Body/equipment mounting directives

FP.FV.FS

Australia/New Zealand

FUSO

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MITSUBISHI FUSO TRUCK & BUS CORPORATION
KAWASAKI, JAPAN

Contents

8 Electrics/electronics

9 Calculations

10 Technical data

1 Introduction

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

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

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

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

1.1 The aim of these directives

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

Additional information

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

Make absolutely sure that you observe the technical threshold values selected in Section 4 "Technica l threshold values for planning" (▷ page 35) as planning must be based on these values.

Section 6 "Modifications to the basic vehicle" (▷ page 79) and Section 7 "Construction of bodies" (▷ page 150) represent the main source of technical information contained in these body/ equipment mounting directives.

1.1 The aim of these directives

⚠ Risk of accident

Before installing any attachments, special-purpose bodies, equipment or carrying out any modifications to the basic vehicle and/or its assemblies, you must read the relevant sections of the Instruction 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.

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

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

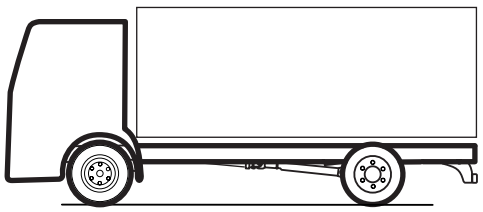
References to regulations, standards, directives etc. are given in keywords and serve for information only.

Additional information is available from any

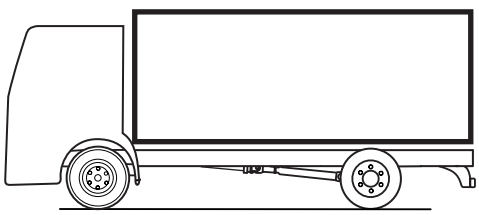
MITSUBISHI FUSO Service Center

Your
MITSUBISHI FUSO TRUCK & BUS CORPORATION

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



Basic vehicle



Body

1.2 Symbols

The following symbols are used in these directives:

Risk of accident

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

Environmental note

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

Property damage

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

Additional information

This note points out any additional information.

▷ page

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

1.3 Vehicle safety

Risk of accident and injury

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

Before installing any attachments, special-purpose bodies, equipment or carrying out any modifications to the basic vehicle and/or its assemblies, you must read the relevant sections of the Instruction 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.

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 exhaust emissions or noise levels

Additional information

Make absolutely sure that you comply with national registration regulations 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 safety

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 Instruction 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.

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

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

1.5 Accident prevention

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

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

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

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

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

1.6 Note on copyright

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

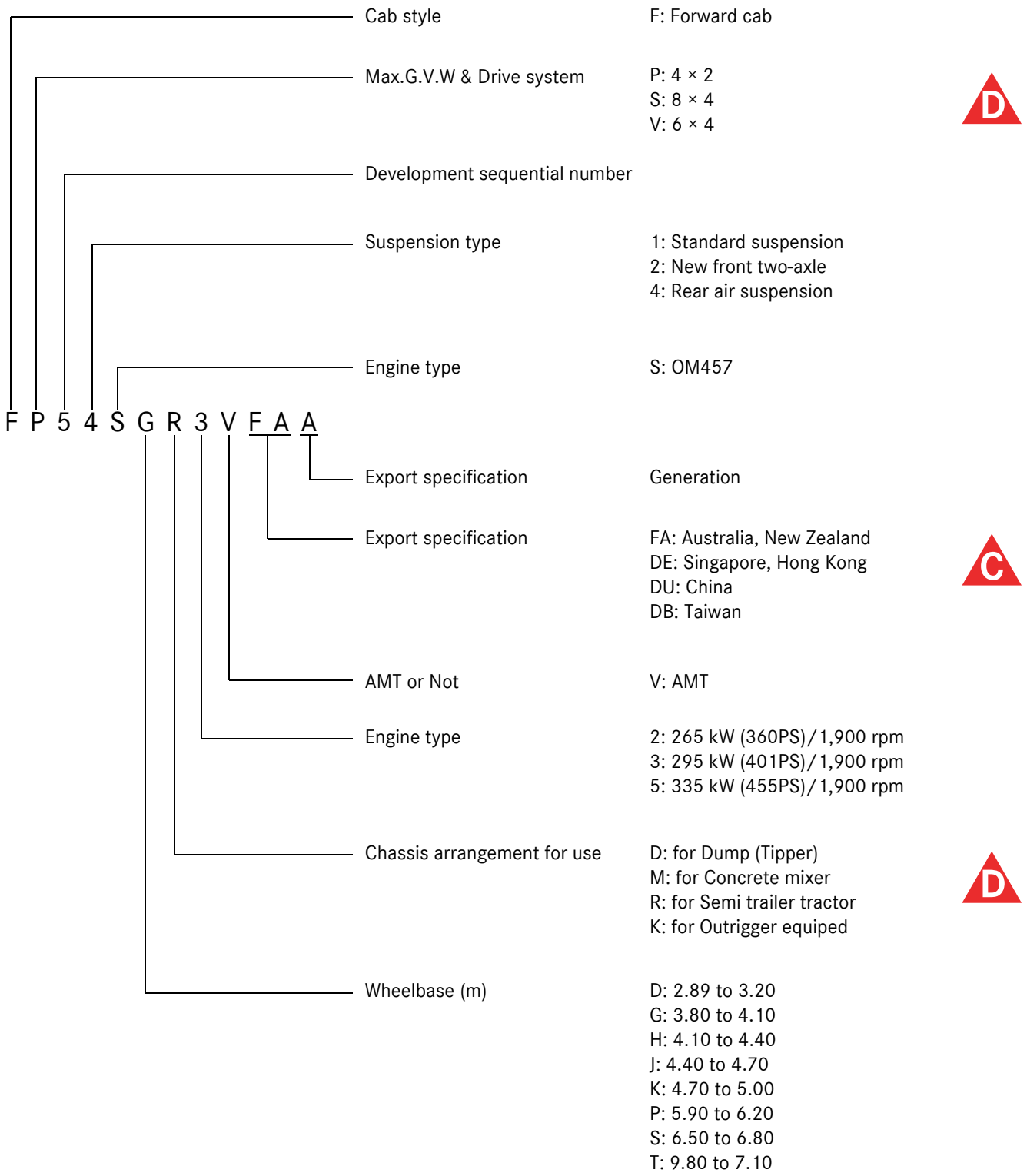
This also applies for the editions on CD-ROM, DVD or other media.

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

2.1 Vehicle and model designations

2.1.1 Model coding system

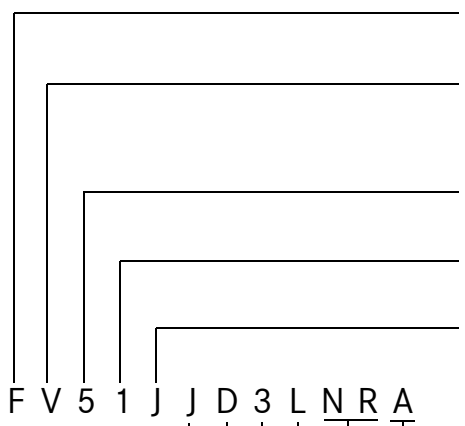
<Euro V-compliant vehicles>



2.1 Vehicle and model designations

C

<Except Euro V-compliant vehicles>



Cab Style	F: Forward cab
Drive system	P: 4 × 2, GVM 10.4 to 13.5 tons V: 6 × 4, GVM 15.0 to 16.0 tons
Development Order	
Suspension Type	1: Leaf suspension (full air brake)
Engine Type	J: 6M70T3, 6M70T4
Export specification	Generation
Code Destination	NR: Ecuador NF: Peru
Steering Wheel Location	L: Left hand R: Right hand
Engine Type	6M70 Model 3: 279 kW (380PS)/2,000 rpm 4: 309 kW (420PS)/2,000 rpm
Chassis arrangement for use	D: For Dump (Tipper) R: For Semi trailer tractor
Wheelbase (m)	G: 3.80 to 4.10 J: 4.40 to 4.70 P: 5.90 to 6.20

D

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2.2 Technical advice and contact persons

Please see the attached sheet. (Click button .doc DOC file down load)

2.3 Product safety

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

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

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

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

Safety design

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

Manufacturing quality

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

Preparing an instruction manual and warning indications

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

2.4 Ensuring traceability

Hazards in your implement/body 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 the Department of Infrastructure in Australia, Transport Agency in New Zealand or comparable registers abroad to be used for determining which owners are affected, we advise you to promptly file the serial number/identification number of your equipment/add-on part linked to the vehicle identification number for the truck in your databases. Similarly, it is also advisable to store the addresses of your customers for this purpose and to grant subsequent purchasers the opportunity to register.

2.5 Mitsubishi three diamonds and Fuso emblem

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

They must not be removed or affixed in another position.

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

Overall appearance of the overall vehicle

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

Third-party trademarks

- may not be affixed next to MITSUBISHI FUSO trademarks

Binding ruling

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

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

2.6 Trademarks

Labels and marks must be applied to the predetermined positions.

For details of the location and method of applying labels and marks, refer to 10.15.2 "Labels and markings" ▷ page 488.

2.7 Recycling of components

Environmental note

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

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

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

2.8 Quality system

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

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

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

3.1 Selecting the chassis

Property damage

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

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

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

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

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

Property damage

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

Additional information

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

Air suspension

The vehicle with an air suspension is right for cargo system body building mainly running on a good road or expressway.

If it is expected that the vehicle is to be run on a rough road or used with the following body building, use conditions and the method of body building and modifications should be examined. Contact the department responsible ▷ page 14.

- Dump truck (carrying industrial waste, raw stone, or chips)
- Bulk (carrying powder and granular materials or feed)
- Flat body (raw stone or raw wood)
- Construction machine carrier (including crane vehicles with long outriggers)
- Removable body

Additional information

For more information on the air suspension, refer to 5.6.2 "Air springs" ▷ page 73.

3.2 Vehicle modifications

⚠ Risk of accident

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

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

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

The vehicles must still comply with the regulations of the country where the vehicle is used after modifications have been carried out.

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

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

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

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

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

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

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

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

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

3.3 Dimensions, weights, vehicle overall height

Risk of accident

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

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

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

Additional information

Further information can be found in Section 4 "Technical threshold values for planning" ▷ page 35.

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

Dimensions and weight details can be found in the drawings and technical data. They are based on a vehicle that is fitted with standard equipment. Weight tolerances of ±3.5% in production must be taken into consideration.

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

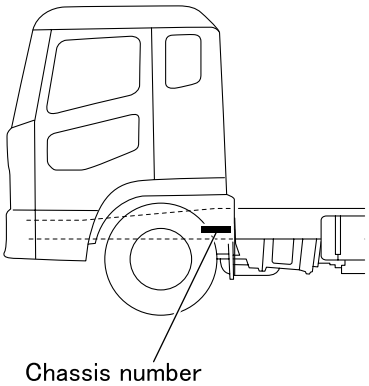
The technical data can be found in the vehicle documents, on the vehicle model plate.

3.4 Vehicle type identification data

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

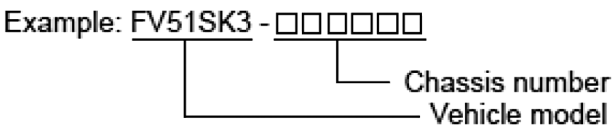
3.4.1 Chassis number

The indicated information varies depending on the country.



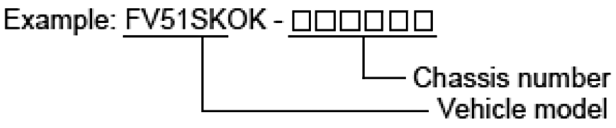
<Type 1>

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



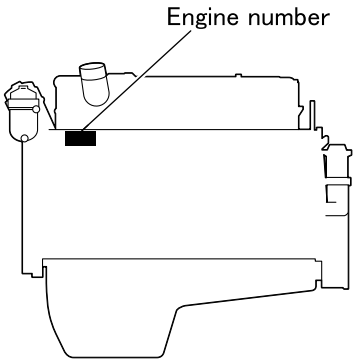
<Type 2>

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



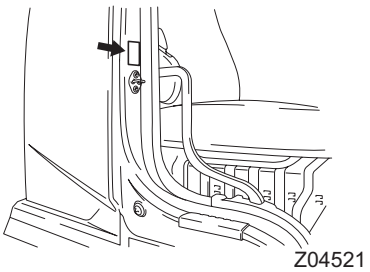
3.4.2 Engine number

The engine number is indicated below the engine start/stop button on the assistant driver's side.



OM457LA.V2 —— Engine model
457.972-00-XXXXXX —— Engine number

3.4.3 Nameplate



This drawing shows left-hand drive vehicles.

<Type 1>

A nameplate showing your vehicle model, chassis number, engine model, and other related information is affixed to the door pillar on the assistant driver's side.

<Type 2>

Both the compliance and data plates are attached to the assistant driver's door opening. The compliance plate certifies that your vehicle complied with Australian Design Rules at the time of manufacture.

In all correspondence related to your vehicle the following information should be quoted.

- The engine number.
- The vehicle identification number (V.I.N.) - shown on compliance plate.
- The S.O.A. No. (where applicable), option code, paint and trim codes located on date plate.

3.5 Tires

The body manufacturer must ensure that:

- the largest permissible MITSUBISHI FUSO 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 national regulations 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.

! Property damage

If you have other wheels fitted

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

3.6 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.

Additional information

Further information on bolted and welded connections can be found in Section 5 "Damage prevention" ▷ page 48 and Section 6 "Modifications to the basic vehicle" ▷ page 79.

3.6.1 Bolted connections

Use the specified bolts and nuts. Unless otherwise specified, refer to 5.4 "Bolted connections" ▷ page 54.

3.6.2 Welded connections

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

Property damage

Parts which must not be welded:

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

Additional information

Further information on bolted and welded connections can be found in Section 5 "Damage prevention" ▷ page 48 and Section 6 "Modifications to the basic vehicle" ▷ page 79.

3.7 Soundproofing

The following modifications can lead to noise problems:

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

Do not modify the vehicle except for those indicated in the Body/Equipment Mounting Directives.

Shielding covers around the engine and transmission, muffler with combined exhaust emission control device and exhaust pipe between exhaust manifold and muffler with combined exhaust emission control device are components to be noise-proofed. Therefore, never attempt to modify them.

Take utmost care not to damage these components if they are to be removed once and then reinstalled for facilitating mounting works.

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.
  See 10.15.5 "Location of sound proofing plates" ▷ page 494.
- The level of interior noise must not be adversely affected.

Additional information

Comply with all national regulations and directives.

3.8 Exhaust system

The exhaust system must not be modified.

If modification is unavoidable, consult with the department in charge of the measures ▷ page 14.

Property damage

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

Additional information

For more information on exhaust system, refer to 6.14 "Exhaust system" ▷ page 128.

3.8.1 Euro 5

<Euro V-compliant vehicles>

Environmental note

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

To satisfy the Euro 5 emissions legislation, the BlueTec, exhaust aftertreatment system is used, which is based on Selective Catalytic Reduction (SCR). BlueTec diesel technology reduces the nitrogen oxide content of the exhaust gas by the injection AdBlue. AdBlue is injected into the hot exhaust gas via a urea (AdBlue) nozzle. The exhaust gas is transformed in the SCR muffler.

3.9 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 32.

Any additional expenses arising from the body in connection with warranty, maintenance or repair will not be borne by MITSUBISHI FUSO TRUCK & BUS CORPORATION or its authorized dealer.

3.9.1 Maintenance instructions

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

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

3.9.2 Preparation for storing the vehicle

Property damage

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

Storage in an enclosed space:

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

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

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

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

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

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

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

Removing the vehicle from storage:

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

3.9.3 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 to 30 °C.

Store the battery in an upright position.

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

Property damage

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

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

3.9.4 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. MITSUBISHI FUSO recommends a MITSUBISHI FUSO Service Center for this work.

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

Additional information

Further details are available from any MITSUBISHI FUSO Service Center.

3.10 Optional equipment

⚠ Risk of accident and injury

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

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

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

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

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

Optional equipment (e.g. , auxiliary tanks 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.

4.1 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 38.
- Take the weight of special equipment into consideration when making calculations.

4.1 Vehicle overhang and technical wheelbases

4.1.1 Maximum vehicle overhangs

Maximum vehicle overhang
60% of wheelbase / 3.7 m or less (whichever is shorter)

Additional information

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

4.2 Weight distribution, CoG height, anti-roll bars

⚠ Risk of accident

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

4.2.1 Weight distribution

Avoid one-sided or laterally asymmetric weight distribution.

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

Example:

- Permissible axle load 10,000 kg
- Permissible wheel load distribution 5,200 kg to 4,800 kg

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.

For CoG height of the kerb weight, see 10.4 "Weight distribution table" ▷ page 279.

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

4.2.3 Stabilizers roll control

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

4.3 Steerability

Risk of accident

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

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

Property damage

The permissible front axle load must not be exceeded.

Observe the notes on product safety ▷ page 15.

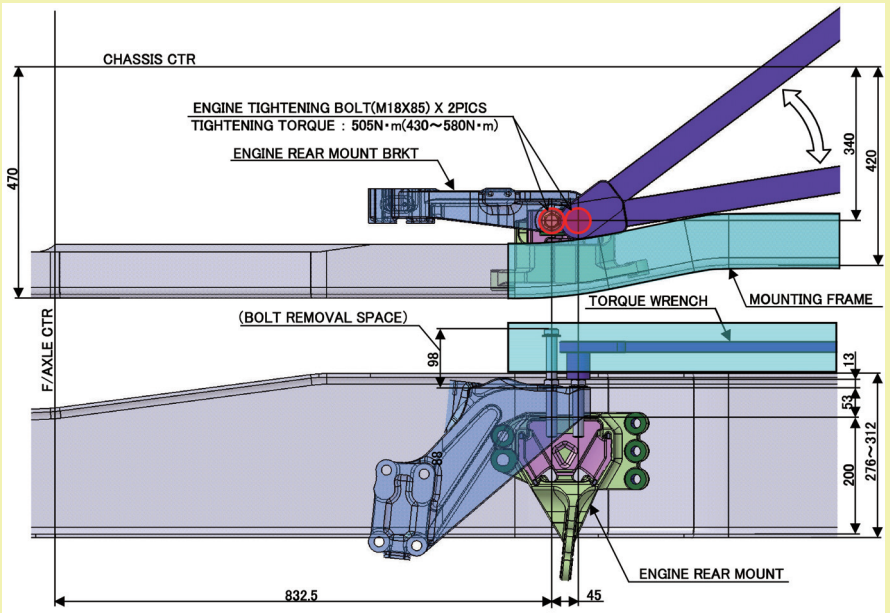
4.4 Clearance for basic vehicle and bodies

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

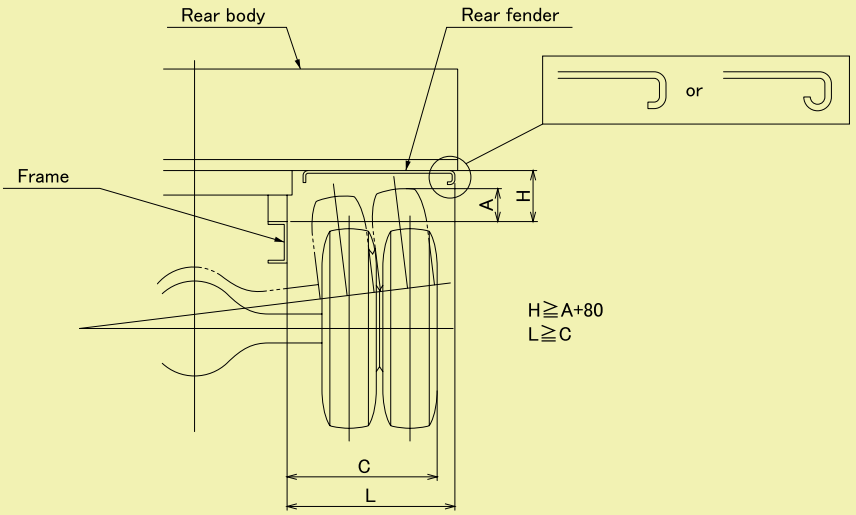
Dimensional data in the Body/equipment mounting directives must be observed.

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

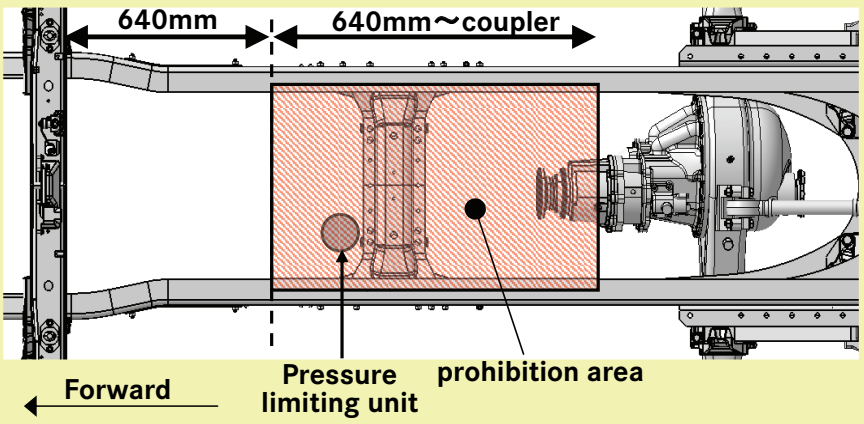
Part	Minimum Clearance and Notes
1. Section behind cab	In the section behind the cab, there are a cab tilt locking unit, coolant reservoir tank or expansion tank, engine oil filler port, engine oil level gauge, etc. Ensure there is a clearance of at least 150 mm between the cab and rear body to facilitate trouble-free operation, inspection and filling works. The atmospheric temperature in the vicinity of the battery rises (to about 100°C) due to the heat generated inside of the engine compartment. For this reason, protect parts that do not withstand heat, such as plastic parts, by installing a heat shield plate, etc. Provide a protector in order to prevent loads from falling from the rear body front window of the dump or other rear body.

Part	Minimum Clearance and Notes
2. Areas around engine	Vertical direction 40 mm Lateral direction 30 mm Longitudinal direction 25 mm <Euro V-compliant vehicles> In order to ensure that the engine can be easily maintained when it is removed from the vehicle, provide sufficient space to enable the engine mounting bolts to be extracted and also to enable the bolts to be tightened using a torque wrench. Make the mounting frame of a profile which conforms to that of the chassis frame so as to prevent the sub-frame from protruding into the inside of the chassis frame. If the sub-frame cannot be made to conform to the profile of the chassis frame, contact the department responsible. ▷ page 14 For the method of removing the engine mounts, contact an authorized MITSUBISHI FUSO dealer or distributor. 
3. Clutch and Transmission Assembly	Do not install any rear body part in the area of 250 mm of rear part, because clutch and transmission assembly is moved backward in the same inclination line of engine, to pull out the clutch spline shaft, when clutch and transmission assembly is removed from engine.
4. The Surrounding part of T/M	25 mm at surrounding part of transmission except rear part.
5. Upper part of Transmission	Keep more than 150 mm of clearance between the upper surface of upper cover and the rear body part if possible, because this clearance is used when the transmission upper cover is removed.
6. The surrounding part of the Propeller shaft and the Rear axle	Min. 50 mm of the surrounding part.

4.4 Clearance for basic vehicle and bodies

Part	Minimum Clearance and Notes
7. The brake hose (which connects to the front and rear wheel)	Keep min. 50 mm of clearance at worst. This brake hose is considered to move when vehicle is driven.
8. Other hoses	40 mm
9. Space above rear axle	Air and electrical lines such as the brake hose and wiring harness are laid on top of the rear axle. Provide enough space above the rear axle so that these lines will not come into contact with any of the mounting parts even when the axle is elevated to the highest position. Refer to 10.7.2 "Differential and tire bound height" ▷ page 346.
10.Attaching the rear fender	The clearance between the rear fender and tire must be designed to be optimum assuming that the vehicle is traveling in bad conditions. Determine the standard clearance from the fender and top and side surfaces of the frame as follows from dimensions A listed in 10.7.2 "Differential and tire bound height" ▷ page 346. 

4.4 Clearance for basic vehicle and bodies

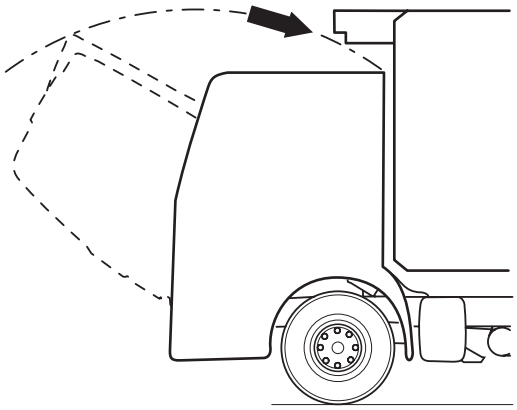
<table>
<tr><th>Part</th><th>Minimum Clearance and Notes</th></tr>
<tr><td>11.The exhaust system</td><td>The heat affection and the interference of the exhaust system is a quite important factor in the safety of the vehicle. Keep the clearance between the rear body parts and these parts at least following figures on the table.
<table>
<tr><th>Parts</th><th>Minimum Clearance (mm)</th></tr>
<tr><td>Air pipe, Air tank</td><td>100</td></tr>
<tr><td>Oil pipe, Brake pipe, air-servo assistance</td><td>150</td></tr>
<tr><td>Wiring harness, Fuel tank, Brake hose, Battery cable, Rubber parts, Plastic parts</td><td>200</td></tr>
<tr><td>Fuel pipe</td><td>200</td></tr>
<tr><td>Fuel hose</td><td>250</td></tr>
</table>
Do not install a tailpipe under the fuel pipe, hose connection and fuel filter drain tube.
Keep body mounting such as wood and rubber parts away from the muffler built in the emission control system and exhaust pipe by at least 100 mm. If this is impossible, install a heat shield plate to avoid a heat effect and check that there is no safety problem.
D In the case of a tractor, in order to protect the pressure limiting unit from heat damage, do not install a catwalk in the area indicated in the drawing below.

</td></tr>
<tr><td>12.Fuel tank</td><td>The fuel tank must be mounted so that refilling operations such as opening/closing the filler cap and pouring fuel are not obstructed.</td></tr>
<tr><td>13.Battery</td><td>Mounting hardware must be located so that battery removal/installation and inspection as well as battery cover detaching/attaching can be done easily.</td></tr>
<tr><td>14.Air dryer</td><td>The air dryer must be inspected and replaced periodically because it contains desiccant. Mounting hardware must be located so that removal/installation of the air dryer body is not obstructed.</td></tr>
</table>

Additional information

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

4.4.1 Attachment above cab

- Observe the permissible center of gravity location and the front axle load.
- Make sure that there is sufficient space for tilting
  Refer to 10.5.1 "Chassis cab drawings"
  ▷ page 286.



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Cab tilting range clearance

4.5 Permissible load on cab roof

When installing exterior equipment such as a roof deck or a ladder on the roof, ensure that the weight of the equipment does not exceed 70 kg.

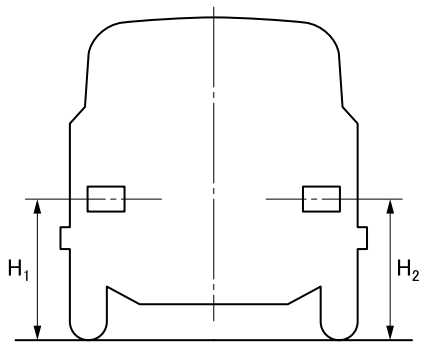
4.6 Vehicle body incline

Plan the difference in weight between the left and right mounted components so that the lateral incline of the vehicle is within the standard value.

Vehicle lateral inclination criteria

Measurement position		Difference in height between right and left
Front end	Headlamp center	15 mm max.
Rear end	Upper surface of frame rear end	10 mm max.

The difference h in headlamp height due to a difference in weight between right and left sides is to be calculated as follows.



4.7 Others

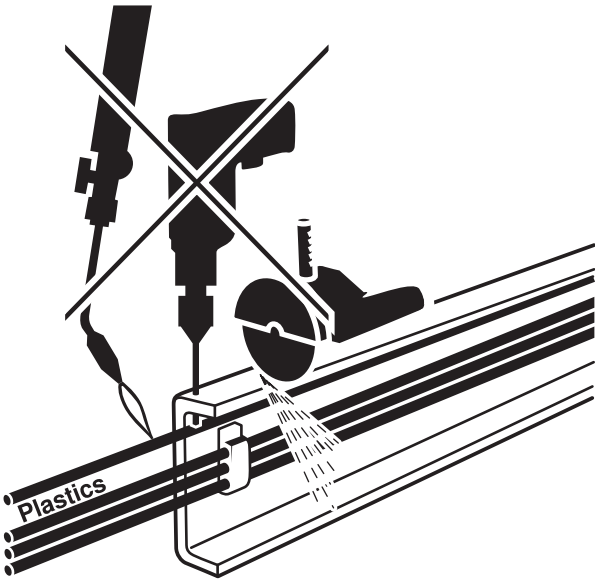
4.7.1 Maximum rear body width

The maximum limits on the rear body width is prescribed in the local laws and regulations.

5.1 Brake hoses/cables and lines

Risk of accident

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



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- Fuel and hydraulic lines and brake hoses must be covered or removed if necessary before carrying out any welding, drilling and grinding work and before working with cutting disks.
- After installing fuel lines, hydraulic lines and brake hoses, the 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 national regulations and laws.

Additional information

Further information on brake hoses can be found in 6.13 "Brake systems" ▷ page 115

5.2 Welding work

⚠ Risk of injury

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

Welding work near the airbags is strictly forbidden.

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

❗ Property damage

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

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

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

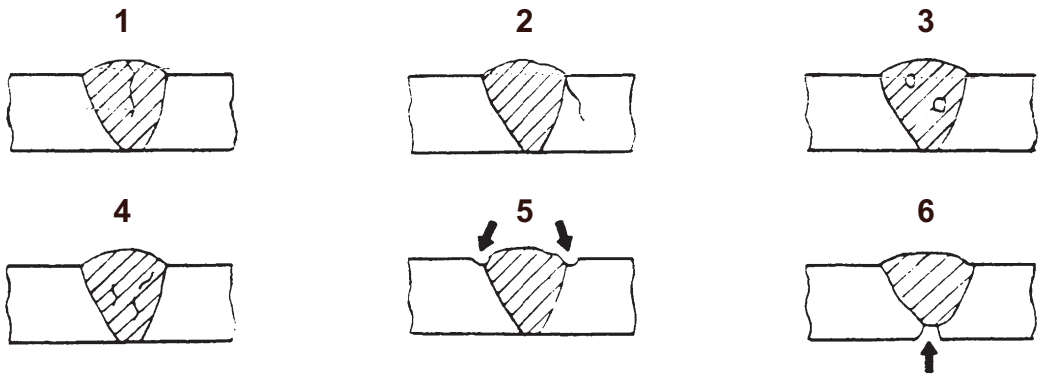


Fig. 1

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

Additional information

Additional information on welded connections can be found in Section 6 "Modifications to the basic vehicles" ▷ page 79 and Section 8 "Electrics/ electronics" ▷ page 173.

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

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

Risk of accident and injury

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

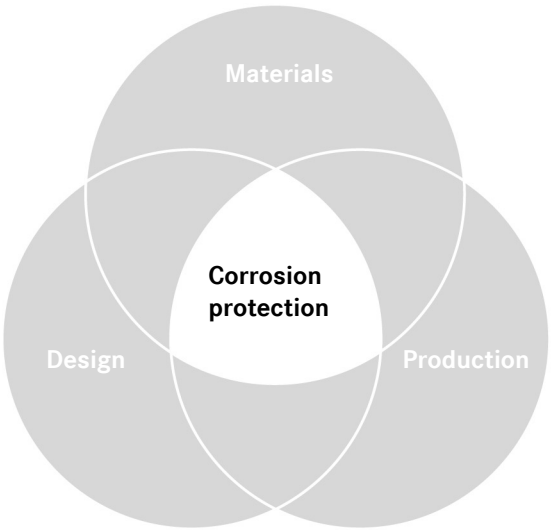
5.3 Corrosion protection measures

General

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

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

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



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Optimum corrosion protection

5.3 Corrosion protection measures

Disassembly of components

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

Damage to components

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

Cutting of components

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

Corrosion protection on reinforcements and fittings

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

5.3 Corrosion protection measures

Corrosion prevention in welding work

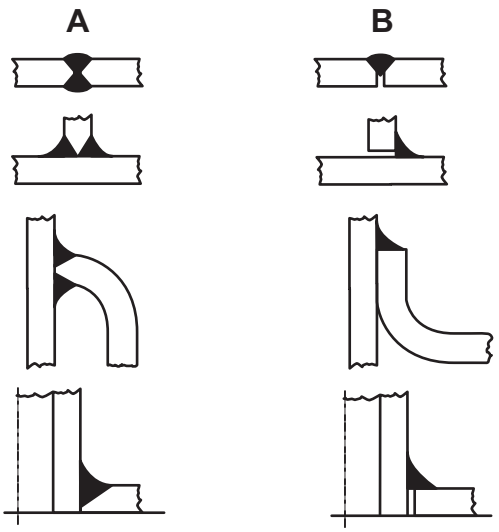
In order to avoid crevice corrosion at weld seams, the welds should be made in accordance with the examples shown.

Preparation

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

After welding work

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



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Example: Weld seams

A – Suitable
B – Unsuitable

Additional information

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

5.4 Bolted connections

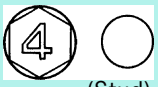
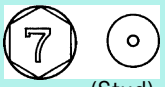
Use the specified bolts and nuts. Unless otherwise specified, tighten to the torques shown in the table below.

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

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

- Hexagon bolt and stud bolt

Unit: N·m {kgf·m}

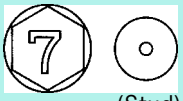
Strength category	4T		7T		8T	
Indication / Nominal diameter mm	 (Stud)		 (Stud)		 (Stud)	
M5	2 to 3 {0.2 to 0.3}	–	4 to 6 {0.4 to 0.6}	–	5 to 7 {0.5 to 0.7}	–
M6	4 to 6 {0.4 to 0.6}	–	7 to 10 {0.7 to 1.0}	–	8 to 12 {0.8 to 1.2}	–
M8	9 to 13 {0.9 to 1.3}	–	16 to 24 {1.7 to 2.5}	–	19 to 28 {2.0 to 2.9}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

5.4 Bolted connections

C

- Hexagon Head Bolts and Stud Bolts

Unit: N·m {kgf·m}

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

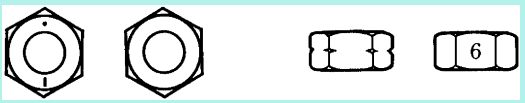
- Hexagon Head Flange Bolts

Unit: N·m {kgf·m}

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

- Hexagon Nuts

Unit: N·m {kgf·m}

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

- Hexagon Flange Nuts

Unit: N·m {kgf·m}

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

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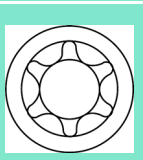
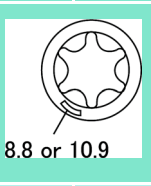
- Hexagon Flange Bolt

Unit: N·m {kgf·m}

		Width across flats mm	Strength class	
			8.8	10.9
			 8.8 or 10.9	or 
Nominal diameter mm	M5	8	5 {0.5}	7 {0.7}
	M6	10	10 {1.0}	15 {1.5}
	M8	13	25 {2.5}	30 {3.1}
	M10	16	40 {4.1}	60 {6.1}
	M12	18	80 {8.2}	100 {10}
	M12×1.5	18	80 {8.2}	100 {10}
	M14	21	120 {12}	180 {18}
	M14×1.5	21	120 {12}	180 {18}
	M16	24	180 {18}	270 {28}
	M16×1.5	24	180 {18}	270 {28}

- Hexagon Socket Bolt

Unit: N·m {kgf·m}

		Width across flats mm	Strength class	
			8.8	10.9
			 8.8 or 10.9	
Nominal diameter mm	M5	4	5 {0.5}	–
	M6	5	10 {1.0}	–
	M8	6	–	30 {3.1}
	M10	8	–	60 {6.1}
	M12	10	–	100 {10}
	M12×1.5	10	–	100 {10}
	M14	12	–	160 {16}
	M14×1.5	12	–	160 {16}
	M16	14	–	250 {25}
	M16×1.5	14	–	250 {25}

- Stud Bolt

Unit: N·m {kgf·m}

		Width across flats mm	Strength class	
			8.8	10.9
			 8.8 or 10.9	
Nominal diameter mm	M5	–	2.5 {0.3}	3.5 {0.4}
	M6	–	5 {0.5}	7.5 {0.8}
	M8	–	12.5 {1.3}	15 {1.5}
	M10	–	20 {2.0}	30 {3.1}
	M12	–	40 {4.1}	50 {5.1}
	M12×1.5	–	40 {4.1}	50 {5.1}
	M14	–	60 {6.1}	90 {9.2}
	M14×1.5	–	60 {6.1}	90 {9.2}
	M16	–	90 {9.2}	135 {14}
	M16×1.5	–	90 {9.2}	135 {14}

- Eyebolt

Unit: N·m {kgf·m}

		Tightening torque
Nominal diameter mm	M8×1	8 {0.8}
	M10×1	15 {1.5}
	M12×1.5	25 {2.5}
	M14×1.5	35 {3.6}
	M16×1.5	35 {3.6}
	M18×1.5	40 {4.1}

5.5 Painting work

If you removed parts, securely install them in their original positions.

If you peeled off labels, obtain new labels and stick them in their original positions.

Environmental note

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

Dispose of paints and lacquers in an environmentally responsible manner.

General precautions

- If you removed parts, be sure to re-install them in their original positions.
- If you removed any labels, obtain new labels and apply them to the same positions from which you removed the old labels.
- Paint compatibility should be checked when epainting. 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.
- Depending upon the specifications, there are colors and parts which are not applicable. For details, please contact MITSUBISHI FUSO's service center.

5.5.1 Repainting prohibited positions

The parts and components listed below may cause trouble if repainted. Mask these parts and components before starting painting to protect them against paint spray.

- Brake hoses and brake-related parts
- Various nylon tubes and identification tape
- Various rubber hoses
- Rubber and plastic parts of cab suspension, engine, chassis suspension and steering systems
- Electronic controls
  - MR2 (Engine ECU)
  - SCR-FM (SCR ECU)
  - Other systems' ECU
- Electrical wiring, connectors and sensors for electronic controls
- Electric devices such as lamps, switches and battery
- Drive shaft connecting flanges (propeller shaft, power take-off output shaft)
- Piston rods of pneumatic cylinders
- Various air line control valves
- Breathers of transmission and axles
- Caution plates and name plates
- Rubber and PP resin parts
  - Weather-strip
  - Washer nozzle
  - Mudguards
  - Corner panel lower shield (mirror mounting area, front panel upper area, flash lamp mounting area, antenna mounting area, grip mounting area, corner panel front area)
  - Fender splash shields
  - Antenna legs
  - Under-mirror body
  - Run channel
  - Retractable mirror motor unit
  - Overrider
  - Tilt pump box
  - Tilt link, hook cover
  - Mudguard apron
  - Splash apron
  - Packing rubber
  - Bumper side air duct
  - Step protector
- BlueTec exhaust gas aftertreatment
  - Supply unit
  - Pressure limiting unit
- Parts which must not be painted for design reasons
  - Emblems such as the Mitsubishi logo
  - Outside mirror stay and covers
  - Antenna and antenna bracket
  - Outside mirror housing
  - Front grille
  - Wiper arms and blades
  - Outer handles & covers

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If you removed weatherstrips or opening seals, observe the following instructions when reinstalling them.

- Adhesive tapes cannot be reused. If you peeled off adhesive tapes, use new adhesive tapes and primer.

Part name	Manufacturer/ product number	Remarks
Adhesive tape	Sumitomo 3M/ GT7108 or equivalent	
Primer	Sumitomo 3M/K-520 or equivalent	

- If you removed a door weatherstrip, check that the plastic clip hook is not deformed and that the hook can be inserted correctly before reinstalling the weatherstrip. If the clip hook is deformed or damaged, replace the clip with a new one.

Part name	Manufacturer/ product number	Remarks
Clip	MC146853 (Mitsubishi part number)	For door weatherstrip

- If you removed the front panel weatherstrip, replace the clip with a new one. It cannot be reused.

Part name	Manufacturer/ product number	Remarks
Clip	MU481027 (Mitsubishi part number)	For front panel weatherstrip

5.5.2 Precautions during paint curing

Forced drying

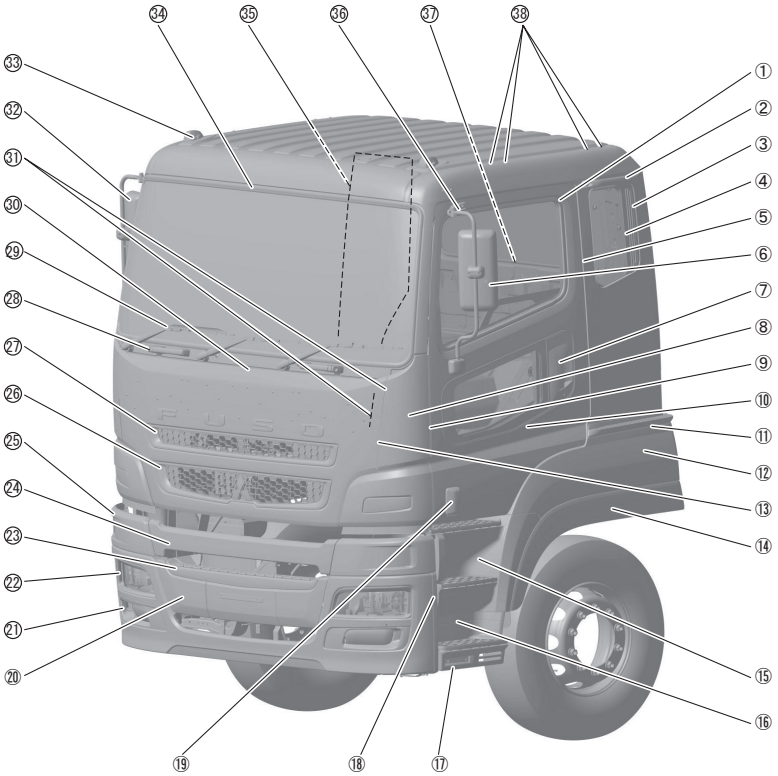
- Forced drying after painting the cab or bumper must be done at a temperature not exceeding 80°C.
- Avoid removing the under-window moulding, and protect it against heat by masking.

The front panel hinges are die-cast aluminum parts and can therefore be painted and dried together with other metal parts.

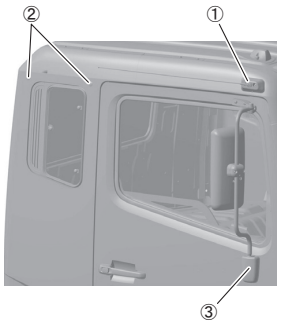
- If forced drying above 80°C is unavoidable, remove resin and rubber parts from the vehicle or shield them against heat.

Parts to be removed or heat-shielded when drying at higher than 80°C

<Right hand drive, Door mirror type>

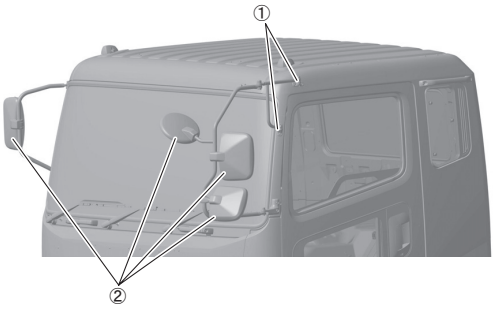


① Door run channel
② Back side grip
③ Air outlet garnish
④ Side window weatherstrip
⑤ Door weatherstrip
⑥ Outside mirror
⑦ Door outer handle and cover
⑧ Corner panel
⑨ Door opening seal
⑩ Under window molding
⑪ Rear step
⑫ Fender
⑬ Corner panel weatherstrip
⑭ Fender splash shield
⑮ Step wall
⑯ Step upper wall
⑰ Step lower wall
⑱ Bumper corner cover
⑲ Side turn lamp
⑳ Hook cover
㉑ Fog lamp bezel
㉒ Head lamp bezel
㉓ Step protector
㉔ Bumper center cover
㉕ Bumper side cover
㉖ Front lower grill
㉗ Front upper grill
㉘ Front grip and cap
㉙ Wiper arm and blade, cap
㉚ Front panel weatherstrip
㉛ Front panel opening seal
㉜ Outside mirror
㉝ Roof marker lamp
㉞ Front windshield weather strip
㉟ Snorkel duct
㊱ Cap, packing (Mirror stay assy)
㊲ Rear window weatherstrip
㊳ Screw seal washer



① Antenna leg
② Plug
③ Mirror stay bracket cover

<Pillar mirror type>

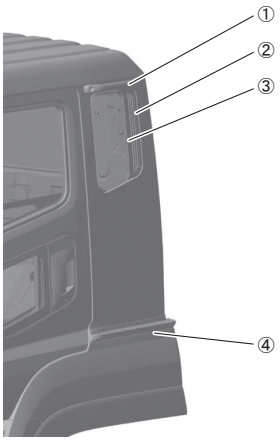


① Cap, packing (Mirror stay assy)
② Outside mirror

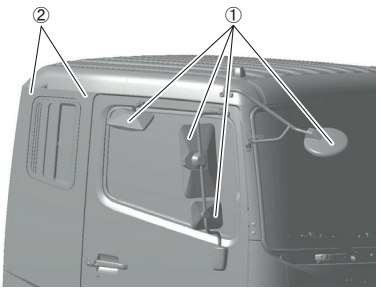
<Left hand drive, Door mirror type>

① Rear quarter garnish
② Door outer handle

<Quater window type>



① Back side grip
② Air outlet garnish
③ Side window weatherstrip
④ Rear step



① Cap, packing
(Mirror stay assy)
② Outside mirror

Natural drying

There is no need to remove resin parts and rubber parts from the vehicle.

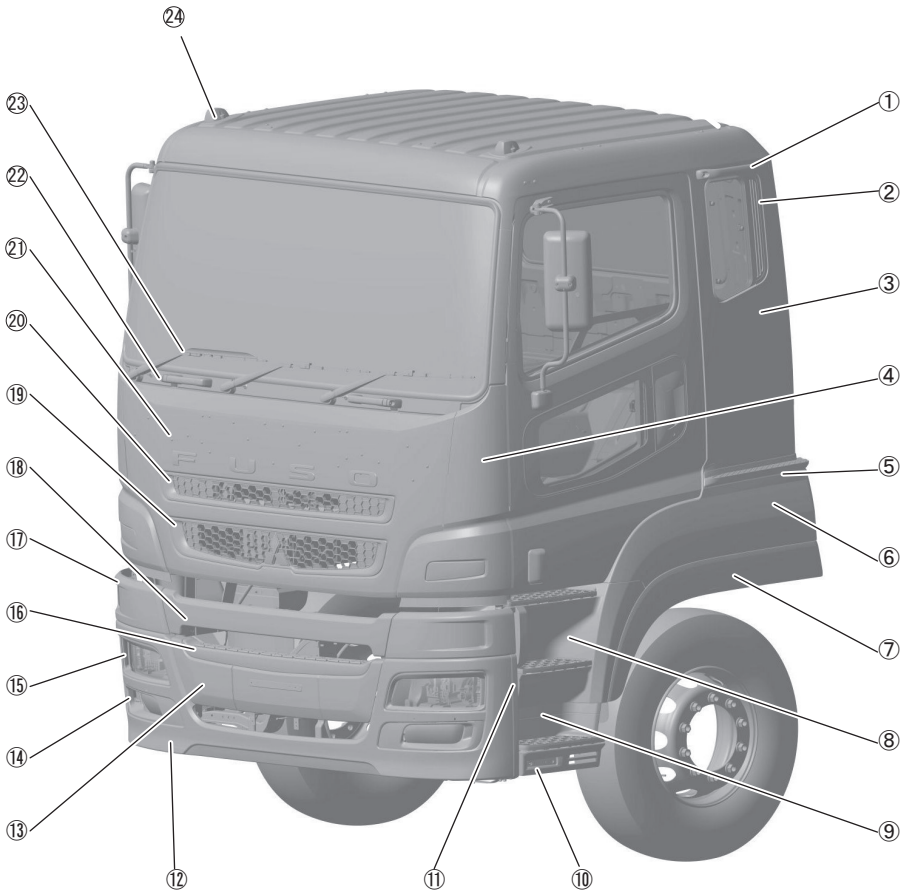
5.5.3 Painting the cab

Cab painting of as-shipped vehicle

The vehicle is shipped with the cab painted as shown below.

