Contents

ISUZU MOTORS LIMITED

Introduction

The purpose of this **Body Builder's Guide** (hereinafter referred to as "guide") is to provide information and guidance to the body builders that take charge of the final stage of vehicle manufacture by mounting their vehicle bodies on the cab chassis (incomplete vehicles) provided by ISUZU MOTORS LIMITED. The body builders are encouraged to refer to the information in this guide in order to perform rear body mounting at suitable conditions with good use of their own experiences.

This guide provides information about rear body mounting on N-series truck chassis for Chile.

Basically, the cab chassis provided by ISUZU MOTORS LIMITED are designed to ensure appropriate balance between functions and performance. Therefore, modification of the chassis frame should be avoided as much as possible. However, if there is no alternative, such modification must be performed according to the instructions in this guide.

The body builders are fully responsible to comply with the official regulations of their own countries with respect to their vehicle bodies, cab chassis modification incidental to rear body mounting, and completed vehicles after body mounting.

ISUZU MOTORS LIMITED will not be responsible for any problems in performance, functions or characteristics of completed vehicles, which are resulted in rear body mounting or modification performed without following the instructions in this guide.

Note: Information and specifications provided in this guide are based on the latest information available at the time this guide is released. The cab chassis manufacturer (ISUZU MOTORS LIMITED) reserves the right to, at any time, without prior notice, discontinue or change specifications, optional parts, materials, equipment, design, or model of the cab chassis.

For exact details of the latest information, contact dealerships of ISUZU MOTORS LIMITED.

ISUZU

Ⅰ. General Precautions

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Chapter 1 Modification of Chassis

1.1. Prohibited modification

Modification incidental to rear body mounting must be avoided as much as possible. Especially, from the viewpoint of compliance with applicable laws and regulations as well as safety assurance, the following components must not be modified :

- Air inlet system
- Diesel fuel injection controls
- Engine assembly with all components of exhaust emission control system
- Exhaust system
- Fuel system
- Engine cooling system
- Turbocharger and associated controls
- Brake and brake control system
- Steering system
- Noise insulation materials
- Transmission and final gear
- Front and rear axles
- Disc wheel

1.2. Modification of a chassis frame

Modification of a chassis frame must be avoided as much as possible. If modification cannot be avoided, modify the chassis frame according to the instructions below. Upon completion of the modification, thoroughly check chassis frame members so as to eliminate any possibility of safety problems.

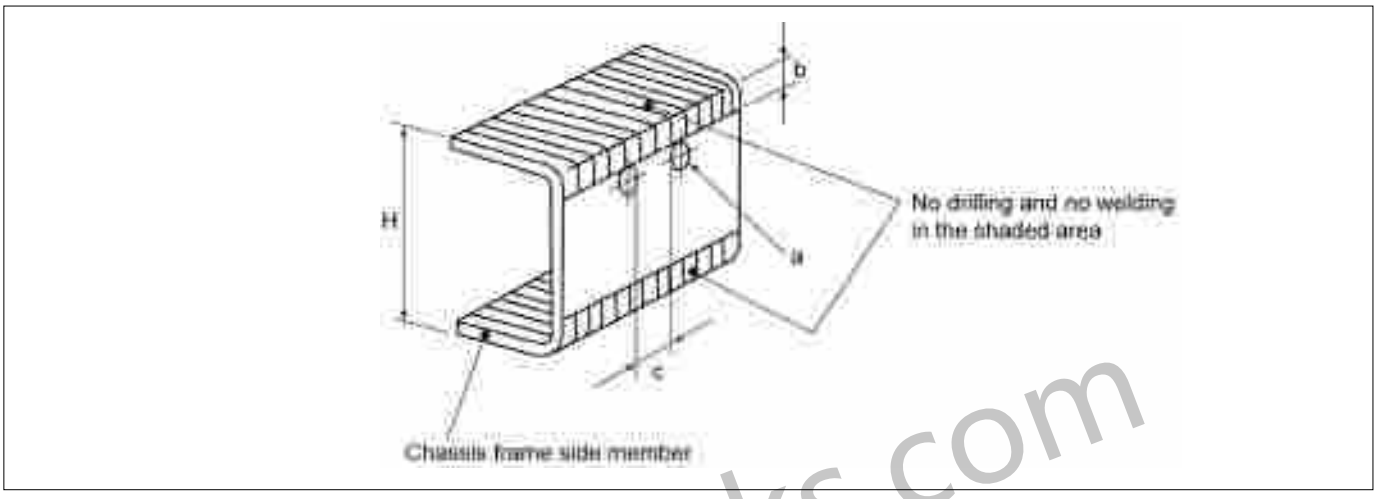
1.2.1. Load on a chassis frame side member

Every chassis frame is designed and assembled in due consideration of appropriate load distribution. When load is evenly distributed on a chassis frame, sufficient physical strength of the chassis frame can be maintained. Installation of special equipments on a chassis frame can change the said load distribution. Therefore, such special equipments must be installed, taking load distribution into account, otherwise stress concentration in particular part of the chassis frame may occur, possibly resulting in cracks in chassis frame members or other problems even if the total weight of these special equipments falls within allowable range.

Because every chassis frame is designed as an integral structure, they must not be cut.

1.2.2. Drilling or welding a chassis frame

Since every chassis frame is designed to bear the load applied to a particular type of vehicle (e.g. Cargo transport vehicle and service vehicle) which the chassis frame is intended for. Installing any special equipment on a chassis frame can negate the frame's load condition. Even if cargo is small, it still can fluctuate stresses in various parts of a chassis frame, possibly resulting in deformation or cracks. Drilling holes and welding are basically prohibited. However, if such works are unavoidable, follow the instructions below.



(1) Side member

Do not drill a hole or make a notch in or weld the shaded areas (flange) in the above figure.

	"a" in the above figure (Allowable maximum hole diameter)	"b" in the above figure (Work-prohibited area)		"c" in the above figure (Minimum required distance)
Heavy duty	ϕ17mm	H/5 (Welding)	H/7 (Hole)	40mm
Medium duty	ϕ15mm			
Light duty	ϕ11mm	20		25mm

(2) Cross member

(a) Alligator type: Hole drilling, notch making and welding are prohibited.

(b) Channel-shaped type: "b" and "c" depend on the side member. Allowable maximum hole diameter "a" is 9mm, and this hole should be used only for piping or harness routing.

(3) Gusset

Hole drilling, notch making and welding are prohibited. If a hole is inevitably required, follow the instructions below.

(a) When making a hole, do not use gas but a drilling machine.

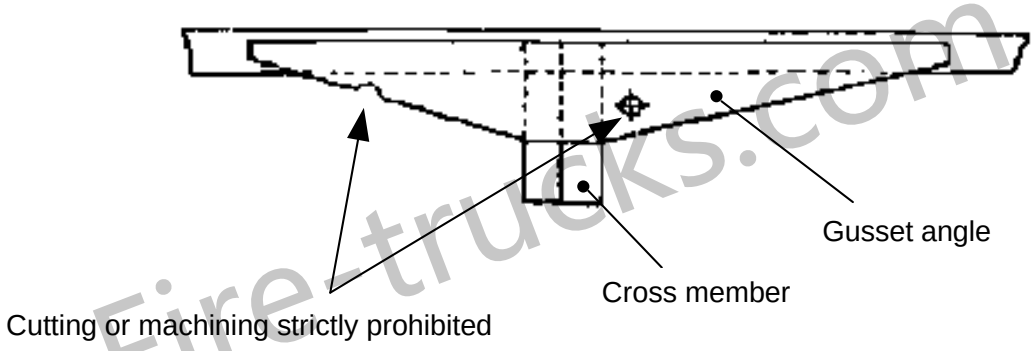
(b) Length of a weld should be 30mm to 50mm, and welds should be spaced a minimum of 40mm.

(c) Be sure that weld beads do not protrude over holes. Welding should be done away from the edge of holes by the distance “c” in the table.

(d) When making a notch by using gas, finish the cut surface by grinding.

(e) Cold rivet only.

(4) On tandem rear axle models (with trunnion-type rear suspension), cutting or machining gusset angles is strictly prohibited.



[Precautions for welding of a chassis frame]

(a) Welding current may damage electronic devices installed in a vehicle. Before starting welding, be sure to disconnect a negative battery terminal and turn off a starter key switch.

(b) To prevent ABS EHCU (electro-hydraulic control unit) from being damaged, pull out the connector of the ABS EHCU before welding.

(c) Keep chassis frames dry at all times.

(d) Attach welder's ground cable to a plated bolt or a metallic part of a chassis frame in the vicinity of welding site.

- When attaching the ground cable on a chassis frame, peel off the paint film on the area of the chassis frame suitable for attaching the ground cable till its metallic base appears. After welding, apply the same colored anticorrosion paint on the area.
- Do not attach the ground cable to a chassis spring, otherwise the spring may break.

(e) To prevent the following components from being damaged by welding spatters or heat, cover them up or temporarily relocate them to somewhere reasonably distant:

- Plastic parts
- Rubber parts
- Electric harnesses
- Air intake duct
- Radiator hose
- Radiator
- Intercooler
- Pipes
- Chassis springs
- Tire

In particular, if welding any area within 200mm from a fuel tank, remove the fuel tank beforehand.

(f) Before welding, remove the paint coating on the area where welding is to be performed. After welding, apply anticorrosion paint in the same color.

(g) Welded area must not be rapidly cooled.

(h) When the material of the chassis frame side member to be welded is either one of the following, use a 55kgf/mm^2 ilmenite welding rod (KOBE STEEL, LTD.'s BW-52 or equivalent).

- High tensile steel HT540 (ISUZU standard) in tensile strength 540Mpa{55kgf/mm^2} Avoid welding problems such as undercut, overlap and pin holes.
- Steel for general frame JSH440 (ISUZU standard) in tensile strength 440Mpa {45kgf/mm^2}

1.2.3. Reinforcing a chassis frame side member

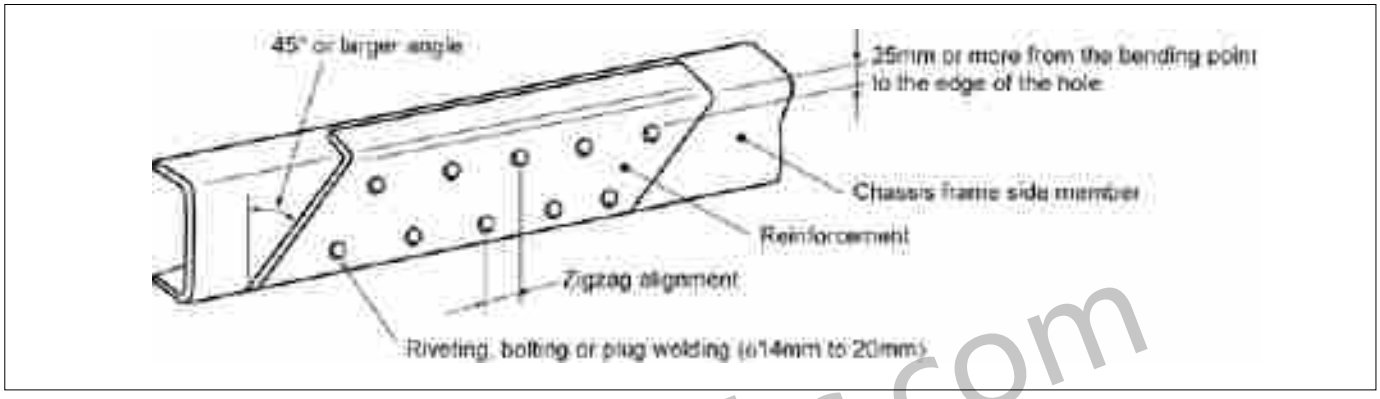
When reinforcing a chassis frame side member, follow the instructions below to prevent an acute change in rigidity.

(1) Preventing an acute change in the section modulus and stress concentration due to welding

(a) Ends of outer reinforcement and inner reinforcement should not overlap.

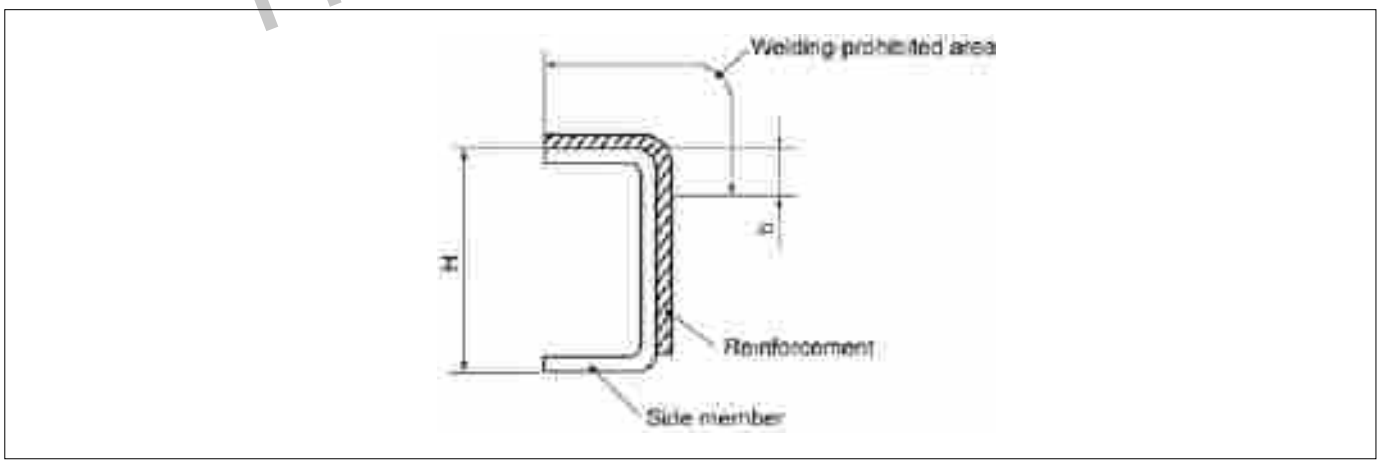
(b) An end of outer reinforcement and cross member should not overlap.

(c) An end of outer reinforcement and spring bracket should not overlap.



(2) Welding on a flange

When fitting a reinforcement on a chassis frame, secure it by riveting or plug welding. When performing plug welding, be sure that electrical components such as electric harnesses on the inner side of a chassis frame side member are a minimum of 50mm apart from welding site.



	Heavy duty / Medium duty	Light duty
b	H/5	20mm

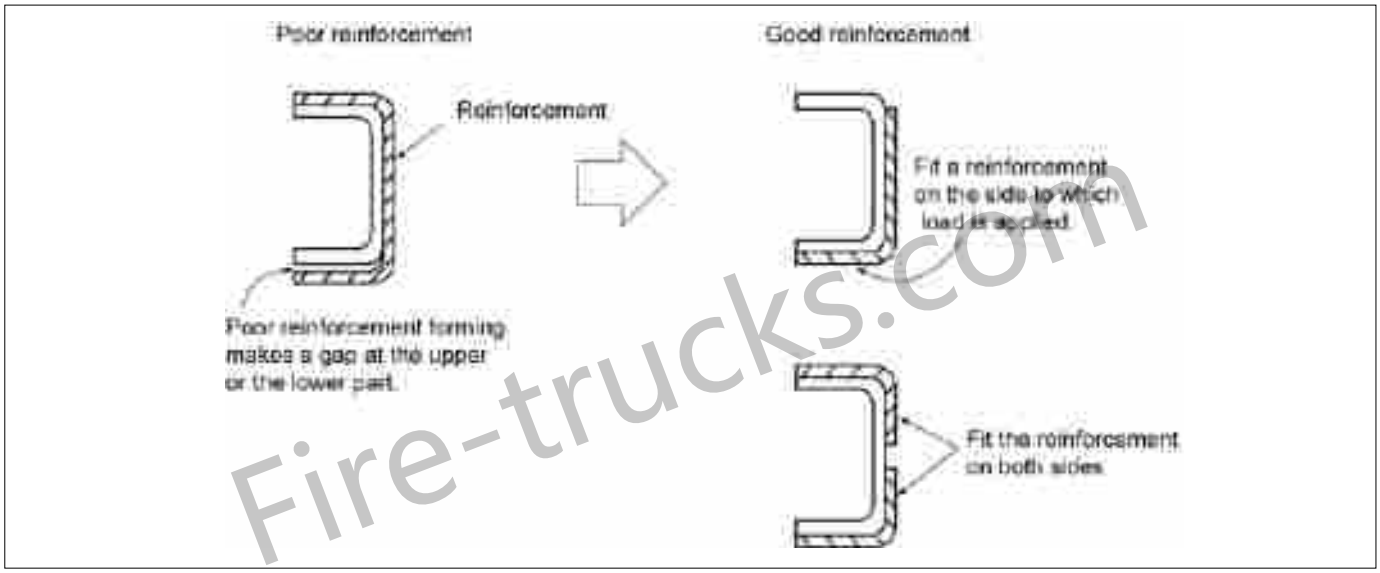
(3) Reinforcement material

	Heavy/Medium/Light duty
Outer reinforcement	Same as side member's
Inner reinforcement	Steel for general frame

Determine the thickness and the dimensions of reinforcements in due consideration of rear body mounting conditions and vehicle use conditions.

(4) Shape of reinforcements

Difference in shape between a channel-shaped reinforcement and a chassis frame side member results in insufficient strength and reinforcing effect. For this reason, use of L-shaped reinforcement material is recommended.



(5) Inserting a new rivet in a hole from which another rivet has been removed

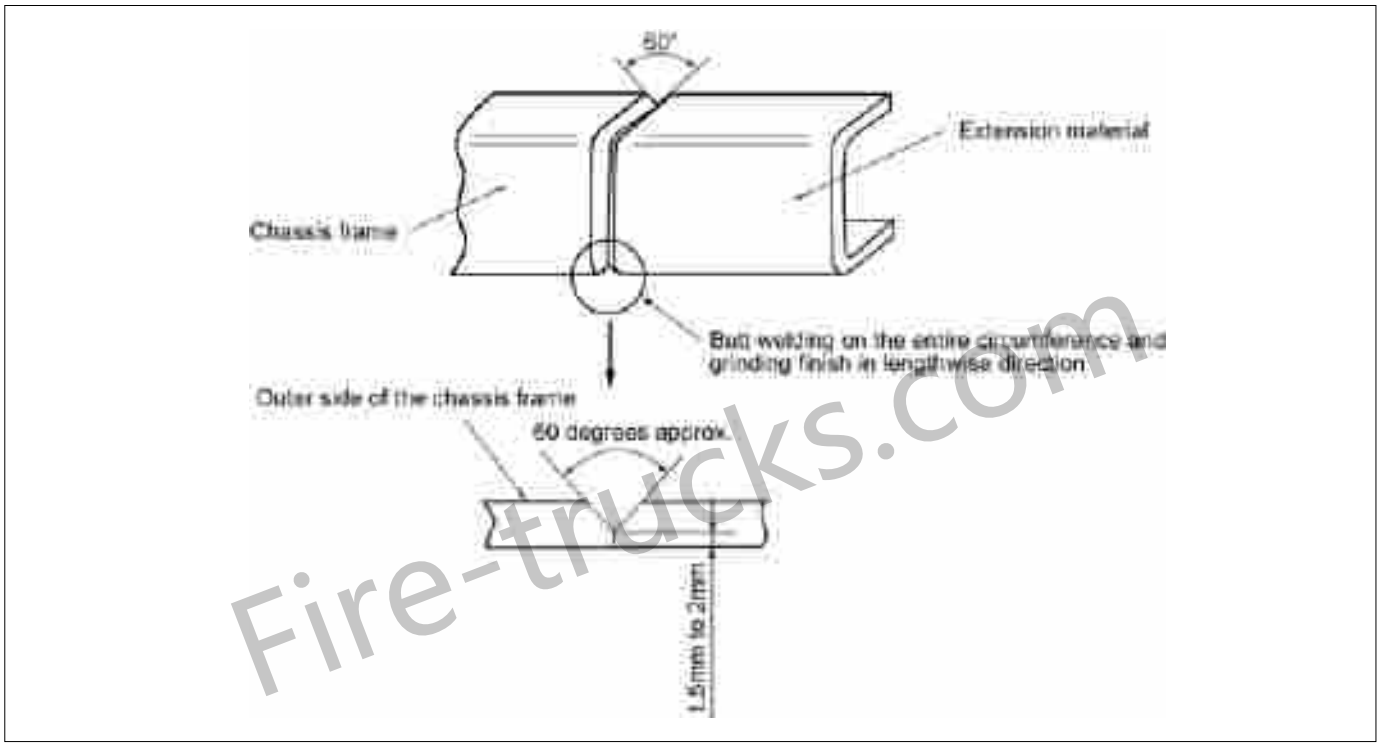
When inserting a rivet in a hole from which another rivet has previously been removed, the rivet should be 1 or 2mm larger in diameter than the removed one. Cold rivet only.

1.2.4. Modifying rear overhang of a chassis frame

If a rear body constrains a sub frame to necessarily protrude outward from the rear end of a chassis frame by 300mm or more, lengthen rear overhang of the chassis frame according to need. If it is absolutely necessary to cut a side member of a chassis frame for modification, make sure that the cut line does not split existing holes.

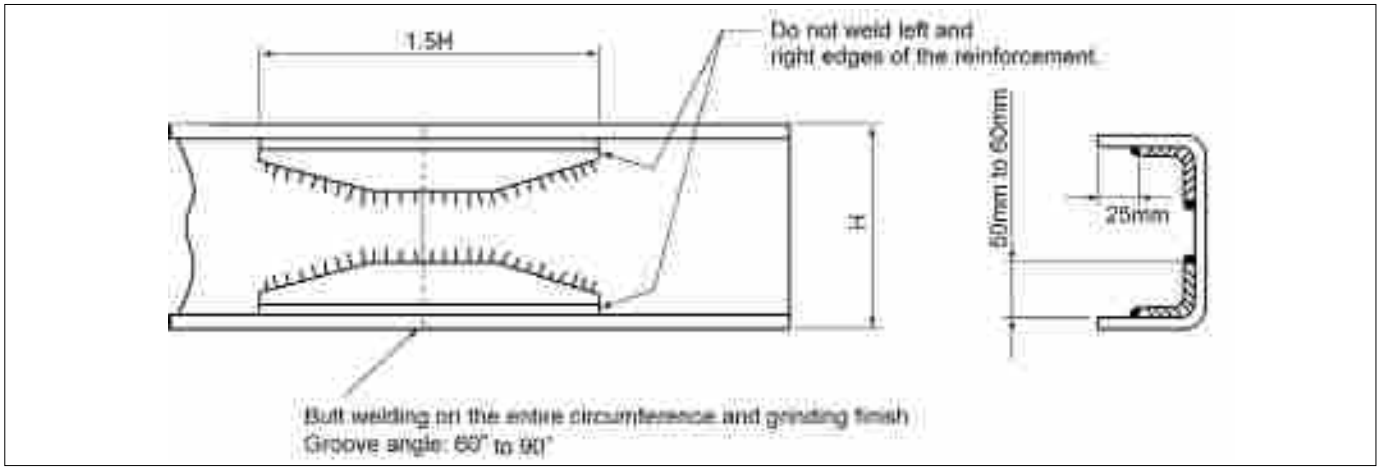
(1) In case that extension material is 300mm or shorter:

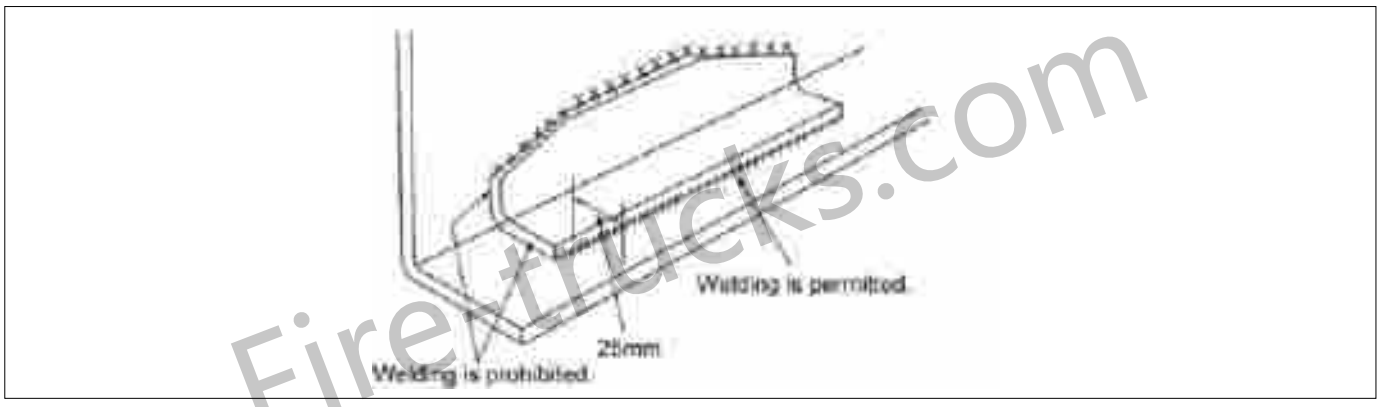
Join an extension material and a chassis frame by continuous butt welding. After welding, grind weld surface.



(2) In case that extension material is longer than 300mm:

Join an extension material and a chassis frame by butt welding, and then fit a reinforcement on the inner side of them.





