

Chapter 5

CHASSIS MODIFICATION

1. GENERAL CAUTIONS
2. PRECAUTION FOR THE TIGHTENING BOLT AND NUT OF THE CHASSIS FRAME
3. MATERIAL FOR CHASSIS FRAME MODIFICATIONS
4. CHASSIS FRAME HOLE PATTERN
5. CHASSIS FRAME DRILLING
6. FLANGE CUTTING
7. CHASSIS FRAME WELDING
8. REAR OVERHANG EXTENSION
9. STIFFENING OF SIDE RAILS
10. PROPELLER SHAFT MODIFICATION AND ALTERATION
11. SERVICE BRAKE MODIFICATIONS
12. ELECTRIC WIRING MODIFICATIONS
13. ALTERATION OF EXHAUST SYSTEM
14. CAUTIONS NEEDED IN ADDITIONAL MACHINING AND ALTERATION OF THE CAB

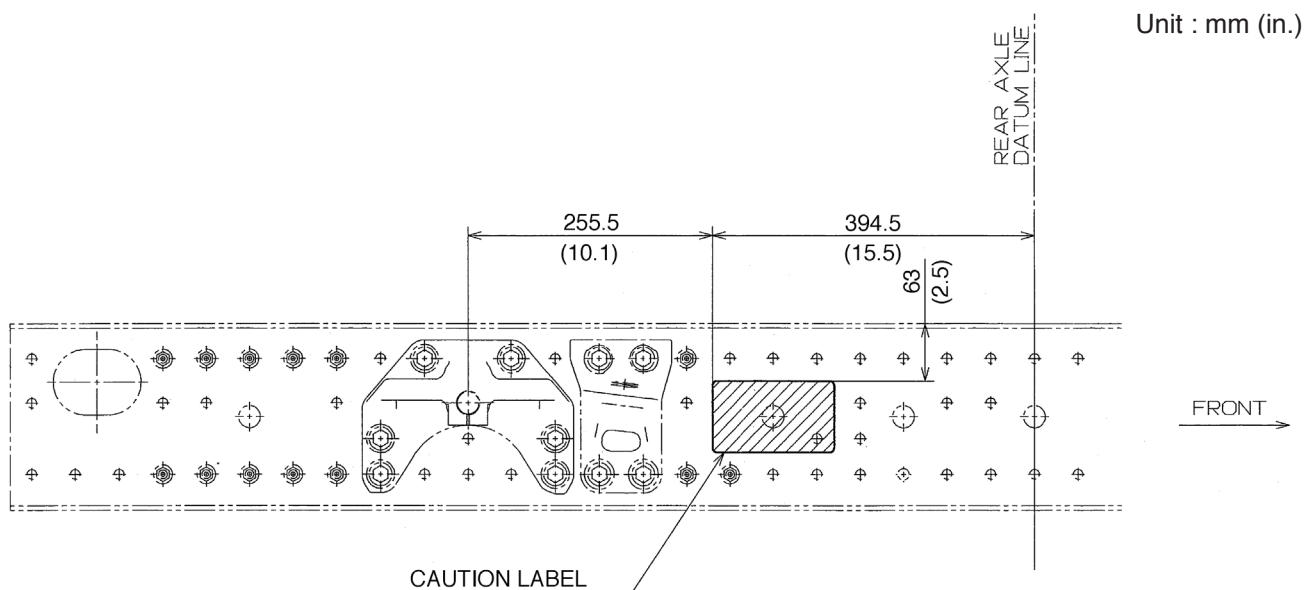
1. GENERAL CAUTIONS

We do not recommend that a wheelbase is changed by any methods.

Prior to modifying the chassis frame, be certain the application and installation of the body type is suitable for the model.

Be sure to follow the WARNING described in the caution label which is pasted on the chassis frame. See the following figure.

If the caution label become dirty or to be scratched, change the new one.



⚠ WARNING	CHASSIS FRAME
<p>No repair or modification shall be made to the chassis frame unless it is made by a Hino dealer or a body builder in accordance with the appropriate Body Builder Book / Workshop Manual provided by Hino. Otherwise, the chassis frame may be damaged, which can cause an accident resulting in death or serious injury.</p>	
⚠ AVERTISSEMENT	CADRE DU CHÂSSIS
<p>Aucune réparation ni aucune modification ne devraient être effectuées au cadre du châssis, à moins qu'elles ne soient entreprises par un concessionnaire Hino ou par un carrossier-construteur, conformément aux manuels pertinents «Body Builder Book» / «Workshop Manual» fournis par Hino. Autrement, le châssis risquerait d'être endommagé, ce qui pourrait provoquer un accident susceptible d'occasionner des blessures graves, voire mortelles.</p>	
37070	

Part No. 86995-37070

Chassis frame modifications (including changes to the rear overhang) should be kept to the absolute minimum since there is a danger that they will reduce the frame strength and service life of the vehicle and impair the vehicle's safety and running performance.

If such modifications are unavoidable, cautions and standards should be strictly adhered to and the modifications should be kept to the absolute minimum.

The original Gross Axle Weight Rating (GAWR) and Gross Vehicle Weight Rating (GVWR) must not be exceeded when a chassis frame has been modified.

When cutting the side rails, the vehicle should be placed on a flat floor and the modification should be performed while supporting the side rails on both sides of the modification.

When modifying chassis frame and tightening modified parts, metric sized bolts and nuts complying with SAE J1199 class 10.9 should be used.

When tightening a parts to be used bolt and nut method to the chassis frame, you must tighten the nut, not to bolt, in order to get proper regulation axial tension. So there is a no chance that a bolt and nut will come loose.

After the chassis frame has been modified, checks should be made as to whether the modifications have been performed as required by the procedures and cautions referred to herein.

After body installation a steering alignment should be carried out.

2. PRECAUTION FOR THE TIGHTENING BOLT AND NUT OF THE CHASSIS FRAME

When loosening bolts and nuts or chassis frame parts (ex: tightening with the crossmember and DEF tank bracket etc.), exchange nuts for new ones because friction stabilizer has been painted on the thread of nut.

Also exchange the bolt for new one, if paint etc. adheres to the thread of the bolt.

Part number & tightening torque

- BOLT (M10) : 91552-010** (** bolt length)
 - NUT (M10) : 94151-21001
- tightening torque : T= 392~588kg·cm (28.4~42.6 ft·lb)

WARNING

When the above-mentioned nut is re-use, even if it will be tightened with the proper torque, enough axial tension does not occur.