C

① Back side grip
② Air outlet garnish
③ Cab metal
④ Corner panel
⑤ Rear step
⑥ Fender
⑦ Fender splash shield
⑧ Step wall
⑨ Step upper wall
⑩ Step lower wall
⑪ Bumper corner cover
⑫ Front bumper
⑬ Hook cover
⑭ Fog lamp bezel
⑮ Head lamp bezel
⑯ Step protector
⑰ Bumper side cover
⑱ Bumper center cover
⑲ Front lower grill
⑳ Front upper grill
㉑ Front panel
㉒ Front grip and cap
㉓ Wiper arm and blade, cap
㉔ Roof marker lamp



Metal sheet parts (cab metal, front panel, bumper, bumper skirt and corner panel rear bracket)

Body color (color name)	Color part number	Paint manufacturer and product number		
Natural White	AC17031	Kansai Paint	MHS Amilac (modified)	Natural White
Uranus Blue	AC17016	Kansai Paint	Neo-Amilac	Uranus Blue
Fiji Green	AC17088	MHS Amilac	Fiji Green	
Bright Orange	AC17024	Kansai Paint	Neo-Amilac	Bright Orange
Mars Red	AC17023	Kansai Paint	Neo-Amilac	New Mars Red
Shannon Blue	AC17089	Nippon Paint	Olga G-80	Shannon Blue AC17089
Active Yellow	CFY10013	Kansai Paint	Neo-Amilac	Active Yellow

Body color parts other than metal sheet parts

- Corner panel

Body color (color name)	Material	Color part number	Paint manufacturer and product number
Natural White	AEPDS	AC27731	(Material coloring)
Uranus Blue	ABS	AC17016	Nippon Bee Chemical Co., Ltd. R241T AC17016
Fiji Green	ABS	AC17088	Nippon Bee Chemical Co., Ltd. R241T AC17088
Bright Orange	ABS	AC17024	Nippon Bee Chemical Co., Ltd. R241T AC17024
Mars Red	ABS	AC17023	Nippon Bee Chemical Co., Ltd. R241T AC17023
Shannon Blue	ABS	AC17089	Nippon Bee Chemical Co., Ltd. R241T AC17089
Active Yellow	ABS	CFY10013	Nippon Bee Chemical Co., Ltd. R241T CFY10013

- Hook cover, bumper center cover, bumper side cover

Body color (color name)	Material	Color part number	Paint manufacturer and product number
Natural White	AEPDS	AC27731	(Material coloring)
Uranus Blue	ABS	AC17016	Dai Nippon Toryo Co., Ltd. Planitto 3000 AC17016
Fiji Green	ABS	AC17088	Dai Nippon Toryo Co., Ltd. Acrythane 1000 AC17088
Bright Orange	ABS	AC17024	Dai Nippon Toryo Co., Ltd. Acrythane 1000 AC17024
Mars Red	ABS	AC17023	Dai Nippon Toryo Co., Ltd. Acrythane 1000 AC17023
Shannon Blue	ABS	AC17089	Dai Nippon Toryo Co., Ltd. Acrythane 1000 AC17089
Active Yellow	ABS	CFY10013	Kansai Paint Co., Ltd. Retan PG602 (modified) CFY10013

- Step lower wall

Body color (color name)	Material	Color part number	Paint manufacturer and product number
Natural White	AEPDS	AC27731	(Material coloring)
Uranus Blue	PC+ABS	AC17016	Dai Nippon Toryo Co., Ltd. Planitto 3000 AC17016
Fiji Green	PC+ABS	AC17088	Dai Nippon Toryo Co., Ltd. Acrythane 1000 AC17088
Bright Orange	PC+ABS	AC17024	Dai Nippon Toryo Co., Ltd. Acrythane 1000 AC17024
Mars Red	PC+ABS	AC17023	Dai Nippon Toryo Co., Ltd. Acrythane 1000 AC17023
Shannon Blue	PC+ABS	AC17089	Dai Nippon Toryo Co., Ltd. Acrythane 1000 AC17089
Active Yellow	PC+ABS	CFY10013	Kansai Paint Co., Ltd. Retan PG602 (modified) CFY10013

- Step upper wall

Body color (color name)	Material	Color part number	Paint manufacturer and product number		
Natural White	AEPDS	AC27731	(Material coloring)		
Uranus Blue	PC+ABS	AC17016	Dai Nippon Toryo Co., Ltd.	Acrythane 1000	AC17016
Fiji Green	PC+ABS	AC17088	Dai Nippon Toryo Co., Ltd.	Acrythane 1000	AC17088
Bright Orange	PC+ABS	AC17024	Dai Nippon Toryo Co., Ltd.	Acrythane 1000	AC17024
Mars Red	PC+ABS	AC17023	Dai Nippon Toryo Co., Ltd.	Acrythane 1000	AC17023
Shannon Blue	PC+ABS	AC17089	Dai Nippon Toryo Co., Ltd.	Acrythane 1000	AC17089
Active Yellow	PC+ABS	CFY10013	Kansai Paint Co., Ltd.	Retan PG602 (modified)	CFY10013

- Fender

Body color (color name)	Material	Color part number	Paint manufacturer and product number		
Natural White	AEPDS	AC27731	(Material coloring)		
Uranus Blue	PC+ABS	AC17016	Dai Nippon Toryo Co., Ltd.	Acrythane 1000	AC17016
Fiji Green	PC+ABS	AC17088	Dai Nippon Toryo Co., Ltd.	Acrythane 1000	AC17088
Bright Orange	PC+ABS	AC17024	Dai Nippon Toryo Co., Ltd.	Acrythane 1000	AC17024
Mars Red	PC+ABS	AC17023	Dai Nippon Toryo Co., Ltd.	Acrythane 1000	AC17023
Shannon Blue	PC+ABS	AC17089	Dai Nippon Toryo Co., Ltd.	Acrythane 1000	AC17089
Active Yellow	PC+ABS	CFY10013	Kansai Paint Co., Ltd.	Retan PG602 (modified)	CFY10013

- Step wall

Body color (color name)	Material	Color part number	Paint manufacturer and product number		
Natural White	AEPDS	AC27731	(Material coloring)		
Uranus Blue	PC+ABS	AC17016	Dai Nippon Toryo Co., Ltd.	Acrythane 1000	AC17016
Fiji Green	PC+ABS	AC17088	Dai Nippon Toryo Co., Ltd.	Acrythane 1000	AC17088
Bright Orange	PC+ABS	AC17024	Dai Nippon Toryo Co., Ltd.	Acrythane 1000	AC17024
Mars Red	PC+ABS	AC17023	Dai Nippon Toryo Co., Ltd.	Acrythane 1000	AC17023
Shannon Blue	PC+ABS	AC17089	Dai Nippon Toryo Co., Ltd.	Acrythane 1000	AC17089
Active Yellow	PC+ABS	CFY10013	Kansai Paint Co., Ltd.	Retan PG602 (modified)	CFY10013

C

- Rear quarter garnish

Body color (color name)	Material	Color part number	Paint manufacturer and product number
Natural White	PA/PPE	AC27731	-
Uranus Blue	PA/PPE	AC17016	-
Fiji Green	PA/PPE	AC17088	-
Bright Orange	PA/PPE	AC17024	-
Mars Red	PA/PPE	AC17023	-
Shannon Blue	PA/PPE	AC17089	-
Active Yellow	PA/PPE	CFY10013	-

- Parts with specific color regardless of body color

Part name	Material	Color and color part number	Coloring method	Paint manufacturer and product number
Front panel hinge	ADC	Black, AC17082	Painting	Kansai Paint MD Amilac TM3 N5.5
Front grill	AEPDS	Black, AC20157	Material coloring	–
Front grip	PA-GF60	Black, AC20157	Material coloring	–
Lamp bezel	AEPDS	Black, AC20157	Material coloring	–
Step protector	PP+E/P-TD5 PP+E/P-TD9	Black, AC20157	Material coloring	–
Roof grip	PC/ABS	Black, AC17082	Painting	Dai Nippon Toryo Planet #3000
Back side grip	PC/ABS	Black, AC17082	Painting	Dai Nippon Toryo Planet #3000
Air outlet garnish	ASA AES	Black, AC20157	Material coloring	–
Rear step	PA	Gray, AC27712	Material coloring	–
Bumper corner cover	PP+E/P-TD9	Black, AC20157	Material coloring	–

A

Painting the cab body

Cab painting of as-shipped vehicles uses non-sanding, high adhesion paint for the natural white color. However, to completely remove oils and contaminants on coating surfaces of these parts, sanding before painting is recommended.

Paints other than natural white are not of a high adhesion type. Perform sanding before painting. (Sanding method: Use #400 sanding paper to sand evenly until the gloss of the coating surface is gone.)

5.5 Painting work

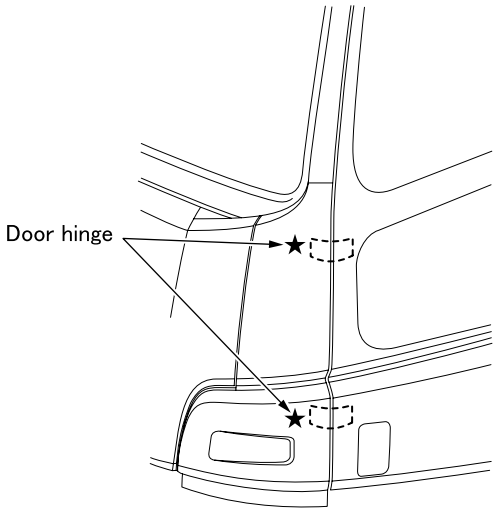
Repainting the cab

- Paint
  For repainting with lacquer or urethane paint, the following brands have been verified to provide sufficient coating adhesion without sanding.

Manufacturer	Paint name	Manufacturer	Paint name
Kansai Paint	Retan PG80 Retan PG60 Acric #1000	Dai Nippon Toryo	Auto V-Top Auto V Top Monarch Auto Magnum Auto Squall Auto Acrose Super Neo Lacquer
Rock Paint	38 Line Co-Rock 79 Line Rock Ace 73 Line High Rock 38 Line Rock Lacquer	Nippon Paint	Nax Mighty Lac Nax Superio Nax Besta Nippe Acryl
Isamu Paint	AU21 High Art #3000		

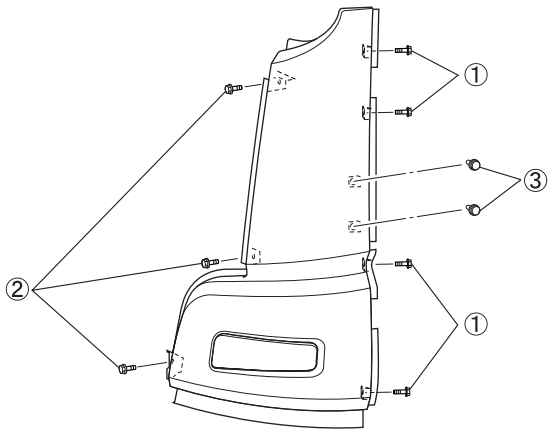
For paints other than the above brands, you need to contact the paint manufacturer and confirm whether or not sanding is required.

- Masking the sealing rubber on the corner panel
  When repainting the cab, mask the sealing rubber at the front end of the door as follows:
  - Fully open the door and stick masking tape on the sealing rubber from inside.
  - Stick masking tape on the door hinges (indicated by a ★ in the figure) from outside the vehicle after closing the door.



Removing the corner panel

- Fully open the door and remove the four screws ① connecting the corner panel.
- Open the front panel and remover the three bolts ② connecting the corner panel.
- Completely close the door and remove the two clips ③, then remove the corner panel by pulling it outward of the vehicle.
- To reinstall the corner panel, follow the above procedure in reverse.



When removing or reinstalling the corner panel, be very careful not to allow the front end of the door to touch and damage the corner panel when the door is opened or closed.

Painting the bumper

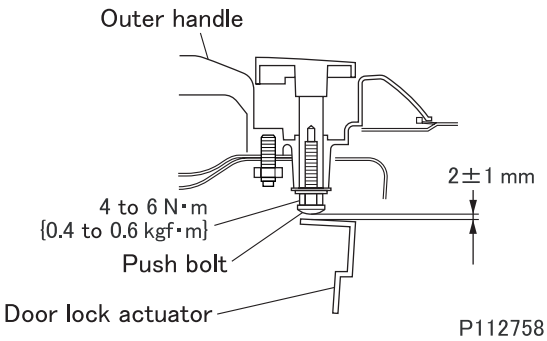
The vehicle is shipped with the bumper and bumper skirt finished with paint coating. Sand the bumper before painting.

Cautions after painting the door

To install the outer handle and door trim after painting the door, follow the procedure below.

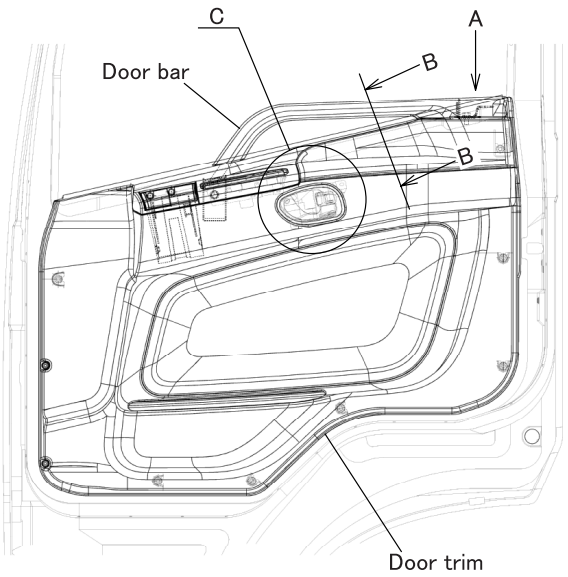
Installing the outer handle

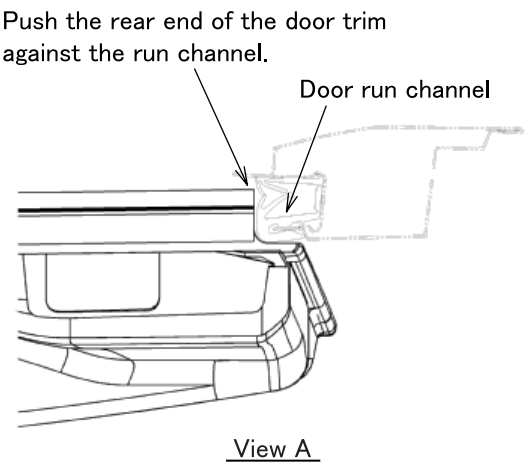
- Install the outer handle on the door panel. Tightening torque: 4 to 6 N·m (0.4 to 0.6 kgf·m)
- Turn the push bolt on the outer handle so that the clearance between the push bolt and door lock actuator (or door lock) is as shown in the figure. (Only on the right side)
- After installing the outer handle, operate the outside handle to confirm that the door opens and closes normally.

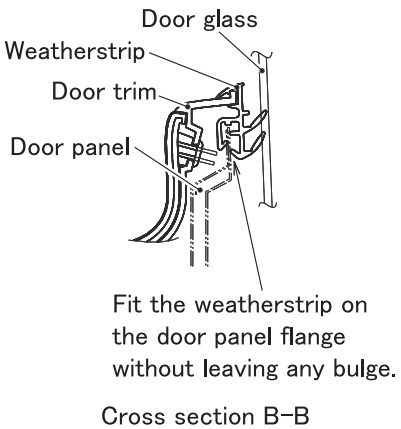


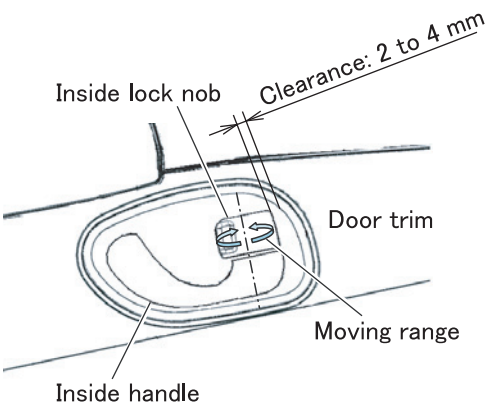
Installing the door trim

- Push the top rear end of the door trim against the run channel and fit the weatherstrip on the door panel flange without leaving any bulge, then push the trim clip into the door panel.
- Confirm that there is a clearance of 2 to 4 mm between the door trim and the moving range of the inside lock knob, then install the screws.
- After installing the door bar, confirm that the inside handle and inside lock knob move smoothly, then install the inside handle cover. (The figure shows the right side. Do the same on the left side.)









Section C

Painting the plastic parts

If you bake finish the cab body, remove the following plastic parts in advance.

- Front upper grill
- Front lower grill
- Fender
- Air outlet garnish
- Bumper corner cover
- Lamp bezel
- Step wall
- Step upper wall
- Step lower wall
- Front grip cap
- Back side grip
- Front grip
- Step protector
- Hook cover
- Bumper center cover
- Bumper side cover

The mounting bolts of the back side grip are sealing types, so cannot be reused. When reinstalling the grip, use the bolts indicated in the table below.

Part name	Part number	Quantity
BOLT, WASHER ASSEMBLED (8 × 30)	MH001576	4

The mounting bolts of the bracket for the head roof duct and the bracket at the top of the upper duct for the high roof are sealing types, so cannot be reused. When reinstalling the brackets, use the bolts indicated in the table below.

- Bracket for the head roof duct

Part name	Part number	Quantity
BOLT, WASHER ASSEMBLED (8 × 22)	MH001575	4

- Top bracket of the upper duct for the high roof

Part name	Part number	Quantity
BOLT, WASHER ASSEMBLED (8 × 22)	MH001575	2

It is recommended to use the following conditions for the paint and painting method.

Paint manufacturer	**Dai Nippon Toryo**
Paint type	Acrylic/urethane-based
Paint name	Planitto #3000
Hardener	Planitto #721 hardener
Mix ratio	Resin : Hardener = 100 : 15
Thinner	Planitto #30 thinner
Paint viscosity	12 to 14 seconds/Measured using Iwata cup*
Dried coating thickness	20 to 35 μ
Setting	5 to 10 minutes at normal temperature
Drying of coating	30 to 40 minutes at 60 to 70°C Touchably dry = approx. 15 to 20 minutes
Pretreatment of surface	1. Sanding white paint surface 2. Degreasing with IPA 3. Air blowing
Painting method	Spray gun

Note

1. If acrylic-based lacquer is used, swelling of paint coating may occur. Contact the paint manufacturer for details.
2. Without sanding treatment, poor adhesion may result.

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

For design's sake, the front upper grill, front lower grill and air outlet garnish should be painted black or gray. Mask the Mitsubishi mark before painting.

The synthetic resins used in the grill and other parts are susceptible to organic solvents. If paint has adhered to these parts, be sure to select the correct solvent to wipe it off. Otherwise, cracks or marks may result.

- Usable organic solvents
  - Kerosene
  - Light oil
  - Non-freezing solution
  - Wax sol (from Nihon Parkerizing) Neo Rider
  - Industrial soap
  - Uni Gold
  - Car Spray 99
- Unusable organic solvents
  - Thinner
  - Turpentine oil
  - Gasoline
  - Escoat
  - Origin Veil
  - Tolepika
  - Emulsion wax
  - Commercially available wax
  - Acetone
  - Reagent alcohol (Japanese Pharmacopoeia grade 1)
  - Ketone
  - Ester
  - Chlorinated hydrocarbon

Handling of laminated glass

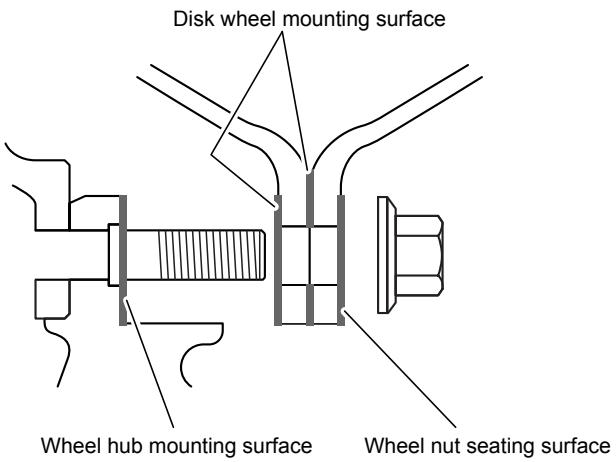
- When a repainted cab body is forced-dried, the temperature should not exceed 100°C and the process must be completed within 60 minutes. When using a temperature above 100°C, cover the glass surfaces with shields to prevent them from being heated beyond 100°C or remove the glass.
- Laminated glass is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

5.5.4 Painting the disk wheels

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

Prohibition of additional painting

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



Vehicles with 10-bolt disk wheels

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

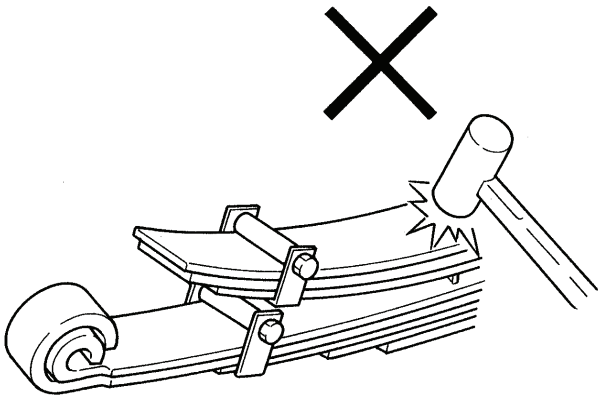
Tire rotation

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

5.6 Chassis springs

5.6.1 Leaf springs

- When removing or reinstalling the leaf spring, use care not to damage the anticorrosive coating on the surface of the leaf.



- Only use spring leaves which have been tested and approved for the vehicle model in question. Reinforcement by installing 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.

A

5.6.2 Air springs

- Do not damage the air springs when carrying out installation work.
- Before carrying out welding work, cover the air springs to protect them against welding spatter.

5.7 Tilting the cab

Risk of injury

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

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

5.8 Towing and tow-starting

Risk of accident and injury

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

Property damage

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

5.9 Risk of fire

⚠ Risk of fire

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

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

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

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

5.10 Electromagnetic compatibility (EMC)

The different electrical consumers 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 EC Directive 2009/19/EC and must bear the "e" mark.

The following standards provide information on this:

- DIN50498
- DC11224 (EMC component requirements)
- DC10613 (EMC vehicle requirements)
- EU Directive 2009/19/EC

Additional information

The notes on operating safety and vehicle safety in Section 1 "Introduction" ▷ page 8 and ▷ page 9 must be complied with.

5.11 Storing and handing over the vehicle

Storage

To prevent any damage while vehicles are in storage, MITSUBISHI FUSO recommends that they be serviced and stored in accordance with the manufacturer's specifications ▷ page 32.

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 33.

6.1 General

Risk of injury

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

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

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

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

Additional information

Further information on bolted and welded connections can be found in Section 3 "Planning of bodies" ▷ page 28 and Section 5 "Damage prevention" ▷ page 48.

6.1 General

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

Main critical safety parts

- Knuckle arm
- Knuckle arm bolt
- Tie rod assembly
- Tie rod arm
- Tie rod arm bolt
- Axle
- Steering shaft assembly
- Power steering booster
- Power steering booster bracket
- Pitman arm ball stud
- Steering drag link
- Steering ball stud
- Slave lever
- Slave lever bracket
- Steering booster end socket
- Steering universal yoke
- Steering slip joint
- Steering spider
- Front two axle steering connecting link-related parts
- Brake hose, brake pipe
- Brake booster
- Air tank, vacuum tank
- Wheel bolt
- Wheel nut
- Spring bracket
- Spring U-bolt
- Propeller shaft

Observe the following precautions during body building work. Failure to observe any of them could damage an engine or intake system part.

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

6.2 Chassis frame material

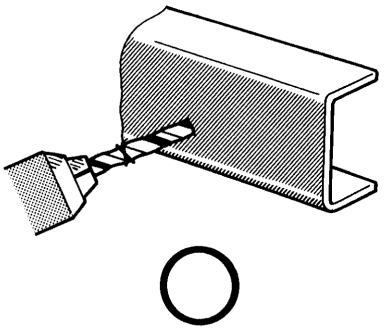
If the frame is extended, the material of the extension element and reinforcing bracket must have the same quality and dimensions as the standard chassis frame.

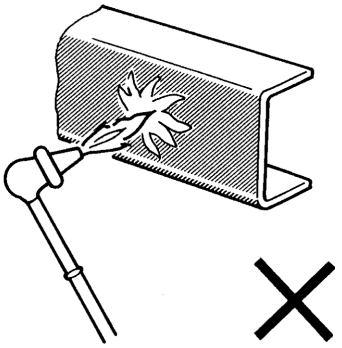
See the respective body/equipment mounting directives for the longitudinal frame member dimensions.

Material
HTP540

6.3 Drilling work on the vehicle frame

For making a hole in frame members, be sure to use a drill bit. Never attempt to make a hole using a gas torch.





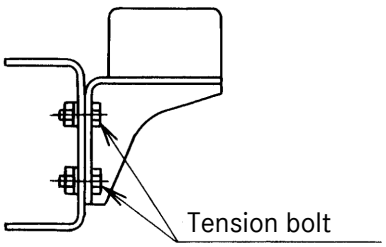
Remember that every drilled hole must be finished by chamfering.

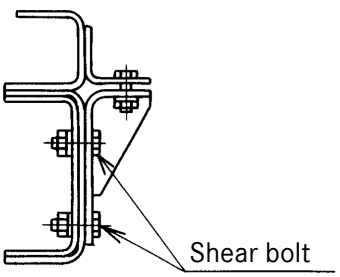
Drilling holes in side rail

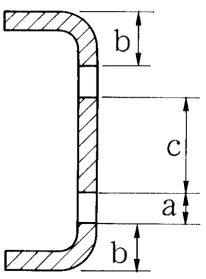
- Note that the hole diameter and the distance between holes given in the following table must be met. Even if existing holes (bolt or rivet holes) are to be used, these requirements must be met.

Unit: mm

Hole diameter: a		Distance between corner and hole brim: b	Distance between holes: c
Tension bolt holes If tensile and compression forces are applied to bolts	Shear bolt holes If only shearing force is applied to bolts		
ϕ13 or less	ϕ17 or less	30 or more	For ϕ13 or less: min. 30 For ϕ15 or less: min. 45 For ϕ17 or less: min. 65

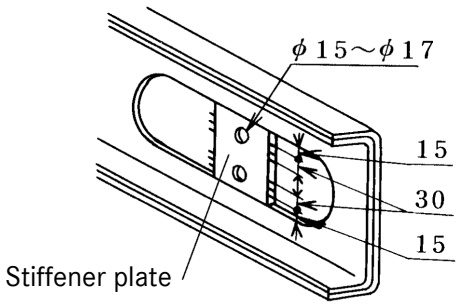




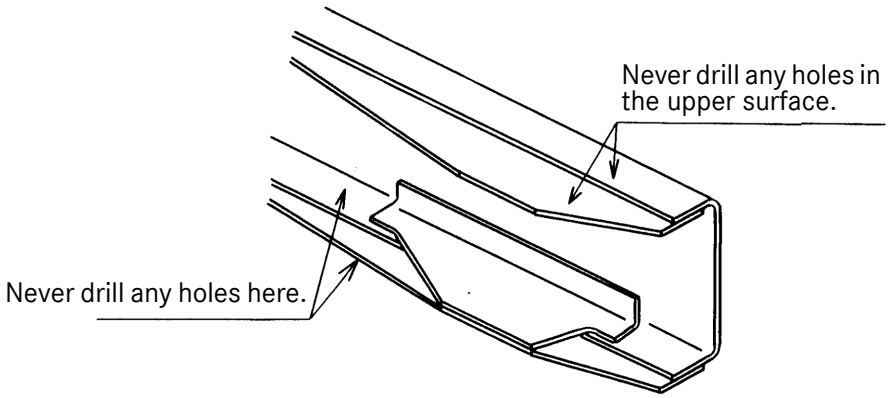


6.3 Drilling work on the vehicle frame

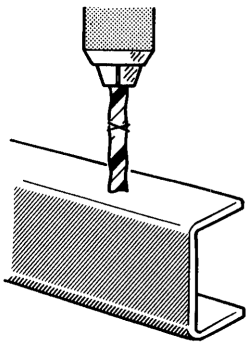
- Shear bolt holes of ϕ15 mm or more can be drilled exclusively in double frame sections (chassis frame with subframe inside). If the portion of the subframe in which a hole is to be drilled has been blanked out, weld a piece of stiffener plate to that section as shown in the figure below.



- Do not attempt to drill any holes in a trunnion stiffener or crossmember gusset.



- Do not drill any holes in either the upper or lower surface of the side rail flanges.



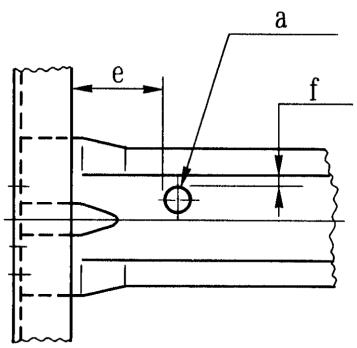
6.3 Drilling work on the vehicle frame

Drilling holes in a crossmember

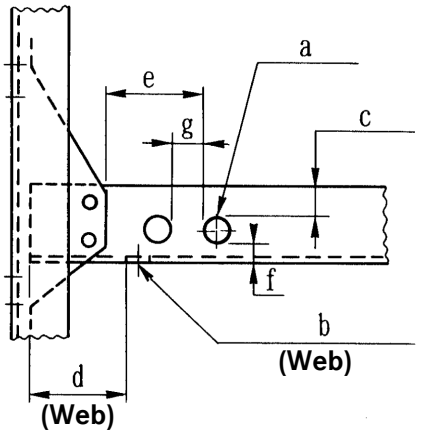
- Note that the hole diameter and the distance between holes given in the following table must be met. Even if existing holes (bolt or rivet holes) are to be used, these requirements must be met.

Unit: mm

Hole diameter		Span between plate end and hole edge		Distance between side rail or gusset edge and hole brim: e	Distance between corner and hole brim: f	Distance between holes: g
Flange: a	Web: b	Flange: c	Web: d			
ϕ11 max.	ϕ13 max.	30 min.	50 min.	100 min.	25 min.	30 min.



Alligator type crossmember

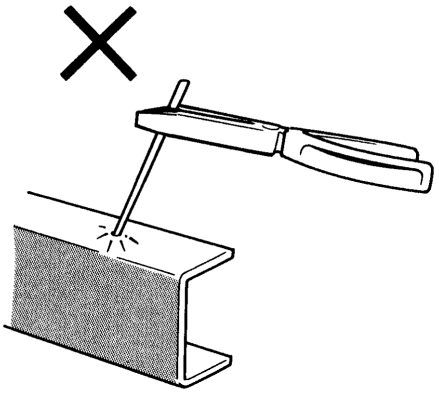


Channel type crossmember

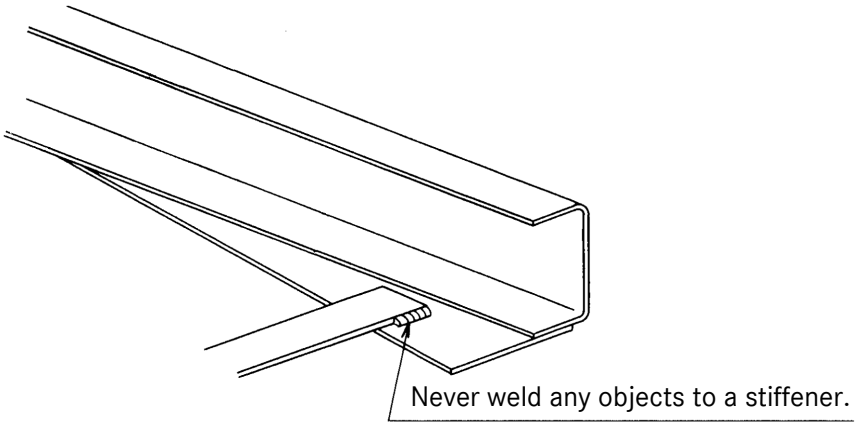
6.4 Welding work on the vehicle frame

For welding procedures, refer to 5.2 "Welding work"
▷ page 49.

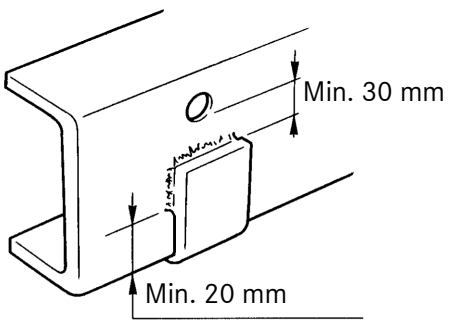
- Do not attempt to attach any objects to the upper or lower surface of side rails by welding.



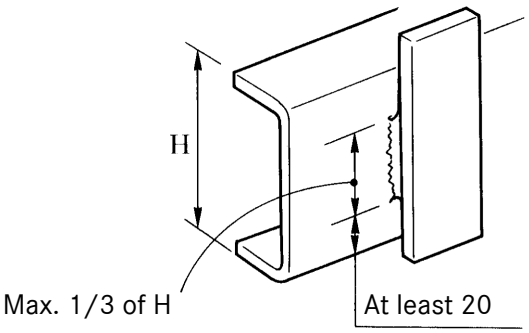
- Avoid welding an object to a trunnion stiffener or crossmember gusset.



- Welding parts should be more than 20 mm away from the web corners and 30 mm away from each hole.



- Within the wheelbase section, the length of a continuous welding bead in the vertical direction should not exceed 1/3 of side rail height.



- Do not tack-weld an object to the frame to hold it in position temporarily.
- Clean the areas to be welded thoroughly beforehand.
- Only use a welding rod of ilmenite base 540 MPa (55 kgf/mm^2) as a electrode.
- Welding rods may be moistened during storage. Ensure that only well-dried welding rods are used.
- Be sure to remove sludge completely from the previous layer.
- Throughout the welding process, take care that such welding flaws as undercut, sludge inclusion, blowhole, cracking, pitting, etc., are completely eliminated.
- Unevenly shaped welding beads can cause stress concentration to occur, which has a great effect on the fatigue strength. Finish the welding beads as smooth as possible using a grinder.
- Cover the hoses, nylon tubes, harnesses, chassis springs and so on with appropriate means to protect them against welding spatters (sparks).

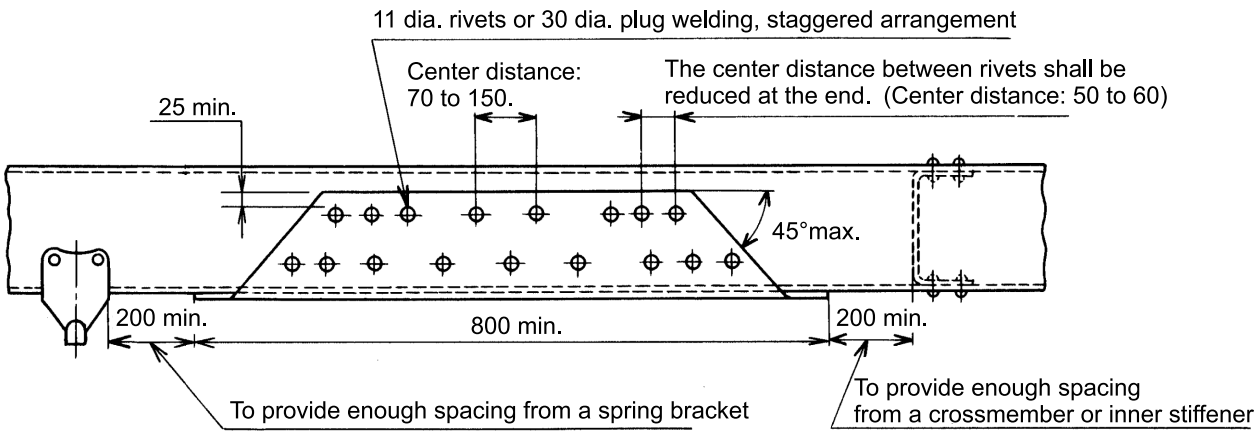
Precautions to be taken during welding on high tensile steel frame

- The side rails are made of high tensile steel plate. Welds on a high tensile steel plate are hardened more easily than those on a steel panel for an automobile structure (SAPH440: tensile strength of 440 MPa {45 kgf/mm^2}). When performing welding work on side rails, pay attention to the following:
- Always use a welding rod of a low-hydrogen type. For areas requiring the same strength as base metal, in particular, use a welding rod of a low-hydrogen type for high tensile steel plates.
- Welds having a shorter bead are low in their hardening rate, that is, likely to crack. Accordingly, the bead length should be more than 40 mm unless it is not possible. In an unavoidable case, pre-heat or post-heat the welded area to prevent the welds from prematurely being hardened.

6.5 Reinforcements

Avoid adding outside reinforcement to the side rail, as this can actually produce stress concentrations which cause cracks in the frame. If additional reinforcement is absolutely necessary, perform the procedures described below.

- An L-shaped stiffener is recommended. The channel type stiffener should not be used as it produces a gap with the side rail flange.
- Position the L-shaped stiffeners so the flange will be on the side of the side rail stress that receives the tension (the lower surface within the wheelbase and the upper side for the overhang).
- Do not align the outer stiffener ends with the ends of the sub side rail that have already been installed.
- Do not position the ends of the stiffener near stress concentration locations such as the rear surface of the cab, spring hangers, crossmember ends, etc.
- Do not cut the outer stiffener ends vertically. They should be cut at an angle of less than 45°.
- Do not use any outer stiffener which is shorter than 800 mm.
- Attach the stiffeners and the side rail by riveting or plug welding on the web.
- When drilling rivet holes, the outer stiffeners and side rails should be processed together. The difference between the rivet and hole diameters should be less than 0.7 mm.
- Do not attempt to secure the stiffeners again using rivets of the same diameter as the previous in the same positions. However, it is allowable to rivet the stiffeners again after enlarging the rivet hole diameter from ϕ10 to ϕ13 if the minimum distance between the outer stiffener end and the rivet hole brim is more than 25 mm.
- Use rivets of ϕ11 and arrange them in zigzag alignment. Use a riveter for riveting.
- Separate rivets and bolts at least 70 mm to prevent heat damage or distortion when they are plug welded.
- Holes for plug welding should be at least 30 mm dia and arranged in a zig-zag pattern.
- Position the end of the outer stiffeners 25 mm – 30 mm from the holes for rivets or plug welds.
- The pitch for rivets and plug welds should be 70 mm – 150 mm. Keep the pitch small (50 – 60 mm) near the edge of the stiffener.
- Do not drill any additional holes in the side rail flange. Only use the holes which have been already drilled in the flange.

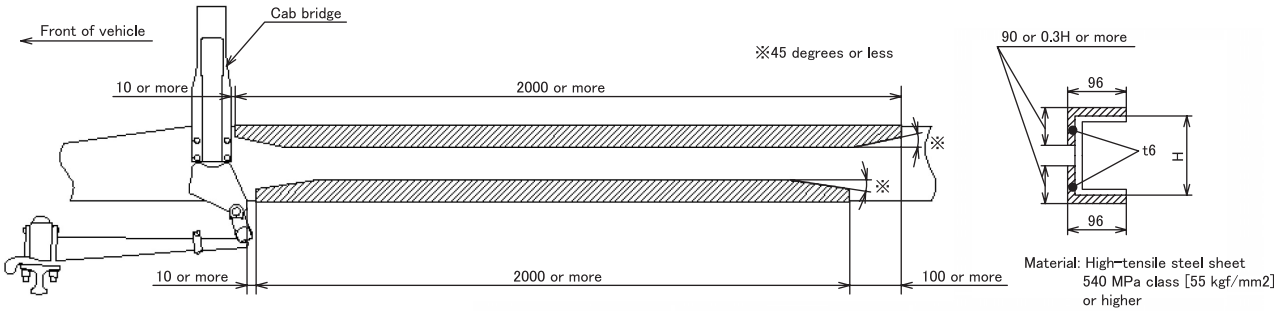


Example of reinforcement of crane mounting

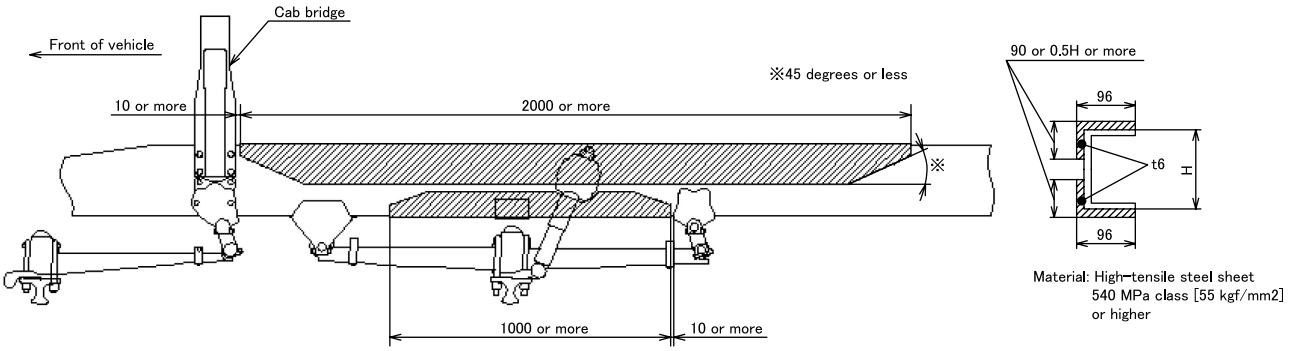
Be sure to reinforce a frame because stress is concentrated locally in the surrounding of crane mounting during crane operation.

<Example of reinforcement>

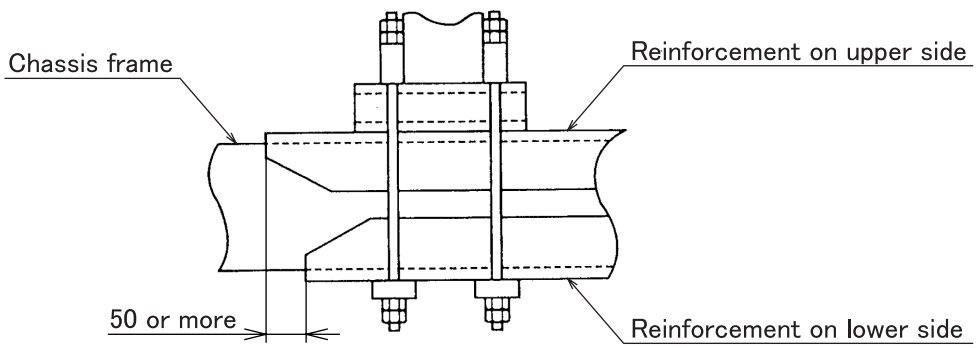
Front one axle vehicle



Front two axle vehicle



Secure a level difference of 50 mm or more for front end positions of reinforcement on the upper and lower sides as shown below to prevent local stress concentration caused in the side rail.



6.6 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 length are required.

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

6.6.1 Prohibition on modifying the propeller shaft

⚠ Risk of accident

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

An improperly modified propeller shaft may cause vibration during operation, which in turn may cause cracks and fractures in the clutch housing, separation of the propeller shaft, and other dangerous conditions, possibly resulting in a serious accident.

6.7 Frame modifications

The frame is a critical component exerting a great influence on the vehicle strength. Execute the modification of the frame only after fully examining the structure of the body to be mounted and the conditions of vehicle applications. If it is difficult to use modification methods described in the Body/ equipment mounting directives, contact the department responsible ▷ page 14.

6.7.1 Precautions for modification

In the case that a rear body of special design is mounted or the vehicle is to be used in special conditions, use utmost care that neither the structure nor the strength of the frame is impaired during mounting or modification work.

When mounting a rear body of special design, pay full attention to even weight distribution on the frame. Refer to 10.6.2 "Frame section modulus" ▷ page 328

Attaching stiffeners, drilling holes or welding objects to the frame can affect the strength of the frame greatly, possibly resulting in a deformed or cracked frame. Avoid performing any unnecessary reinforcement, drilling or welding work on the frame.

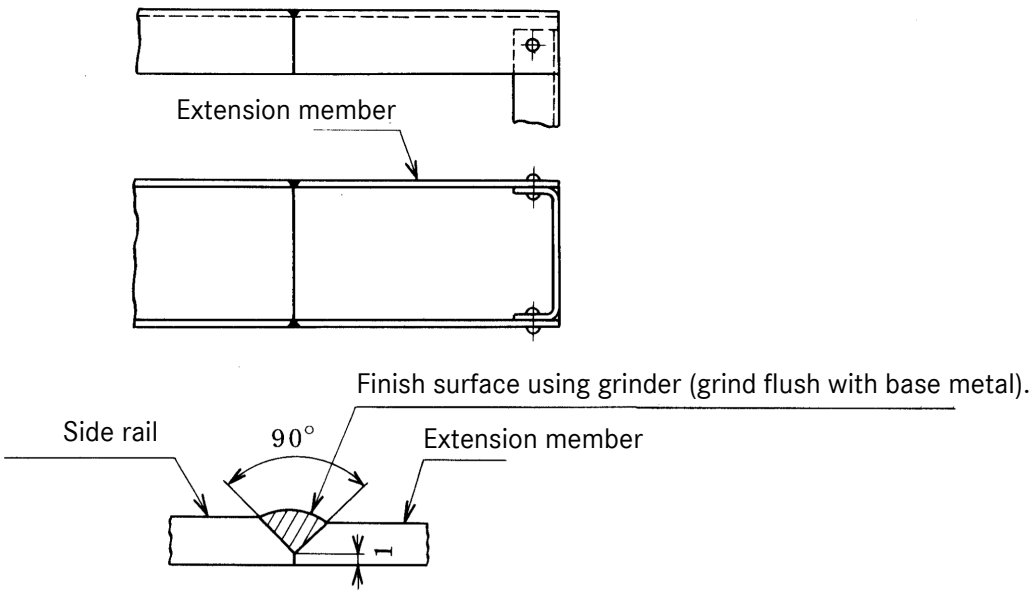
6.7.2 Extension or shortening of frame

If the frame rear overhang is to be extended, proceed as follows:

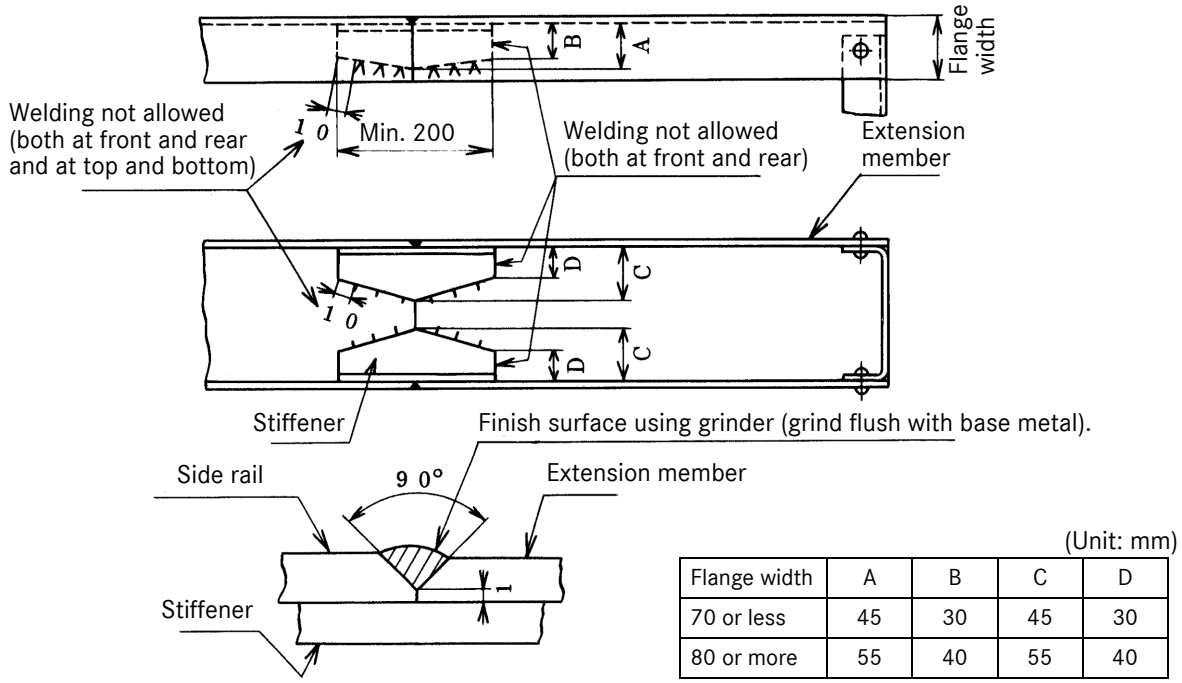
Materials

Member for extension		Stiffener	
Material	**Plate thickness**	**Material**	**Plate thickness**
SAPH440	To be the same as side rail plate	SAPH440	6 mm

- When length of extension is 300 mm or less: Perform butt-welding continuously from the outside and grind-finish the surfaces. No reinforcements are required for ordinary applications



- When the length of an extension is more than 300 mm or when a large weight may be exerted on the extended section during operation:
  With stiffeners added to the inside of the side rail, perform butt-welding continuously to joint the extension member to the side rail and grind-finish the surfaces.

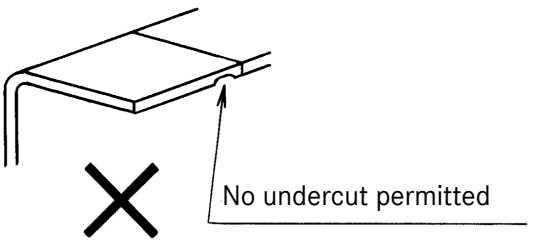


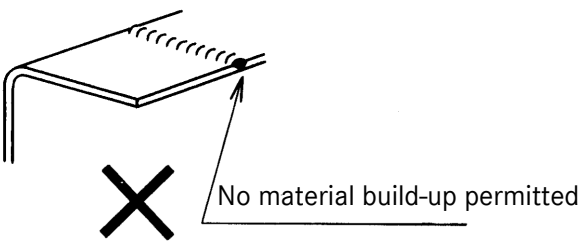
(Unit: mm)

Flange width	A	B	C	D
70 or less	45	30	45	30
80 or more	55	40	55	40

- On some models, the side rail has a slope provided on the bottom surface at the rear end. When cutting the rail or connecting an extension to it, take the slope into account.

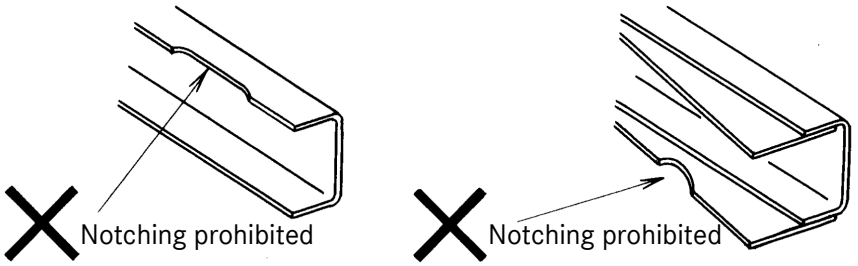
- Finish the inside surfaces of the butt-welded flange sections of the side rails thoroughly by grinding them to such a extent that neither undercuts nor material build-up are found.