Thickness of reinforcement material (Unit: mm)

Side member	Reinforcement material
8.0 at minimum	7.0
7.5	5.5 to 7.0
7.0	4.5 to 6.0
4.0 to 6.0	4.5

- Thickness of the extension material should be the same as that of side members.
- The extension material should be equivalent to that of side members.

1.2.5. Rivet plate

It is prohibited to weld parts or components on a chassis frame flange because doing so may deform or crack the chassis frame. However, if a rivet plate needs to be used for offsetting a rivet on the upper flange of a chassis frame side member to enhance rear body mountability, be sure that such rivet plate is properly shaped and attached so that it will not adversely affect the chassis frame.

(1) To prevent an acute change in rigidity of a chassis frame, the ends of a rivet plate should be formed as shown below.

(2) Remove burrs and sharp edges from rivet plates.

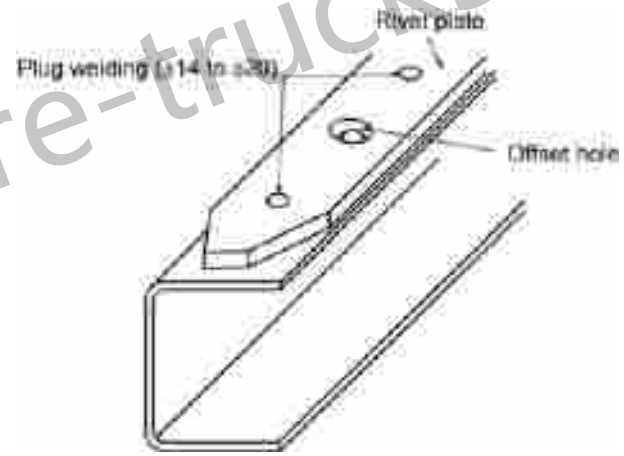
(3) Attach a rivet plate on a chassis frame by plug welding. Do not weld the longitudinal edges of the rivet plate and a chassis frame flange.

(4) After attaching a rivet plate, apply anticorrosion paint on the rivet plate and the chassis frame to prevent corrosion.

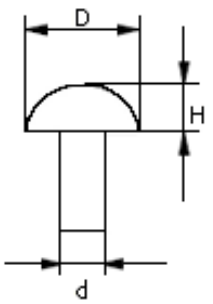
(5) Rivet plates should not factor into strength calculation.

(6) If rivet plates have to be welded on a chassis frame for the purpose of mounting a rear body, consult us if necessary.

Example of attaching a rivet plate



Shape of rivet



Unit ; mm

Vehicle type	Rivet Diameter(d)	Diameter (D)	Height (H)
Light duty	10	16	7
Medium duty	11	18	7.7
Heavy duty	13	21	11

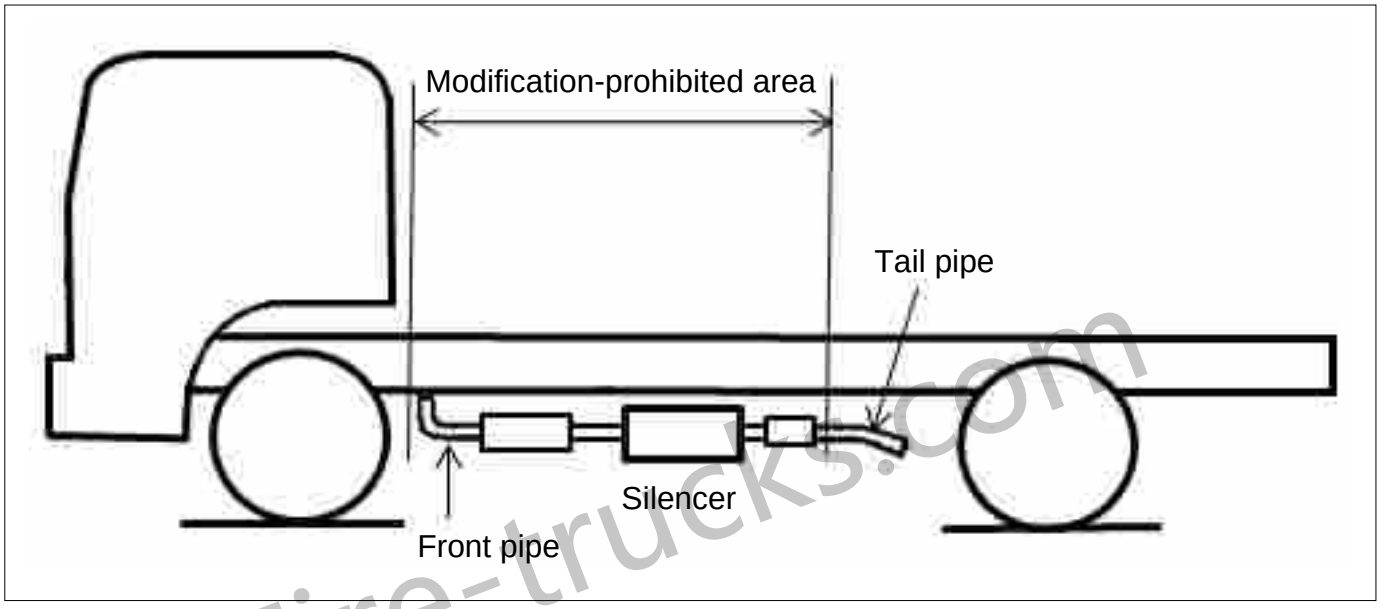
1.3. Precautions for modification of exhaust system and fueling system

1.3.1. Modifying an exhaust system

(1) Modification of an exhaust system is basically prohibited. Especially, modification to the following area is strictly prohibited because it will adversely affect engine or emission control device.

(2) Modification-prohibited area

Modification is prohibited from the front end of the front pipe to rear end of the silencer.



(3) If modification of a tail pipe cannot be avoided, follow the instructions below.

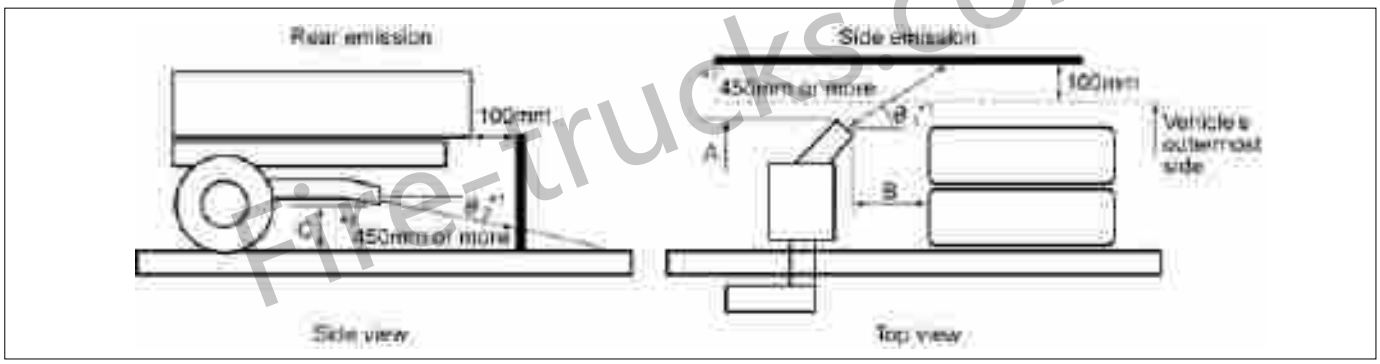
(a) Diameter and material of the pipe to be used for tail pipe modification should be equivalent to those of the factory-installed tail pipe. When welding, use a welding wire suitable for the base metal of the pipe.

(b) Lengthening or bending a tail pipe is not recommended because doing so increases exhaust resistance. If bending cannot be avoided, bend the pipe so as to make its inside bending radius become at least 1.5 times the pipe diameter, and be sure that exhaust pressure does not exceed a specified value.

(c) Tail pipe support should be the same as the factory-installed one or a genuine ISUZU pipe support with equivalent specification. Support a tail pipe by means of rubber elasticity. Do not reduce the number of supporting points.

(d) For the clearances between a modified tail pipe and a neighboring equipment or component on a chassis, see *(a)* through *(d)* under *(1) Relation of components layout and heat damage* in *2.1.3. Precautions for an exhaust system*.

(e) The angle and the position of a tail pipe opening shall be as follows, and they shall comply with applicable laws and regulations of body builders' country.



	A	B	θ_1*1	θ_2 *1	C
Recommendation	· It should not protrude outward from vehicle's outermost side. · It should not protrude outward from the side guard.	200mm or longer (*2)	0° to 15°	25° or smaller angle	200mm or longer
Japanese safety standard (For reference)	· It should not protrude outward from vehicle's outermost side.	—	30° or smaller angle to the left and right	—	—

*1: If the angle θ_1 exceeds 15° and θ_2 exceeds 25°, consult the ISUZU dealership. A tail pipe opening should be located a minimum of 450mm by extension away from the bold line in the above figure, which is 100mm outside from the outermost side of a vehicle. The dimensions θ_1, θ_2, and C apply to both rear emission and side emission.

*2: Be sure that exhaust gas does not directly blow on a rear tire.

1.3.2. Modifying a fueling system

In case of difficulty in mounting a rear body with the fuel tank remaining in its present position, relocation of the fuel tank is permitted according to the instructions below.

Adding an extra fuel tank is not recommended.

(1) Relocating a fuel tank

(a) When relocating a fuel tank, make sure whether there are free holes in a chassis frame side member adjacent to the area to which the fuel tank is to be relocated, so that these holes can be used for fitting a bracket. Using these holes is recommended rather than making new holes. If more holes are required, drill them in the chassis frame side member. For details, see the section *1.2.2. Drilling or welding a chassis frame*.

(b) Do not fit the bracket together with other equipment by sharing same hole.

(c) When lowering the position of the fuel tank, carefully determine the ground height of a fuel tank not to contact the ground with particular attention to the conditions of use.

(d) The fill opening of a fuel tank must be a minimum of 300mm apart from the opening of an exhaust pipe and a minimum of 200mm from any uncovered electrical terminal.

(e) Be sure that the relocated tank is sufficiently apart from any movable or projecting object.

(f) Be sure that the breather opening of the relocated fuel tank will not be subjected to water. There are two types of the breather: One of them is fitted on a fuel tank body, which can be opened with a hose, and the other type is at a filler cap.

(2) Changing a fuel pipe

(a) If a fuel pipe different from the factory-installed one is preferable, use a genuine ISUZU rubber fuel hose. Poor quality hose will possibly cause a fire. It is highly recommended to use a genuine ISUZU hose purchased from the ISUZU dealerships.

The following part numbers are the latest available at the time this guide is released. Prior to placing an order, please check the stock.

Feed side fuel hose Unit: mm

Vehicle type	Nominal size	Inner diameter	Outer diameter	Part number		
				Length: 3,000	Length: 1,500	Length: 1,000 to 1,150
Light duty	09	9.3±0.4	17.0±0.7	001259-3000	001259-1500	001259-1150
Medium duty	10	9.5±0.4	14.5±0.7	001260-3000	001260-1500	001260-1050
Heavy duty	12	11.3±0.5	19.0±0.8	001262-3000	001262-1500	001262-1000

Return side fuel hose Unit: mm

Vehicle type	Nominal size	Inner diameter	Outer diameter	Part number		
				Length: 3,000	Length: 2,000	Length: 940 to 1,050
Light duty	05	5.8±0.4	12.2±0.7	001855-3000	—	001805-9600
Light duty (Q-Series)	06	5.8±0.4	13.5±0.7	001256-3000	—	001206-9400
Medium duty	08	7.5±0.3	13.5±0.7	001558-3000	001558-2000	001558-1050
Heavy duty	10	9.5±0.4	14.5±0.7	001260-3000	001260-2000	001260-1050

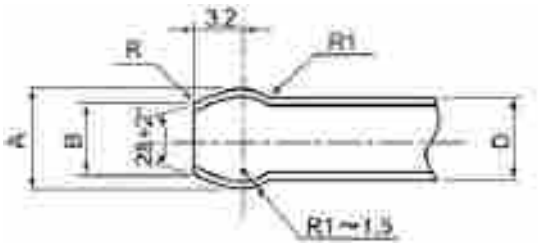
(b) In the engine compartment, use steel pipes with anti-corrosion treatment on their surface.

Inner surface	Copper plating (Thickness: 3μ at minimum)
Outer surface	Galvanization (Thickness: 13μ at minimum) & Organic coating (*)

Note: * Corrosion resistance: 2500hrs. at minimum before reddish brown corrosion appears after salt spray test.

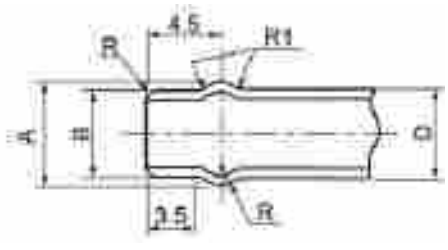
Perform bulge forming or spool forming on both ends of the said steel pipes as follows:

Bulge forming



Hose Nominal Size	D	A	B
05/06	6.35	7.4±0.3	6.1±0.3
08	8	9.3±0.3	7.9±0.3
10	10	11.5±0.3	10.0±0.3
12	12	13.5±0.3	12.0±0.3

Spool forming Unit: mm



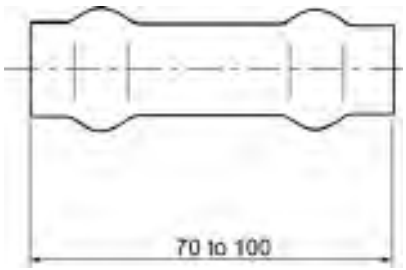
Hose Nominal Size	D	A	B
05/06	6.35	7.4±0.3	6.35
08	8	9.3±0.3	8
10	10	11.5±0.3	10
12	12	13.5±0.3	12

(3) Connecting pipes

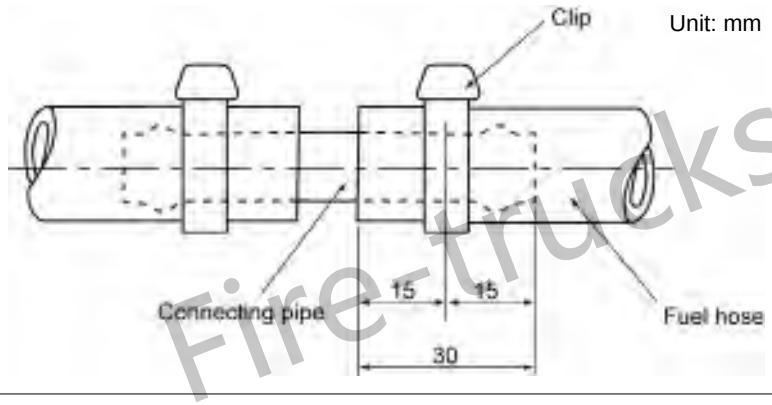
Do not connect two or more hoses to lengthen a single hose. When connecting hoses, follow the instructions below.

(a) Fabricate a connecting pipe from a steel pipe. Perform bulge forming or spool forming on both ends of this pipe.

Unit: mm



(b) Insert this connecting pipe into hoses by more than 30mm, and secure with clips.

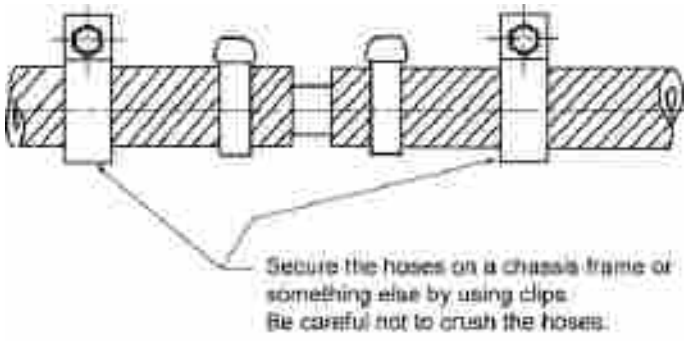


Unit: mm

Hose Nominal Size	Clip part number
05	898150-3580
06	898150-3570
08	898150-3570
09	898008-0980
10	109704-1020
12	898150-3560

If bulge forming and spool forming are impossible, the insertion depth should be 35mm or more.

(c) Secure the hoses on a chassis frame or something with clips.

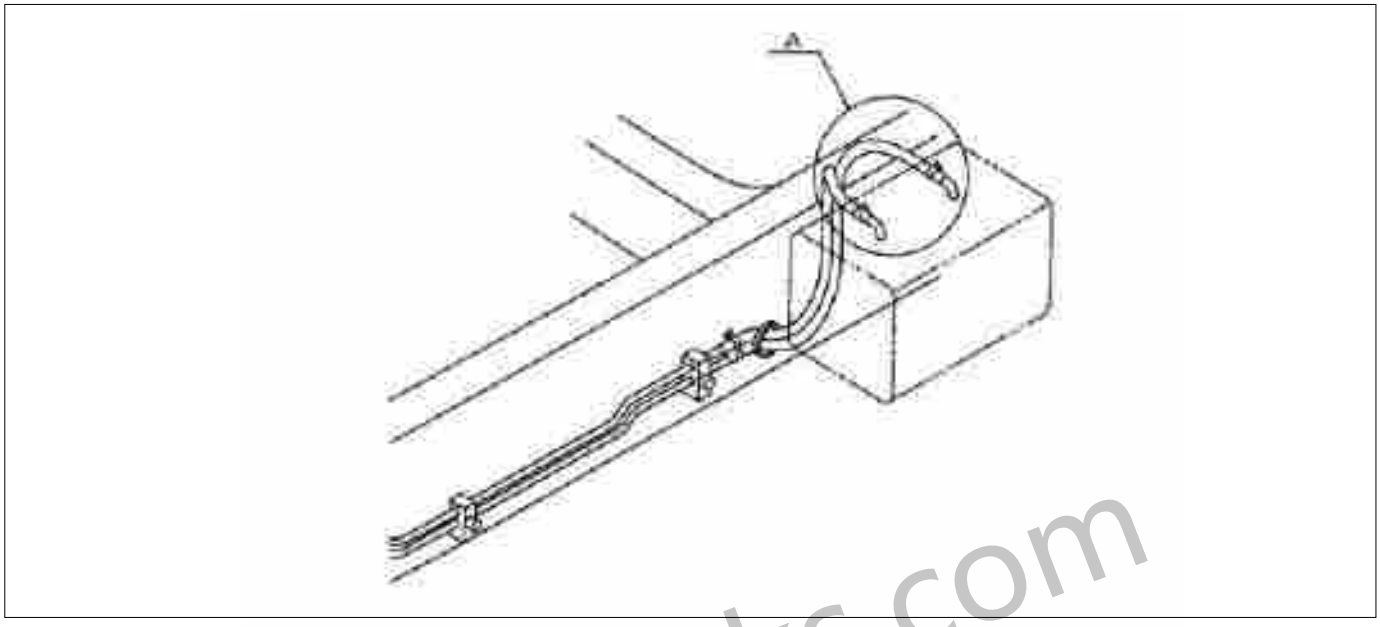


(d) Hose joints must not be located above an exhaust system.

(e) After completing the hose connection, confirm that there is no fuel leakage.

(4) Clearance around a fuel tank

(a) Maintain sufficient clearances between the hoses for a fuel tank (“A” in the figure below) and the object to be mounted on a chassis frame such as sub frame, U-bolt and double-ended bracket. If contact is anticipated, wrap the hoses with corrugated tubes or protectors.



(b) In the engine compartment, use steel pipes.

(c) The fill opening of a fuel tank should be easily accessible so that its cap can be removed or attached and fuel can be fed without problems.

(d) Do not join a fuel hose to the factory-installed one to take out fuel. Fuel must not be taken out from a branched hose.

(e) When installing a steel pipes, follow the instructions under *(3) Connecting pipes* in this section.

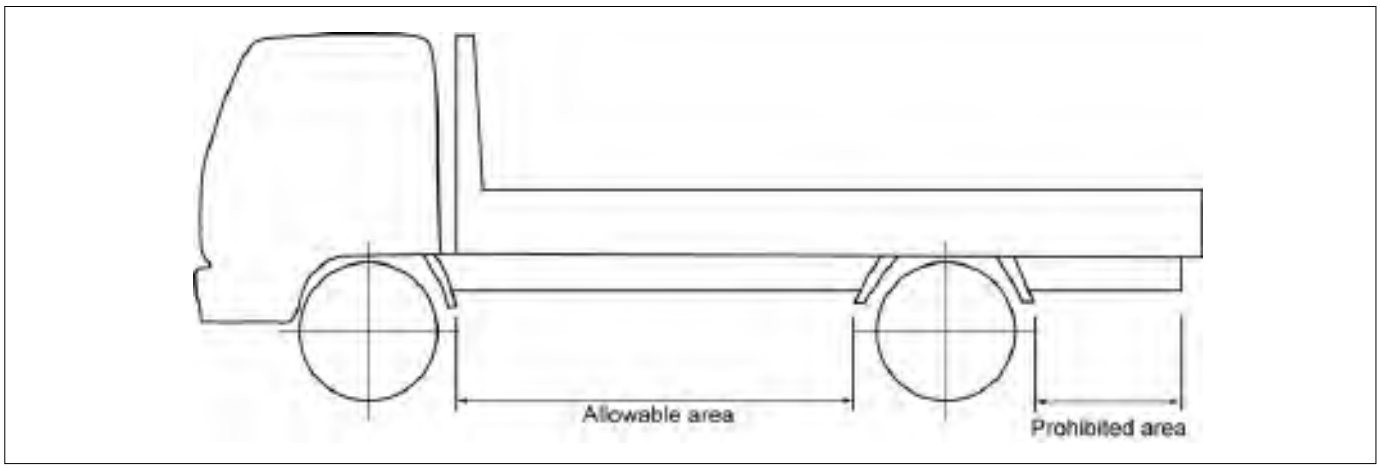
(f) Maintain a reasonable clearance between an exhaust system component (front pipe, silencer and tail pipe) and a fuel tank or a fuel tube.

(g) When fitting any equipment (e.g. side guard and marker lamp) near a fuel tank, maintain a minimum of 25mm clearance in front and back of the fuel tank and a minimum of 40mm on its outer side.

(h) In cold regions, when installing a sub tank on a vehicle, to prevent a fuel hose from sagging due to snow, secure the fuel hose on any retaining component (e.g. stay) attached to a tank hanger bracket.

(5) Location of a fuel tank

Place a fuel tank somewhere between wheelbase. Do not place it in rear overhang area.



(6) Relocation or addition of a fuel tank

When relocating or adding a fuel tank, follow the instructions below.

(a) When changing a fuel hose, use a fuel hose of the same material as the factory-installed one's or a steel pipe.

(b) Since use of low quality rubber hoses may cause fire, please purchase genuine ISUZU products from the ISUZU dealerships.

(c) If there is no alternative but to install an additional fuel tank, use of a genuine ISUZU fuel tank is recommended.

(d) The factory-installed fuel tank should be a main tank. Fuel must be supplied from this main tank.

(e) If the Fire Defense Law of body builders' country imposes regulation on the amount of fuel that a vehicle can carry, when installing an additional fuel tank, be sure that the total amount of fuel does not exceed the regulation.

1.4. Precautions for piping

1.4.1. Modifying a brake pipe or a clutch pipe

Do not modify a brake pipe and a clutch pipe unless absolutely necessary. If there is no alternatives but to modify them, follow the instructions below for safety assurance.

- Brake pipe must not be cut and reconnected. No exceptions.
- Cutting and reconnecting a clutch pipe is not recommended.

If modification of the clutch pipe cannot be avoided, fabricate a connecting pipe using appropriate tools, and then connect cut pipes by using this connecting pipe. After the pipe connection, conduct a pressure test on joint.
Note that a steel pipe used to make the connecting pipe is in metric size.

1.4.2. Hydraulic or air steel pipes

(1) Pipe materials and forming

(a) Use brand new genuine ISUZU pipes.

(b) When flare-forming or bending a pipe, use the tools specified by ISUZU MOTORS LIMITED, and do these works according to the ISUZU standards.

(c) Do not bend the same portion of a pipe more than once. Do not perform heat flare forming and heat bending. Before and after forming a pipe, for safety assurance, check the surface of the pipe for damage, deformation or dent, and make sure of no foreign substance inside.

(d) Leave factory-installed clips unremoved, and use them as much as possible when securing pipes.

(e) After forming a pipe, clean up the inside of the pipe.

(2) Clearance between steel pipes and other components

Steel pipes must not contact with rear body components, and must not be subjected to heat and vibration.

(a) If there is possibility that a pipe may contact with a rear body component, secure the pipe with clips. Allow a minimum of 10mm (0.39 in.) clearance between pipes (See Fig.1).

(b) No metal pipes should be placed intersecting each other. If such intersection cannot be avoided, provide a minimum of 10mm (0.39 in.) clearance between the intersecting pipes (See Fig.1).

If vibration of a pipe is anticipated, secure such pipe with clips so that it will not contact with neighboring components (See Fig.2).

(c) Location of clips
To prevent pipes from being damaged by vibration, locate clips at such distances that absorb vibration. Place bended pipes at appropriate angles.

(d) Use rust-proofed clips. Apply vinyl coating to the part of the clips where pipes may contact (See Fig.2).