The slack of those nuts may be led to a serious accident.

Be sure to use the Hino genuine bolt, in case of you use the bolt of different length by body mounting.

Part No. (M10) 91552-010** (** bolt length)

3. MATERIAL FOR CHASSIS FRAME MODIFICATIONS

When a chassis frame is to be modified, the material used for the modification must be the same as that of the original chassis frame.

Use of non-specified material will impair the vehicle's service life and safety and lead to trouble.

The material of the original chassis frame is specified in following table.

FRAME SPECIFICATION

Model	Wheelbase designation mm (in.)	Class 4 (GVWR:14,500 lbs)	Class 5 (GVWR:17,950 - 19,500 lbs)
XJC700L	2,900 (114)	A	A
XJC710L XFC710L	3,500 (138)	A	A
XJC720L XFC720L	3,800 (150)	A	A
XJC730L XFC730L	4,100 (161)	—	A
XJC740L XFC740L	4,400 (173)	A	B

	A	B
Chassis frame rail material	High tensile. SAE J1392(Grade 070X)	
Minimum yield strength	40 kgf/mm ² (56900 PSI)	
Section modulus (one side)	1.018×10 ⁵ mm ³ (6.21 in. ³)	1.218×10 ⁵ mm ³ (7.43 in. ³)
Resisting bending moment (one side)	40.72×10 ⁵ kgf·mm (353400 in·lbs)	48.72×10 ⁵ kgf·mm (422900 in·lbs)
Width of frame assembly	838 mm (33 in.)	840 mm (33.1 in.)

4. CHASSIS FRAME HOLE PATTERN

Holes have been drilled at intervals of 50 mm (1.97 in.) on the side of the side rail.

By the vehicle, some of holes are used or have not been drilled.

You should use existing holes when installing parts.

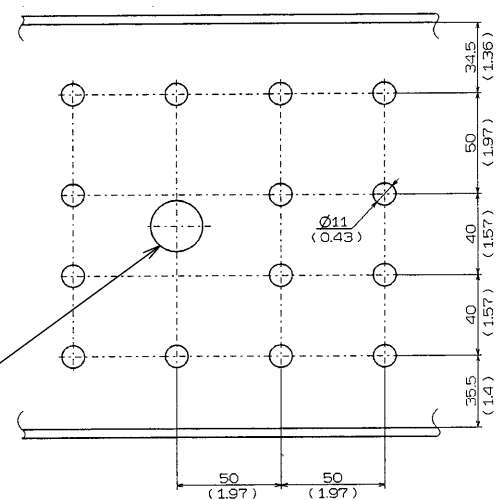
In the case of a new hole is required, drill a hole according to the pattern of the figure.

Never drill around pilot hole.

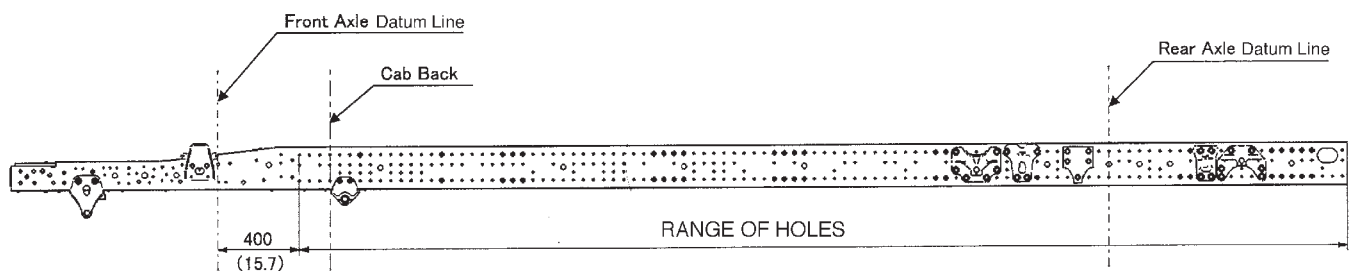
Unit : mm (in.)

WHEEL BASE	RANGE OF HOLES
2900mm (114 in.)	3675mm (144.7 in.)
3500mm (138 in.)	4275mm (168.3 in.)
3800mm (150 in.)	4575mm (180.1 in.)
4100mm (161 in.)	4875mm (191.9 in.)
4400mm (173 in.)	5175mm (203.7 in.)

Pilot hole



The Basic Pattern of Holes



Frame Hole Pattern

5. CHASSIS FRAME DRILLING

Drilling of the chassis frame greatly affects strength and if such operations are executed improperly, the frame might be seriously damaged. When drilling the chassis frame, follow the instructions given below carefully.

Drilling holes through the upper and lower flanges, must be strictly avoided.

Drilling holes through the side rail changing the exterior shape, or changing the section modulus such as the inner stiffener is fitted, must be strictly avoided.

Drilling holes through the cross members must be strictly avoided.

Drilling holes near the spring brackets and the maximum bending moment sections of the side rail must be strictly avoided.

Original holes in the chassis frame must not be drilled again.

Holes should be deburred after drilling.

When drilling holes, brake hoses, brake pipes, and electrical wiring should be protected against damage.

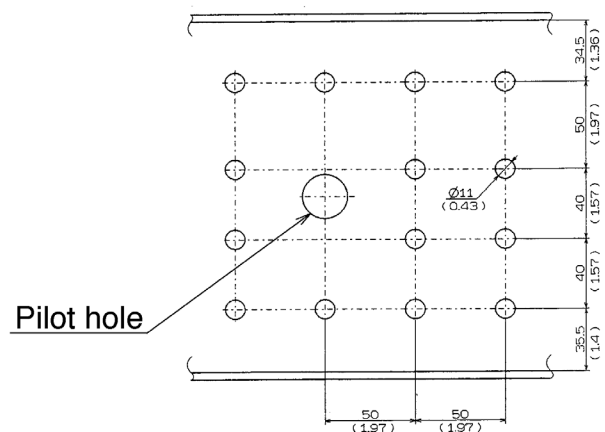
Be sure to use a drill in making holes. Never use a gas torch or the like.

To avoid increasing the temperature of a drill, use an appropriate drill having a tip angle to suit the material drilled.

The diameter of the hole in a side rail must be less than 11 mm (0.43 in.). Hole diameters must not exceed bolt diameters by more than 1 mm (0.039 in.).

