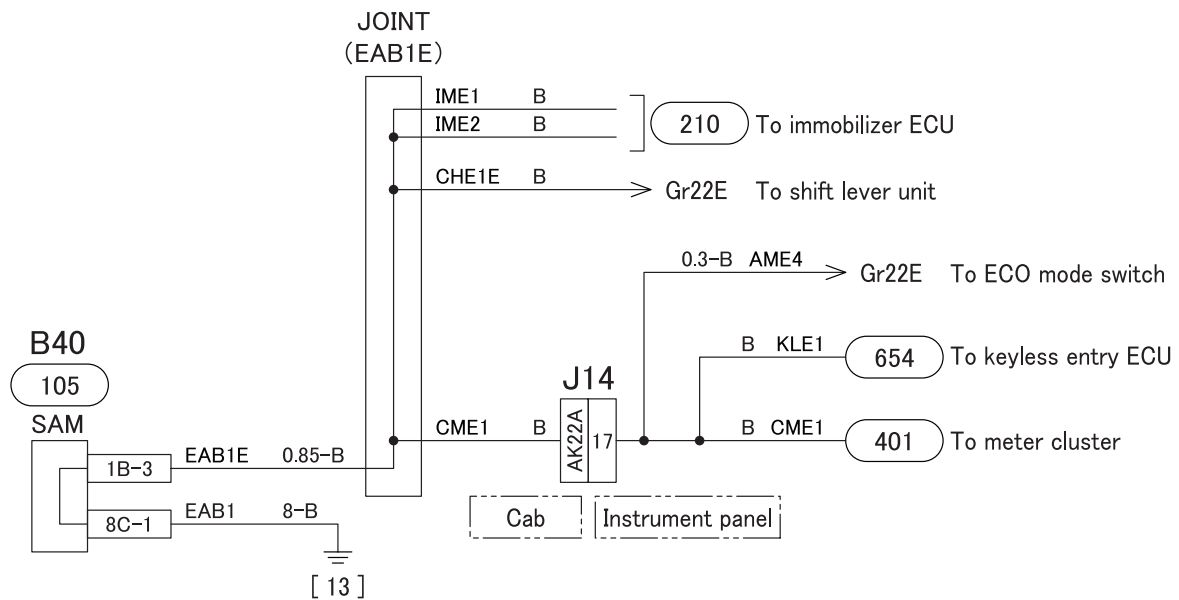


130-C07348EAB1-1

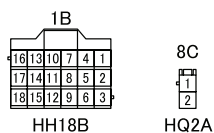
GROUND (6)

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

ECU : Electronic control unit



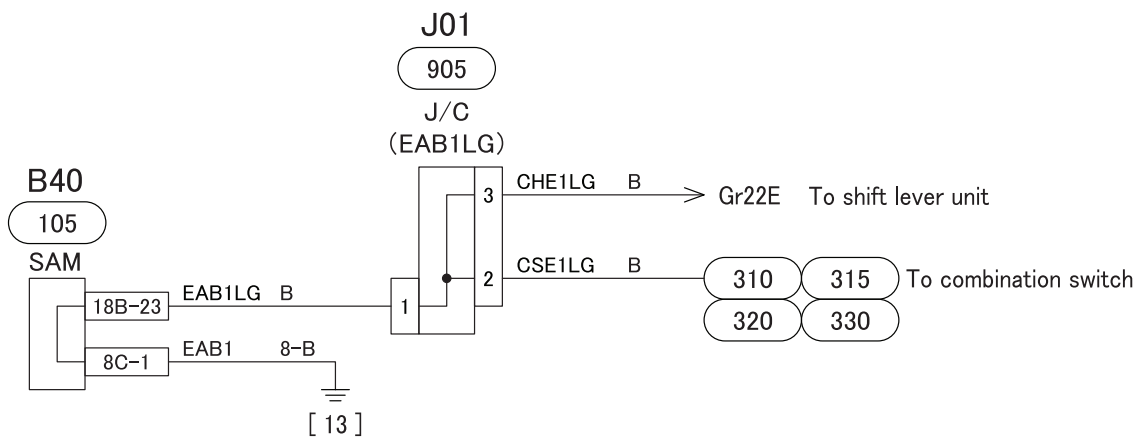
SAM connector (harness side)



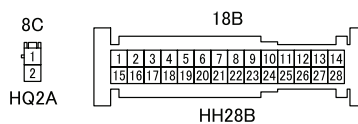
130-C07348EAB1-2

GROUND (7)

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



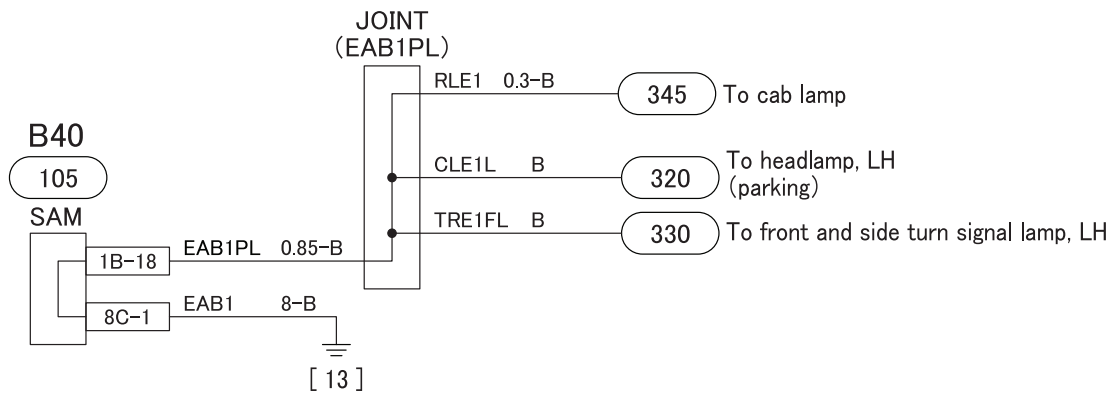
SAM connector (harness side)



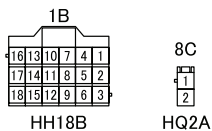
130-C07348EAB1-3

GROUND (8)

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



SAM connector (harness side)

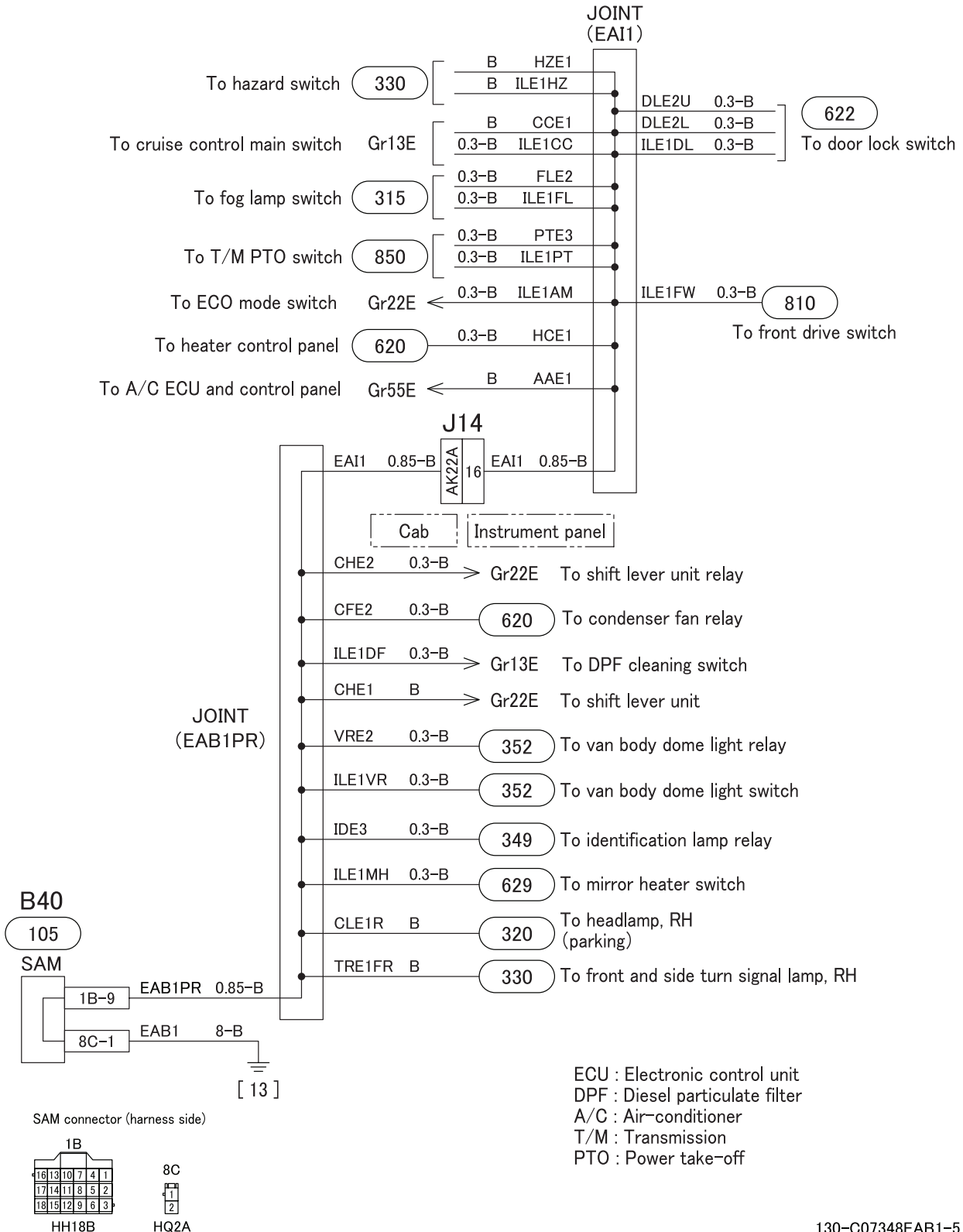


130-C07348EAB1-4



GROUND (9)

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

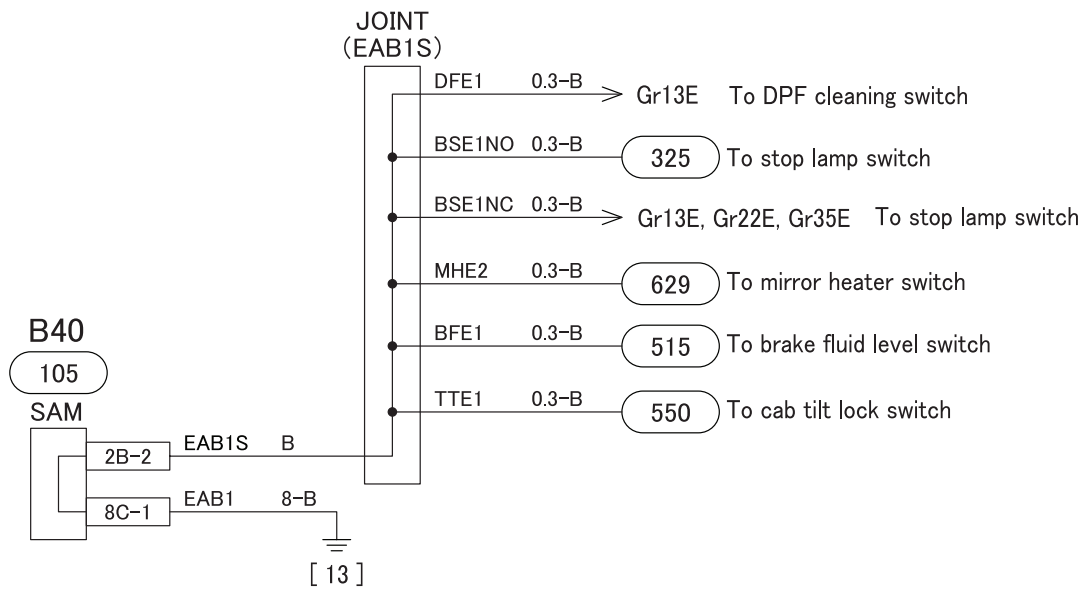


130-C07348EAB1-5

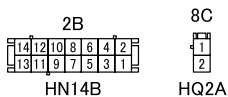
GROUND (10)

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

DPF : Diesel particulate filter



SAM connector (harness side)

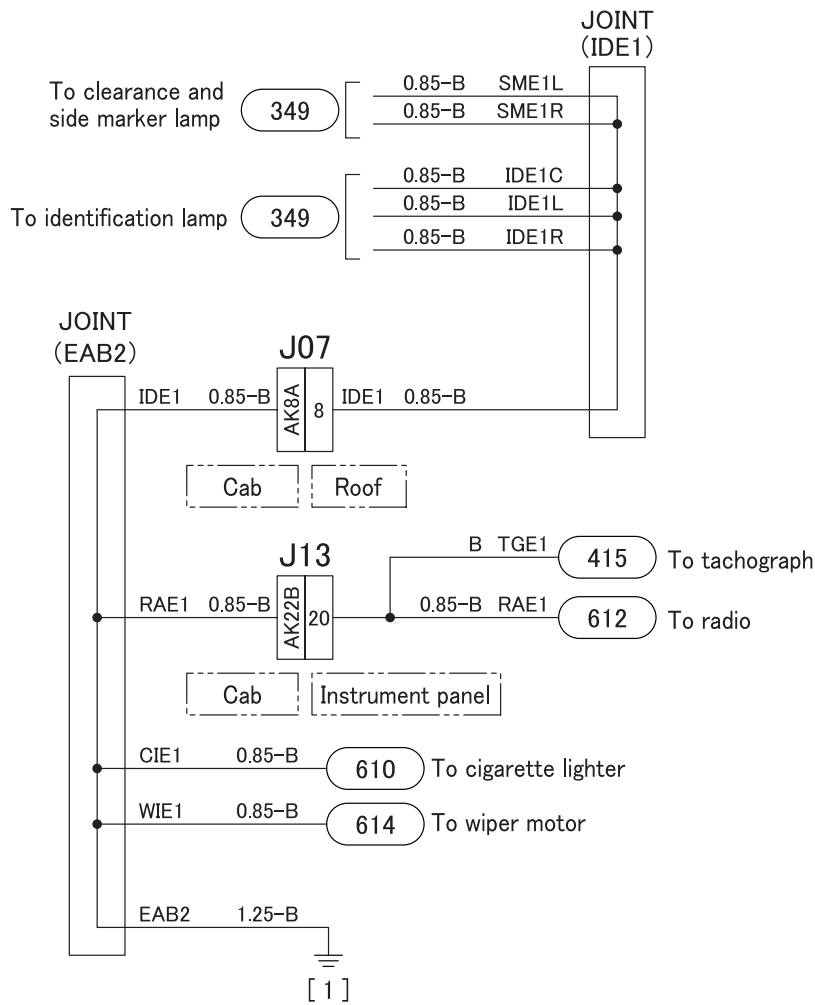


130-C07348EAB1-6



GROUND (11)

Circuit No. EAB2 ground

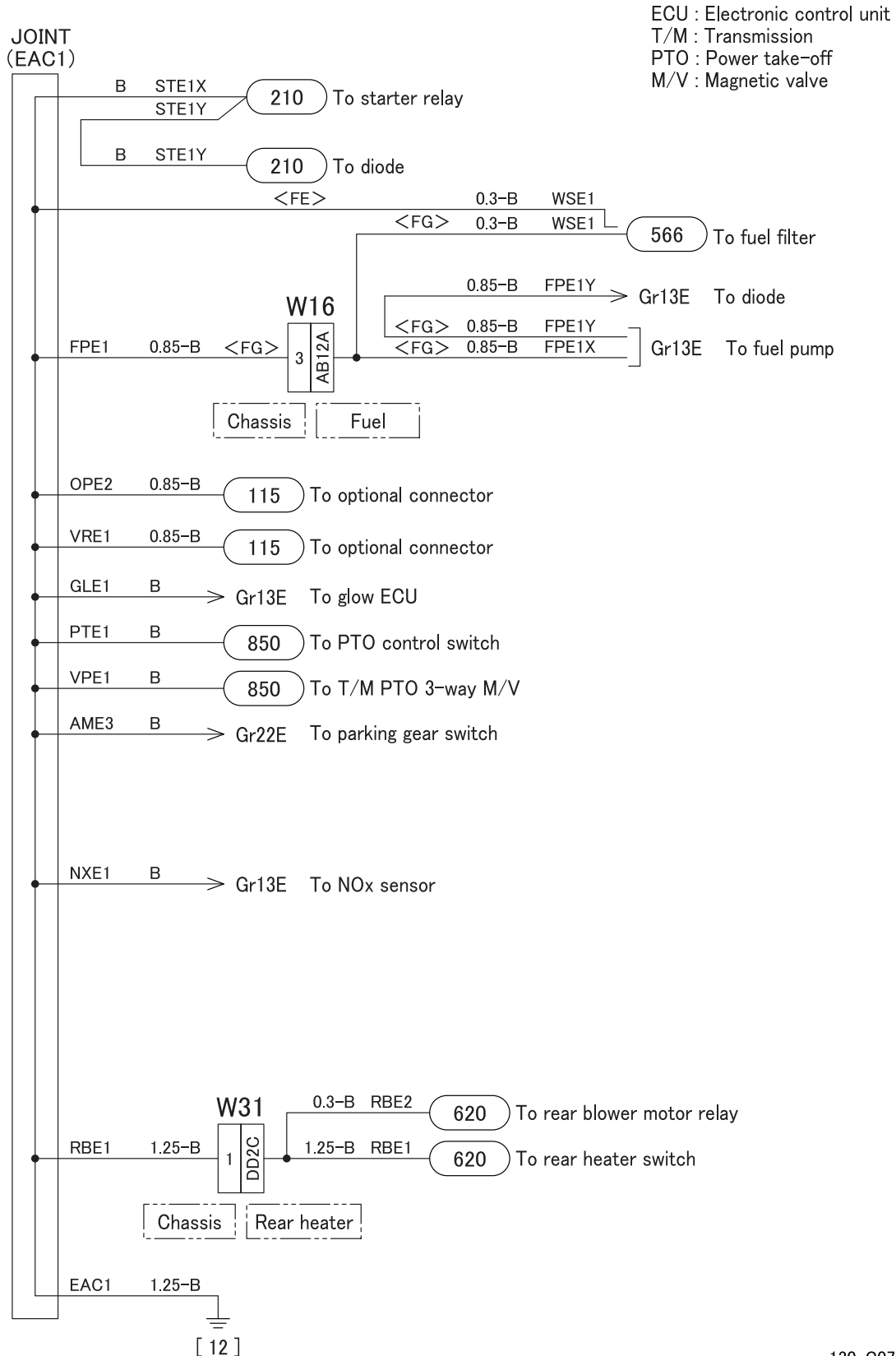


130-C07348EAB2



GROUND (12)

Circuit No. EAC1 ground



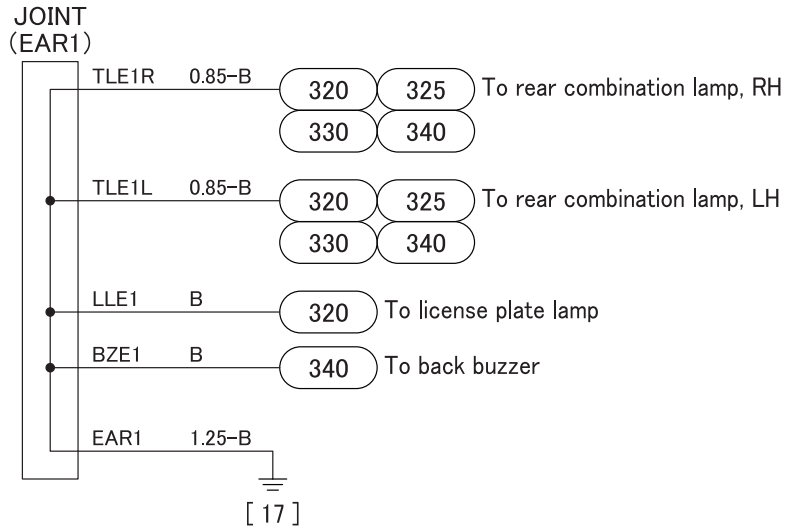
130-C07348EAC1



GROUND (13)

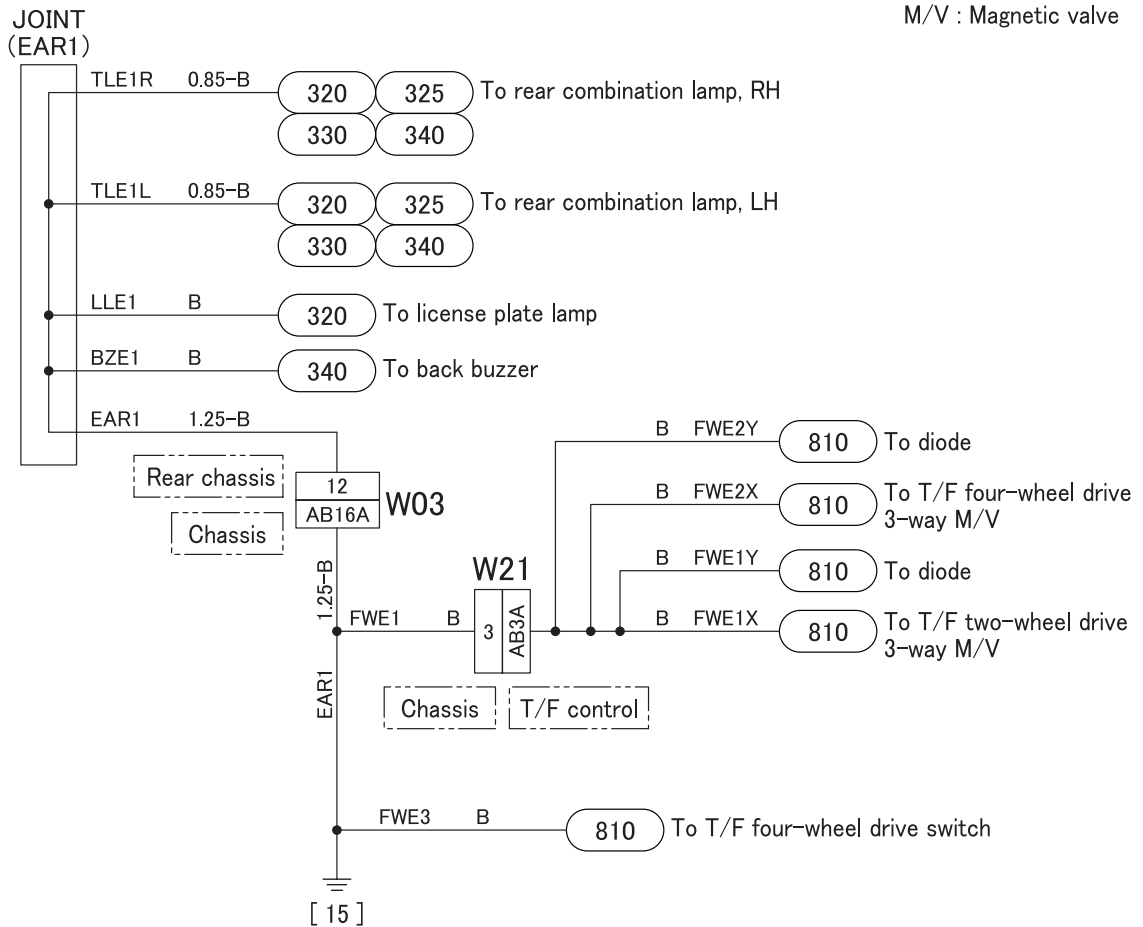
Circuit No. EAR1 ground

<FE>



<FG>

T/F : Transfer
M/V : Magnetic valve

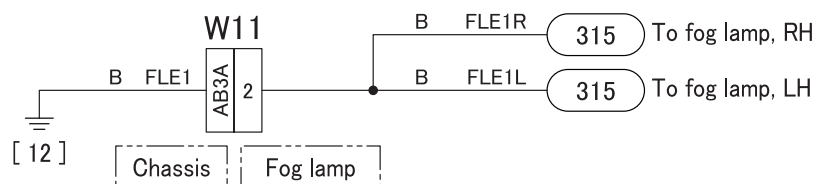


130-C07348EAR1



GROUND (14)

Circuit No. FLE1 ground



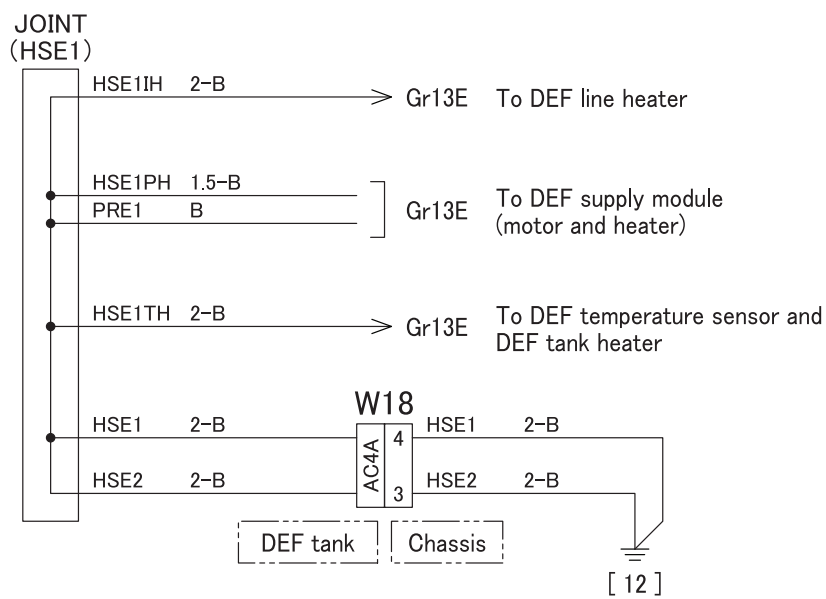
130-C07348FLE1



GROUND (15)