Fig.1

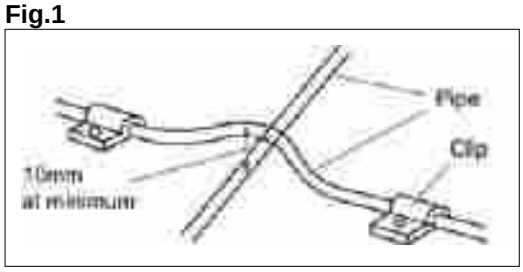


Fig.2

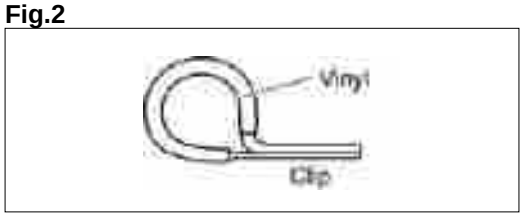
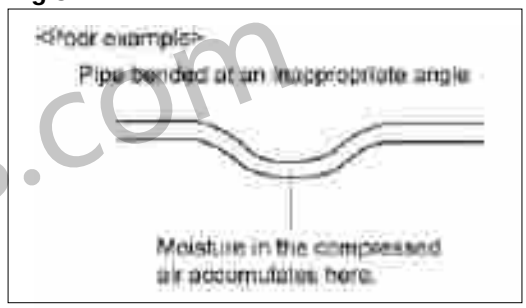


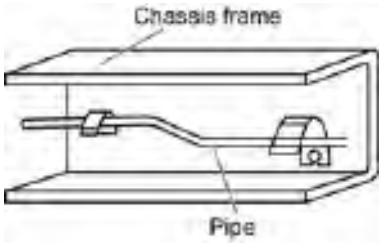
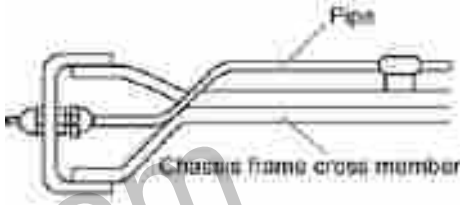
Fig.3



(e) Protect pipes from dust, sand, water and other foreign objects raised from road. Water accumulation inside pipes must be avoided (See Fig.3).

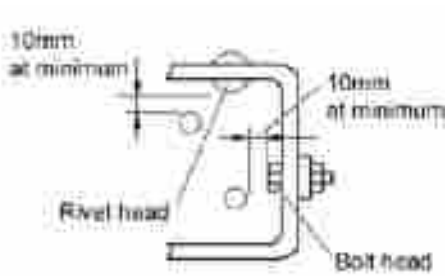
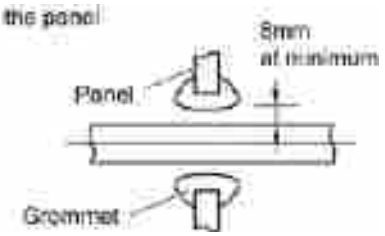
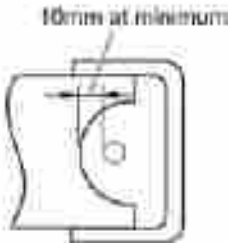
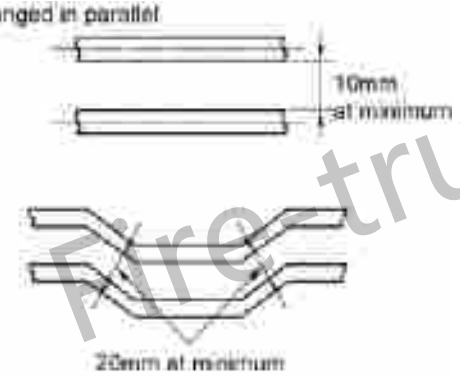
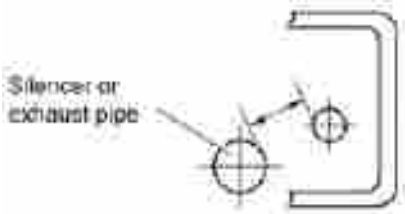
(f) If some clips were removed due to rear body mounting, after the body mounting, put these clips back in place. If piping cannot be restored to its original state, secure pipes with clips according to Table 1.

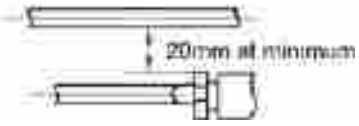
Table 1 Distance between clips Unit: mm

	Pipe diameter			
	ϕ 4.76 to 6.35	ϕ 8 to 10	ϕ 12	
Small vibration	500 at maximum	600 at maximum	800 at maximum	
Large vibration	400 to 500	500 to 600	600 to 800	

(g) After any modification to a pipe, check whether the following clearances have been maintained.

Table 2 Clearance between a steel pipe and other components

<table>
<tr>
<td>Bolt head or
rivet head on
chassis frame
member
 
</td>
<td>Hole in the panel
 
</td>
</tr>
<tr>
<td>Edge
 
</td>
<td>Moving components such lever, link and arm: 30mm (moving range +30mm)</td>
</tr>
<tr>
<td>Pipes arranged in parallel
 
</td>
<td rowspan="2">Silencer and exhaust pipe
① In case that the pipe and the component intersect with each other – 80mm at minimum
 

② In case that the pipe and the component are placed in parallel – 200mm at minimum (150mm if a heat insulation panel is provided.)</td>
</tr>
<tr>
<td>Flared nut
 
</td>
</tr>
</table>

1.5. Precautions for cab modification

1.5.1. Modification or addition to a cab

(1) Cab modification is prohibited except for drilling holes. Do not deform or weld cab panels.

(2) After making holes in the inner or outer surface of a cab for installing equipments, thoroughly apply rust-proofing agent on the inner surface and the circumference of such holes. If a hole of more than 10mm diameter is made in a strength-critical area such as floor, be sure to reinforce the area around the hole.

(3) When installing levers or switches for controlling a rear body from a cab, to avoid contact during operation, they must be sufficiently apart from the other levers and switches that have already been fitted in the cab.

(4) Affix plates or labels on such newly-added levers and switches to make their intended usage identifiable.

(5) When installing a warning buzzer in a cab for a rear body equipment, be sure that the sound of the buzzer is different from the safety-alerting sounds of other warning buzzers such as the one for brake.

(6) Since every cab had undergone thorough anticorrosion treatment, when making any additional works on a cab such as drilling holes, or when a cab surface was falsely scratched, apply rust-proofing treatment on such portions.

1.5.2. Installing equipments on a roof

(1) For installation of equipments (e.g. Air deflector), a total of eight welded mounting nuts as shown in the Fig.1 are available on the left and right edges of a cab roof (four each). See the Fig.2 for the location of the nuts. The location of the nuts on a crew cab roof, viewed from front, is the same as that on a full cab roof.

(2) Before fitting equipments on a roof, remove the factory-installed dummy bolts from nuts. Do not use the removed dummy bolts for fitting equipments because they do not have sufficient strength.

(3) When fitting a rear body, be careful not to damage the roof, and for rust-proofing, be sure to insert a packing between the rear body and the roof. To prevent crack in the packing due to ozone, the material of such packing should be neoprene rubber or EPDM rubber.

(4) Use anticorrosive M8 nickel chrome stainless steel bolts, and washers.

(5) After tightening bolts, to prevent water leakage, apply silicone sealant on the entire circumference of the bolts.

Fig.1 Equipment attachment with M8 bolt

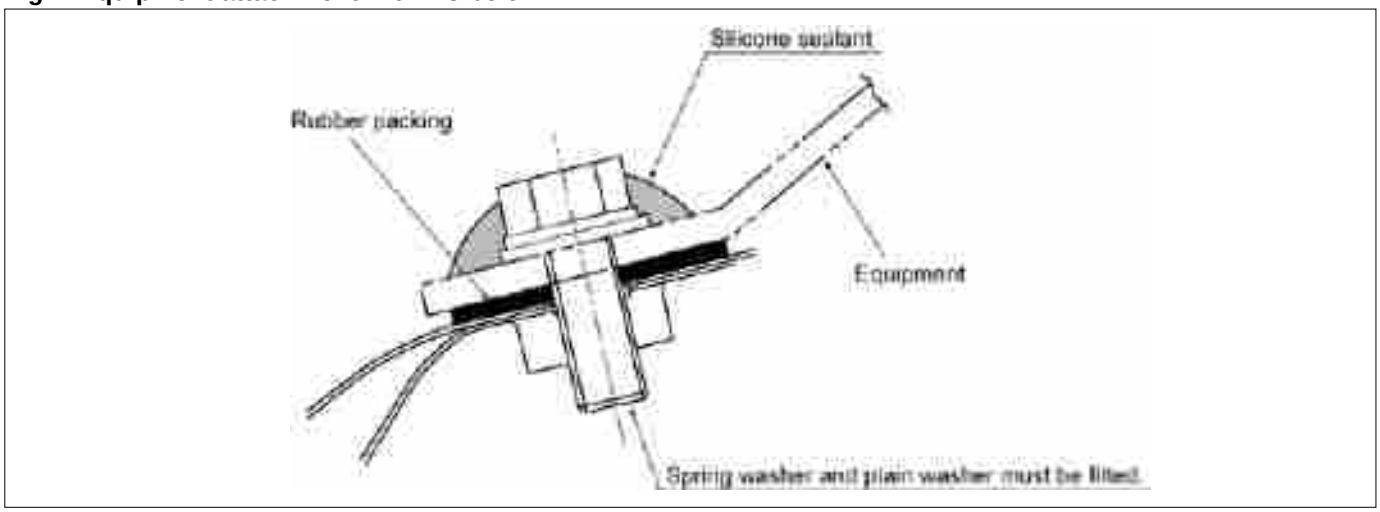
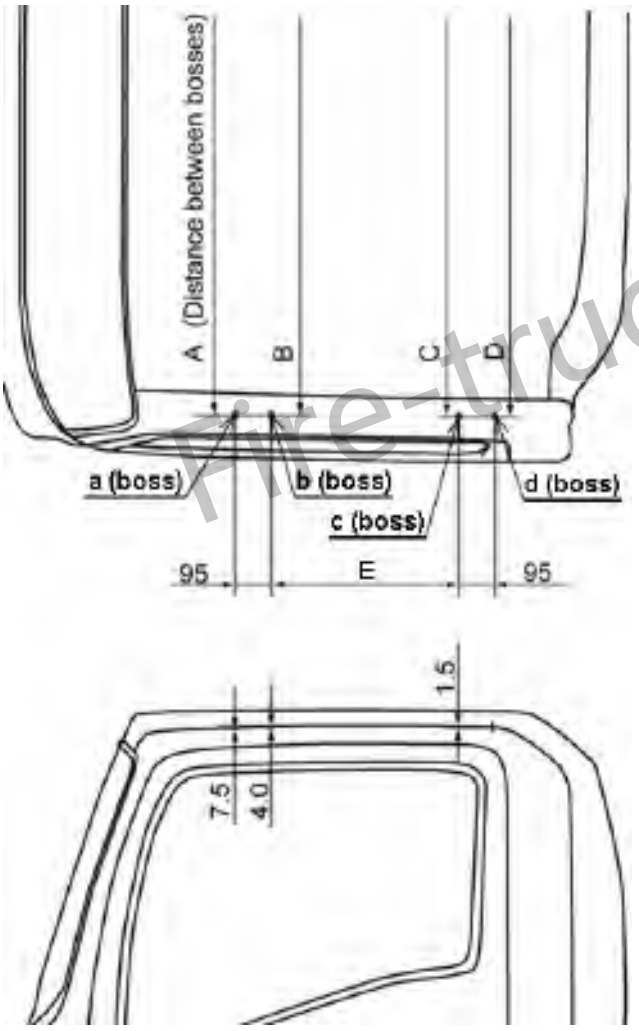
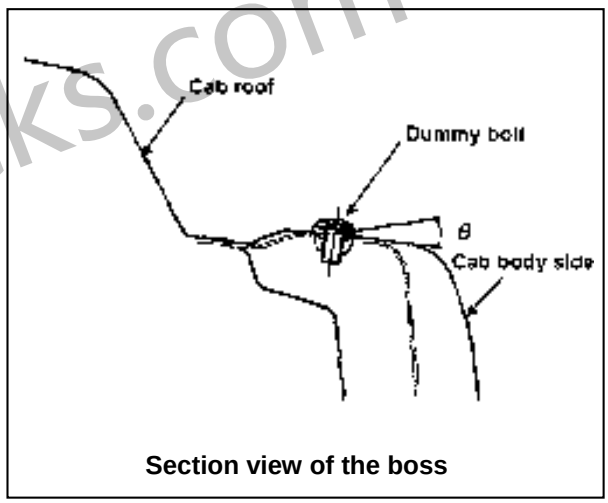


Fig.2 Location of the nuts on the cab roof





Section view of the boss

Unit: mm

Cab type	Distance between bosses				E	Gradient angle of bosses (θ°)			
	A	B	C	D		a	b	c	d
High cab	1,535	1,535	1,535	1,535	468	9	8	5	5
Wide cab	1,760	1,760	1,760	1,760					

1.5.3. Load limit on a roof

Load on a roof must not exceed the following weight:

Table 1 Load limit on a roof

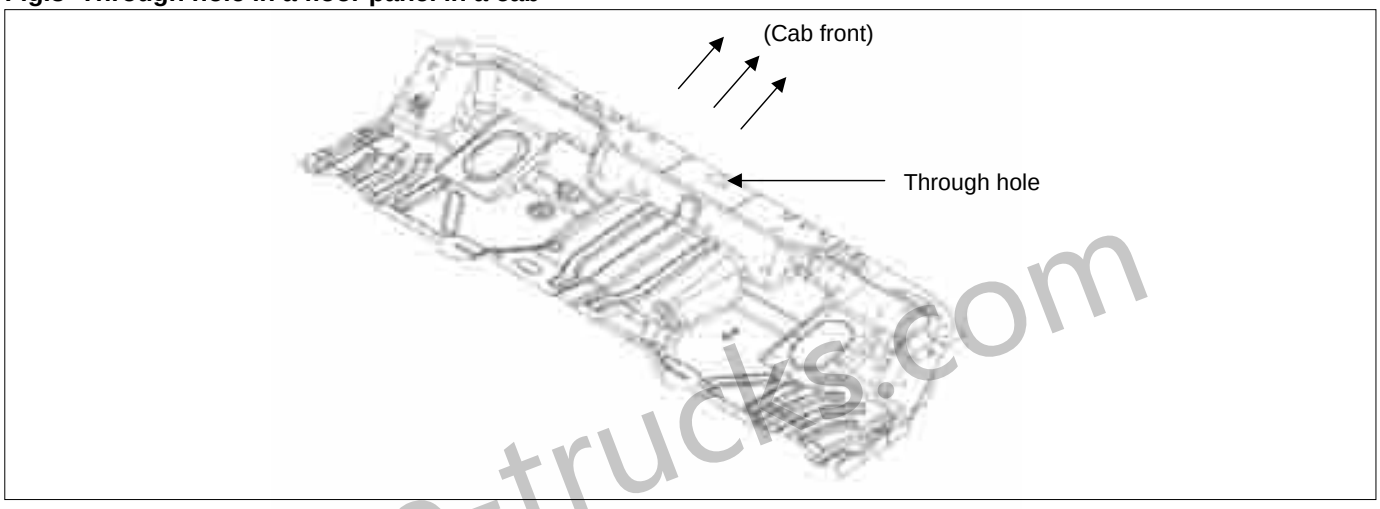
Light duty vehicle	Medium duty vehicle	Heavy duty vehicle
45kg	75kg	80kg

1.5.4. Through holes inside a cab for harnesses or an antenna cable

(1) Through hole for harnesses

As shown in the Fig.3, in a floor panel in a cab there is a through hole for harnesses.

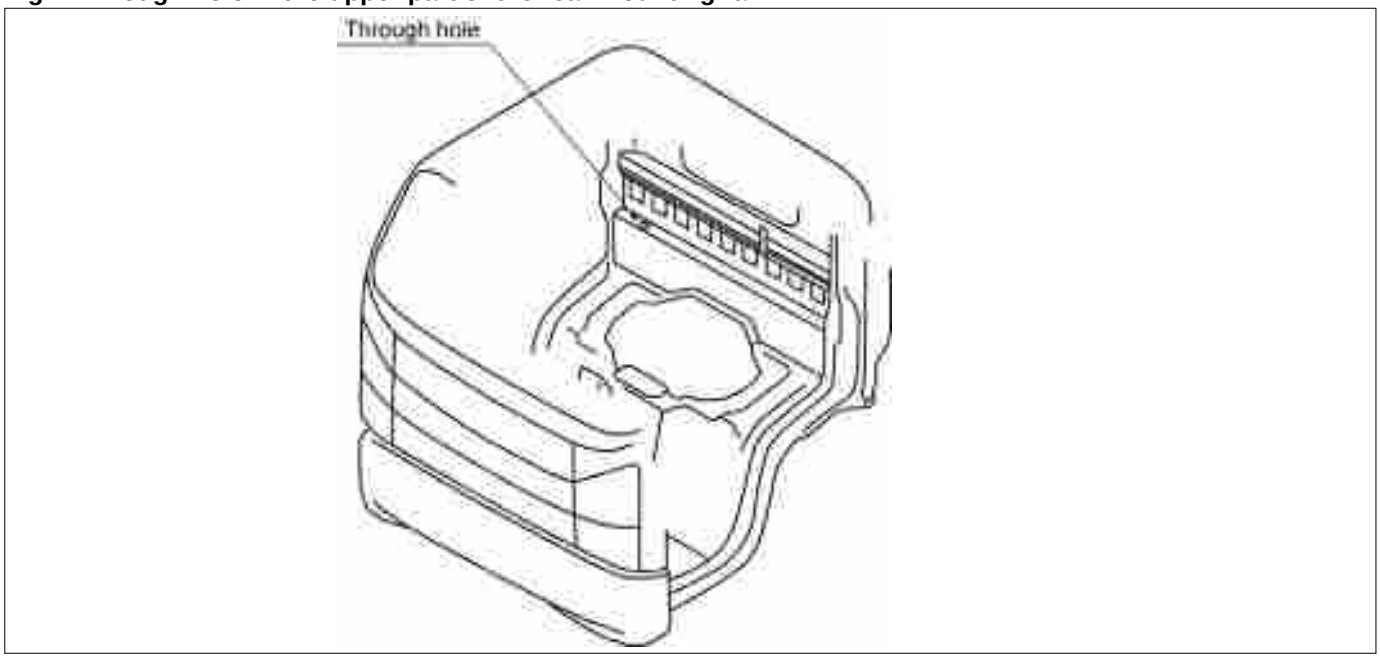
Fig.3 Through hole in a floor panel in a cab



(2) Through hole for an antenna cable (RHD only)

As shown in the Fig.4, in the upper part of the rear mounting rail behind driver's seat in a cab there is a through hole (ϕ25) for an antenna cable.

Fig.4 Through hole in the upper part of the rear mounting rail



1.5.5. Works to be performed on a cab roof panel

In view of the strength of a roof, any works and walking on a roof panel are basically prohibited. If necessary, gently step on a sunken area of a roof panel. At this time, get on the roof not with rigid-soled shoes such as safety shoes but with bare feet or soft-soled shoes. Never get on a risen area. Since roof is made of thin steel plate, getting on the risen area may buckle the roof. When performing any major works on a roof, do them on wooden boards placed over a spread blanket.

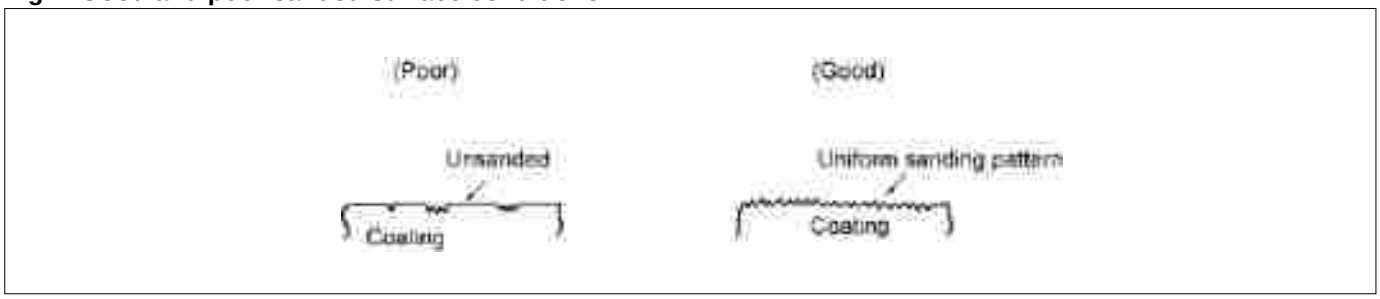
1.6. Precautions for painting

1.6.1. Cab painting

(1) Top coat

To enhance coating adhesion, thoroughly sand undercoat surface (See Fig.1). Be sure that the sanding pattern is uniform, and the sealant at the joints of steel plates must not be removed.

Fig.1 Good and poor sanded surface conditions



(a) Urethane paint is recommended for its high luster and distinctness-of-image gloss, and it allows low-temperature baking. Compared to lacquer composition, urethane paint provides better finish quality and has lower fading property. Top coat thickness should be 30μ or thicker.

(b) When cleaning a cab, do not use thinner and gasoline but IPA (isopropyl alcohol).

(2) Cab painting

(a) Painting-prohibited components

The following are the major components against which painting is prohibited. Apply masking to them when painting a cab.

- Brake hose and brake-related components such as brake booster
- Rubber hoses and vinyl hoses
- Electric harnesses and connectors
- Cab suspension and rubber or plastic steering components (In no circumstances should the air bellows be painted.)
- Cab power tilt-related components
- Wiper blades and washer nozzles
- Reservoir tank for coolant water and washer tank
- Caution plates and other identification plates
- Rubber or resin parts around windows

(b) Components that should be removed before painting

Remove the following components before painting:

- Assist grip on front panel (Since the assist grip is made of polycarbonate, it is weak against chemical solvent.)
- Mirrors (except for Stay)
- Air intake duct
- Fender step covers
- Fender rubber
- Side panel covers

(c) Re-attachment of removed components

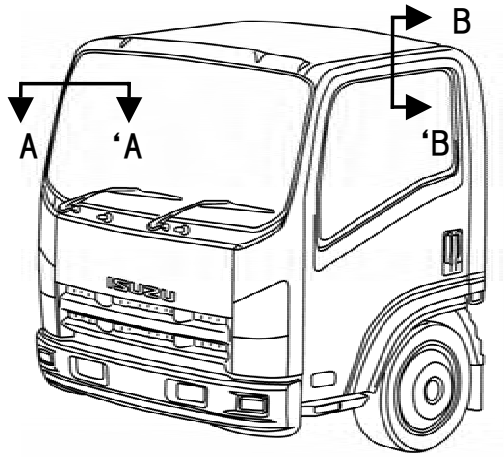
When re-attaching components after completion of painting, follow the instructions below.

- Do not re-attach the components until paint completely hardens.
- For the scratches that can be made during unfastening and fastening screws, bolts, or nuts, touch them up with a brush soaked in clear lacquer, etc.
- If mirrors and other components are removed, re-install them, tightening nuts with sufficient torque.

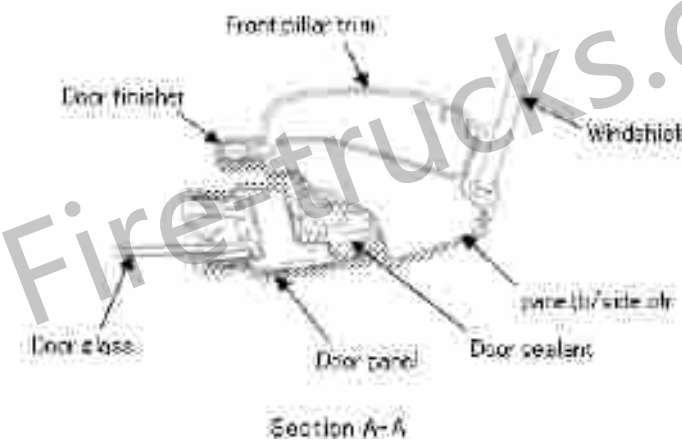
(3) Paint boundary

Fig.2 shows paint boundary. Shaded areas indicate the areas to be painted.

Fig.2 Paint boundary



Note: Shaded areas (\\\\\ ) indicate the areas to be painted.



Note: This is a simplified image of a vehicle.

(4) Paint drying

(a) There is no temperature restriction on the air seasoning. When conducting high temperature forced drying, be sure that the atmospheric temperature of painted surface does not exceed 80°C.

(b) Due consideration must be given to the drying temperature. Drying temperature over 80°C may deform rubber and resin parts, and result in separation of adhesive-bonded joints.

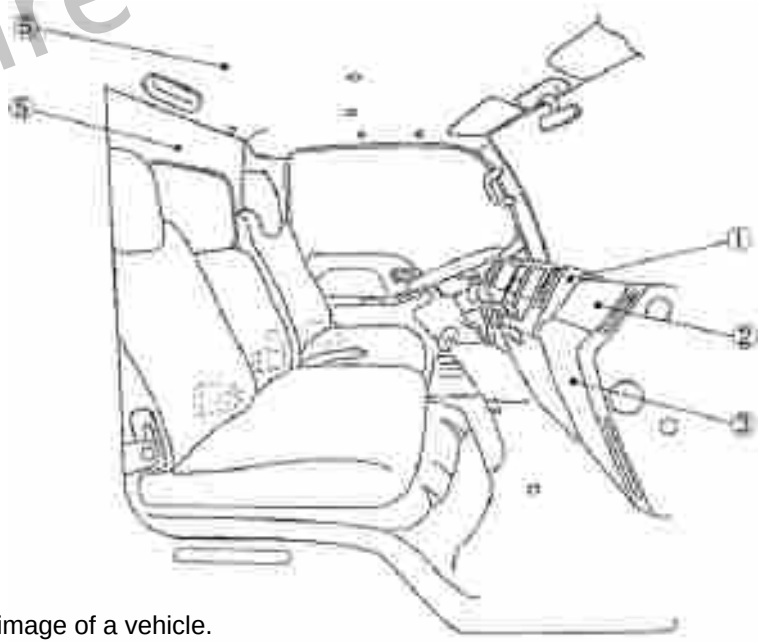
(c) If the drying temperature inevitably exceeds 80°C, referring to the allowable temperature limits in Table 1 and Table 3, remove components or protect them from high temperature with tinfoil, blanket, etc. The Fig.3 and Fig.5 show the locations of the components in Table1 and Table 3 respectively.