When drilling hole through the web, drill a hole according to the pattern of the following figure.

Unit : mm (in.)



The Basic Pattern of Holes

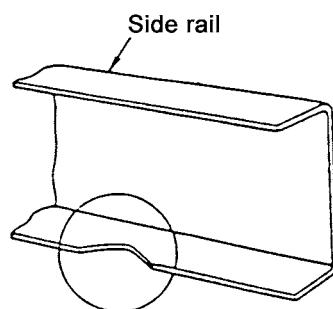
CAUTION

Do not drill the upper or lower flanges.

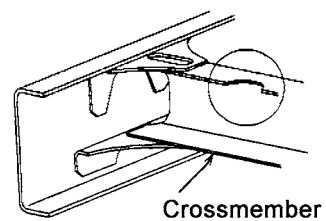
6. FLANGE CUTTING

Never cut off the side rail flange and crossmember for the reasons of a body mounting.

Wrong



Wrong



7. CHASSIS FRAME WELDING

General Warning

Welding the chassis frame greatly affects its strength, and if such operations are executed improperly, it can be seriously damaged.

When welding the chassis frame, carefully follow the instructions bellow.

- An experienced professional should always perform the welding to assure the following welding conditions since a poor welding job on the frame can cause damage.
- Before and during welding, make sure that there are no flammable materials such as oil, rags around working area.
- When arc welding, ventilate and/or wear an antitoxic mask against noxious gas.
- To prevent burns, electric shock, and gas poisoning during arc welding, wear a hard hat, apron, antitoxic mask, safety goggles, arm coverings, leg coverings, safety boots, and gloves.
- Other basic cautions on welding to perform it before and after, refer to Chapter 4. TRUCK BODY AND SPECIAL EQUIPMENT INSTALLATION PROCEDURE AND PRECAUTIONS.

Welding Conditions

Consult the table below for welding conditions.

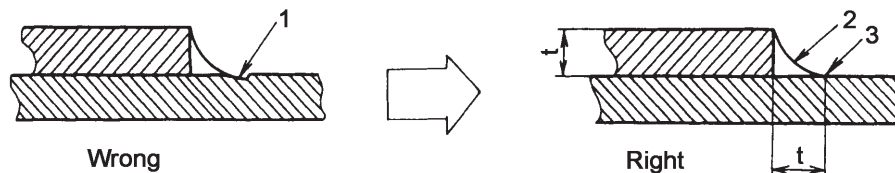
WELDING CONDITIONS

		Electric current (Unit: A)					
	Rod dia. ϕ	3.2 mm {0.126 in.}		4 mm {0.157 in.}		5 mm {0.197 in.}	
	Welding position	Flat	Vertical overhead	Flat	Vertical overhead	Flat	Vertical overhead
Mechanical property of weld metal & rod	Weld Metal (Hot roll plate) Tensile strength, 538 MPa {55 kgf/mm ² , 78.228 lbf/in. ² } Welding Rod Tensile strength: 490 MPa {50 kgf/mm ² , 71.116 lbf/in. ² } Illuminate type (JIS Z3211 E4916-U) (AWS A5.1 E7016) Coated electrode	90 - 140	80 - 130	141 - 190	110 - 160	180 - 250	—

NOTE : • Diameter of welding rod $\phi 3.2$ mm {0.126 in.} or $\phi 4$ mm {0.157 in.} - plate thinner than 5 mm {0.197 in.}
• Diameter of welding rod $\phi 4$ mm {0.157 in.} or $\phi 5$ mm {0.197 in.} - plate thicker than 6 mm {0.236 in.}


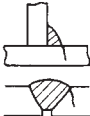




Welding Bead Shape

Make sure that the shape of the welding beads corresponds to the shape figure below.



1. Under-cut
2. Concave welding
3. This area should be smooth and free from under-cuts.

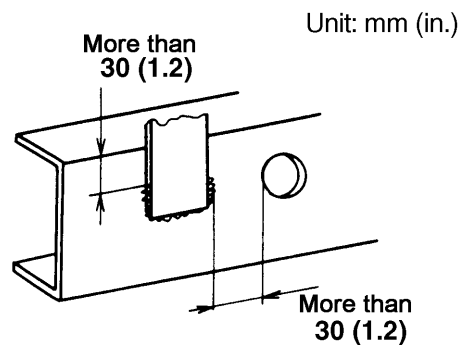
Avoid the following defects in welding beads:

Deposited Metal Cracking 	Toe Crack 	Blow Hole 
Slag Inclusion 	Under cut 	Poor Penetration 

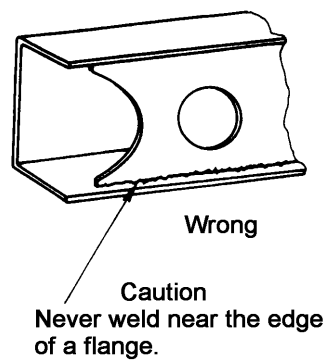
In order to reduce the stress caused by welding, the welding length should be as short as possible and the welding volume should be kept at a required minimum to secure the strength. Avoid concentration or proximity of welding joints as far as possible. Don't carry out the welding work on edges or bent portions as it demands a considerable welding skill.

Welding Positions

Side rail web welding must be conducted at least 30 mm (1.2 in.) away from the edges of the side rail or any hole.



Never weld near the edge of a flange.



In welding, make sure that there is no undercut or the overlap of the bead and a pin hole.

8. REAR OVERHANG EXTENSION

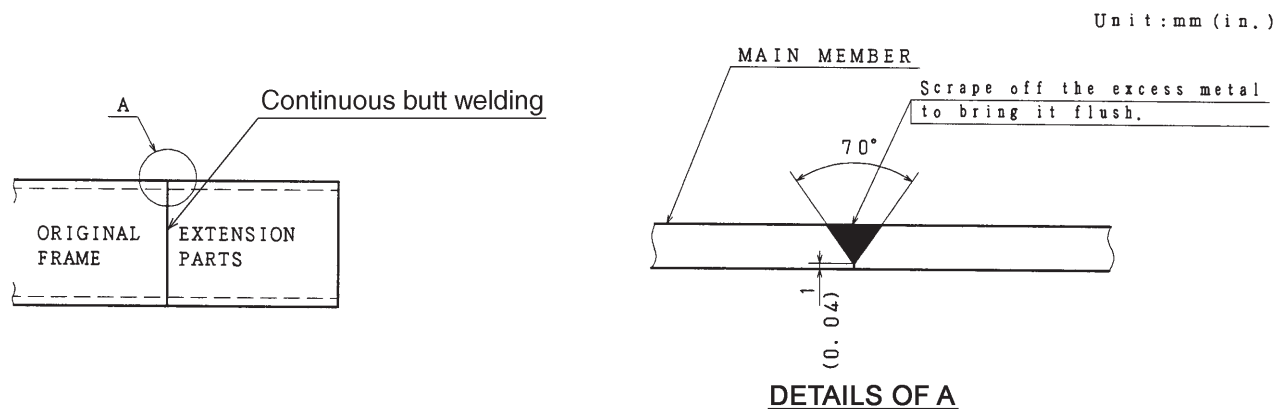
Rear overhang extension should be minimized since extension can reduce the service life of the vehicle and impair its safety.