6.7.3 Other points to be noted

- Never attempt to work a notch in the edge of a side rail, crossmember flange, trunnion stiffener and crossmember gusset.



- Do not attempt to secure the rear body together with the units attached on the frame side surface (fuel tank, air tank, brake booster, battery, etc.) by using their bolts.

6.8 Mounting of implements and auxiliary components

⚠ Risk of accident

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

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

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

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

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

6.8.1 Mounting equipment on the side rail

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

Example:

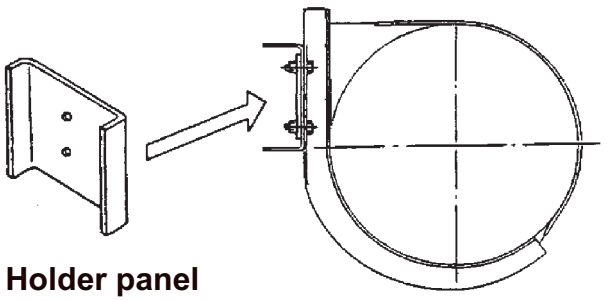


Fig. 1

- 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.

6.8.2 Wheel chocks

Mounting

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

6.8.3 Spare tire carrier

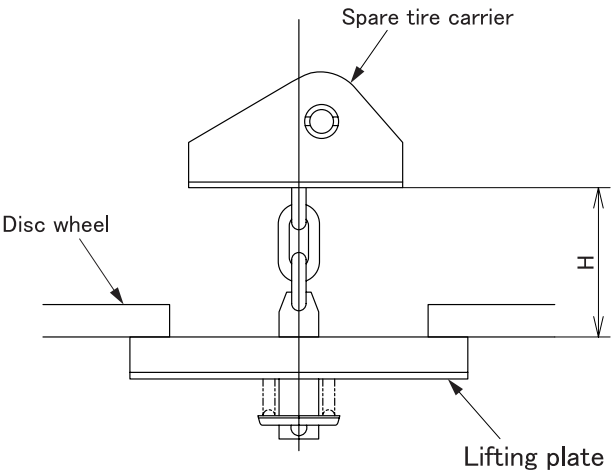
When mounting a spare tire carrier, observe the regulations of the country where the vehicle is used.

Examination of mounting position and other parameters

- On vehicles with spare tire carriers, do not relocate or modify the carrier or bracket. If relocation or modification is inevitable, contact the department responsible. ▷ page 14
- Use the genuine parts (handled by MITSUBISHI FUSO dealers) for the spare tire carrier and bracket. If non-genuine parts are to be used, find ones having sufficient strength and durability.
- Examine the mounting position of the spare tire carrier so that the spare tire, when mounted on the spare tire carrier, does not protrude from the rear end or the outside of the vehicle.
- Allow a clearance between a rotating part, movable part, and high-temperature part of the vehicle and the spare tire.
  E.g.: propeller shaft, spring, brake hose, exhaust pipe, and muffler
  For clearance specifications, 4.4 "Clearance for basic vehicle and bodies" ▷ page 39
- Allow a ground clearance so that the spare tire will not be damaged through its contact with, for example, the road surface during running (running on a rough road, reversing, etc.).
- Allow an operating space for removal and reinstallation of the spare tire.
- Allow an inspecting and servicing space for the spare tire, carrier, and bracket.
- Set the crank handle to achieve the tightening force recommended by the carrier manufacturer.

Precautions for installation

- When mounting the bracket on the frame, see 6.3 "Drilling work on the vehicle frame" ▷ page 82 and 6.4 "Welding work on the vehicle frame" ▷ page 85.
- Support the spare tire by way of the disk wheel.
- Strictly observe dimension H (disk lifting plate height when the tire is wound up) recommended by the carrier manufacturer. Dimension H can be checked with a brochure prepared by the carrier manufacturer.
  Failure to observe dimension H impairs spare tire holding strength, resulting in the spare tire falling.

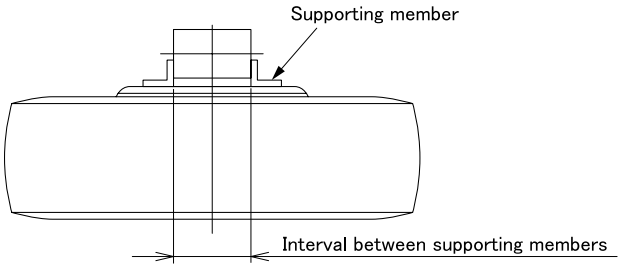


- Affix the spare tire caution plate.

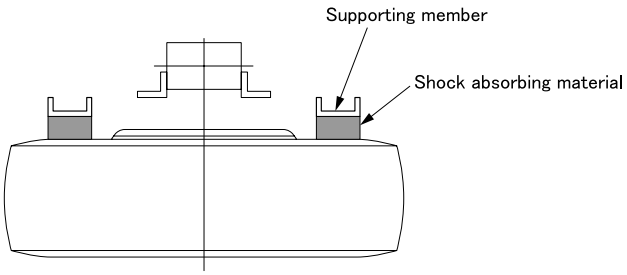
Checks after installation

- The spare tire can be removed and reinstalled by one person.
- There is a clearance available between the spare tire and chassis parts.
- There should be no harmful binding when the spare tire is raised.
- The spare tire, when tightened, may interfere only with an intended stopper.

- For supporting of the spare tire via the disk wheel, the interval between the supporting members should be such that an ample surface of the supporting member contacts the disk wheel. The spare tire carrier should also be structured so as to offer reaction to tightening when a tire that has gone flat is mounted.



- For supporting of the spare tire via the spare tire, the interval between the supporting members should be near the maximum tire width. If a shock absorbing material is to be inserted, fix it properly to the supporting member. The spare tire carrier should also be structured so as to offer reaction to the spare tire when a tire that has gone flat is mounted.



6.8.4 Mudguards and wheel arches

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

Rear mudguards

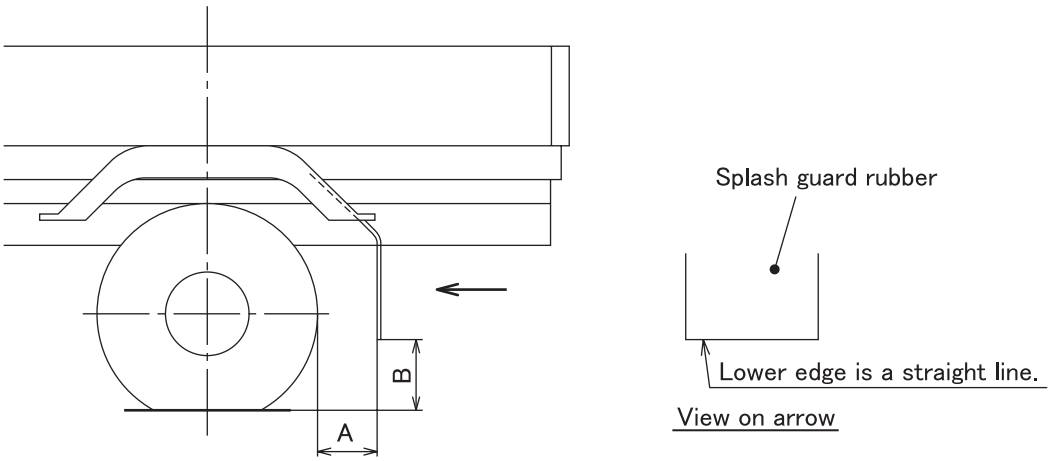
Mount components in accordance with local regulations.

Front mudguards <model FS>

Install the fender with care about movements of tires during steering action.

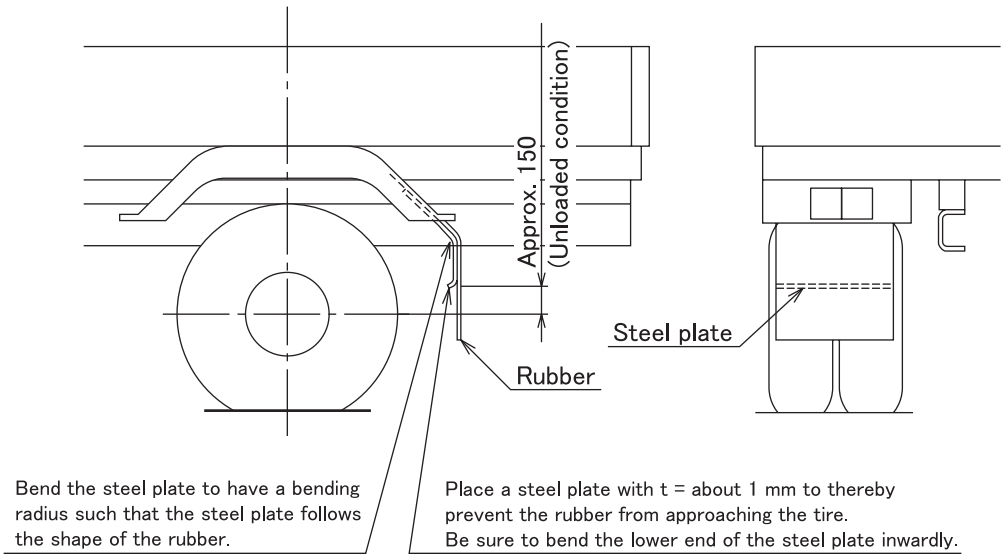
Splash guard rubber of rear fender

Install the splash guard rubber in consideration of splash guard effect and pedestrian protection side guard relative to the shape of the fender.



A	200 to 250
B (Unloaded condition)	300 to 400

If a long splash guard rubber is to be mounted, take necessary measures to prevent the rubber from being caught by the tire.



6.8.5 Front underrun protection

<Vehicle with Front underrun protection>

Installed height

Front under-run protection (FUP) is a device to avoid the under run entry of a passenger car to the front of a truck during head to head collision and to improve safety against inflicting injury.
If FUP ground clearance is changed, the FUP function may be lost and running through performance may be decreased.

<Ground clearance of FUP>

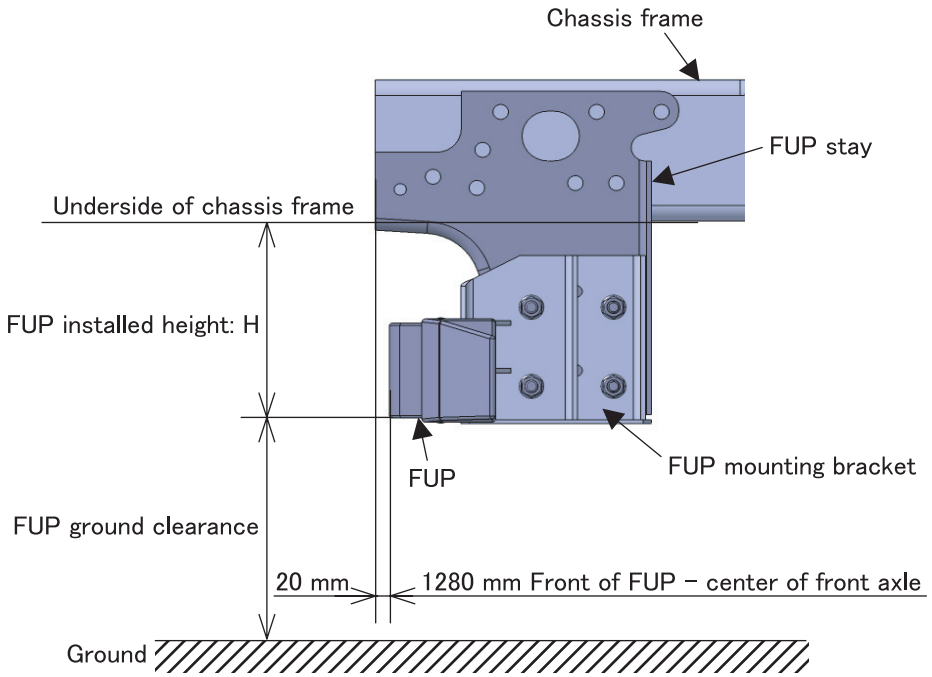
Guideline of FUP minimum ground clearance when laden

Model	FUP Minimum ground clearance (mm)
FV, FV-R	285
FS	250
FP-R	260

FUP set ground clearance < Ground clearance when unladen / Ground clearance when laden < Local regulation values

Therefore, if vehicle posture is changed due to a change of tires, springs and so on and body mounting, and FUP ground clearance is unavoidably changed, make settings so that FUP ground clearance is in the range listed below in full consideration of running conditions.
If FUP installed height needs to be changed, mounting brackets are available as shown by "List of types of FUP mounting bracket height and parts used for FUP mounting bracket" ▷ page 99. Consult with an authorized MITSUBISHI FUSO distributor or dealer.

FUP installed dimensions



6.8 Mounting of implements and auxiliary components

List of types of FUP mounting bracket height and parts used for FUP mounting bracket

Part name	Part No.	Number of pieces used					
		FUP installed height H dimension*					
		250 mm	270 mm	290 mm	310 mm	330 mm	350 mm
① BRKT SHORT ASSY, FUP	MK656355	1					
	MK656356	1					
	MK656357		1				
	MK656358		1				
	MK656359			1			
	MK656360			1			
① BRKT LONG ASSY, FUP	MK656337				1		
	MK656338				1		
	MK656339					1	
	MK656340					1	
	MK656341						1
	MK656342						1
② BOLT, FLANGE	MC040479	8	8	8	8	8	8
③ BOLT, FLANGE	MK380809	4	4	4	4	4	4
④ BOLT, FLANGE	MC058410	4	4	4	4	4	4
⑤ NUT, FLANGE	MH004158	8	8	8	8	8	8
⑥ STAY ASSY, BUMPER	ML260081	1					
	ML260082	1					
	ML260083		1				
	ML260084		1				
	ML260085			1			
	ML260086			1			
	ML260087				1		
	ML260088				1		
	ML260089					1	
	ML260090					1	
	ML260091						1
	ML260092						1

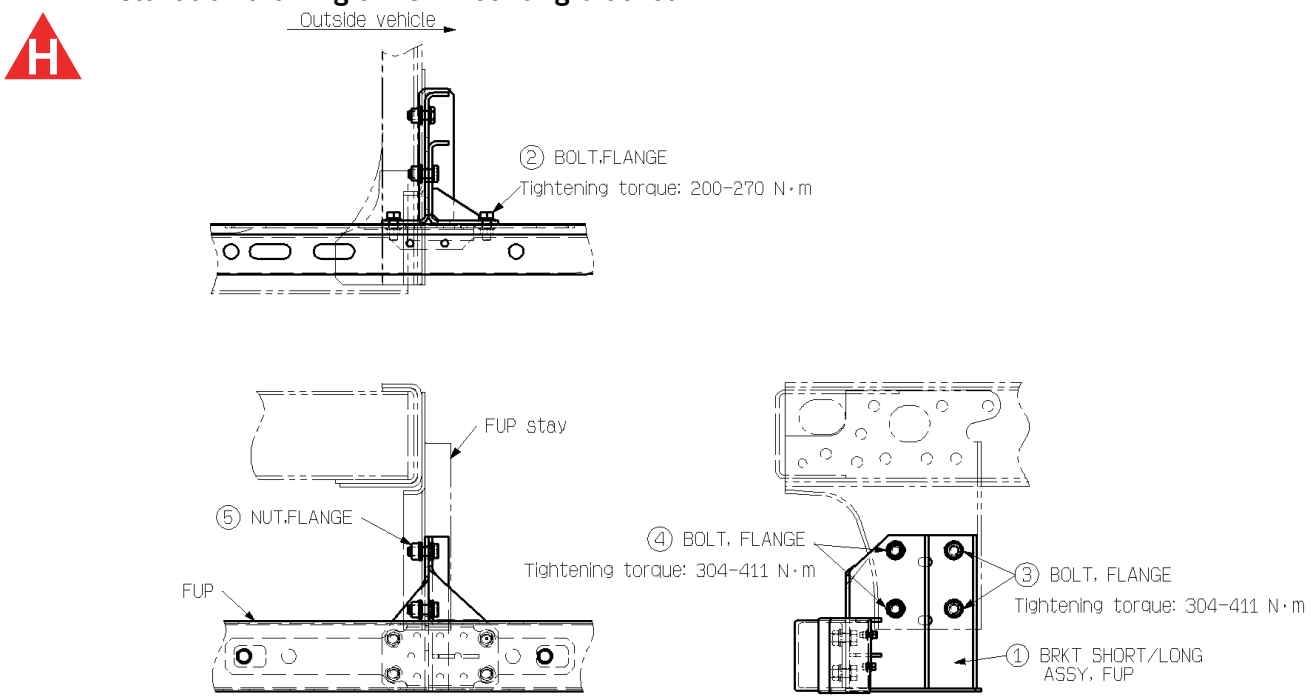
* There are variations within 3 mm depending on side rail plate thickness.

6.8 Mounting of implements and auxiliary components

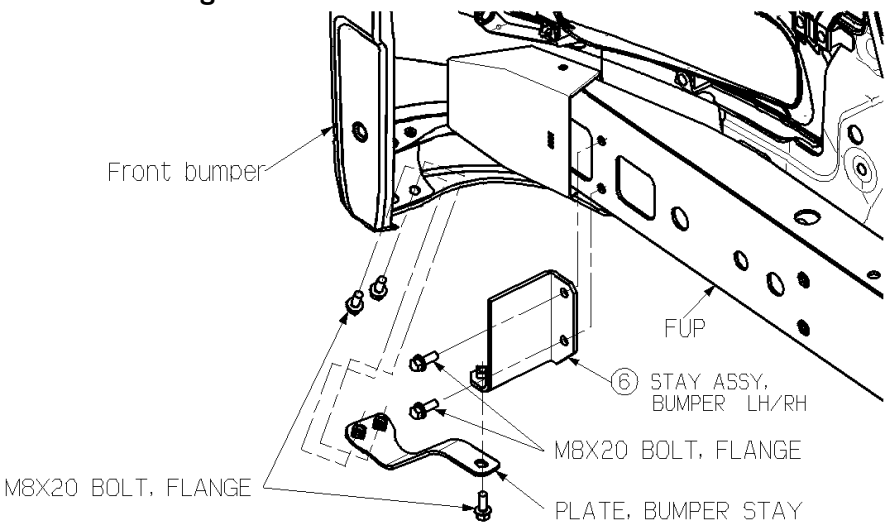
Changing a FUP bracket

When a FUP bracket is changed, install it as shown below.
Replace a bumper stay to be installed on FUP according to FUP installed height.

Installation drawing of FUP mounting bracket



Bumper stay installation drawing



6.8.6 Rear underrun protection

Mount components in accordance with local regulations.

6.8.7 Side underrun protections

Mount components in accordance with local regulations.

6.8.8 Rear hooks

Relocation to side surface of frame

- If no crossmember is fitted at the rear end of the frame, attach a stiffener made of a 4.5 mm (T) × 150 mm (L) × 100 mm (W) steel plate to the inside of the frame by means of intermittent welding with a pitch of 20 mm.
- If a crossmember is available, install the hook in position directly.

Relocation to bottom surface of frame

- If a crossmember is available, secure the hook on the frame by sharing the fasteners of the crossmember.
- If frame rear ends are open (not linked), place a stiffener made of a 4.5 mm (T) × 150 mm (L) × 60 mm (W) steel plate on the frame bottom inside.

6.9 Cab

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

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

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

6.9.1 Attaching the roof deck and ladder

- When attaching externally mounted parts such as roof deck or drag foiler onto the roof, use the exclusive mounting holes provided on the roof. (See Figs. 1 and 2.)
- Prevent the weight of externally mounted parts attached to the roof from exceeding 70 kg.
- On the upper part of the rear quarter garnish or side window glass panel, welded nuts are provided on the body for mounting a ladder.
  To attach an externally mounted part, remove the clips from the nuts and fit the part with M8 bolts. (See Figs. 1 and 2.)
- Use nickel-chrome plated stainless steel bolts and washers.
- Take special care to prevent the body from becoming scratched when attaching externally mounted parts.
- Insert packing between externally mounted parts and the body to prevent rusting. Use RC710CP (EPDM) rubber or equivalent with a thickness of 2 mm or less and a hole diameter of 8 mm (for ozone crack prevention).
- After attaching externally mounted parts, coat the entire periphery of the mounting bolts with sealer.
- The top coat of paint must be applied to externally mounted parts before attaching to the roof. (See Fig. 3.)

Standard roof

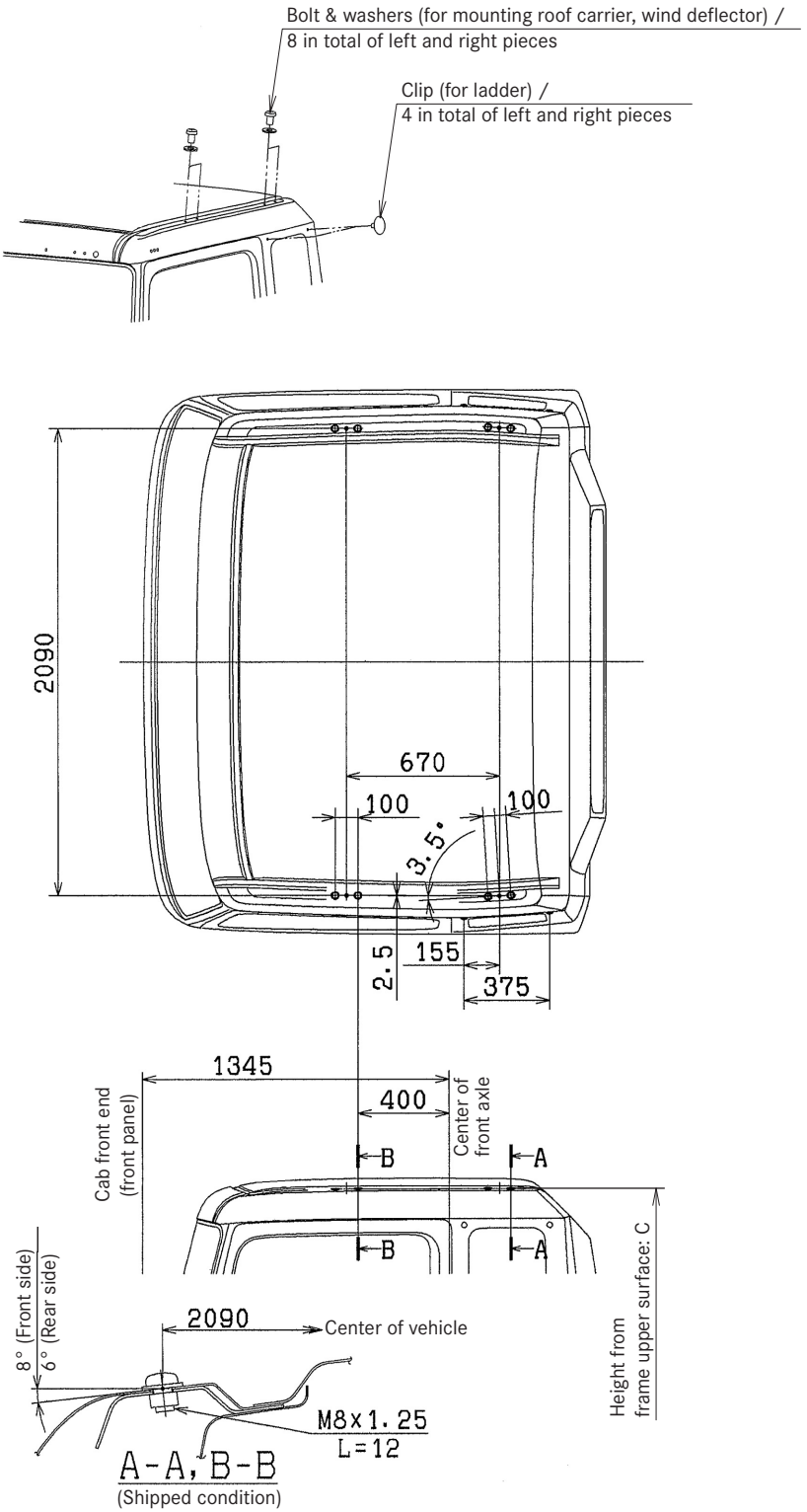


Fig. 1

(Unit: mm)

Frame height	Height from frame upper surface: C
300	2045
280	2065

High roof

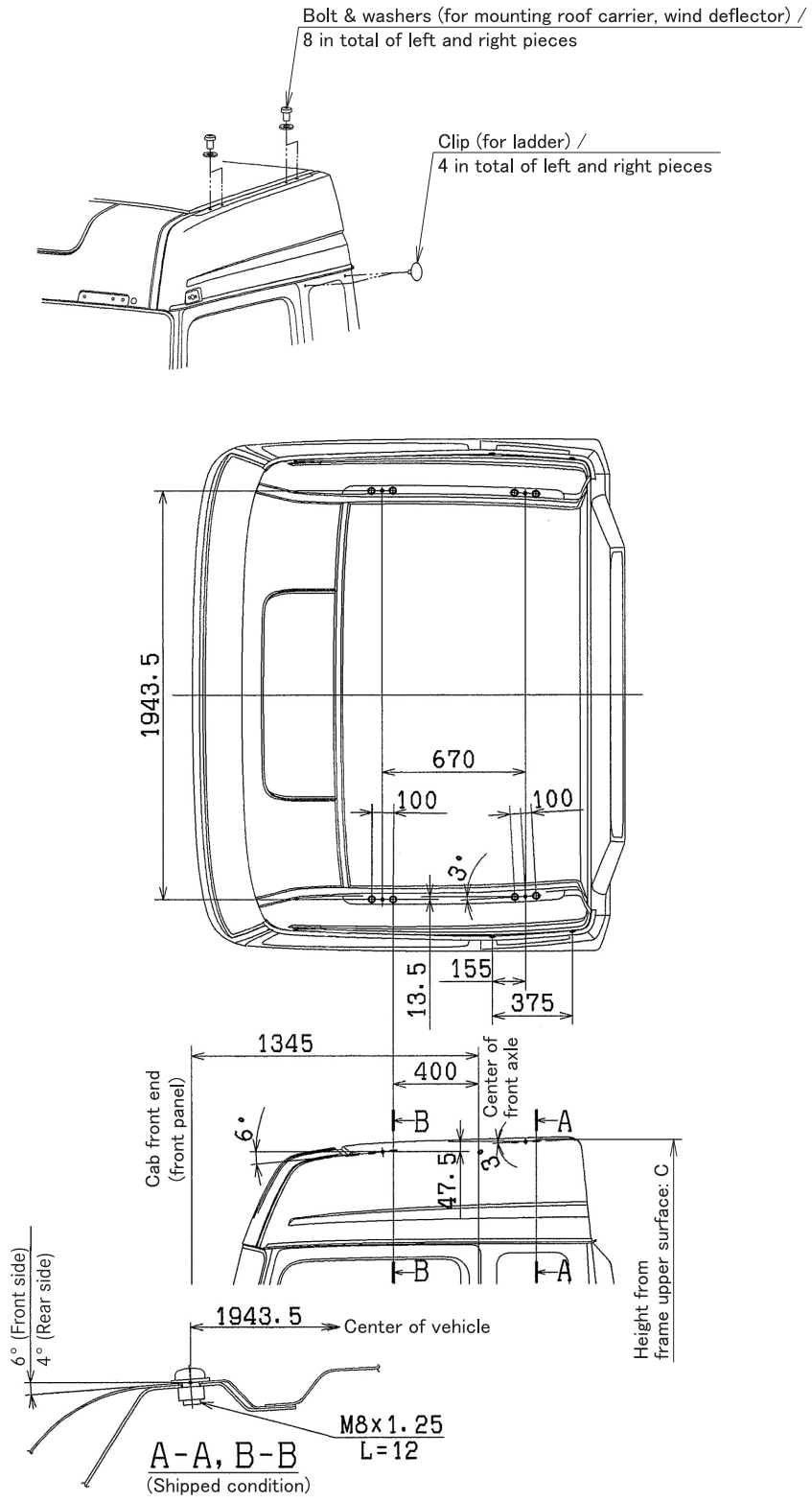


Fig. 2

(Unit: mm)

Frame height	Height from frame upper surface: C
300	2400
280	2420

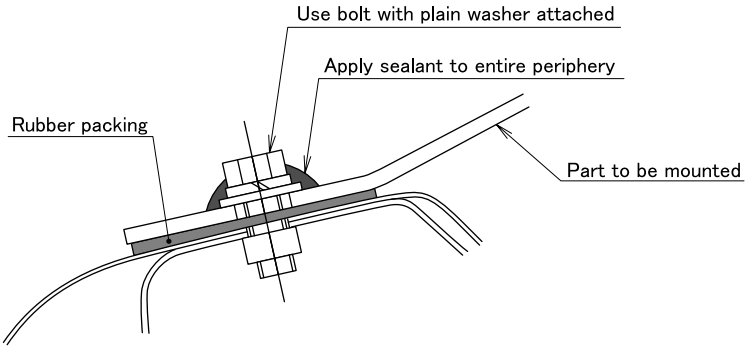


Fig. 3

6.9.2 Additional work and modification of cab

- When installing a control lever and so on for mounted parts in the cab, secure clearance of at least 50 mm from levers and switches on the vehicle side.
- When drilling or notching is performed on the cab floor to install a control lever and so on for mounted parts, reinforce the floor so that its strength does not decrease. Rustproof worked areas to prevent rust from occurring.
- Oil that soaks into glass wool for noise insulation in the floor causes a fire. Securely perform after-treatment.
- See to it that removal and installation and maintainability of equipment parts on the vehicle side are not affected.
- Put identification marks on levers, switches and lamps of mounted parts to prevent misoperation and confusion.
- Do not install a deck or cab hand rail that needs drilling in the roof panel or drip rail in consideration of water leaks in the interior and rust prevention.

6.9.3 Floor mat

A

- Lay the floor mats on the cab floor on the left and right sides. Remove the following parts before laying the floor mats. Be sure to fully push in the left and right ends of the floor mats under the scuff plates so that they are held by the plates.

D

(a) Assistant seat side
Entrance scuff plate, seat under tray (if equipped)

(b) Driver's seat side
Entrance scuff plate, heel pad (if equipped)

Care needs to be taken with the following when reinstalling the floor mats:

- Install the driver's seat side floor mat with reference to the heel pad and mounting bracket. After installation, make sure that the floor mat does not interfere with the operation of the pedals.
- Be sure to fully push in the left and right ends of the floor mats below the scuff plates so that they are held by the plates. There is an electric wiring harness inside the scuff plates. When installing the scuff plates, be careful not to allow them to pinch the harness.

6.10 Seats and seat belts

Risk of injury

Modifications to or work incorrectly carried out on a restraint system (seat belt and seat belt anchorages, belt tensioner or airbag) or its wiring, could cause the restraint systems to stop functioning correctly, e.g. the airbags or belt tensioners could be triggered inadvertently or could fail in accidents in which the deceleration force is sufficient to trigger the airbag. For this reason, never carry out modifications to the restraint systems.

Comply with all national regulations and directives.

The retrofitting of original 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 department responsible ▷ page 14.

6.11 Power take-offs

6.11.1 Transmission-driven power take-off

- Unless special circumstances require otherwise, use the genuine power take-off.
- When special circumstances require the use of non-genuine power take-off, contact us before use. ▷ page 14.

Additional information

For more information on transmission-driven power take-off, refer to 10.9 "Power take-offs" ▷ page 351.

Power taking-off torque

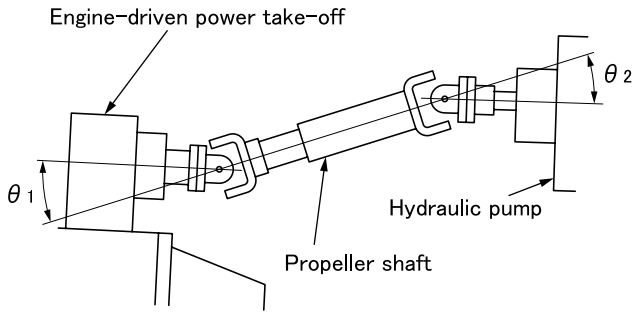
- When power for driving body equipment is obtained through transmission-driven power take-off, set the body equipment-side drive system so that the power taking-off torque does not exceed the allowable maximum take-off torque for the PTO. If excessive torque is imparted to the power take-off, the inside of the transmission could be damaged.

Propeller shafts driven by the power take-off

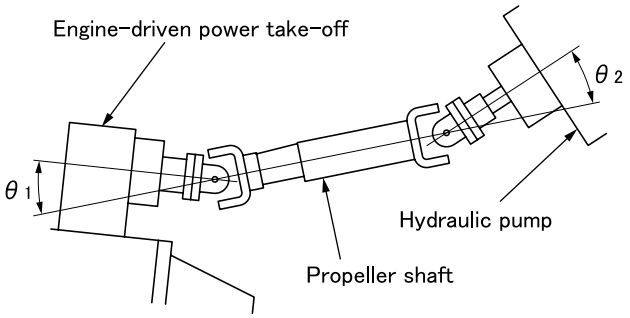
- Set the angle of intersection for the power take-off-driven propeller shaft so that it does not exceed 15 degrees in solid angle.
- Make the angles of intersection at both ends of the propeller shaft equal.
- Vertical and lateral displacements of ±10 mm can occur at the PTO outlet when the vehicle is running. Pay particular attention to the allowable intersection angle of the propeller shaft.

6.11.2 Engine power take-off

Propeller shaft driven by power take-off



A-type drive system



B-type drive system

- Propeller shafts connected to the engine power take-off are generally short in length, which means that the intersecting angle of the propeller shaft is likely to be large. Therefore, the location of the device to be driven by the propeller shaft (e.g., hydraulic pump in case of a mixer) should be selected so that the intersecting angles θ_1 and θ_2 of the propeller shaft are as small as practically possible and the difference between the intersecting angles is almost zero.
- Too large intersecting angles θ_1 and θ_2 , or too large equivalent crossing angle $\sqrt{|\theta_1^2 - \theta_2^2|}$ made by a difference between the intersecting angles can cause excessive torque variations to be generated in the driving system, possibly resulting in a broken flywheel power take-off, propeller shaft or hydraulic pump.
- Determine the location of each relevant device such that the intersecting angles of the propeller shaft meet the following requirements and that torque variations of the driving system are minimized.
  - Intersecting angles of propeller shaft: 12° or less in solid angle
  - Equivalent crossing angle made by difference between the intersecting angles: $\theta_1^2 - \theta_2^2 \approx 0$ (in stationary state for each case)
- When travelling on a rough road, such amounts of displacement as shown in the table below may occur at the power take-off outlet on the engine side. Therefore, an intersecting angle of 12° in the stationary condition can increase to around 15° during running. Mount all relevant devices such that the intersecting angles of the propeller shaft are as small as practically possible.

Displacement

Unit: mm

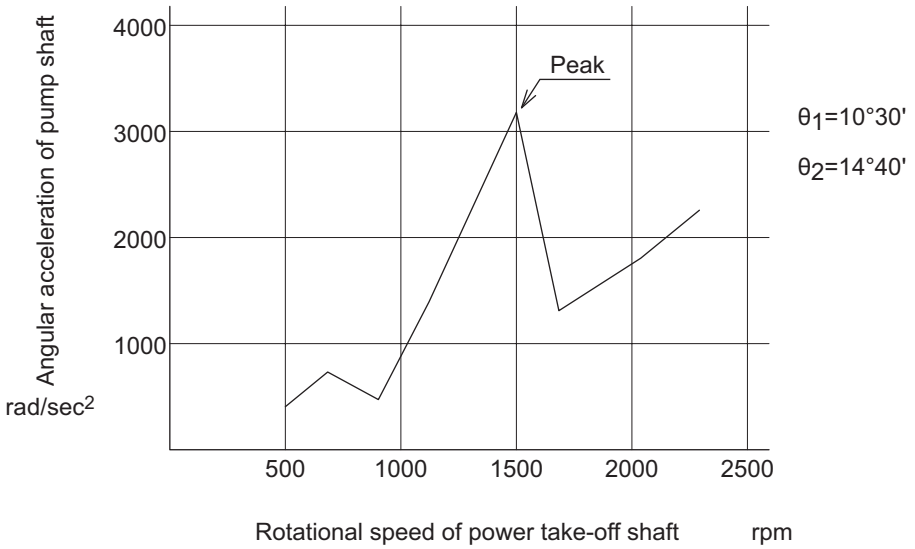
Vertical direction	Lateral direction	Longitudinal direction
Upward: 5 Downward: 10	Left: 10 Right: 5	±5

- In case of the B type driving system, some intersecting angle difference may be produced during running even if the difference between the intersecting angles (θ_1 - θ_2) in the stationary state is almost zero. Especially in the case of larger intersecting angles (θ_1 , θ_2), therefore, the intersecting angles (θ_1 , θ_2) should be set as small as possible since the equivalent crossing angle $\sqrt{|\theta_1^2 - \theta_2^2|}$ made by the difference between the intersecting angles is increased as well during running.
- Excessive torque exerted on the drive system could damage major components of the engine. Be sure to arrange the drive system such that these component parts are not subjected to torque exceeding maximum permissible torque even momentarily.

6.11 Power take-offs

Reference:

- The graph below shows a typical example of the relationship between the rotational speed of the power take-off shaft and the angular acceleration of the pump shaft. If the equivalent crossing angle produced by the difference between intersecting angles of the propeller shaft is larger, the angular acceleration of the pump shaft will reach a greater peak when the rotational speed of power take-off is around 1500 rpm.



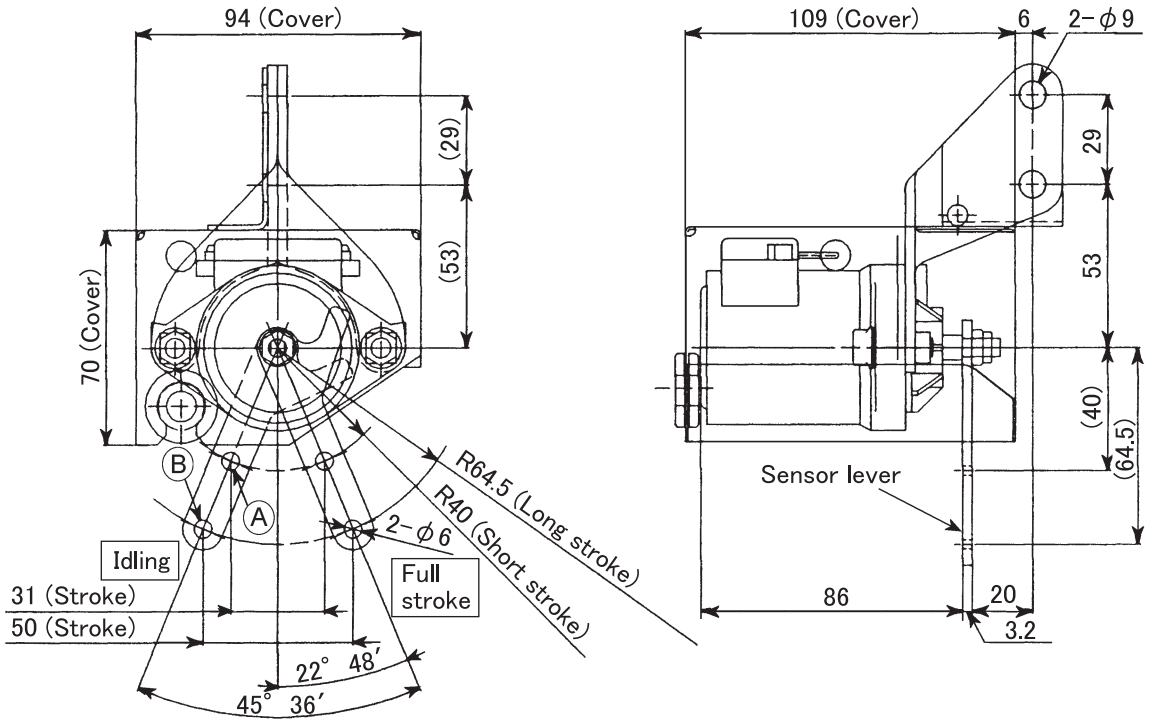
Additional information

For more information on engine power take-off, refer to 10.9 "Power take-offs" ▷ page 351.

6.11.3 Cab back engine control

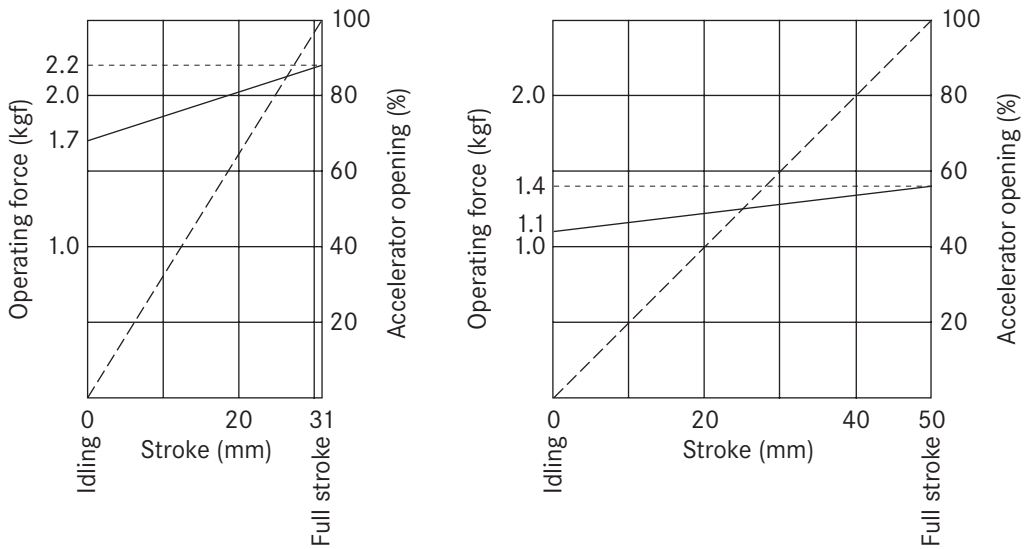
Accelerator sensor

- By selecting the crevice mounting hole for the accelerator sensor, two lever strokes can be selected.



	Lever hole used	Stroke (mm)	Operation force N {kgf}		Lever length (mm)
			Idle	Full	
Short stroke	A	31	17 {1.7}	22 {2.2}	40
Long stroke	B	50	11 {1.1}	14 {1.4}	64.5

- The accelerator sensor is a potentiometer (non-contacting type) voltage output type. The output characteristics and the operating force characteristics are shown in the figures below.



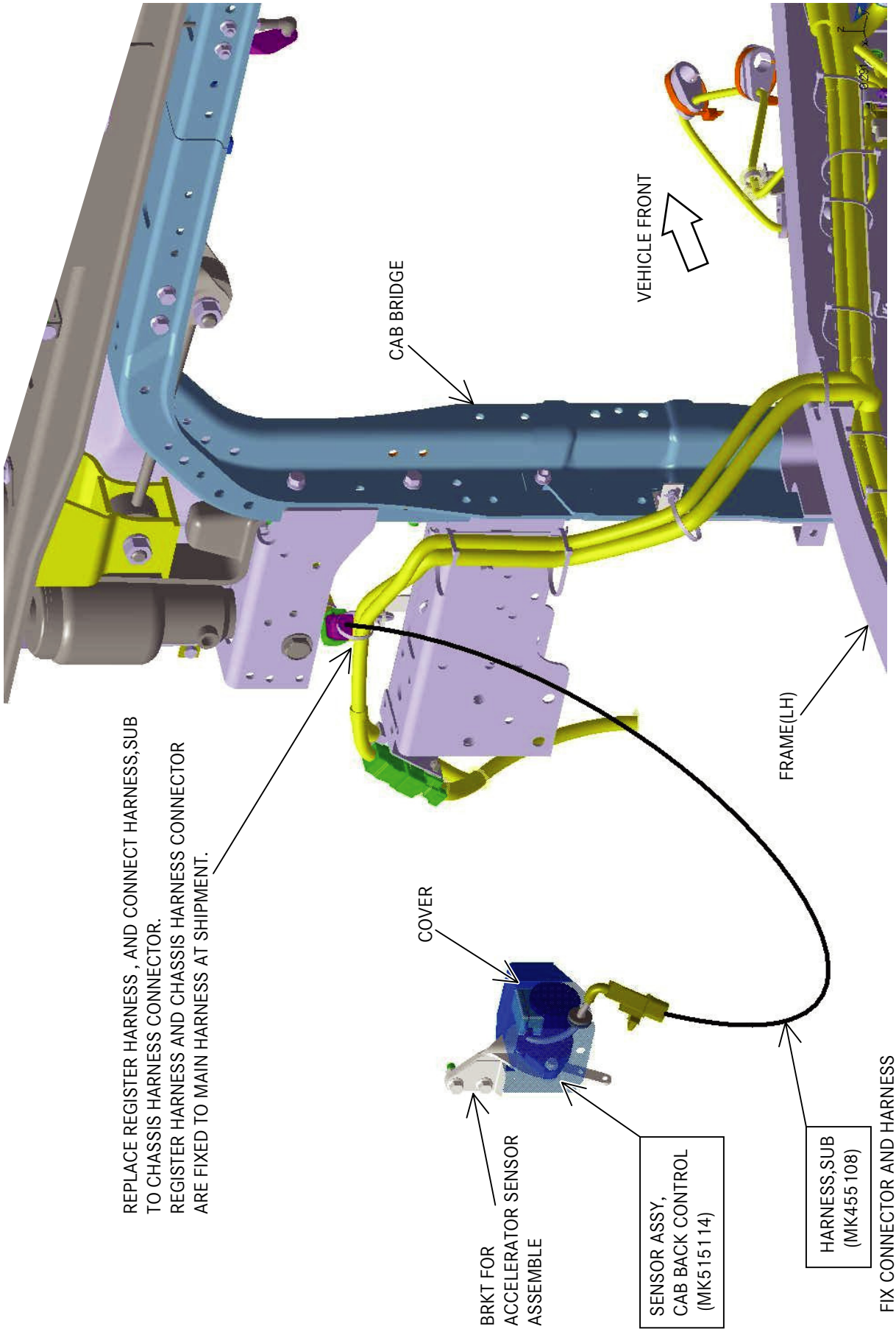
Installation of the accelerator sensor

- The accelerator sensor can be operated by simply connecting the harness from the vehicle side, so install it in a readily mountable location and then use it. For the method of installation, refer to "Outline of Procedure for laying the cab back control accelerator sensor harness" ▷ page 112.
  - Study the installation position, and then install the sensor on the body-building side using the mounting bracket attached to the accelerator sensor. Be sure to install the sensor cover as well.

Precautions concerning installation of the accelerator sensor

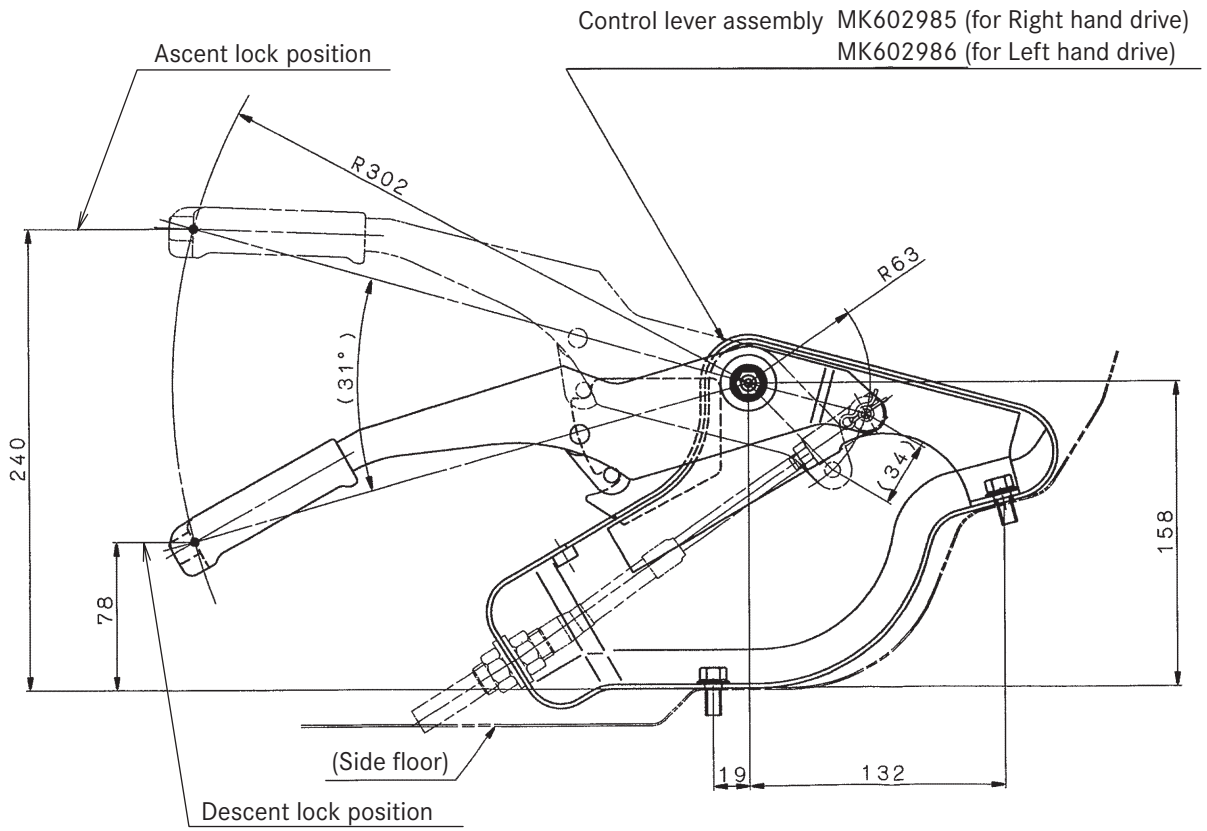
- Install the sensor in such a way that it is not directly exposed to flying stones, muddy water, or other contaminants due to water when the vehicle is being washed with high- pressure water jets, or due to dirt and mud being thrown up by the tires.
- Be sure to install the cover while being careful to avoid dust, heat, vibration and interference with other parts.
- Install the sensor in a location where the ambient temperature is between –30 and 85°C.
- Set the accelerator sensor in such a way that the pull direction of the sensor lever is parallel to the lever stroke direction. Also, take care that the lever does not become bent or twisted.
- Do not adjust the stopper bolt of the special fitment acceleration sensor.
- Adjust the control on the body building side so that it reaches the full stroke ahead of the accelerator sensor lever.
- While laying the harness, fix it securely using suitable tape, bands (MB249339) or the like at intervals of between 200 and 300 mm to prevent the harness from moving about and causing an unreasonable force to be applied to either the harness or the connectors.