(d) The above-mentioned heat protection is imperative for the air cylinder for cab suspension because the temperature over 80°C degrades its durability.

Table 1 Allowable temperature limit of high cab-interior components

No.	Component name	Material	Allowable temperature limit (° C)
1	Meter cluster	PPF	80
2	Fuse lid	PPF	80
3	Instrument panel cover	PPF	80
4	—	—	—
5	Trim cover	PP or PPF	80
6	Head lining	PET	90

Fig.3 Location of the high cab-interior components [LHD is shown here. RHD is symmetrical.]



Note: This is a simplified image of a vehicle.

Table 2 Allowable temperature limit of wide cab-interior components

No.	Component name	Material	Allowable temperature limit (° C)
1	Meter cluster	PPF	80
2	Fuse lid	PPF	80
3	Instrument panel cover	PPF	80
4	Header tray	PP or PPF	80
5	Trim cover	PP or PPF	80
6	Head lining	PET	90

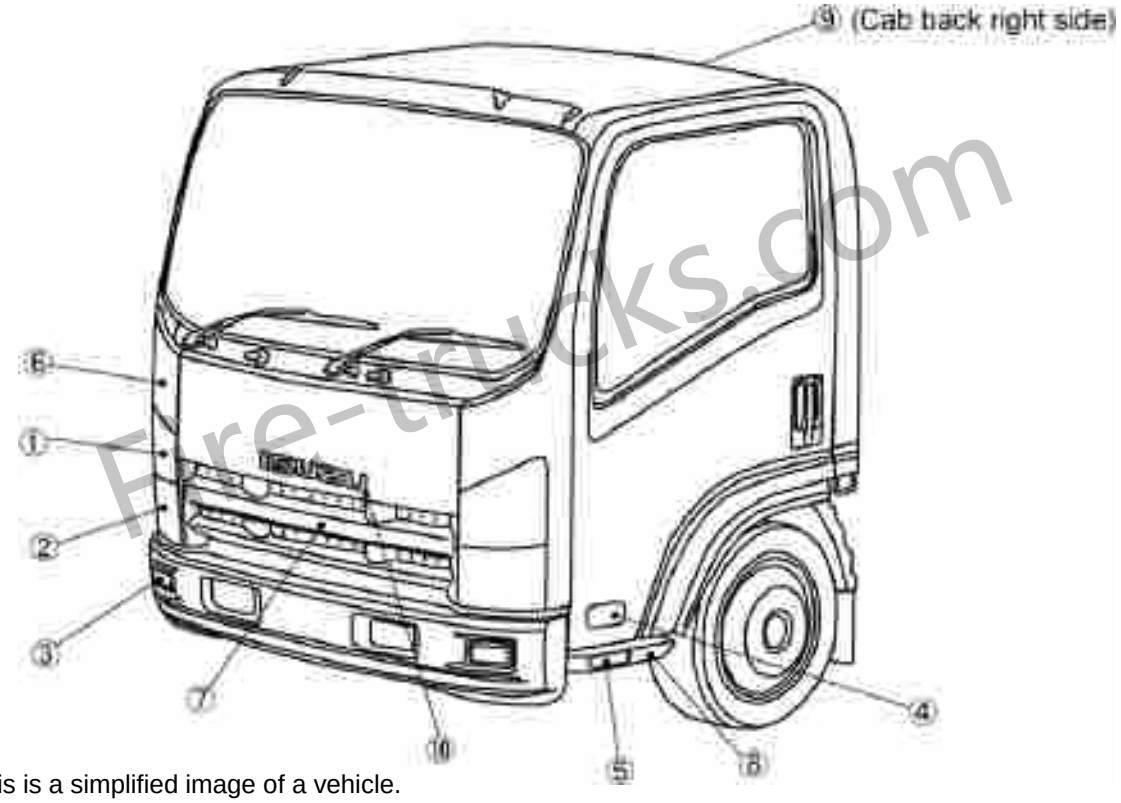
Fig.4 Location of the wide cab-interior components [LHD is shown here. RHD is symmetrical.]

Note: This is a simplified image of a vehicle.

Table 3 Allowable temperature limit of cab-exterior components of high cab and wide cab

No.	Component name	Material	Allowable temperature limit (° C)
1	Front turn signal lamp	PMMA	80
2	Headlamp	PC	90
3	Fog lamp	PP (Housing)	90
4	Side turn signal lamp	PC	90
5	Side reflector	PMMA	80
6	Corner panel	ABS	80
7	Grille	ASA	80
8	Step closing	PP	90
9	Air duct	PP	90
10	Emblem	PET	90

Fig.5 Location of the heat resistant cab-exterior components high cab and wide cab



Note: This is a simplified image of a vehicle.

(5) Removing control units with built-in computers during baking coating

The allowable temperature limit of various control units with built-in computers is 80°C. If the ambient temperature inside a cab, specifically the area 5mm above a floor, exceeds 80°C during baking coating on the outer panels, or if such situation is expected, remove the control units.

(6) Laminated glass

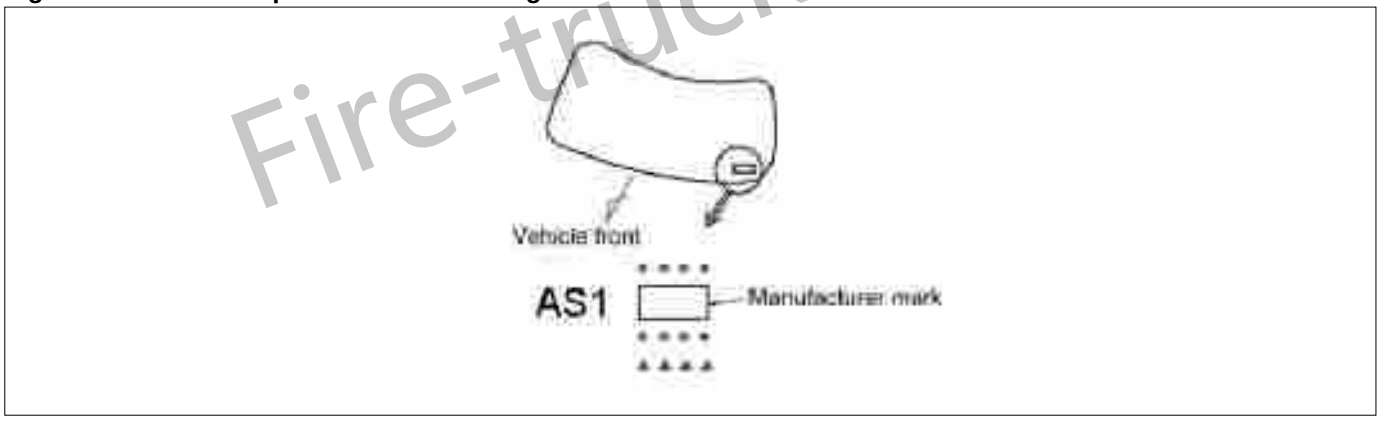
A laminated glass consists of two thermal-bonded glasses between which a polyvinyl butyral film is sandwiched. There is nothing to worry about the laminated glasses under normal use conditions. However, in hot and humid conditions during paint drying, follow the instructions below. Failure to follow these instructions may result in problems such as peeling of the polyvinyl butyral film and bubbles between the glasses.

(a) When conducting forced infrared drying, do it within 30 minutes at temperature no higher than 120°C.

(b) If the temperature during such forced drying inevitably exceeds 120°C, before starting the forced drying, cover the glass to prevent the temperature of the glass surface from exceeding 120°C, or remove it.

(c) Laminated glasses can be identified by “LP”, “LS”, “L”, “AS1” or “LAMINATE” printed at the lower left corner (See Fig.6). Partially tempered glasses have a “Z” print.

Fig.6 Location of the print on a laminated glass



(7) Affixing emblems and decals on the front face of a cab

(a) Emblem and decals

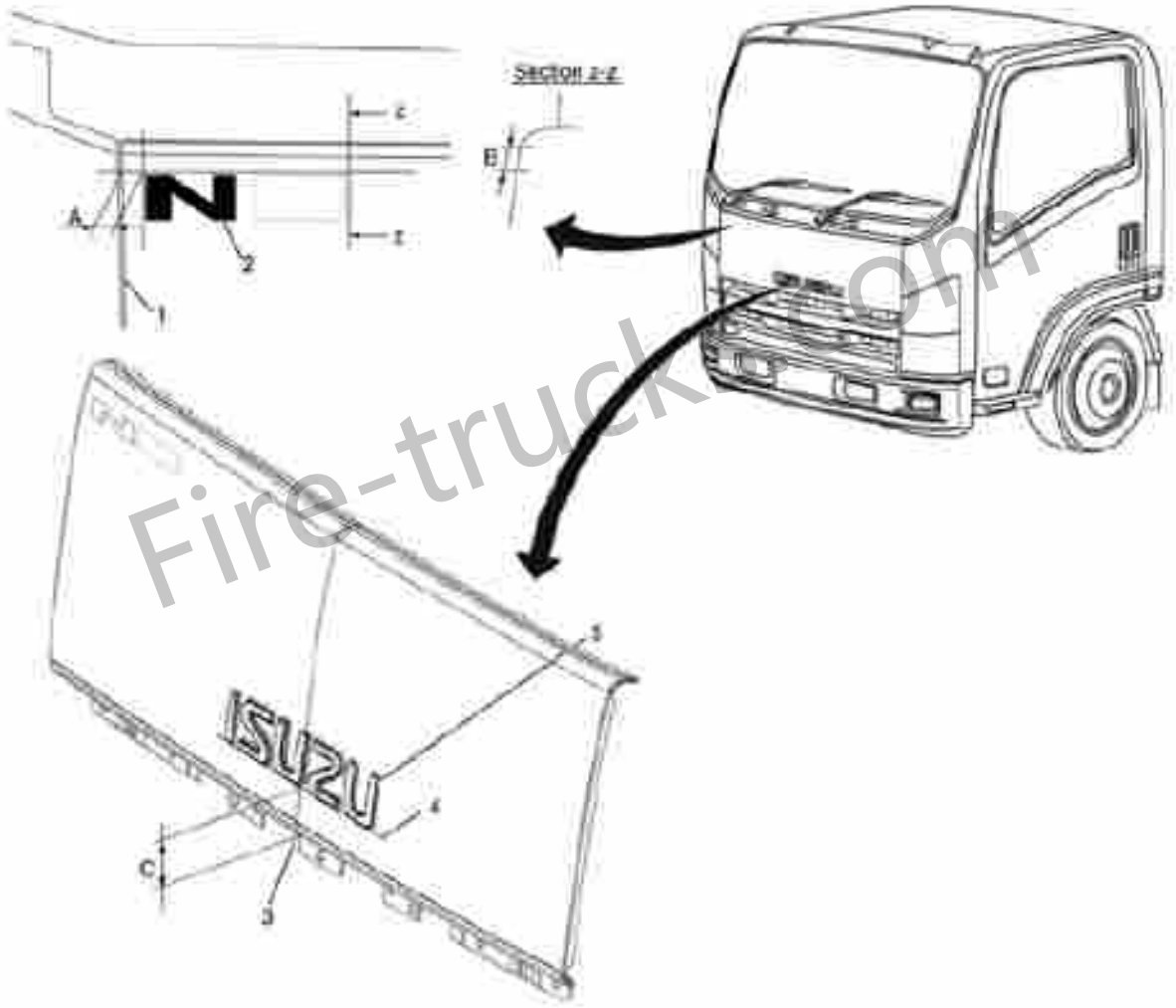
"ISUZU" emblem is shown in Fig.7 and "CHEVROLET" emblem is shown in Fig.8.

"N∗" decal is shown in Fig.7.

(b) Locations of emblem and decals

Fig.7 shows the locations of "ISUZU" emblem and "N∗" decal on the front lid of a standard vehicle. The location of "CHEVROLET" emblem is in Fig. 8.

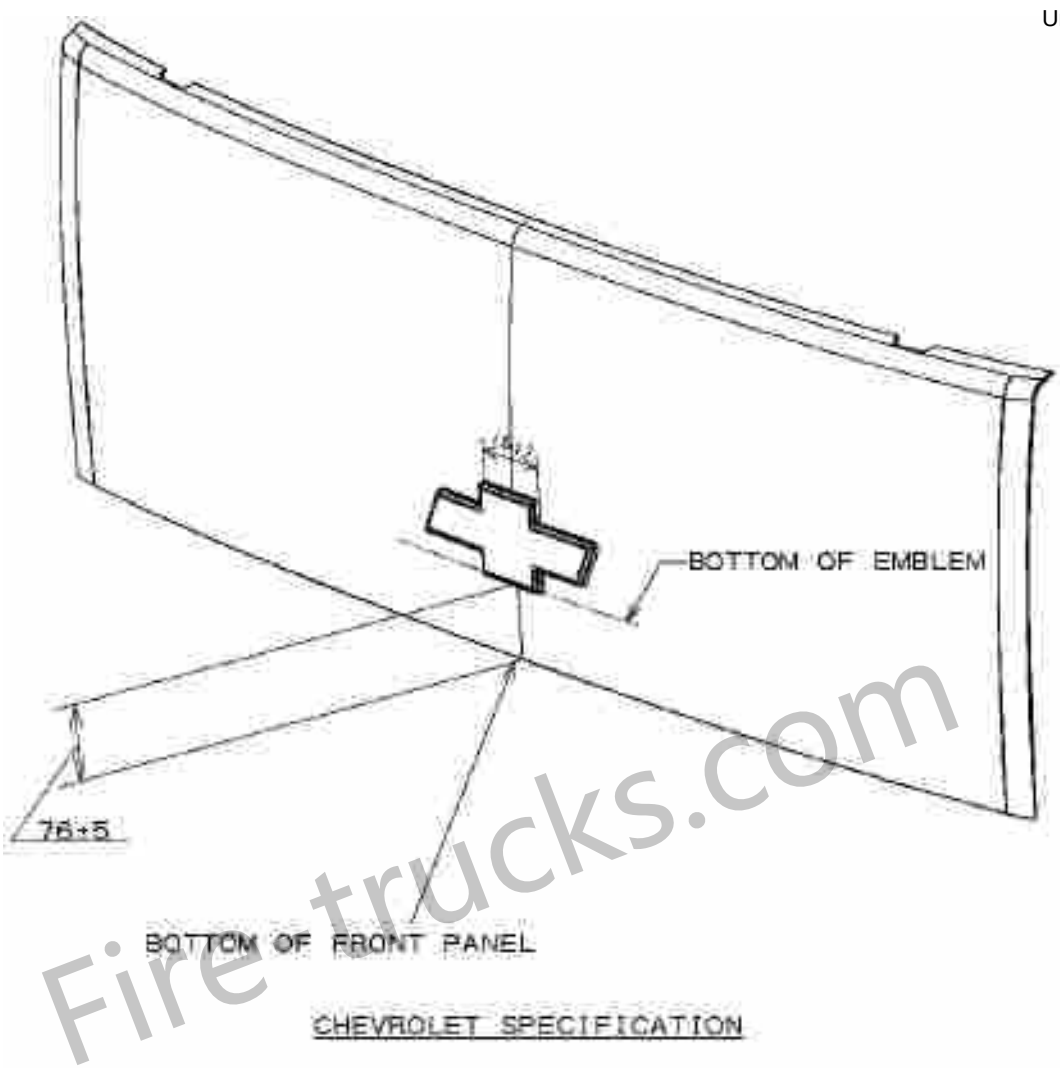
Fig.7 Locations of "ISUZU" emblem and "N∗" decal in standard vehicle



1. Edge of the panel
2. "N∗" decal
3. Bottom edge of the panel
4. Bottom edge of the emblem
5. "ISUZU" emblem

Distance
A: 20mm B: 19mm C: 43mm

Fig.8 Locations of “CHEVROLET” emblem



(c) How to affix an “ISUZU” or “CHEVROLET” emblem

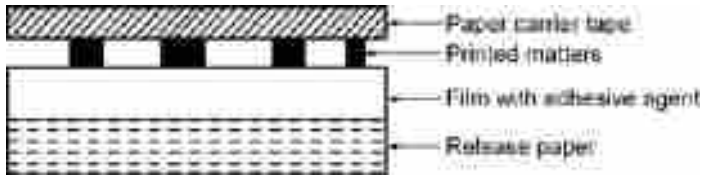
As for affixing “ISUZU” emblem, set the jig that came with a chassis on the front lid of a cab, and then stick each letter sticker by using cut-outs of the jig as a guide.

- If there is any extraneous matter on a bonding surface such as water, oil and dust, letter stickers will not firmly stick to the surface. If there is any, wipe them off completely with a clean cloth soaked in non-leaded gasoline.
- The ideal ambient temperature for adhesion is 30°C to 40°C. Make the temperature of the bonding surface fall within this temperature range as much as possible.
- The sticky side of stickers requires pressurization for bonding. To firmly stick the stickers, apply sufficient and uniform pressure on the stickers. Use of a roller is recommended as they provide uniform pressurization. The pressure of the roller should be no less than 5kg.
- Exposing the sticky side of stickers to the air for long hours weakens their adhesivity due to adhesion of dust, etc. To protect the sticky side, do not remove a release-paper until immediately before use.
- Since this sticky-side has very strong adhesive property, once stickers are affixed, peeling them off is not easy. Before sticking them, carefully check sticking position.

(d) How to affix a decal

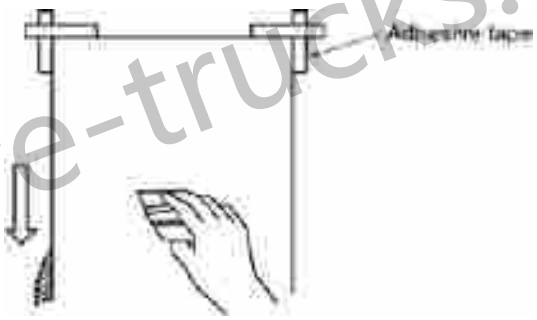
- The ambient temperature should be no lower than 20°C.
- If there is any extraneous matter on a bonding surface, wipe it off with ethanol. If the matter cannot be removed, completely wipe it off with lacquer thinner, etc., and then wipe the surface again with ethanol.
- To protect printed matters on a decal, as shown in Fig.9, cover the front face of the decal with a paper carrier tape before pressing the decal.

Fig.9 Composition of a decal



- Without removing a release paper, temporarily place the decal in position, and as shown in Fig.10, fix the two corners of the decal with adhesive tape.

Fig.10 Positioning with adhesive tape



- Peel off the release paper from the upper edge of the decal by approximately 20mm, and then fold down the paper at 180°.
- Press and paste up the area 20mm from the upper edge of the decal. Temporarily fix the lower corners with adhesive tape so that the decal will not move.
- Slowly peel off the release paper, and press the decal carefully.
- After sticking the entire area, remove the positioning tapes.
- If there are bubbles trapped inside the decal, pop and press them out.
- Press the entire surface hard, and then carefully remove the paper carrier tape.

Note:

- The base material of a decal is thin, soft and stretchable vinyl chloride. Therefore, strictly follow the procedure to firmly affix decals without making wrinkles, bubbles or stretching.
- Decals can easily be affixed directly on the front face of ISUZU cabs. However, if any decor made of polypropylene, polyethylene, Teflon, Noryl, urethane, etc. are underneath the decals, there is possibility that the decals may not stick at all or may come off shortly after being affixed.

(e) How to remove a decal

- If a decal has been affixed not more than one week, raise the edge of the decal with a fingernail, and then peel it off. If adhesive agent remains on a bonding surface, wipe it off with toluene and wipe again with isopropyl alcohol.
- If the decal has been affixed more than one week, coat the decal with toluene, and then peel it off with a spatula.

(8) Rust prevention with Ziebart's rust-proofing agent

The United States' Ziebart's rust-proofing agent is globally popular in protection from road snow melting agent, salty wind, etc. Apply this Ziebart's rust-proofing agent on cab under floor area, inner sides of fenders, outer side of a front panel, lower parts of doors, and joints of panels. Before applying the agent, cover the weep holes in the doors and in other areas with tape in order to prevent them from being plugged up with the agent. After completion of the agent application, remove the tapes and check the weep holes for blockage. Since a cab is made from thin steel plates, if the weep holes are plugged up by something such as rust-proofing agent, water or salty water may consequently corrode the panels, in the worst case making holes in them or weakening the strength of the members that are assuring the strength of the cab. In addition to the above weep holes, also cover the air bleeding holes in air valves, etc. with tape to protect them from blockage.

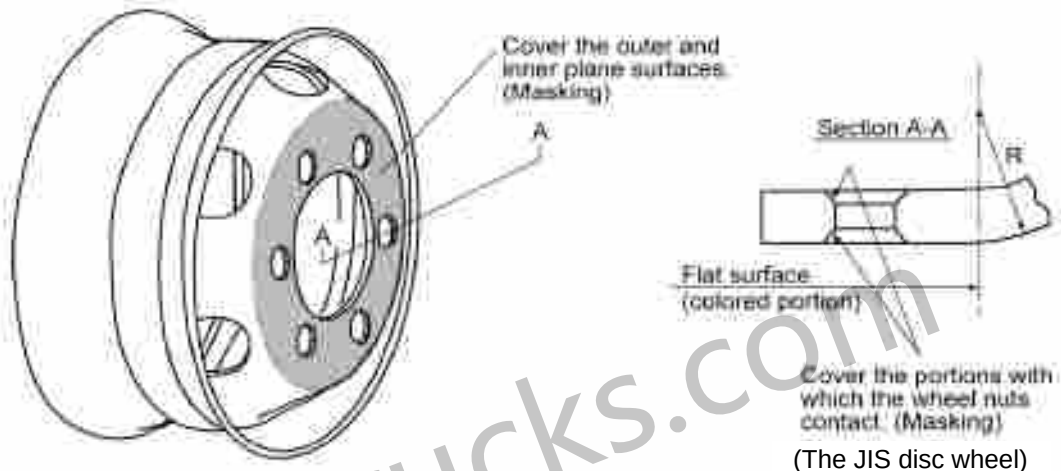
1.6.2. Painting-prohibited components or equipments

Painting-prohibited area on components or equipments are described below.

These equipments or components may not be installed in some vehicles.

(1) Disc wheel

Do not apply additional painting on the contact faces of a mating disc wheel and a hub, and the portions with which wheel nuts contact because thickening the painting may eventually loosen or damage wheel nuts.



(The JIS disc wheel)

※ The disc wheel shown here is one example.

(a) Painting a disc wheel after mounting it on a chassis

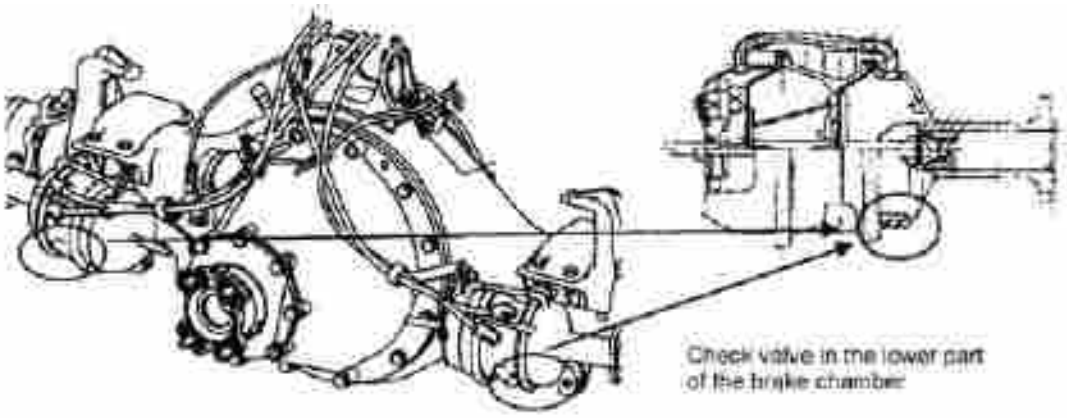
If a touch-up is required on a custom-painted disc wheel already mounted on a chassis with wheel nuts, paint it as thin as possible in the same user-requested color.

(b) For the purpose of preventing custom-painting on the disc wheel from causing wheel nuts to loosen, make sure in the event of tire rotation, that no portion of custom-coating on a disc wheel contacts with a mating disc wheel. If there is any contact, peel off the coating from the contact face, clean the surface with a wire brush, etc. and then lightly apply anti-rust coating. Before applying anti-rust coating, apply masking tape to the portions with which wheel nuts contact when they are fastened.

(2) Magnetic valve installed in AMT (Automated Manual Transmission)

If the exhaust port of the magnetic valve is blocked by the paint, it precludes transmitting.