The material and dimensions of the extension rail must be the same as those of the original side rail.

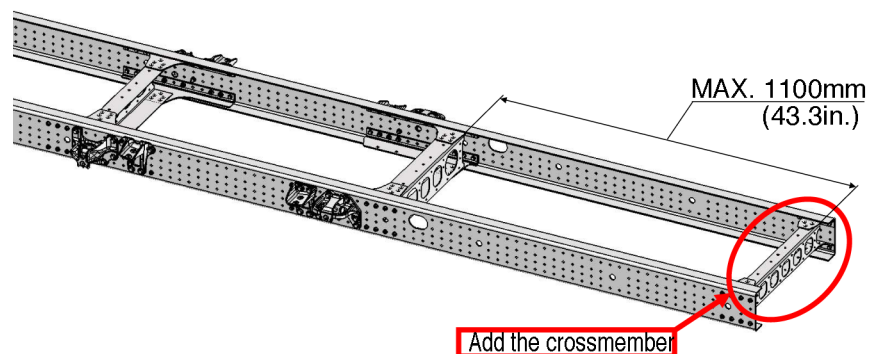
The extension rail should be aligned with the original side rail.

Rear overhang extension should be done in the way of adding the extension rail to the original side rail end.

- Rear overhang extension
(less than 1350 mm (53.1 in.))



It is recommended that the proper stiffener and the crossmember are installed when adding the extension rail.




Install the parts of a crossmember in the back end of the chassis frame.
Make a crossmember's interval below into 1100mm (43.3 in.)

9. STIFFENING OF SIDE RAILS

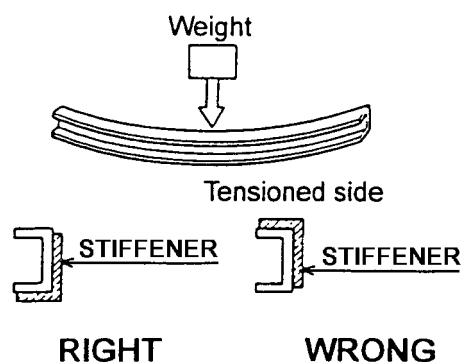
(WHEN STIFFENING OF SIDE RAILS EXCEPT ALTERATIONS OF THE WHEELBASE OR THE REAR OVERHANG)

Normally, it is not necessary to attach the additional outer stiffeners and making of such alterations to the side rail is not recommendable. The use of such stiffeners are, however, inevitable due to some special fittings or operating conditions, pay close attention to the following points.

When side rail are to be stiffened, be sure to use the high tensile strength steel which is equal to or better than that of the main rail of side rail.

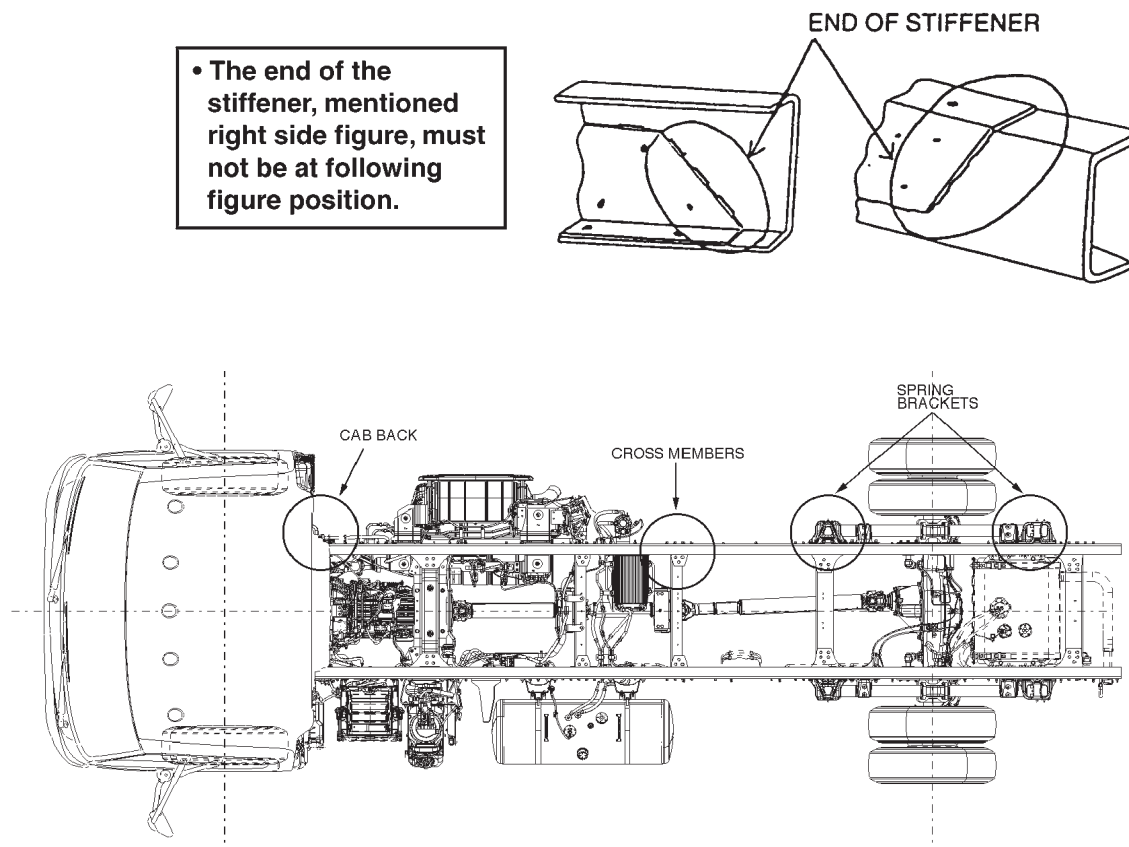
As -shaped steel stiffener could not be strictly fitted to the main rail of side rail due to difficulty of machining accuracy, L-shaped stiffener is recommended.