Outline of Procedure for laying the cab back control accelerator sensor harness

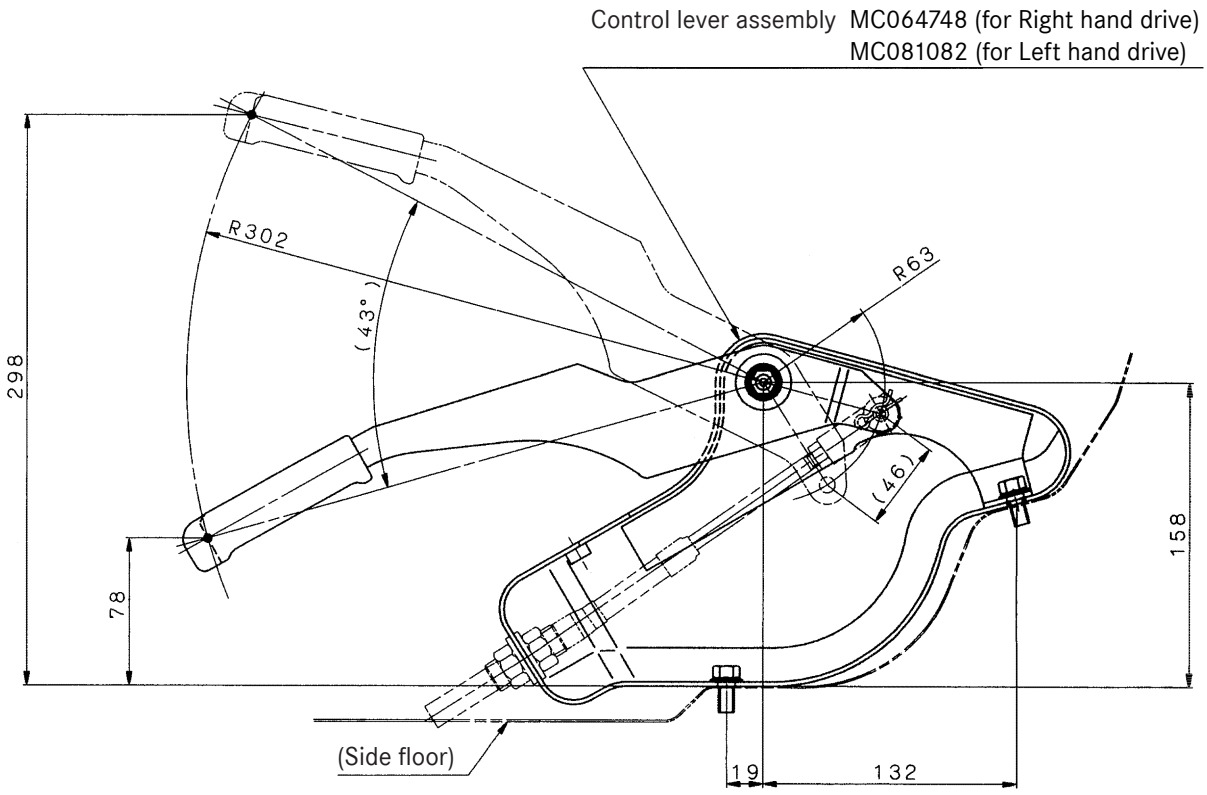


6.11.4 Control lever

Dump control lever



Mixer control lever

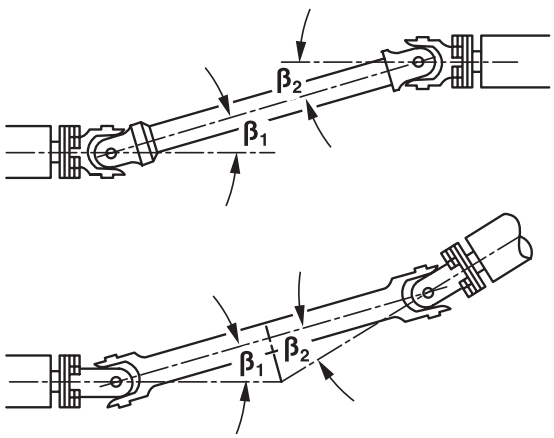


6.12 Installation of propeller shafts

The modification of extending or shortening the wheelbase or additional installation of a transmission to the drive line requires the modification of the propeller shaft. If the propeller shaft is improperly modified such as a change in the pipe length by welding to the main unit of the propeller shaft, vibration caused by the propeller shaft can lead to a serious trouble or accident such as cracks and rupture of the clutch housing and falling-off of the propeller shaft. Therefore, the modification of the propeller shaft is strictly prohibited.
If the modification of the propeller shaft is necessary due to a customer's request or body mounting layout, be sure to consult with the department responsible.
▷ page 14

Observe the following when installing propeller shafts:
- Installation guidelines of the propeller shaft manufacturer.
- If necessary, fit several propeller shafts with intermediate bearings.
- The flanging surfaces must be completely flat.
- The angular offsets must be identical at both universal joints ($ß_1 = ß_2$). They must not be greater than 10°.
- Balancing plates must not be removed.
- Eliminate any vibrations, e.g. by optimising the propeller shaft angles.

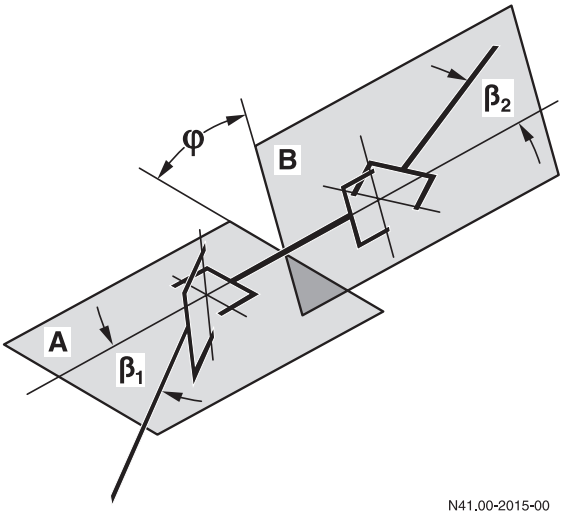
6.12.1 Types of angular offset



N41.00-2014-00

Angle in one plane (two-dimensional offset)

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



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Angles in two planes (three-dimensional offset)

$ß_1 = ß_2$

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

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

! Property damage

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

6.13 Brake systems

Risk of accident

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

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

Comply with all national regulations and lows.

Additional information

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

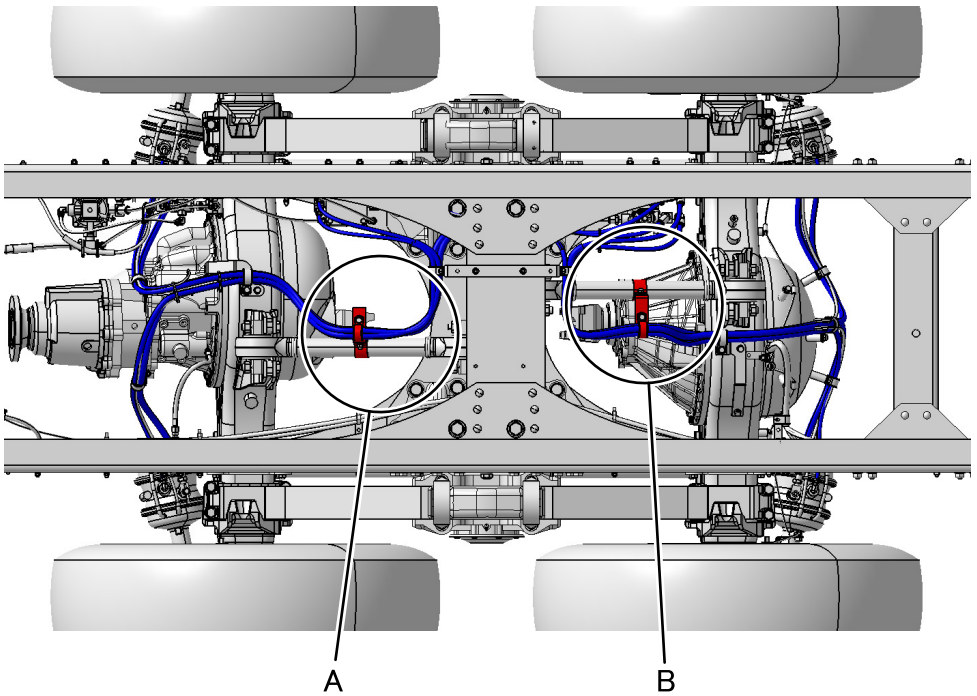
Further information can be found in Section 5 "Damage prevention" ▷ page 48.

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.

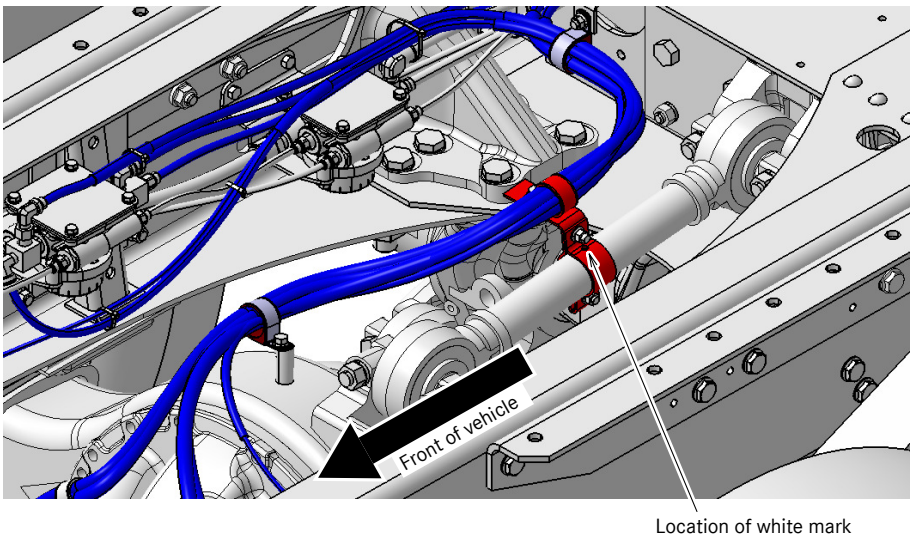
6.13.1 Air piping nylon tube

Nylon tube is used for the brake air piping in this vehicle. The nylon tube is susceptible to heat, acid, and impact. Observe the following precautions:

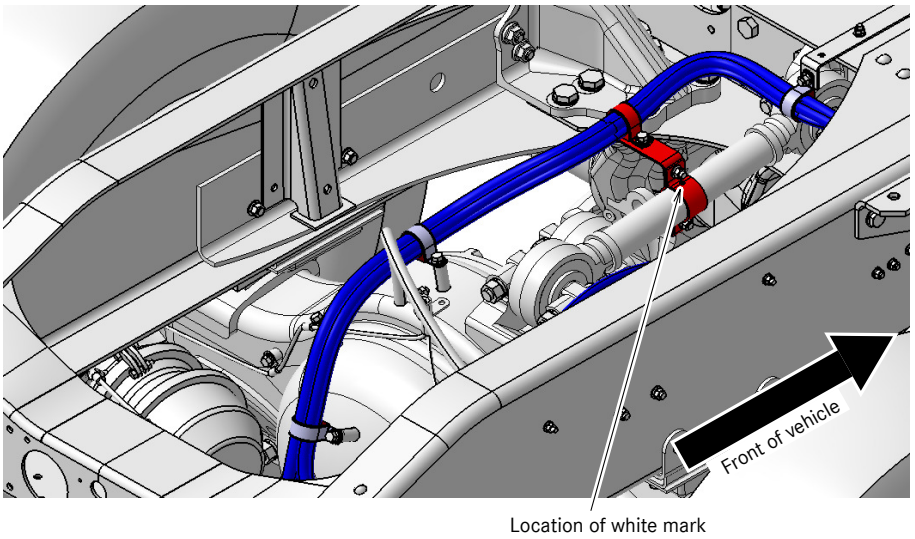
- When performing a welding operation, take sufficient heat insulation measures to prevent the nylon tube and connectors from being exposed to heat or sparks (spatter). After the welding operation, check the nylon tube and replace any damaged one with a new one.
- Use care to prevent to nylon tube from being deposited with battery fluid.
- Do not step on or bend the nylon tube. Do not let it hit against an edge. A damaged nylon tube may burst when air pressure acts on it. Replace any damaged nylon tube with a new one.
- During high-pressure washing, do not bring the injection port of a high-pressure washing machine near the nylon tube, as a hole could be made in the tube.
- Wherever feasible, avoid disconnecting or connecting the nylon tube from/to a connector. If a damaged tube needs replacement, or if a tube must be temporarily removed for modification work, see 6.13.2 "Hydraulic and pneumatic pipings" ▷ page 118.
  Depending upon the vehicle model, there are cases in which the tube is clamped to the top of the rear axle rod. This has been done in consideration of the motion of the rear axle, so do not change the location of the tube. If it is unavoidably necessary to temporarily remove the clamp, reinstall it at the location of the white mark on the rod.



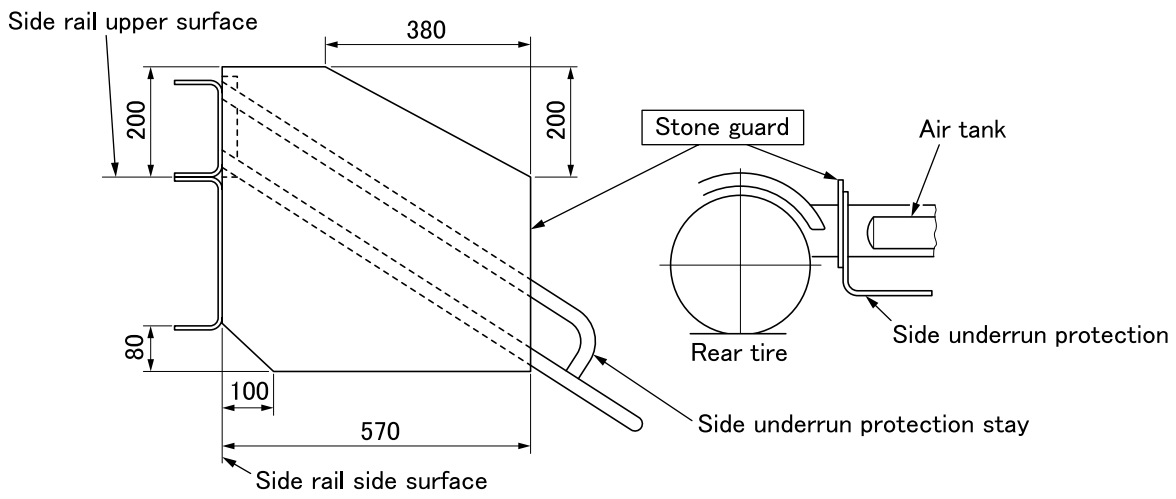
Details of A



Details of B



- Install a stone guard in the rear of the air tank for protection of the nylon tube.



6.13.2 Hydraulic and pneumatic pipings

The hydraulic and pneumatic pipings of the brake and steering systems are critical parts for safe operation of vehicles. Never attempt to modify these parts. If it is necessary to remove the pipings for a compelling reason such as body mounting work involving temporary pipe removal/installation or replacement, be sure to follow the cautionary instructions shown in "Steel pipes for fluid line" ▷ page 118 and "Nylon tubes for air piping" ▷ page 122.

Extreme caution is required in handling brake piping because of the importance of the components in respect to brake safety. Pipings, joints, and brake components should be protected with covers during mounting work to prevent them from denting, damage, welding sparks, and heating. Addition and routing change of piping necessary for coupling with trailer, etc, should be performed in accordance with the following standard.

Tapping compressed air for auxiliary consumers

To take out pneumatic power for rear body equipment from the brake piping, many preliminary examinations are required to make clear the relationship between the frequency of equipment operations and the air supply capacity, the points to be checked for safety assurance, etc. If this method is to be used, be sure to consult the department responsible beforehand ▷ page 14.

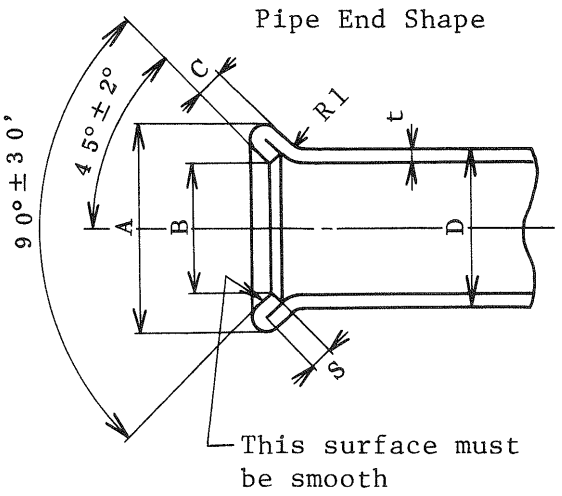
Steel pipes for fluid line

The chassis uses steel pipes conforming to specifications below.

Flare-jointed pipes

Unit: mm

Nominal diameter D	A	B	t	C	S min.	Minimum bend radius allowable	Material	Surface treatment
4.76	6.6-7.1	3.0-3.7	0.7	1.4	1.0	20	Double walled steel tube of SPCC under JIS G3141 or equivalent	Inner surface:Copper plating not less than 3μ thick,except for double-walled tube whose copper plating should remain unaltered because of brazing. Outer surface:Zinc plating 8μ thick.
6.35	8.6-9.1	4.5-5.2	0.7	1.4	1.0	30		
8	10.5-11.0	6.2-6.9	0.7	1.4	1.6	30		
10	13.0-13.5	8.2-8.9	0.7	1.4	1.6	30		
12	15.0-15.7	9.8-10.5	0.9	1.8	1.6	35		
15	18.1-18.8	12.7-13.4	1.0	2.0	1.6	40		

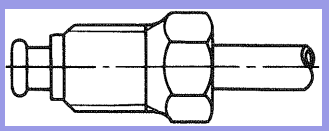
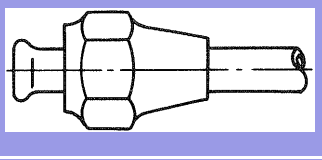


The tightening torque for tube nuts or union nuts used in combination with the pipes specified in the table above should be as follows.

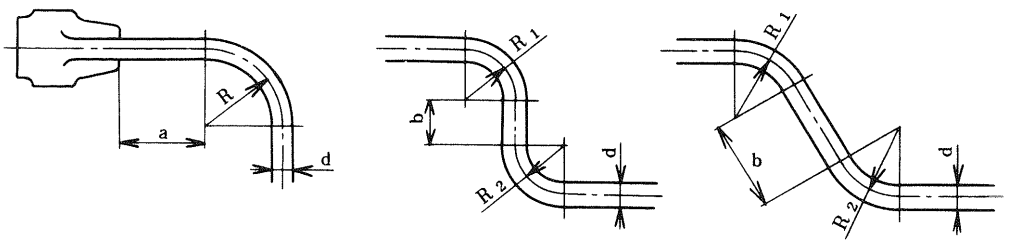
Nominal diameter (mm)	Tightening torque (N·m {kg·m})
4.76	13-17 {1.3-1.7}
6.35	19-26 {1.9-2.6}
8	29-39 {3.0-4.0}
10	39-50 {4.0-5.1}
12	77-90 {7.5-8.9}
15	85-100 {8.3-9.8}

Notes on piping

- When extending pipes, new pipes of the same material should be made. Connect pipes with proper connectors.
- If the same materials are not availabe in your country, consult the department responsible ▷ page 14.
- Use union nuts and tube nuts specified in the table below.

Nominal diameter (mm)	Part No. of tube nuts 	Part No. of union nuts 
	Pipe material	Pipe material
	Steel	Steel
5 (4.76)	MF651001	
6 (6.35)	MF651002	
8		MF651205
10		MF651206
12		MF651207
15		MF651209
Remarks	Material SS400	Material SS400

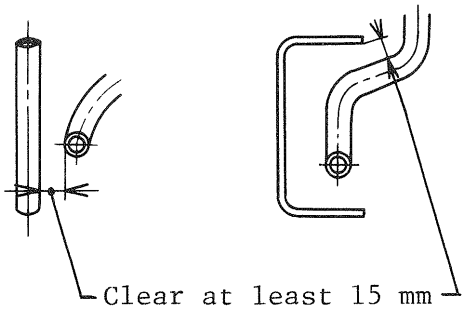
- Perform the pipe bending work as follows:
  (a) The bending of pipes should be performed with a bender. Do not use heat bending.
  (b) Bend roundness R should be strictly in accordance with the allowable minimum bend radius R in the table.
  (c) The required length of the straight portion of pipe end and bent portion should be in accordance with the figure below.



a≧2d b≧2d

  (d) Clean and remove foreign matters from inside of the pipes with a high pressure air blower before use. Use compressed air for cleaning. Cleaning oil is not recommended, but if used completely remove any residue.
- Do not attempt to splice one pipe to another.
- If it is unavoidable to connect an extension pipe, always use a flare type joint provided with arrangements for retightening.
- The pipes have a corrosion preventive coating provided on both inner and outer surfaces. Avoid brazing and other similar acts which can expose the pipes to high temperatures.

- If it is necessary to run a pipe through the frame, always provide a grommet in the through-hole and secure the grommet firmly to prevent the pipe from directly contacting the brim of the through-hole.
- For dismounting the transmission, it is necessary to draw it rearward along the slope of the engine. Therefore, a space large enough for that purpose must be saved there. Do not lay any piping over the area from behind the transmission to just before the crossmember.
- Avoid locating fuel, oil or fluid pipe joints over or near the component parts of the exhaust system to prevent a fire resulting from oil leaks.
- Do not lay any pipings in the vicinity of rotating parts such as propeller shaft.
- Avoid laying pipes in a place where dirt is likely to accumulate or moisture is hard to be removed. Also, avoid covering the pipes with pieces of rubber or a vinyl tube. Otherwise, moisture may be trapped in-between, resulting in rust formation.
- Avoid crossing pipes. If unavoidable, allow each pipe to clear any other by more than 15 mm space.

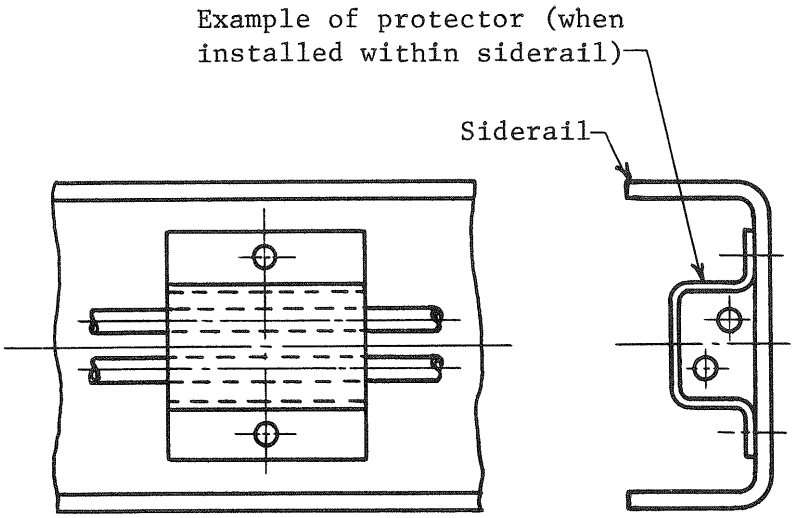


- Do not allow pipes to come in contact with sharp edges of the frame or other components.
- Securely clamp pipes with vinyl-coated clamps or grommets in order to prevent vibrations when the vehicle is running.
- The standards of pipe clamp distances are given in the table below.
- A shorter pipe clamping distance is acceptable if doing so is necessary to prevent interference with adjacent parts or to assure the safety in operations. If any pipe is to be laid near a movable part, clamp the pipe in a position as close to the part as practically possible.

Unit: mm

	Pipe Dia.	Clamp distance
Straight pipe	4.76 to 8	550 max.
	10 to 15	750 max.
Curved pipe	4.76 to 8	400 max.
	10	550 max.
	12 to 15	750 max.

- Pipes should be laid along the inside web of the side rail as a rule. When they cross over to the opposite side rail, they should be placed along crossmenbers. Place pipes more than 10 mm away from bolts and rivets.
- Make sure oil pipes can be easily air bled.
- Do not leave a wave form in the air pipe such as will permit water to stay in the pipe. (Use of a form such as ⋃ is prohibited.)
- Electrical wires should never be clamped or taped to the brake pipe lest it should cause pipe corrosion. Maintain the clearance described in 8.2 "Electrical wiring" ▷ page 174.
- When replacing oil line pipes, do not reuse the extracted fluid. Completely drain the fluid and replace with fresh fluid.
- The clearance between the pipes and exhaust system components should be in accordance with the specifications in 4.4 "Clearance for basic vehicle and bodies" ▷ page 39.
- Install pipings in order to protect against damage due to flying pebbles when driving.
- If necessary to prevent above damage, install a protection panel in accordance with the requirements below.
  (a) Do not allow the protection panel to deform by the flying pebbles and to come in contact with the pipes.
  (b) Position and form the protection panel properly (for drain holes, etc) allowing water to run well off.



Pipe connection procedure

- Insert the pipe in the joint and tighten the flare nut loosely by hand to check for proper fit. If no abnormalities are found, tighten the pipe joint to the specified torque.
- If it is difficult to fit, do not proceed to fully tighten the joint until necessary remedial measures are taken to fit the pipes in the joint correctly.

Nylon tubes for air piping

Do not disconnect the nylon tubes from the connectors unless it is absolutely necessary. If it is unavoidable because the damaged tube must be replaced or the modification to be made requires temporary removal of them, proceed as follows:

Applicable standards and dimensions

Exclusively use nylon tubes having the following data indicated on the outer surface. Never use any tubes having no such indications.

Example of indications	DIN number	Nominal size	Material	Maker name	Production date
	DIN74324	10 × 1.25	PA11	ABCD	9803

Nominal diameter x Thickness (mm)	Nylon material	Minimum bending radius (inner side) (mm)	Nylon tubes for parts supply	
			Part No.	Length (m)
6×1	PA12-HIPHL PA12-PHLY PA11-PHLY (According to DIN 73378)	30	MK651587	10
8×1		40	MK651588	10
10×1.25		60	MK651589	10
12×1.5		60	MK651590	10
16×2		95	MK651591	10

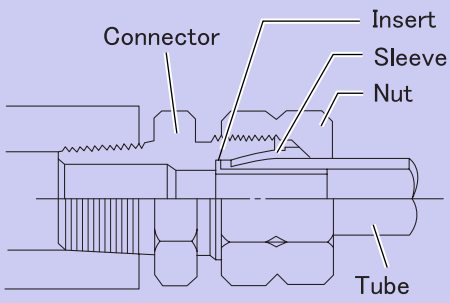
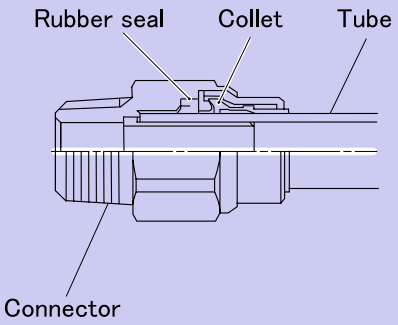
C

Notes on nylon tube

Pay attention to the following since the nylon tube is vulnerable to heat, acid and impact. If any abnormalities are found on the tube during body mounting work, be sure to replace it with a new one.

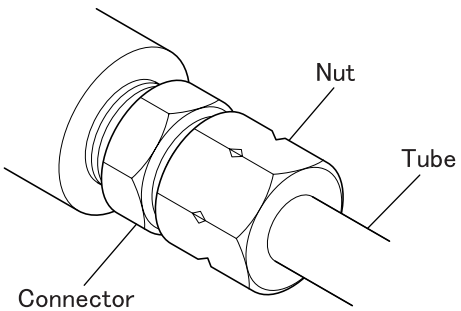
- Do not expose the tube (including connector) to a temperature higher than 100 °C.
  (The nylon tube with no pressure applied can withstand a temperature of a maximum 125 °C even if it is temporary, but its service life will become shorter due to thermal aging.)
- During welding work, protect the tube against heat and welding spatters (sparks).
- Keep the nylon tubes away from battery electrolyte and brake fluid.
- Avoid stamping on, sharply bending or holding the tube against a sharp edge.
  (These can damage the tube, causing it to burst when high air pressure is applied.)
- During cleaning using a high pressure cleaning machine, be careful that the jetting nozzle is not oriented to the nylon tube. (There is a potential of it being pierced.)

Nylon tube piping connecter

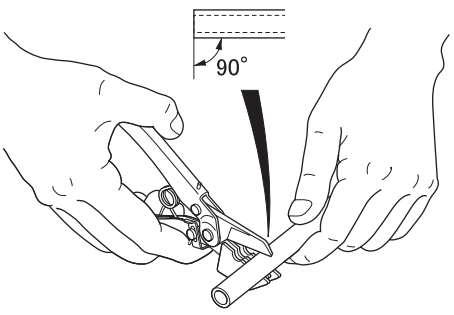
	Cross section	Structure
Compression type		• Install the nylon tube with fitted insert into the connector through the sleeve and tighten with the nut. • The sleeve deforms and cuts into the tube, thus preventing air from leaking and maintaining the sealed condition. • The tube, insert and sleeve are deformed and cannot be reused once connected.
Push-in type		• The nylon tube can be installed only by inserting it into the push-in connector. • Seal the air pressure using the rubber seal. Damage or contamination in the rubber seal can cause air leakage. • The collet prevents the tube from coming off. • The tube can be removed by pressing the collet.

Removal and installation procedure for a compression connector

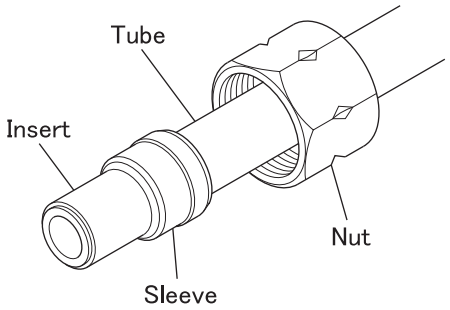
- Removal
  (a) Bleed air from inside the tube completely. The connector becomes unusable if its inner surface is contaminated. Be sure to clean the outer peripheries of the connector, nut and tube before loosening the nut.



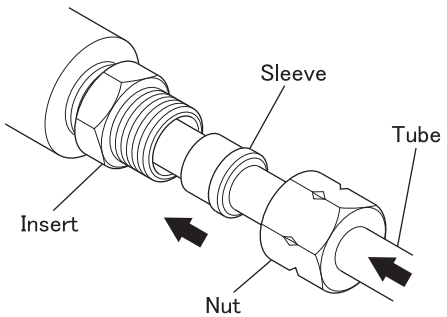
- Installation
  (a) Ensure that the tube insertion section is free from any damage or contamination. If the section is damaged, cut it off using a tube cutter.



(b) Check to confirm that the insert, sleeve, nut and tube are positioned as shown in the figure.



(c) Insert the tube into the connector until it is brought in contact with the connector end. Slide the sleeve into the connector and secure it by tightening the nut by hand. Tighten the nut to the specified torque. Then, pull on the tube to confirm that there is no air leakage or that it does not cause the tube to slip off.



- Part numbers and tightening torques of connector components

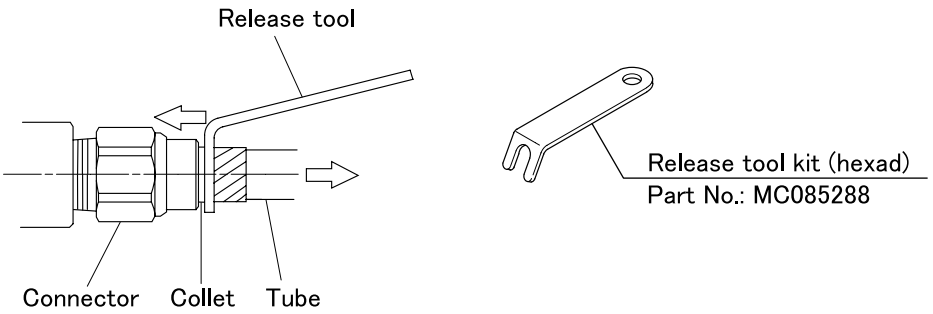
Nominal diameter (mm)	Part number			Part number of relay connector	Tightening torque N·m {kgf·m}
	Insert	Sleeve	Nut		
6	MH038022	MH038014	MH037911	MH038148	20 {2.0}
10	MH038023	MH038015	MH037912	MH038149	34 {3.5}
12	MH038027	MH038019	MH037931	MH039082	49 {5.0}
15	MH038028	MH038029	MH037935	-	54 {5.5}

Removal and installation procedure for the push-in connector

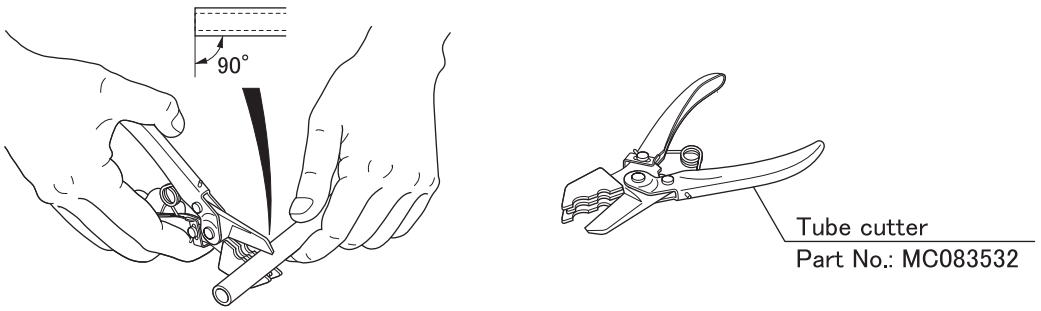
For push-in connectors, it is very important that the insertion section of tubes is free from any damage, contamination, etc. (Damage or contamination in the seal rubber contacting section of tubes, in particular, can cause air leakage.)

Avoid disconnecting/reconnecting of tubes unless it is absolutely necessary. These actions can increase the chance of damaging the tube.

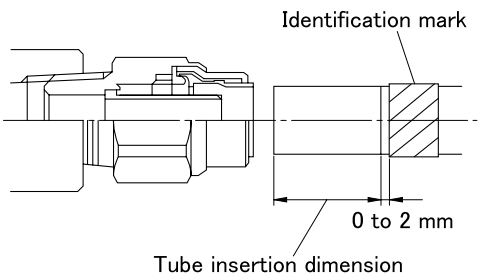
- Removal
  (a) Bleed air from inside the tube completely.
  (b) The connector becomes unusable once it is contaminated with foreign objects. Be sure to clean the connector and tube before pulling off the tube.
  (c) While pressing the collet with a release tool, pull out the tube by hand.
  (d) Avoid pulling out the tube with undue force or using a tool other than the special release tool. Otherwise, a damaged tube or collet could result.



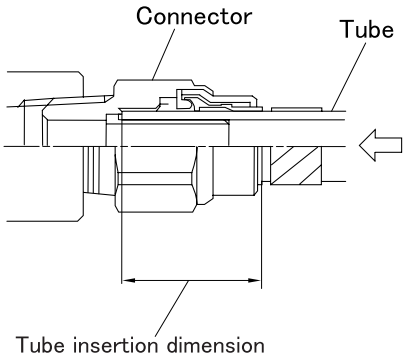
- Installation
  (a) Ensure that the insertion section of the tube is free from any damage or contamination.
  (b) If the insertion section is damaged, cut the part off. The connector whose inside surface is contaminated can no longer be used. Replace the connector with a new one.



  (c) Put an identification mark on the tube at a distance of the tube insertion dimension plus 0 to 2 mm. This mark can be used as a reference for insertion.

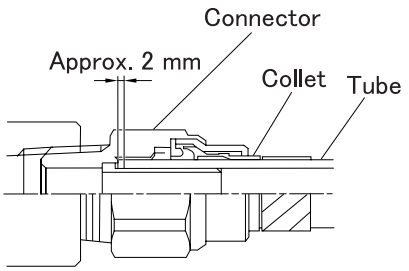


(d) Insert the tube into the connector straight until it is stopped at the far end. During insertion, use care that the tube is not slanted. Otherwise, it could result in a damaged tube.



(e) After securing the tube, pull on the tube to check that it has not slipped off. Note that the collet and the tube move as a unit approximately 2 mm in the direction of coming off when air pressure is applied or a pulling force is exercised.

(f) Check the connector for air leakage.



- Tube insertion dimension and relay connecter

Nominal diameter (mm)	Tube insertion dimension (mm)	Part number of relay connector
6	20	MC072033
8	21	MC084118
10	22	MC072308
12	22	MC072309
15	24	-
16	29	-
16 with cover	32	-

Notes on piping

- Cut each tube perpendicular to the center line of the tube using a tube cutter.
- The bending radius must be larger than the minimum bending radius given in the table under "Applicable standards and dimensions" ▷ page 122.
- Provide suitable heat shields around the components which become hot during engine running to prevent tubes and connectors from being heated up to a temperature higher than 100°C.
- Portions likely to be damaged or worn must be provided with a suitable protector such as a corrugate tube, grommet, etc.
- The piping must have an allowance of ±1% in length for expansion or shrinkage due to temperature change after being laid down.
- The tube must be secured at an interval of about 500 mm with clamps of such design that will not damage tubes.
- Tubes must be replaced with new ones, the length of which is reduced below the specification due to cutting off of a damaged end or for some other reason.
- As far as possible, do not use a relay connector. If it is unavoidable, clamp the connector in such a way that its deflection is suppressed while giving full consideration to protection of the clamped side.
- The nylon tube hardens considerably within several months after it is produced. In other words, it loses the flexibility gradually and becomes harder to be laid down with the lapse of time. Use as new a tube as possible.
- After piping work is completed, recheck that the piping is free from any air leaks, tube deflection and interference with adjacent parts.

6.14 Exhaust system

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

6.14.1 Exhaust gas purification devices (BlueTec system) and sensors

<Euro V-compliant vehicles>

- Exhaust gas purification devices (BlueTec system) may be damaged by heavy impact against their body or fall. When mounting, handle them with sufficient care.
- To prevent the exhaust gas purification devices (BlueTec system) and engine proper from being adversely affected, do not relocate the exhaust gas purification devices (BlueTec system), exhaust temperature senor and NOx sensor.
  If temporary removal of these parts becomes inevitable during mounting, be sure to reinstall these parts in the original places.
- Exhaust gas purification devices and sensors are periodically removed for maintenance. Install them so that removal and reinstallation work can be carried out without any problems.

6.14.2 BlueTec system

<Euro V-compliant vehicles>

BlueTec exhaust gas aftertreatment

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

- SCR muffler
- Urea tank unit
- Supply unit
- Dosing unit
- Pressure limiting unit
- Urea hose

C

Property damage

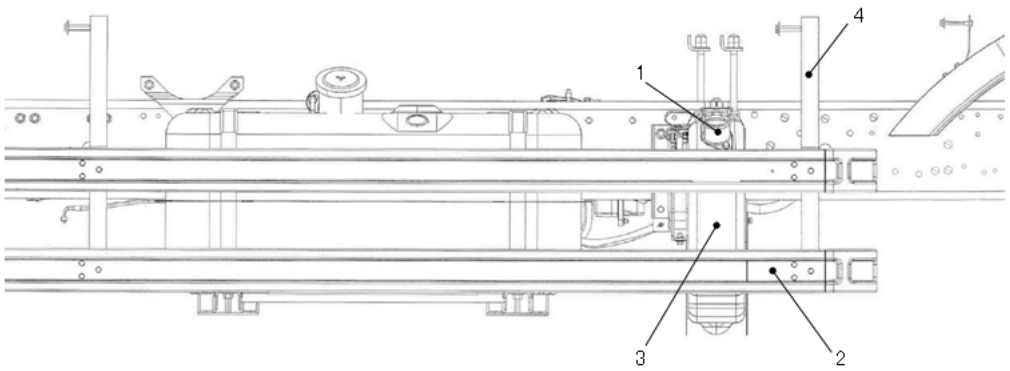
Don't take out the power for other electric components from the existing fuse.

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.

Installing a side guard and other parts around the urea tank

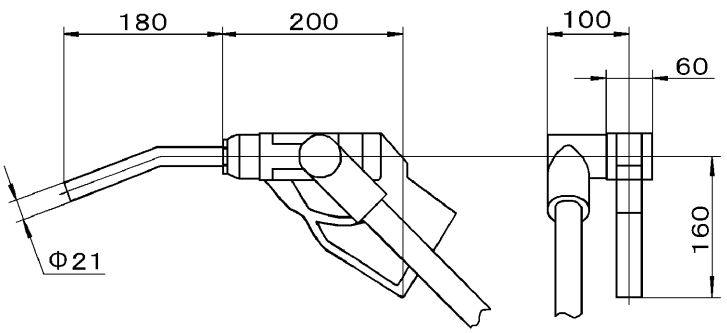
- Care is required when installing a side guard around the urea tank. Do not let the side guard and its mounting stay hide the filler cap of the tank and interfere with refilling the tank with AdBlue. Be sure to open up sufficient space around the cap to allow a filler gun of AdBlue to be inserted; typical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



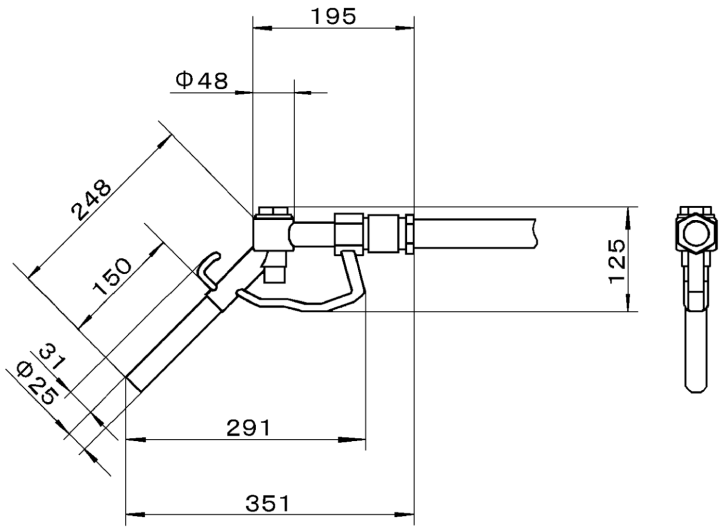
1 Cap
2 Side guard
3 Urea tank
4 Side guard mounting stay

AdBlue filler gun - Examples

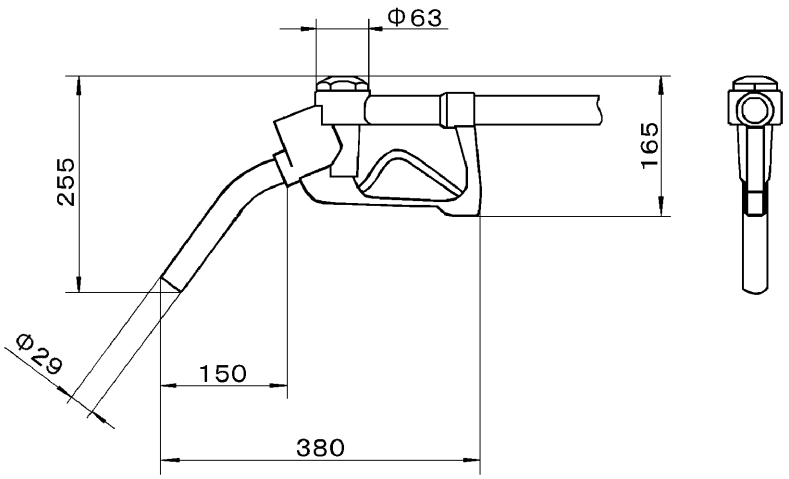
Filler gun for dispensers



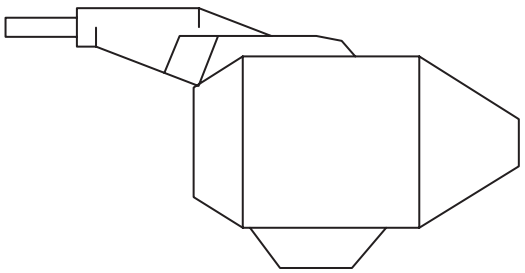
Filler gun for IBC pump units



Filler gun for IBC pump units (with auto-stopping function)

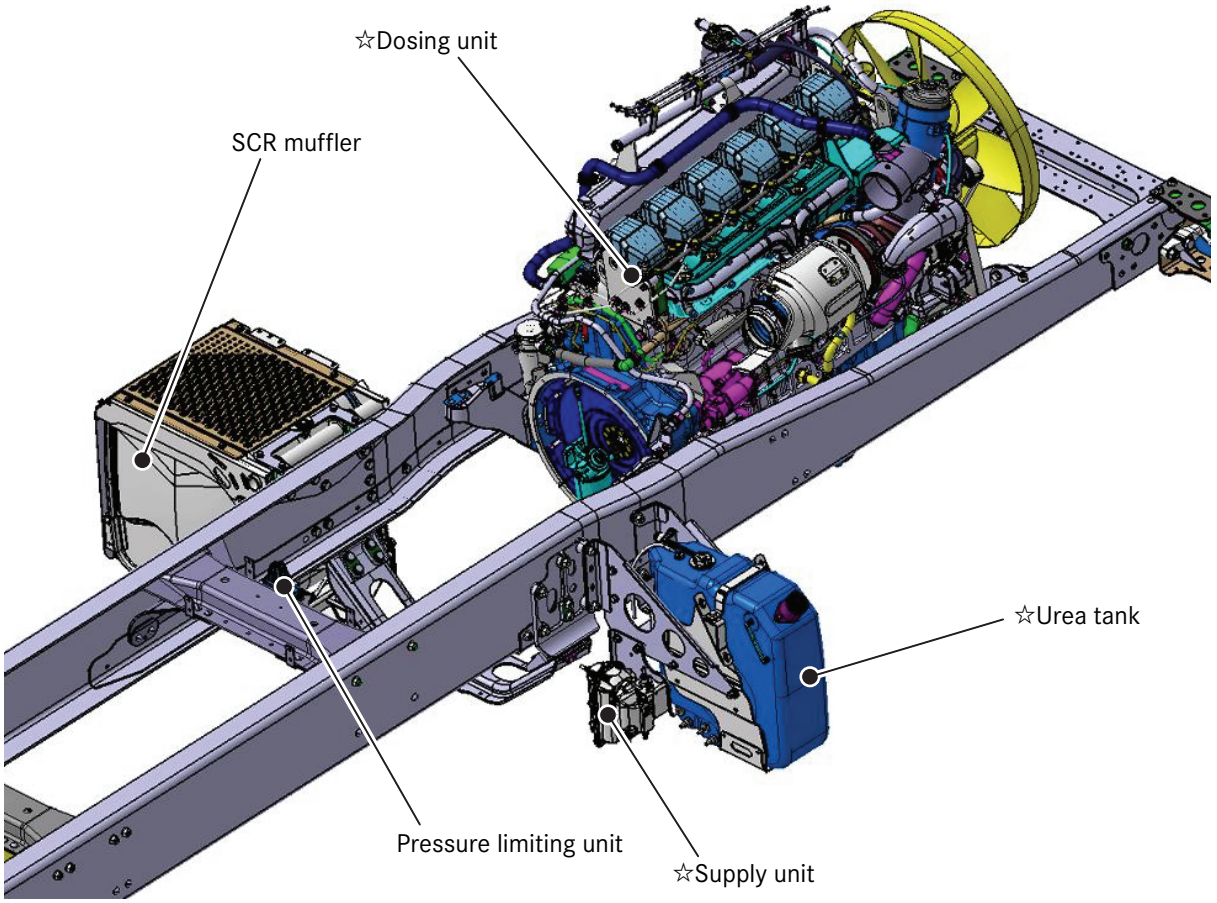


Filler gun for ISO/DIS 22241-5 type



Urea tank and connection piping

The SCR muffler, the urea tank unit, the supply unit, the dosing unit, the pressure limiting unit and their connection piping are all installed conforming to the relevant exhaust gas control requirements. It is prohibited to relocate these components and change their piping when mounting the body or equipment.



There are Urea (AdBlue) connecting ports near the paints marked ☆ (3 places in total). After any operation including mounting the body or equipment, visually check that the clamps of the coupling connector is fully closed regardless of whether you touch the piping or not.

Property damage

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

Precautions for electric welding

If electric welding is performed while the electric wiring for the supply unit 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 5 minute. (This is necessary for the after-running processing.)
- Be sure to ground the welder close to the welding area.

6.15 Fuel system

6.15.1 Fuel tanks

General information

- Fuel hoses of poor quality can cause a fire. If any fuel hose is to be replaced, always utilize an fuel hose or a steel pipe of the following type.