Circuit No. HSE1, HSE2 ground

DEF : Diesel exhaust fluid

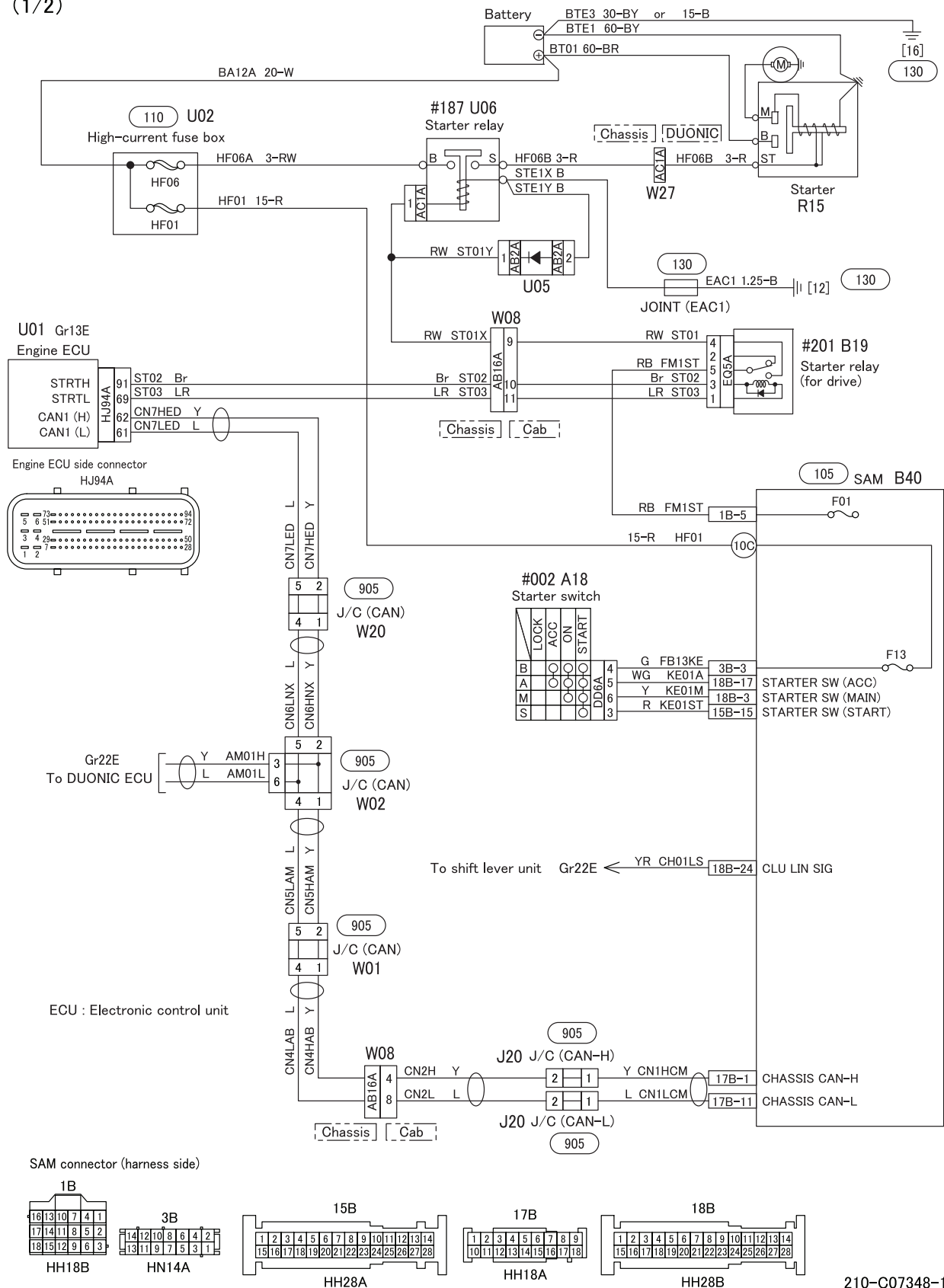


130-C07348HSE1



ENGINE STARTING CIRCUIT (1)

(1/2)

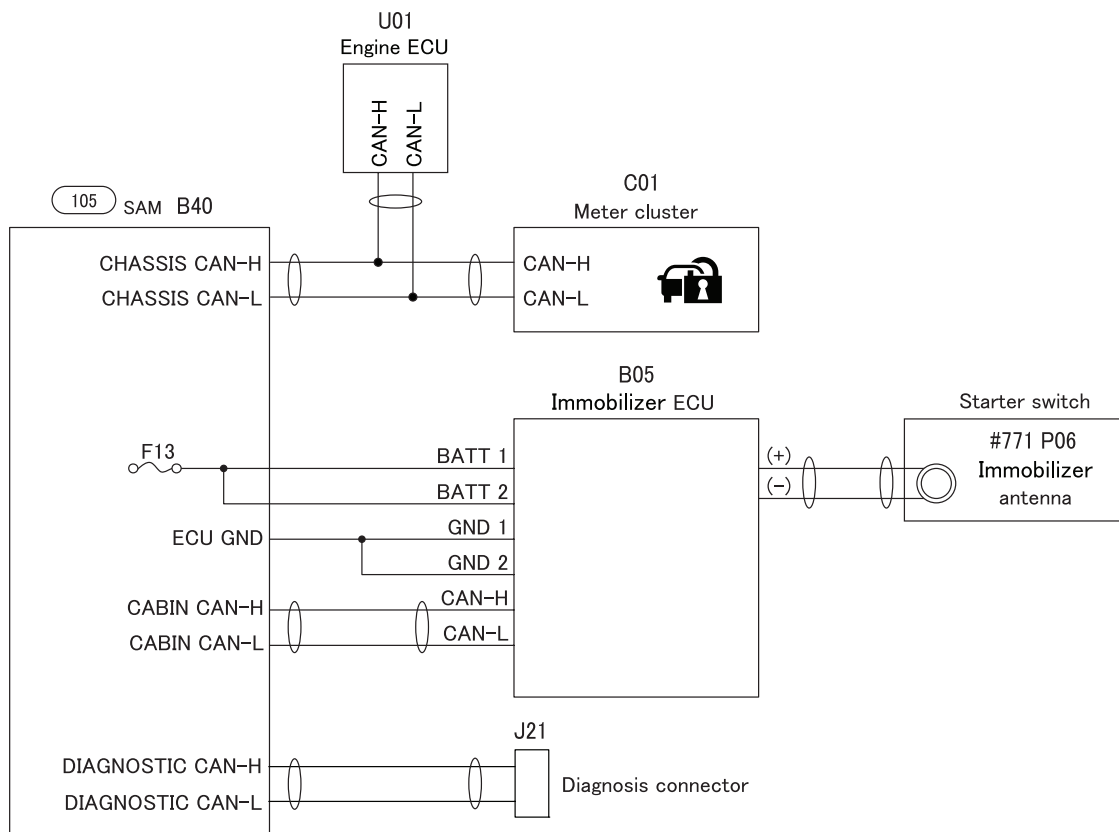


ENGINE STARTING CIRCUIT (2)

(2/2)

A part of immobilizer circuit is omitted.

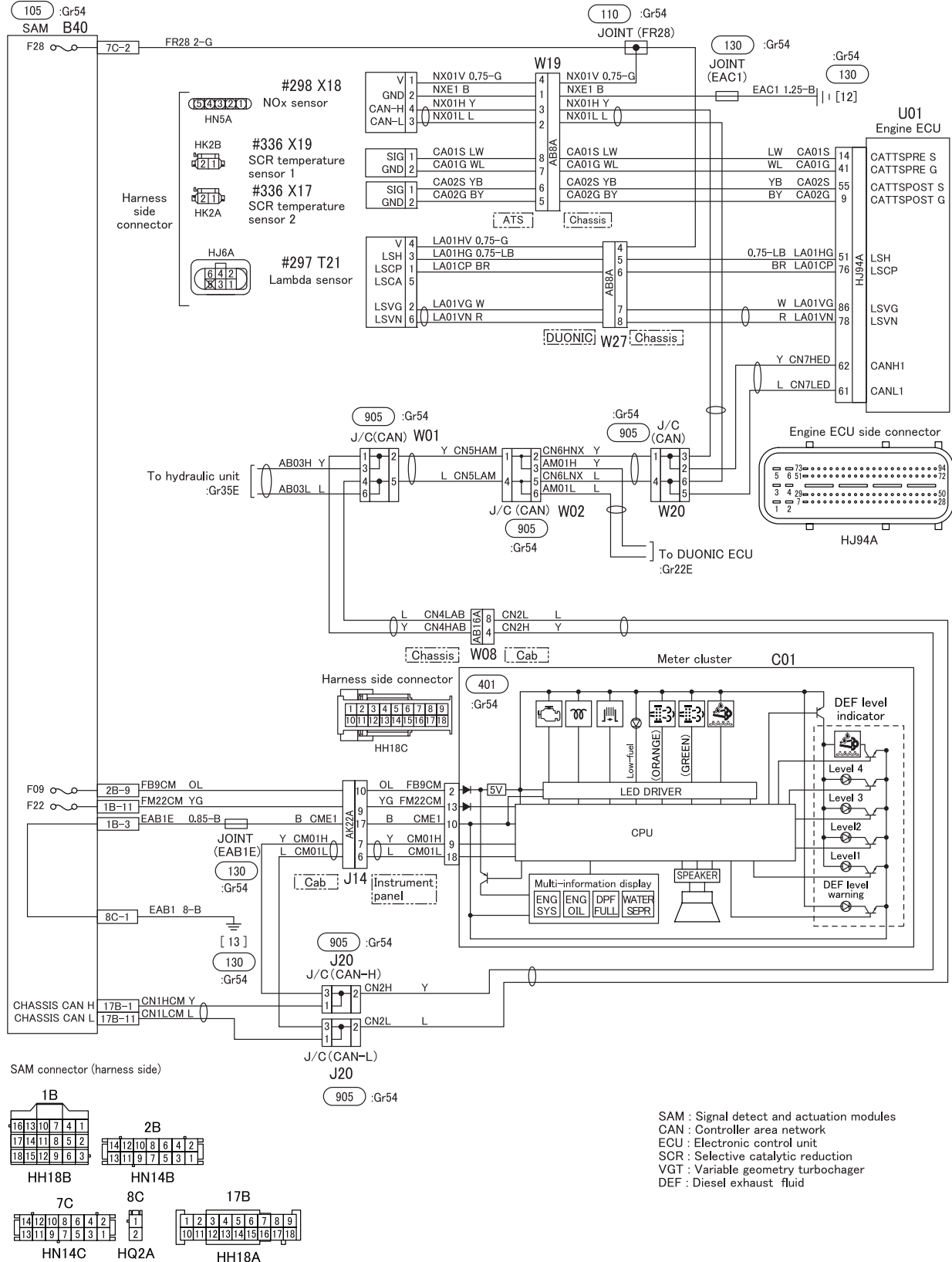
ECU : Electronic control unit



210-C07348-2

ENGINE ELECTRIC CIRCUIT (3/6)

(3/6)

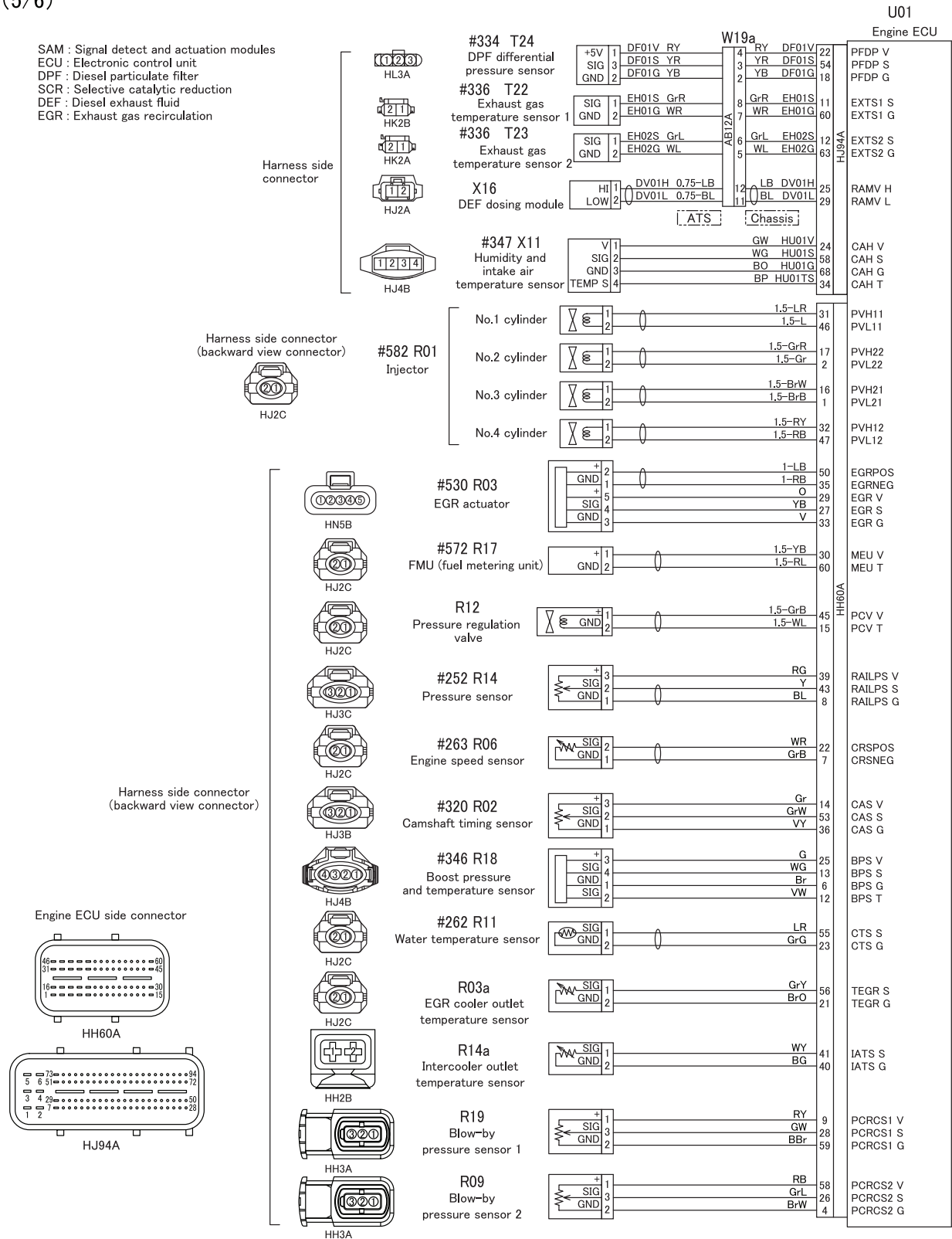


13E-C07348-3

ENGINE ELECTRIC CIRCUIT (5/6)

(5/6)

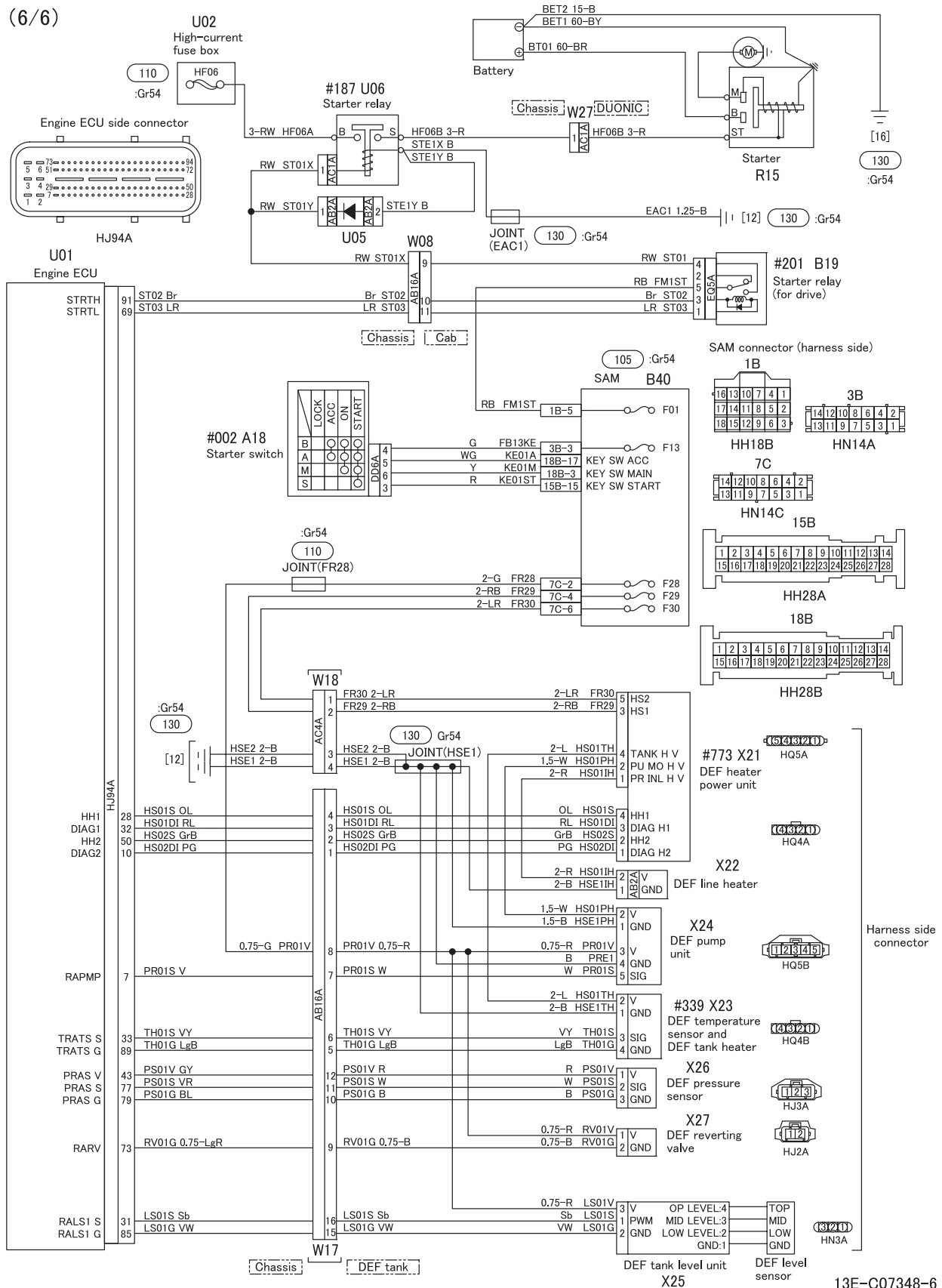
SAM : Signal detect and actuation modules
 ECU : Electronic control unit
 DPF : Diesel particulate filter
 SCR : Selective catalytic reduction
 DEF : Diesel exhaust fluid
 EGR : Exhaust gas recirculation



13E-C07348-5

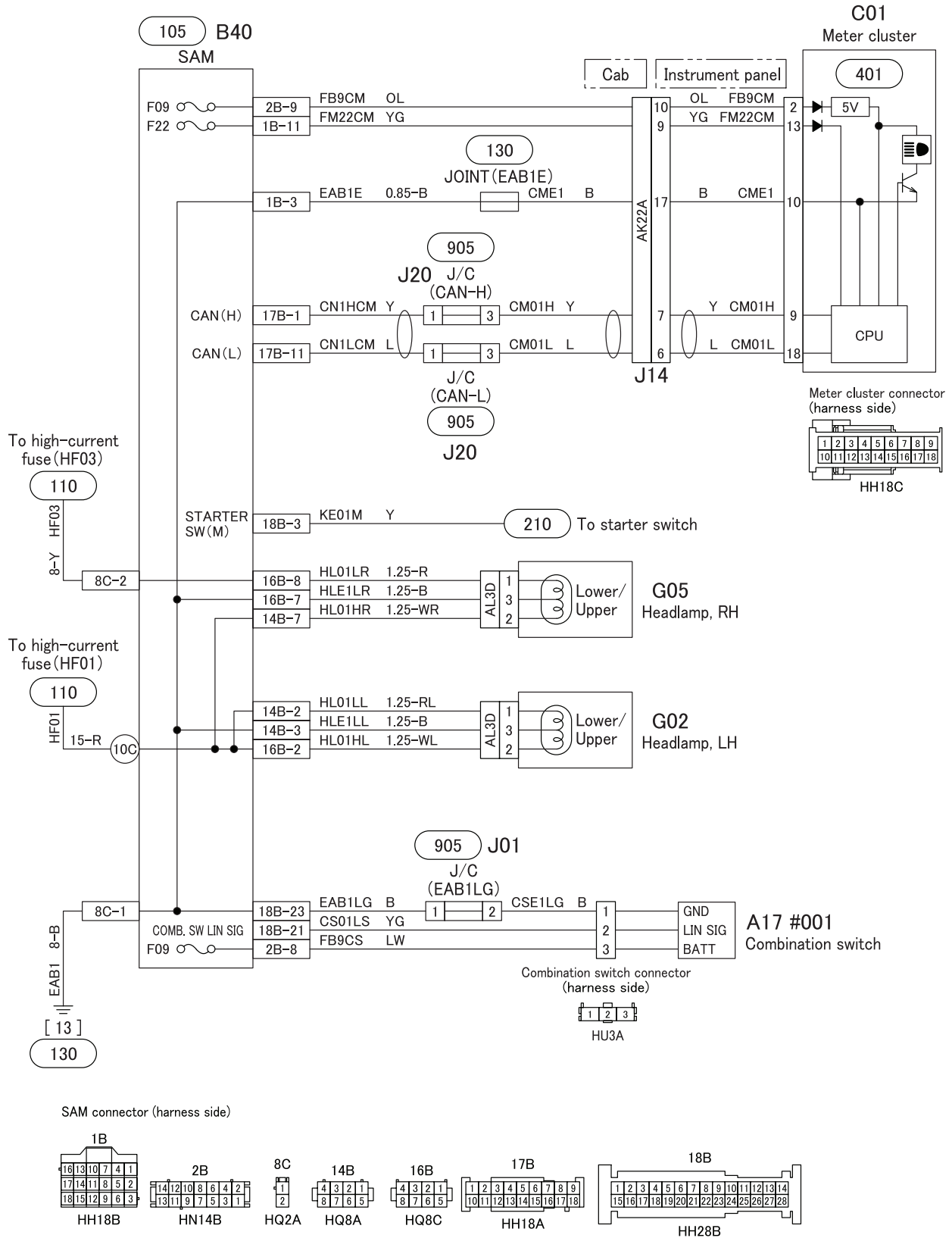
ENGINE ELECTRIC CIRCUIT (6/6)

(6/6)