When installing an L-shaped stiffener, its flange side must be placed onto the tensioned side of the side rail stress.



If the ends of outer stiffener are positioned onto the end of inner stiffener or the cross member or the spring brackets where the rigidity undergoes sudden changes or load is concentrated, it may cause the concentration of stress resulting damages or cracks of the side rail.

Take adequate care in determining the position of the stiffener end.

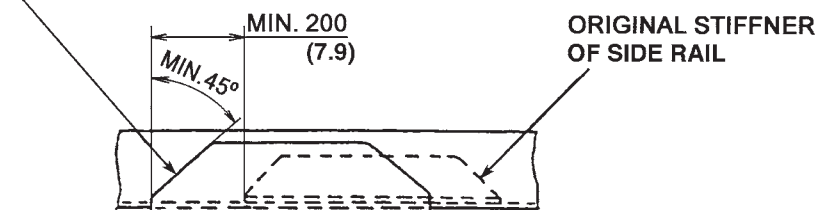


End of original inner stiffener or outer stiffener

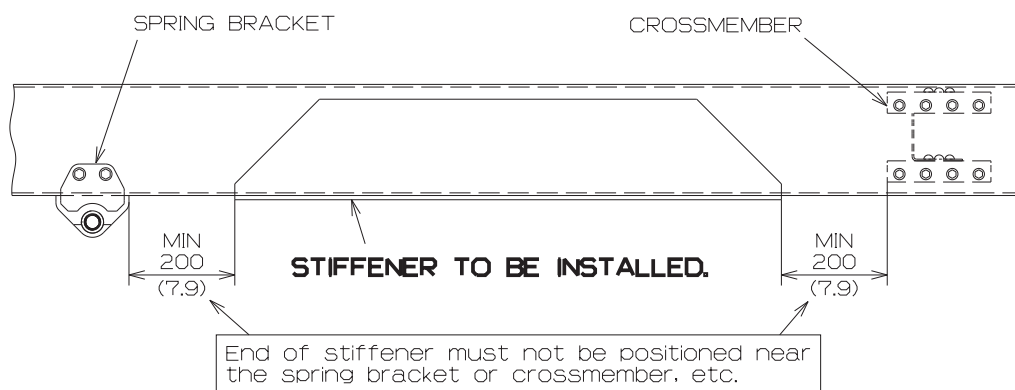
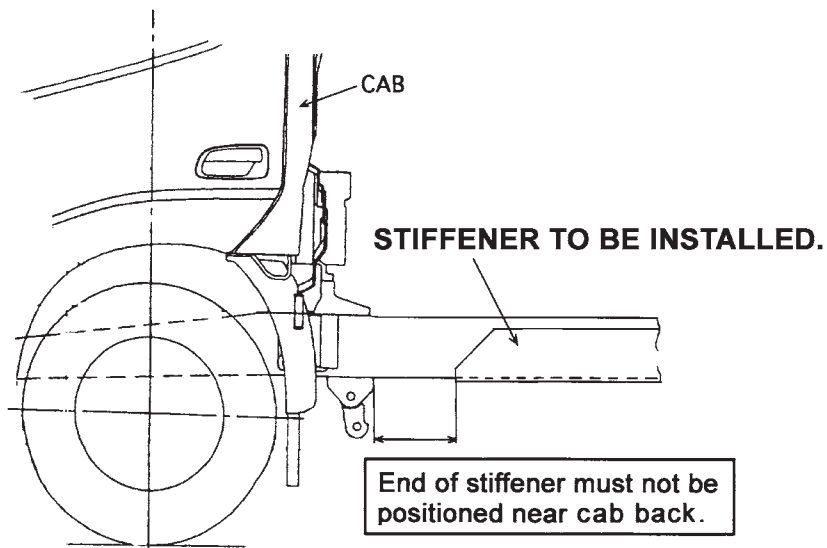
Unit : mm (in.)

DETAIL OF STIFFENER END POSITION

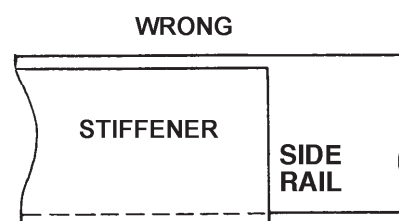
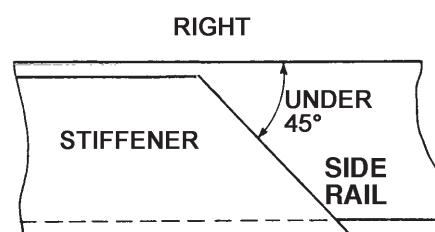
End of original inner or outer stiffener

STIFFENER TO BE INSTALLED.

End of stiffener must be installed at the position of min.200mm (7.9 in.) from the original stiffener as shown the above figure.