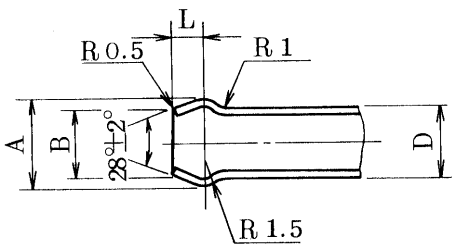
Fuel hose

Unit in mm

Nominal diameter D	Part No.	Length
6	MS602908	5000
	MS602999	10000
8	MS603171	5000
	MS603998	20000
10	MH030038	5000
	MH030029	20000
12	MH030586	5000
	MH030587	20000

Steel pipe

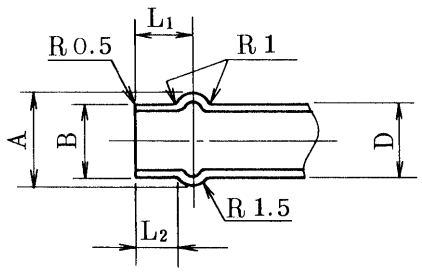
Bulge type



Unit in mm

Nominal diameter D	A	B	L (Reference)	Corrosion protection	Inner diameter of rubber hose (Reference)
6.35	7.1 -7.7	5.8 - 6.4	2.8	Inner surface: Copper plating (thickness: 8µ or more) Outer surface: Zinc plating (thickness: 8µ or more)	5
8	9.0 -9.6	7.6 - 8.2	3.2		7
10	11.2 - 11.8	9.7 - 10.3	3.2		9
12	13.2 - 13.8	11.7 - 12.3	3.2		11
15	16.4 - 17.0	14.7 - 15.3	3.6		14

Spool type



Unit in mm

Nominal diameter D	A	B	L1	L2	Corrosion protection	Inner diameter of rubber hose (Reference)
6.35	7.1 -7.7	6.35	4.5	3.5	Inner surface: Copper plating (thickness: 8µ or more) Outer surface: Zinc plating (thickness: 8µ or more)	5
8	9.0 -9.6	8	4.5	3.5		7
10	11.2 - 11.8	10	4.5	3.5		9
12	13.2 - 13.8	12	4.5	3.5		11
15	16.4 - 17.0	15	4.5	3.5		14

- Adding fuel hoses is prohibited.
- Use metal tubes within the engine compartment.
- Any change of clips or transfer of clamp locations with regard to relatively movable parts between the engine and frame are prohibited.
- If the freezer engine will be supplied with fuel from the fuel tank for a vehicle engine, be sure to take out fuel from the fuel tank. Never attempt to supply fuel for a freezer engine through a branch line from the fuel supply line for a vehicle engine. Such an attempt could result in the vehicle engine suffering from an instable fuel supply.
- Ensure that the filler port in the fuel tank is located at least 300 mm away from the exhaust pipe opening and 200 mm away from exposed electric terminals or switches.
- Route the fuel piping in such a way that any fuel leaked from the fuel piping does not reach the exhaust pipe. (Avoid a piping design in which a fuel pipe joint is located above the exhaust pipe.)
- Never attempt to modify the fuel tank.
- Do not tamper with the plug of the spare fuel tank except when replacing the fuel tank with a new larger tank.

Transfer of fuel tanks

- Do not relocate the fuel tank to a position where it may interfere with the side guard.
- The fuel tank installation position should be in the wheelbase section.
- Clamp the fuel hose to the frame at an interval of 400 to 500 mm. Do not lay down the piping along the electric wiring or battery cable. Ensure that the fuel hose is at least 20 mm distant from the electric wiring and battery cable.
- The fuel pipes must be so routed and clamped that at least 15 mm distance from every corner of adjacent parts and 25 mm distance from the movable parts may be assured.

Addition of fuel tanks

- Fuel tanks of a larger capacity can be procured from an authorized MITSUBISHI FUSO distributor or dealer.
- When adding fuel tanks, attach a cut-off valve to the union tube connecting each tank. The necessary parts can be procured from an authorized MITSUBISHI FUSO distributor or dealer.
- If any commercially available tank is used, check the tank for the presence of foreign objects before installing it.

Installation of fuel tank

- Install the fuel tank in such a way that no loosened fasteners will occur under any circumstances, taking the conditions such as vibrations and mounting position fully into consideration. If new type brackets should be used, verify that they can provide sufficient strength to the construction.
- To fasten the fuel tank to the frame, be sure to use the flange bolts and nuts categorized into the following strength classes and tighten them to the specified torque.

	Size	Strength class	Tightening torque
Bolt	M12	7T or higher	54 to 72 N·m (WET)
Nut		6T or higher	
Bolt	M14	10T or higher	150 to 204 N·m (WET)
Nut		8T or higher	
Bolt	M16	10T or higher	320 to 368 N·m (DRY)
Nut		8T or higher	

6.16 Others

6.16.1 Supplemental restraint system(SRS)-air bag

<Vehicle with SRS-air bag>

When installing equipment or making modifications on vehicles equipped with an SRS air bag and pretensioner-equipped seat belt, observe the following precautions. Otherwise, normal operation could be hampered or the air bag could explode accidentally while working.

Precautions on installing equipment or modifying vehicles

- If modifications are made in the front section of the vehicle or equipment is installed on the front of the cab, the SRS air bag may not operate normally. When making such modifications or installing such equipment, modify the air bag to disable its activation after explaining the reason to the purchaser of the vehicle.

If you have any questions about the modification method to disable air bag activation or if you install special equipment other than those listed below, consult the department in charge ▷ page 14.

(a) Modifications to front bumper, vehicle front frame or cab (mobile X-ray vehicles, etc.)
(b) Installation of grill guard or winch (off-road vehicles, etc.)
(c) Installation of snow plow (snow-removal vehicles)
(d) Installation of front hanging type cab back crane without hook stowing mechanism (vehicles driven with the hook hanging in front of the cab)

- Never disassemble or modify the steering wheel (including pad section), air bag module (driver's seat), air bag ECU, emergency locking retractor (ELR) of pretensioner-equipped seat belt or air bag harness.
- Do not install or mount equipment above the steering wheel.
- Do not modify or reinforce the cab floor or air bag ECU mounting bracket. Also, take care to ensure they are not subjected to strong shocks.

Precautions when performing electric welding

- Never perform welding work near the air bag. This could cause the air bag to deploy or the SRS air bag system to malfunction.
- In order to discharge electricity stored in the back-up capacitor in the SRS air bag ECU, turn the starter switch OFF, then disconnect the negative terminal of the battery cable and leave it disconnected for at least 1 minute.
- Ground the welding machine near the welded section.
- When the welding work has completed, reconnect the battery cable. Check that AIR BAG is not indicated on the multi-information display when the starter switch is turned ON. If AIR BAG is indicated on the multi-information display, be sure to consult an authorized MITSUBISHI FUSO distributor or dealer.

Precautions when installing equipment

- The SRS air bag system components are installed near the steering wheel and on the seat belt retractor. Do not apply shock to these components, e.g. by hitting the nearby area.
- Do not remove the SRS air bag system components.
- Do not modify the harnesses or connectors for the SRS air bag system. Do not secure other harnesses to the air bag or pretensioner harnesses.
- Do not check the SRS air bag circuit using a multimeter.
- When doing work that subjects the cab to heat (e.g. painting), remove the air bag ECU, air bag module, clock spring and ELR of the pretensioner-equipped seat belt in advance if the cab is heated above 93°C. Consult the department in charge before removing these components. ▷ page 14.
- If the air bag module has been removed, store it on a flat surface with the horn pad facing up. Do not place any objects on the air bag module.
- Take special care when handling the air bag module and air bag ECU. Do not drop them or splash water or oil on them. Never apply shock to the air bag ECU. If the air bag module or air bag ECU is dropped, be sure to replace it with a new one even if there appears to be no problem.
- Do not modify the electric circuit of the SRS air bag. Never use a general-purpose multimeter.
- Never draw power from the SRS air bag fuse.
- Do not turn the clock spring more than 3 revolutions from the neutral position (straight-forward position). Otherwise, the internal harness may break.
- When removing the steering wheel and steering shaft joint, be sure to place the front tires in the straight-forward position and remove the starter key to lock the steering.
- To reinstall the steering wheel, place the front tires in the straight-forward position and the clock spring in the neutral position.
  The clock spring neutral position is where the alignment marks are aligned after turning the spring clockwise as far as it can go and then returning it counterclockwise by the number of revolutions indicated on the label.
- After completing the work, check the SRS air bag warning to confirm that the air bag operates normally. Check that AIR BAG is not indicated on the multi-information display in the meter cluster when the starter switch is turned ON. If AIR BAG is indicated on the multi-information display, be sure to consult an authorized MITSUBISHI FUSO distributor or dealer.

Miscellaneous

- When doing work that is not listed in this section, be sure to consult an authorized MITSUBISHI FUSO distributor or dealer.
- When replacing or disposing of an SRS air bag, or when taking actions to put the vehicle out of service with an SRS air bag, be sure to consult an authorized MITSUBISHI FUSO distributor or dealer.
- If you have any questions about installing equipment or modifying the vehicle, consult the department in charge ▷ page 14.

6.16.2 Hill start assist system <Vehicles with hill start assist system>

The hill start assist system is an electronic system controlled by a computer.

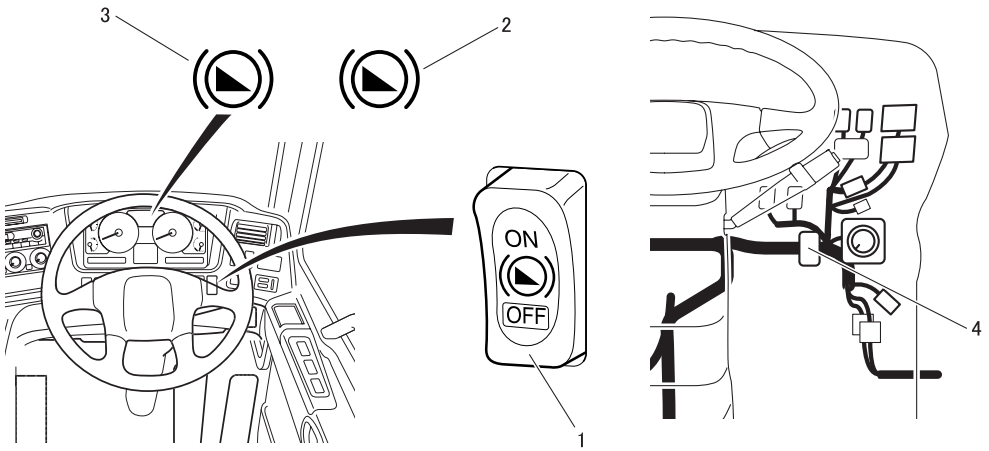
To prevent damage to electronic parts, special attention must be paid to this system when performing body mounting operations involving electric welding.

Functions

The hill start assist system is set on a vehicle equipped with INOMAT-II. It maintains a constant braking force when the vehicle is stopped on a hill, even after the driver removes his foot from the brake pedal, and automatically removes this braking force when the vehicle moves off.

This system prevents the vehicle from reversing (or moving off) when the vehicle is stopped on a hill, from when the driver removes his foot from the brake pedal until he depresses the accelerator pedal.

In the case of a tractor, this system can only maintain a force sufficient to brake the vehicle, so it may be unable to completely stop the vehicle on account of the weight of the trailer and the gradient of the hill.



Names of parts

1 *Hill start assist system main switch*
2 *Indicator lamp (green)*
3 *Warning lamp (amber)*
4 *Hill start assist system reset switch*

Operations

- The hill start assist system is activated when the hill start assist system main switch is turned ON and deactivated when it is turned OFF.
- While the hill start assist system is active, the indicator lamp (green) remains lit.
- The warning lamp (amber) is lit when the starter switch is placed in the ON position, and extinguished in a few seconds if no abnormalities are found. If the lamp does not come on when the starter switch is turned ON or it does not go out after several seconds, have the system checked at an authorized MITSUBISHI FUSO distributor or dealer.
  If the lamp illuminates during travelling, the hill start assist system may be faulty. Turn the hill start assist system main switch to the OFF position and have the system checked at an authorized MITSUBISHI FUSO distributor or dealer.
- The hill start assist system reset switch is used to restore the brake release timing if its setting is disturbed by replacing the clutch or adjusting the play of the clutch play.

Precautions during body mounting

- For precautions to be taken when performing electric welding works, refer to 5.2 "Welding work" ▷ page 49.
- For safety, avoid sharing exsiting fuse with extra electrical device. In the case of fuse for Hill start assist system blow out, the system stops working.

6.16.3 Anti-lock brake system (ABS)

<Vehicles with ABS>

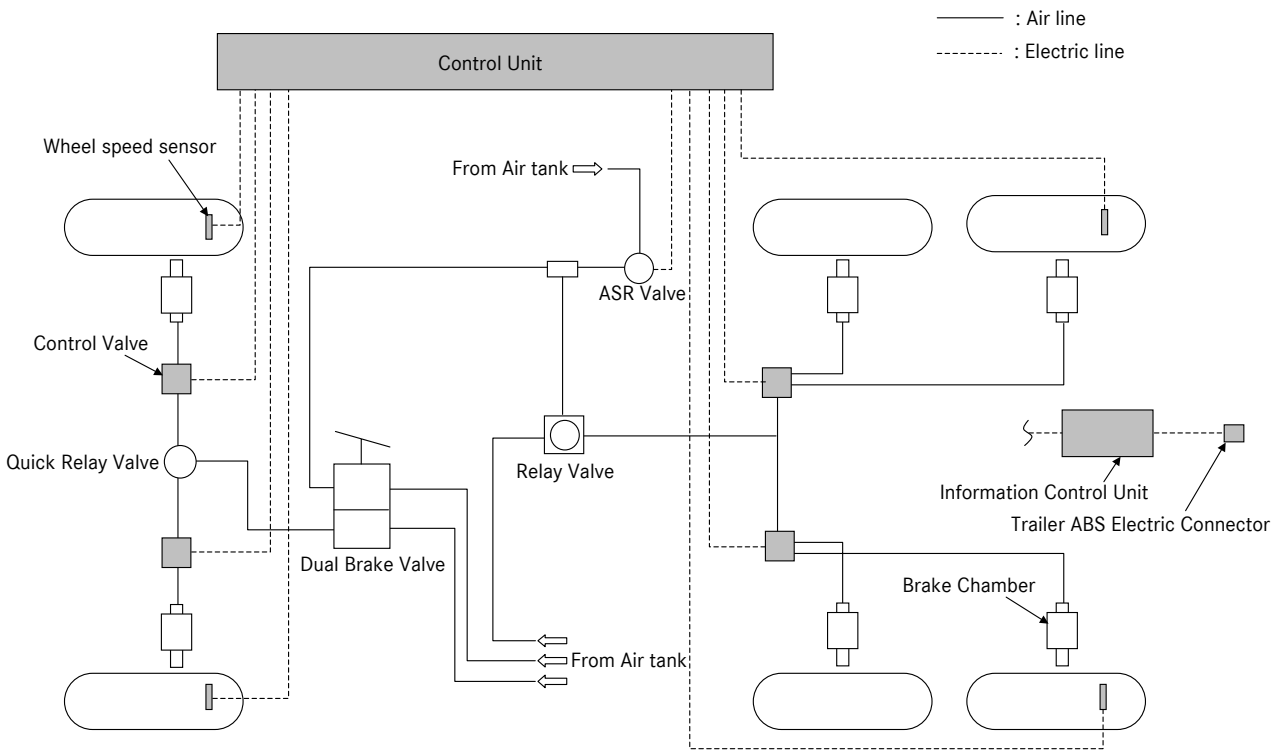
Place the starter switch in the "OFF" position before disconnecting the harness connector of the anti-lock brake system control unit.

For precautions when performing electric welding, refer to 5.2 "Welding work" ▷ page 49.

When cleaning the inside of the cab, be careful not to splash water on the control unit, relay, connectors, etc.

Do not attempt to make the following modifications, otherwise the parts may malfunction:

- Modification (such as cutting off, splicing, etc.) of wiring harnesses and connectors of the anti-lock brake system, ASR and hill start assist system
- Reconfiguration of the control unit



Schematic system diagram <Full air brake>

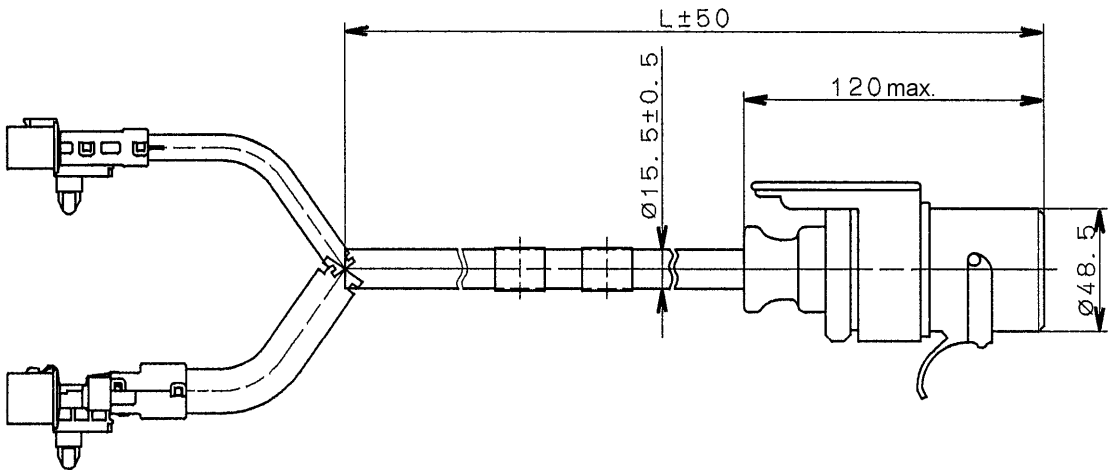
Change of anti-lock brake system-related parts

- The control valve may not operate normally if its exhaust port is blocked with ice, snow, etc. Install the control valve in a place free from ice or snow accumulation, with enough space below the exhaust port.
- Pipes and tubes may be extended provided it is done before the control valve.
  However, only extension the pipe or tube of the specified size must be used.

Checking the anti-lock brake electrical system after completing the body mounting procedure

- Upon completion of body mounting works, check the anti-lock brake electrical system for abnormalities using an appropriate tester such as MUT.
- For details on how to use an MUT, contact an authorized MITSUBISHI FUSO distributor or dealer.

ABS jumper cables (for trailer)



L	Mitsubishi part number
5000	MK419779

6.16.4 INOMAT-II (mechanical automatic transmission)

<Vehicles with INOMAT-II>

Precautions for removal of INOMAT-II parts (main unit and pipes and wires)

Do not step on the transmission main unit during the procedure.

- Pipes
  - If pipes or tubes have been removed, use care not to allow foreign objects to enter any of the INOMAT parts and pipes during reinstallation. Entry of foreign objects could cause the INOMAT parts to malfunction.
  - After the reinstallation procedure, be sure to perform "INOMAT-II system initial setting" ▷ page 141.
- During electrical welding operations
  Current from the welding machine may flow backward to damage electronic devices. See 8.7 "Precautions for electric welding" ▷ page 189.
- Clearance from pipes and harnesses
  Allow a clearance of 25 mm or more between a pipe or harness and another part.
  If it is not feasible to allow a clearance of 25 mm or more from a part placed on the same plane, clamp the pipe or harness at an appropriate position, ensuring that the pipe or harness will not be loose.

INOMAT-II system initial setting

- The INOMAT-II system initial setting is an operation that stores the sensor voltage values of each sensor at each of the gear positions, at the partial clutch position, and at the G sensor when the vehicle is on a flat road in the INOMAT-II ECU.
  Be sure to make the initial setting after the vehicle has been serviced.
  With a faulty symptom evident during ordinary running, the initial setting procedure may eliminate the problem.
- Calibrating the air suspension or performing body building of any sort may result in an error in recognition of gradient of the INOMAT-II system. After such an operation, therefore, make the initial setting of the INOMAT-II system (initial settings of the partial clutch engagement starting point and the road gradient calculation value) with the vehicle on a flat road and in an unloaded condition.

Initial setting items

Item	Description	Performance timing
Gear position initial setting, initial settings of the partial clutch engagement starting point and the road gradient calculation value	• Store in memory the voltage value of the stroke sensor of the gearshift unit at each gear position (shift, select, range, splitter). • Store in memory the partial clutch engagement voltage value of the stoke sensor of the clutch actuator.	• When the gearshift unit (shift cylinder, select cylinder, range cylinder) is removed and reinstalled • When the transmission is replaced with a new one • When the clutch main unit or flywheel is replaced with a new one • When the clutch actuator is replaced with a new one • When the INOMAT-II ECU is replaced with a new one

- Procedure
  Initial setting of the road gradient calculation value is made at the same time of the initial setting of the partial clutch engagement starting point. Make the initial settings under the following conditions:
  - The vehicle is stationary, with its brake released and its tires in contact with a flat road so as to be able to remain stationary without drifting in a longitudinal direction.
  - The vehicle is mounted with tires inflated to the specified air pressure.
  - The cab tilt is locked.

Set the vehicle into the following conditions:
- Stationary
- Parking brake applied
- Shift lever in "N" position
- Starter switch in ON position
- Engine stationary
- Connector "Initialization mode switch" disconnected

↓

Reset the initial setting values (see the table (a) below.)

↓

Initial settings of the partial clutch engagement starting point and the road gradient calculation value (see the table (b) below.)

↓

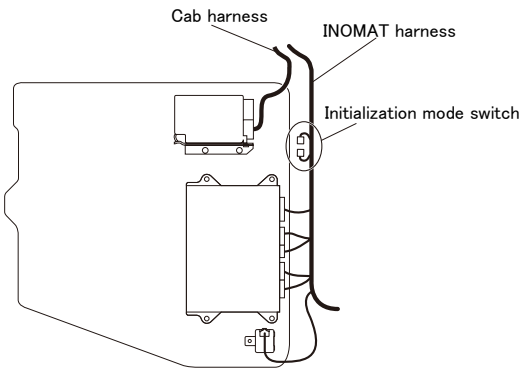
Gear position initial setting (see the table (c) below.)

↓

Connect the connector "Initialization mode switch". This cancels the initial setting mode.

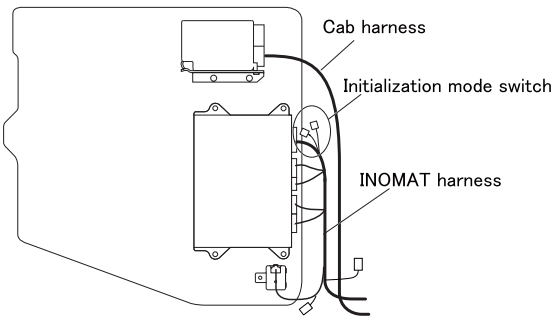
D

For right hand drive
(Bed on assistant driver's seat side)



H

For left hand drive
(Bed on driver's seat side)



(a) Resetting the initial setting values

Operator action	System operation
• Stop the vehicle. • Apply the parking brake. • Place the shift lever in "N" position. • Turn ON the starter switch. • Stop the engine. • Disconnect the "Initialization mode switch" connector. • Apply the foot brake.	Enters the initial setting mode standby state. Gearshift indicator "1" flashes off and on.
Check the engine is stopped and that the shift lever is in "N" position. While keeping the brake pedal pressed (while keeping the brakes applied), keep the accelerator pedal pressed fully (or to a throttle opening of at least 80%).	Gearshift indicator "2" and "3" flash off and on in that order.
	• Gearshift indicator "N" flashes off and on and a buzzer sounds for 1 second. → Resetting is completed. • Gearshift indicator "R" flashes off and on and a buzzer remains sounding. → System failed in resetting.
Release the foot brake or the accelerator (75% or less).	Gearshift indicator "1" flashes off and on and the system enters the initial setting mode standby state.

(b) Initial settings of the partial clutch engagement starting point and the road gradient calculation value

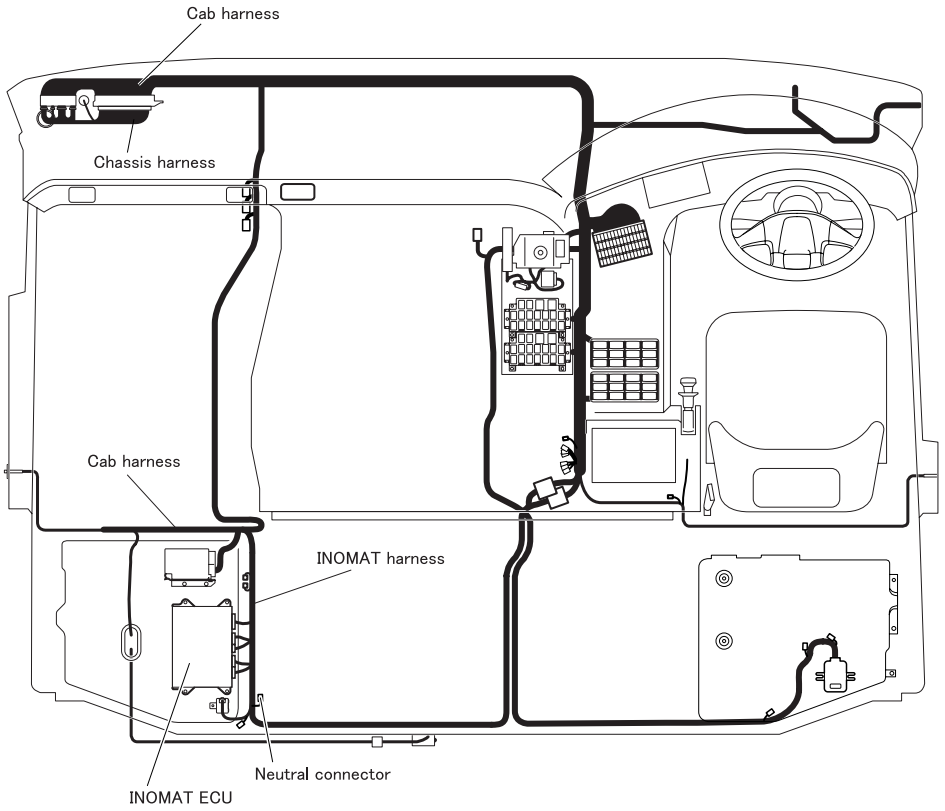
Operator action	System operation
With the system in the initial setting mode standby state, move the shift lever once from the "HOLD" position to "+" position.	• The clutch is disengaged, gearshift unit is set into the neutral position, gearshift indicator "2", "3", and "4" flash off and on in that order, and the buzzer sounds.
Start the engine.	• Recognizing that the engine has been started, the system causes gearshift indicator "5" to flash off and on.
Move the shift lever once from the "HOLD" position to "-" position.	• Initiates a partial clutch engagement starting point detection sequence, with its progress being indicated by gearshift indicators "6", "7", and "8" flashing off and on in that order.
–	• Gearshift indicator "N" flashes off and on and the buzzer sounds for 1 second. → Initial setting is successful. → (Return the shift lever back in the "N" position; with the system in the initial setting mode standby state, initial setting of the partial clutch engagement starting point is completed.) • Gearshift indicator "R" flashes off and on and the buzzer remains sounding. → System failed in initial setting. → Return the shift lever back in the "N" position and make the initial setting again. → If the sequence fails again, check the clutch actuator.

(c) Gear position initial setting

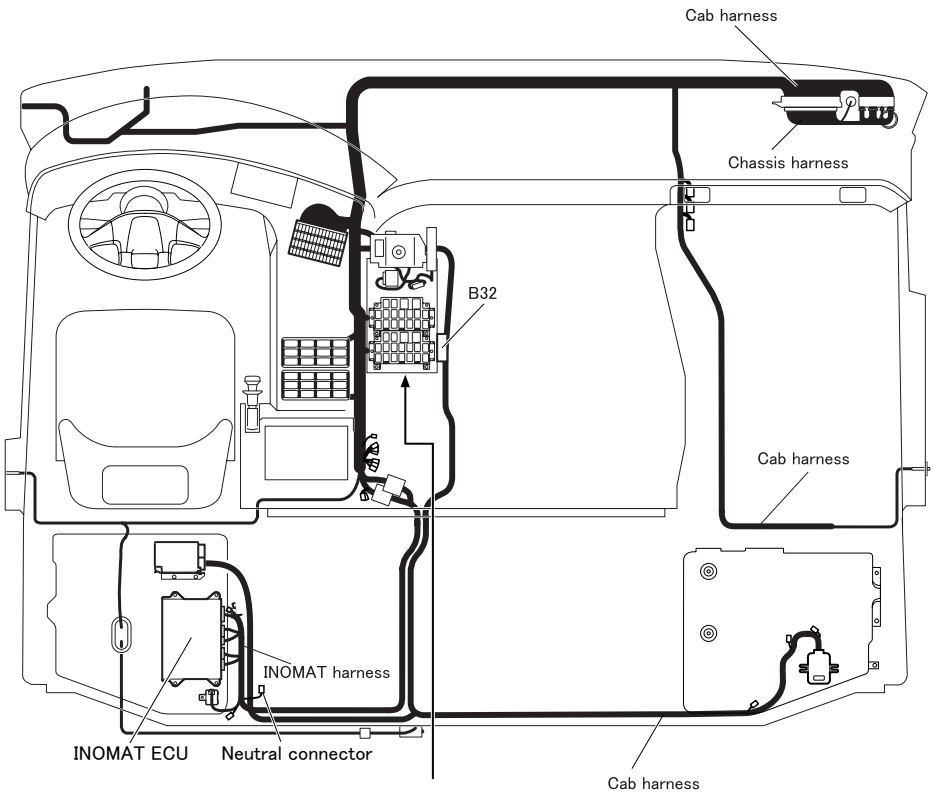
Operator action	System operation
With the engine started and the system in the initial setting mode standby state, move the shift lever once from the "HOLD" position to "-" position.	• The clutch is disengaged and gearshift indicator "2", "3", and "4" flash off and on in that order, and the buzzer sounds.
Start the engine.	• Initiates a sequence to detect each gear position. • The progress is displayed by gearshift indicator "1" → "2" → ... "7" → "8" flashing off and on.
–	• Gearshift indicator "N" flashes off and on and the buzzer sounds for 1 second. → Initial setting is successful. → (Return the shift lever back in the "N" position; with the system in the initial setting mode standby state, gear position initial setting is completed.) • Gearshift indicator "R" flashes off and on and the buzzer remains sounding. → System failed in initial setting. → Return the shift lever back in the "N" position and make the initial setting again. → If the sequence fails again, check the gear shift unit.

Taking out the transmission neutral signal

An identification flag is provided near the neutral signal output connector.



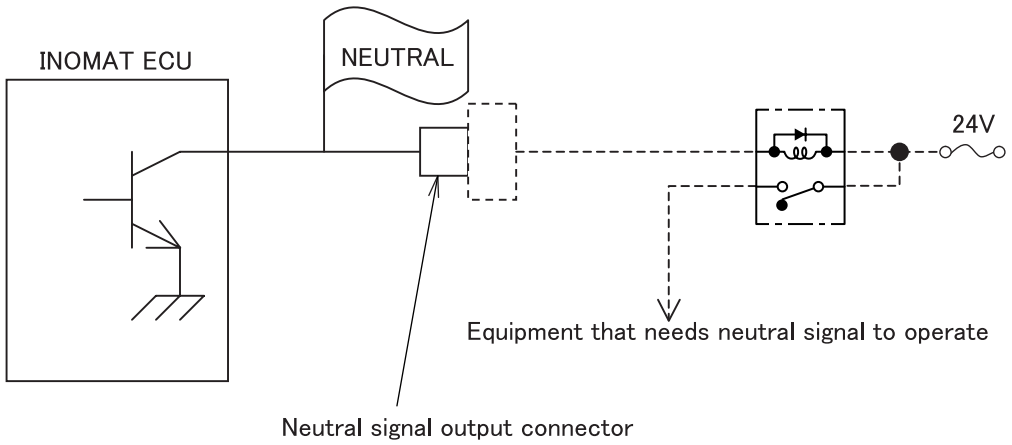
D



When equipment that needs neutral signal to operate is installed as custom-built truck body, use the neutral signal output connector provided near the INOMAT electronic control unit. In this case, allowable current for the INOMAT electronic control unit is so small (0.2A) that additional relay is required.

When the transmission is in neutral: Transistor ON (relay coil is energized to switch contact)

When the transmission is not in neutral: Transistor OFF



6.16.5 Precautions for a concrete pumping truck

<Vehicle with INOMAT-II>

Be sure the customer understands the procedures and precautions in this section to ensure safe operation of the concrete pumping truck.

Risk of accident

NEVER carry out the following operations.

These operations may result in the drive force to the tires being lost or cut off, leading to an unforeseen accident.

- Operating the PTO switch while the truck is traveling
- Operating the PTO switch while the concrete pump is operating
- Operating the concrete pump without operating the parking brake
- Releasing the parking brake while the concrete pump is operating
- Operating PTO switch while depressing accelerator pedal.
- Operating PTO switch without shift lever N position.

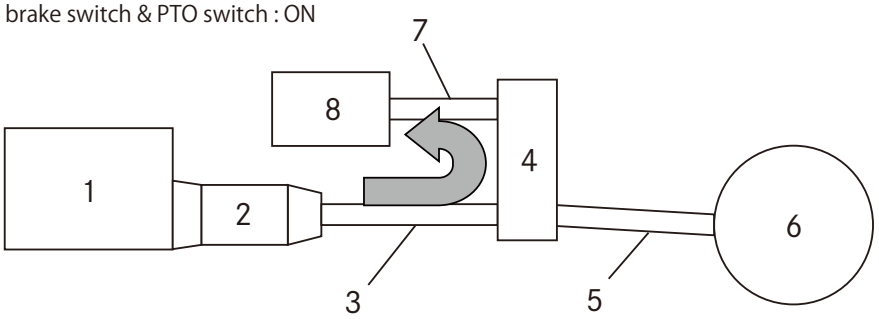
Additional information

The failsafe function sounds a warning if the transfer PTO is operated incorrectly as follows:

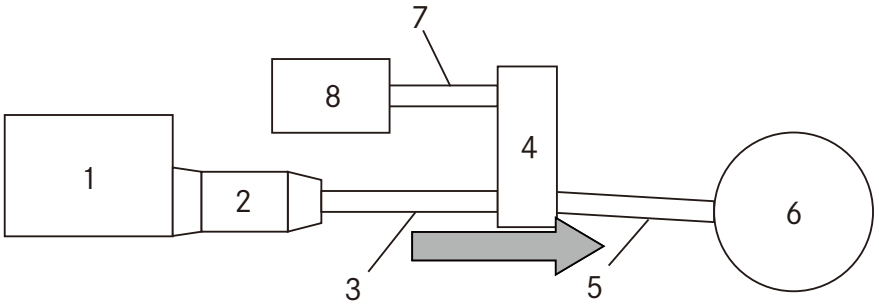
- If the PTO switch is turned on when the shift lever is not in the "N" position. (The warning sound stops when the shift lever is set in the "N" position or the PTO switch is turned off.)
- If the starter switch is turned on when the PTO switch is in the "ON" position. (The warning sound stops when the starter switch or PTO switch is turned off.)

Switching diagram of power transfer

Parking brake switch & PTO switch : ON



Parking brake switch or PTO switch : OFF



1. Engine
2. Transmission
3. Properller shaft front
4. Transfer
5. Properller shaft rear
6. Rear axle and Tire
7. PTO properller shaft
8. PTO

Operation

(a) Concrete pump operating procedure

Operator action	System operation
• Operate the parking brake. • Check that the parking brake indicator lamp lights.	• Parking brake indicator lamp is turned on.
• Put the shift lever in the “N” position. • Check that the “N” gear shift indicator lights.	• "N" gear shift indicator lamp is turned on.
• Start the engine. (Run the engine until warming up.)	
• Set the PTO switch to “ON.”	• Indicator of PTO operation lamp is turned on and indicator of PTO non-operation lamp is turned off. • The “N” gear shift indicator flashes, indicating that the concrete pump is ready to operate. • The control switches over to the specially-equipment vehicle governor.

Operator action	System operation
• Check that indicator of PTO operation lamp is turned on, indicator of PTO non-operation lamp is turned off, the “N” indicator flashes.	
• Put the shift lever in the “D” position.	• Start changing to the concrete pump operating gear position (11th gear). • The target gear position (11) on the gear shift indicator flashes.
• Check that the concrete pump operating gear position (11) indicator lights. • Jack up the vehicle using the outrigger. • Start operating the concrete pump.	• The shift to the concrete pump operating gear position is completed, and the clutch engages. • The concrete pump is ready to operate.

(b) Concrete pump stopping procedure

Operator action	System operation
• Check that the parking brake indicator lamp is lit. • Check that the concrete pump operating gear position (11) indicator is lit. • Stow the outrigger. • Put the shift lever in the “N” position.	
• Check that the “N” gear shift indicator is lit. • Check that speed meter shows 0 [km/h].	• The “N” gear shift indicator flashes, indicating that the concrete pump is ready to operate.
• Set the PTO switch to “OFF” position.	• The control switches over to the normal (for traveling) governor. • Indicator of PTO operation lamp is turned off and indicator of PTO non-operation lamp is turned on.
• Do not release the parking brake until you are about to move off.	• The parked vehicle is ready to travel.

7.1 General

Risk of accident and injury

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

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

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

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

Risk of fire

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

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

Property damage

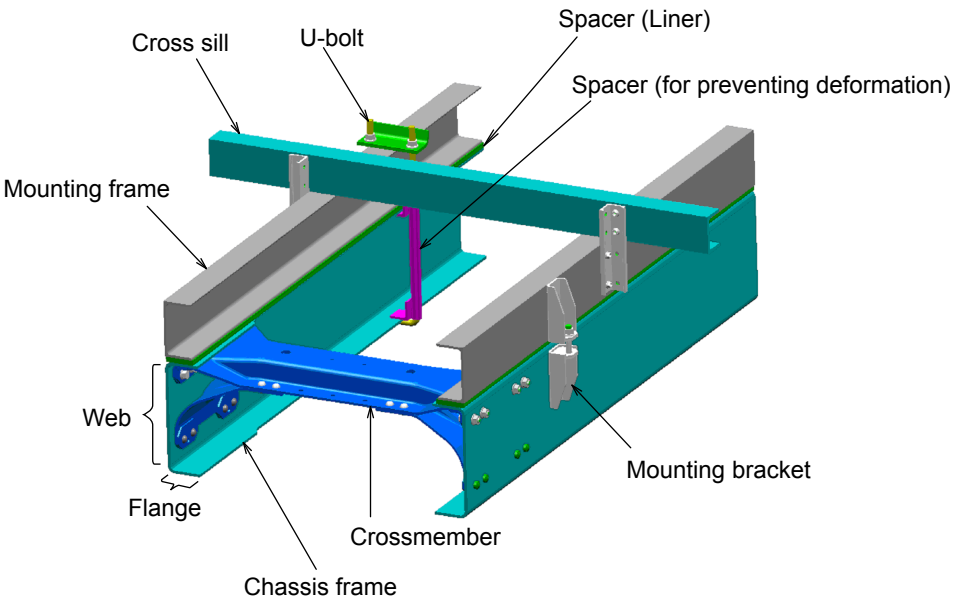
Bodies on which the transmission can be expected to be exposed to high levels of water, e.g. cleaning water (flushing, overflowing or similar), require an effective cover over the transmission (transmission guard) which will prevent abrupt cooling as well as water ingestion via the transmission breather.

Additional information

Further information on bolted and welded connections can be found in Section 3 "Planning of bodies" ▷ page 28 and Section 5 "Damage prevention" ▷ page 48.

7.1.1 Body mounting methods

General



Correct calculation of load on the chassis frame

- If a mounting frame is used, the stress calculation of the chassis frame must be conducted for beams combined with the body to be mounted.
- The mounting frame must be fastened to the chassis frame so firmly that the rear body weight may be borne evenly by the combined chassis frame and mounting frame.
- For the strength calculation of the chassis frame and mounting frame, refer to 10.4 "Weight distribution table" ▷ page 279 and 10.6.2 "Frame section modulus" ▷ page 328.
- The frame stress should be less than the values shown in the table below.

Table of frame stresses (when loaded to rating)

Material / Condition	High tensile steel plate: HTP540 Tensile strength: 540 MPa {55 kgf/mm^2}
Vehicles mainly driven on paved roads	88 MPa {9.0 kgf/mm^2} or less
Vehicles mainly driven on rough roads	64 MPa {6.5 kgf/mm^2} or less

Front structure of the rear body

The cab, air intake duct, side deflector and drag foiler move while the vehicle is travelling. Take care that the mounted components do not interfere with the cab, the air intake duct or other parts.

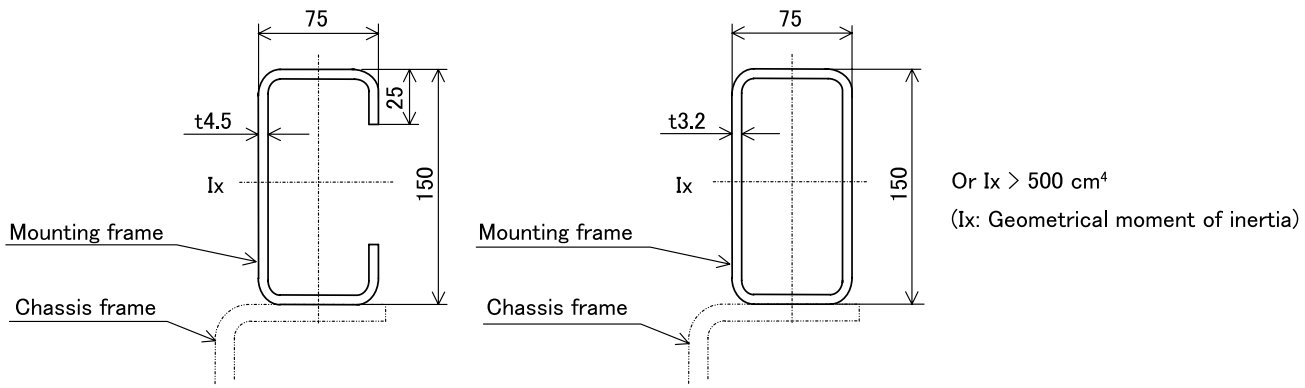
7.2 Mounting frame

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

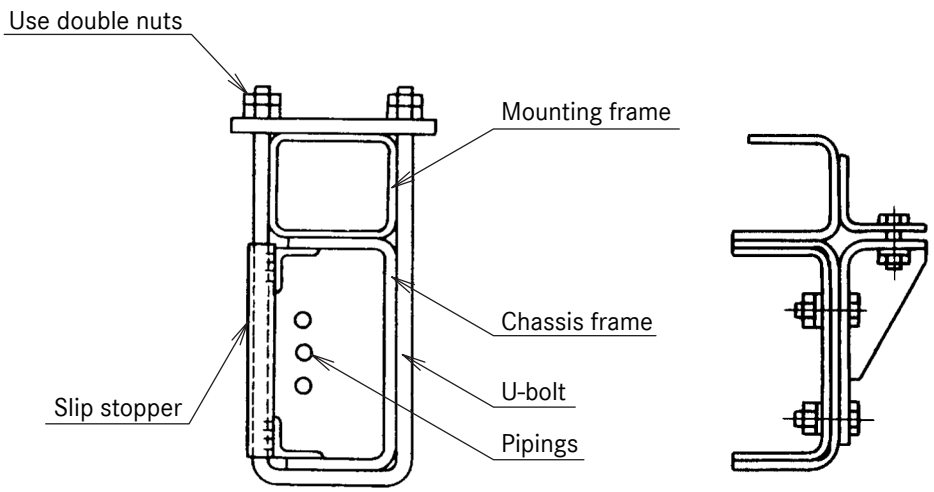
Property damage

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

- For the mounting frame, use one made of steel having the following dimensions or a geometrical moment of inertia greater than those.



- To connect the mounting frame to the chassis frame, either use U-bolts, or in the case of a heavy body building part fix the mounting frame with opposing brackets and ensure that the load imposed by the body building part plus the freight is borne by both the mounting frame and the chassis frame.
  Ensure that the front end connecting part is frontward of the No.2 cross member (transmission suspension part). A large number of holes and wires pass through this area, so take care not to damage them when installing the U-bolts.



Position of mounting frame

- The front end of the mounting frame should be installed as close to the rear of the cab as possible. Extend the mounting frame as far toward the cab as possible when the rear body is installed far from the cab.

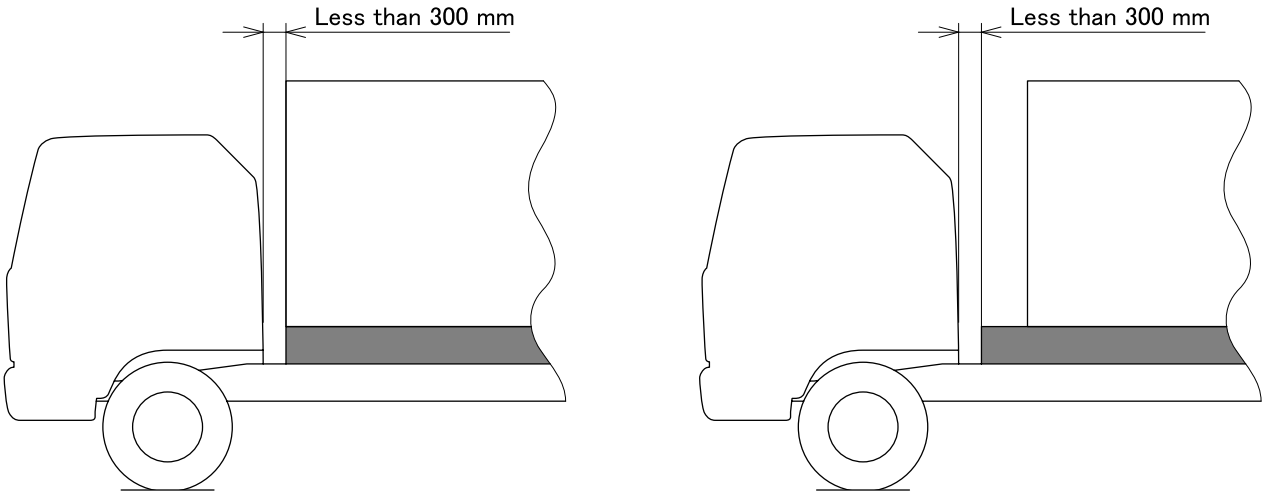
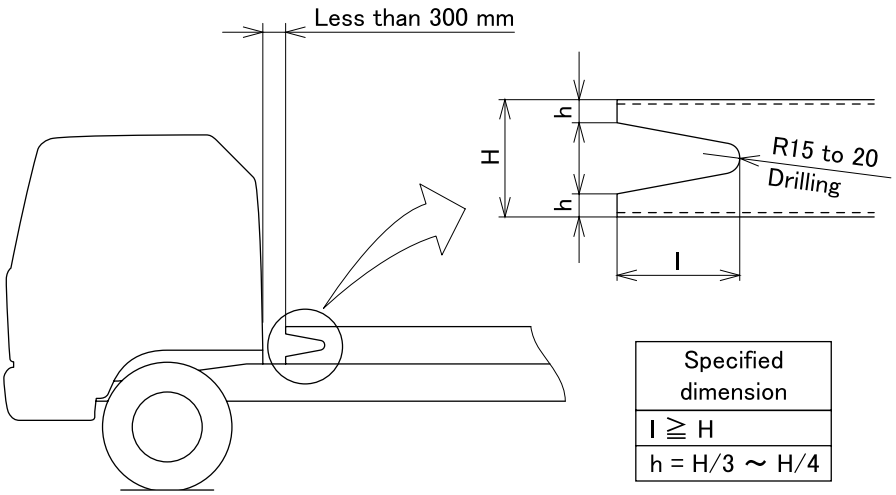


Fig. 1

Examples of front-end shape of mounting frame

- Install the mounting frame having the shape as shown in Fig. 2 to gradually reduce the stress concentrations in the front end.



Specified dimension
l ≧ H
h = H/3 ～ H/4

Fig. 2

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

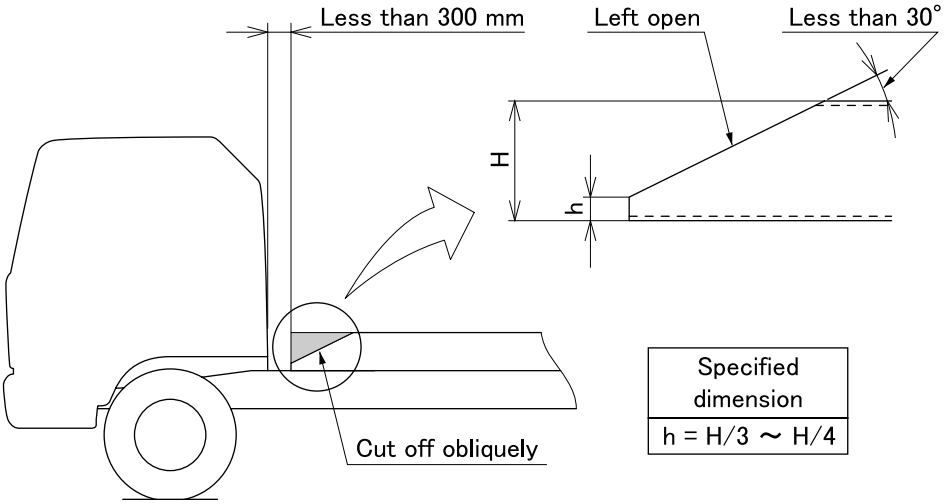


Fig. 3

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

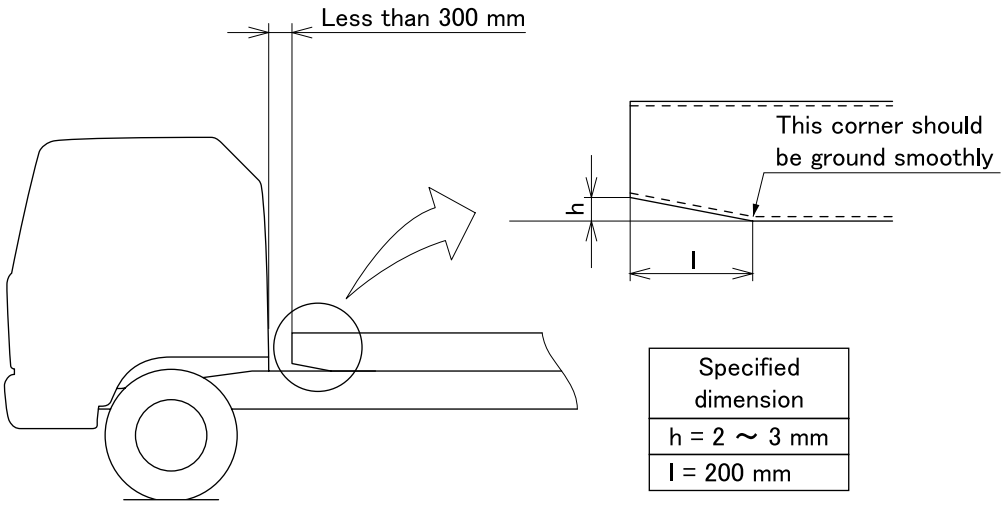


Fig. 4

- When using a wooden block as a mounting frame, shape its front end as shown in Fig. 5 so that no stress concentration may occur between the front end of the mounting frame and the chassis frame.