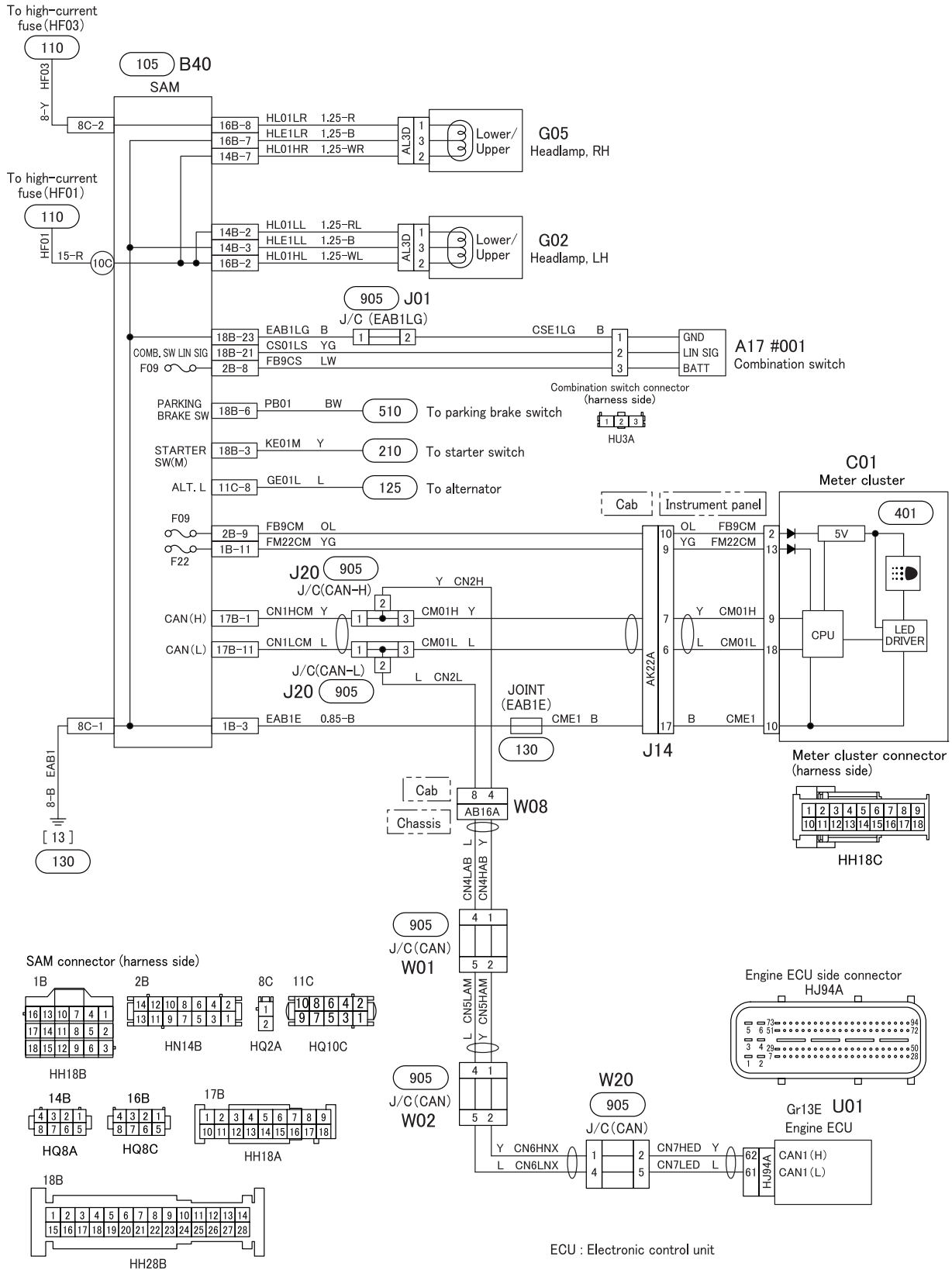
13E-C07348-6

HEADLAMP CIRCUIT



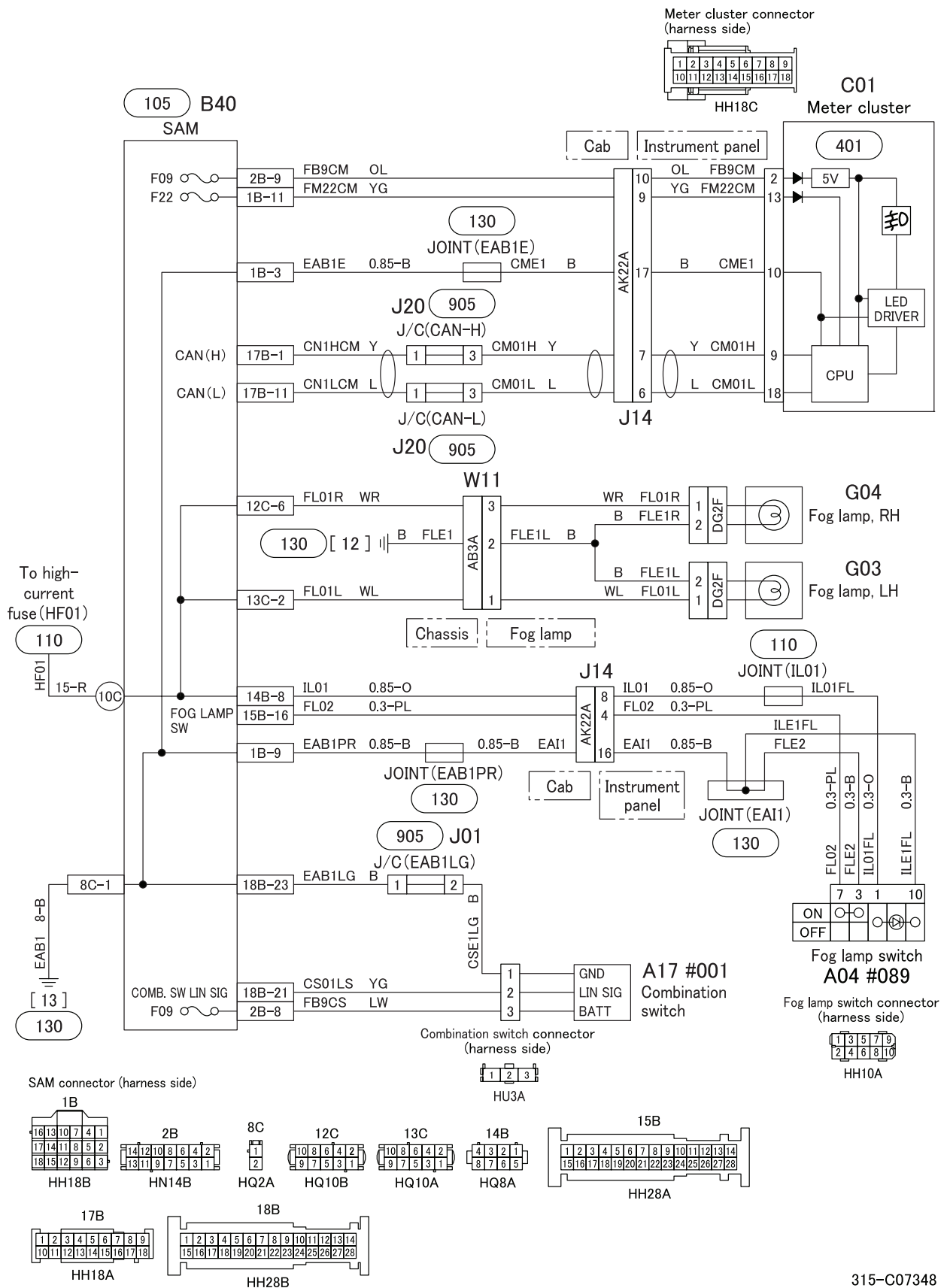
310-C07348

DAYTIME RUNNING LIGHT CIRCUIT



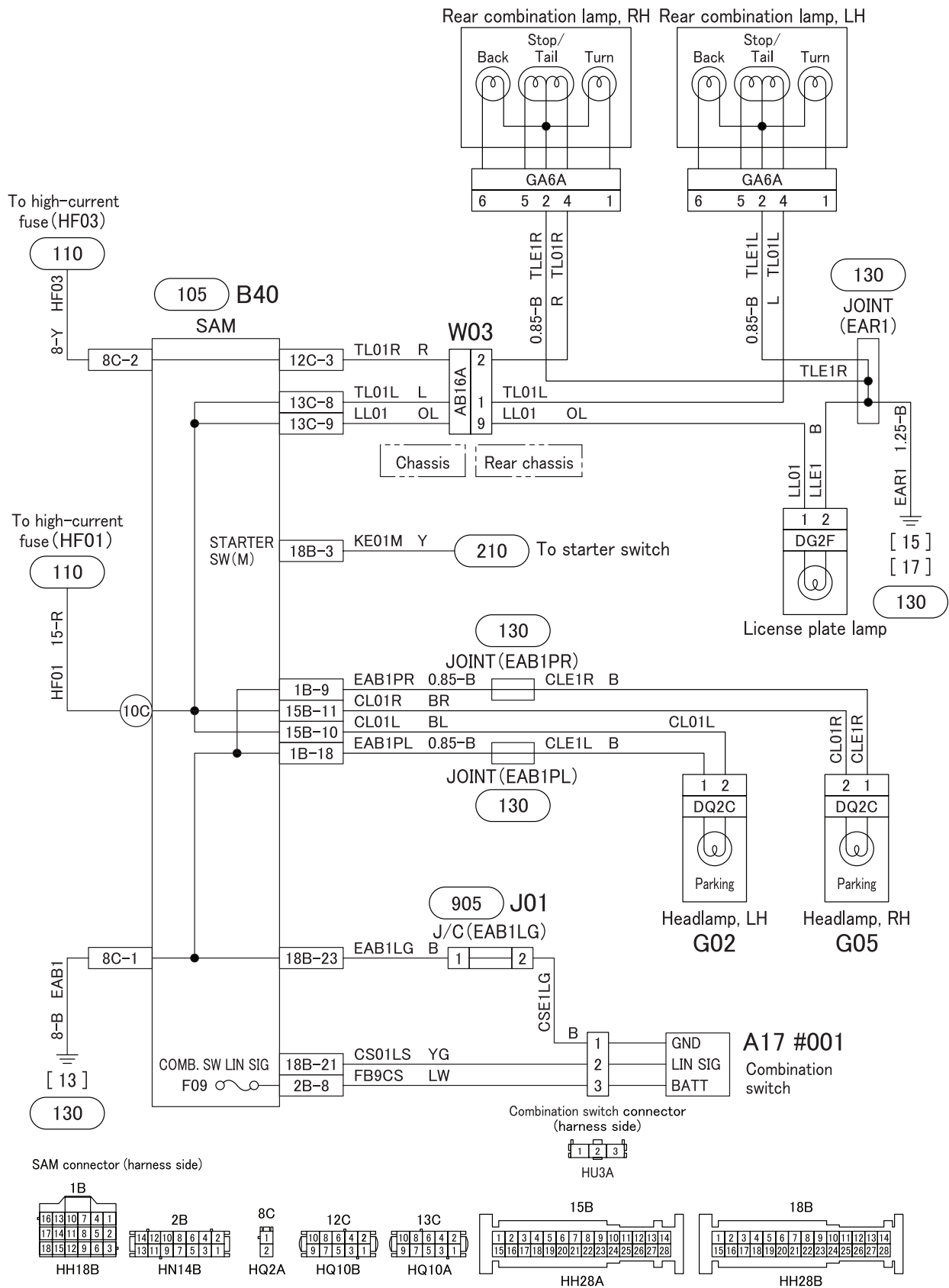
313-C07348

FOG LAMP CIRCUIT



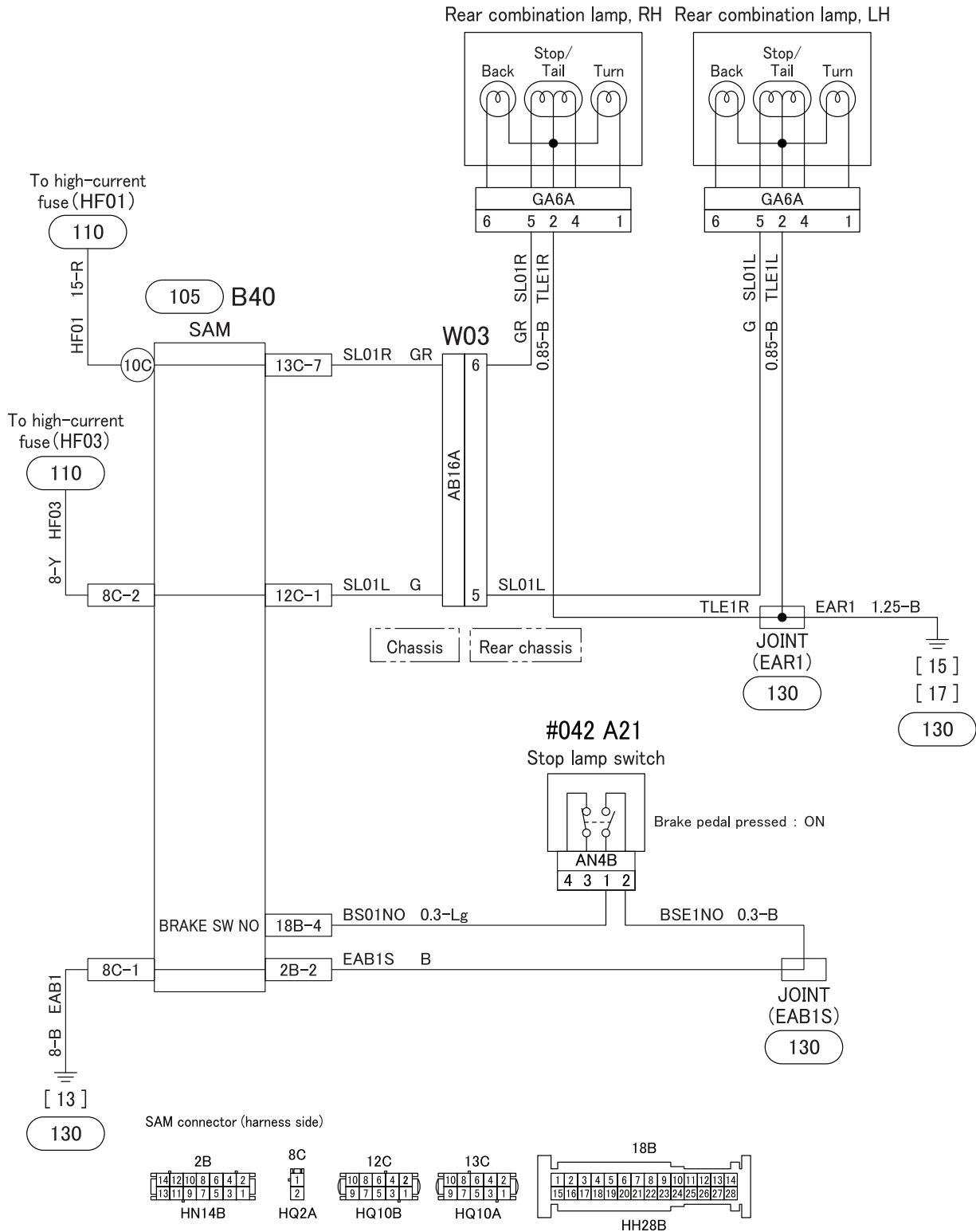
315-C07348

TAIL, POSITION AND LICENSE PLATE LAMPS CIRCUIT



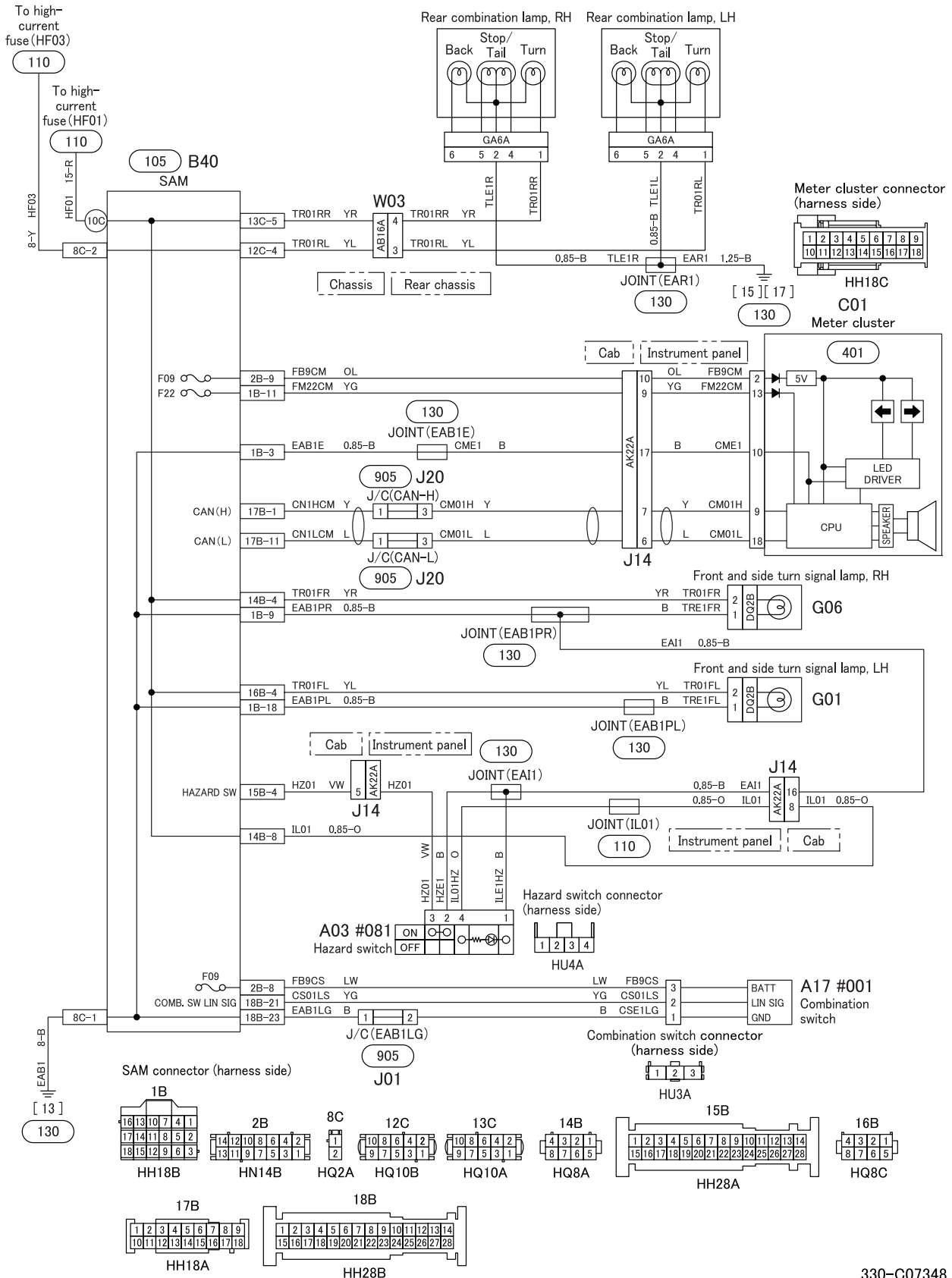
320-C07348

STOP LAMP CIRCUIT



325-C07348

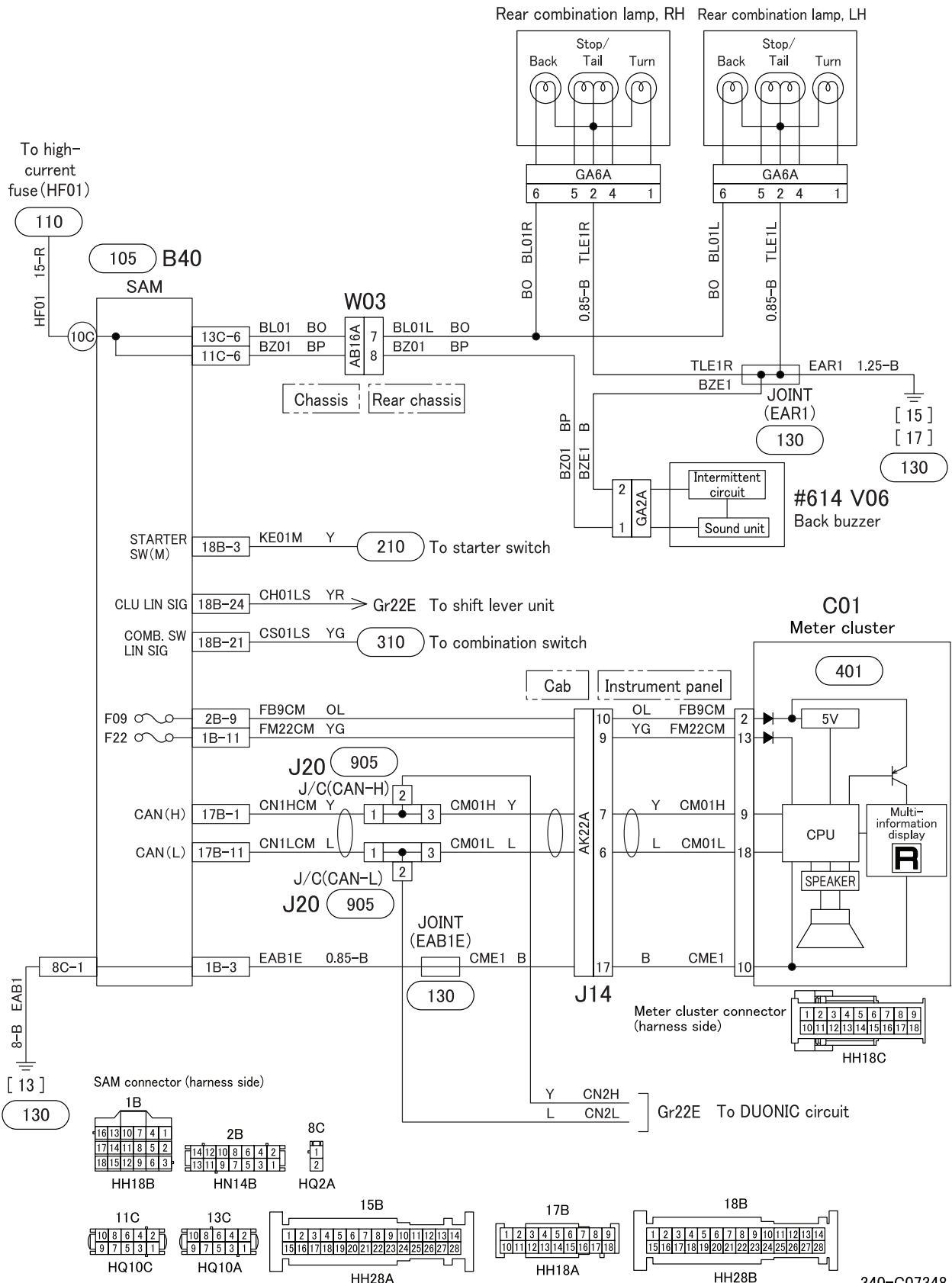
TURN SIGNAL AND HAZARD LAMP CIRCUIT



330-C07348



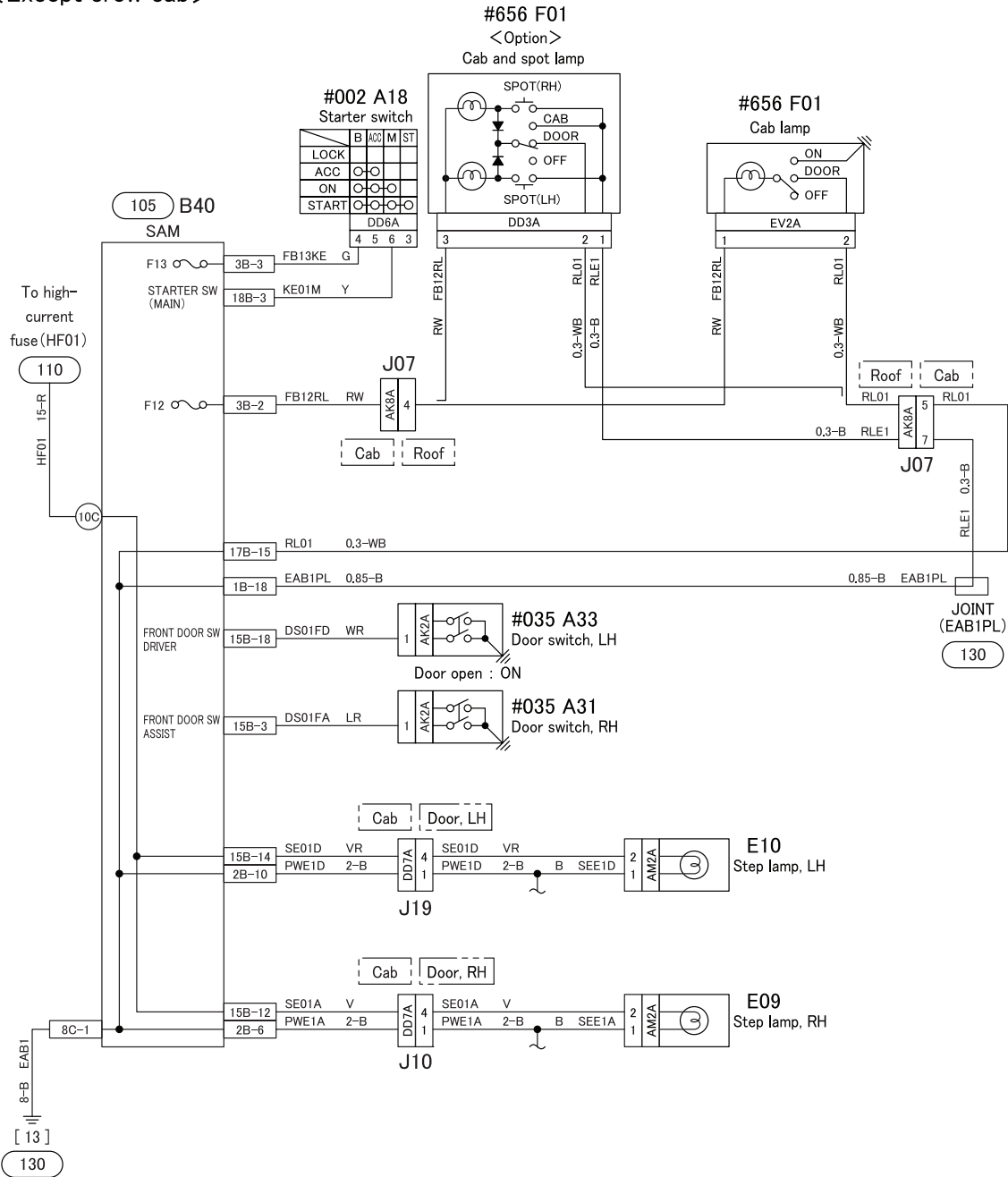
BACKUP LAMP CIRCUIT



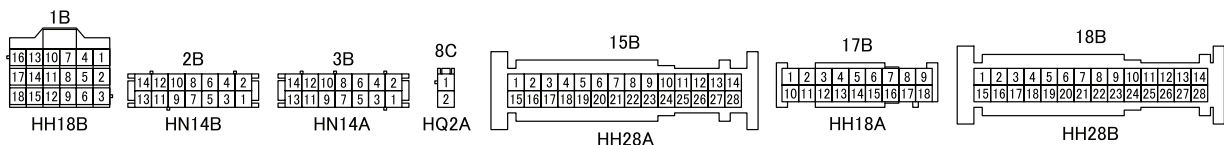
340-C07348

CAB LAMP CIRCUIT

<Except crew cab>



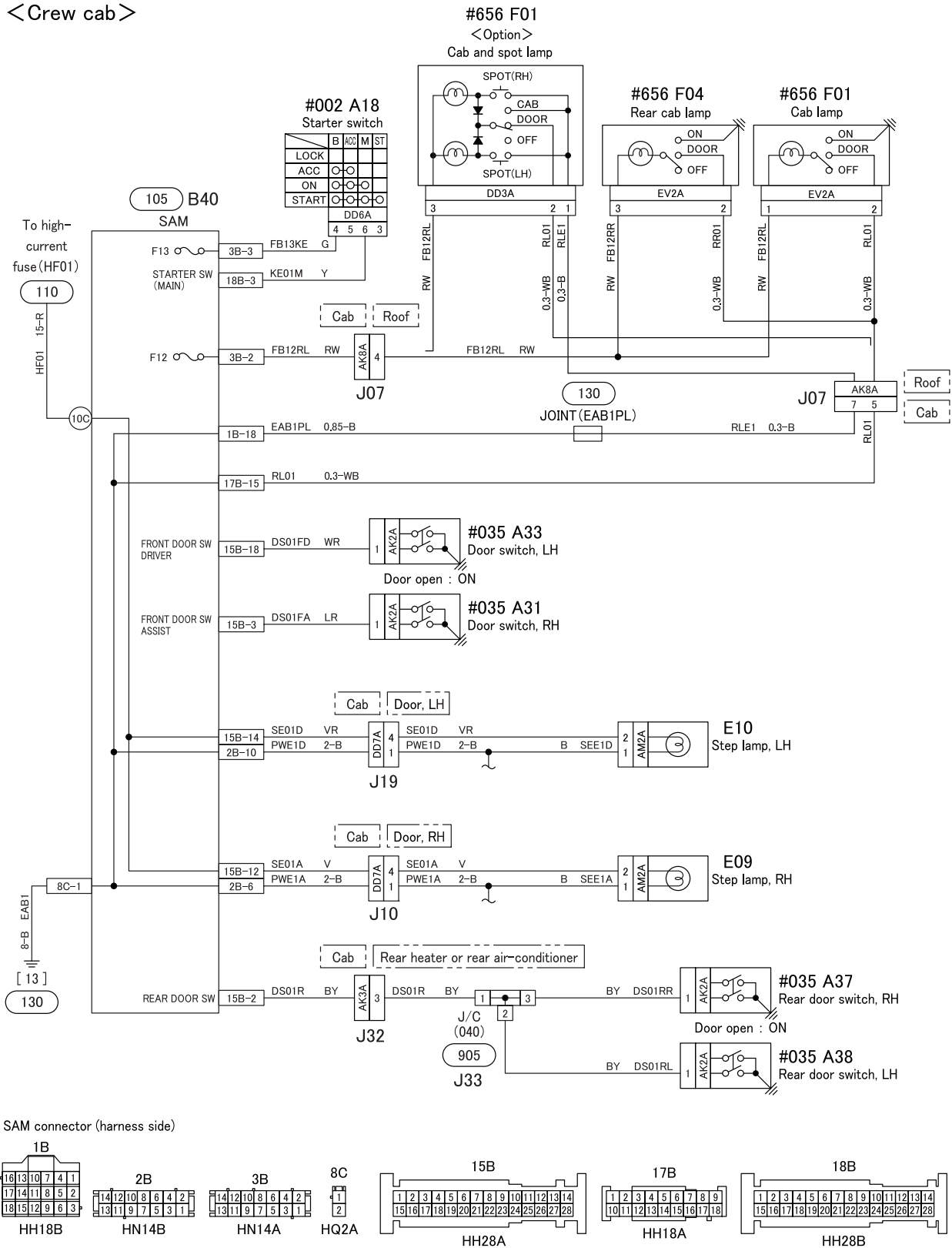
SAM connector (harness side)