Near CROSS MEMBER or SPRING BRACKET**Near CAB BACK**

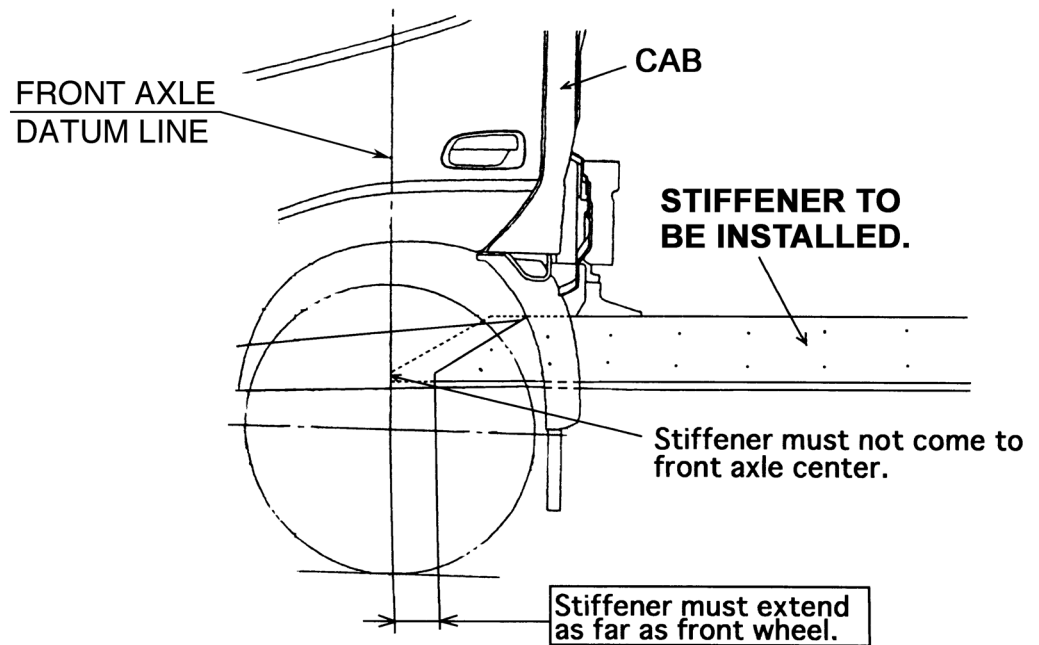
It should be cut so that its end has an angle max. 45° or less.



When outer stiffeners are installed, the parts which are not stiffened may become relatively weak in rigidity.

If the rigidity is weakened in a particular area, it may cause the breakage or crack of the side rail. By this reason, great care is needed in deciding the area where the stiffener is applied.

As side rail of a truck are most vulnerable generally in the area between the cab and the rear body, it is recommended that the stiffener is extended as close to the front axle if heavy concentrated loading is expected to be applied just behind the cab.



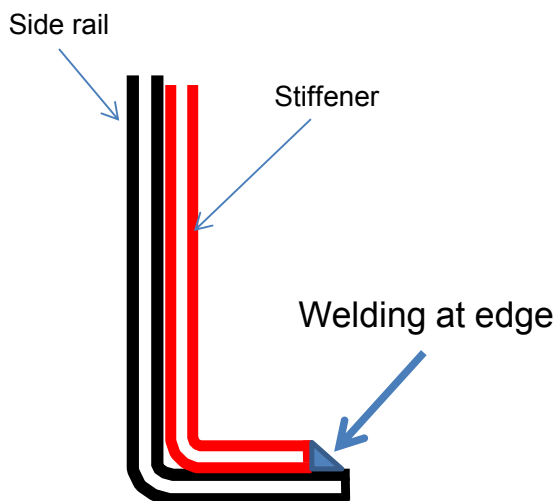
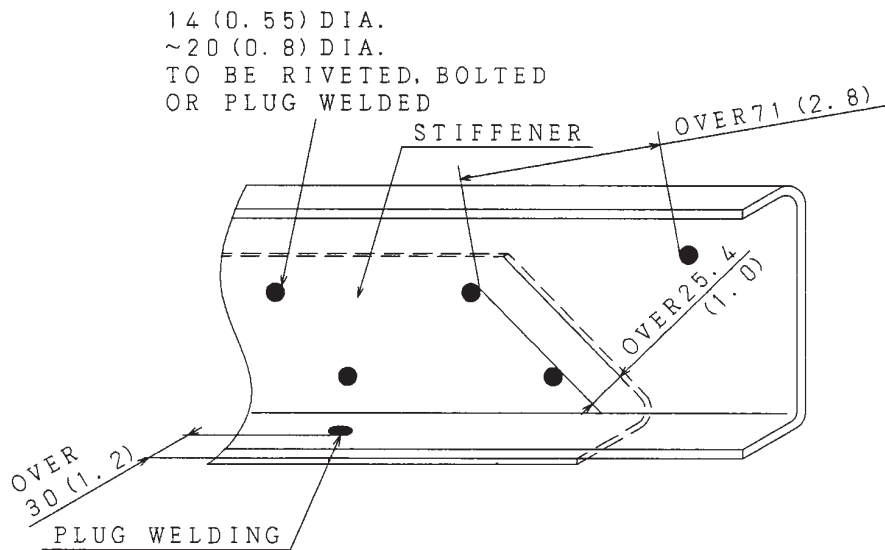
How to fix stiffener to side rail

As a rule a stiffener should be fixed to the side rail by means of riveting or bolting, when it is inevitable to weld them together, do not weld the stiffener to the flange but to the web.

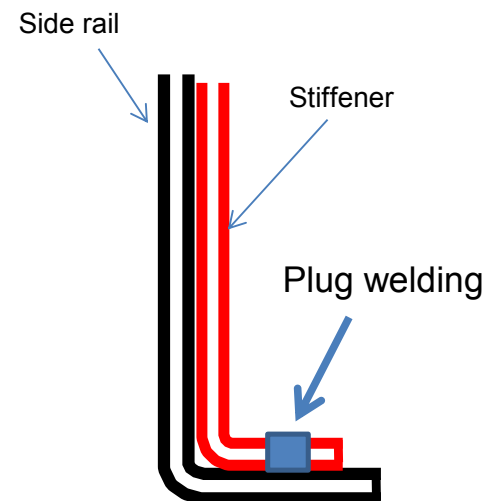
As a rule the plug welding method should be used in this case.

In plug welding, be sure that the plug welding hole is at least 25.4 mm (1 in.) removed away from the edge of the stiffener and 71 mm (2.8 in.) or more away from a bolt and rivet hole. The plug welding hole should be 14 mm (0.55 in.) to 20 mm (0.8 in.) in diameter as a rule.

Unit: mm (in.)



DO NOT WELD the edge of flange on side rail, because it may become a starting point of side rail crack.



Allow to use plug welding on the flange of side rail

10. PROPELLER SHAFT MODIFICATION AND ALTERATION

Alteration of propeller shafts is not recommended.
If remove propeller shafts when mounting of body,
refer to a workshop manual or contact HMC or Hino authorized dealer.

11. SERVICE BRAKE MODIFICATIONS

Do not Modify the Brake System

The brake system is the most important safety component of the vehicle and you must never modify it when mounting a body or equipment.

If you must modify the piping of the brake system in order to make other modifications to the chassis during body or equipment mounting (moving the fuel tank, etc.), please contact HMC or Hino authorized dealer and follow the advice that they provides.