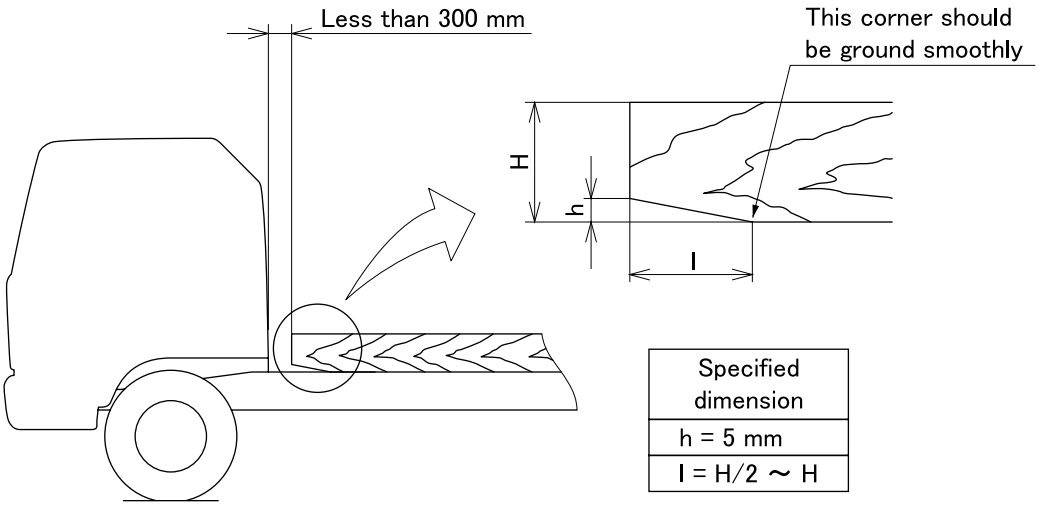


Fig. 5

- If the chassis frame changes its width behind the cab back as shown in Fig. 6 and the mounting frame should extend forward beyond the width-changed portion, the mounting frame must also change its width along the chassis frame. The portion of the mounting frame where the width changed must have the internal surface reinforced with stiffeners as shown in the figure.

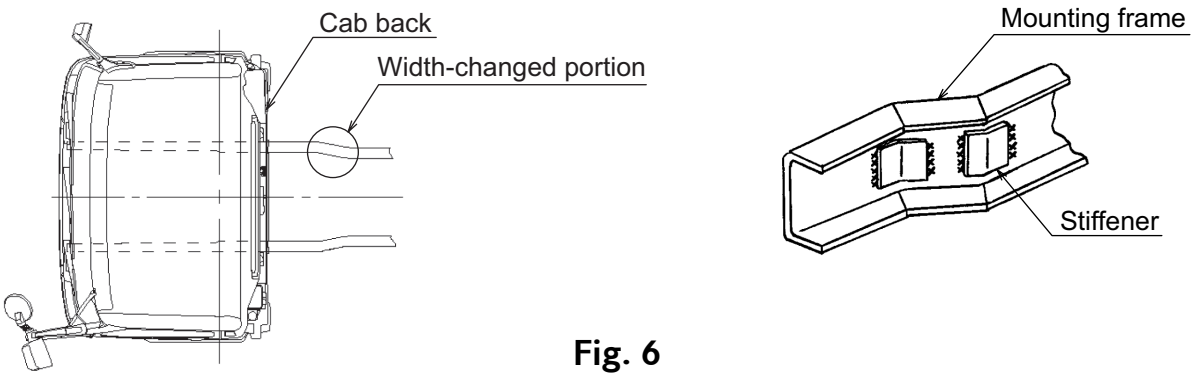
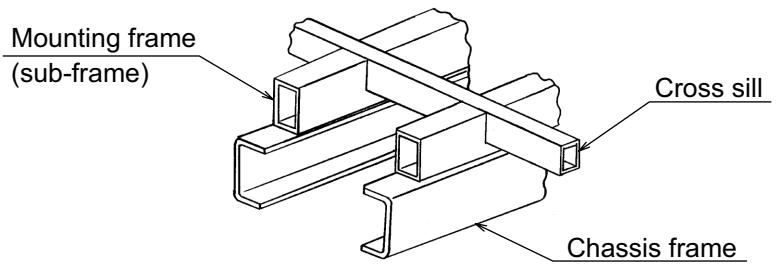


Fig. 6

Other notes

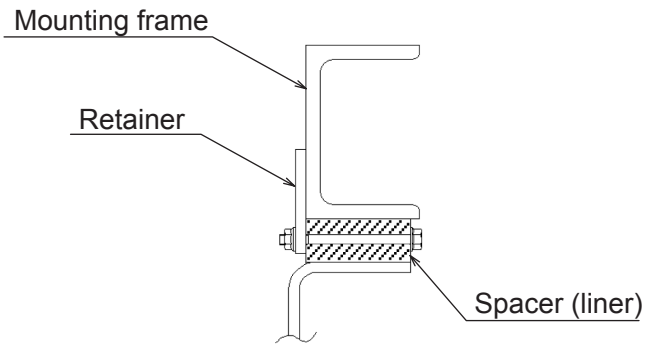
- If, for the sake of a low deck design, the mounting frame and the cross sill must be arranged on the same plane, pass the cross sill member through the mounting frame.



7.3 Mounting frame attachment

7.3.1 Spacer (liner)

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

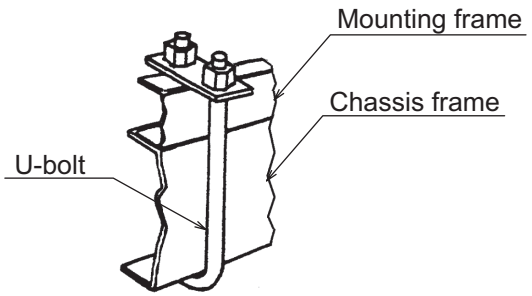


Installation of out-of-position preventive retainer

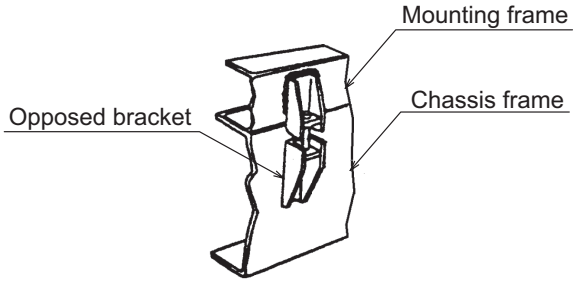
7.3.2 Fastening mounting frame to chassis frame (securing mounted body)

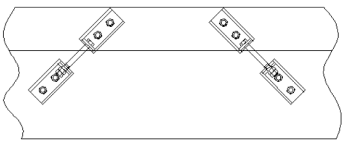
Frame fasteners and their features

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

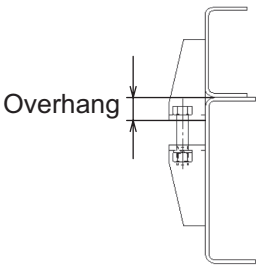


- Opposed bracket
  This is a fastener composed of two brackets opposed to each other (one on chassis frame, one on mounting frame) and one bolt connecting these brackets. This offers a larger fastening force in a vertical direction as compared to a U-bolt. However, it is inferior in the longitudinal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



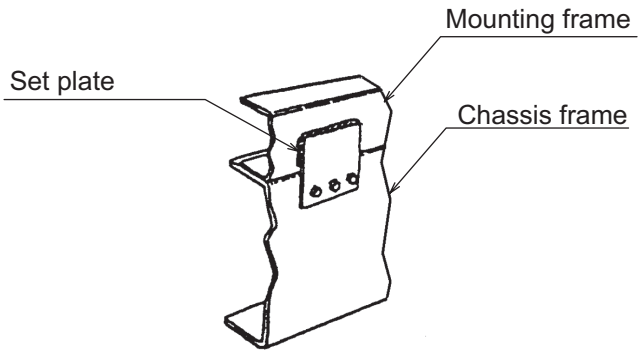


For increasing longitudinal holding force



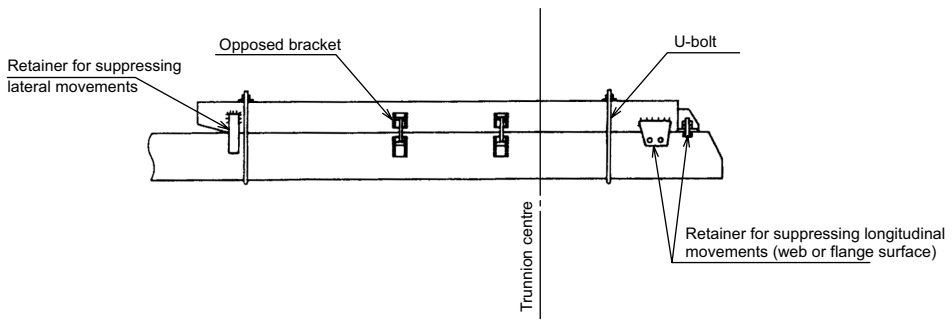
For increasing lateral holding force

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

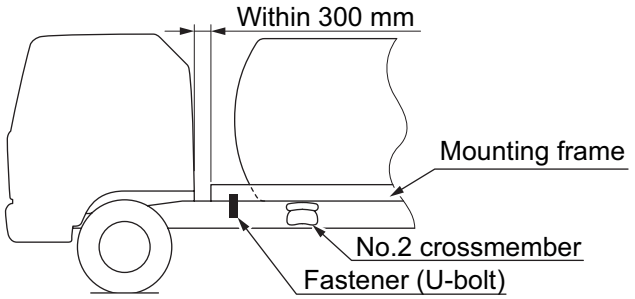


Precautions for fastening frames

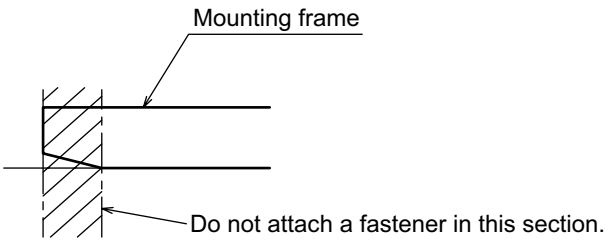
- When fastening the mounting frame to the chassis frame using U-bolts and opposed brackets, use retainers for preventing longitudinal and lateral movements together.



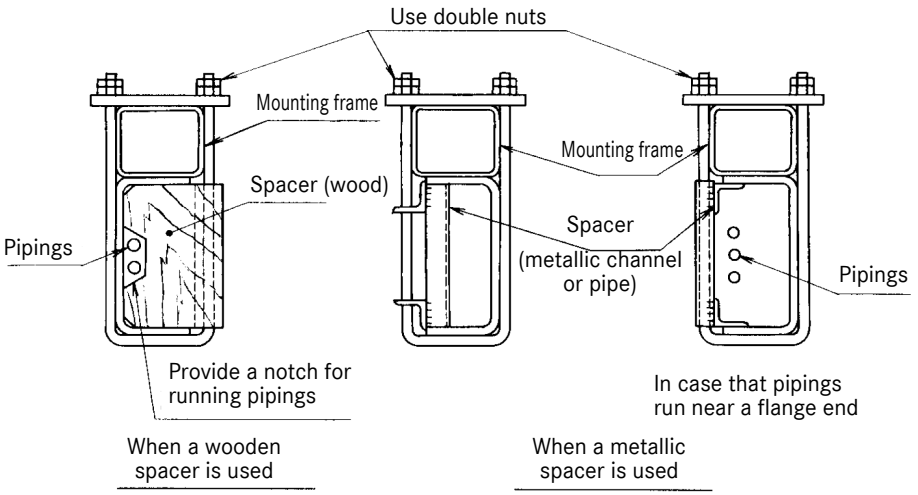
- Even if the distance between the cab back and body front end is larger, extend the mounting frame to near the cab back and secure it at a position before a No.2 crossmember with a fastener.



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

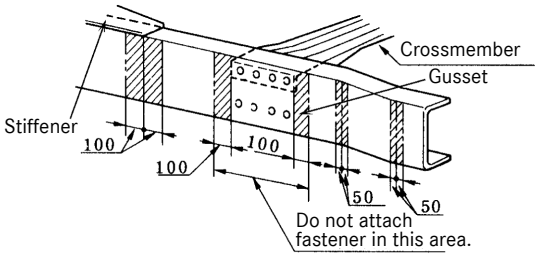


- When the mounting frame and chassis frame are combined with a U-bolt, insert a spacer in the chassis frame at the combined position to prevent the side rail flanges from deforming. When attaching the U-bolt near a hot component such as a muffler, use a metallic spacer, not a wooden spacer which can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



7.3 Mounting frame attachment

- Attaching opposed brackets to a chassis frame should be done with bolts. For the procedure, refer to 6.2 "Chassis frame material" ▷ page 81.
- Do not use U-bolts or opposed brackets for crossmember, stiffener and gusset attaching sections or near the curved section of the chassis frame because these sections are likely to be subjected to stress concentration.

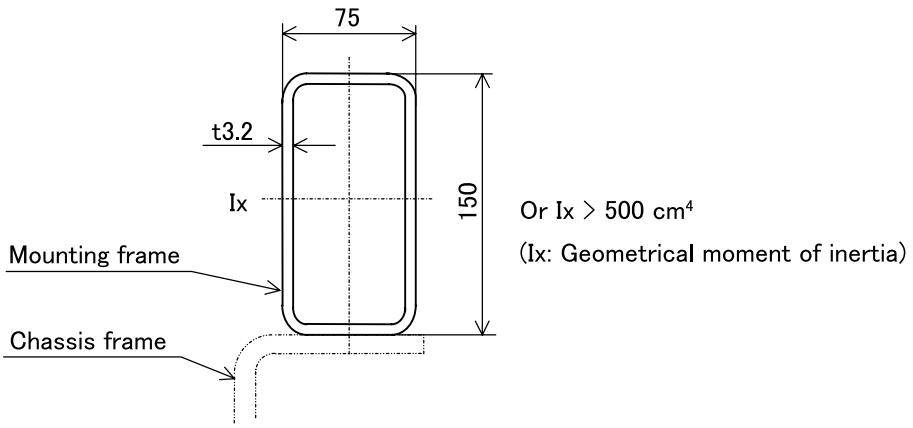


7.4 Others

7.4.1 Dump trucks

Mounting frame

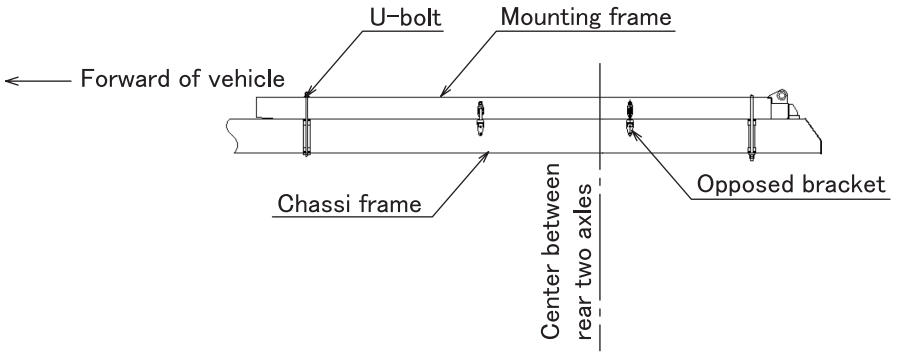
- To achieve vehicle torsional rigidity on rough roads, make sure that the mounting frame is of a closed section structure.
- Ensure that the mounting frame has the following dimensions or a geometrical moment of inertia greater than those.



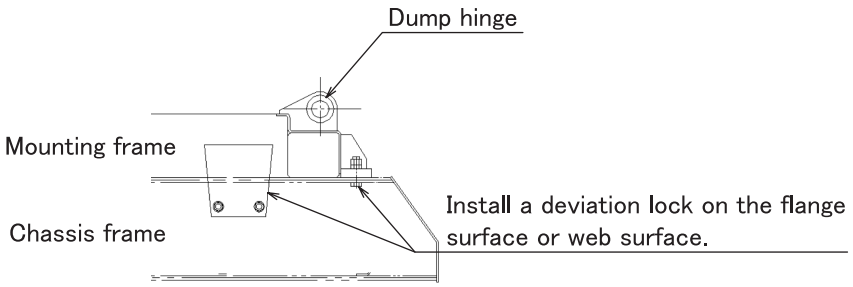
- Be sure to install a mounting frame. If your body building does not have any mounting frames, the chassis frame needs reinforcement. In this case, consult the department responsible ▷ page 14.

Fastening of body

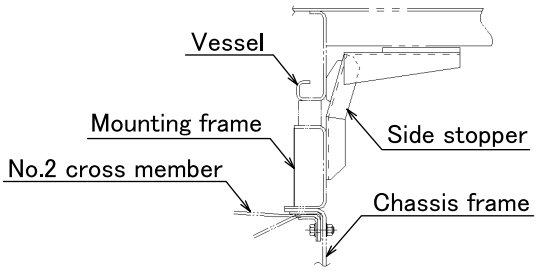
- Rigidly fasten the chassis frame with the mounting frame so that the two bears the load as a single integrated body.
- Use of a U-bolt is recommended for fastening at the frontmost portion in order to absorb relative displacement between the chassis frame and mounting frame.
  The U-bolt should be of M16 or more. Dispose it forwardly of the No. 2 cross member.



- Install a rigid deviation lock at the rear end of the mounting frame. A large load acts from the dump hinge.



- The side stopper for supporting lateral load at the front side of the bezel helps reduce stress on the chassis frame. Dispose the side stopper forwardly of the chassis frame No. 2 cross member.



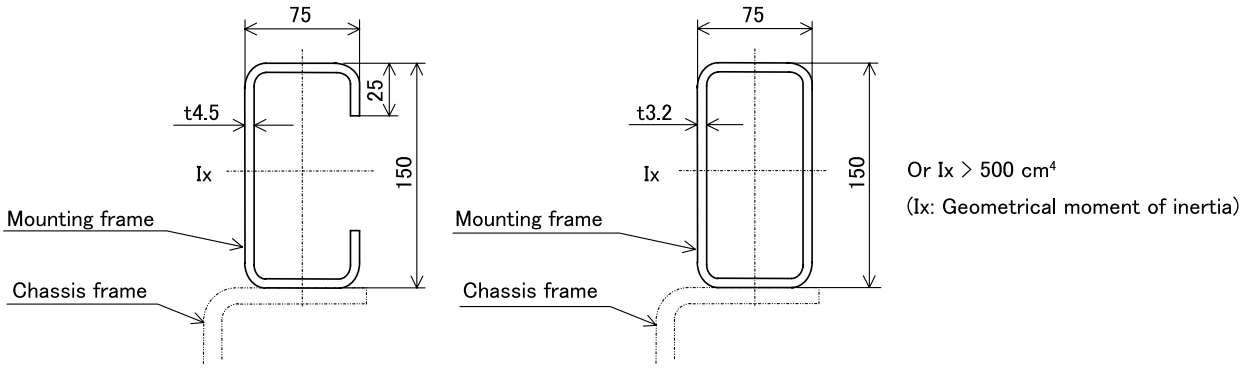
Spacer (liner)

- Never insert a spacer (liner), as it reduces the fastening force between the chassis frame and mounting frame.

7.4.2 Cargo trucks

Mounting frame

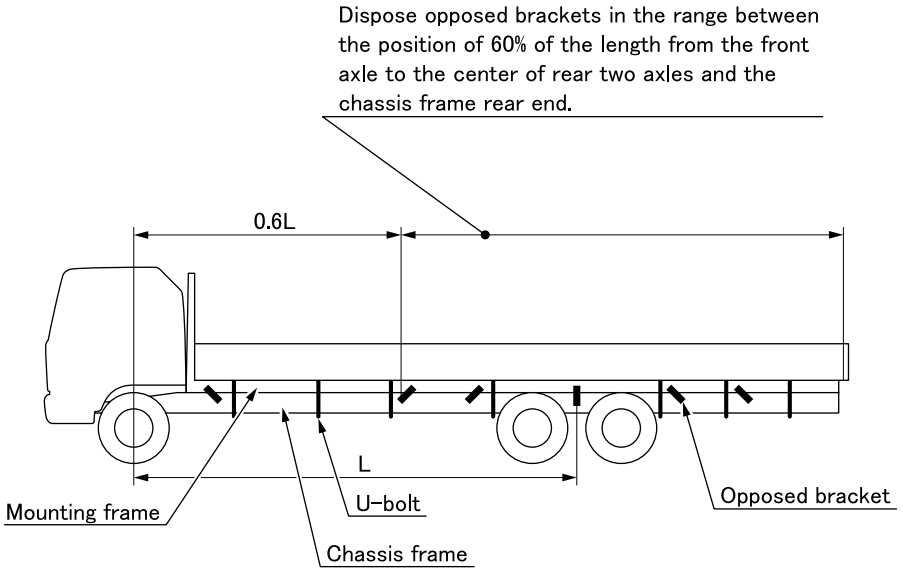
- On a long wheelbase model to be used for carrying heavy articles, use a mounting frame made of steel having the following dimensions or a geometrical moment of inertia greater than those so that centralized load does not act on the chassis frame.



- Lower floor body building may involve the mounting frame being lowered in height. Even in that case, ensure the above geometrical moment of inertia.

Fastening of body

- If there is a concern over the rear overhang drooping on a long wheelbase model, dispose U-bolts and facing brackets as shown below and rigidly fasten the mounting frame and chassis frame in the rear portion of the built body. As guidelines for a long wheelbase model, install seven or more U-bolts and facing brackets at five or more locations on one side of the vehicle.

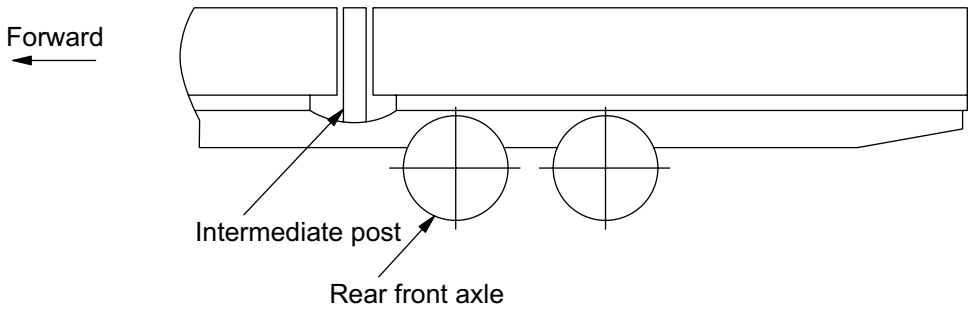


Spacer (liner)

- It is recommended that a spacer (liner) inserted between the chassis frame and mounting frame not be inserted, as it reduces the fastening force.
- For a spacer (liner) to be inserted to adjust floor surface height, use a material having a high rigidity, such as a steel belt and polymer waste.

Intermediate post

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

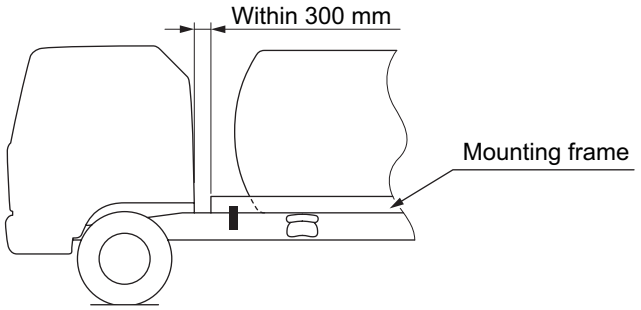


- When installing an intermediate post on a truck with a long wheelbase, taking the chassis frame deflection during loading into consideration, provide an ample space between the post and the side gate so that trouble-free side gate opening/closing operations may be assured.

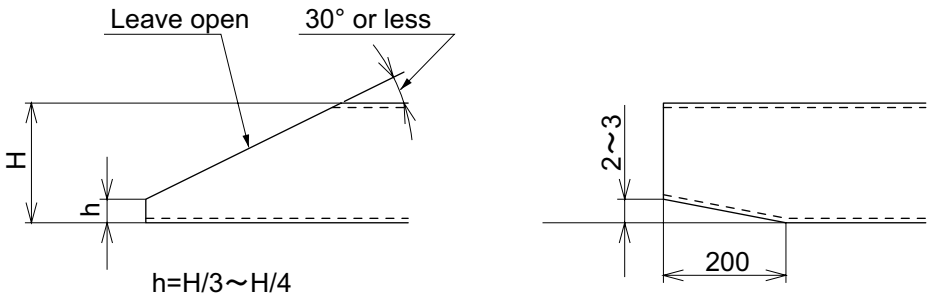
7.4.3 Tank truck, powder carrying vehicle

Mounting frame

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

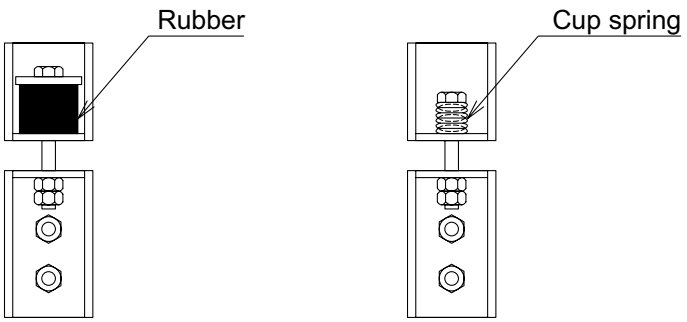


- Cut off the front end of the mounting frame slant or taper to prevent stress concentration.

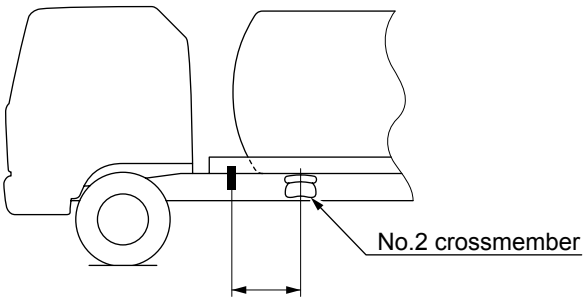


Fastening of body

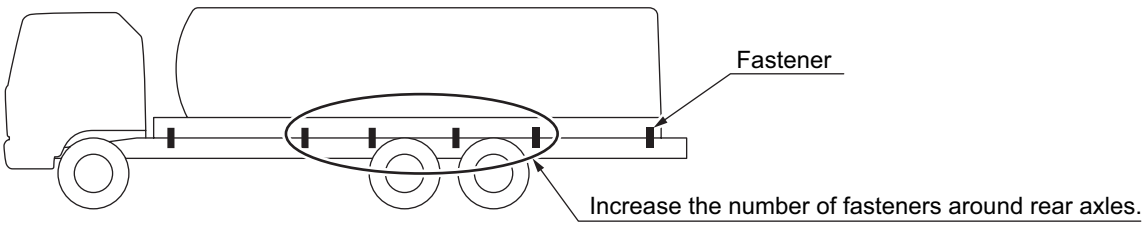
- For fastening at the forefront, use a flexible joint such as shown in the figure below to absorb the relative displacement between the mounting frame and chassis frame.



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



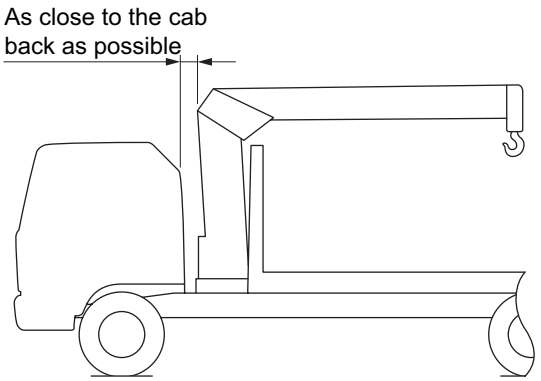
- In case of body mounting on a chassis with a rear tandem axle, use an adequate number of opposed brackets for the area around the rear axles because the body weight is concentrated in the area of the mounting frame and the chassis frame.



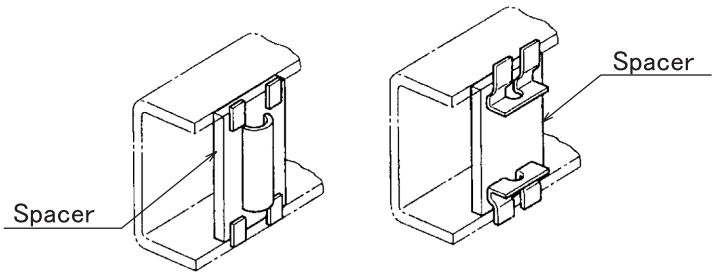
- Inserting spacers (liners) between frames is not recommended because it reduces the fastening force.

7.4.4 Loading crane

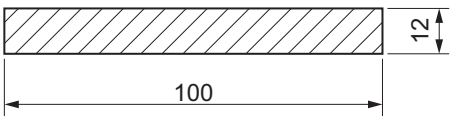
- Be sure to use a mounting frame of box construction for ensuring higher rigidity.
- For reducing cab vibrations and protecting a chassis frame, mount the crane at a position as close to the cab back as possible.



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



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



- Avoid inserting a spacer (liner) between the frames. This can lead to reduced fastening force.
- The frame section near the crane mounting position can be locally subjected to stress concentration during crane operation. Do not forget to reinforce this section with stiffeners. For the frame reinforcement procedure, refer to 6.5 "Reinforcements" ▷ page 87.

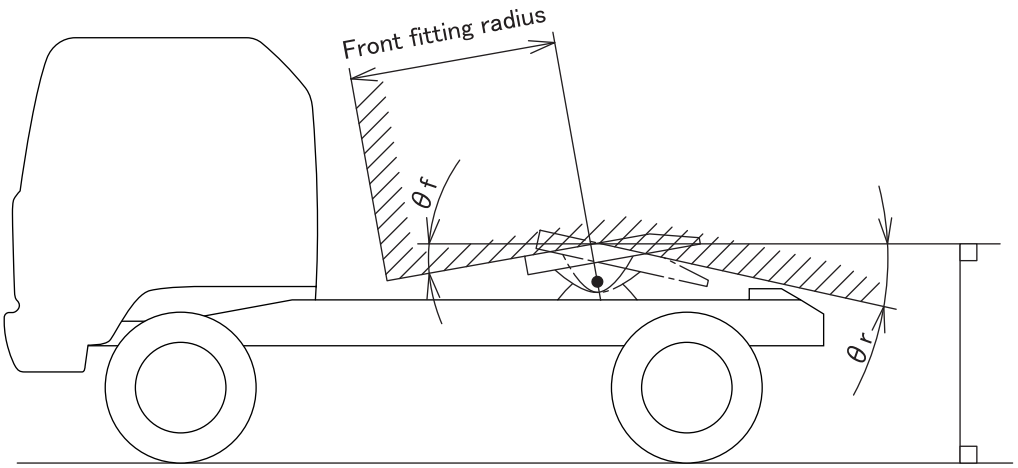
7.4.5 Tractor

Examination of body building

Make sure that the built body on the upper portion of the fender or upper surface of the frame falls within the following limits in order to prevent interference with the trailer lower surface during pitching.

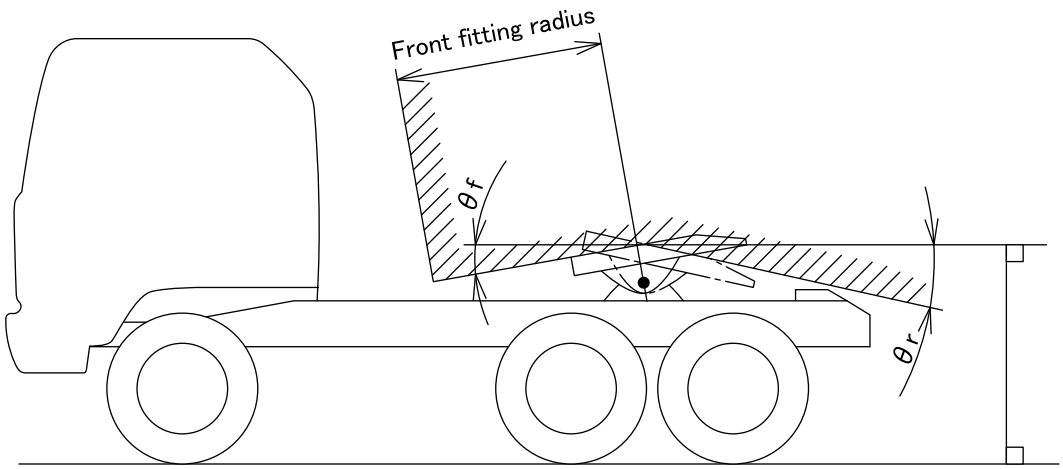
<Model FP-R>

Front fitting radius	θf	θr
Up to 1540	6	7
1540 or more	5	6



<Model FV-R>

Front fitting radius	θf	θr
Up to 2040	6	7



Make sure to achieve allowances for the front fitting radius and lower fitting radius when the trailer is connected.

Connection with trailer

Install air brake hoses and jumper cables so as not to interfere with other parts during swing or cab tilt.
For combination with a type of trailer having a long front overhang, use of coil type hoses and cables is recommended.

Types of coupler

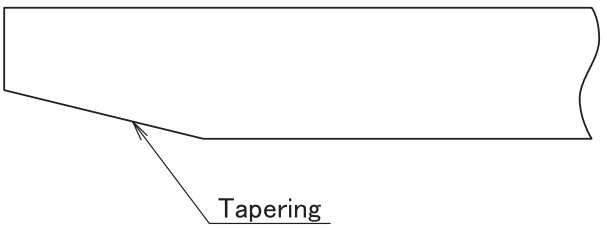
Couplers for general use may be classified into two types: single axle type (pitching type) and double axle type (pitching and rolling types).
The following show the basic rules to be applied for selecting the specific type of coupler according to the purpose of use of the vehicle.

<FP-R>

Purpose of vehicle use	Coupler	Ground clearance of coupler upper surface (empty vehicle)	
		Vehicle with leaf suspension	Vehicle with rear air suspension
For general, high-speed transportation	Single axle type	About 1250 mm	About 1225 mm
For towing ocean container trailer	Single axle type	About 1210 mm	About 1185 mm
For transporting heavy articles and running on rough roads	Double axle type	About 1300 mm	About 1275 mm
		Keep small the difference in height from the kingpin plate of the towed trailer	

Coupler body building

- If it is inevitable to insert a spacer between the coupler base and coupler base bracket in order to raise the coupler height, extend the length of the spacer forwardly as much as possible to thereby ensure that the end portion of the spacer does not cause stress concentration to occur on the frame.
- For double axle coupler body building, do not fix the sub-base directly to the coupler base bracket and, instead, insert a spacer.
- Ensure that the spacer is shaped as shown in the figure below.



<FP-R>

- When connecting the vehicle to a trailer that has a large overall height (container, van, and so on), check the height of the frame above ground, and then take into account the height of the coupler to ensure that the overall height when the vehicle is coupled to the trailer falls within the limit value stipulated by the regulations of the country where the vehicle is used.
- If the coupler base and coupler stopper are not integrated with each other, make sure that the structure avoids stress concentration on the coupler base bracket.

<FV-R>

- The model mainly tows a heavy trailer. Mount the coupler so that the coupler height will be about 1345 mm to 1400 mm.
- The trailer floor surface is particularly low when towing a mid-to-low-floor trailer. Determine the tractor coupler height with care about the trailer kingpin plate height.

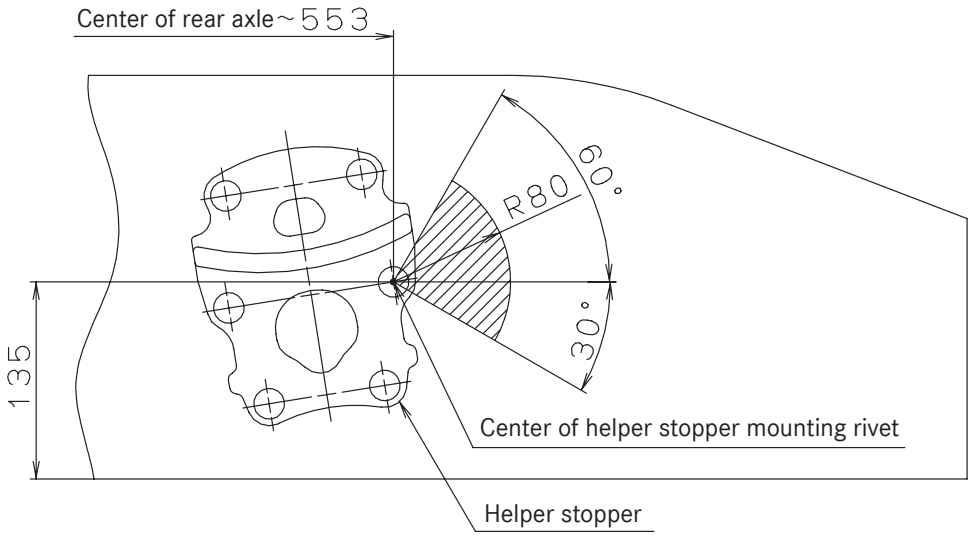
Coupler offset, and front fitting radius and lower fitting radius

Margins for dimensions of the front fitting radius and lower fitting radius when the trailer is connected should be 50 mm and 75 mm, respectively.

Rear fender

<FP-R>

- When installing the rear fender, take into account the dimension when the tire is at the highest position. 10.7.2 "Differential and tire bound height" ▷ page 346
- For the single axle coupler, the clearance between the frame upper surface and coupler upper surface is 195 mm to 253 mm; thus circular rear fender cannot be mounted. Generally, a substantially V-shaped rear fender is mounted.
- For a tractor towing an ocean container trailer, in particular, a structure must be achieved in which the rear fender does not result in an increased lower fitting radius.
- If a circular rear fender is to be attached on a vehicle mounted with a double axle coupler, a spacer of 30 mm or more should be inserted between the coupler and frame to thereby avoid interference between the trailer lower surface and fender during rolling.
- The rear fender is mounted on a tractor with lateral overhangs. So, mount one particularly securely and make sure that its structure prevents resonance during running.
- For rear fender mounting holes, see "Details of rear fender mounting holes" ▷ page 171.
- To prevent interference between the rear fender and the helper spring, do not reinforce the fender stay in the shaded area shown below. (FP51SDR)



- If a mud guard rubber is to be mounted, take necessary steps to prevent it from being wedged and damaged.

<FV-R>

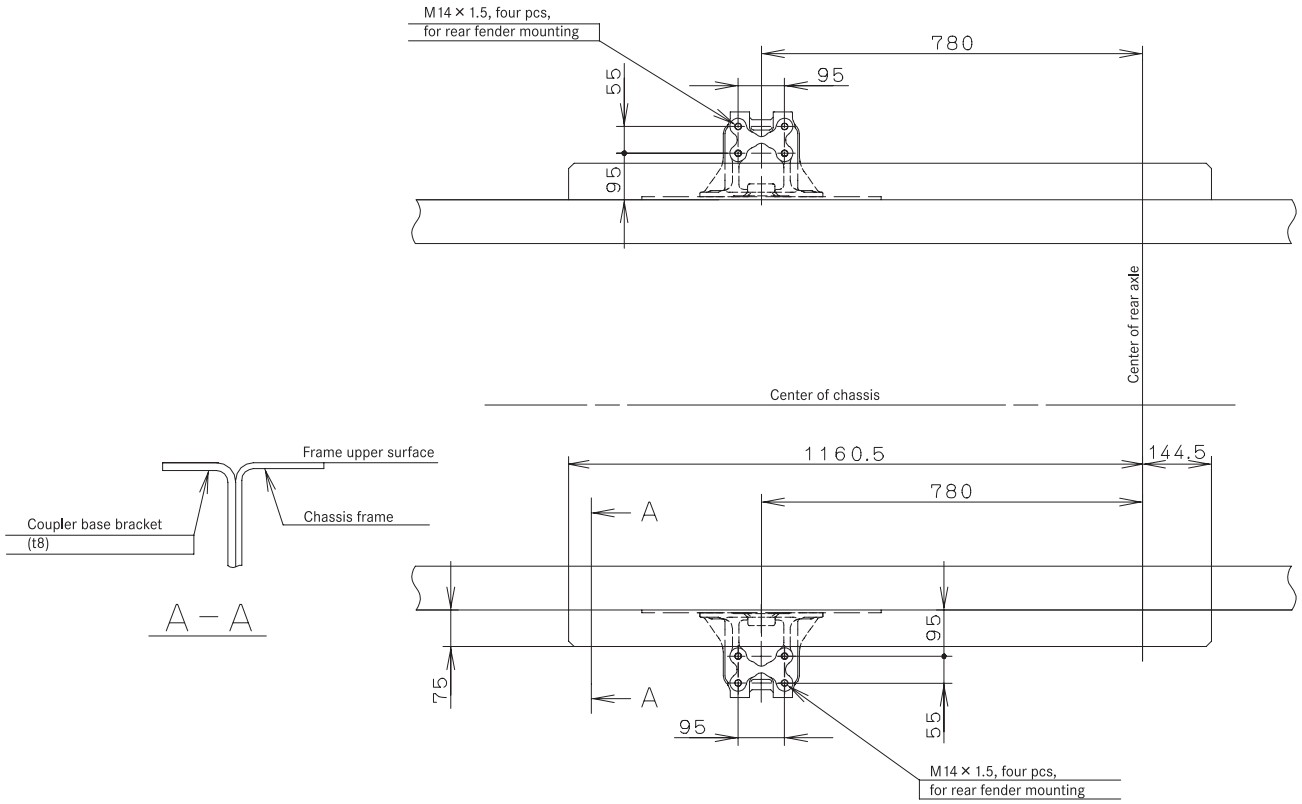
- The low floor and mid-to-low floor trailers typically have a small lower fitting radius. The tractor should therefore also have a small lower fitting radius. Determine the shape of the rear fender based on the abovementioned aspect.
- The rear fender is mounted on a tractor with lateral overhangs. So, mount one particularly securely and make sure that its structure prevents resonance during running.
  For rear fender mounting holes, see "Details of rear fender mounting holes" ▷ page 171.

Details of rear fender mounting holes

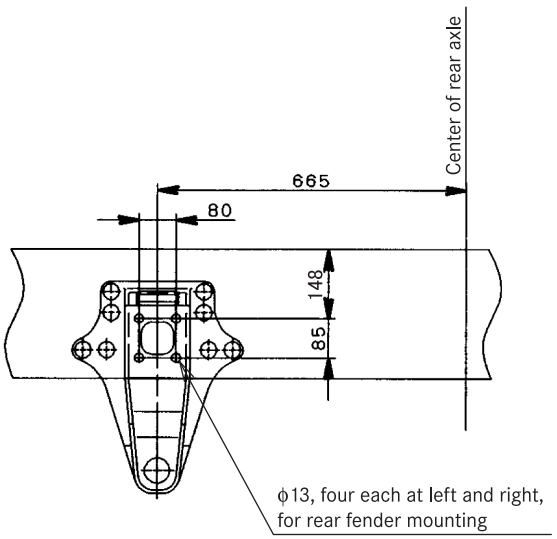
<FP-R>

Front

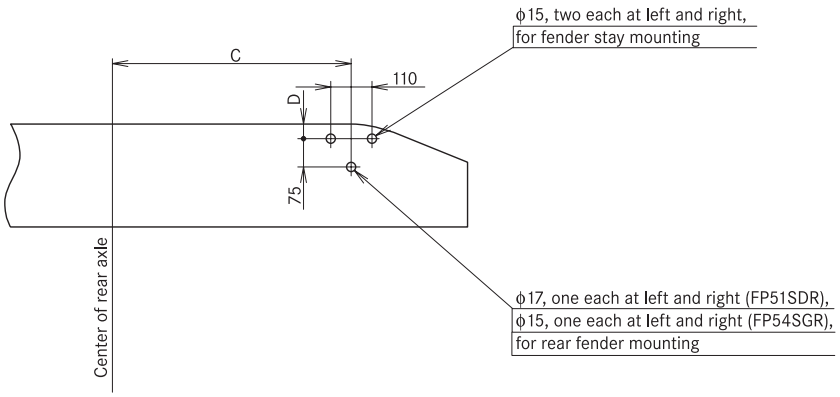
FP51SDR



FP54SGR



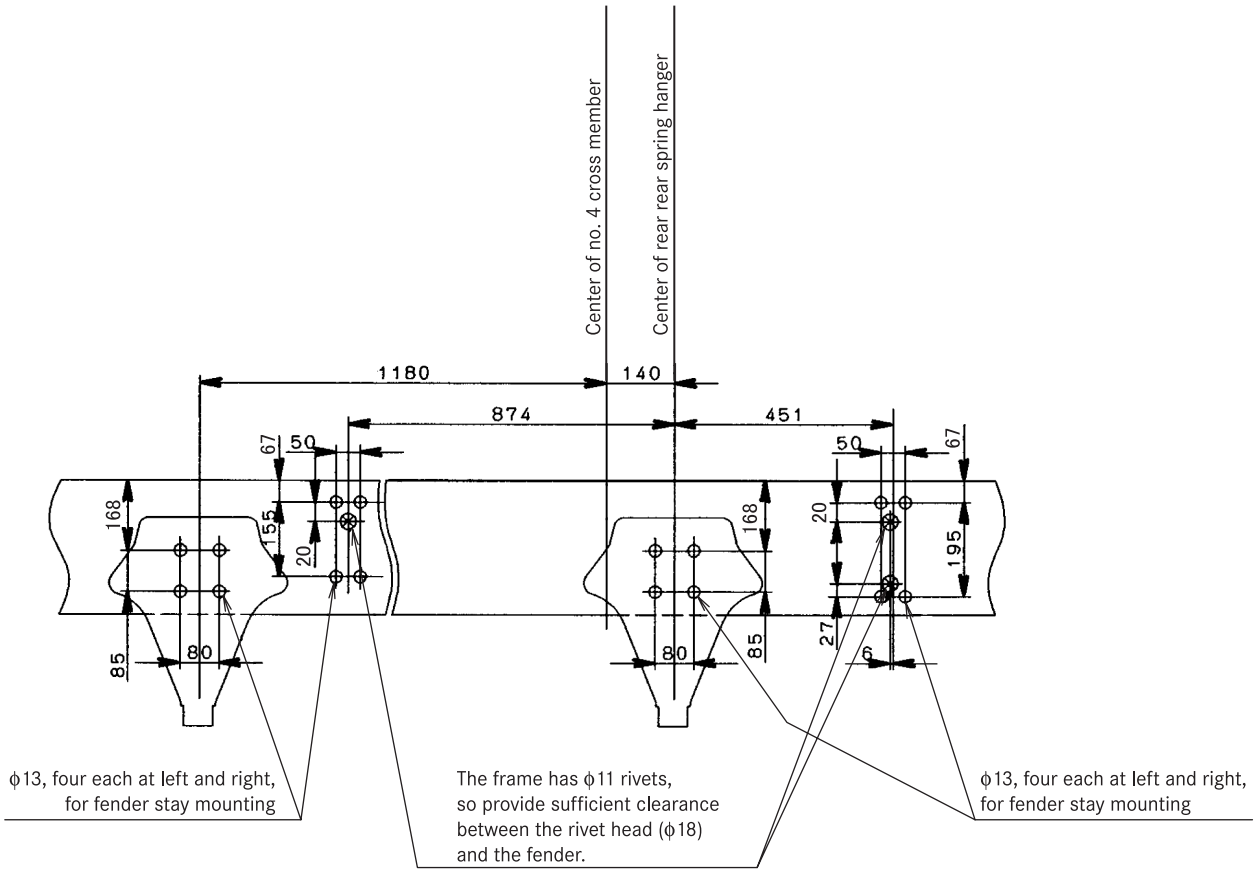
Rear



Model	C (mm)	D (mm)
FP51SDR	635	39
FP54SGR	672	46

<FV-R>

FV54SJR



Side guards

A box-shaped muffler is mounted at the left cab back portion in the wheelbase. Make sure that a side guard and stay, when mounted on the vehicle, do not interfere with the muffler.

8.1 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.

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

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

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

Comply with all national regulations and laws.

Additional information

Observe the notes on operational safety and vehicle safety in Section 1 "Introduction" ▷ page 8 and ▷ page 9.