(3) Check valve in the lower part of the brake chamber



(4) Equipments or components of Braking system

Do not paint the air inlet/outlet of the following valves for brake:

- Relay valve
- Quick release valve
- Brake valve
- LSPV (Load Sensing Proportioning Valve)
- Modulator
- TCV (Trailer Control Valve)
- Multi protection valve
- Servo unit (Air master)
- Air Dryer

(5) Brake hose and rubber hose, etc.

(6) Electric wiring and connectors

(7) Components and equipments related to suspension, steering wheel, such as these made of rubber or plastic. Especially painting on the air bellows is strictly prohibited.

(8) Caution plates

1.7. PTO control

1.7.1. PTO control lever/switch

	Control of PTO main body	Control device in cab	Figure	Remarks
PTO control	Electric	Switch (Button)	Fig.1	Ref.Ⅱ.5.1.2
	Cable	Lever	Fig.2	Ref.Ⅱ.5.1.2

Fig.1

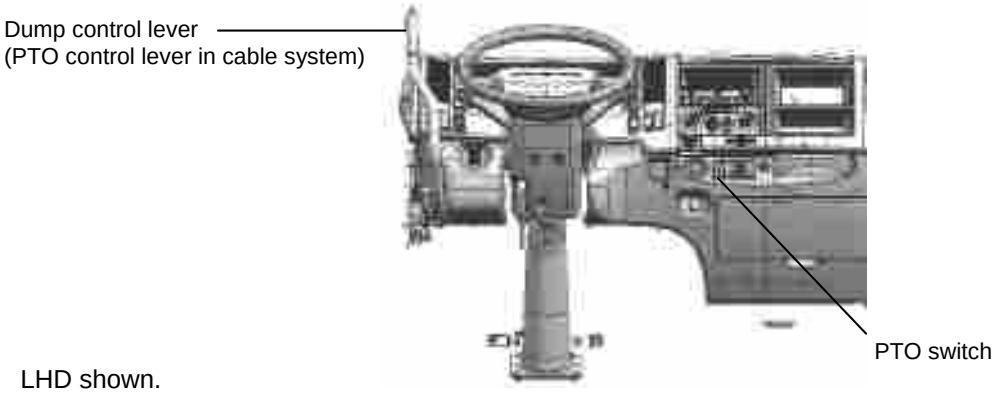
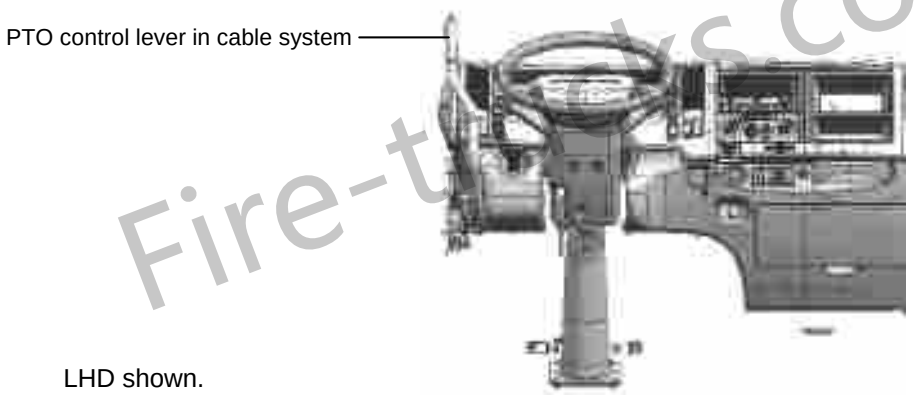
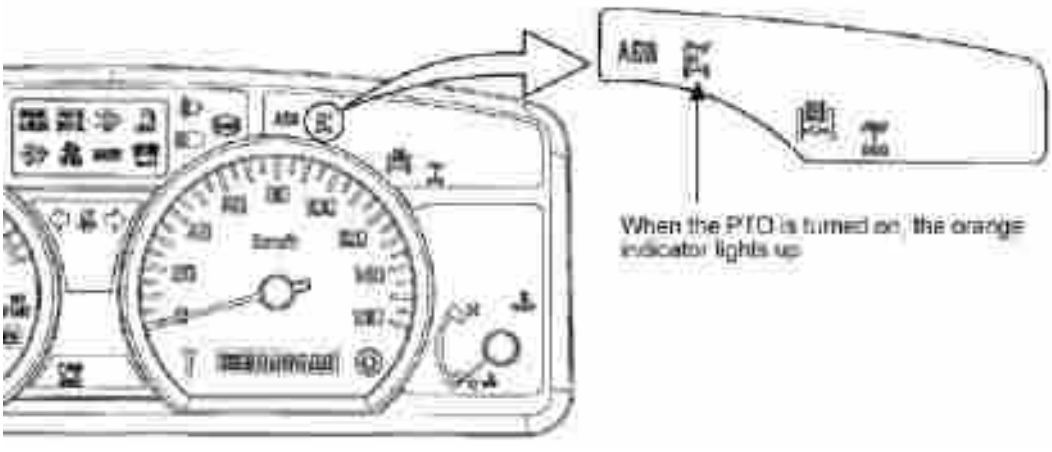


Fig.2

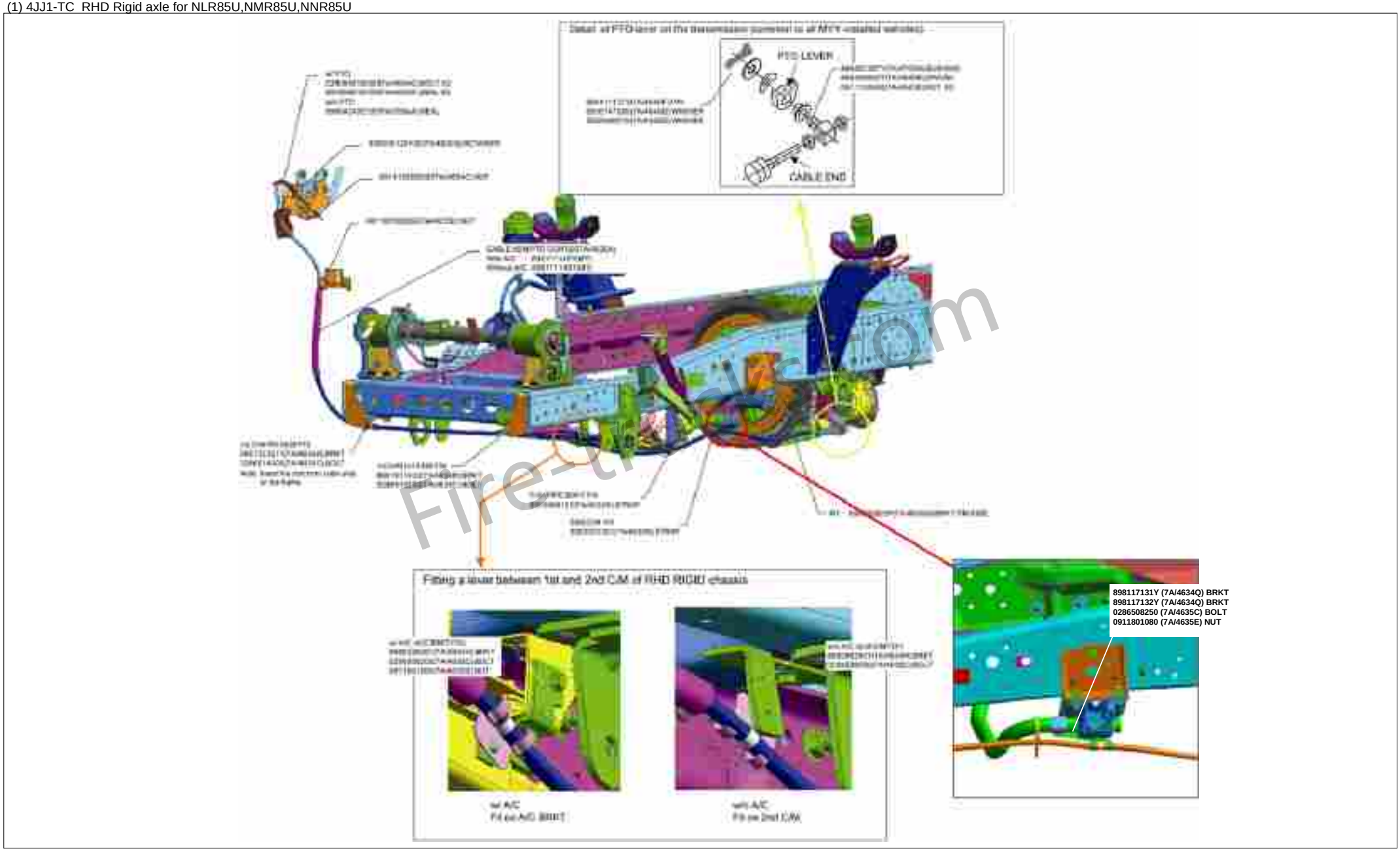


Note: For genuine ISUZU side PTO control, as a standard equipment, there is a PTO indicator on the upper right side of the meter panel, that indicates engagement of side PTO.

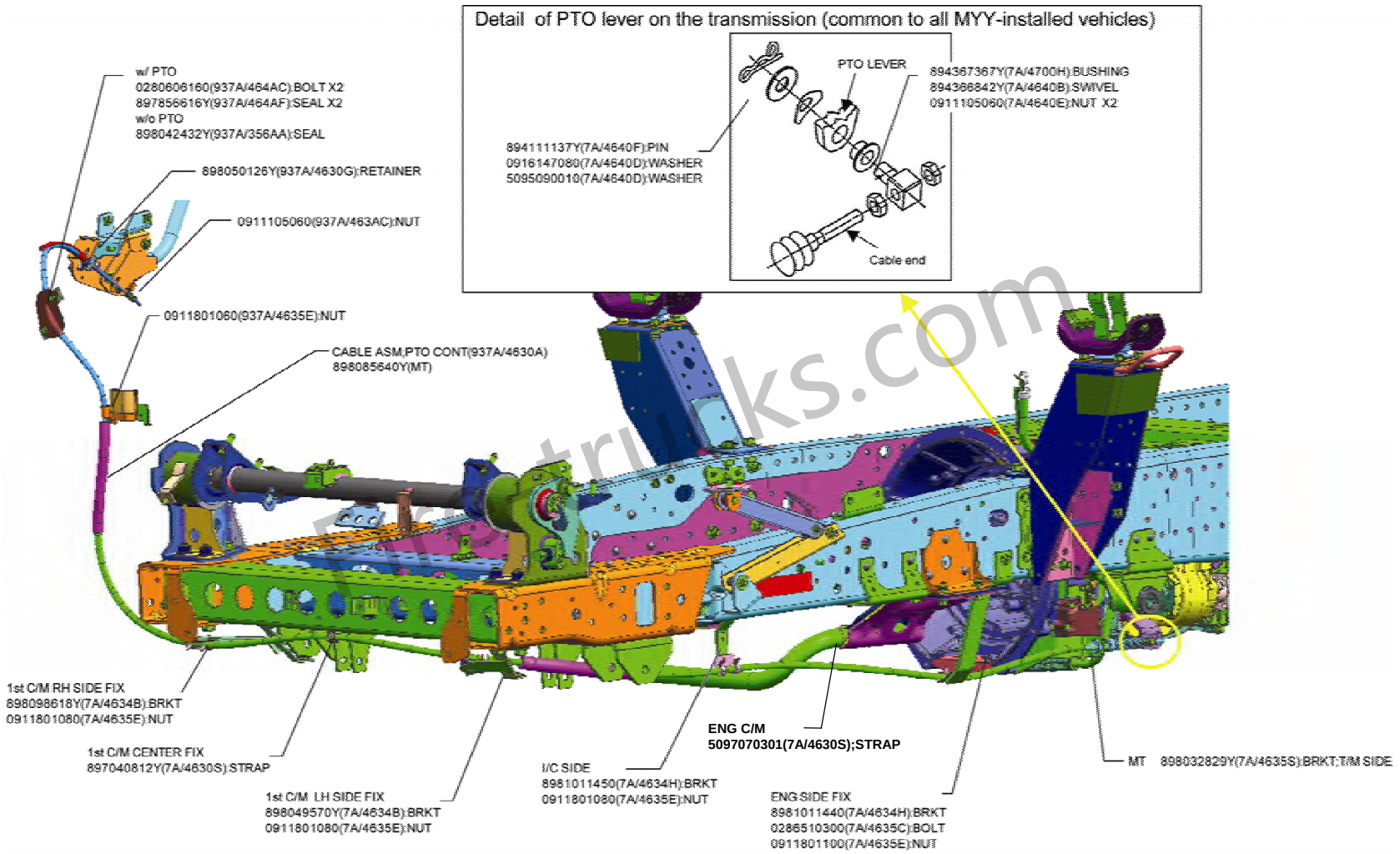


1.7.2. Installing a control cable

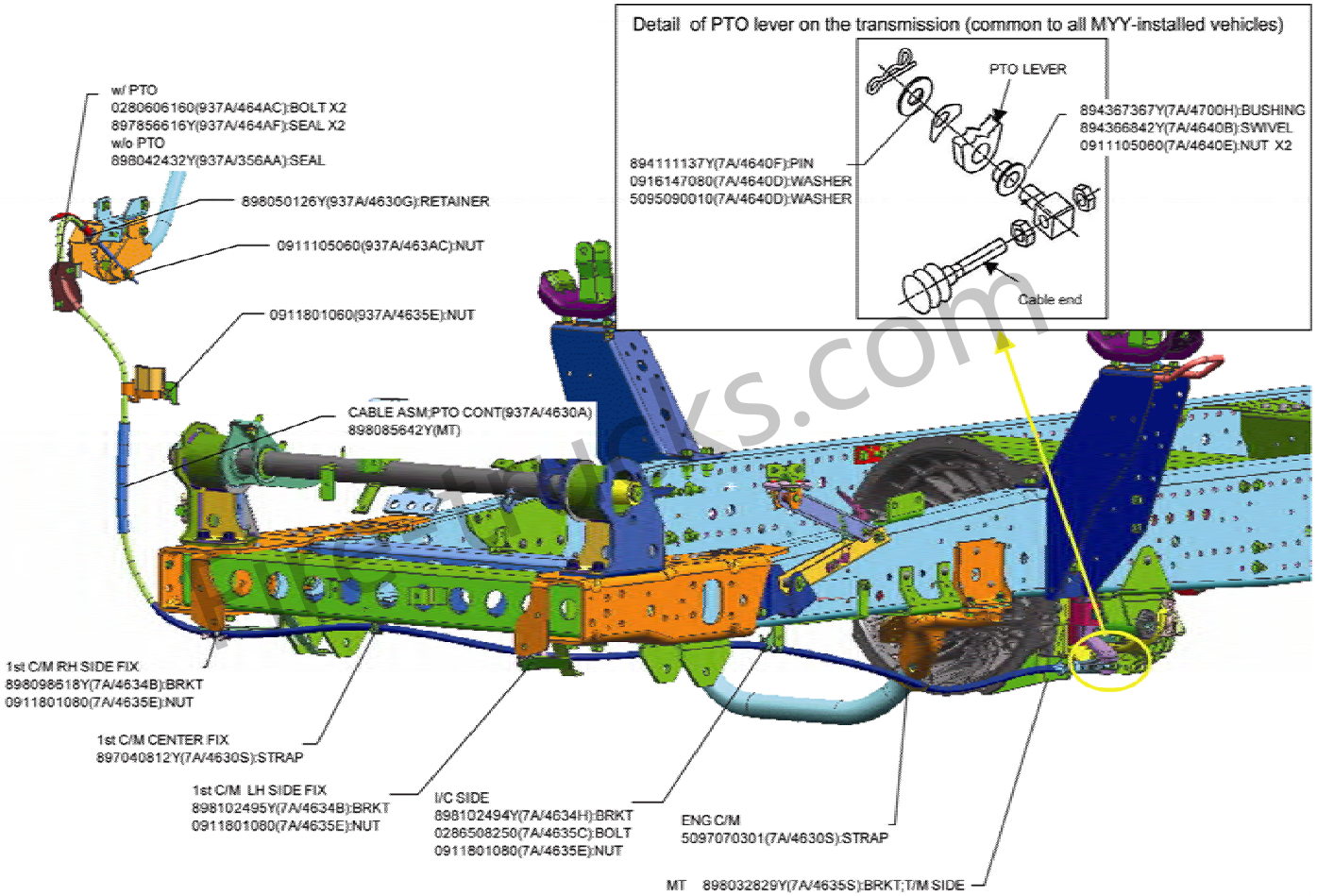
(1) 4JJ1-TC RHD Rigid axle for NLR85U,NMR85U,NNR85U



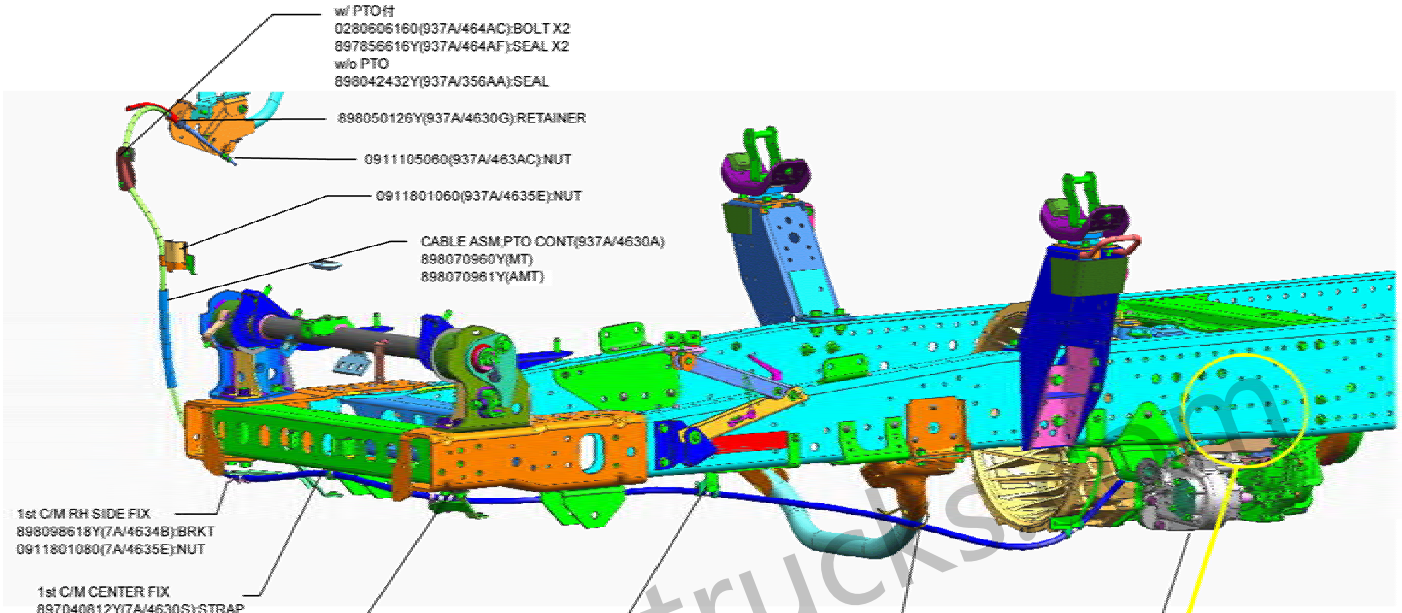
(2) 4JJ1-TC RHD Rigid axle for NPR85U, NQR85U

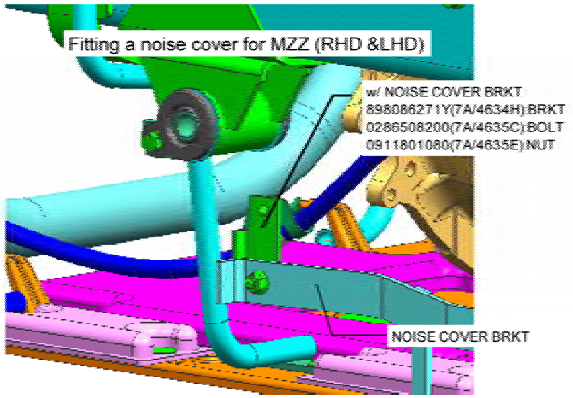


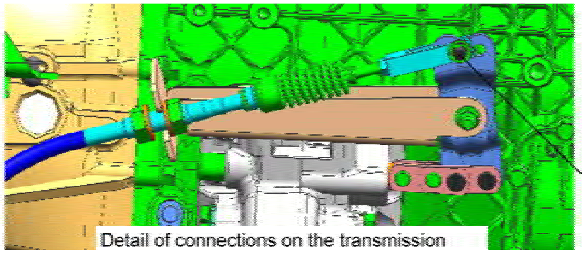
(3) 4HK1-TC RHD Rigid axle for NPR75U and NQR75U



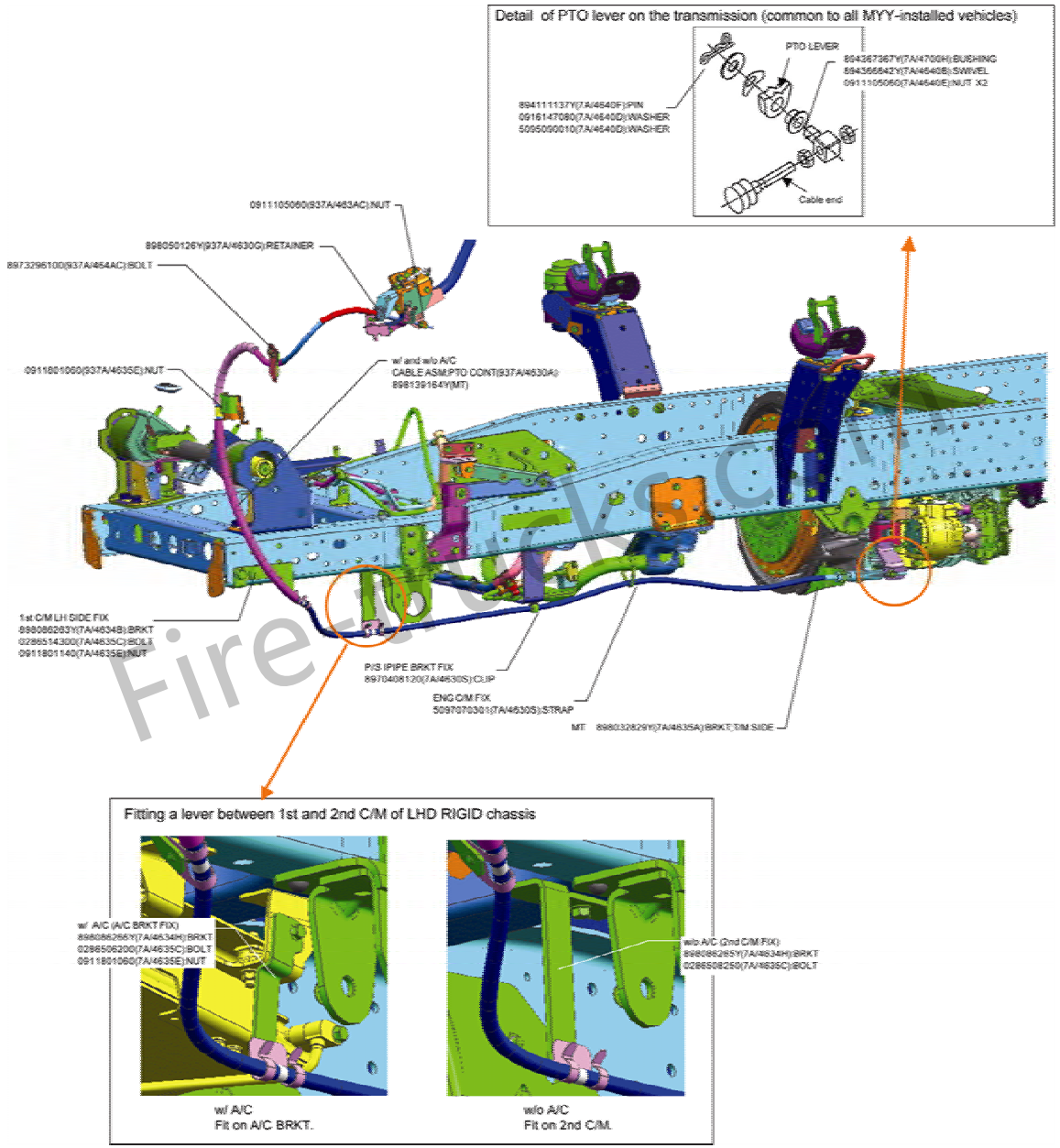
(4) 4HK1-TCS; MZZ transmission RHD RIGID AXLE for NPR75 and NQR75