Compliance to CMVSS

This incomplete vehicle, when completed as a truck, will conform to CMVSS 105, Hydraulic Brake, provided that;

- Neither the GVWR nor the GAWR is exceeded.
- No alterations are made to suspensions, foundation brake, wheel equipment or brake control system.
- The height of center of gravity from the ground to the completed vehicle with pay load should not exceed 1,600mm (63in.), and no alteration is made to any brake system component.

General Points of Brake System

Brake System Specifications

Hino chassis are equipped with an assisted brake system that is matched to the size of the vehicle to allow the driver to operate the brakes in safety and comfort.

The table below shows, in outline, how brake systems are matched to chassis models.

CHASSIS MODEL	BRAKE ASSISTANT SYSTEM
Class 4	VACUUM
Class 5	HYDRAULIC

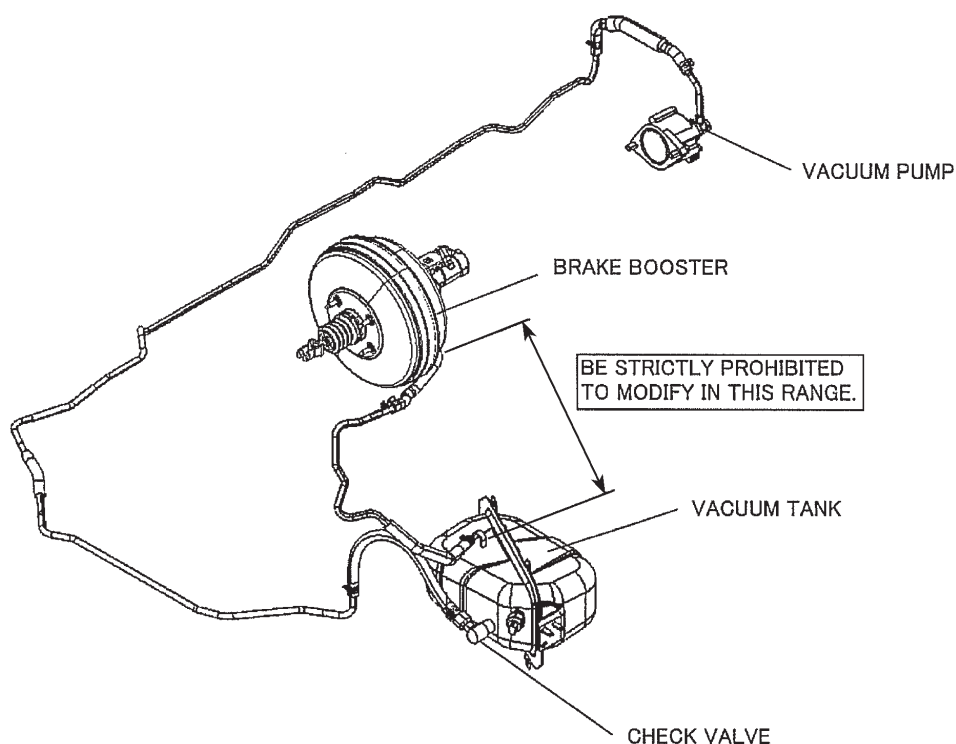
If body equipment design means that you need to take power from the brake system such as vacuum air to control transmission P.T.O. provided by body or equipment manufacturer, be sure to make a thoroughly study of the basic brake system before performing these modifications.

Taking the Power from the Brake System (Class 4 model only)

- As a general rule, the taking of vacuum air to power a body or equipment from the brake system is prohibited.
- If you must take vacuum air pressure to power a body or equipment from the brake system piping, take account of the frequency of use of the equipment, the performance of the vacuum air supply and safety considerations, and consult HMC or Hino authorized dealer beforehand.
- When you install vacuum air piping, make sure it will not affect brake system during operation or in the event of a breakdown and follow the rules given below;

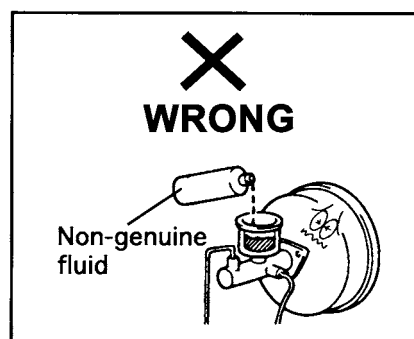
PROCESS HOW TO TAKE VACUUM POWER

- Don't take the vacuum air from the main brake vacuum piping. (between the vacuum tank to the brake booster.)
- Take the vacuum air from the joint of piping between the vacuum pump and the vacuum tank.
- Install a protection device as check valve between the brake system and the body equipment to protect the main brake system.
- Must be followed the instruction of piping precautions for installation of piping of the body equipment.



Refilling Brake Fluid and Hydro Booster Fluid (Class 5 model only)

- When changing brake and clutch fluids, use only genuine HINO brake and clutch fluids. (For details of brake and clutch fluids, see the appropriate workshop or owner's manual.)
- Use only genuine HINO hydro booster fluid for the hydro boost circuit at the time of changing and refilling.
- Never reuse old brake or clutch fluids.
Never use mineral oil or mix HINO products with other brands.



Avoiding Effect of Exhaust Heat

Locate the brake hose, pipes and the parking brake outer cable min. 200 mm (8.0 in.) away from the exhaust system.

If the specified clearance cannot be maintained, heat insulators need to be installed.

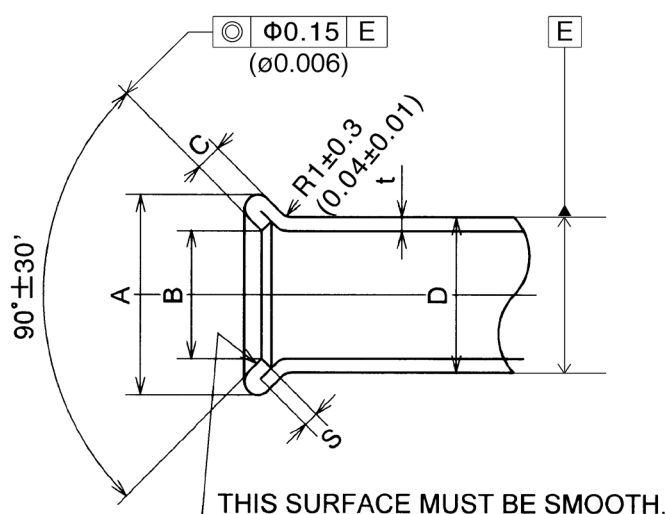
Brake Piping Used in The Chassis

Steel Piping Used in the Chassis

The table below shows the material of the piping used in the chassis and the configuration of the flare of each type of pipe.