8.2 Electrical wiring

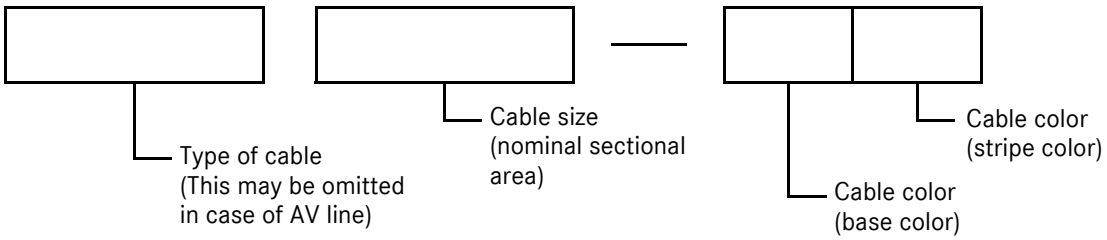
8.2.1 General precautions

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

8.2.2 Cable Identification

Cable size and cable color

Coding system

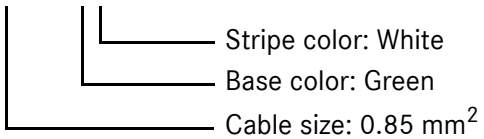


Alphabetical symbols of cable colors

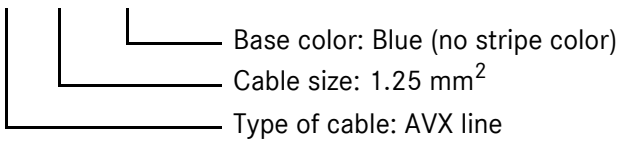
Symbol	Color	Symbol	Color
W	WHITE	L	BLUE
B	BLACK	Br	BROWN
R	RED	Lg	LIGHT GREEN
Y	YELLOW	O	ORANGE
G	GREEN		

Typical examples of cable identification codes

- 0.85 – GW



- AVX1.25 – L



Select types of cables

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

Type of cable

Select necessary types of cables from the list below.

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

Cable size

Select necessary cable sizes from the list below.

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

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

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

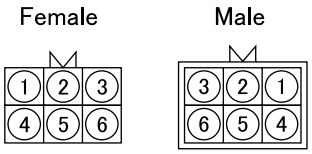
8.2.3 Connector code

Connector pin numbers

Numbering of terminals

Female terminals: Numbering started from upper left

Male terminal: Numbering started from upper right



8.2.4 Existing wiring and truck body on chassis side

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

8.2.5 Change and extension of wiring

Cables to be used

- Use cables conforming to JIS C 3406 (low voltage cables for automotive use), JASO D 608 (heat-resistive low voltage cables for automotive use) or equivalent. As to vinyl tape, use products conforming to JIS C 2336 (vinyl adhesive tapes for electric insulation) or equivalent. See "Type of cable" in "8.2.2 Cable Identification" ▷ page 175.
- When selecting a cable size, make sure that its allowable current conforms to the system rating. Especially in a system where a motor, etc. is used as a load, allow for the current in case the motor locks (restricted). See "Cable size" in "8.2.2 Cable Identification" ▷ page 175.

B

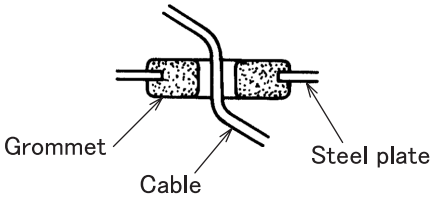
Wiring procedure

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

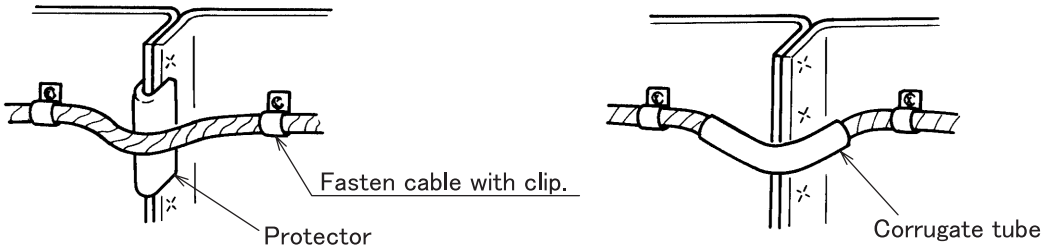
  Secure the following clearances.

Location	Minimum clearance
Between moving part and wiring	10 mm
Between sharp edge and wiring	10 mm

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



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

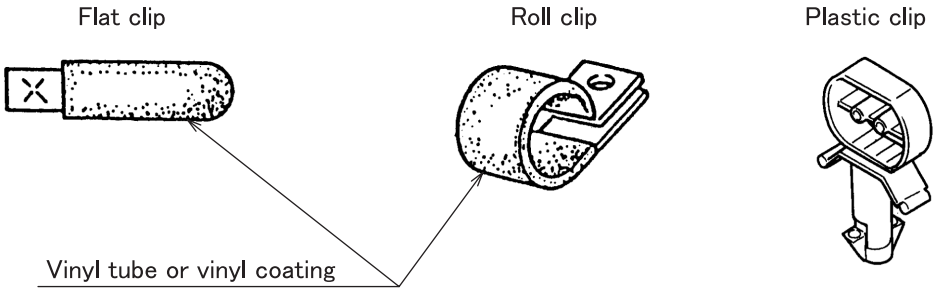


- If a harness exists nearby, tape the cable along to the harness. It is positively prohibitive to lay cables along the brake piping (including brake hose and brake pipe), fuel piping (including all metal and rubber hoses) and grease piping. Maintain clearances between cable and existing harness.

Wiring method	Minimum clearance
Parallel	10 mm
Crossover	20 mm

- For clearance between cable and exhaust system part, see 4.4 "Clearance for the basic vehicle and bodies" ▷ page 39.
- Install harnesses or battery cables where they will not be covered with accumulated dirt, snow, etc., iced nor damaged by flying stones. In an unavoidable case, provide a metal shield to protect the harness or cable.
- Do not connect cables with sheathing broken and wires drawn out.
- When equipment is wired, water may run down the cable into the equipment. Seal the through hole firmly with a grommet or the like and install the cable with its terminal upward.
- Route cables through places where they are not splashed with water or covered with dust.
- Do not install cables onto the top and outer sides of the frame. They may be damaged by feet put on the frame or stones flying to the frame during running.
- Install cables in the engine compartment apart enough from heat sources and along existing harness. Bind cables extensively with heat-resistive vinyl tape or fasten with metal sheet clamps (rubber- or vinyl-coated). Do not use non-heat-resistive vinyl tape because it is degraded to separate by heat.
- Install cables to engine- and transmission-mounted parts routing along existing harnesses so that their relative movements can be absorbed. Also, give cables a proper amount of slack so that they do not contact with other parts.
- When the routing of battery cables is changed for relocation of battery or other reason, do not extend or shorten battery cables and/or charging circuits of alternator, etc. Especially, do not change clamping method, clamping position, slack, etc. in areas of relative movement between starter and frame.
- When battery is relocated, locate it at least 200 mm apart from the exhaust system (muffler with emission gas purifier and tail pipe). If less than 200 mm apart, provide a heat insulator.
- When cables are shortened, do not cut them short but bind excess length of cable to existing harness or the like bundled with vinyl type.
- Hold MWP water-proof connectors for rear combination lamp, license lamp, side turn lamp, etc. in place by fastening the connector body with hook type plastic clips (MH056347 to MH056350) or band clips.
- When cable bands are cut off for convenience of work, obtain other same ones and restore the cable bands to their original state.

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

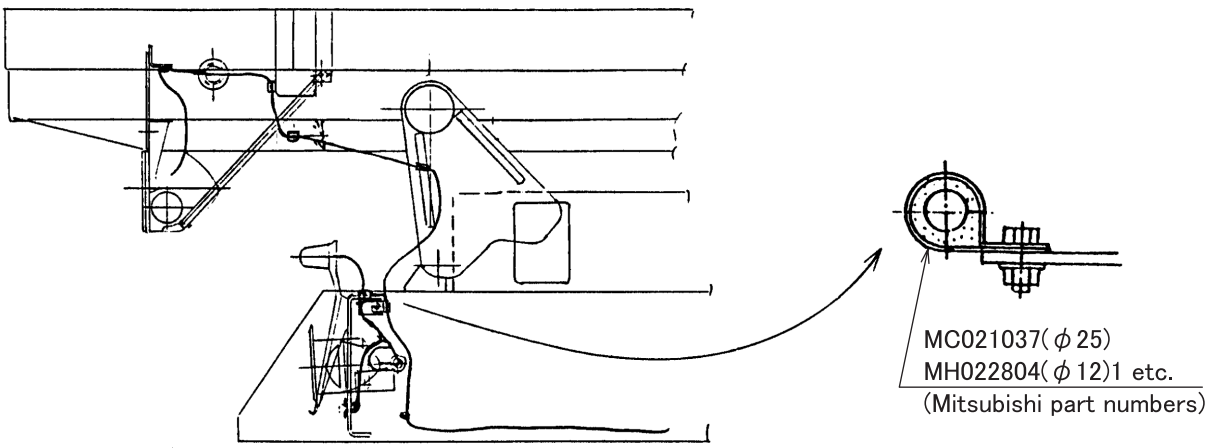


Given below are the standard limits of spacing for cable clamps.

(Unit: mm)

Harness diameter	Limit of spacing
Up to 5	Up to 300
5 to 10	400
10 to 20	500

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



Procedure for wire connection

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

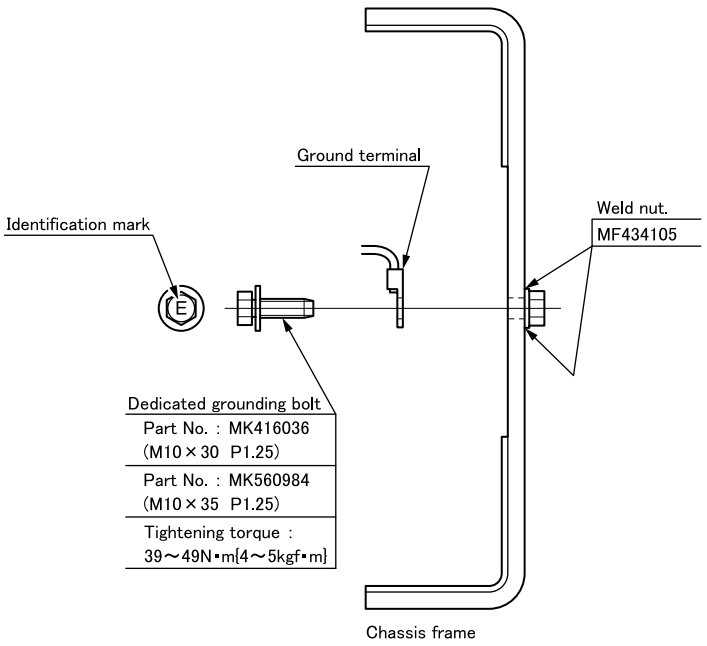
8.2.6 Grounding

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

Use eyelet terminal for grounding.

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

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



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

8.2.7 Fuse and relay

Existing fuses on the chassis side optimally match in capacity with the kind of load used, frequency of use of such load, etc. When additional truck body-related electric devices are installed, avoid using such parts and harnesses as may cause false signals to the chassis side power line and grounding line.

Extension from existing wiring at a midway point or replacement of existing fuse with one having larger capacity could cause an excessive current to flow through power fuse box, resulting in a fire. Be sure to obtain power for truck body-related equipment and lamps power by way of designated fuses or connectors.

For Fuse arrangements information, Refer to 10.14 "Electrical systems" ▷ page 391.

For Relay arrangements information, Refer to 10.14 "Electrical systems" ▷ page 391.

8.3 Handling of electric/electronic equipment

8.3.1 Available types of electronic control systems (typical examples)

- Engine electronic control unit
- Anti-lock brake system (ABS)
- Anti-spin regulator (ASR)
- Hill start assist system
- Retarder control
- INOMAT-II (Mechanical type automatic transmission)
- SRS air bag
- Emergency locking retractor (ELR)
- Keyless entry

8.3.2 Handling of electronic parts

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

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

8.3.3 Handling of batteries

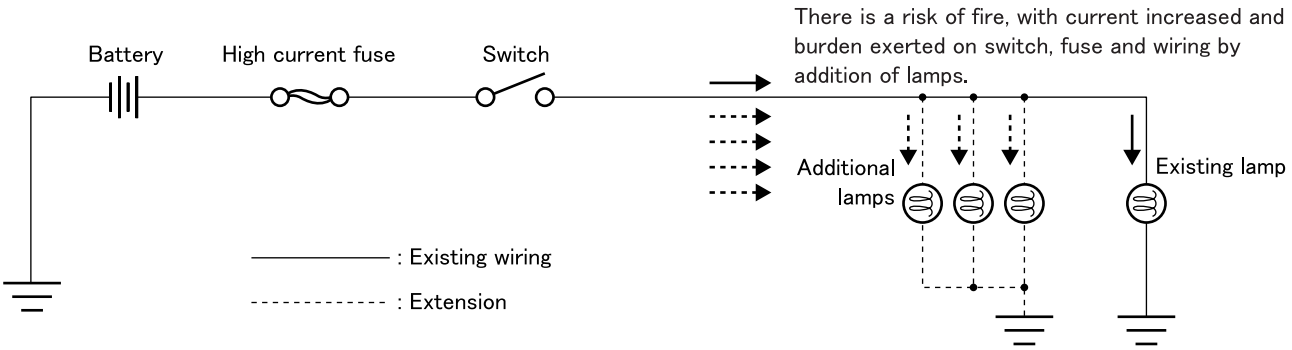
- Never place any metal objects or tools on the batteries.
- There is a risk of short circuit if the positive terminal clamp on the connected battery comes into contact with vehicle parts. This could cause the highly explosive gas mixture to ignite. You and others could be seriously injured as a result.
- 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.
- Protect the cable to be routed near the exhaust system with a heat-resistant outer jacket.
- Route cables so that none rub together.

8.4 Power supply

8.4.1 Power supply from existing wiring

Obtain power for body-building-related lamps and equipment by way of designated connectors. When body-building-related electric equipment are additionally installed, do not use such parts and harnesses as may cause false signals to the power and grounding lines for vehicle-side electric equipment.
Extension of existing wiring at a midway point or use of fuse with increased capacity could cause an excessive current to flow through the power supply or fuse box, resulting in a fire. Any change or extension of electric wiring not specified in this manual is prohibited.

Typical example of improper wiring for power

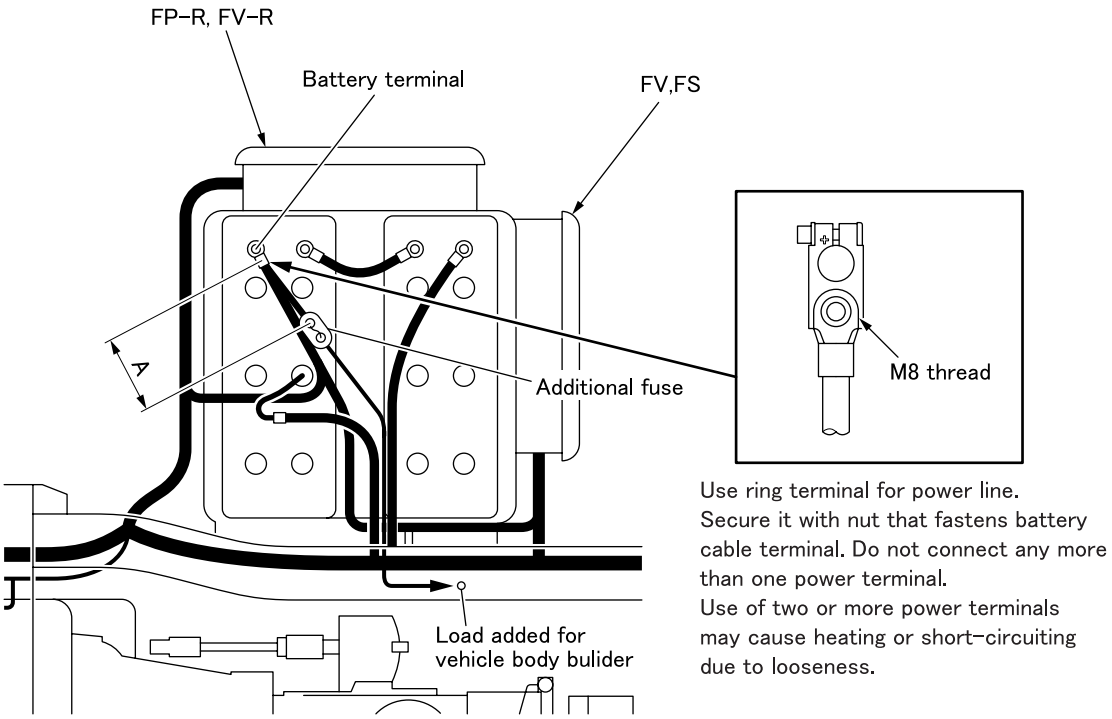


8.4.2 Power supply from vehicle-mounted battery

Do not use the vehicle-mounted battery for power for truck body-related electric equipment unless it is unavoidable for convenience of truck body.
If connection to the vehicle-mounted battery for power is unavoidable, carry it out taking care in the following respects:

- Add proper fuse to the extension to protect the circuit.
- Of the extension, use a cable of 5.0 mm^2 or more in size over the range A (see "Between battery terminal and fuse" ▷ page 183). Make it as short as practically possible and protect it properly so as to avoid damaged sheathing and consequent short circuit.
- Select optimal combination of additional fuse capacity and fuse-to-additional load cable size by (○) mark in the "List of recommended fuse capacity and cable size combinations" ▷ page 183
- Install additional fuse in water cover (electric cover or the like) or provide equivalent water protection.
- The use of a direct-connected power supply is liable to drain the vehicle-mounted battery. For this reason, please tell the customer not to draw power from the battery for a long period in order to drive a clock or a memory, for example, while engine is not running.

Between battery terminal and fuse



Use ring terminal for power line.
Secure it with nut that fastens battery cable terminal. Do not connect any more than one power terminal.
Use of two or more power terminals may cause heating or short–circuiting due to looseness.

List of recommended fuse capacity and cable size combinations

○: Usable ×: Unusable

Fuse		Cable size (mm^2) [upper] and allowable current for cable (A) [lower]							
Type	Specifications	0.3	0.5	0.85	1.25	2.0	3.0	5.0	(mm^2)
		11	14	18	23	31	42	57	(A)
Blade type and glass tube type	5 A	○	○	○	○	○	○	○	
	7.5 A	○	○	○	○	○	○	○	
	10 A	×	○	○	○	○	○	○	
	15 A	×	×	○	○	○	○	○	

Note: Continuous allowable current must be 70 % or less of specified fuse capacity.
(Example) If fuse in use is 10 A in current capacity
10 × 0.7 = 7 (A)
→ Load is allowable up to 7 A.

Fuse capacity and cable size/length

When extension harnesses are manufactured by the truck body, select appropriate types, sizes and lengths of cables by reference to the following tables.

Blade type fuse

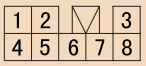
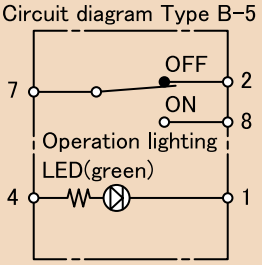
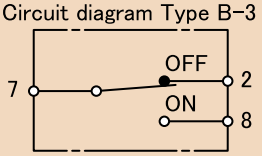
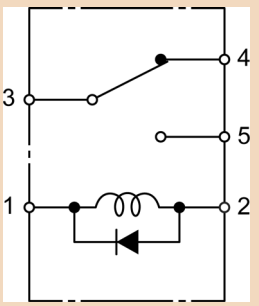
Fuse current capacity (A)	Cable type	Ambient temperature	Cable size (sectional area)/length						
			0.5 mm²	0.85 mm²	1.25 mm²	2 mm²	3 mm²	5 mm²	8 mm²
5	AV/AVS	40°C or less	34 m or less	–	–	–	–	–	–
	AVX	80°C or less	30 m or less	48 m or less	–	–	–	–	–
10	AV/AVS	40°C or less	17 m or less	27 m or less	39 m or less	–	–	–	–
	AVX	80°C or less	15 m or less	24 m or less	35 m or less	–	–	–	–
15	AV/AVS	40°C or less	11 m or less	18 m or less	26 m or less	43 m or less	–	–	–
	AVX	80°C or less	×	16 m or less	23 m or less	38 m or less	–	–	–
20	AV/AVS	40°C or less	×	13 m or less	19 m or less	32 m or less	–	–	–
	AVX	80°C or less	×	×	17 m or less	28 m or less	44 m or less	–	–

Heavy current fuse

Fuse current capacity (A)	Cable type	Ambient temperature	Cable size (sectional area)/length						
			0.5 mm²	0.85 mm²	1.25 mm²	2 mm²	3 mm²	5 mm²	8 mm²
30	AV/AVS	40°C or less	×	×	×	8 m or less	13 m or less	21 m or less	33 m or less
	AVX	80°C or less	×	×	×	7 m or less	12 m or less	19 m or less	29 m or less
40	AV/AVS	40°C or less	×	×	×	6 m or less	10 m or less	16 m or less	24 m or less
	AVX	80°C or less	×	×	×	5 m or less	9 m or less	14 m or less	22 m or less
50	AV/AVS	40°C or less	×	×	×	×	8 m or less	13 m or less	19 m or less
	AVX	80°C or less	×	×	×	×	7 m or less	11 m or less	17 m or less
60	AV/AVS	40°C or less	×	×	×	×	6 m or less	10 m or less	16 m or less
	AVX	80°C or less	×	×	×	×	×	9 m or less	14 m or less
80	AV/AVS	40°C or less	×	×	×	×	×	8 m or less	12 m or less
	AVX	80°C or less	×	×	×	×	×	×	11 m or less

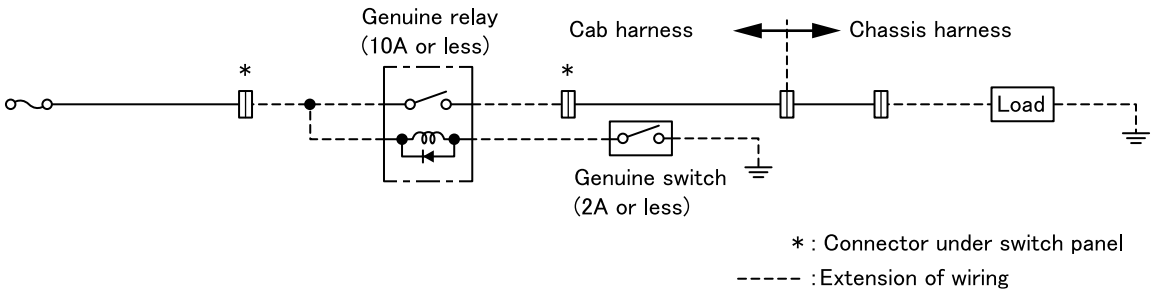
Note 1: ×: Not usable; –: 50 m or less
Note 2: AV/AVS: Ordinary cable; AVX: Heat resistive cable

8.4.3 Specifications for switches and relay for truck body

Part name	Mitsubishi parts number	Allowable current	Connector (harness side)	Circuit
Seesaw switch	MK322980 (with operation lighting circuit)	2.0 A or less	 Connector type: AK8A (MH056882)	Circuit diagram Type B–5 
	MK322979 (without operation lighting circuit)	2.0 A or less		Circuit diagram Type B–3 
Relay	MK420479 for 24-V vehicle	• Between (5) and (4) (Normally open side): 10 A or less • Between (5) and (2) (Normally close side): 5 A or less	 Connector type: EQ5A (MH059820)	 1: Power supply side 2: Grounding side

- When switches for truck body are used, allowable current is so small (2 A) that use of appropriate relays is required to prevent flow of load current to the switch.
- Do not connect any load exceeding allowable current (10 A) for relay.

Typical example of use



8.5 Charging/discharging balance

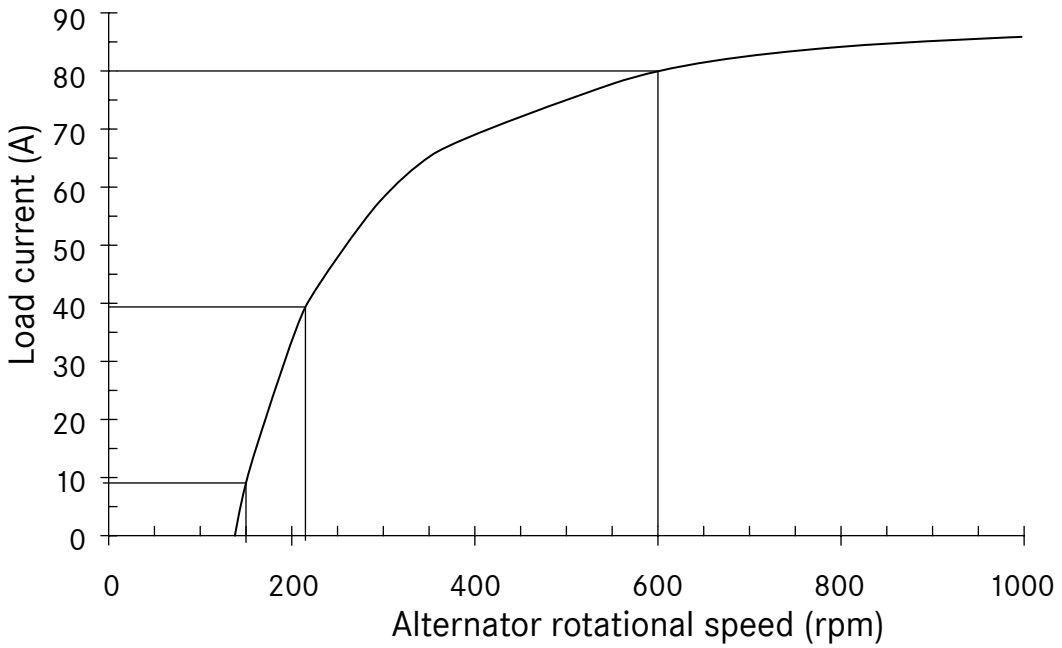
The charging/discharging balance may become unequalized in the following operating conditions. For this reason, reduce the electrical load during work referring to 8.5.1 "Engine alternator performance curves" ▷ page 186.

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

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

8.5.1 Engine alternator performance curves

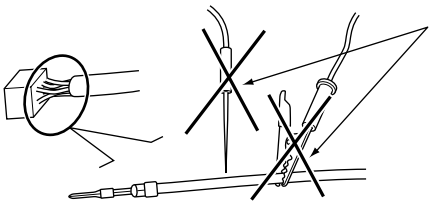
OM457 Engine Alternator Performance Curve
Nominal output: 24V 80A



8.6 Electric circuit continuity check

Needling check is prohibitive.

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



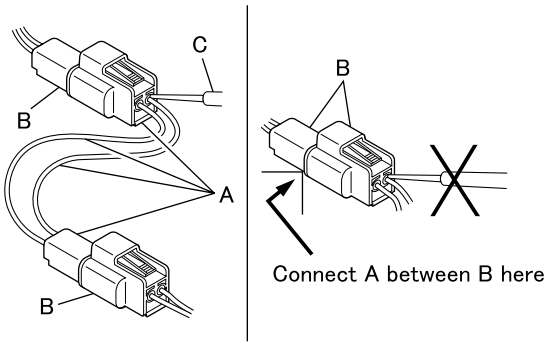
Sticking of test bar or electric circuit check lamp needle into cable insulation is prohibitive.

8.6.1 Check procedures

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

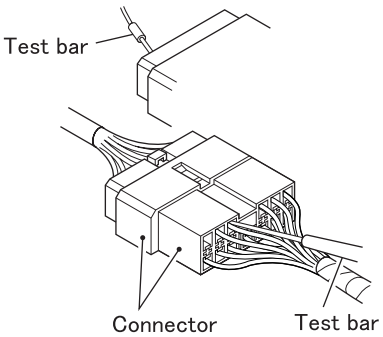
Waterproof connector

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



Non-waterproof connector

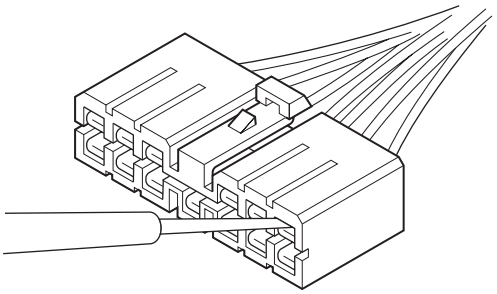
- Insert the test bar from the harness side.
- If joined connectors are so small that test bar cannot be inserted, such as control unit connectors, do not push in the test bar by force but use a superfine pointed test bar.



Continuity check with connectors disjoined

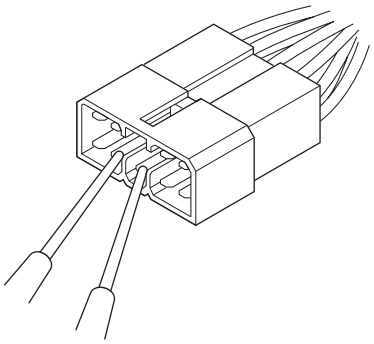
Check with female connector pins

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



Check with male connector pins

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



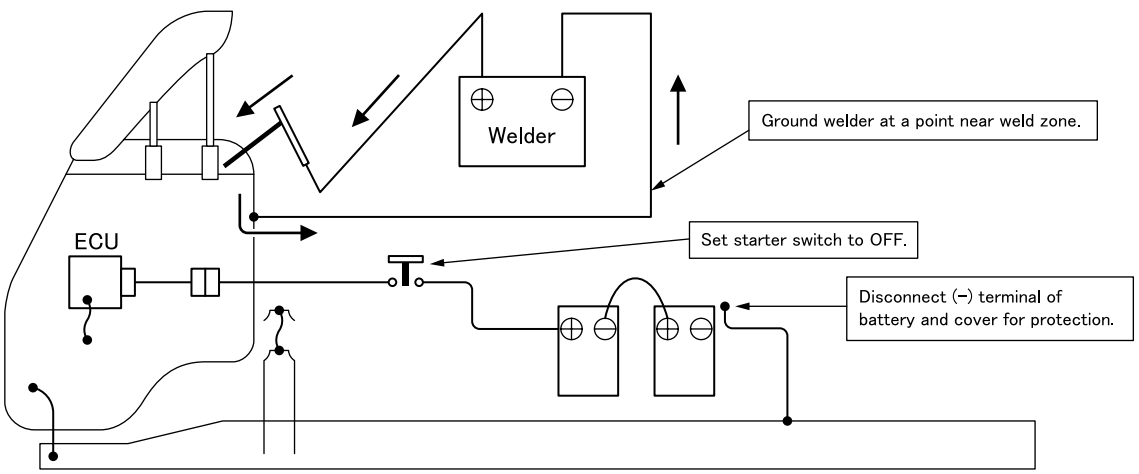
8.7 Precautions for electric welding

Electric wiring harnesses and electronic parts of vehicle may be damaged during electric welding work. To prevent it, follow the precautionary instructions described below.

Preparatory procedures for electric welding

Vehicles are equipped with electronic equipment directly coupled to battery and electronic control units. Neglect of necessary preparation for electric welding may result in damaged electronic equipment, etc. due to back flow of welder current to the grounding circuit. If precautionary instructions for welding work are not followed ▷ page 14.
Be sure to carry out the following preparatory work before welding.

- Set the starter switch to OFF and leave it as it is for at least 5 minutes (after-run procedure).
- Disconnect the minus (–) battery cable and cover the minus (–) terminal for protection.
- Be sure to ground the welder at a point near the weld zone.
  - Welding to cab
    Ground the welder at a nearby plated bolt or at a proper point on cab metal near the weld zone. When grounding the cab itself, peel paint from the surface where it is connected to ground.
  - Welding to frame
    Ground the welder at a nearby plated bolt or at a proper point on the frame near the weld zone. When grounding the frame itself, peel paint from the surface where it is connected to ground. Do not ground at the chassis spring as it could cause damage to the spring.



8.7 Precautions for electric welding

Other cautions

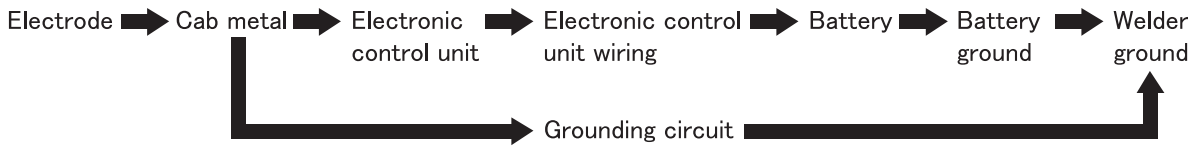
- Cover electronic equipment rubber hoses, wiring harnesses, pipes, tubes, chassis springs, tires, etc. in the neighbourhood of weld zone for protection against spatters during welding. Use utmost care when welding near an electronic control unit. If the welding electrode directly touches the housing of an electronic control unit, damage due to consequent short-circuiting is unavoidable.
- Perform welding under adequate welding conditions to achieve the quality of weld as required while using care to minimize impact on the neighbouring areas.

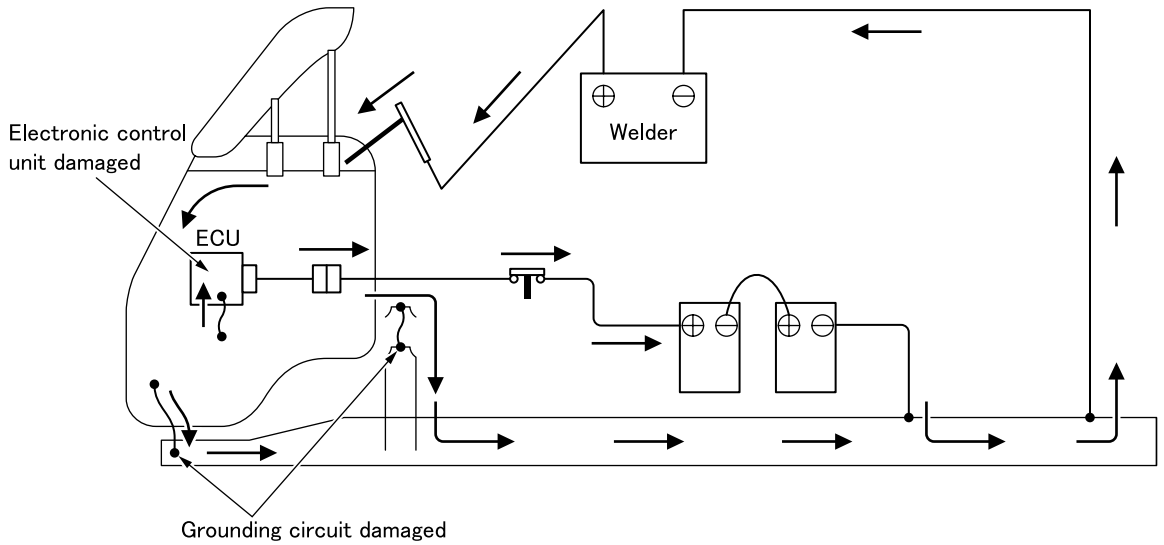
Post-welding procedure

- Connect the minus (–) cable back firmly to the battery.
  Recoat the paint-stripped surfaces of the fame or cab with rust preventive paint in the same color.
- Check electronic equipment for function
  For details on the check, contact an authorized MITSUBISHI FUSO distributor or dealer.
- For cautions to take in electric welding involving SRS airbag, refer to 6.16.1 "Supplemental restraint system (SRS)-air bag" ▷ page 135
- For cautions to take in electric welding involving BlueTec exhaust cleaner, refer to 6.14.2 "BlueTec system." ▷ page 128

If precautionary instructions for welding work are not followed

The welding current will flow as shown below, resulting in damage to other circuits including the ECU and ground wire.

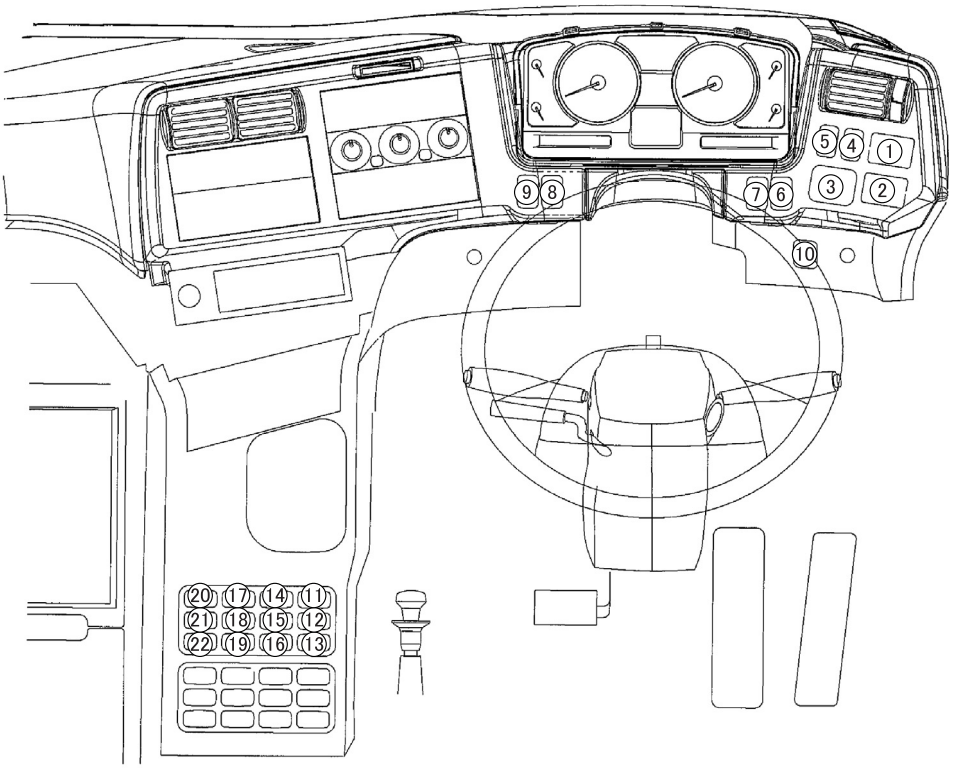




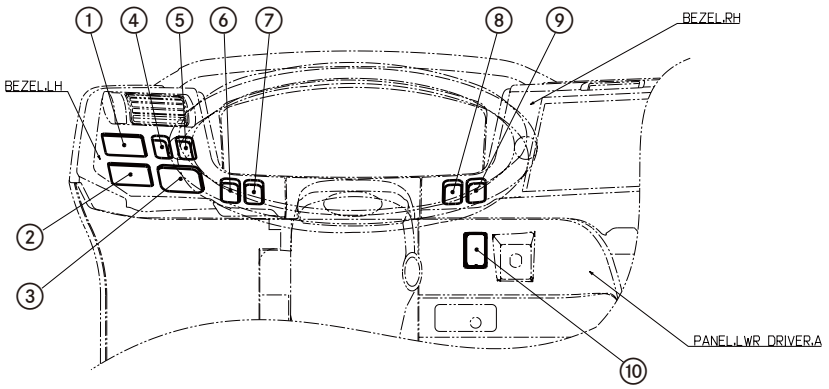
8.8 Locations and identification of various switches in cab

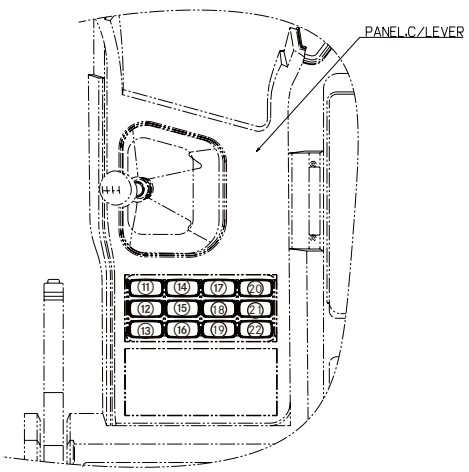
8.8 Locations and identification of various switches in cab

Right hand drive



Left hand drive





8.8 Locations and identification of various switches in cab

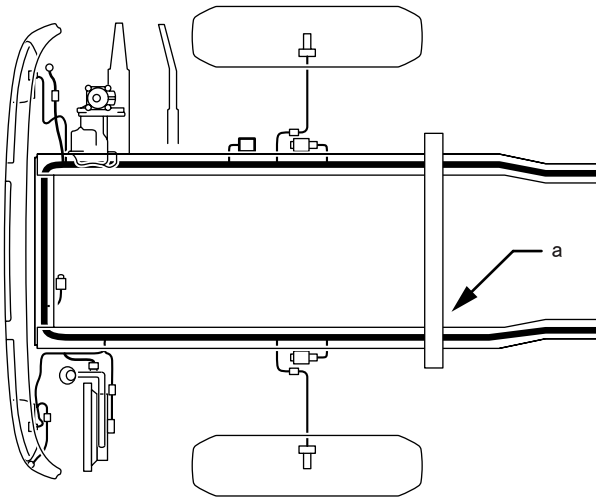
Identification No.	Switch name	Switch-equipped vehicle
①	Headlamp leveling switch	All types of vehicles as standard provision
②	Multi-information display operation panel	All types of vehicles as standard provision
③	Remote control mirror switch	Vehicles with remote-control mirror
④	Fog lamp switch	All types of vehicles as standard provision
⑤	Cruise control main switch	All types of vehicles as standard provision
⑥	Hill start assist system main switch	Vehicles with hill start assist system
⑦	Governor control switch	Concrete mixer truck
⑧	Transmission power take-off switch	Vehicles with Transmission PTO
⑨	Snow mode switch	Vehicles with INOMAT-II
⑩	Hill start assist system reset switch	Vehicles with hill start assist system
⑪	Mirror heater switch	Vehicles with mirror heater
	Mirror wiper switch	Vehicles with mirror wiper
⑫	ASR cutoff switch	Vehicles with ASR
⑬	Economy mode switch	Vehicles with INOMAT-II
⑭	Height control switch	Right hand drive vehicles with rear air suspension
	Rear fog lamp switch	Vehicles with rear fog lamp
⑮	Start-off gear selection switch	Tractor with INOMAT-II
⑯	Reverse high/low switch	Vehicles with INOMAT-II
⑰	Height control switch	Left hand drive vehicle with rear air suspension
⑱	-	-
⑲	Interior lamp switch	All types of vehicles as standard provision
⑳	Differential lock switch	Except tractor
㉑	-	-
㉒	(Hill start assist system adjust switch)	Manual transmission vehicles with hill start assist system

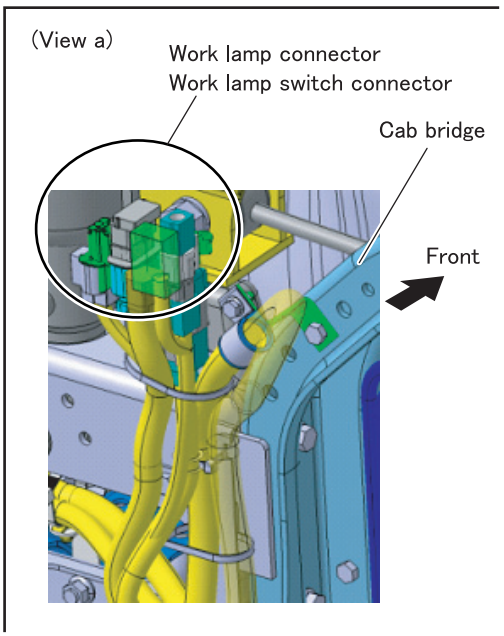
8.9 Lighting

8.9.1 Installation of additional lamps and equipment

Work lamp

- When the work lamp is turned on, the indicator lamp in the meter cluster is lit. Do not run the vehicle with the work lamp left on.
- Use 2-wire type work lamp.
- The work lamp used must be resistive enough to accumulated dirt, sludge and vehicle vibrations.
- A work lamp connector and a work lamp switch connector are installed together at the following point "a".





8.9.2 Installation of rear end lamps

The rear combination lamps, backup lamps and number plate lamp are attached on the chassis temporarily before shipping. Use these lamps as rear end lamps.

Install these lamp groups symmetrically about the vertical center line of the vehicle. Lay the lamp wiring harnesses along the frame members, crossmember and rear end face edges of the rear body. Secure them as necessary with clamps to keep the appearance looking neat.

Rear combination lamp

In the case of a chassis with cab, the rear combination lamps are temporarily attached with the upper side down, and so the water drain holes in the lamp body are covered with a strip of tape. This tape must be removed after installing the lamps in the designated positions.
Do not attempt to arrange the combination lamps vertically.
For details on the rear combination lamp, refer to 10.15 "Other equipment" ▷ page 486.

Rear registration plate lamp

For details on the rear combination lamp, refer to 10.15 "Other equipment" ▷ page 486.

Side direction indicator lamp

When you add side direction indicator lamp, change flasher relay to the followings and use 21watt bulb of side direction indicator lamp.

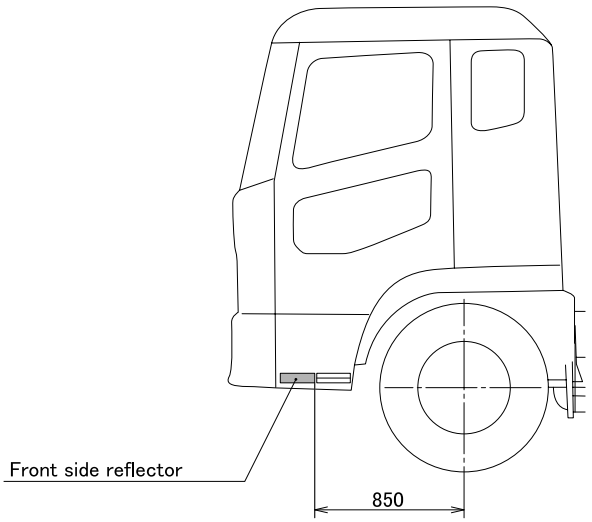
Flasher relay

Type	Parts No.
24V	MC899471 (TRUCK) MK542344 (TRACTOR)

8.9.3 Installation of side reflectors

Front side reflector

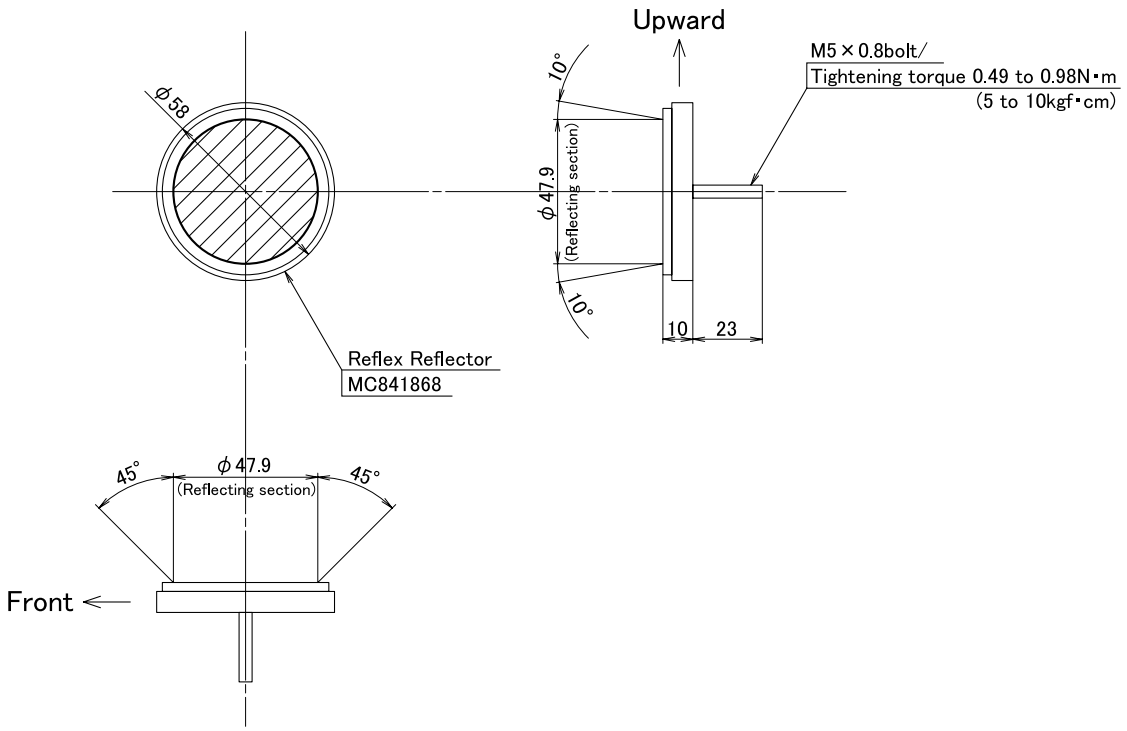
All cabs are equipped with front side reflectors (side reflectors on frontmost end). The fitting parts of the front side reflectors cannot be reused. If any damaged front side reflector is to be replaced, attach a new deflector with new fitting parts.



Side reflector

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

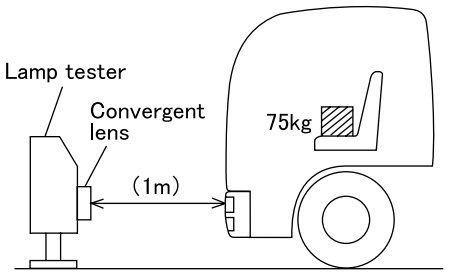
If any additional side reflectors are to be installed, be sure to use MITSUBISHI FUSO genuine reflectors.

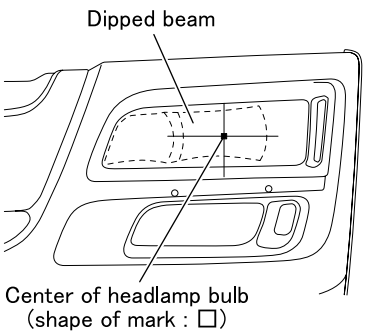


8.9.4 Headlamp aiming

Preparation before Adjustment

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





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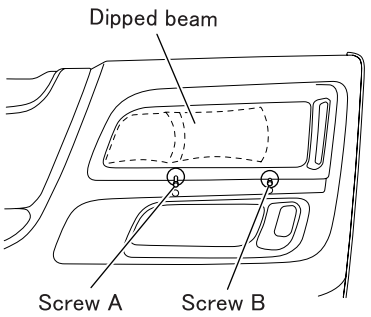
Adjustment

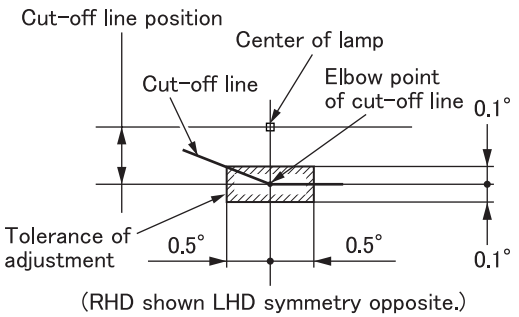
- Do not mask a lit headlamp for more than 10 minutes or the heat generated might cause a fire.