345-C07348-1

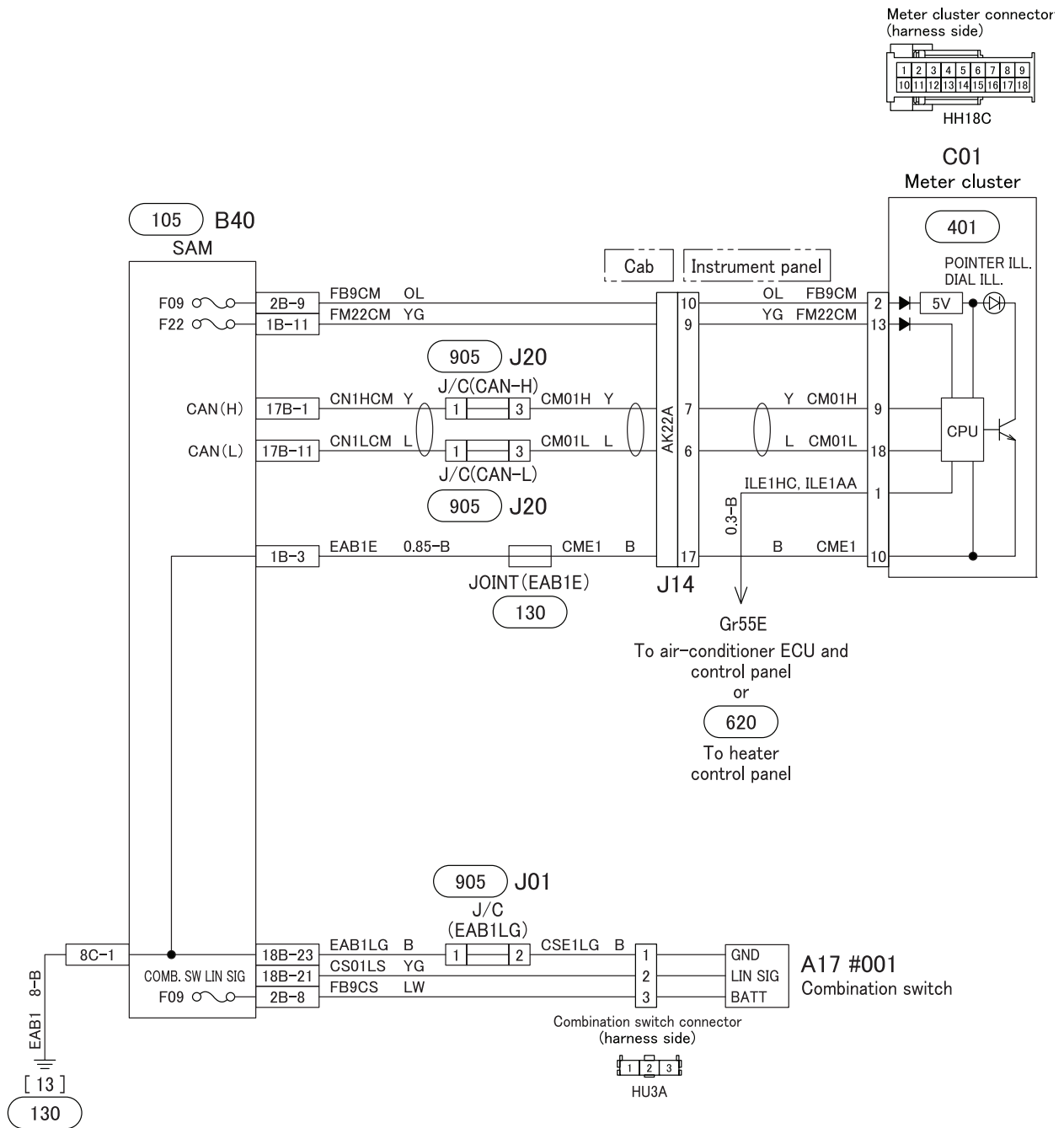
CAB LAMP CIRCUIT

<Crew cab>

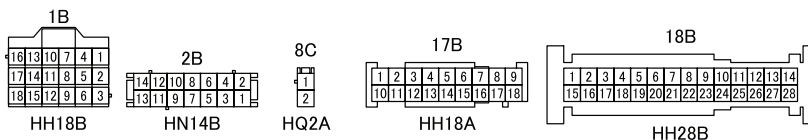


345-C07348-2

ILLUMINATION LAMP CIRCUIT

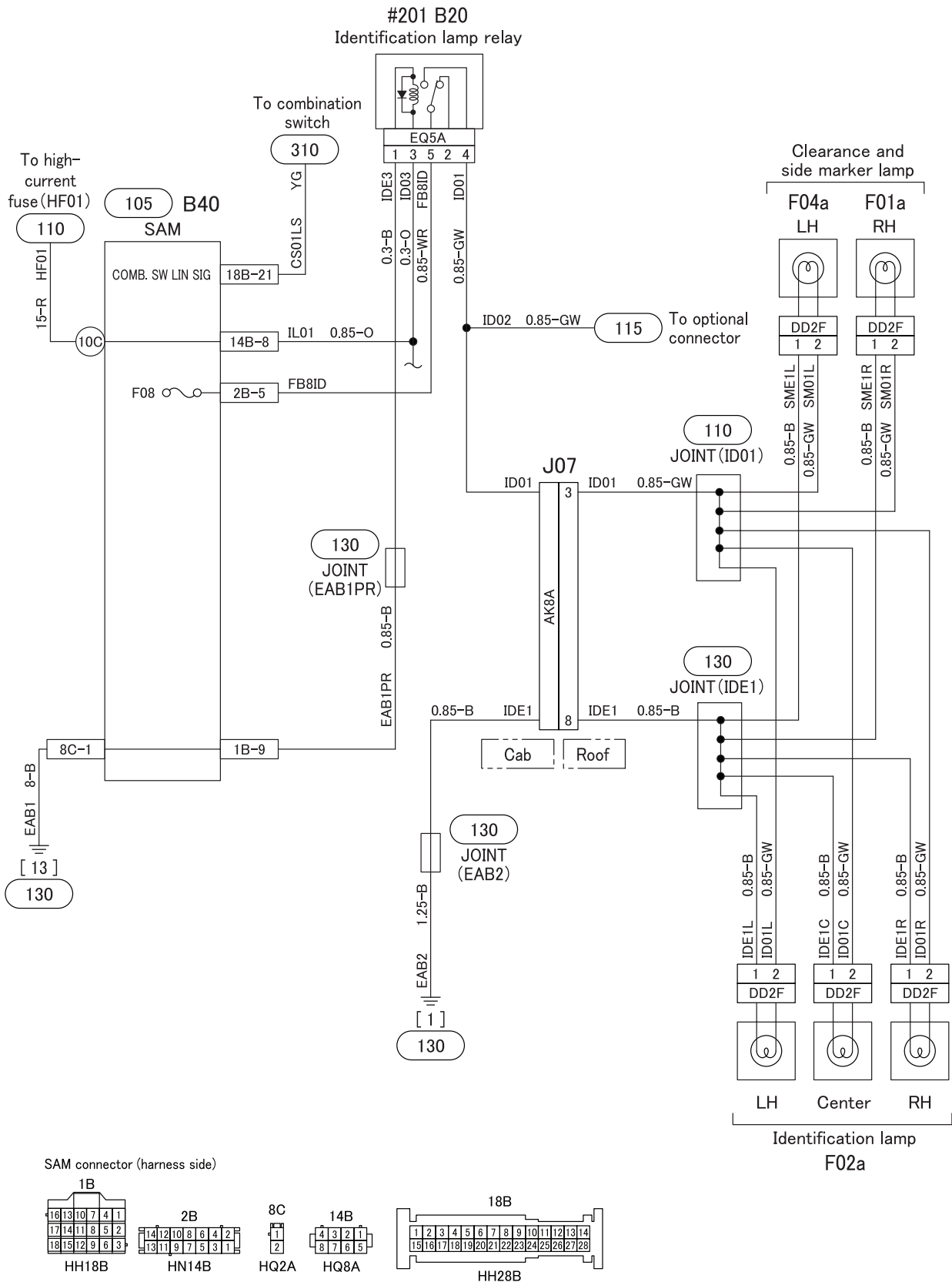


SAM connector (harness side)



348-C07348

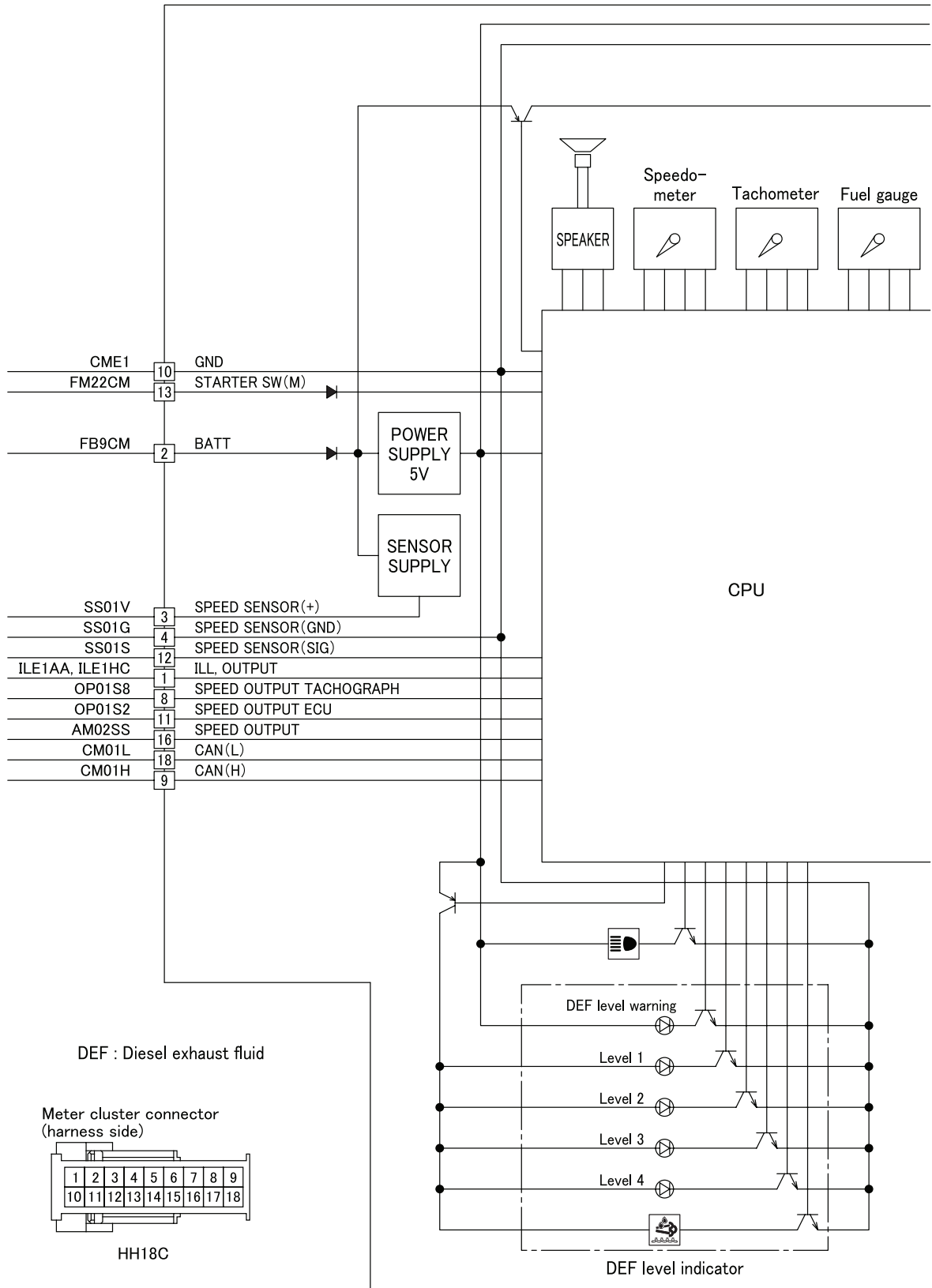
END-OUTLINE MARKER LAMP CIRCUIT



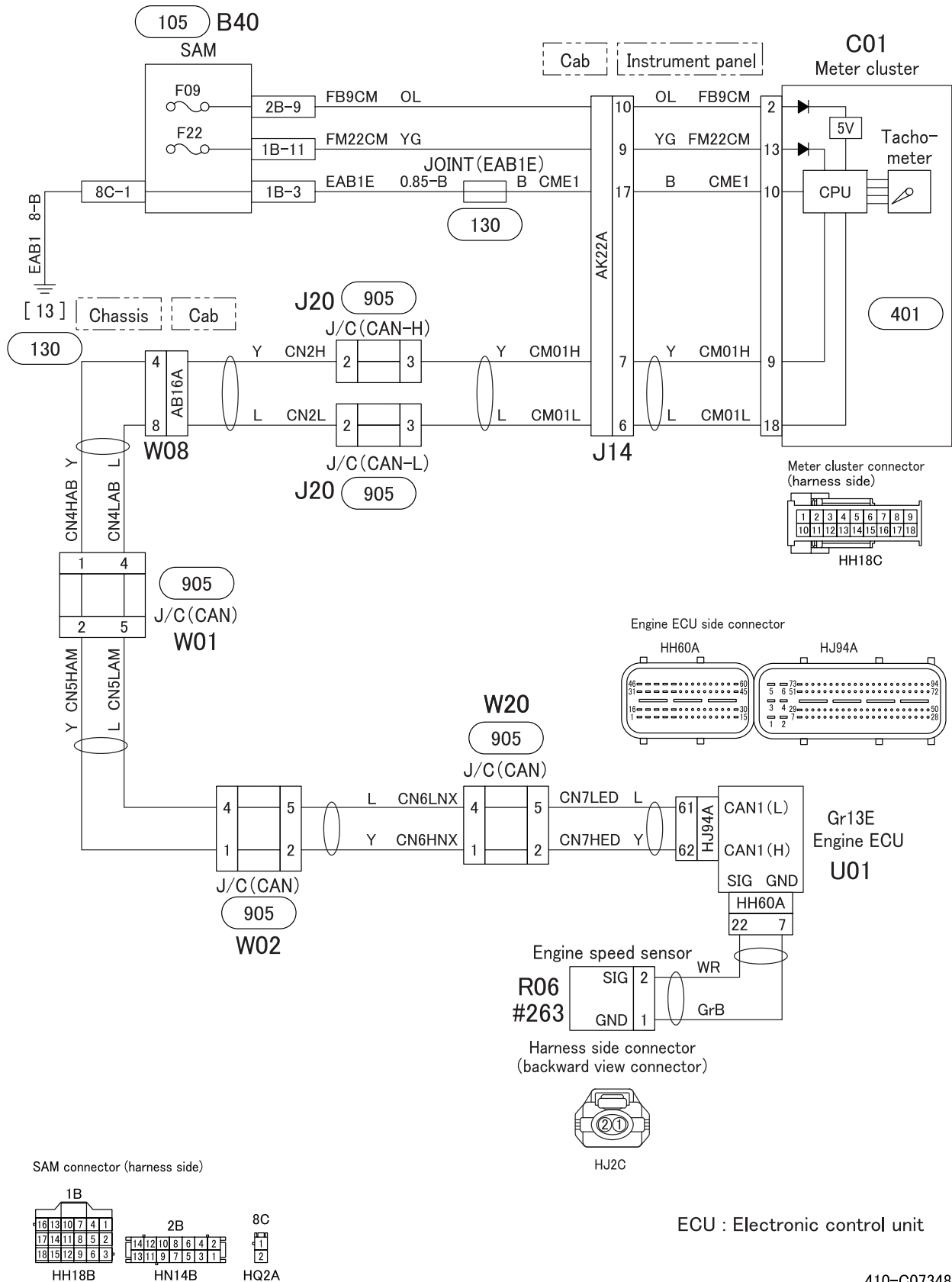
349-C07348

METER CLUSTER INTERNAL CIRCUIT

(1/2)