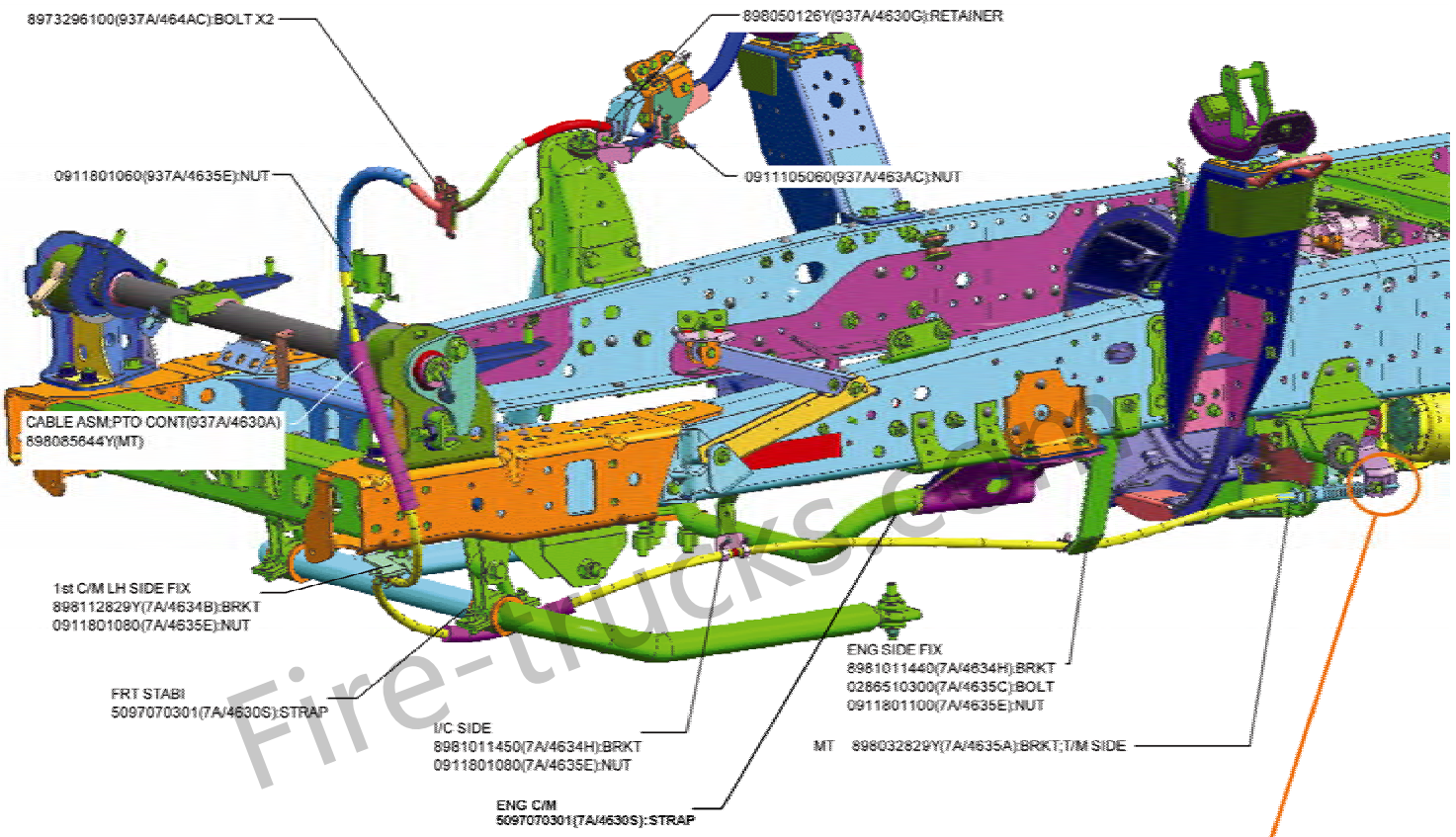




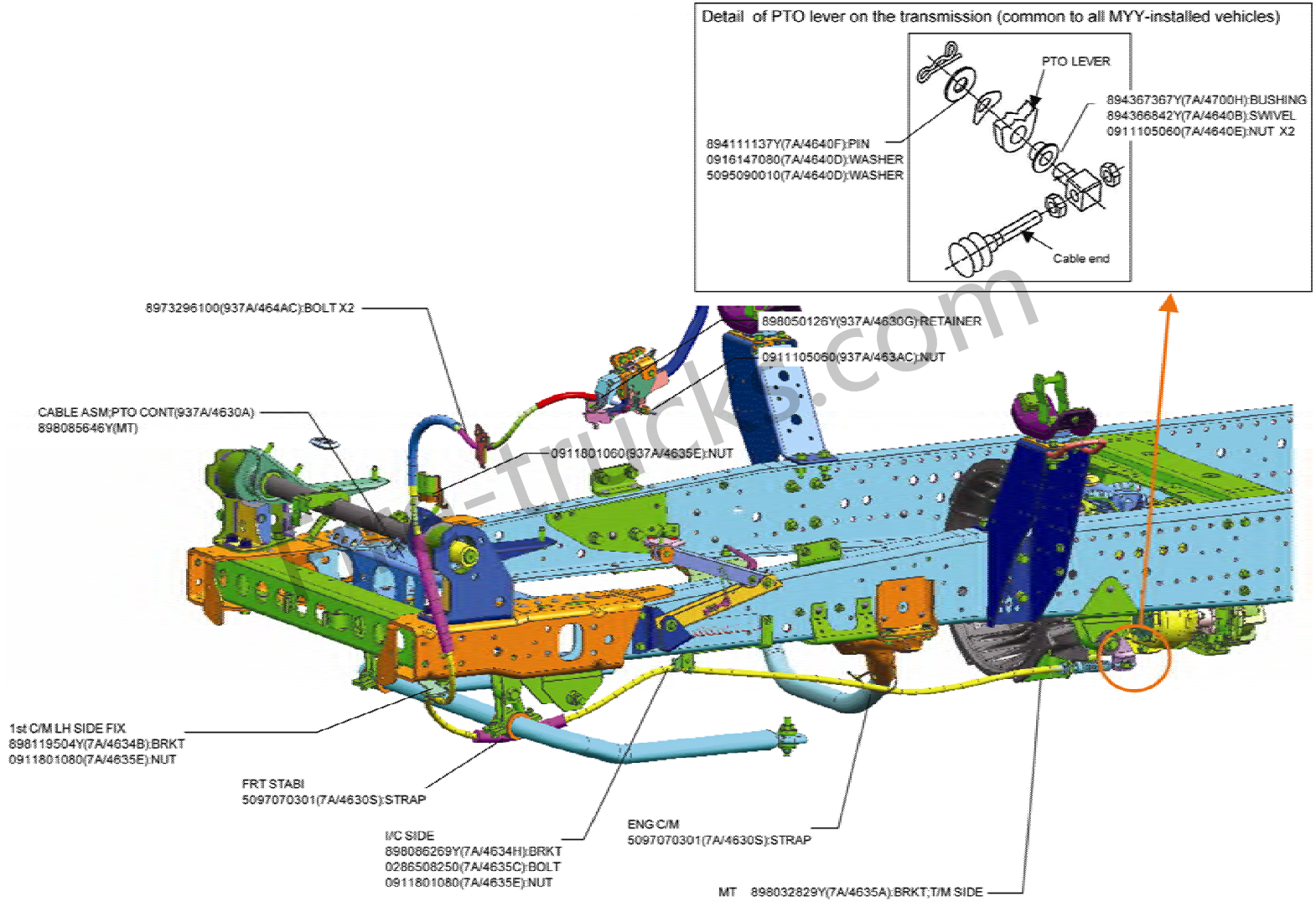
(5) 4JJ1-TC LHD Rigid axle for NLR85L, NMR85L and NNR85L



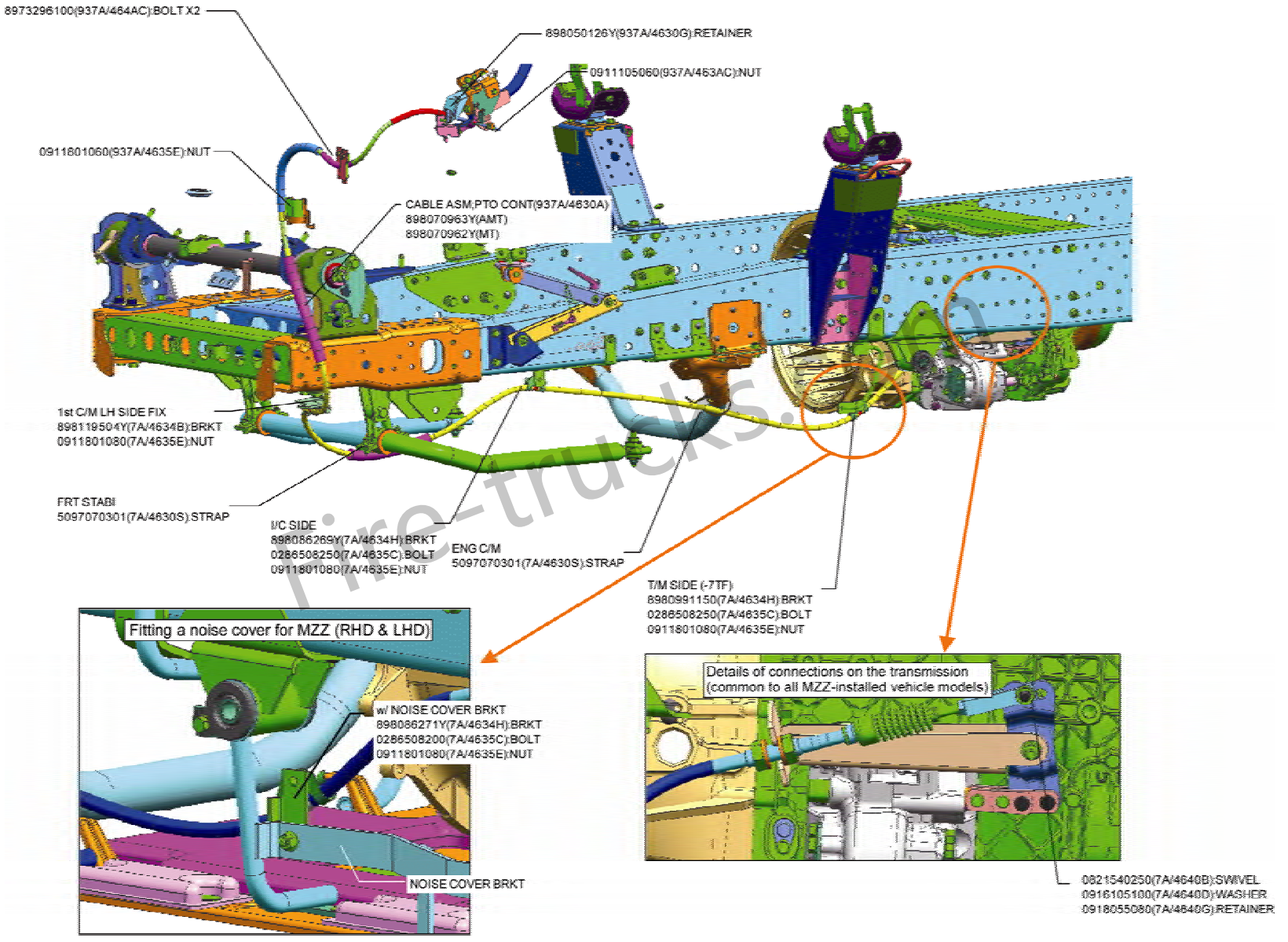
(6) 4JJ1-TC LHD Rigid axle for NPR85L, NQR85L



(7) 4HK1-TC;MYY transmission LHD Rigid axle for NPR75L, NQR75L

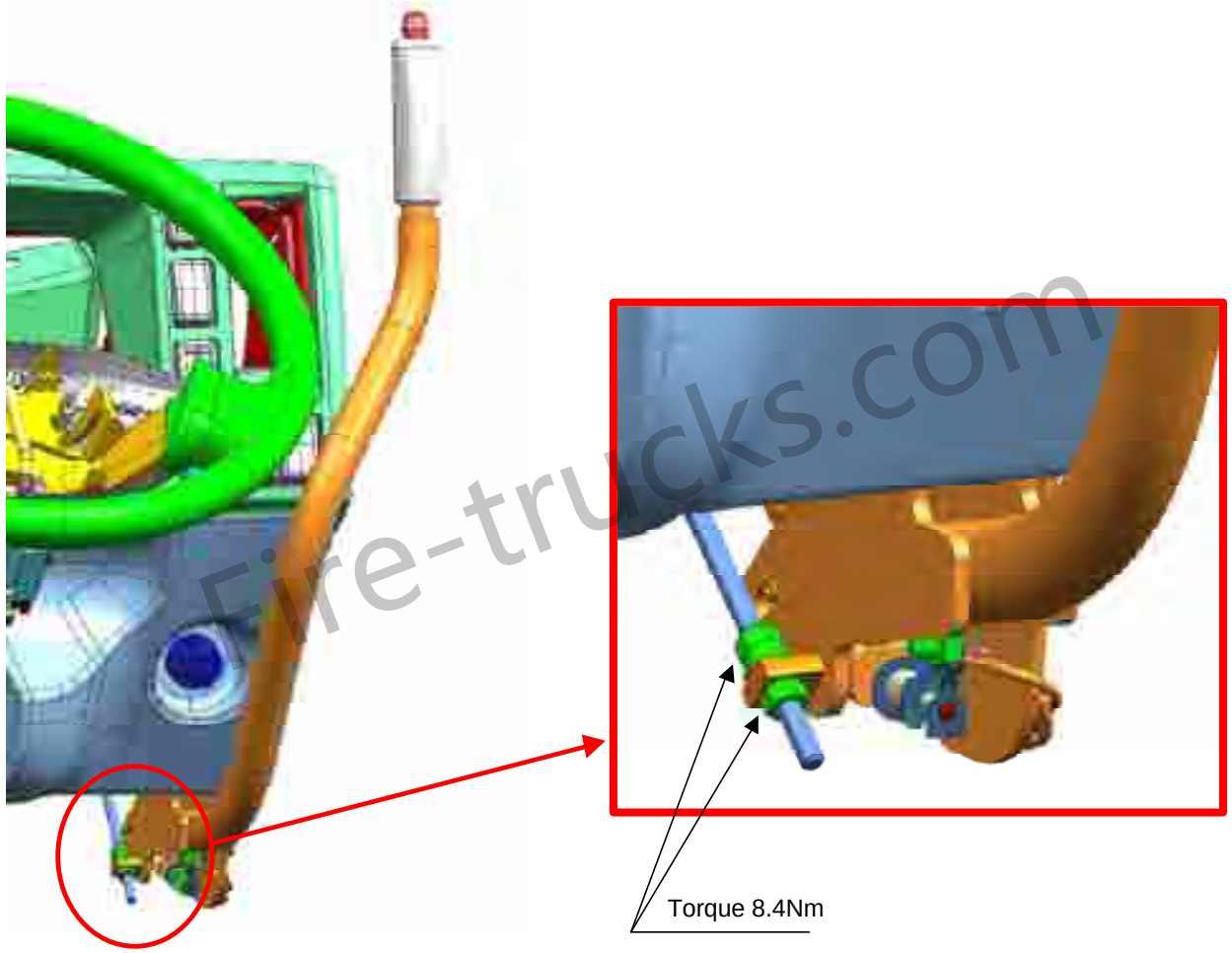


(8) 4HK1-TC MZZ transmission LHD for NPR75L



(9) Detail of PTO control cable on the PTO lever

If removing the dump cable, tighten it back on by specific torque as shown below.
Adjust the cable on the PTO side, not on the lever side.



1.7.3. External engine control lever

(1) Outline of the external engine control

(a) External acceleration control is electrically performed. The cable for external acceleration control is to be installed on the rear body, and the movements of the cable are converted into electrical signals by LEVER ASM; ENGINE CONTROL. Engine speed is controlled by the signals.

(b) External engine control lever and harness

The external engine control lever assembly and ECU must be connected with harness. Appropriate adjustment in harness routing allows installation of LEVER ASM; ENGINE CONTROL at a required place.

The harness consists of a shielded wire, so extension and fabrication of the harness is strictly prohibited.

Required parts

No.	Part No.	Part name	Qty	Remarks
①	897219-4664	LEVER & BRKT ASM; ENG. CONT	1	Common to all engine
②	897223-5780	HARNESS; EXT. PTO TPS	1	Length: 2.0m approx.

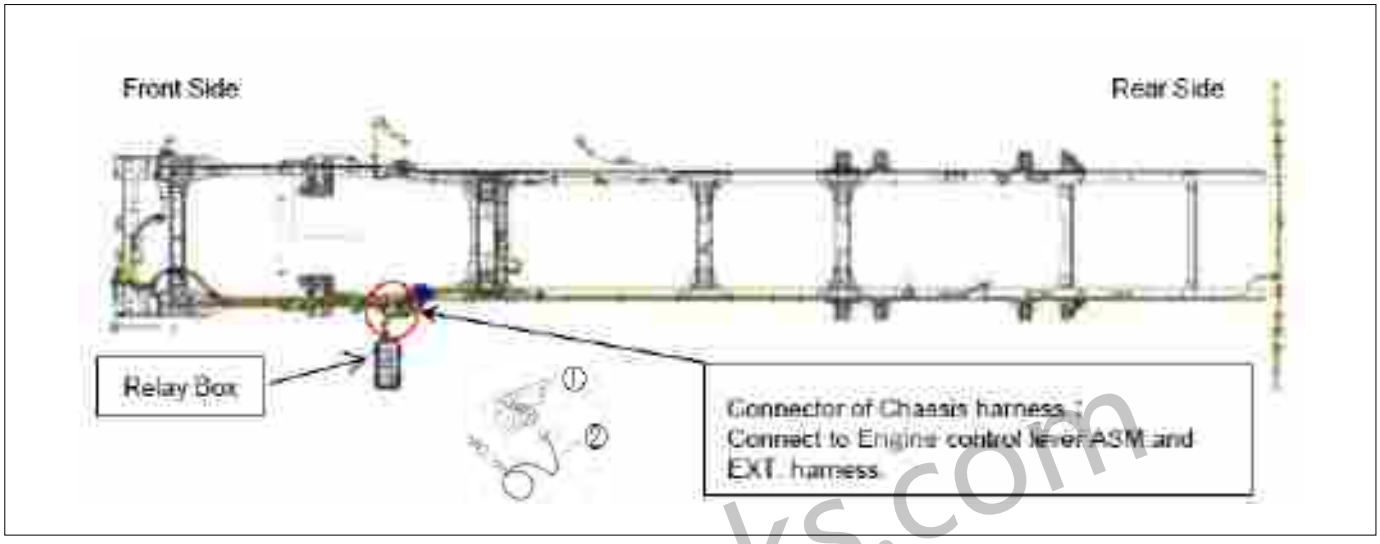
Note: - The above part numbers are subject to change without notice due to specification change, etc. Please make sure of the latest part numbers with the ISUZU MOTORS dealership, when an order is to be placed.

- When ordering a chassis with optional PTO, check if an external engine control lever assembly and a harness will come with it. If they do not come bundled, please order them along with the chassis.

(2) Installation of HARNESS;EXTENSION, PTO T.P.S. and external engine control

For installing an external engine control, or a harness, stop the engine, and then, connect the lever ① to the connector located near the relay box with the harness ② as shown in the figure. After installing the harness, make sure that the connector is securely fitted. Otherwise, ECU may be damaged, or the engine malfunction will be caused. Therefore, all these works have to be done with careful attention.

Harness routing



Connect the one end of the harness ② to the external engine control lever ① and the other end to the connector located near the relay box.

[Precautions for routing HARNESS; EXTENTION, PTO T.P.S]

(a) Tie the extension harness and the harnesses laid on the chassis frame together by using nylon band clips so that the extension harness will not contact with neighboring objects such as cables, pipes and equipments.

(b) Secure the harness so as for none of the electric wires to be damaged by vibration.

(c) Clearance between clips for securing harnesses should be 400mm or less.

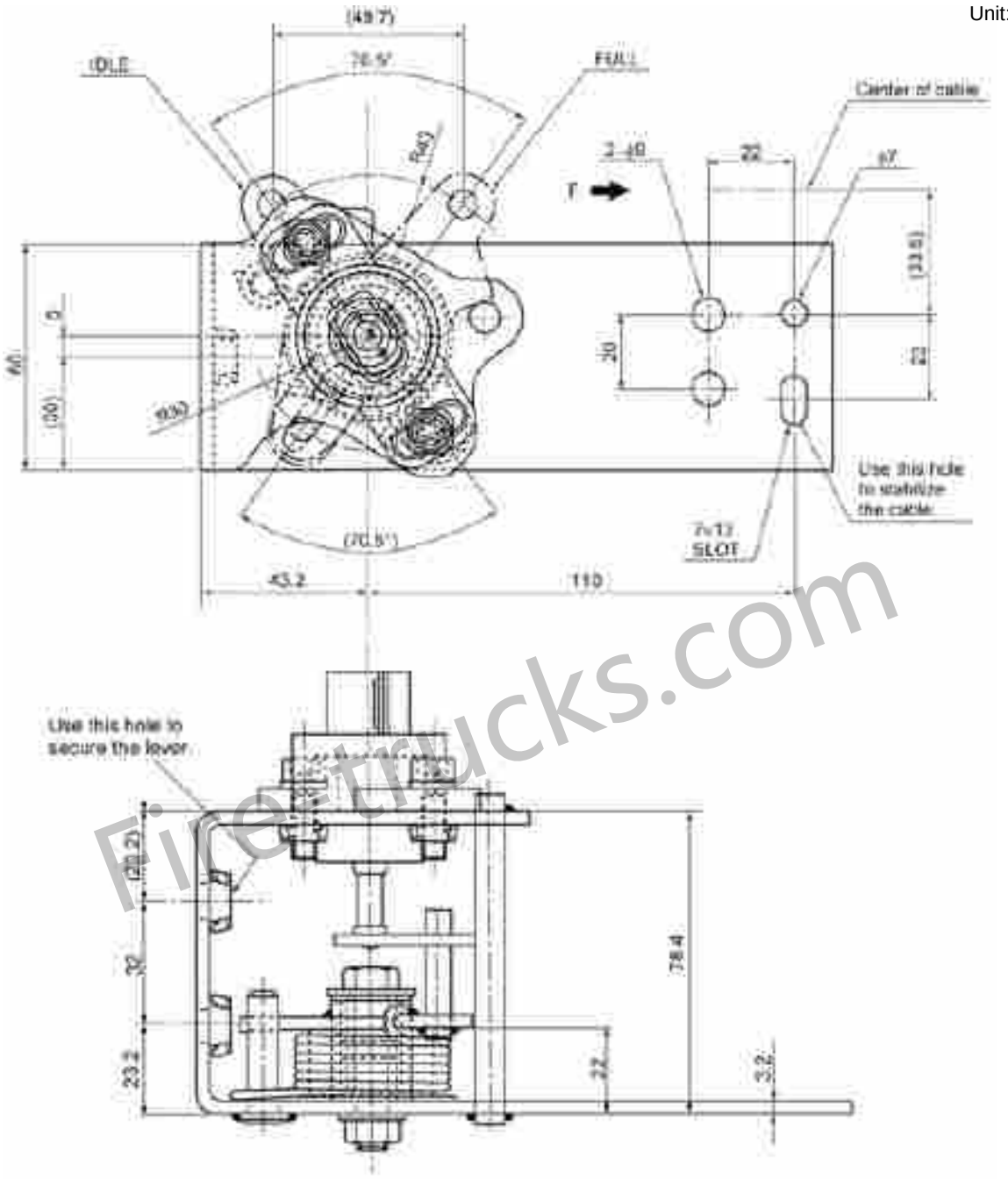
(d) Do not twist or excessively bend the harness, and ensure to avoid high temperature area for routing harnesses.

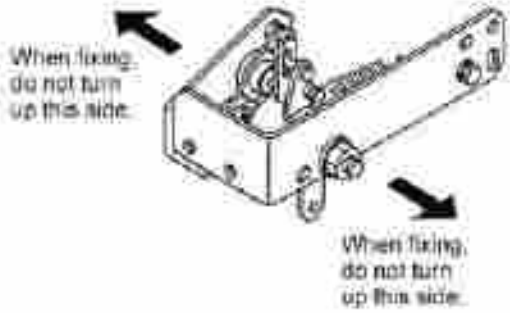
(e) To avoid interference from electric currents or signals on rear body, do not tie the harness with any harnesses laid on rear body (e.g. Power harness and signal harness) together.

(f) For harness routing, follow the instructions under *1.8.1. Modification of electrical wiring and electrical welding* and *1.8.2. Electrical wiring* as well as *6.3. How to add power sources and precautions for such addition* in *II. Specific Information*.

(3) Detailed view of external engine control lever

Unit: mm





	Acceleration	
	IDLE	FULL OPEN
Lever reaction	4.9 N·m (0.5kgf·m)	20.6 N·m (2.1kgf·m)

[Precautions for installation of an external engine control lever]

(a) Do not fit the control lever in such an orientation that foreign objects (e.g. Water) may pile up in the connector.

(b) Fit the control lever in the orientation as shown in the figure on the previous page. The sides indicated with arrows must not be top, otherwise foreign objects (e.g. Water) will pile up in the connector, resulting in breakdown of the control lever.

(c) Install external engine control lever in a place that is barely affected by dust, grease, moisture, chemical and vibration. If the lever is possibly subject to them, protect it with cover, rubber mount, etc.

(d) Lever can be used at temperature in the range from -30°C to 75°C. The ambient temperature must fall within this range. Do not install the lever on the place anticipated to be subject to heat out of engine, exhaust pipe, or rear body.

(e) Securely fit the bracket in order to protect the control lever from large vibration (e.g. Running vibration).

(f) Do not fit the control lever in such a place where it may receive any shock from falling objects, flying gravels, etc.

(g) Since the position sensor had been adjusted before shipment, do not loosen its fixing bolt or disassemble it.

(h) Handle the control lever with extra care not to drop or give a shock to it, which may result in malfunction or breakdown of the sensor.