Adjustment of dipped beam

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

Cut-off line position	Standard value
	0.57°





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Adjusting direction for optical axis

<Left-hand headlamp>

	Upward	Downward	Leftward	Rightward
Screw A	Counter-clockwise	Clockwise	–	–
Screw B	Counter-clockwise	Clockwise	Clockwise	Counter-clockwise

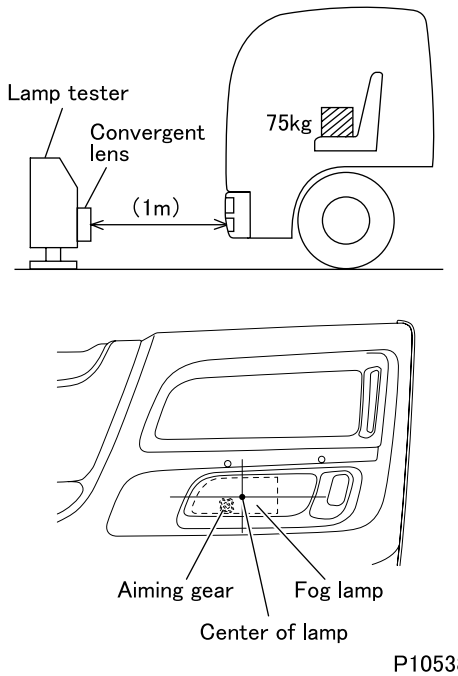
<Right-hand headlamp>

	Upward	Downward	Leftward	Rightward
Screw A	Counter-clockwise	Clockwise	–	–
Screw B	Counter-clockwise	Clockwise	Counter-clockwise	Clockwise

8.9.5 Fog lamp aiming

Preparation before Adjustment

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



P105381E

Adjustment

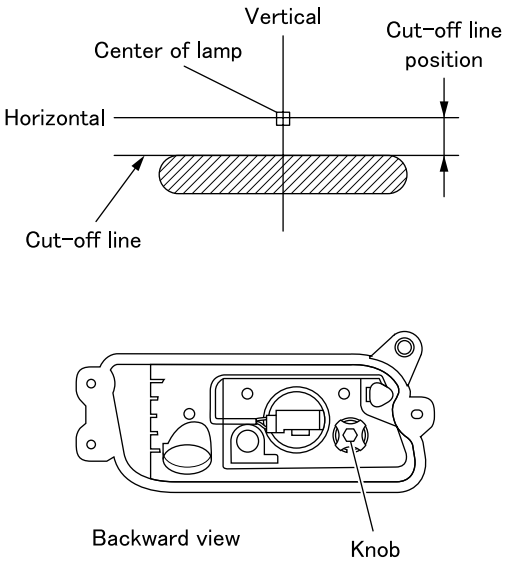
- Do not mask a lit fog lamp for more than 10 minutes or the heat generated might cause a fire.

Adjustment of fog lamp

- Turn on the fog lamp.
- Make adjustments by turning the knob so that the fog lamp's cut-off line will be in the illustrated position.

Cut-off line position	Standard value
	1.15 ± 0.2°

	Adjusting direction for optical axis	
	Upward	**Downward**
Knob	Counter-clockwise	Clockwise



P105382E

8.10 Mobile communications systems

Regulation of the country of use 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

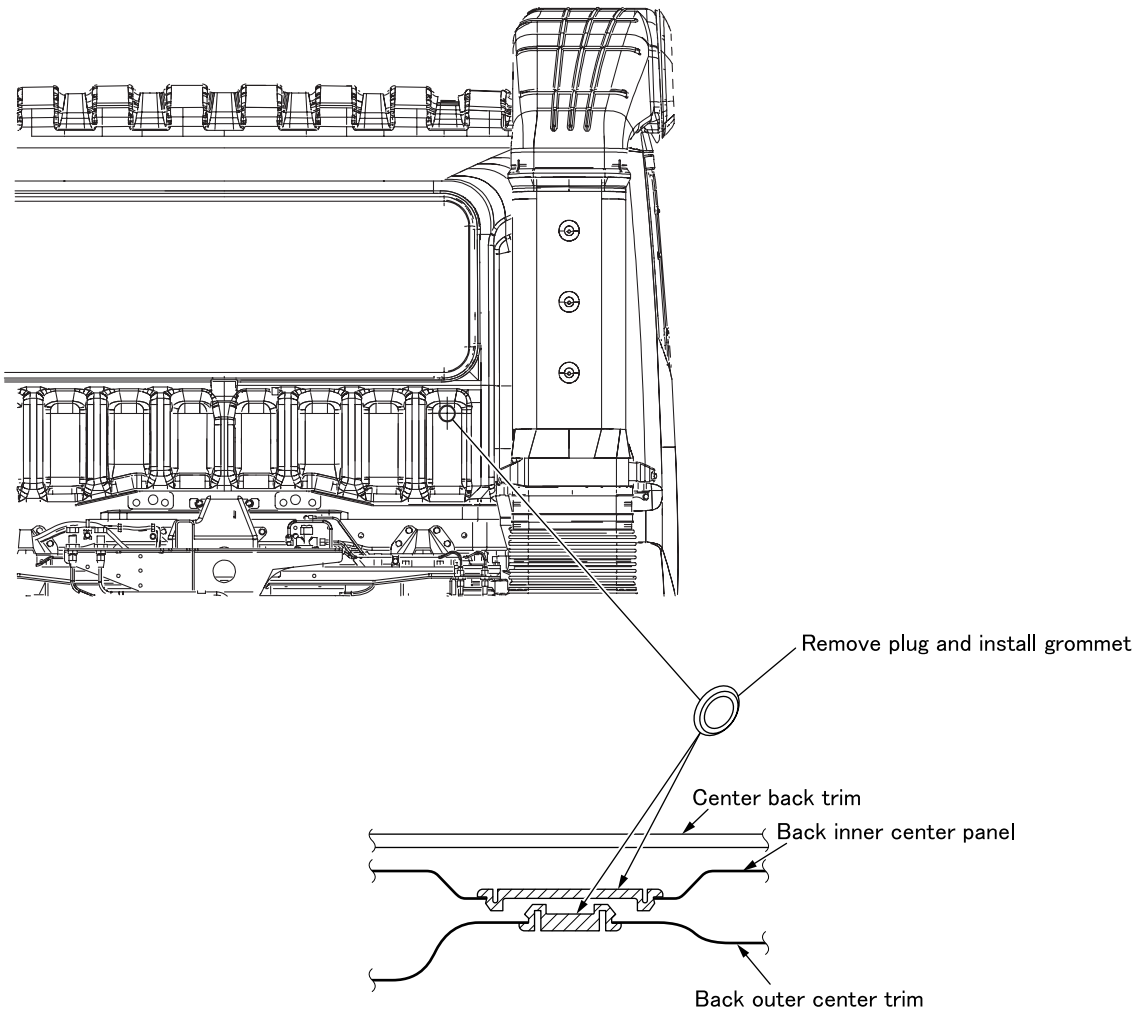
- The equipment must have official approval and meet regulation of the country of use for power, operating frequency, and interference.
- The equipment must be permanently installed.
- Operation of portable or mobile equipment inside the cab is only permitted if this equipment is connected to a permanently 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 teriminal inside cab.
- 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.
- Do not run the radio antenna cable along vehicle's harnesses or wires.
  Route the antenna cable about 300 mm or more away from these harnesses and wires.
  Electronic device malfunction could occur if the antenna cable is routed along the harnesses or wires.
- The antenna cable portion that is routed outside the cab should be secured with corrosion-resistant wire stickers or the like.
- Clamp the antenna cable so that it does not touch edged parts such as a drip rail.
- Make sure that the aerial cable is not kinked or crushed.
- Install the antenna using nickel-chrome stainless steel bolts and nuts. Do not use tapping screws, which could cause rust.
- To bring the antenna cable into the cab, run it through the hole in the back panel using grommet MH022627 (Mitsubishi part number) for water proofing.



Additional information

The notes on operating safety and vehicle safety in Section 1 "Introduction" ▷ page 8 and ▷ page 9 must be complied with.

8.11 Additional wiring for PTO

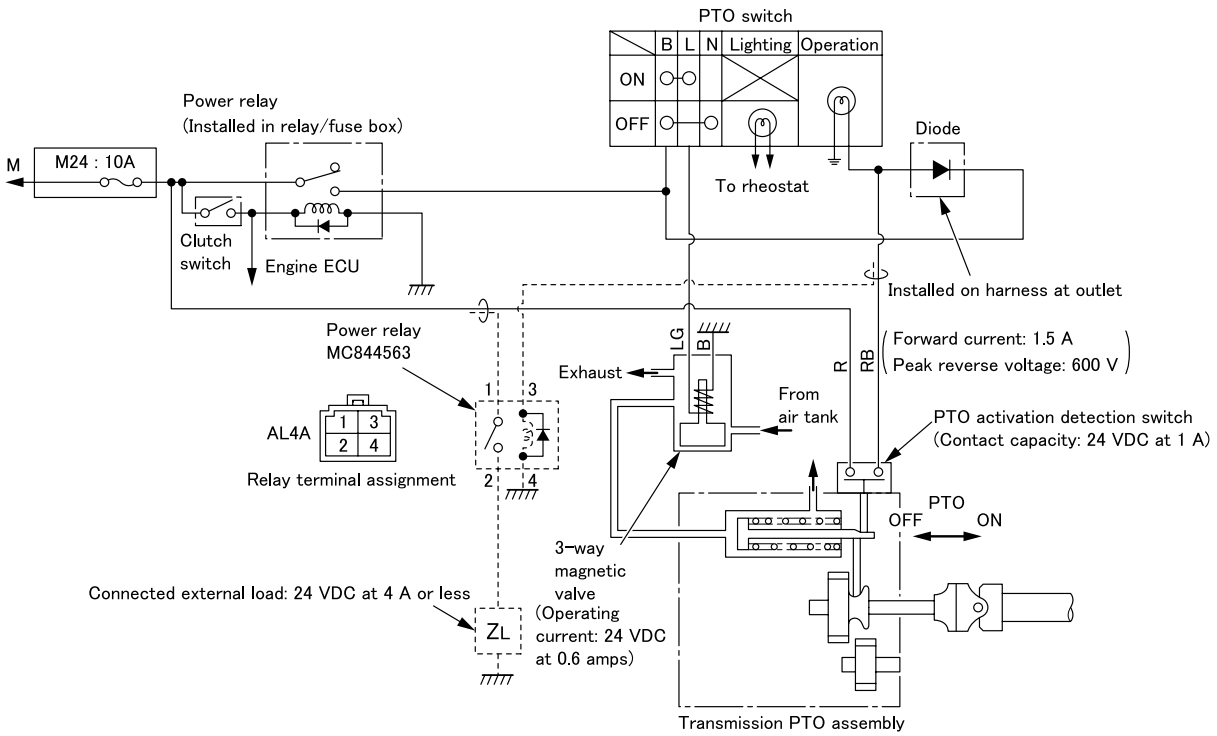
8.11.1 Adding electric circuits

When adding an electric circuit to the pneumatic PTO actuation circuit to supply power to the electric load of installed equipment simultaneously with PTO actuation, add a power relay for protecting the diode as shown below.

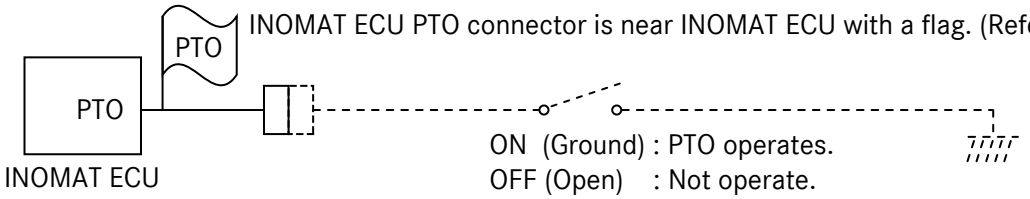
Electric wiring instructions

- The wirings indicated in solid lines (——) in the wiring diagram below are included in the chassis harness. To add an electric circuit to the pneumatic PTO actuation circuit, make additional wiring as indicated in broken lines (- - -).
- Use power relay MC844563 (Mitsubishi parts number). Install the relay in the cab or on the electric parts cover.
- The connected external load should be 24 VDC at 4 A or less.
- Use electric wires of AV 0.5 size.
- Refer to 8.2 "Electrical wiring" ▷ page 174 for precautions on wiring.

Circuit diagram

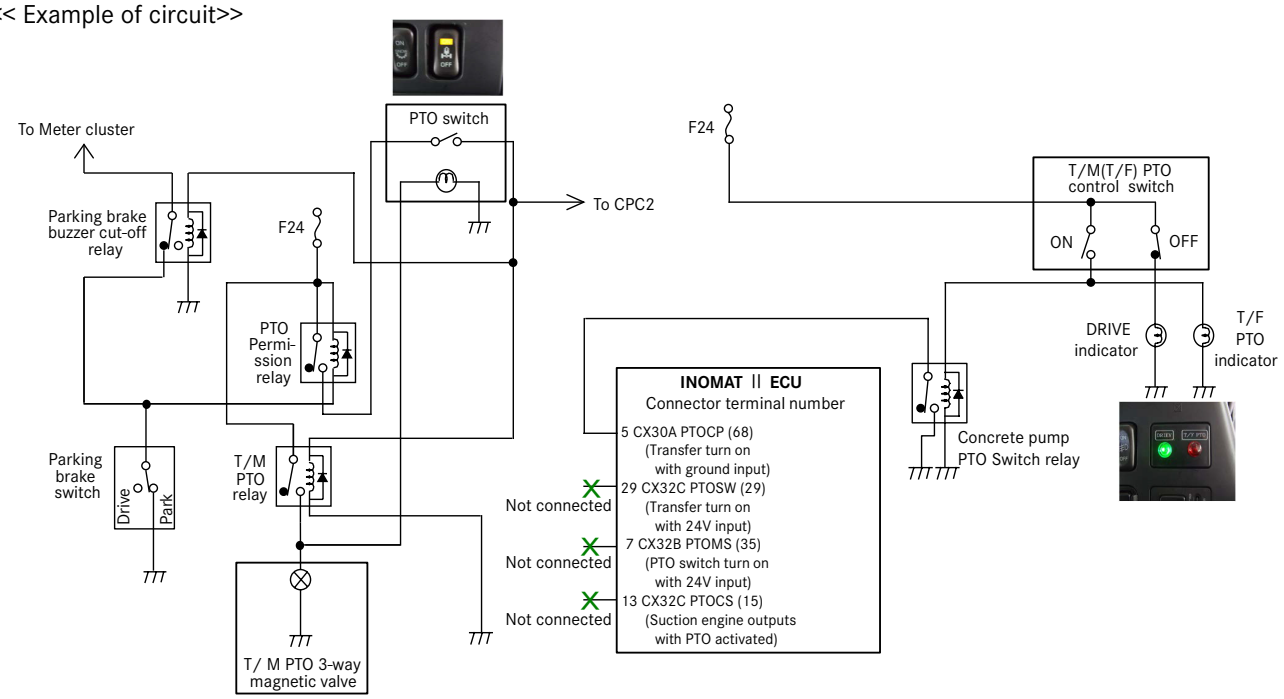


<<INOMAT-II with concrete pump>>
INOMAT-II with concrete pump needs hardwire and switch of the following dash line.
(INOMAT ECU must detect PTO operation state.)



8.11 Additional wiring for PTO

<< Example of circuit>>

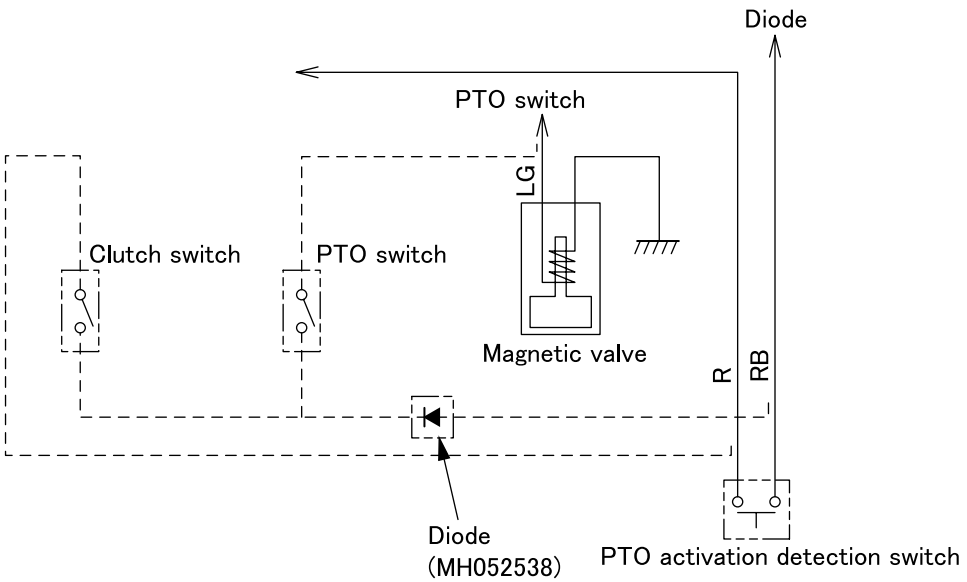


8.11.2 Adding a PTO switch

Electric wiring instructions

- The wirings indicated in solid lines (——) in the wiring diagram below are included in the chassis harness. To add an electric circuit to the pneumatic PTO actuation circuit, make additional wiring as indicated in broken lines (- - -).
- Use power relay MH052538 (Mitsubishi parts number). Install the relay in the cab or on the electric parts cover.
- The connected external load should be 24 VDC at 4 A or less.
- Use electric wires of AV 0.5 size.
- Refer to 8.2 "Electrical wiring" ▷ page 174 for precautions on wiring.

Circuit diagram



8.12 Standard electric load limits on trailers

The limits of standard electric loads available on trailers through a 7-way cable are as shown in the table below.

Terminal assignment			Standard load limit		Remarks
No.	Color	Circuit name	Capacity	Related element	
1	White	Ground	360 W	Maximum power consumption of jumper connector	
2	Black	Spare power	330 W	Fuse rating (R49)	
3	Yellow	Left turn signal, hazard lamp	50 W	Flasher open circuit detection relay	
4	Red	Brake light	25 W × 2	Open circuit detection relay	
5	Green	Right turn signal, hazard light	50 W	Flasher open circuit detection relay	
6	Brown	Taillight, license plate light, side marker light	240 W	Fuse rating (B9)	
7	Blue	Backup light	50 W	Fuse rating (R37)	

- With regard to turn signals and brake lights, addition of lights exceeding the standard load limit is prohibited as this will cause the open circuit detecting function to deteriorate.
- With regard to Nos. 2, 6 and 7 in the above table, addition of lights exceeding the standard load limit is prohibited as this will dangerously affect the upstream circuits, relays, switches, etc. on the tractor.
- Observe the instructions in 8.2.1 "General precautions" ▷ page 174 when using the special power supply on the trailer.

8.13 Others

8.13.1 Installing the tachograph

Preparations

- Turn the starter switch to OFF when performing installation work that involves electric welding.
- Disconnect the negative terminal (–) of the battery cable.
- Ground the welding machine near the welded section.

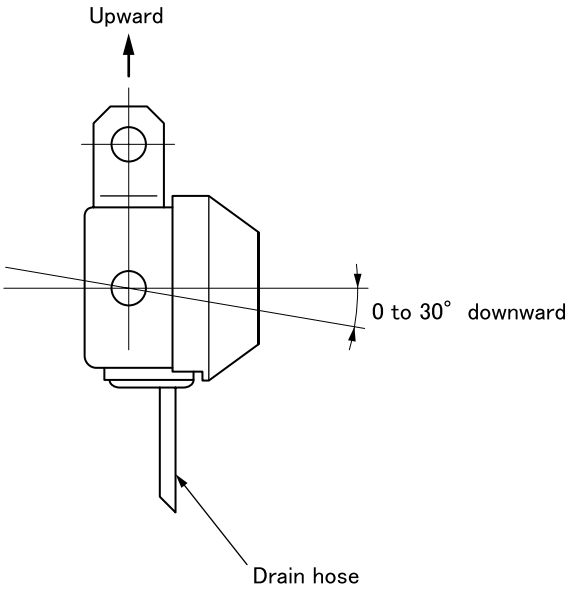
When dropped

- A tachograph is precision equipment. If it is subjected to impact by dropping, etc., replace it.

8.13.2 Installing the back buzzer

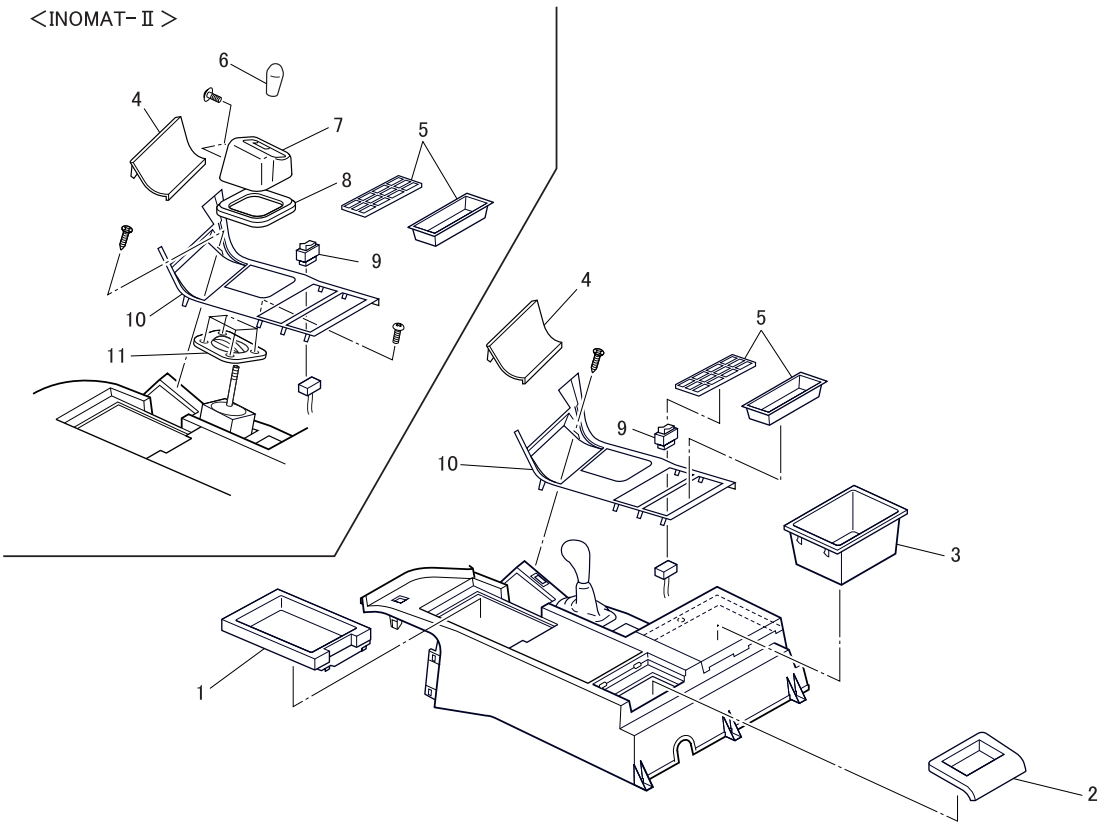
Relocating the back buzzer

Direct the back buzzer should be angled downward to prevent malfunction caused by water entry into the buzzer.



8.13.3 Floor console

- Removal and installation procedures



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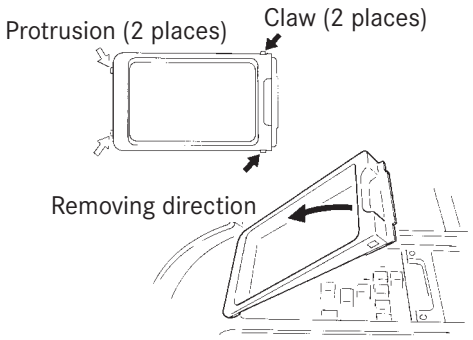
(a) Order of removal

1 *Console lid B*
2 *Floor console tray*
3 *Console box*
4 *Fuse box lid*
5 *Switch panel or tray*
6 *Selector knob <INOMAT-II>*
7 *Indicator panel A <INOMAT-II>*
8 *Lower gear shift cover <INOMAT-II>*
9 *Switch or plug*
10 *Gear shift lever panel*
11 *Indicator panel B <INOMAT-II>*

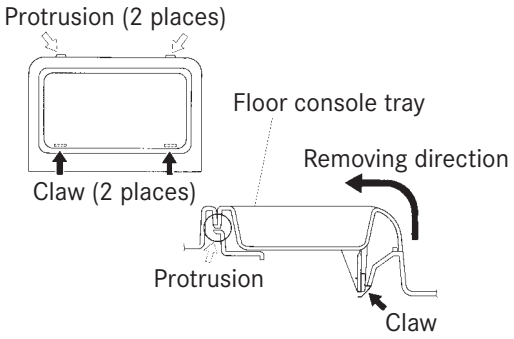
(b) Order of installation

Follow the removal procedure in reverse.

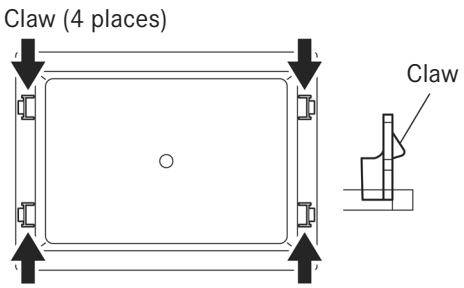
- Removal method
  (a) Console lid B



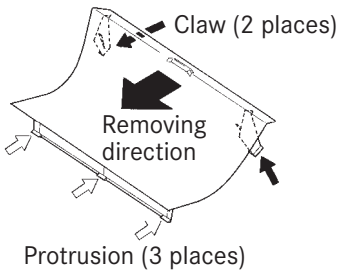
(b) Floor console tray



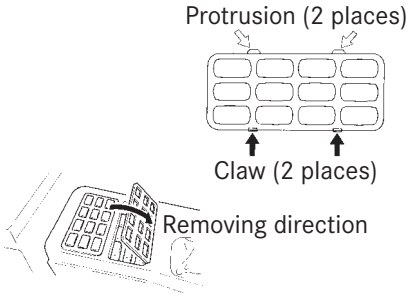
(c) Console box



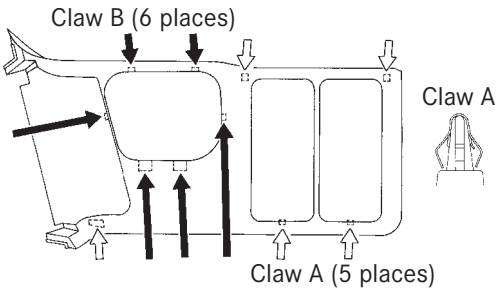
(d) Fuse box lid



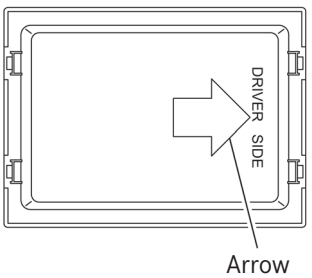
(e) Switch panel or tray



(f) Gear shift lever panel



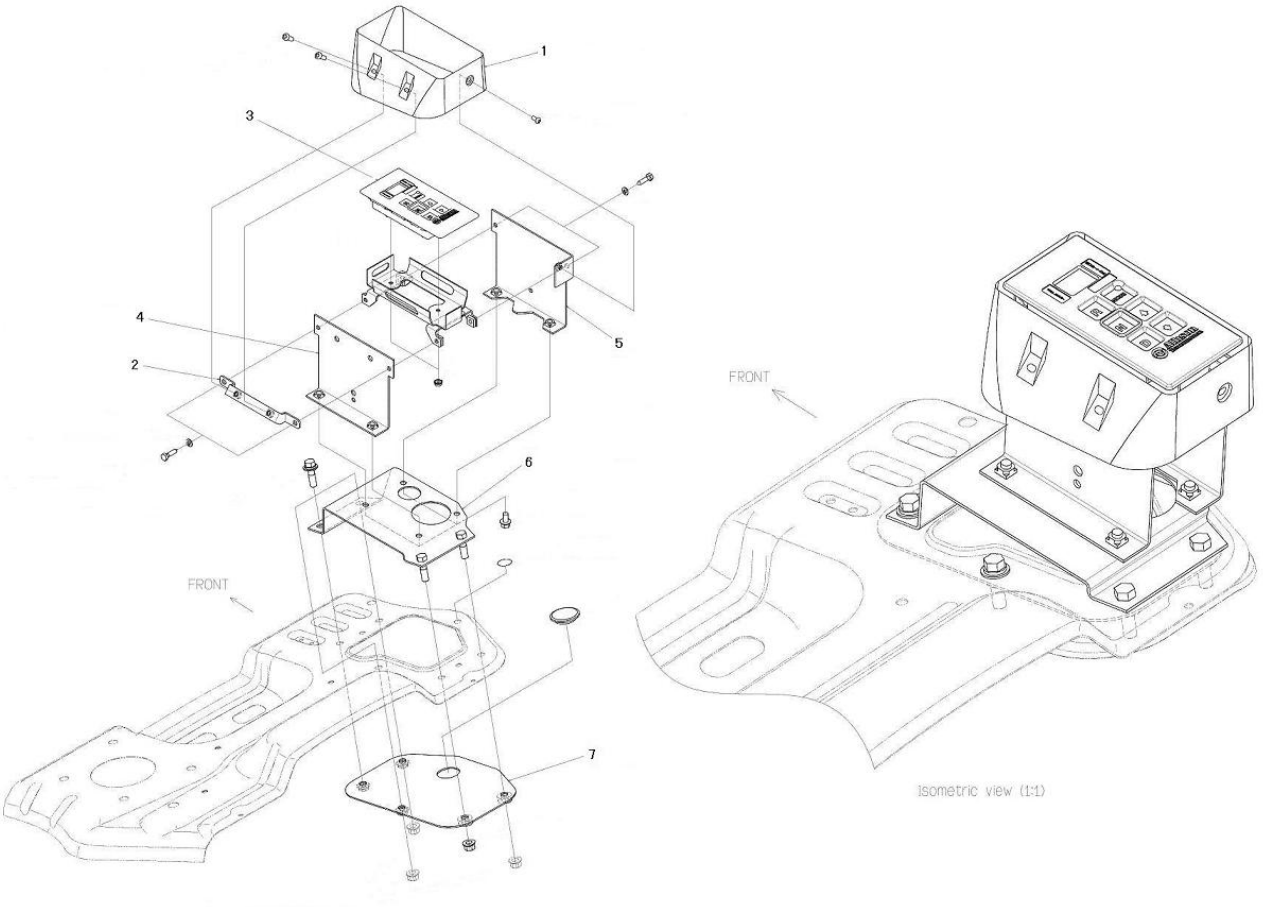
- Installation procedures
  (a) Console box
  Install the console box with the arrow mark toward the driver's seat.



8.13.4 Range selector

<Vehicle with range selector>

- Removal and installation procedures



(a) Order of removal

1 *Range selector garnish*
2 *Bracket C*
3 *Range selector*
4 *Bracket A*
5 *Bracket B*
6 *Stiffener*
7 *Plate*

(b) Order of installation

Follow the removal procedure in reverse.

9.1 Technical wheelbase

9.1.1 Technical wheelbase calculation for 3-axle vehicles

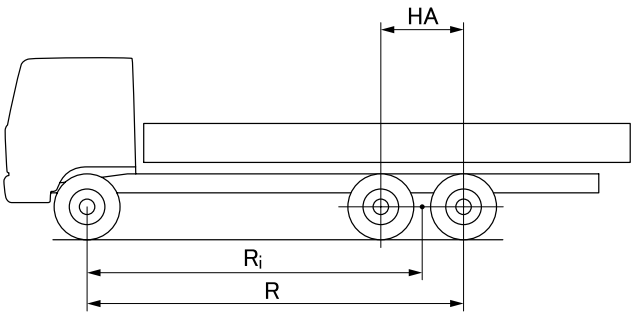
You require the following values to calculate the technical wheelbase Ri:

R = Vehicle wheelbase measured from center of axle 1 to center of axle 3

HA = Rear axle distance

The following formula is used to calculate the technical wheelbase:

$$Ri = R - \frac{(HA)}{(2)}$$



3-axle vehicle

9.1.2 Technical wheelbase calculation for 4-axle vehicles

You require the following values to calculate the technical wheelbase (Ri):

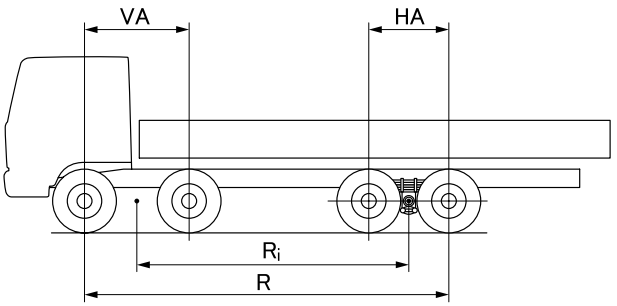
R = Vehicle wheelbase measured from center of axle 1 to center of axle 4

VA = Front axle distance

HA = Rear axle distance

The following formula is used to calculate the technical wheelbase:

$$Ri = R - \frac{VA}{2} - \frac{HA}{2}$$



4-axle vehicle

9.2 Axle load calculation

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

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

It has proved useful to make the following calculations:

Weight

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

Axle distance

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

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

$$\triangle G_{HA} = \frac{G_{component} \cdot a}{R} \text{ [kg]}$$

$\triangle G_{HA}$	=	Change in weight on rear axle in [kg]
$G_{component}$	=	Component weight in [kg]
a	=	Axle distance to theoretical center of front axle in [mm]
R	=	Theoretical wheelbase [mm]

$$\triangle G_{VA} = G_{component} - G_{HA} \text{ [kg]}$$

$\triangle G_{VA}$	=	Change in weight on front axle in [kg]
$G_{component}$	=	Component weight in [kg]
$\triangle G_{HA}$	=	Change in weight on rear axle in [kg]

9.2.1 Method of calculating the weight distribution on the front two axles

Front suspension with equalizer

The axle load on each of the two front axles can be calculated by means of the following equations:

First front axle load = Total weight of the front two axles/2

Second front axle load = Total weight of the front two axles/2

Front suspension without equalizer

The front axle is divided into two axles which are constructed in such a way that each axle bears a load independently of the other. For this reason, the weight above the spring is supported at three points, and it is not possible to obtain the weight distribution of each axle by static balance alone. Accordingly, the weight distribution is determined by additionally taking into account the spring deflection of each axle. When building the rear body, calculate the weight distribution using the following procedure.

Empty vehicle

- Calculation of the moment around the center of the front two axles of the rear body

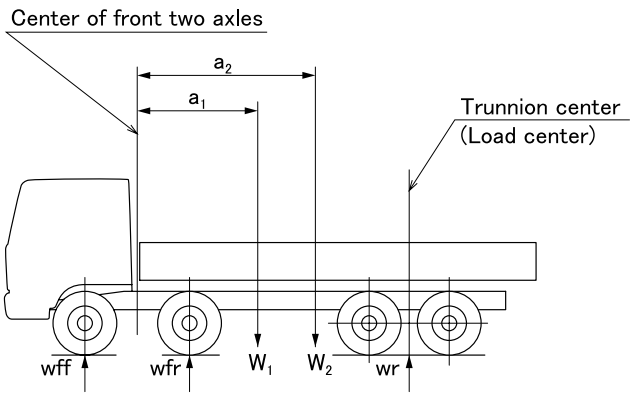
M_2 = Moment around the center of the front two axles of the rear body [N·m]
W_2 = Weight of the rear body [kg]
a_2 = Horizontal distance from the center of the front two axles to the center of gravity of the rear body [m]

$$M_2 = W_2 \times a_2 \times 9.80665 \text{ [N·m]}$$

- Calculation of the weight and the moment around the front two axles when the vehicle is empty

M_1 = Moment around the front two axles of the chassis with the cab installed
W_1 = Weight of the chassis with the cab installed [kg]
a_1 = Horizontal distance from the center of the front two axles to the center of gravity of the chassis with the cab installed [m]
W = Weight of the empty vehicle [kg]
M = Moment around the front two axles when the vehicle is empty [N·m]

$$M_1 = W_1 \times a_1 \times 9.80665 \text{ [N·m]}$$
$$W = W_1 + W_2 \text{ [kg]}$$
$$M = M_1 + M_2 \text{ [N·m]}$$



- Load on each axle when the vehicle is empty

By calculating W and M using the following equations, it is possible to obtain the load on each axle when the vehicle is empty. The coefficients α_1, α_2, α_3, β_1, β_2, β_3, γ_1, γ_2 and γ_3 differ according to the separation between the axles of the vehicle, the suspension characteristics and the weight below the spring.

wff = Load on the first front axles when the vehicle is empty [kg]
wfr = Load on the second front axles when the vehicle is empty [kg]
wr = Load on the rear axle (total for the rear two axles) when the vehicle is empty [kg]

$wff = \alpha_1 \cdot W + \beta_1 \cdot M + \gamma_1$
$wfr = \alpha_2 \cdot W + \beta_2 \cdot M + \gamma_2$
$wr = \alpha_3 \cdot W + \beta_3 \cdot M + \gamma_3$

<For Australia, New Zealand>

Model	Load distribution calculation equation
FS52SS***** Front suspension without equalizer (Option)	wff = 0.57304·W – 0.01228·M – 464 wfr = 0.39308·W – 0.00745·M + 679 wr = 0.03388·W + 0.01973·M – 215

<For Singapore>

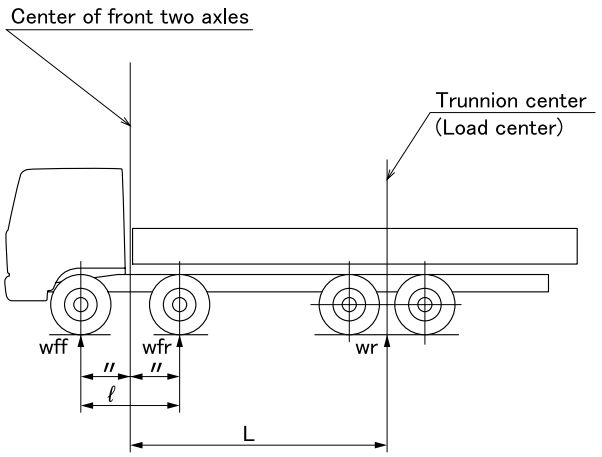
Model	Load distribution calculation equation
FS52SS***** Front suspension without equalizer (Standard)	wff = 0.57304·W – 0.01228·M – 256 wfr = 0.39307·W – 0.00745·M + 375 wr = 0.03389·W + 0.01973·M – 119

Loaded vehicle

When the vehicle is loaded, the vehicle posture is roughly horizontal, and the spring deflection of each of the front two axles is more or less equal, so it is possible to calculate the load distribution by assuming 2-point support using the center of the front two axles and the center of the rear axles as support points.

The method of calculating the weight of the loaded vehicle after calculating the weight of the empty vehicle is set out below.

- When the vehicle is empty, the frame rises at the rear, so the spring deflection of the front axle is larger than that of the middle axle, and the also the share of the load borne by the front axle is greater. Consequently, the center of the load imposed by the total weight of the front two axles is forward of the center of the front two axles.
  When the vehicle is in a loaded condition, the center of the load shifts to the center of the front two axles, necessitating correction of the distribution of the weight of the empty vehicle.
  Add the correction calculated using the following equation to the front two axles, and subtract it from the rear axles.

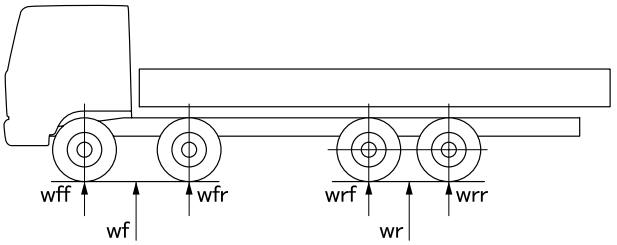


ΔW = Correction [kg]
wff = First front axle load when the vehicle is empty [kg]
wfr = Second front axle load when the vehicle is empty [kg]
ℓ = Distance between the front two axles when the vehicle is empty [m]
L = Distance between the center of the front two axles and the center of the rear two axles [m]

$$\Delta W = (wff - wfr) \times \frac{\ell/2}{L} \text{ [kg]}$$

- After correcting the distribution of the weight of the empty vehicle, the weight distribution of the loaded vehicle can be obtained by calculating the weight distribution of the occupants and loaded goods by assuming 2-point support using the center of the front two axles and the center of the rear-front axle as support points.

9.2 Axle load calculation



Calculation of the axle load distribution (when the vehicle is empty) by measurement on an actual vehicle

When obtaining the weight of an actual vehicle and the load distribution at each axle by actual measurement, if you perform measurement on each of the front two axles on which equalizers are not installed, errors are likely to occur. For this reason, measure the load on the first front and that of the second front axle simultaneously, and calculate the load distribution using the following equations.

Coefficients A, B and C differ according to the distance between axles and also the characteristics of the suspension.

wf = Total load on the front two axles when the vehicle is empty (simultaneous measurement) [kg]
wr = Total load on the rear two axles when the vehicle is empty (simultaneous measurement) [kg]
wff = Load on the first front axle when the vehicle is empty [kg]
wfr = Load on the second front axle when the vehicle is empty [kg]

wff = A·wf – B·wr – C
wfr = wf – wff

<For Australia, New Zealand>

Model	Load distribution calculation equation
FS52SS***** Front suspension without equalizer (Option)	wff = 0.5941·wf – 0.0284·wr – 598 wfr = wf – wff

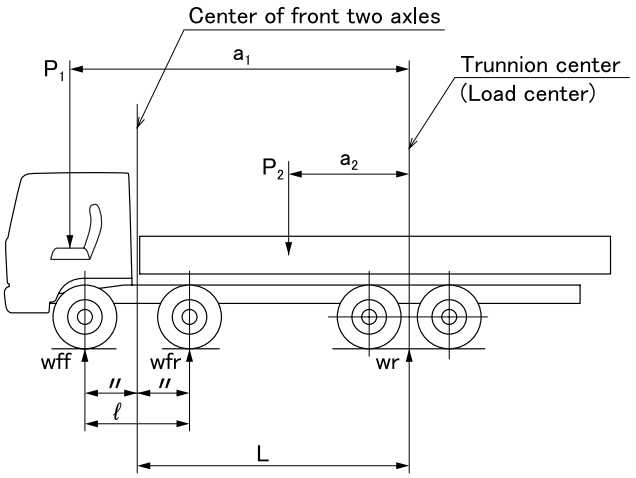
<For Singapore>

Model	Load distribution calculation equation
FS52SS***** Front suspension without equalizer (Standard)	wff = 0.5941·wf – 0.0283·wr – 330 wfr = wf – wff

9.2 Axle load calculation

Calculation of the axle load distribution by measurement on an actual vehicle

W = Gross vehicle weight [kg]
Wf = Total load on the front two axles when the vehicle is loaded [kg]
Wr = Total load on the rear two axles when the vehicle is loaded (simultaneous measurement) [kg]
wf = Total load on the front two axles when the vehicle is empty (simultaneous measurement) [kg]
wff = Load on the first front axle when the vehicle is empty [kg]
wfr = Load on the second front axle when the vehicle is empty [kg]
wr = Total load on the rear two axles when the vehicle is empty (simultaneous measurement) [kg]
ℓ = Horizontal distance between the front two axles when the vehicle is empty [m]
L = Horizontal distance between the center of the front two axles and the rear axle [m]
$p_1, p_2, p_3 \cdots p_n$ = Load due to the loaded goods and occupants [kg]
$a_1, a_2, a_3 \cdots a_n$ = Horizontal distance between the location on which load $p_1, p_2, p_3 \cdots p_n$ acts and the rear axle [m]
Pf = Load on the front axle due to the loaded goods and occupants [kg]



$$Wf = wf + \frac{\ell/2(wff - wfr)}{L} + Pf$$

$$Wr = W - Wf$$

$$Pf = \frac{a_1 \cdot p_1 + a_2 \cdot p_2 + a_3 \cdot p_3 + \cdots\cdots a_n \cdot p_n}{L}$$

9.2 Axle load calculation

- Conversion table of wff–wfr and $\frac{\ell/2(\text{wff} - \text{wfr})}{L}$
  (wff – wfr: From 0 to 1,790 kg)

(Calculation example)

In the case where wff – wfr = 740 kg, the value of $\frac{\ell/2(\text{wff} - \text{wfr})}{L}$ is 139 kg which lies at the point of intersection of 700 kg in the left column and 40 kg in the top row.

Unit : kg

	0	10	20	30	40	50	60	70	80	90
0	0	2	4	6	8	9	11	13	15	17
100	19	21	23	24	26	28	30	32	34	36
200	38	40	41	43	45	47	49	51	53	55
300	56	58	60	62	64	66	68	70	72	73
400	75	77	79	81	83	85	87	88	90	92
500	94	96	98	100	102	104	105	107	109	111
600	113	115	117	119	120	122	124	126	128	130
700	132	134	136	137	139	141	143	145	147	149
800	151	152	154	156	158	160	162	164	166	168
900	169	171	173	175	177	179	181	183	184	186
1000	188	190	192	194	196	198	200	201	203	205
1100	207	209	211	213	215	216	218	220	222	224
1200	226	228	230	232	233	235	237	239	241	243
1300	245	247	249	250	252	254	256	258	260	262
1400	264	265	267	269	271	273	275	277	279	281
1500	282	284	286	288	290	292	294	296	297	299
1600	301	303	305	307	309	311	313	314	316	318
1700	320	322	324	326	328	329	331	333	335	337

9.2.2 Method of calculating the weight distribution on the rear two axles

<FV51S******>

First rear axle load = (Total weight of the rear two axles + 77)/2

Second rear axle load = (Total weight of the rear two axles – 77)/2

<FV51S*D****>

First rear axle load = (Total weight of the rear two axles + 67)/2

Second rear axle load = (Total weight of the rear two axles – 67)/2

<FV51S*R*****>

First rear axle load = (Total weight of the rear two axles + 89)/2

Second rear axle load = (Total weight of the rear two axles – 89)/2

<FV54S******>

First rear axle load = (Total weight of the rear two axles + 78)/2

Second rear axle load = (Total weight of the rear two axles – 78)/2

<FV54S*R*****>

First rear axle load = (Total weight of the rear two axles + 72)/2

Second rear axle load = (Total weight of the rear two axles – 72)/2

<FS52S******>

First rear axle load = (Total weight of the rear two axles + 77)/2

Second rear axle load = (Total weight of the rear two axles – 77)/2

9.3 Connecting devices

The size of the trailer and fifth wheel coupling required is defined by the drawbar ratio.

The drawbar ratio is defined as the theoretical comparative force for the force between tractor vehicle and trailer/semitrailer.

9.3.1 Trailer coupling (without tongue weight capacity)

For mechanical coupling devices that are not suitable for carrying tongue weight, apply the drawbar ratio formula:

$$D = g \cdot \frac{T \cdot R}{T+R} \text{ [kN]}$$

D = Drawbar ratio [kN]

g = Acceleration due to gravity 9.81 m/s^2

T = Permissible gross weight of the towing vehicle in [t]

R = Permissible gross vehicle weight of trailer with vertically free-moving towing device in [t]

9.3.2 Trailer coupling (with tongue weight capacity)

For mechanical coupling devices that are suitable for rigid drawbar trailers/center-axle trailers, the Dc value and V value apply. The V value defines the vertical comparable acceleration in the coupling point, depending on the rear axle suspension of the towing vehicle and a constant factor.

$$Dc = g \cdot \frac{T \cdot C}{T + C} \text{ [kN]}$$

Dc = Drawbar ratio [kN]

g = Acceleration due to gravity 9.81 m/s^2

T = Permissible gross weight of the towing vehicle including tongue weight in [t]

C = Permissible gross weight of the center-axle trailer without tongue weight in [t]

$$V = a \cdot \frac{X^2 \cdot C}{l^2} \text{ [kN]}$$

V = V value [kN]

a = 1.8 m/s (for towing vehicles with air suspensions or comparable suspensions)

a = 2.4 m/s (for towing vehicles with other suspensions, e.g. leaf-spring suspension)

X* = Length of loading area of center-axle trailer in [m]

l* = Theoretical drawbar length, measured from the center of the axle unit to the center of the towing eye in (m)

C = Permissible weight of the center-axle trailer without tongue weight in [t]

*For values calculated $X^2/l^2 < 1$, use 1.0.

9.3.3 Fifth wheel coupling

For mechanical coupling devices that are suitable for semitrailers/trailers, apply the drawbar ratio formula:

$$D = g \cdot \frac{0{,}6 \cdot T \cdot R}{T + R - U} \text{ [kN]}$$

D = Drawbar ratio [kN]

g = Acceleration due to gravity 9.81 m/s^2

T = Permissible gross weight of the semitrailer tractor including vertical load on coupling in [t]

R = Permissible gross weight of the semitrailer including vertical load on coupling in [t]

U = Vertical load on coupling in [t]

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

I	31. Oct. 2014	Add notice for wiring and transfer PTO operation Other models added
H	18. Dec. 2013	Other models added
G	16. July. 2013	Other models added
F	11. Apr. 2013	Other models added
E	28. Sep. 2012	Other models added
D	24. Aug. 2012	Other models added
C	02. July. 2012	Other models added
B	25. Jan. 2012	Added notices for wiring
A	14. Dec. 2011	Other models added
–	29. July. 2011	Newly issued
Rev. code	Date issued	Remarks

NOTE:

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

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

Body/equipment mounting directives <Common section>

FP.FV.FS

General Export

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