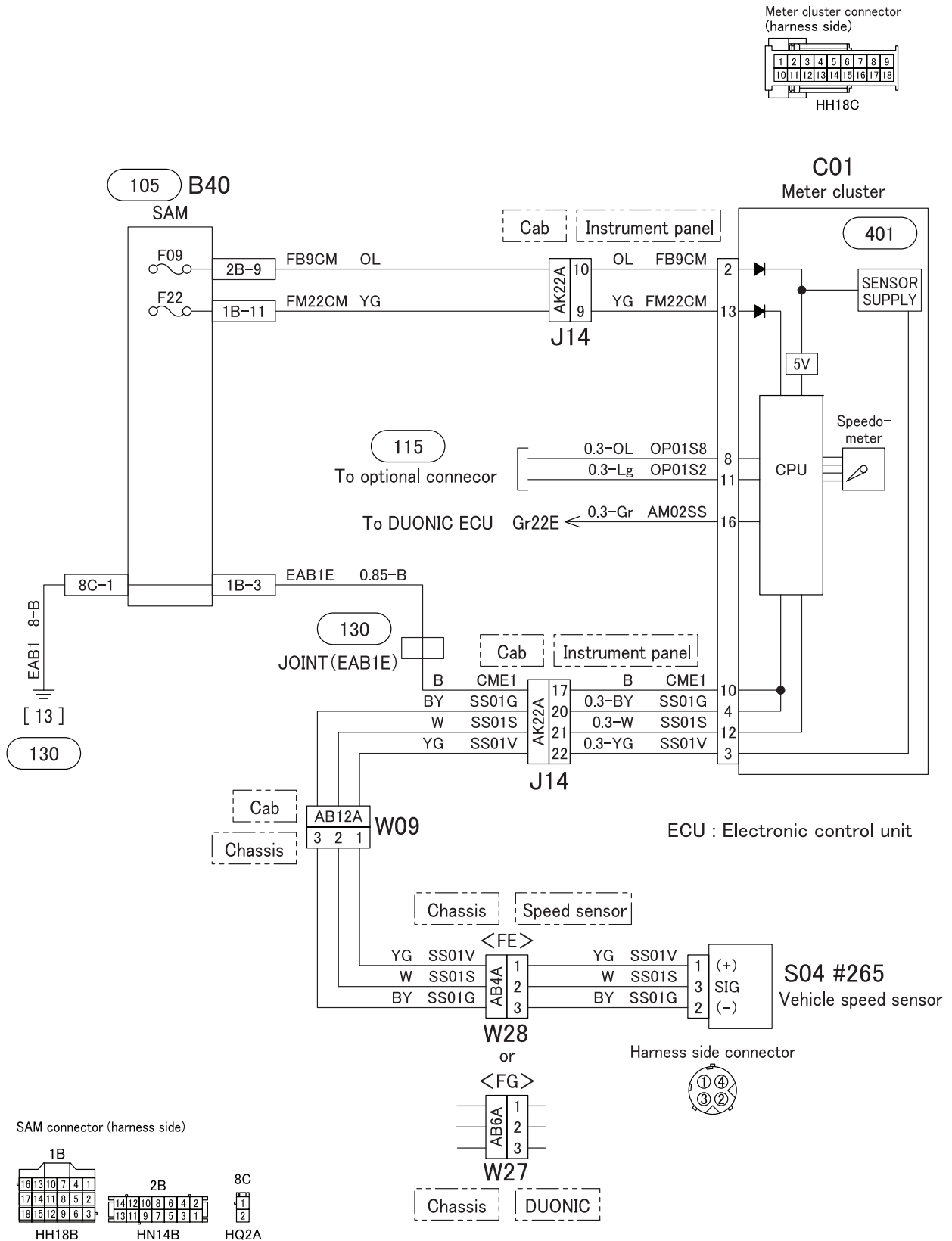


TACHOMETER CIRCUIT



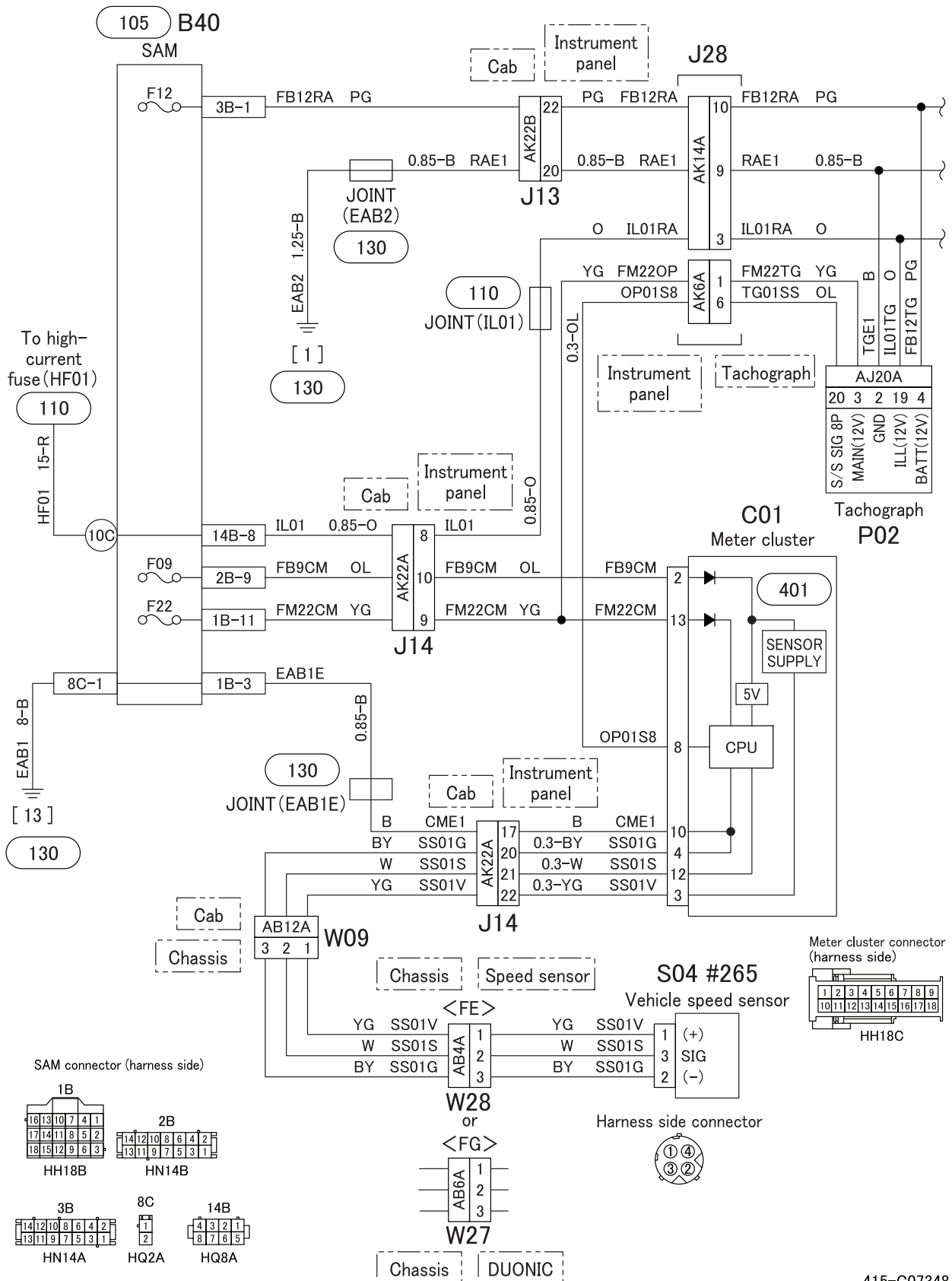
410-C07348

SPEEDOMETER CIRCUIT



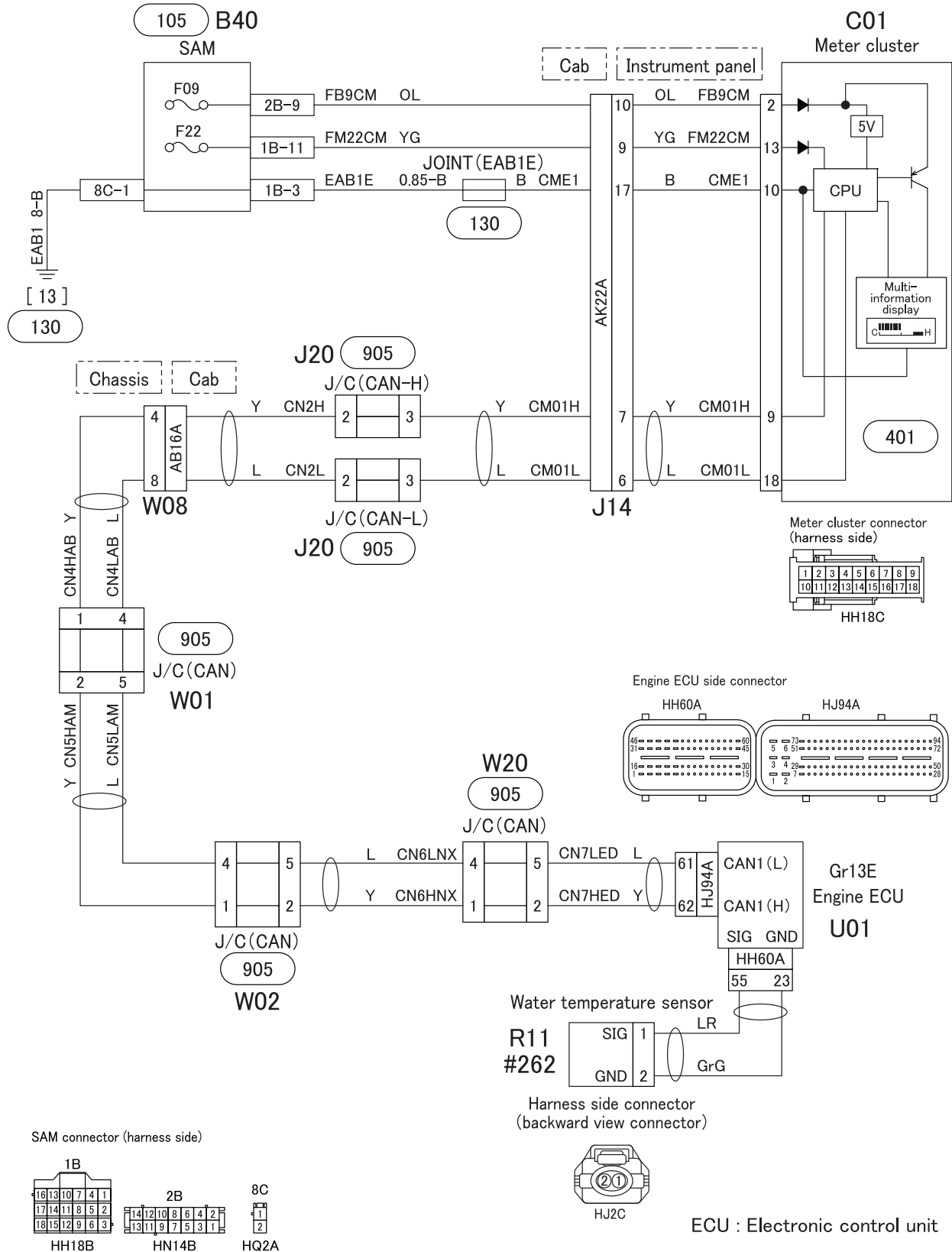
412-C07348

TACHOGRAPH CIRCUIT



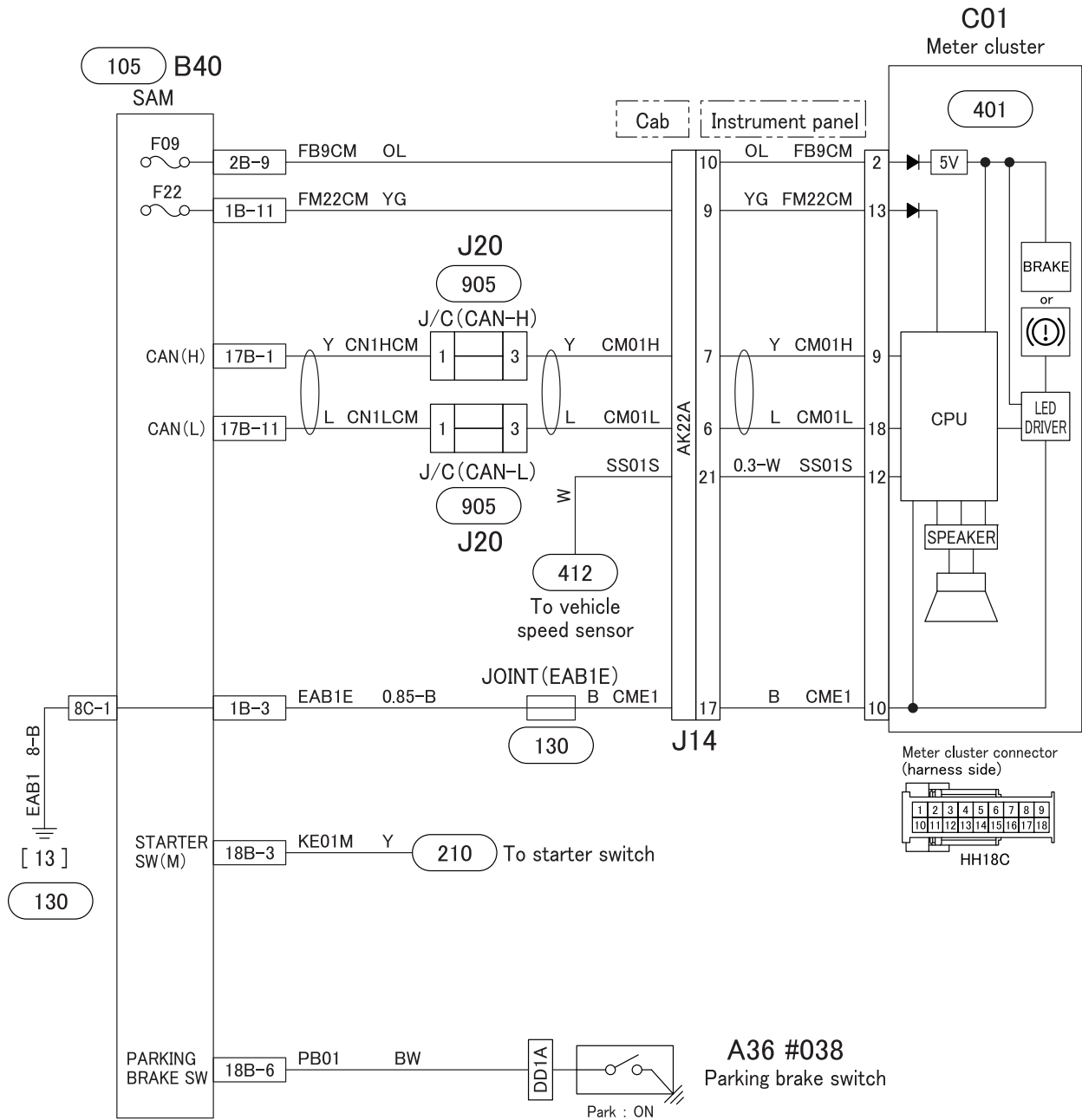
415-C07348

WATER TEMPERATURE GAUGE CIRCUIT

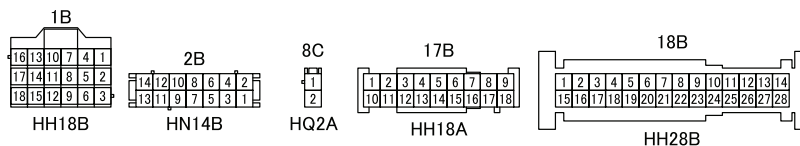


425-C07348

PARKING BRAKE INDICATOR CIRCUIT

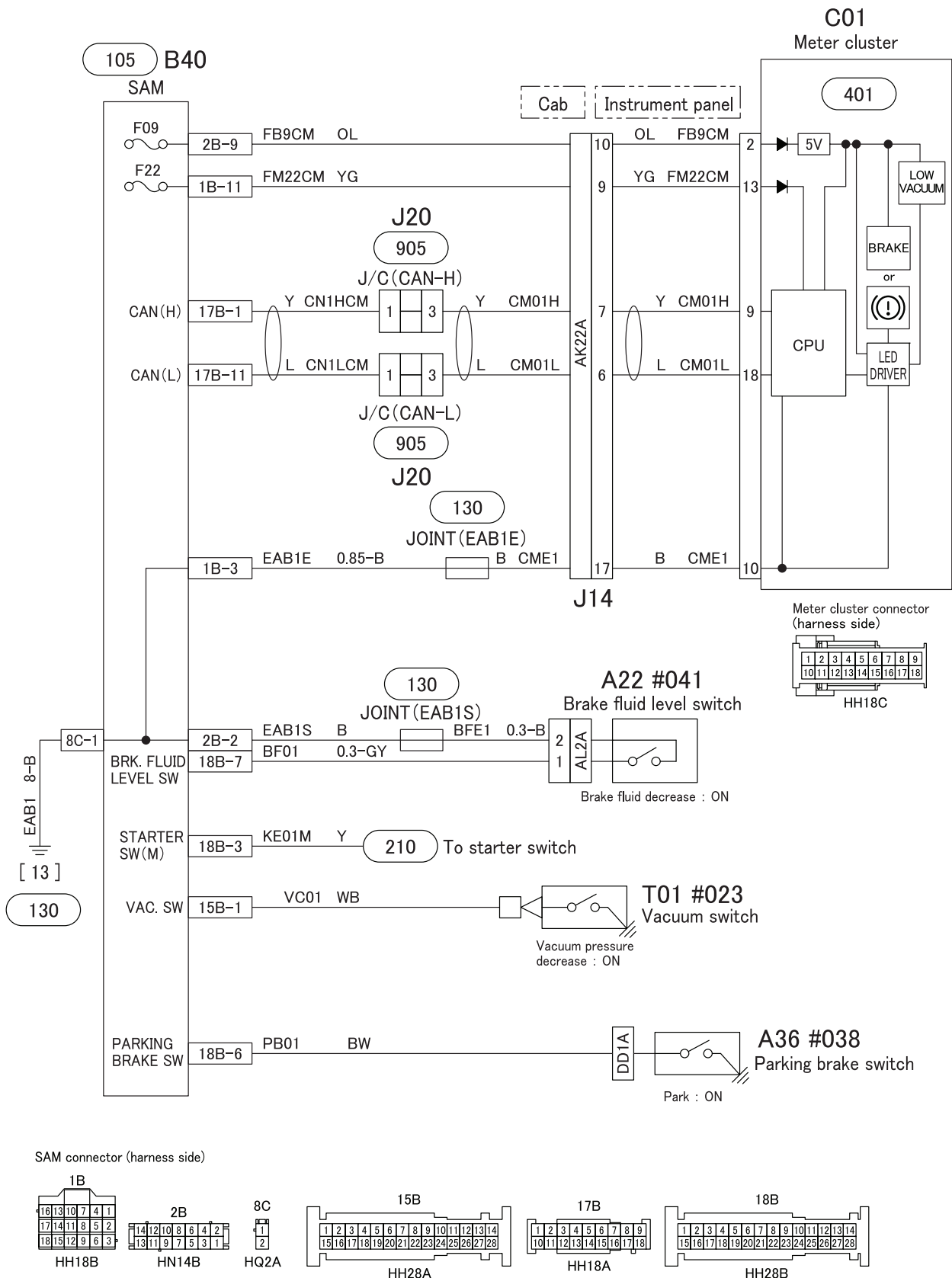


SAM connector (harness side)



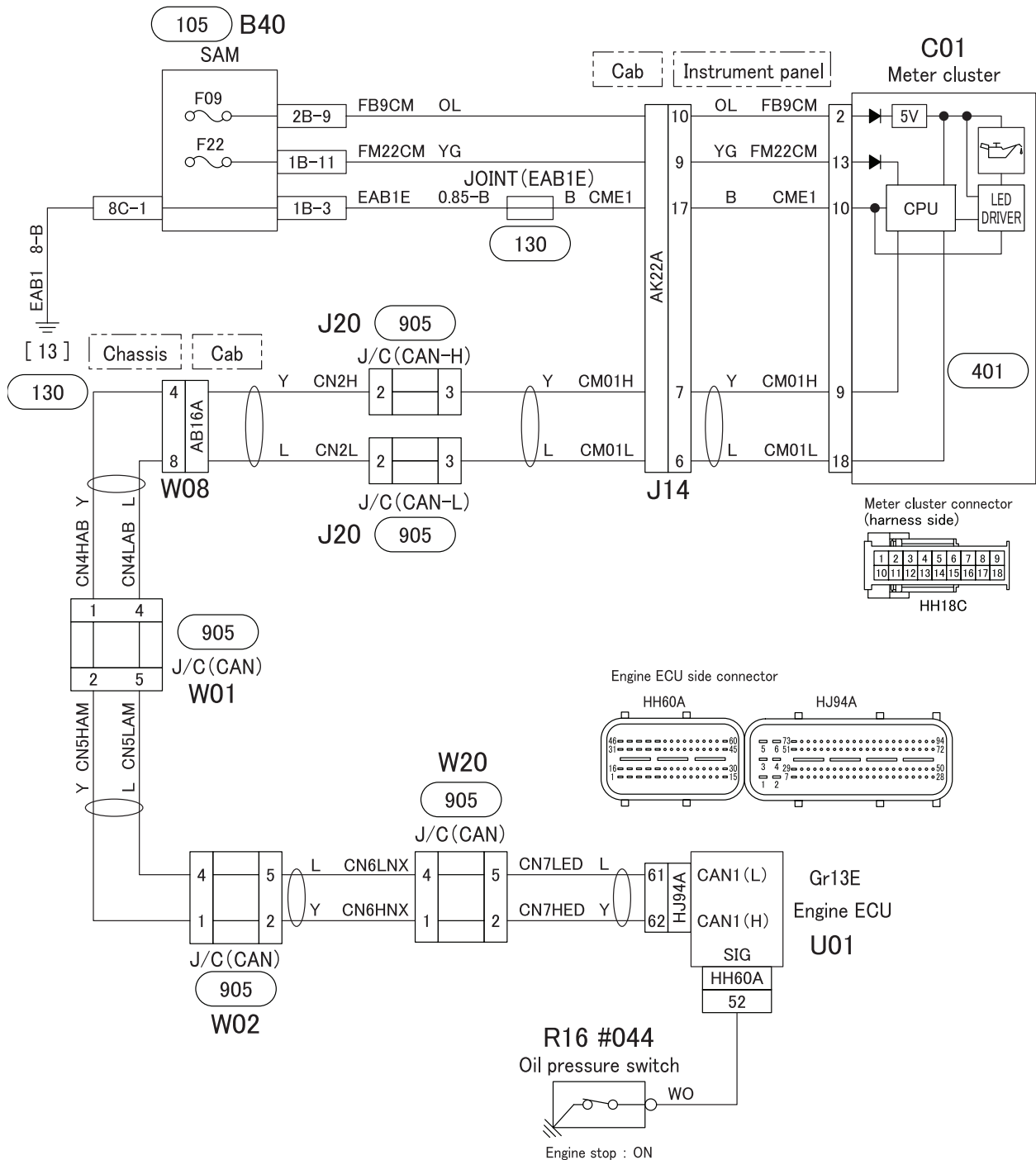
510-C07348

BRAKE WARNING CIRCUIT

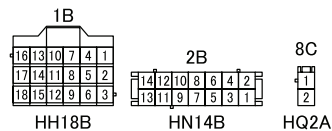


515-C07348

ENGINE OIL PRESSURE WARNING CIRCUIT



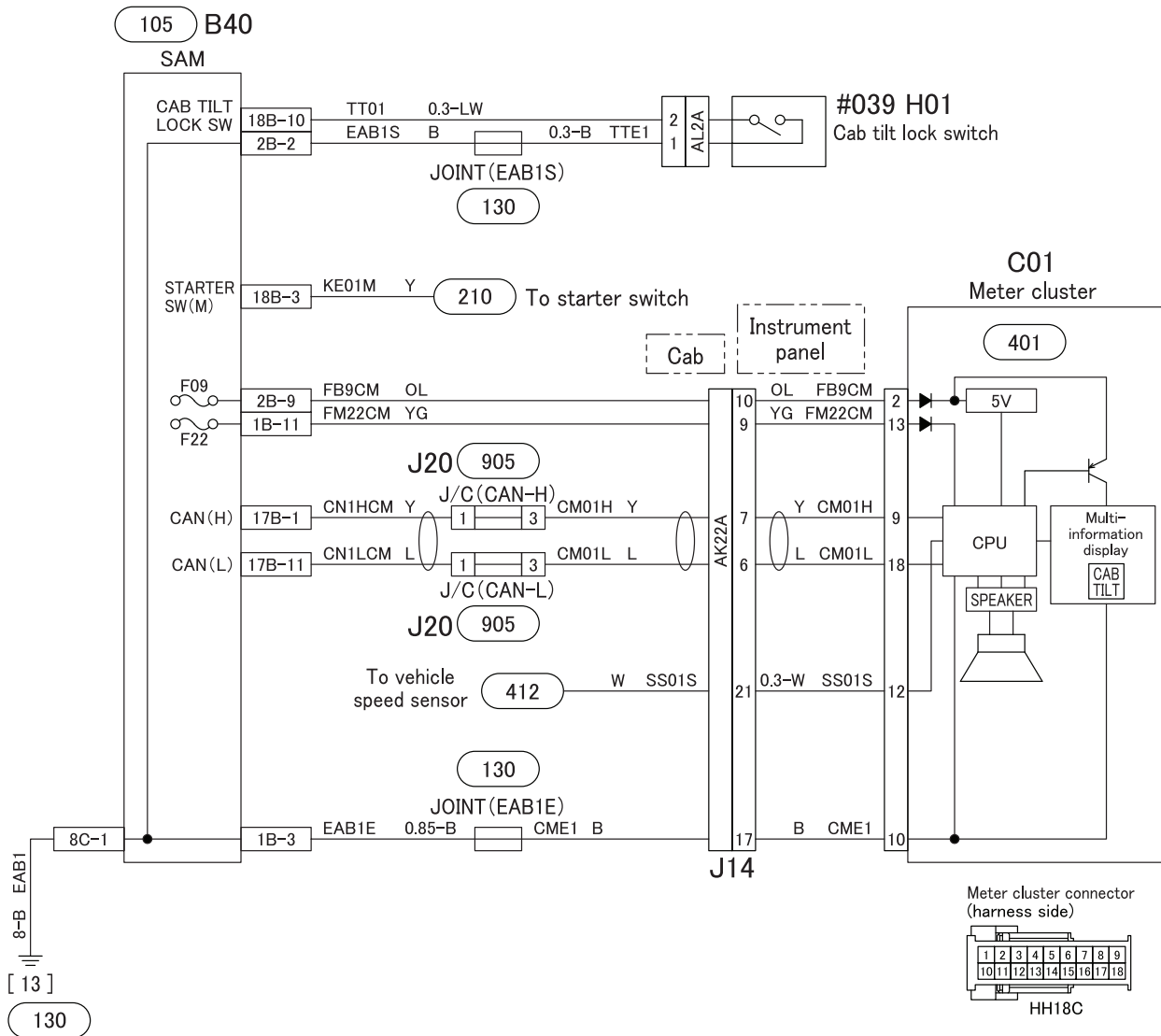
SAM connector (harness side)



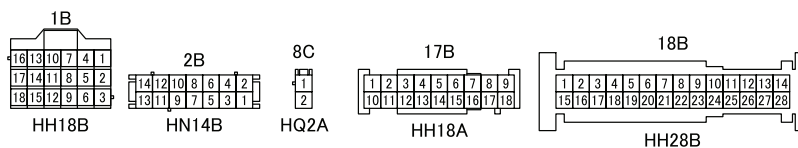
ECU : Electronic control unit

536-C07348

CAB TILT WARNING CIRCUIT

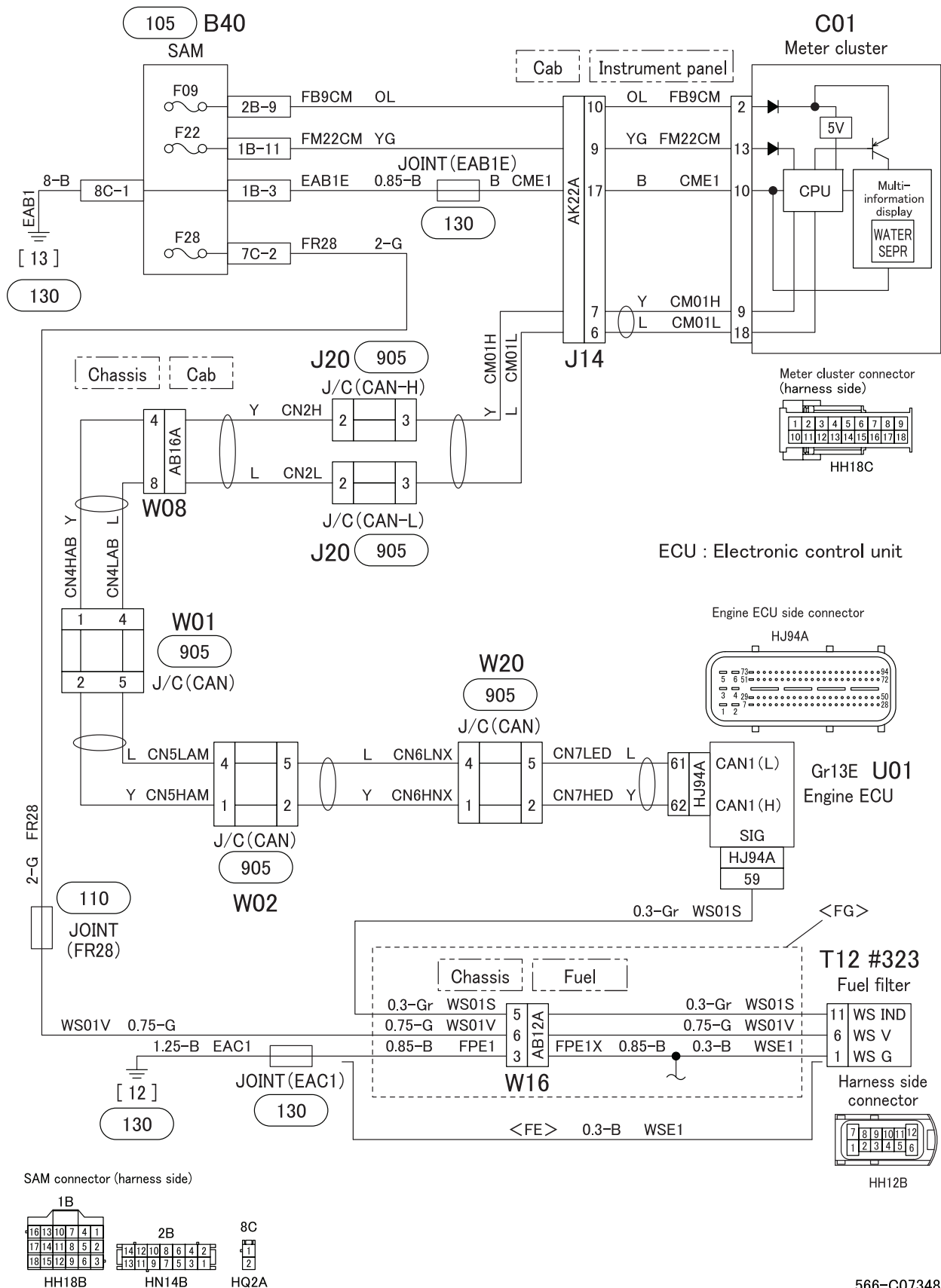


SAM connector (harness side)

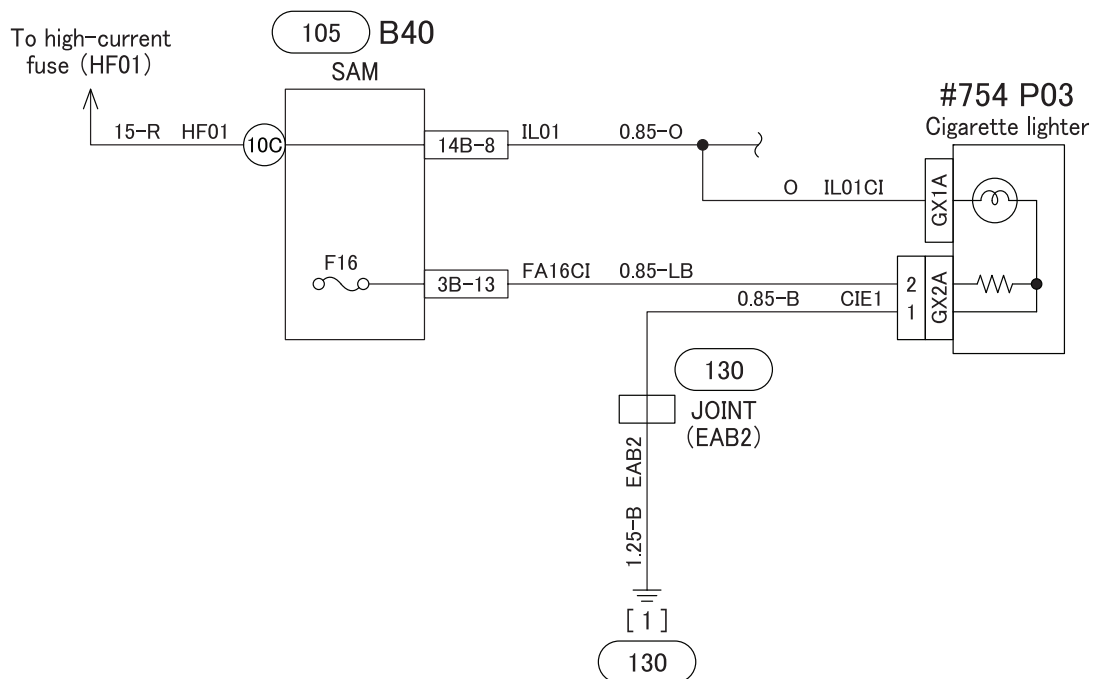


550-C07348

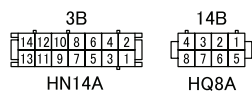
FUEL FILTER WARNING CIRCUIT



CIGARETTE LIGHTER CIRCUIT



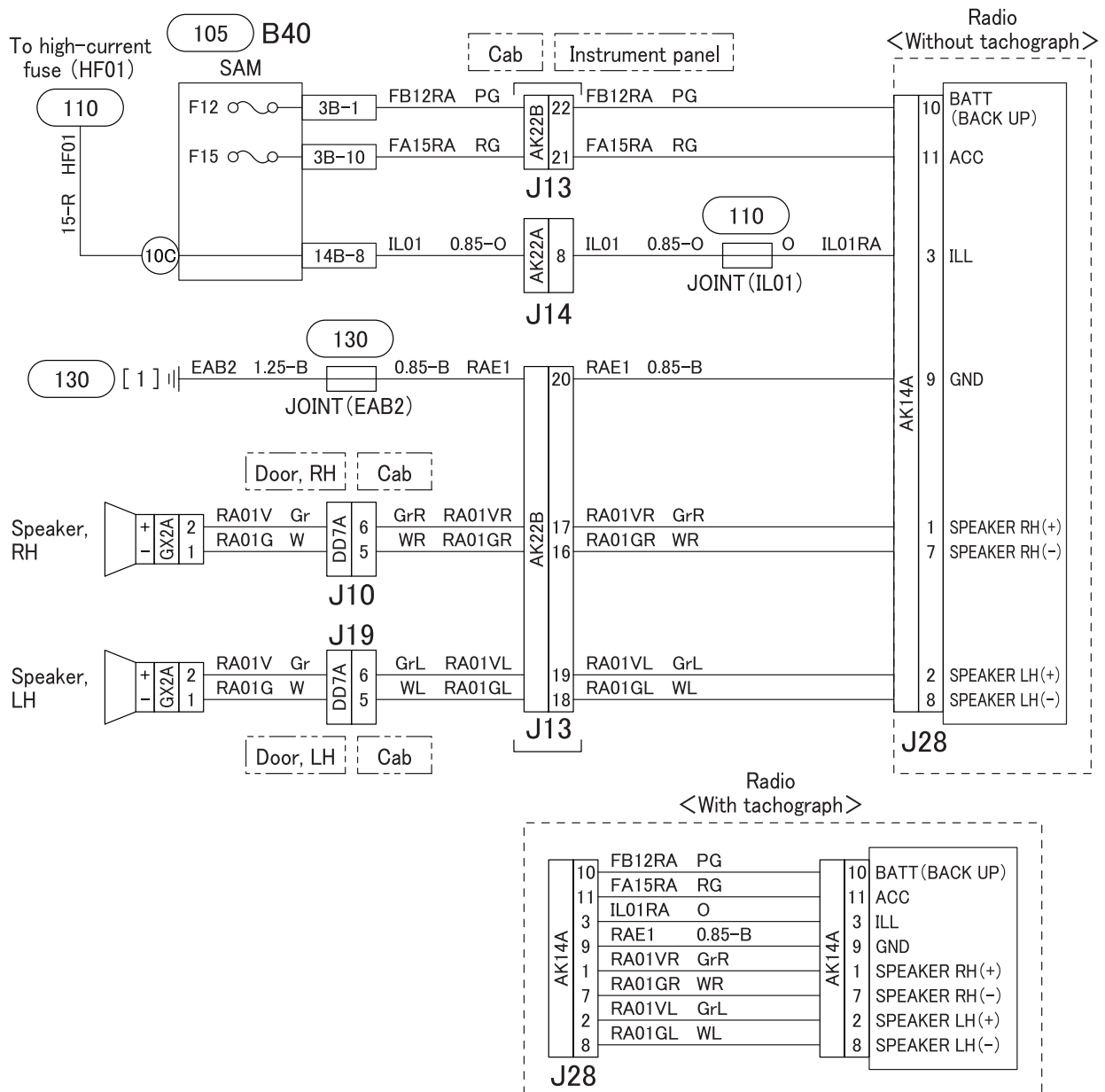
SAM connector (harness side)