(4) PTO control

(a) Outline of PTO control

For convenience and safety in rear body operation, the following settings can be made through the PTO control:

- Setting driving conditions that enable rear body operation while activating PTO
- Switching between Rear Body Operation Governor Characteristic and Running Governor Characteristic

Operations and conditions for PTO control

	PTO control for switching to the external engine control	Acceleration mode switching
Control	Switching driving mode to working mode.	Switching acceleration for driving to that for working
Conditions	While the vehicle is idling, turn on PTO.	Condition for driving acceleration method to enable both driving and working: While the vehicle is idling, external engine control acceleration sensor is being connected.

(b) Details of PTO control

Switching acceleration modes

Input to the acceleration pedal position sensor enables the control by the acceleration pedal, while input to the external acceleration sensor enables the control by the external engine control lever. When a vehicle is in the external engine control mode, both of the acceleration pedal and the external engine control lever can be used.

- Conditions for enabling the use of the external engine control lever, i.e. conditions under which both of the engine control lever and the acceleration pedal are usable.

All of the following conditions must be satisfied:

- None of the external acceleration sensor, transmission and acceleration pedal position sensor is defective.
- Status of vehicle: Stopped
- Shift lever position: Neutral
- Acceleration pedal position: Released
- The engine speed is higher than the idle speed.
- External engine control lever position: IDLE

[Precautions for using external engine control]

(a) If the starter key switch is turned off and back on while the external control is in use, all of the conditions described in *(b) Details of PTO control* must be satisfied.

(b) After completing any work with use of PTO, be sure to return the external engine control lever to IDLE. Keep this in mind because leaving the external engine control lever opened may cause unexpected increase in the engine speed. For instance, if a work with use of PTO is terminated by shifting gear into a non-neutral position or if the PTO switch is turned off while the lever is opened, the use of the external engine control lever is disabled and the engine speed decreases, but, however, shifting gear back into neutral switches to Rear Body Operation governor, increasing the engine speed.

- Conditions for disenabling the use of the external engine control lever

  Any of the following conditions is satisfied:

  • Any of the external acceleration sensor, transmission or the acceleration pedal position sensor is defective.

  • Shift lever position: Non-neutral

  • Vehicle speed: 25km/h or higher

  • Engine stall

  Switching the governor characteristics between Running Governor Characteristic and Rear Body Operation Governor Characteristic

  Satisfying all the conditions for enabling use of the external engine control lever and then opening the lever from IDLE switches to Rear Body Operation Governor. When the acceleration pedal and the external engine control lever happen to be operated at the same time, the ECU determines which output (amount of fuel consumption) is larger, and reflects the determination result on the engine.

  Fuel consumption amount

  • External engine control lever > Acceleration pedal
    ⇒ Rear Body Operation Governor Characteristic

  • Acceleration pedal > External engine control lever
    ⇒ Running Governor Characteristic

(5) Lengthening a signal harness for external engine control

When lengthening the harnesses for the external engine control, be sure that the resistance of the power harness, the ground harness and the signal harness do not increase. Especially, high resistance of the ground harness increases the voltage of the external control signal, creating a condition as if the external engine control lever is being opened. This may result in malfunction of the PTO or sudden increase in the engine speed.

Protect the harnesses from external noise. Just like the harness for the acceleration pedal, appropriately route and secure the harnesses.

(6) Effect of a PTO electromagnetic clutch on a crank sensor

When using an electromagnetic clutch to supply or cut the power from the PTO, noise from the electromagnetic clutch may be superimposed on the crank sensor, possibly causing engine control problems such as unstable engine rotation, torque down in response to the detection of engine troubles, and engine stop.

(7) Acceleration interlocking

Do not perform any modification to make the acceleration pedal unusable when working rear body with use of PTO. Such prohibited modification includes interrupting an acceleration pedal sensor signal and inputting it to a dummy sensor. Vehicles that undergo prohibited modifications will be shipped without safety evaluation of safety-critical components, and may possibly cause runaway accidents.

1.8. Precautions for modification of the electrical system

1.8.1. Modification of electrical wiring and electrical welding

Basically, modification to the factory-installed electrical components such as wires, fuses and relays are prohibited. Do not tear protective corrugated tubes and pull out inside wires to connect add-on equipments because this may damage the remaining harnesses.

If the shape of the rear body of a completed vehicle constrains rain or vehicle washing water to concentrate into particular portions of the vehicle, be sure to keep connectors, relay box, and other factory-installed or add-on electric equipments away from such water. In this case, attach panels, gutters, etc. to disperse or directly lead water out of the vehicle. Be fully aware that exposing connectors, relay box, and electric equipments to such water may cause water intrusion into electric components or internal condensation, resulting in problems such as operational malfunction, and in the worst case, a vehicle fire.

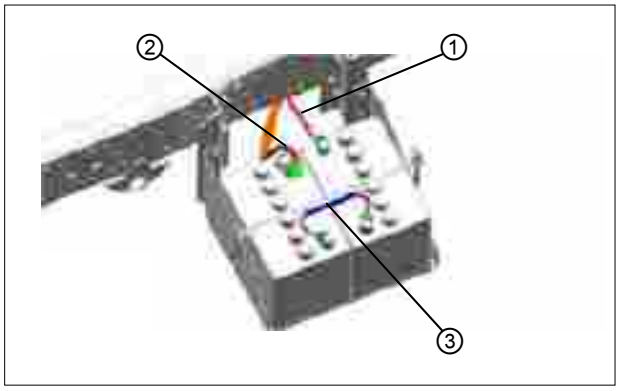
When lengthening or modifying electric harnesses, follow the instructions below.

6.5.Circuit diagrams in *Ⅱ. Specific Information* shows the electrical circuits on the ISUZU chassis.

(1) Lengthening or shortening an electric wire or a cable

(a) Do not change the length of a battery cable by splicing a different cable to it or cutting it. If the length of a battery cable needs to be changed, replace it with a new solid cable in length and diameter that satisfy required electrical load and distance. As for the harness connected to the starter key switch, in consideration of the relative movement between the starter and a chassis frame, changing its clipping points, the way how it is secured, and the sagging volume are strictly prohibited.

(b) Disconnecting or connecting battery cables



- Disconnecting battery cables

1) Turn off all the switches.
2) Disconnect the ground cable ①.
3) Disconnect the positive cable ②.
4) Disconnect the battery cable ③.

⚠ Caution

Disconnect the ground cable first. If disconnecting the positive cable before the ground cable, during disconnecting a terminal with a tool, such tool may contact with battery casing, etc. and cause a short circuit.

- Connecting battery cables

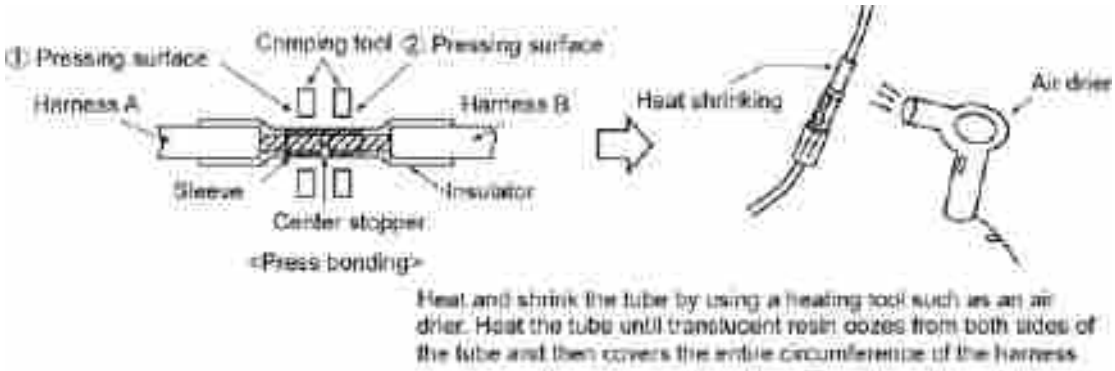
Connect battery cables following the procedure for cable disconnection in reverse order.

⚠ Caution

To prevent battery terminals from corroding, clean them and lightly apply grease on them.

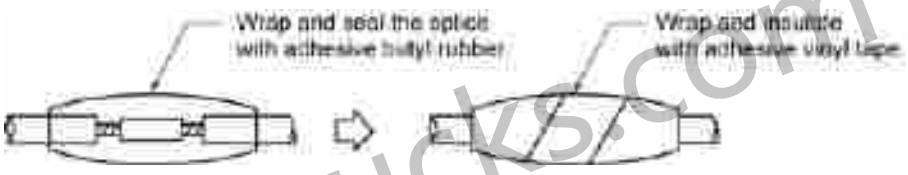
(c) When lengthening a wire, splice a new wire with the same section area and color as those of the wire to be lengthened. Do not splice them inside corrugated tube.

(d) When splicing a wire to an end of another wire, for secure connection, twist them together and then solder the area or clamp with a crimping terminal by using a specified crimping tool. After that, to insulate the area, remove burrs and wrap with an adhesive lined heat shrink tubing.



Covering the splice with butyl rubber

Butyl rubber	182698-263Y



As for the area where spliced wires may be subject to vibration, splicing with crimping terminals is recommended rather than soldering because solder may seep into the inside of the wires, making them harden and lose flexibility, resulting in separation.

Do not splice the wires by only twisting them together without soldering.

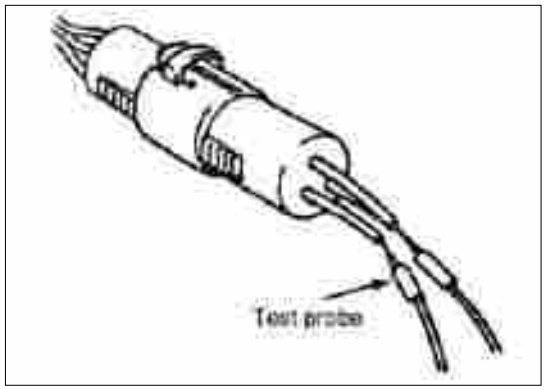
(e) When splicing wires outside a cab, for example on the chassis frame, apply appropriate coating (e.g. Epoxy resin coating) on the splice in order for waterproofing and insulation.

(f) Since there is possibility of separation, do not splice wires in such an area where the harnesses may produce relative vibration.

(g) When shortening a wire or a harness, do not cut it but tie its redundancy with a vinyl tape, and then bind it to the factory-installed harnesses or something else.

(2) Connectors

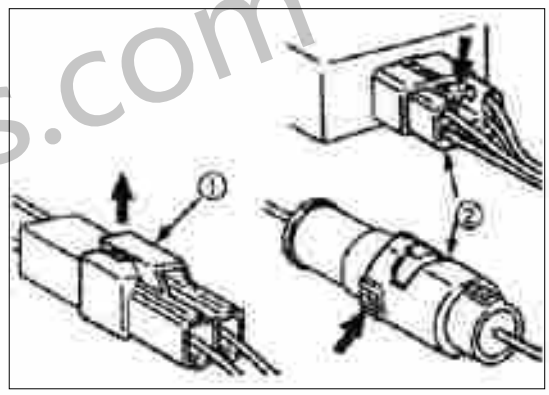
(a) Waterproof connector



Use water-proof connectors for the harnesses placed outside a cab. Do not unnecessarily disconnect these waterproof connectors, otherwise continuity failure will occur. When disconnecting waterproof connectors, to prevent foreign substances such as water and metal chips from getting into the joint, or to protect the sealed part from being damaged, cover the disconnected connectors with vinyl bags or something.
If water or any foreign substance get into the joint, dry up the joint or remove such foreign substance before connecting the connectors.

Note: As for the area where connectors may be subjected to vibration, use connectors with a detach-safe lock.

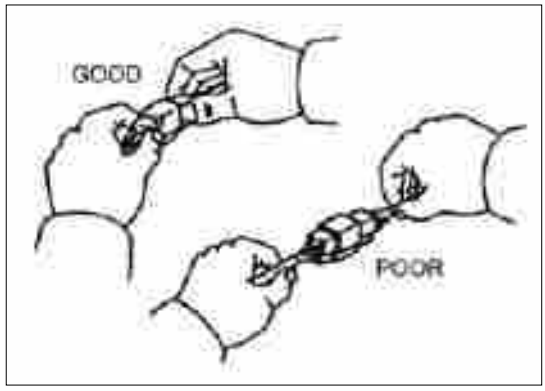
(b) Disconnecting connectors



Certain types of connectors have a tang lock that prevents these connectors from coming off when vehicle is running.

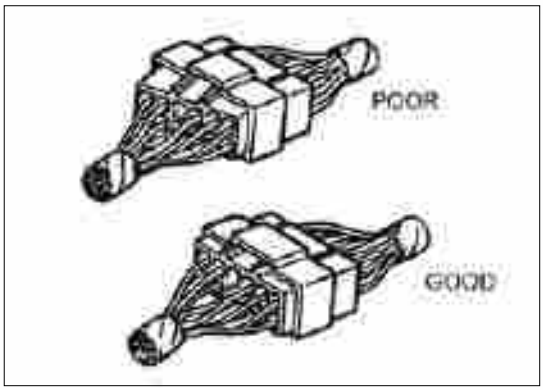
Some tang locks can be released by pulling (①) while the others by pushing in (②). Check which type of tang lock the connectors have.

To prevent harnesses from coming off from the connector or breaking, when disconnecting connectors, do not pull the harnesses but securely hold both connectors (male and female), release the tang lock, and then separate the connectors with care.



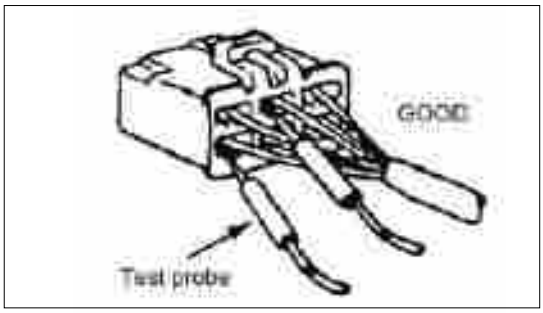
(c) Connecting connectors

Securely hold both connectors (male and female) and check whether the connector pins and the cavities match. Also, check whether the connectors are aligned. Securely hold the connectors and carefully engage them by pushing until the connectors click.

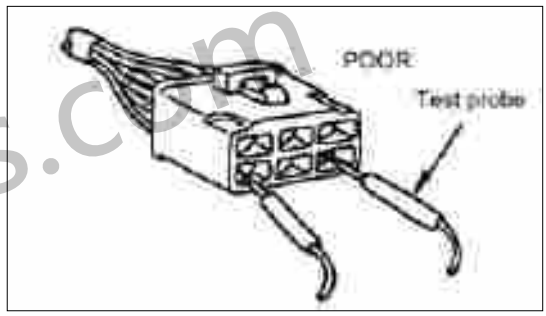


(d) Checking connectors

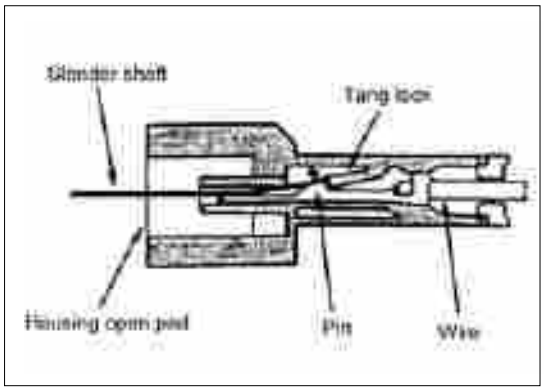
Use a circuit tester to check the continuity of a connector. Insert test probes of the circuit tester from the side where wires are to be connected. This continuity check should be avoided unless absolutely necessary.



When doing a continuity check, do not insert the test probes into the cavities of the connector. This will deform the connecter terminal and cause continuity failure.



(e) Removing a connector pin

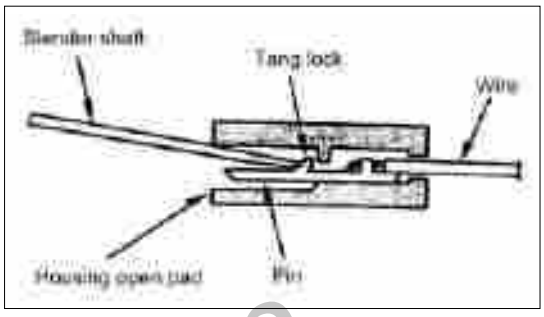


- Built-in tang lock

1) Insert a slender shaft into the opening of the connector housing.

2) Push up the tang lock in the direction of an arrow in the figure. Pull out the wire and the connector pin from connector.

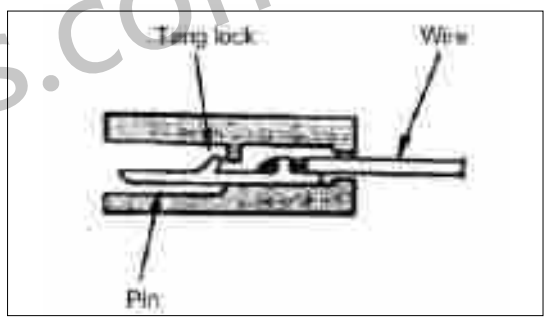
- Pin-type tang lock



1) Insert a slender shaft into the opening of the connector housing.

2) Push the tang lock toward the wire so as to make it flat. Pull out the wire and the connector pin from the connector.

(f) Inserting a connector pin



1) Check if the tang lock is upright.

2) Insert a connector pin into the connector cavity for wires. Push the pin until the tang lock is securely engaged.

3) Gently pull the wire to check if the pin is securely in place.

(g) Using a “GIBOSHI” type plug

When using a “GIBOSHI” type plug, be sure that its socket connector (female) with insulation cover is connected to the wire from the power source and its plug connector (male) to the wire from the electric load. This prevents disconnected “GIBOSHI” type plug from shorting when it comes off and contacts with vehicle body.

(3) Harness routing

(a) General note

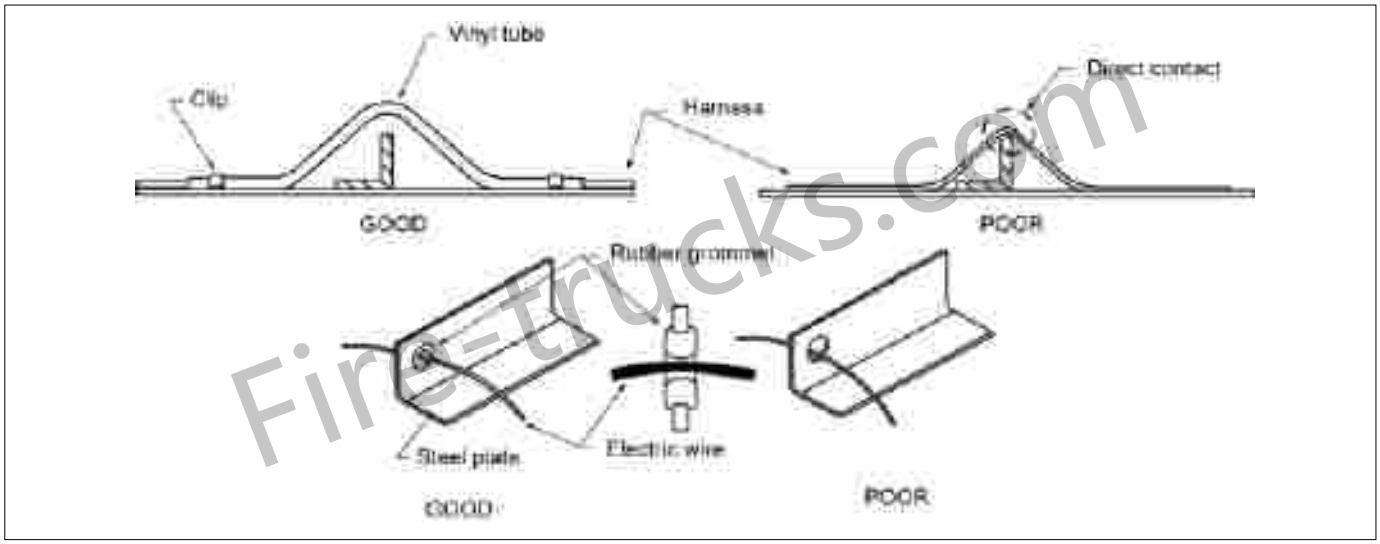
- When laying additional wires, be sure that they will not restrict inspection or maintenance of the vehicle components.
- To increase reliability of wires, protect all add-on wires and harnesses with corrugated tubes or PVC tubes.
- When handling the wires, do not pull them hard.

(b) Routing

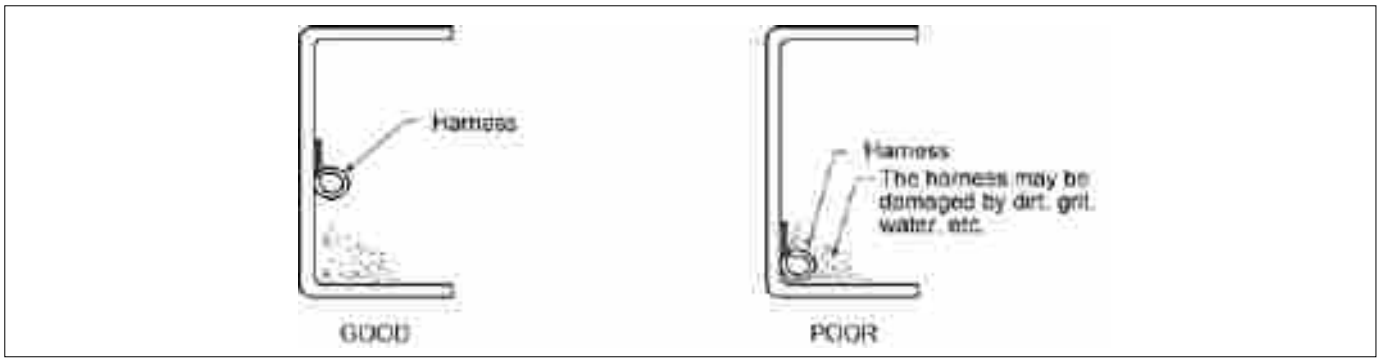
- Add-on harnesses should be laid along and secured on rear body members or on chassis frame. Do not pass them in the air.
- Securely fix the harnesses in place so that they will not contact with moving parts or sharp objects.

Object	Required distance between harness and object
Moving part	10mm (0.4in.) at minimum
Sharp object	10mm (0.4in.) at minimum

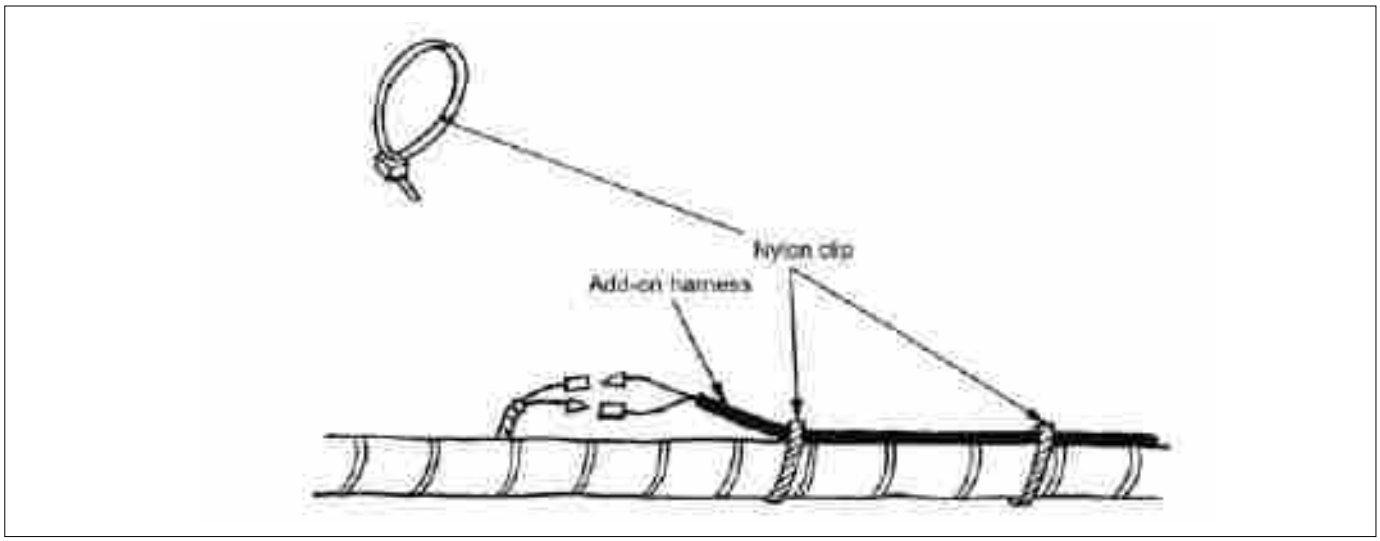
- If there is possibility that a harness contacts with a sharp edge of a metal part, secure the harness somewhere distant from the sharp edge by using clips, or cover the sharp edge with a protector, otherwise vibration will damage the harness coating. To prevent harness coating from being damaged, attach grommets to the through holes in steel plates



- Do not put any harness on top, underside or outer side of chassis frame members because someone may step on it or flying gravels may damage it.
- Do not put any harness in the lower part of the inner side of chassis frame members because harness may be damaged or freeze due to mud, snow, water, etc. that may be built up in this area.

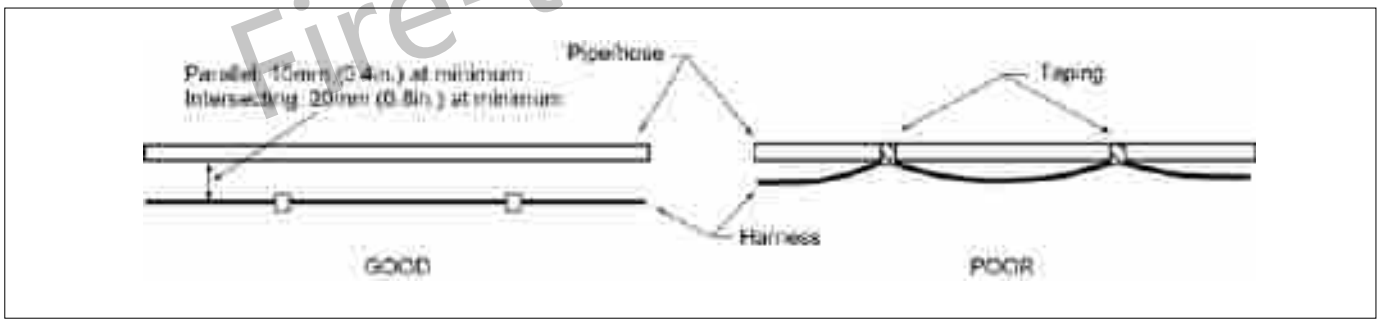


- If there are factory-installed harnesses nearby, secure add-on harness on them with tapes or nylon clips.



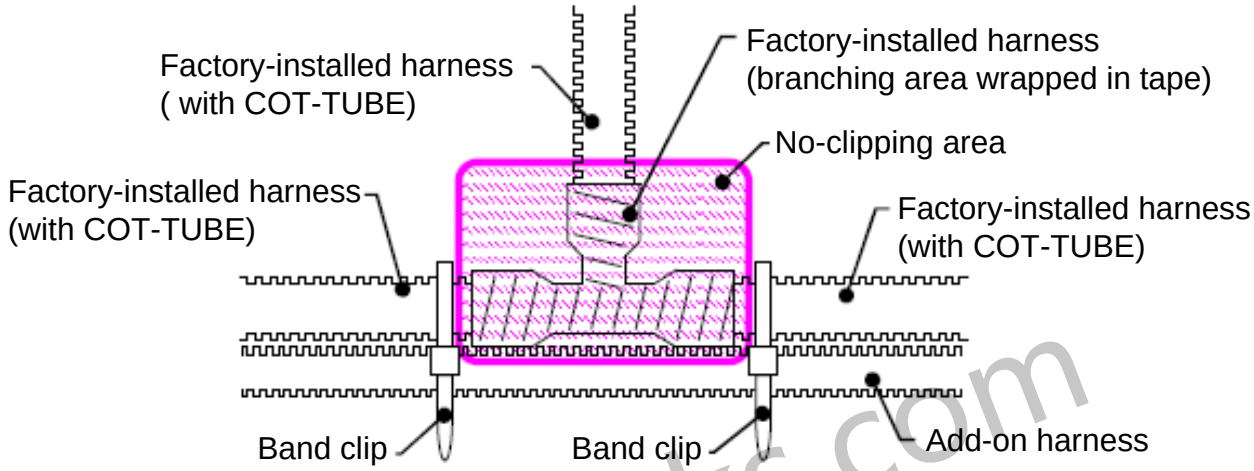
- Do not tape wrap an add-on harness directly on a metal pipe or a rubber hose including the brake pipe and the fuel pipe. Provide sufficient clearance between such pipe, hose and a harness.

Positional relation	Clearance between harness and pipe/hose
Parallel	10mm (0.4in.) at minimum
Intersecting	20mm (0.8in.) at minimum



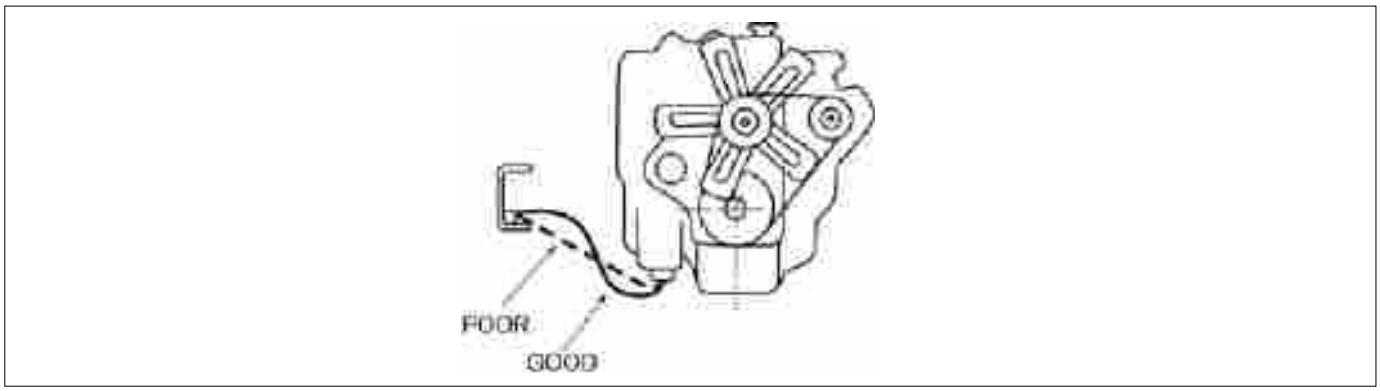
- If an add-on harness is to be laid along the factory-installed harnesses, it should be firmly secured so as to avoid flip-flop movement induced by vibration of engine and vehicle, protecting factory-installed harnesses from being damaged. If clips are to be secured at a place subject to water or mud (e.g. somewhere outside the vehicle), the portion of the factory-installed harness which is protected by the materials such as COT-TUBE, PVC.TUBE, hard tube, and protector, should be chosen to do so.

<Example of clip location>



(c) Moving harness

- When connecting an additional harness to any equipment that produces relative vibration against chassis frame, such as engine and transmission, reasonably slacken the harness and lay it along the factory-installed harnesses so as to absorb the relative vibration. Be sure that the add-on harness does not contact with adjacent parts or equipments.



- As for the factory-installed harnesses connected to the equipments that produce relative vibration against chassis frame, such as engine and transmission, do not change the way how they are secured, the clipping points, and the sagging volume.

(d) Heat protection

- Harnesses must sufficiently be distant from heat source (e.g. Exhaust pipe). Be sure that the temperature of the harnesses does not exceed their allowable temperature limit (80°C in principle). For details, see the subsection *(1) (a) Clearance between an exhaust system component and a neighboring component* under *2.1.3. Precautions for an exhaust system*, and the “Allowable temperature” column of the table under the next section *1.8.2. Wire size*.

- Most of the harnesses placed inside the engine room should be wrapped in heatproof vinyl tape, and laid along and bound to the factory-installed chassis harnesses with band clips.

(e) Clip

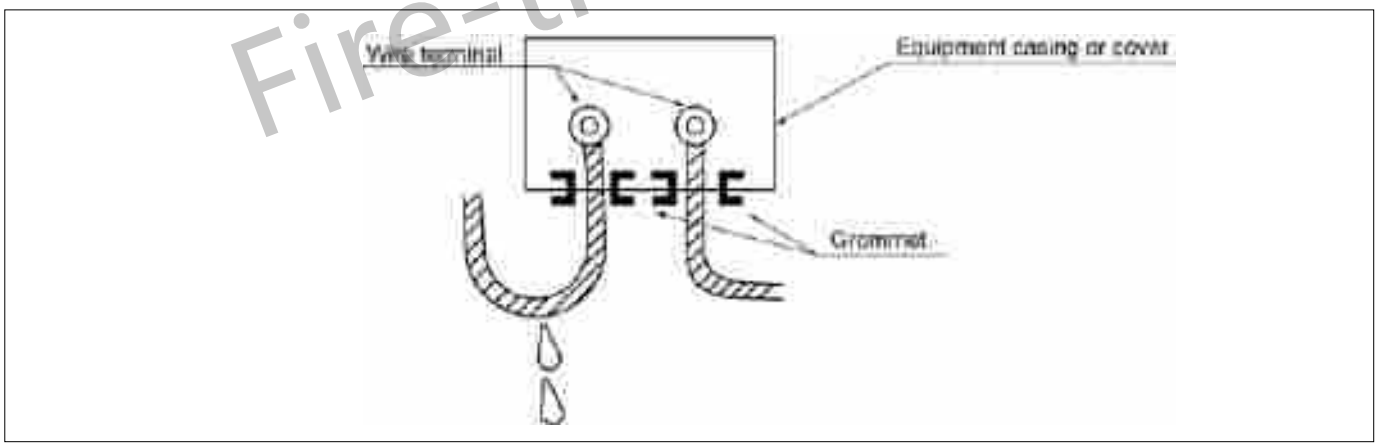
- Use resin clips, or vinyl- or rubber-coated clips whose base material is rust-proofed. Use clips and connectors manufactured for automobiles.
- To minimize vibration of the harnesses, space clips as follows:

Harness diameter	Distance between clips
Below 5mm (0.2in.)	Below 300mm (11.8in.)
5mm to 10mm (0.2in. to 0.4in.)	400mm (15.7in.) approx.
10mm to 20mm (0.4in. to 0.8in.)	500mm (19.7in.) approx.

- In case engine vibration or vehicle running causes harnesses to move around, make shorter distance between clips.
- Adhesive clips should be used only as supplemental parts. Especially, in such a place like the engine room where ambient temperature is high, use rubber- or vinyl-coated plate clips or band clips. Do not use non-heat-proof vinyl tape or adhesive clips to bind add-on harnesses to the factory-installed harnesses because they will come unstuck due to heat aging.

(f) Others

- To prevent water intrusion through wires into equipments, securely seal the inlet ports of the equipment with grommets and make sure that the wire terminals are placed above such inlet ports.



- If it is inevitable to disconnect chassis harnesses due to rear body mounting, after the body mounting, be sure to put them back in place exactly as before the disconnection.
- When installing equipments on a chassis, be sure that they do not crush harnesses.

[Precautions for electrical welding]

Improper welding causes welding current to flow back from the ground circuit, possibly damaging electrical equipments and components. For electrical welding, follow the instructions below:

(1) Welding procedure

(a) Turn off the starter key switch.

(b) Disconnect the negative battery terminal.

(c) Secure the ground cable of the electric welder in the vicinity of welding site.

- Cab welding

Attach the welder's ground cable to a plated bolt or metallic part of the cab in the vicinity of welding site. Before securing the ground cable on such a metallic part, peel off the paint on the area to reveal its base.

- Chassis welding

Attach the welder's ground cable to a plated bolt or a chassis frame member in the vicinity of welding site. Before securing the cable on the chassis frame member, peel off the paint on the area to reveal its base. Do not attach the ground cable on the chassis spring, otherwise the spring may break.

(d) Precautions for welding

- Keep the chassis frame dry.
- To prevent welding spatters from adhering to any components located near welding site such as rubber hoses, electric harnesses, pipes, chassis spring, tires, radiator and resin parts, cover them up before welding. Especially, when performing welding in the area within 200mm from a fuel tank, remove the fuel tank before welding.
- To minimize impact of heat on peripheral area and to assure welding quality, select a suitable welding torch and perform welding at suitable welding conditions.

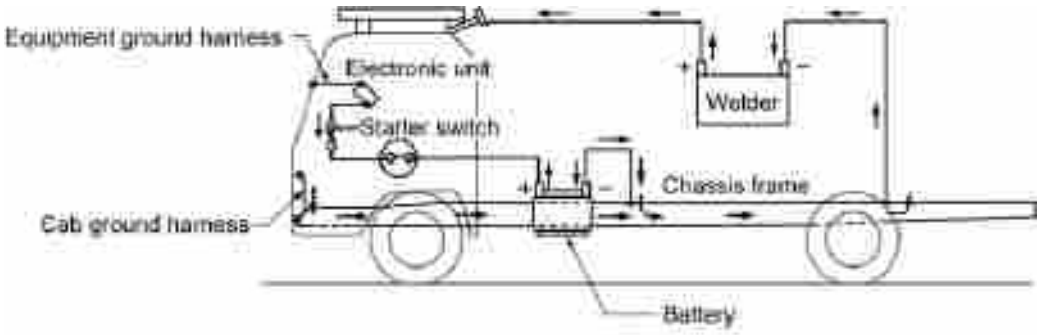
(e) After completing welding, put the disconnected components such as fuses and negative battery terminal back in place exactly as before the disconnection. If peeling off some paint from the chassis frame or the cab, apply anticorrosion paint in the same color on them.

(f) After reconnecting the above components, check if the equipments work normally.

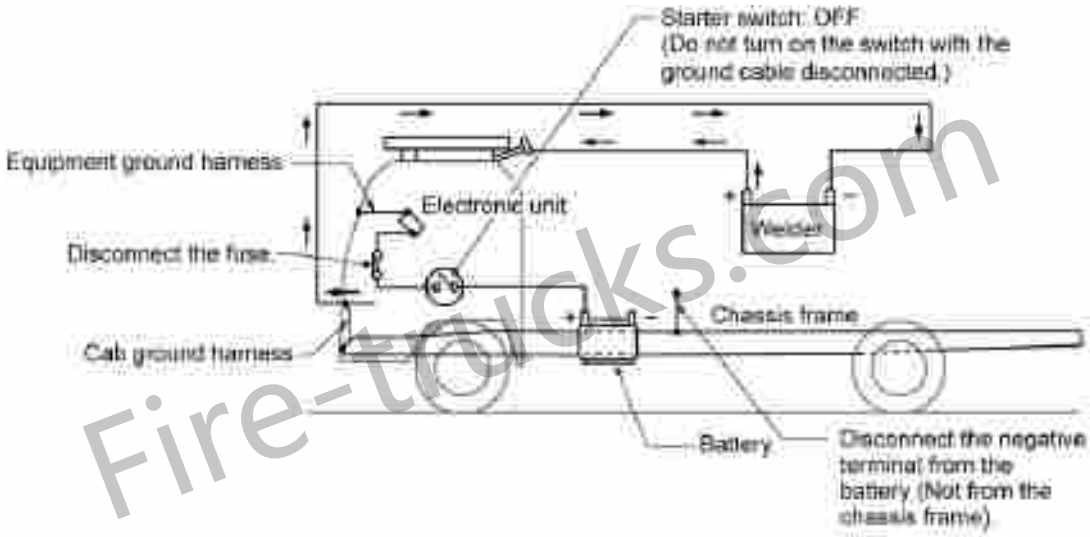
(g) Do not cool down welds rapidly.

Welding current flow direction (Reference)

Poor example: Performing welding without following the procedure 1 through 3



Good example: Performing welding following the procedure 1 through 3



[Precautions for other works]

(1) When drilling or cutting a chassis frame, see *1.2.2. Drilling or welding a chassis frame.* Be sure not to damage electric harnesses and pipes.

(2) When fitting any additional components, be sure that they do not squeeze or crush the harnesses.

(3) Terminals, connectors or wires which have been removed during works must always be put back to their original state.

(4) If removing clips for doing some works, put these clips back in place after such works. If the existing clip is no longer large enough to secure more harnesses for add-on equipments, use comparably-sized clip.

1.8.2. Electrical wiring

(1) Wires

(a) Improper use of wires may result in fire or equipment breakdown. If additional wires are required, select appropriate wires according to the load current to be added, the circuit length, and the harness route.

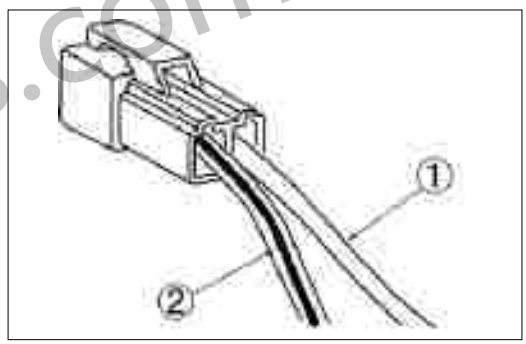
(b) Use the following JIS-certified electric wires for automobiles, or equivalent:

- For common area: AV (Low-voltage wire for automobile) or AVS (Thin-walled low-voltage wire for automobile)
- For the area that needs heat protection: AVX (Cross-linked vinyl insulated heat resistant low-voltage wire for automobile) or AEX (Cross-linked polyethylene insulated heat resistant low-voltage wire for automobile)

(c) When using an AEX wire, parts used with it such as protection tube, corrugated tube, vinyl tape, etc. should also be heat-proofed.

(d) When using a wire whose size is 5sq or larger, solder the pressured part inside the wire terminal to prevent it from heating.

(2) Wire color



Every wire is covered with insulation material with specific color code. The main wires used for electric systems are in solid color ① while the sub wires are with tracers ②.

The following is an example of a color code of a wire with tracer:

0.5 G / R
- R: Red (tracer color)
- G: Green (base color)
- 0.5: Diameter (0.5mm²)

The wire colors are abbreviated in the circuit diagrams as follows:

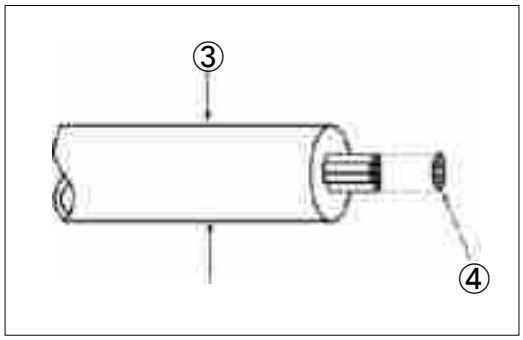
Color code	Color	Color code	Color	Color code	Color
B	Black	L	Blue	P	Pink
W	White	O	Orange	LB	Light Blue
R	Red	BR	Brown	V	Violet
G	Green	LG	Light Green		
Y	Yellow	GR	Grey		

Application of each wire is as follows:

Code	B	W	R	G	Y	L	Br	Lg
Wire color	Black	White	Red	Green	Yellow	Blue	Brown	Light green
Application	Starting, Grounding	Charger	Light	Signal	Meter	Wiper	Auxiliary	Others

(3) Wire size

The size of each wire to be used in a circuit is determined by the current amount (ampere) that will flow into the wire, the circuit length, the allowable voltage drop amount, etc. The following table shows sizes, allowable temperature and allowable current of AV, AVS, AVX and AEX wires. AWG (American Wire Gauge) also specifies wire sizes and allowable current. The nominal size of a wire means its section area.



Wire type	Allowable temperature	Allowable current (ampere)							Remarks
		0.5sq	0.85sq	1.25sq	2sq	3sq	5sq	8sq	
AV	80°	9A	11A	14A	20A	27A	36A	47A	
AVS	80°	8A	11A	14A	19A	26A	35A	No spec.	
AVX	90°	8A	10A	13A	17A	24A	33A	43A	
AEX	110°	7A	9A	12A	17A	23A	32A	42A	
External diameter (mm) ③		2.0	2.2	2.5	2.9	3.6	4.4	5.5	
Section area (mm^2) ④		0.563	0.885	1.287	2.091	3.296	5.227	7.952	
AWG size		20	18	16	14	12	10	8	

Note: “Allowable temperature” means “Ambient temperature” + “Self-heating temperature”.

“Allowable current” indicates the current that is allowed to flow into a wire when the “Self-heating temperature” is approximately 20°C.

(4) Wire size and circuit length

Fuse value on the power source side determines usable wire size and circuit length.

Select appropriate wire size in consideration of the fuse value on the power source side and the wire route.

Fuse			Wire size and circuit length						
Type	Rating capacity	Allowable continuous current	1.5	0.85sq	1.25sq	2sq	3sq	5sq	8sq
Blade fuse	5A	3.5A	Max.25m	Max.40m	–	–	–	–	–
	7.5A	5.2A	Max.15m	Max.25m	Max.40m	–	–	–	–
	10A	7.0A	Max.10m	Max.20m	Max.30m	–	–	–	–
	15A	10.5A	Max.5m	Max.10m	Max.15m	Max.30m	Max.45m	–	–
	20A	14.0A	×	Max.5m	Max.10m	Max.20m	Max.30m	–	–
	25A	17.5A	×	×	Max.10m	Max.15m	Max.25m	Max.40m	–
SBF (Slow-blow fuse)	30A	15.0A	×	×	×	Max.10m	Max.15m	Max.30m	Max.45m
	40A	20.0A	×	×	×	×	Max.10m	Max.20m	Max.30m
	50A	25.0A	×	×	×	×	×	Max.15m	Max.25m
	60A	30.0A	×	×	×	×	×	Max.15m	Max.20m
	80A	40.0A	×	×	×	×	×	×	Max.15m
	100A	50.0A	×	×	×	×	×	×	Max.10m

Legend: ×: Cannot be used –: 50m at maximum

If a wire is connected to an equipment that produces relative movement, the size of the wire should be 0.85sq or larger so as to prevent wire breaking

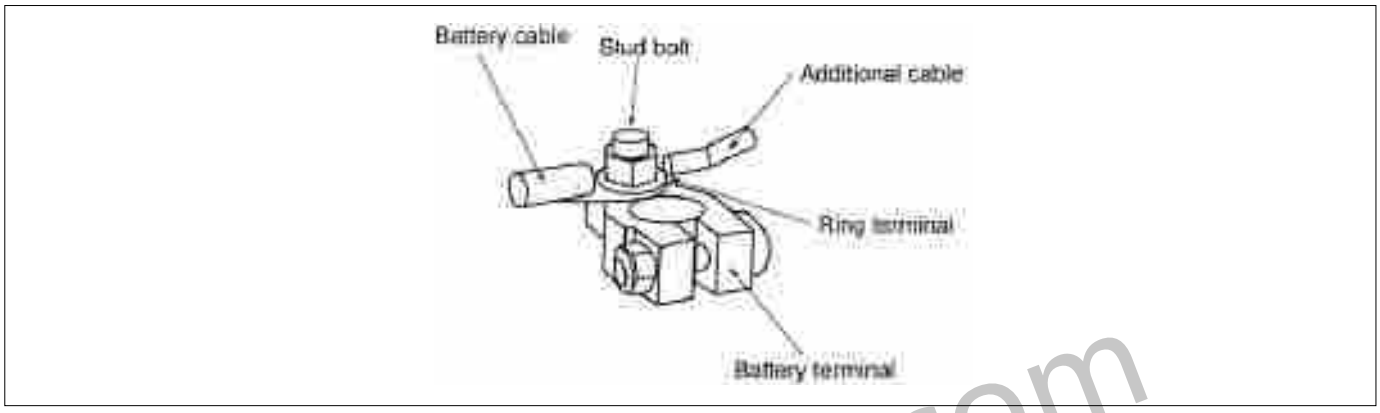
1.8.3. How to add power sources and precautions for such addition

When power sources for additional equipments are needed on a N-series chassis, follow the instructions below:

(1) How to connect a large-load equipment to the positive battery terminal

When fitting an additional large-load equipment, extract power directly from the battery as shown in Fig.1. shows the circuit.

Fig.1 Fitting an additional cable to the battery terminal



To extract power from the positive battery terminal, attach a ring terminal or the similar type terminal to the cable of add-on equipment, and then jointly fasten them on the battery terminal.

(a) To prevent the stud bolt from loosening, the number of the cables stacked on the battery terminal should be minimized.

(b) Provide a fuse in each power extraction circuit. Fuses must be a minimum of 300mm apart from the battery and protected from water. Do not put a fuse directly on the battery body or on the reverse side of the battery cover, otherwise the battery will be damaged or explode.

(c) When using a cable of 5mm^2 or larger, solder the pressured part of the wire terminal, and then wrap the area with a heat shrink tubing.

(2)How to connect the ground wire or cable of an add-on large-load equipment to a chassis frame

(a) The ground wire or cable of an add-on equipment should be connected to the chassis frame member to which the negative battery cable is connected.

(b) Attach a ring terminal to the ground cable. Be sure to firmly secure the terminal on the chassis frame.

(c) Use a ground bolt to secure the ring terminal.

(d) Weld a mating nut on the chassis frame or directly tap the chassis frame.

(e) Relocating the ground points of the factory-installed ground cables and lengthening or shortening these wires or cables should be avoided as much as possible because doing any of these may result in breakdown of electrical equipments or electronics devices due to surge, etc.

(f) Do not secure the ground wire or cable of add-on equipment together with a factory-installed ground wire or cable because the fixing bolt will loosen and contact failure will occur.

1.8.4. Adjusting the position of lamps

At the rear end of a chassis frame, there are temporarily fitted triple rear combination lamps consisted of a tail lamp, a stop lamp, a turn signal lamp and a back-up lamp.

After fitting a rear body and its components on a chassis, fit these rear lamps on the rear body or on the chassis frame following the precautions below.

(1) Fig.2 shows the appearance of the rear combination lamps.

(2) There is a drain hole in the bottom of each lens. For convenience in shipment, these holes have temporarily been turned up and covered with waterproof tape. Before fitting rear combination lamps on a rear body or on a chassis frame, remove this tape.

(3) To prevent the bulb filaments from breaking due to vibration of the lamp housing, after fitting the lamps on a rear body or on a chassis frame, to absorb vibration, fit a stay with its one end fixed to the bottom center of the lamp housing and the other on the rear body or on the chassis frame.

(4) Note that the position and the height of the rear combination lamps relative to the outermost side of vehicle must comply with applicable laws and regulations of body builder's country.