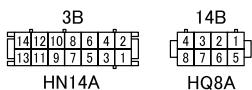
610-C07348



AUDIO CIRCUIT

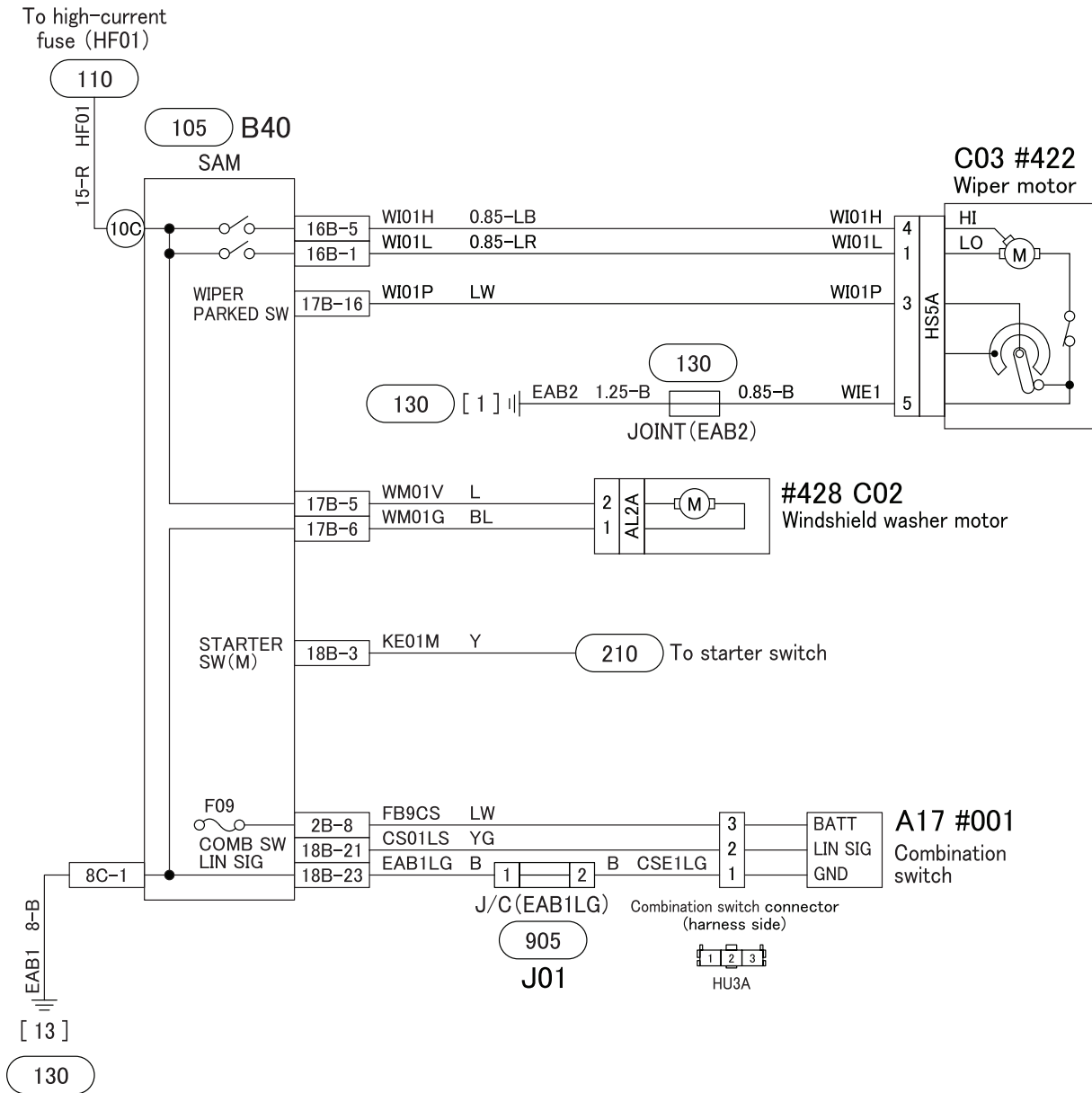


SAM connector (harness side)

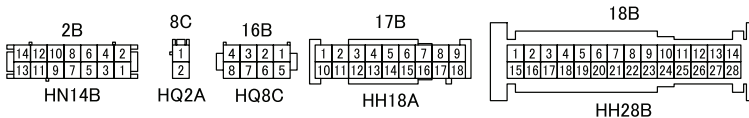


612-C07348

WIPER AND WASHER CIRCUIT

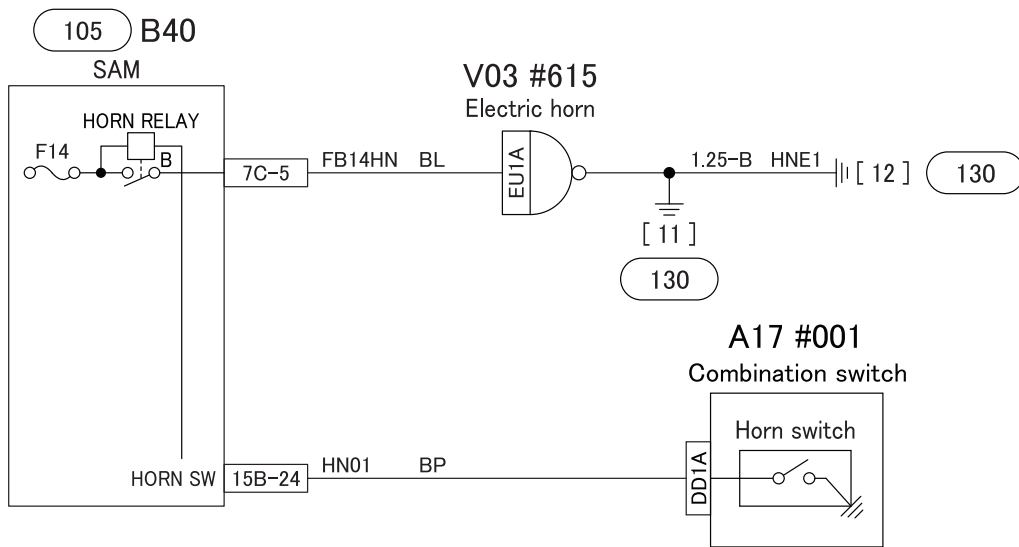


SAM connector (harness side)

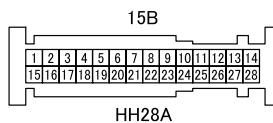
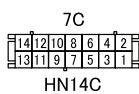


614-C07348

HORN CIRCUIT



SAM connector (harness side)

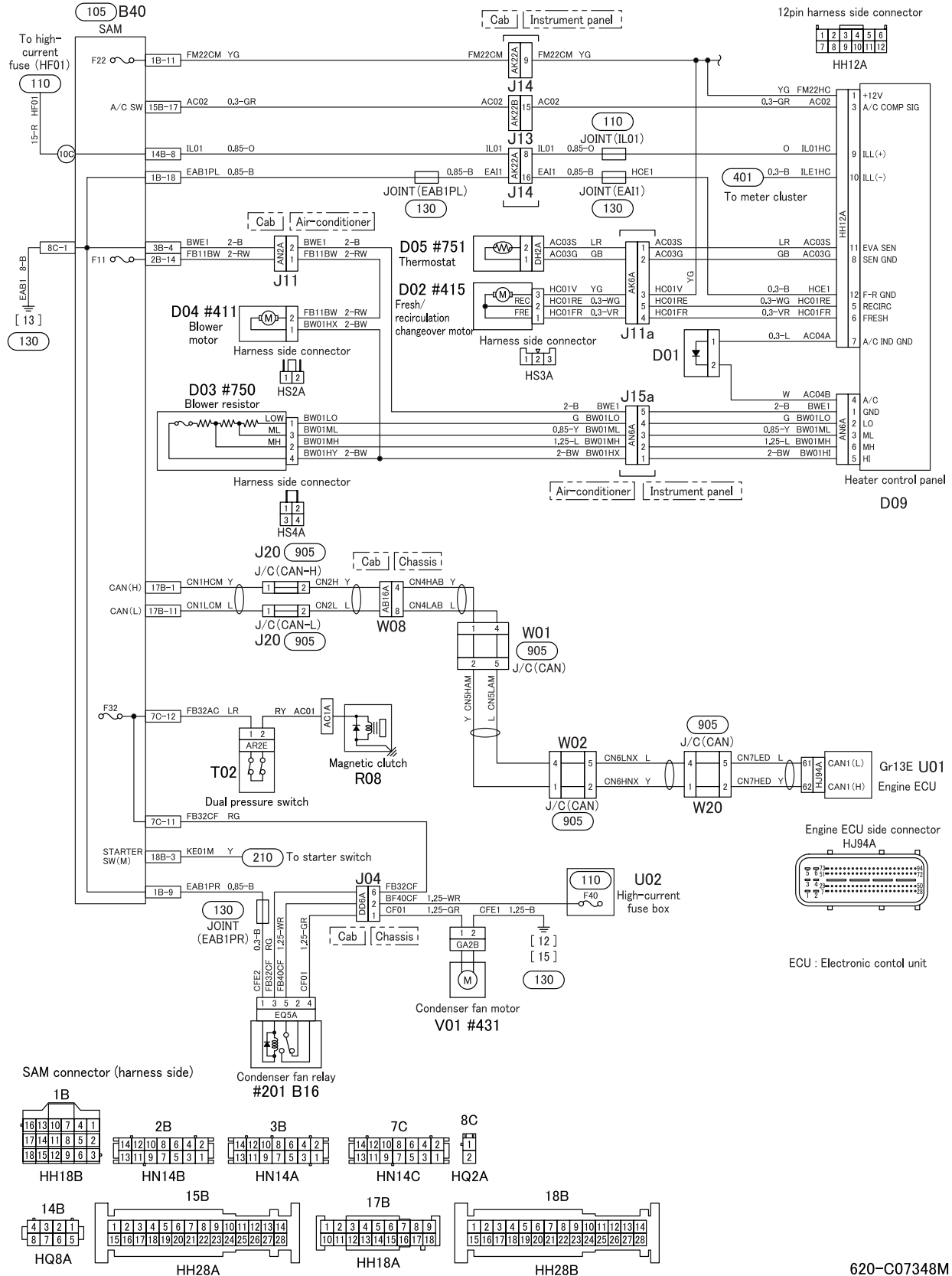


616-C07348



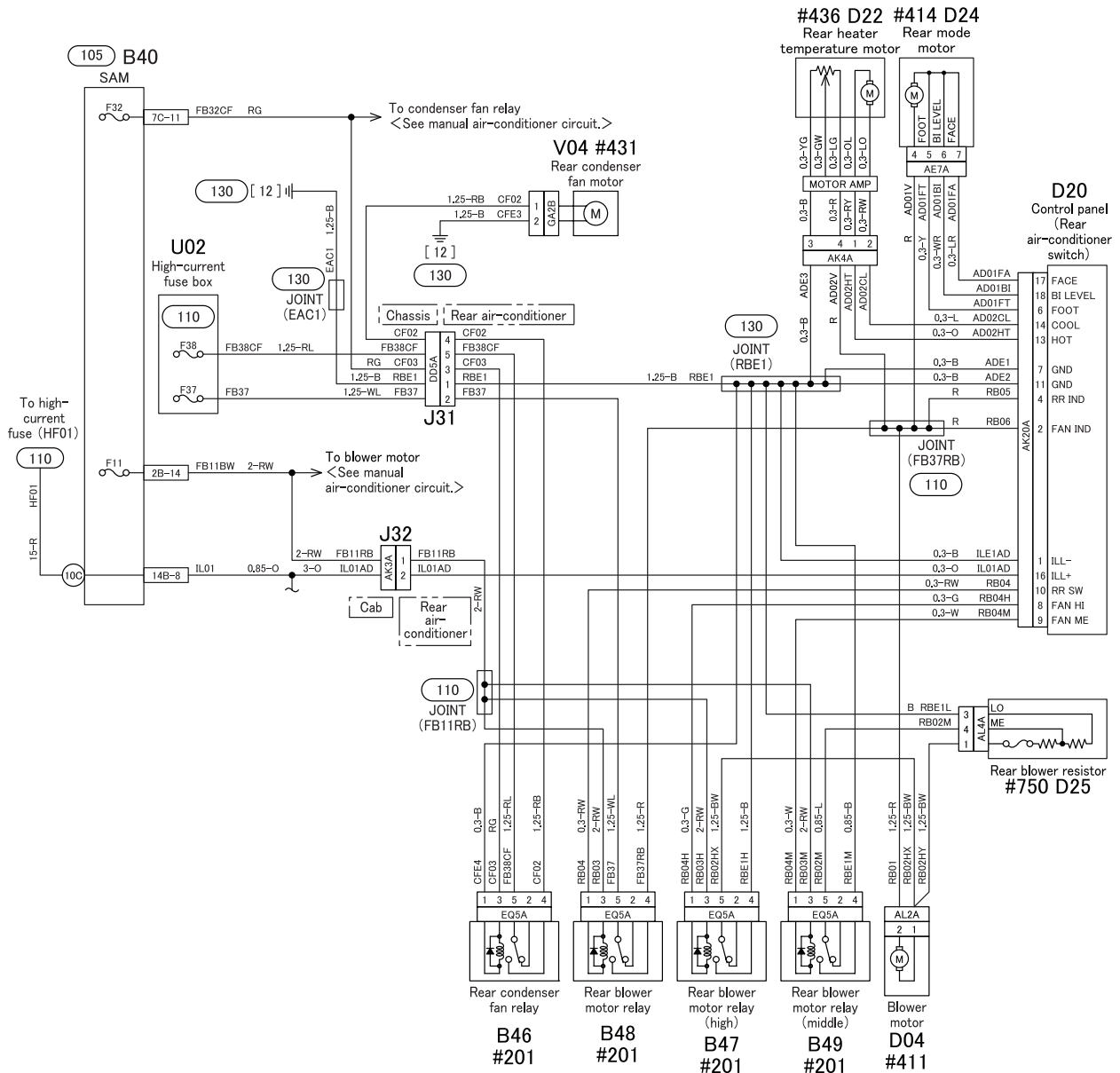
AIR-CONDITIONER CIRCUIT (2)

< Manual air-conditioner >

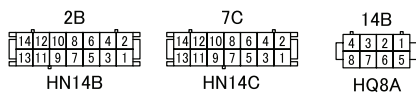


AIR-CONDITIONER CIRCUIT (3)

<Rear air-conditioner>

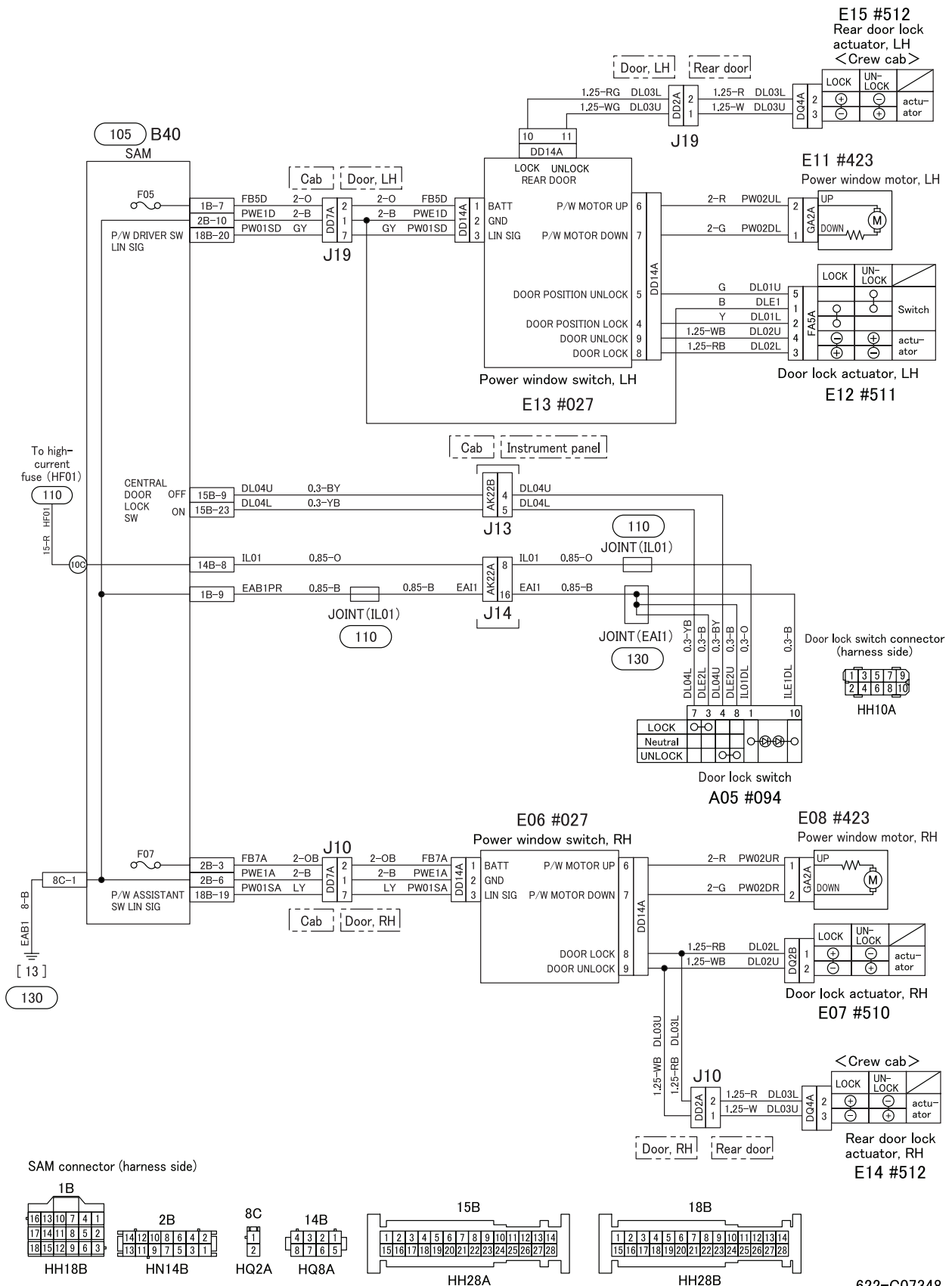


SAM connector (harness side)

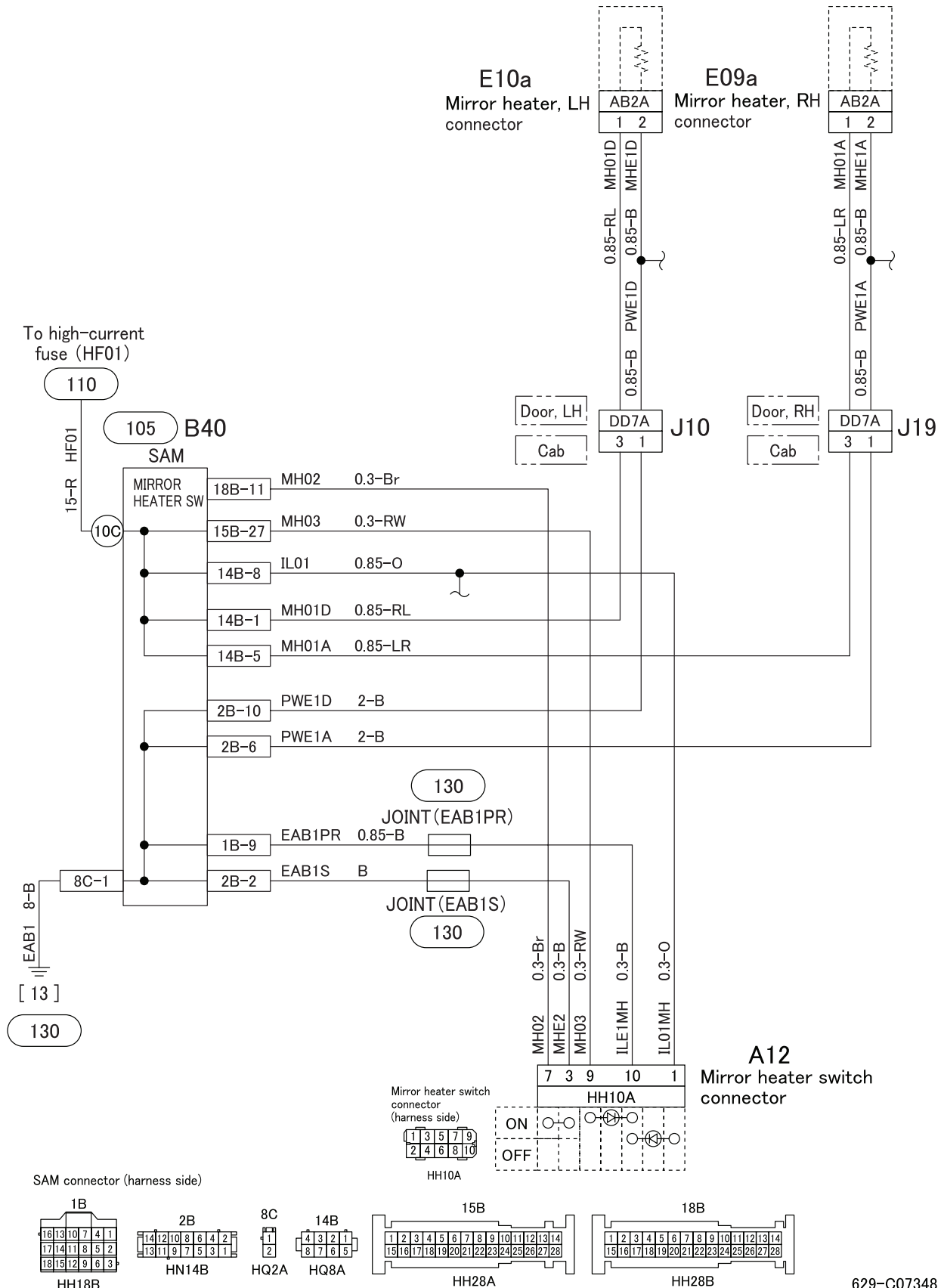


620-C07348R

POWER WINDOW AND CENTRAL DOOR LOCK CIRCUIT

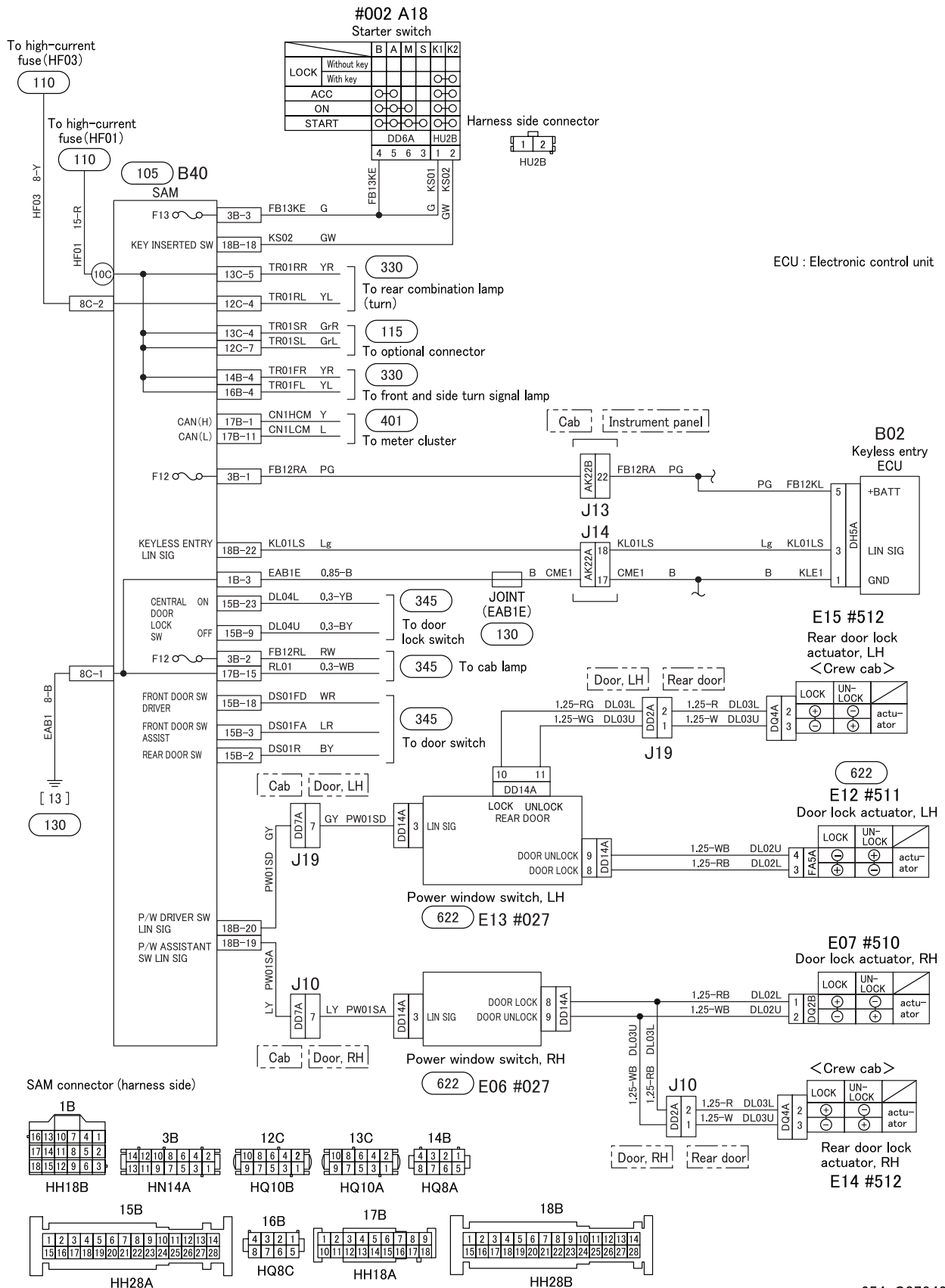


MIRROR HEATER CIRCUIT



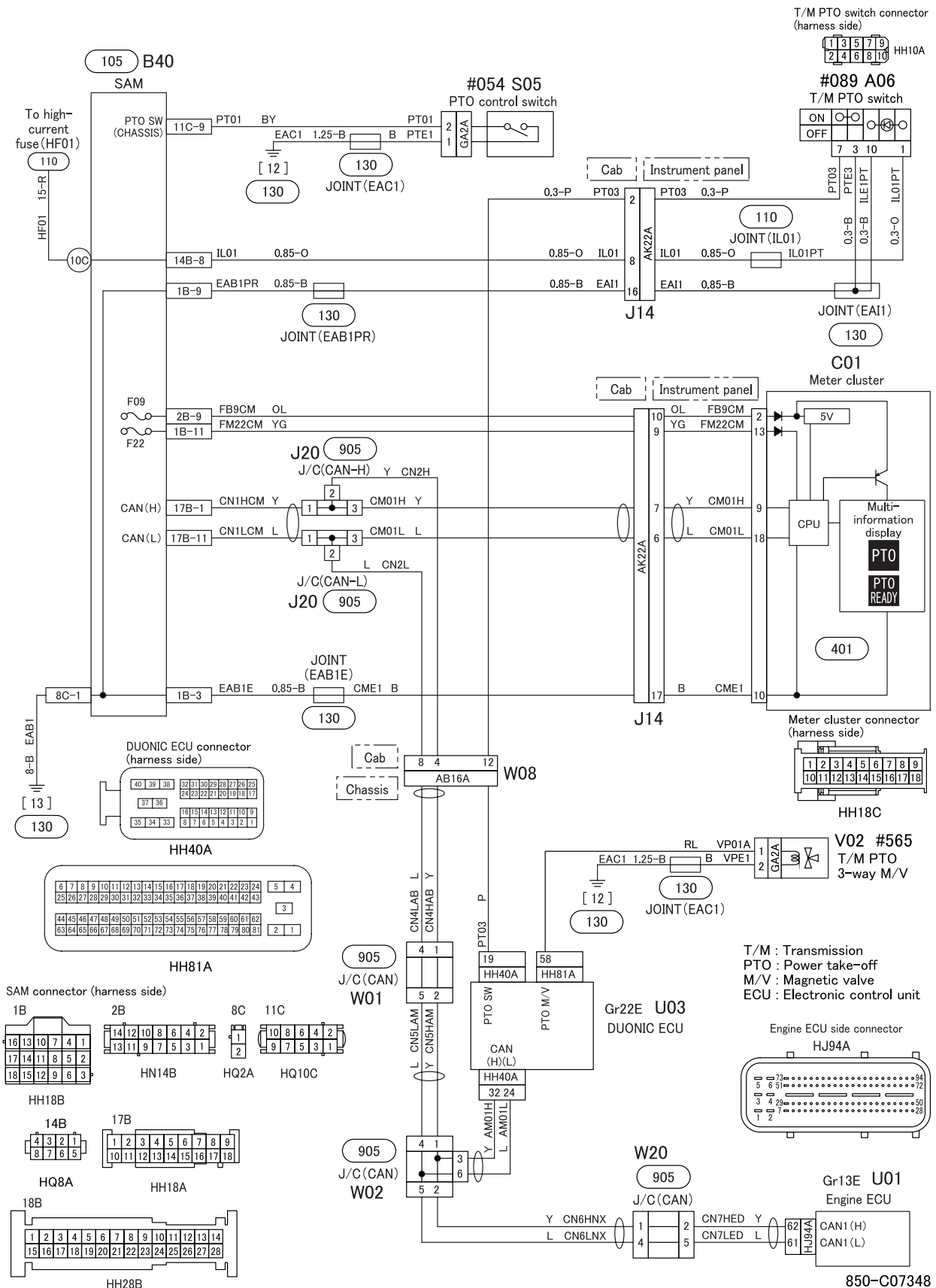
629-C07348

KEYLESS ENTRY CIRCUIT



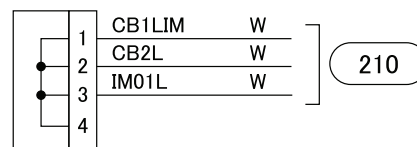
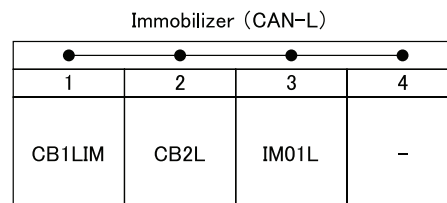
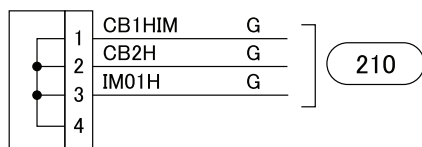
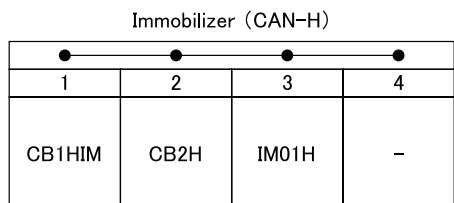
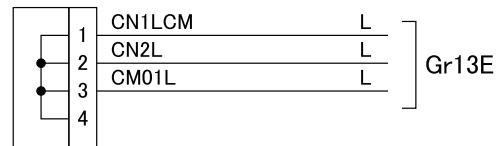
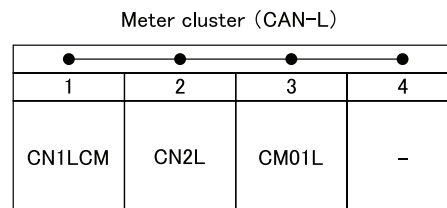
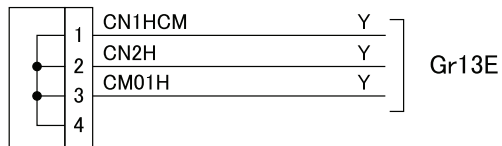
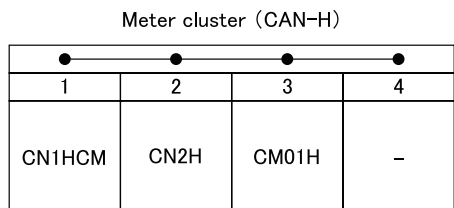
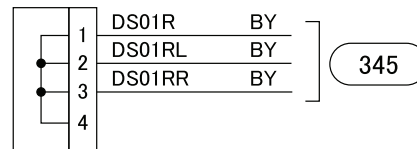
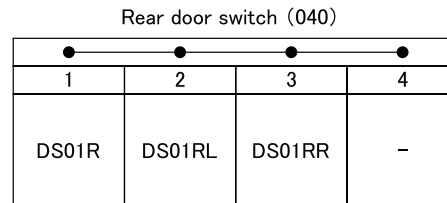
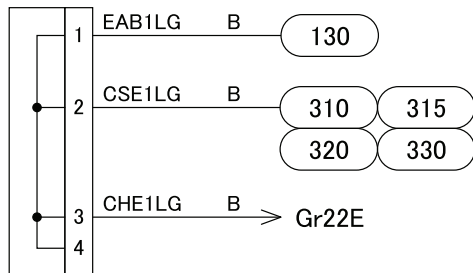
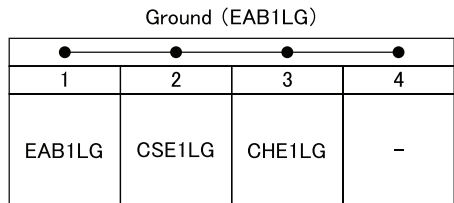
654-C07348

TRANSMISSION POWER TAKE-OFF CIRCUIT



JOINT CONNECTOR

(1/2)



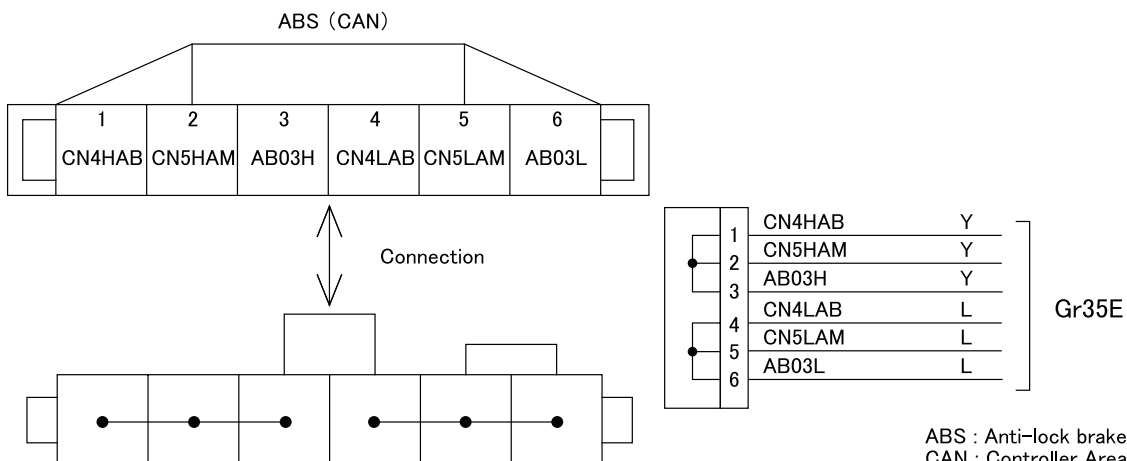
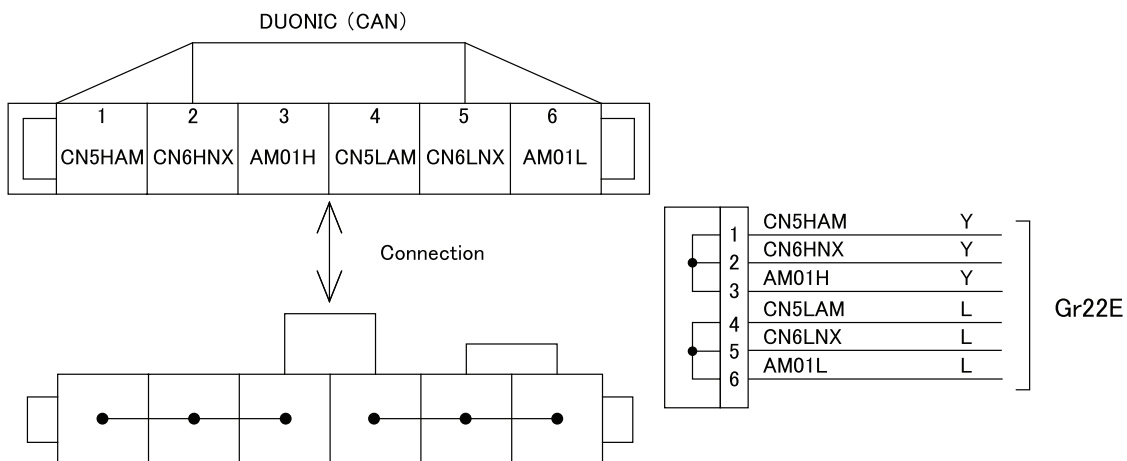
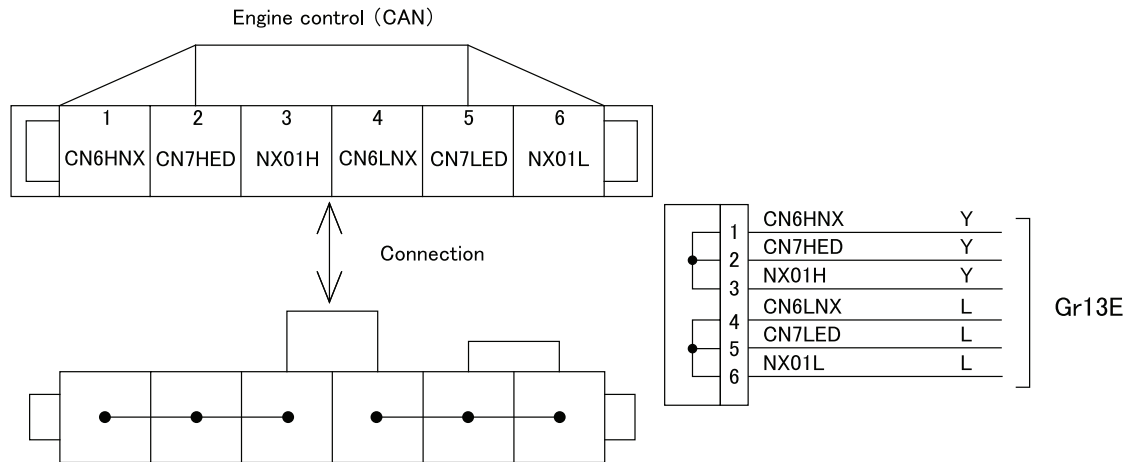
CAN : Controller Area Network

905-C07348-1



JOINT CONNECTOR

(2/2)



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

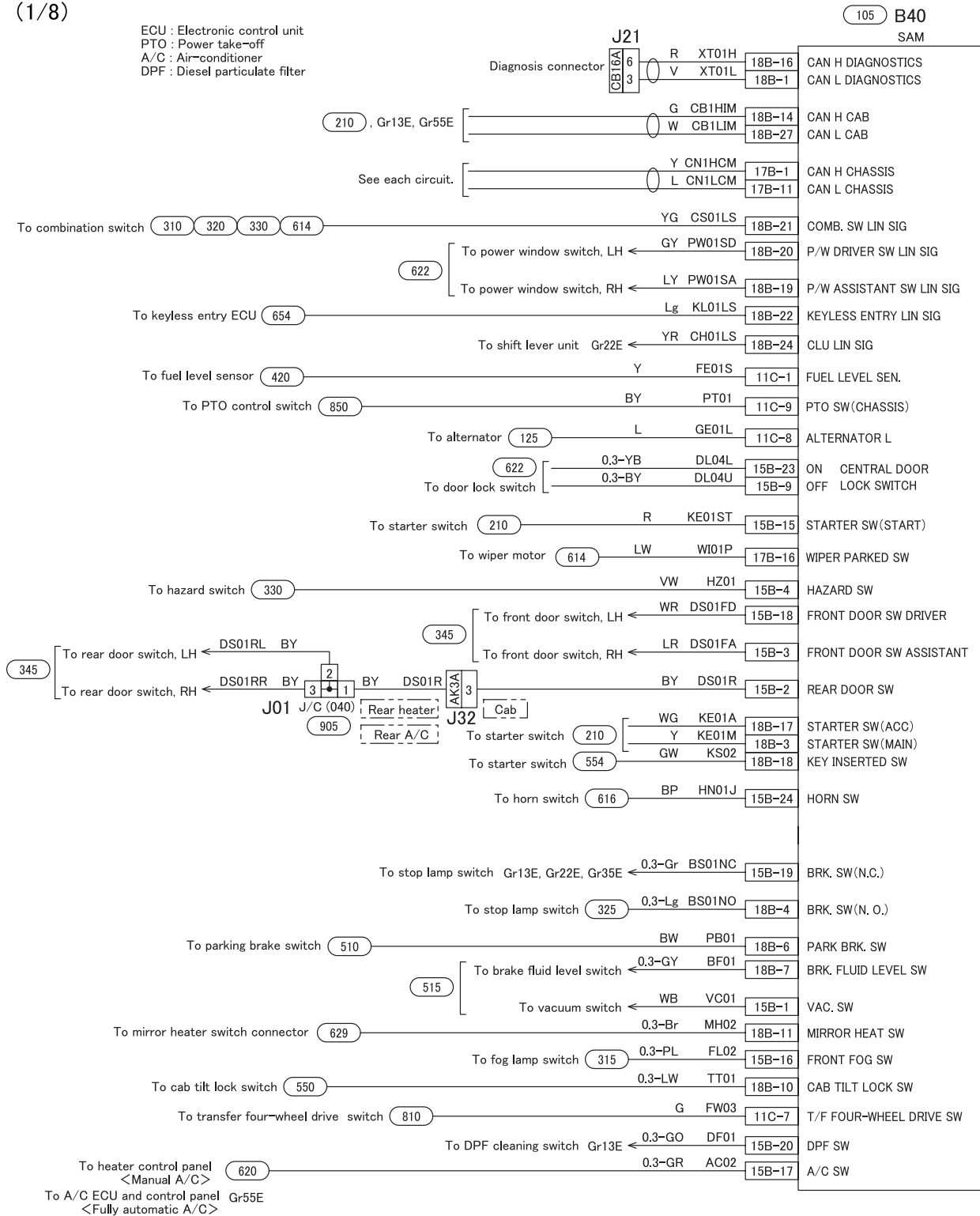
905-C07348-2



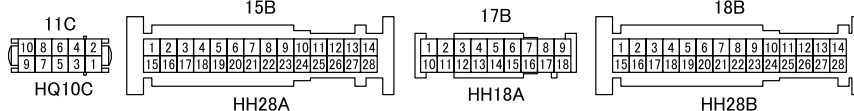
SAM CIRCUIT

(1/8)

ECU : Electronic control unit
 PTO : Power take-off
 A/C : Air-conditioner
 DPF : Diesel particulate filter



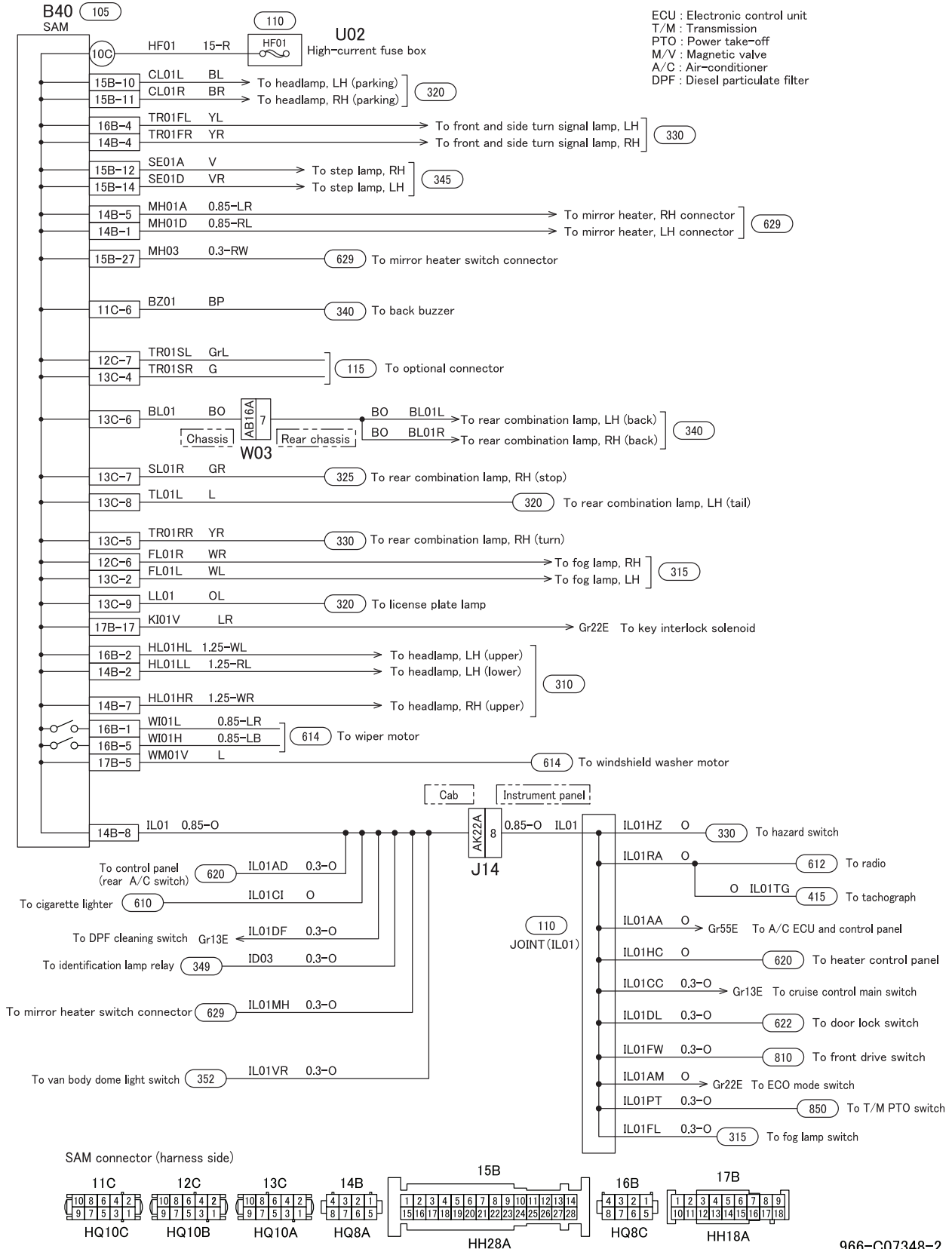
SAM connector (harness side)



966-C07348-1

SAM CIRCUIT

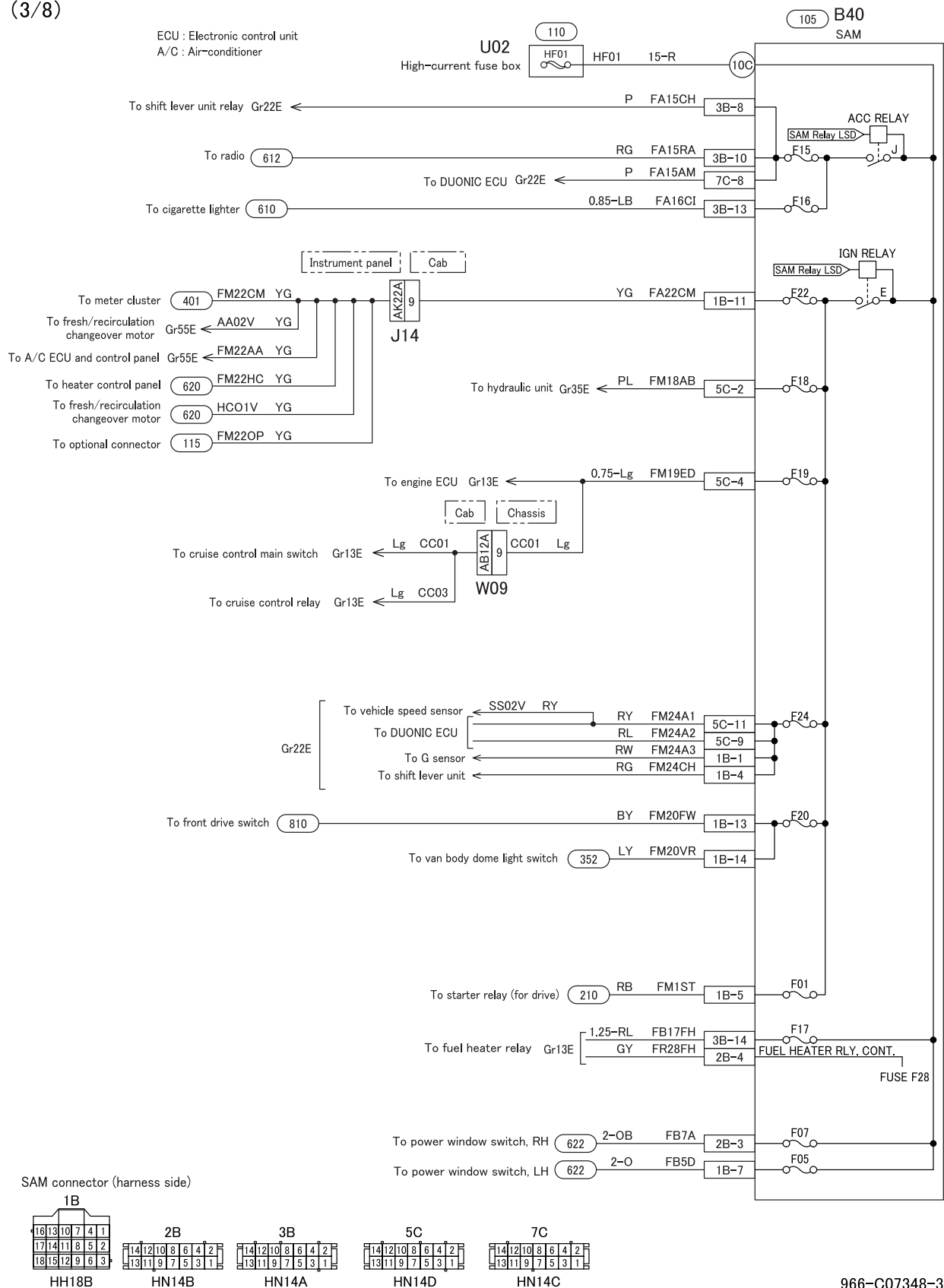
(2/8)



966-C07348-2

SAM CIRCUIT

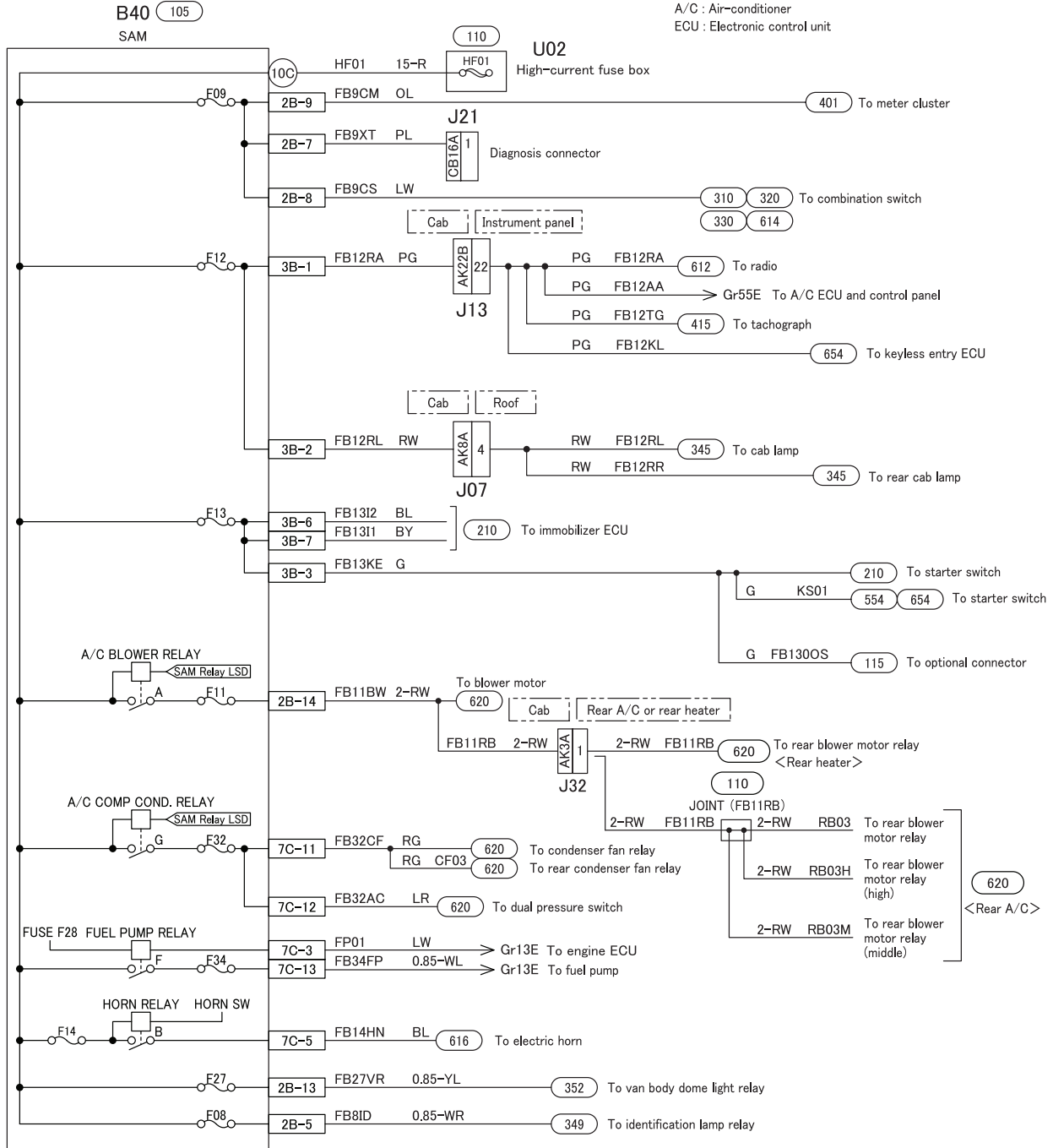
(3/8)



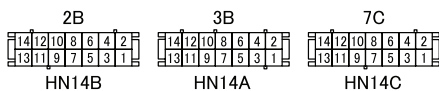
966-C07348-3

SAM CIRCUIT

(4/8)



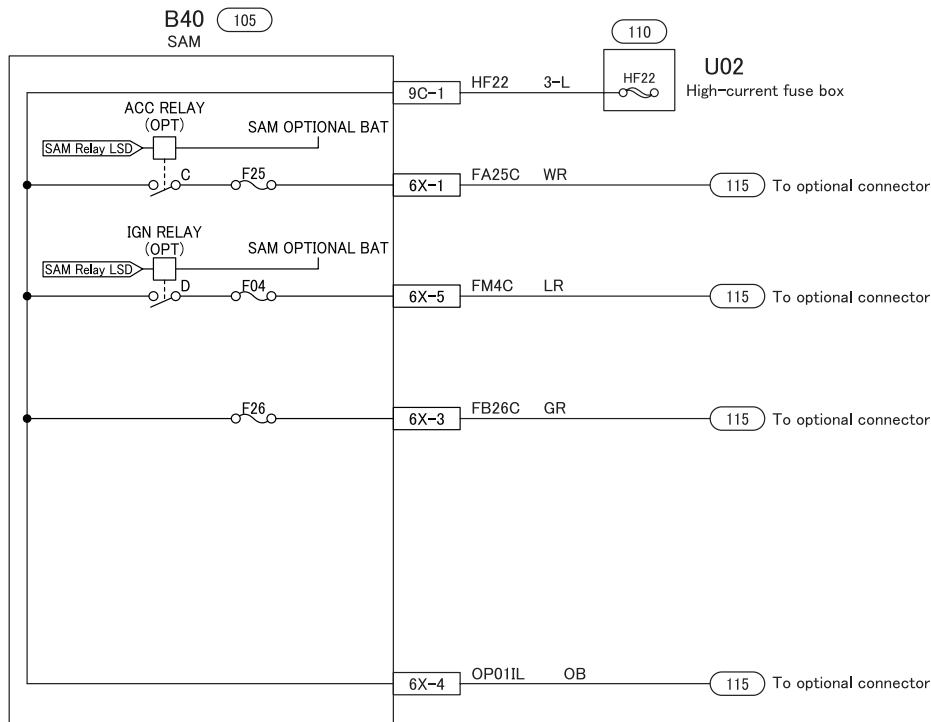
SAM connector (harness side)



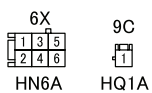
966-C07348-4

SAM CIRCUIT

(5/8)



SAM connector (harness side)

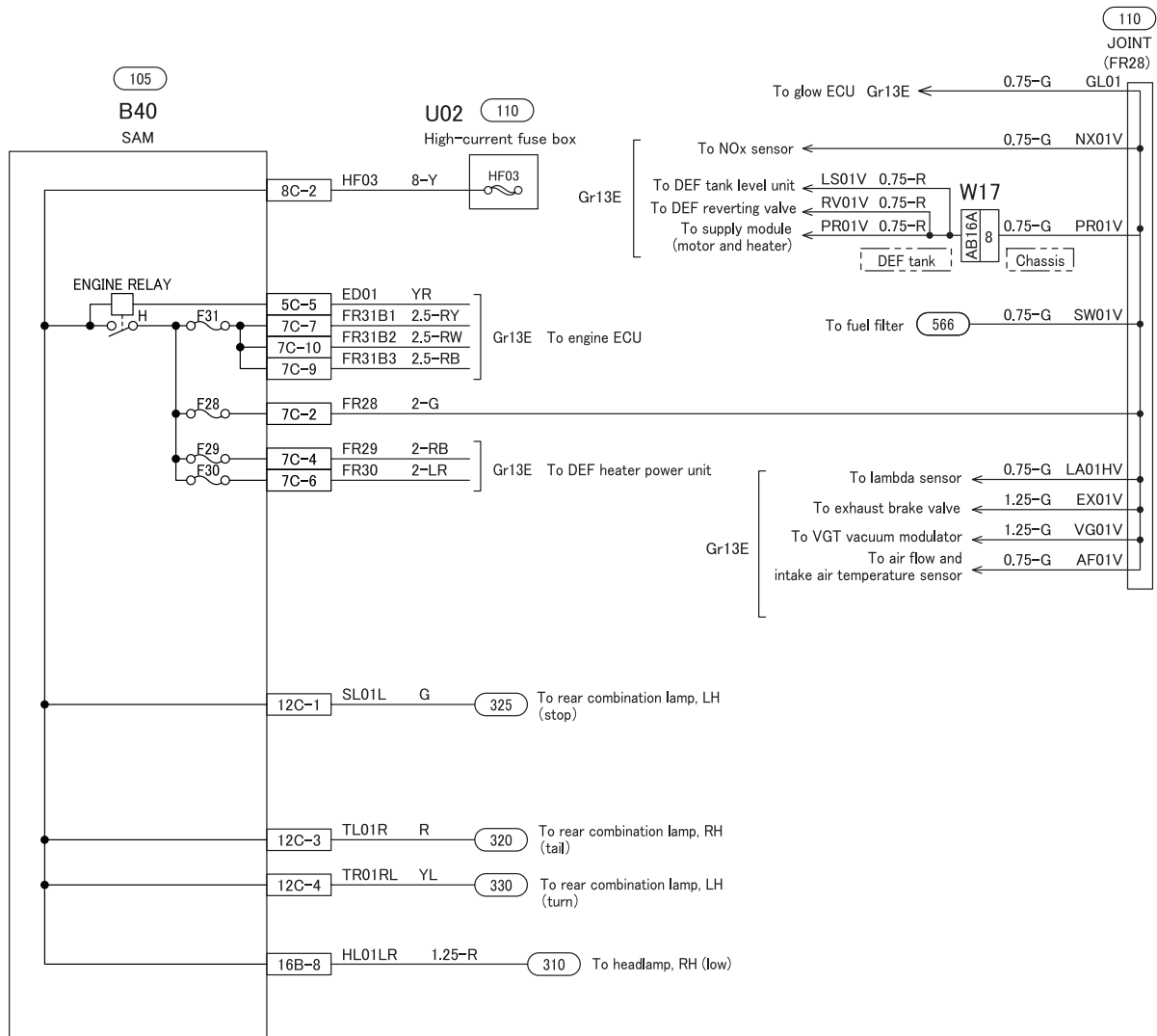


966-C07348-5



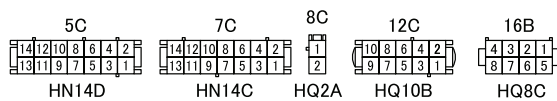
SAM CIRCUIT

(6/8)



ECU : Electronic control unit
 DEF : Diesel exhaust fluid
 VGT : Variable geometry turbocharger

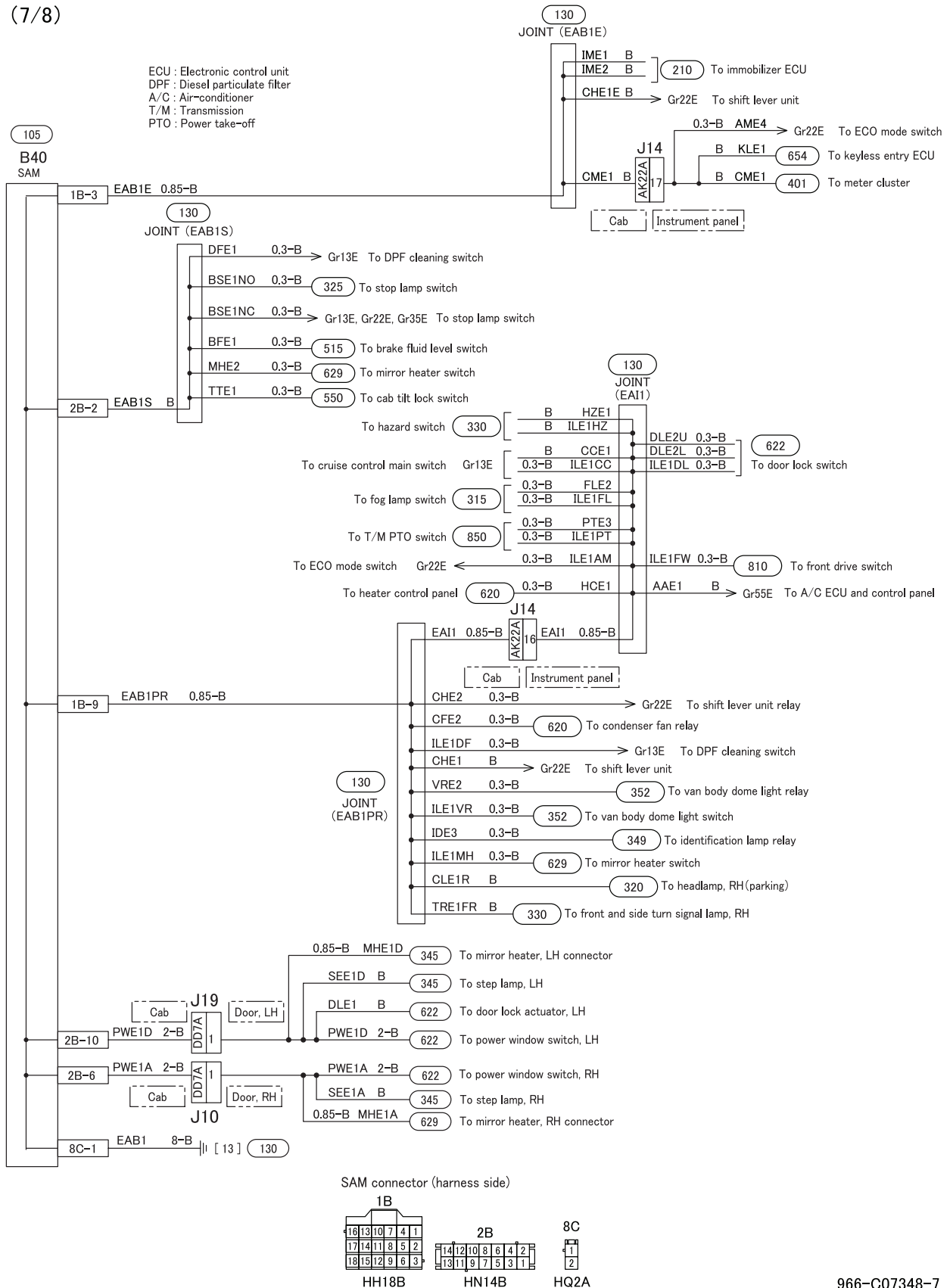
SAM connector (harness side)



966-C07348-6

SAM CIRCUIT

(7/8)

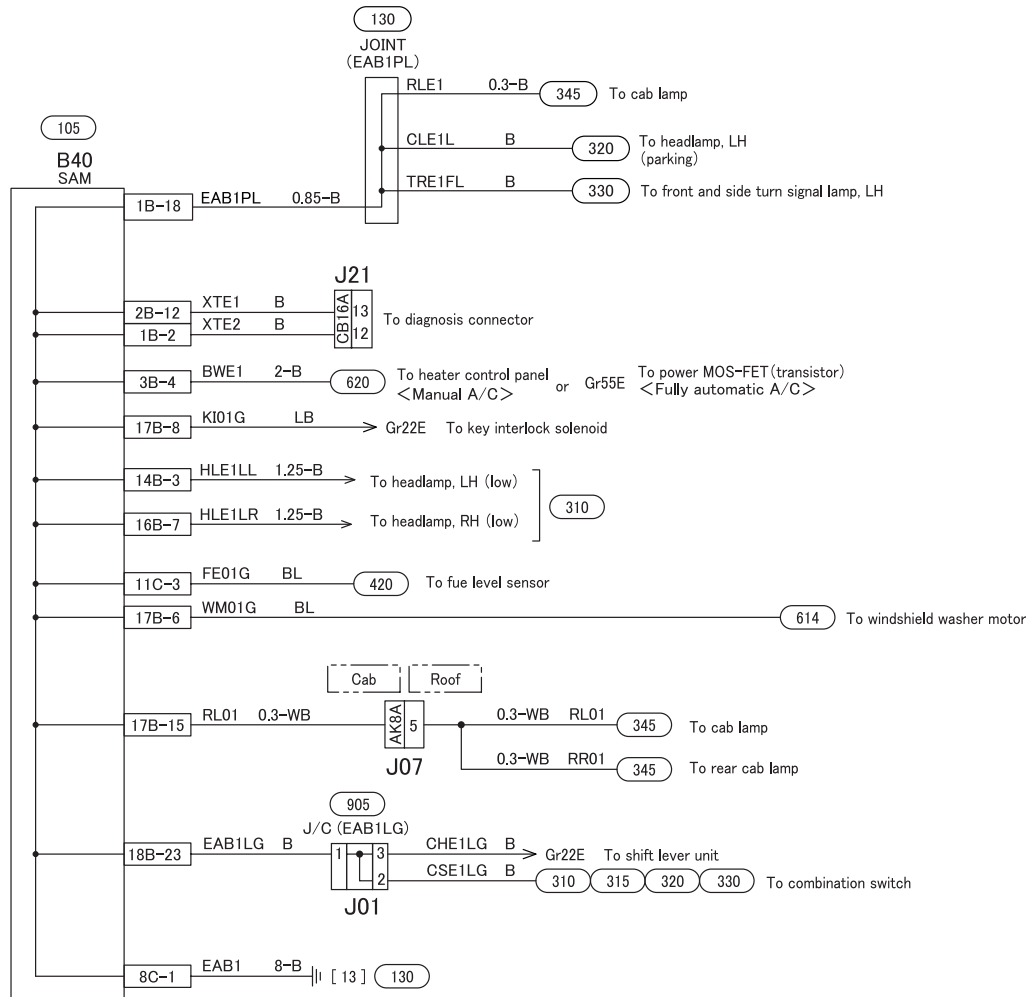


966-C07348-7

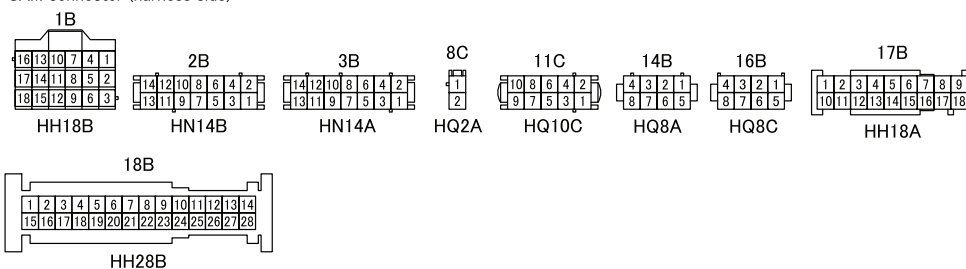
SAM CIRCUIT

(8/8)

A/C : Air-conditioner



SAM connector (harness side)

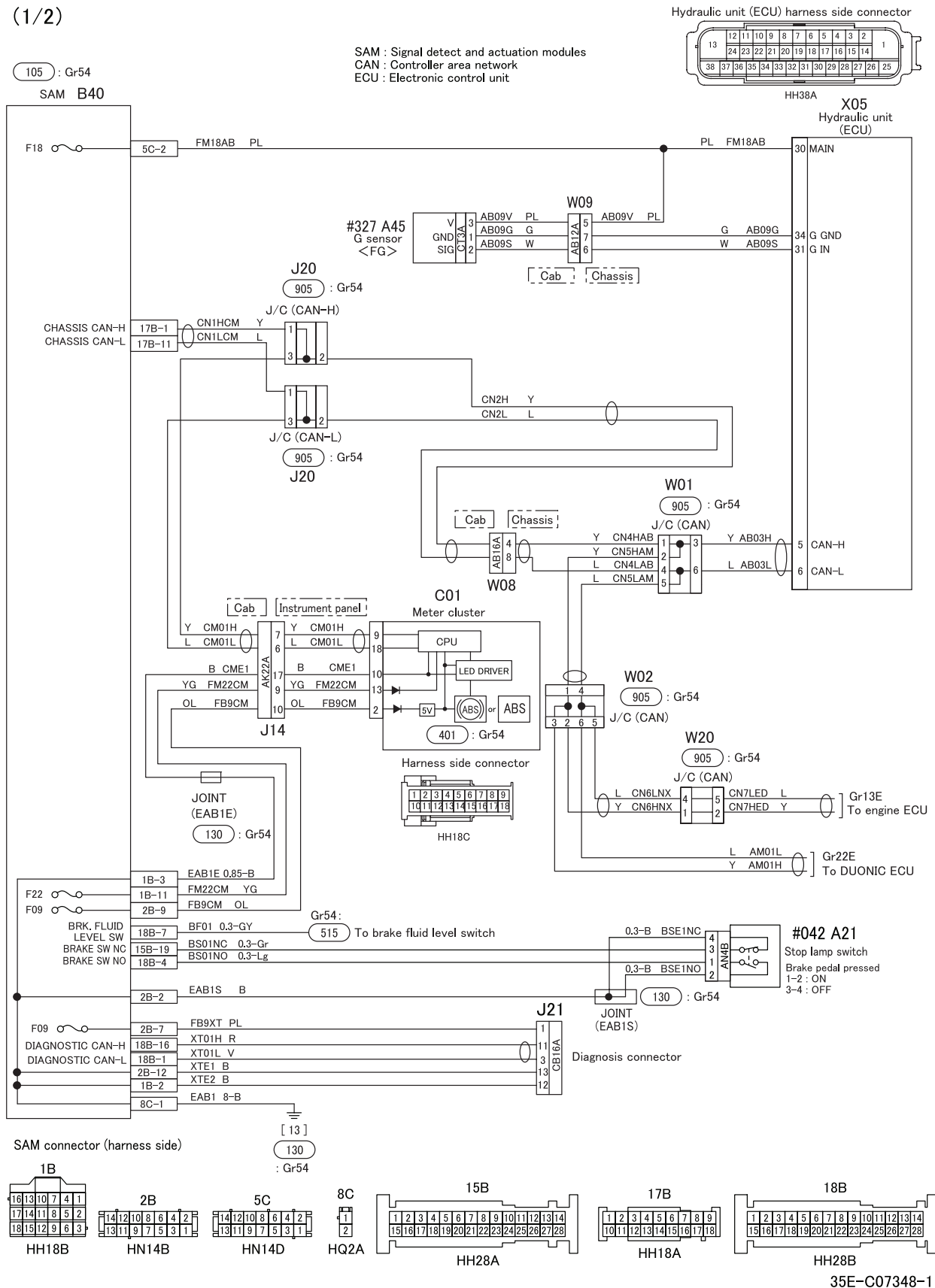


966-C07348-8



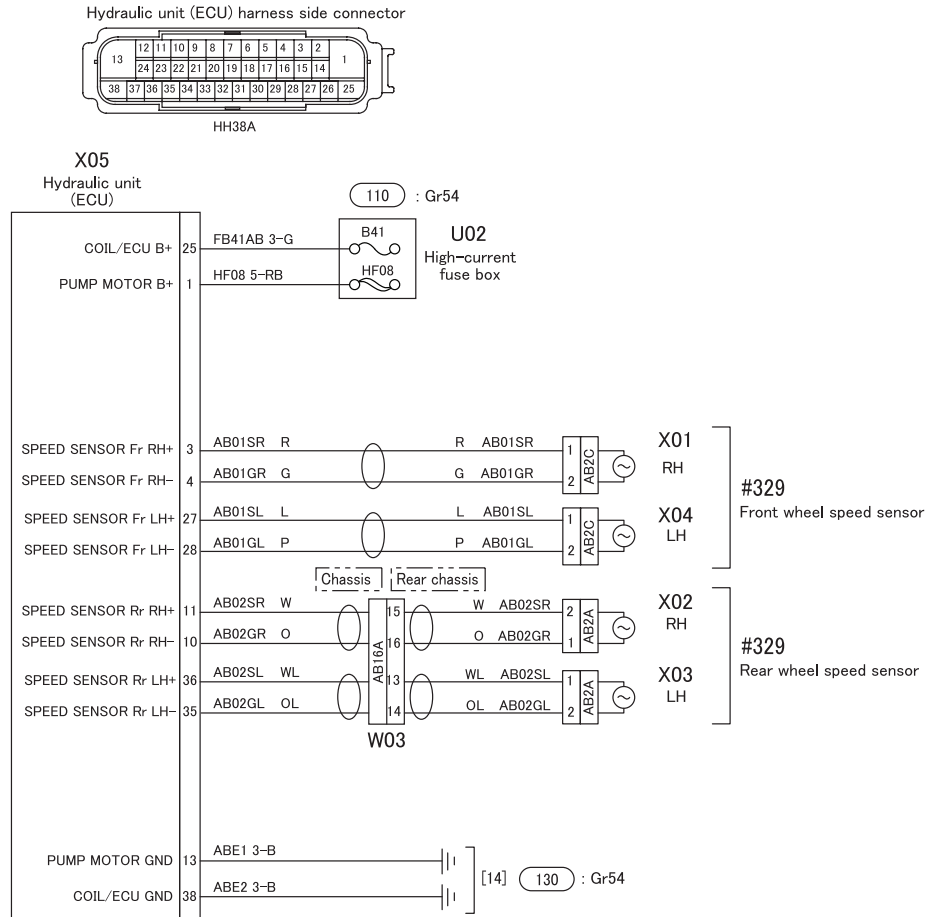
ANTI-LOCK BRAKE SYSTEM CIRCUIT (1)

(1/2)



ANTI-LOCK BRAKE SYSTEM CIRCUIT (2)

(2/2)



ECU : Electronic control unit

35E-C07348-2



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Revision record

		
		
	16. May. 2011	FG Model added
-	29. Mar. 2011	Newly issued
Rev. code	Date issued	Remarks

BlueTec®: A brand of Daimler AG

AdBlue®: The registered trademark of German Association of the Automobile Industry

Body/equipment mounting directives



MITSUBISHI FUSO TRUCK & BUS CORP.

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