Unit : mm (in.)

Nominal diameter D	Flare configuration					Material
	A	B	t	C	S	
4.76 (0.19)	6.6~7.2 (0.26~0.28)	2.9~3.6 (0.11~0.14)	0.7 (0.03)	1.4 (0.06)	1.0 (0.04)	STDW 1
6.35 (0.25)	8.6~9.2 (0.34~0.36)	4.5~5.3 (0.18~0.21)	0.7 (0.03)	1.4 (0.06)	1.0 (0.04)	STDW 1



[DETAILS OF MATERIALS]

Pipe dia.	Type	Pipe	Surface Treatment	
			Inside	Outside
4.76 ~ 6.35 (0.19 ~ 0.25)	Double-wound plated steel pipe	STDW 1	MFCuA	MFZnA-C + Plastic

[Notes]

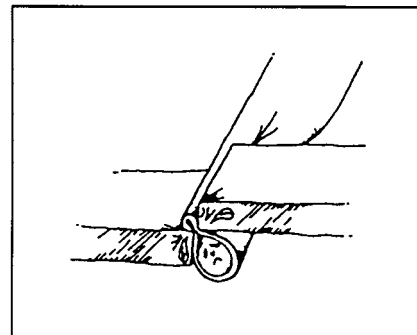
Chemical composition and mechanical properties.

Pipe	Chemical composition (for reference) %						Mechanical properties					
							Tensile strength			Bending		
	C	Mn	P	S	Si	Cu	Tensile Strength N/mm ² {Kg/mm ² }	Yield Point N/mm ² {Kg/mm ² }	Elonga- tion (%)	Applicable pipe dia.	Bending angle	Inside dia. (D= pipe dia.)
STDW 1	0.02	0.22	0.01	0.010	0.02	—	≥ 290 { ≥ 30 }	≥ 175 { ≥ 18 }	≥ 25	≤ 8 (0.3)	360°	1.5D

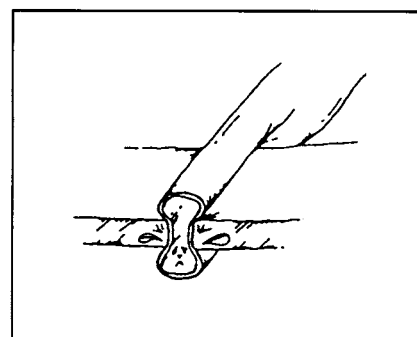
Precautions when Mounting a Body or Equipment

Avoiding Interference with Piping

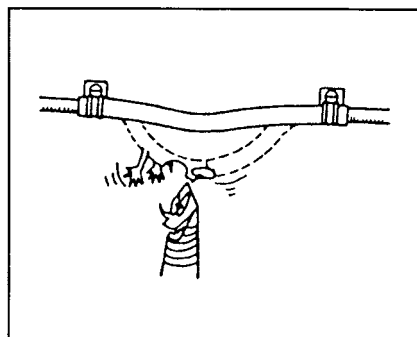
Take care that the piping is not caught by other parts.



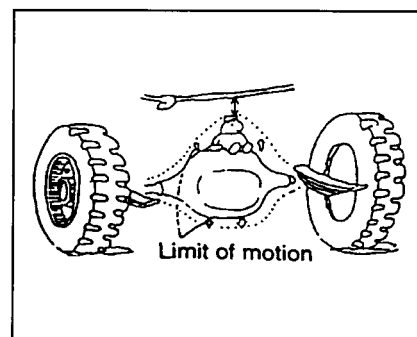
Be sure that the piping is not flattened.



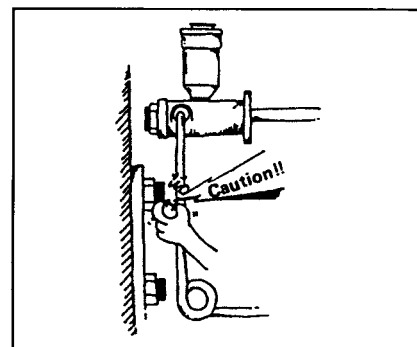
See to it that the piping is not in contact with the sharp-angle portion of other parts.



Pay attention to the displacement of the brake hose connected to the front and rear wheels while the vehicle is running.



Secure a sufficient clearance between the brake piping and installed parts.

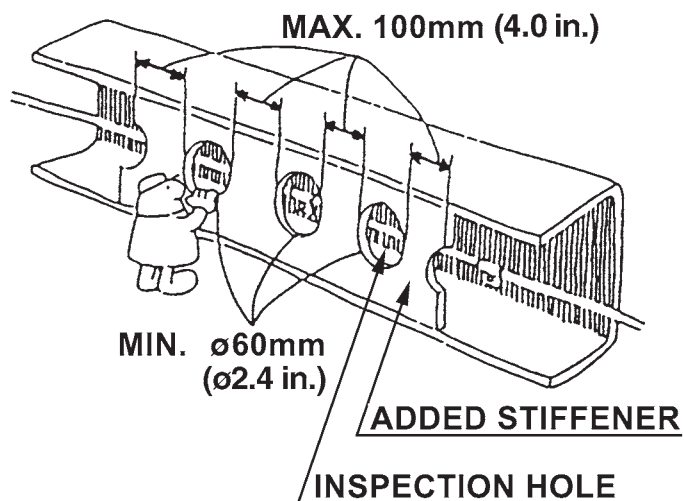


The joints of pipes and hoses must be accessible to allow tightening and so that pipes and hoses can be removed.

If you have fitted stiffeners to bridge the gap between the flanges of side rail, be sure to cut inspection holes in the stiffener.

The pitch between holes must be 100 mm (4.0 in.) or less, and the diameter of the holes must be at least 60 mm (2.4 in.).

Make sure that the holes are in front of the clips used to secure the piping to the side rail. You must be able to insert or remove the clips using a box wrench.



Make sure that brake component parts are easily accessible.

Secure such a structure that refastening, maintenance, inspection and replacement are possible of the brake-related parts even after the particular body mounting or alteration.

Considering the position of the air bleeder of the piping, construct the brake piping to permit air bleeding.

Make sure that the air bleeders of following parts are easily accessible for air bleeding.

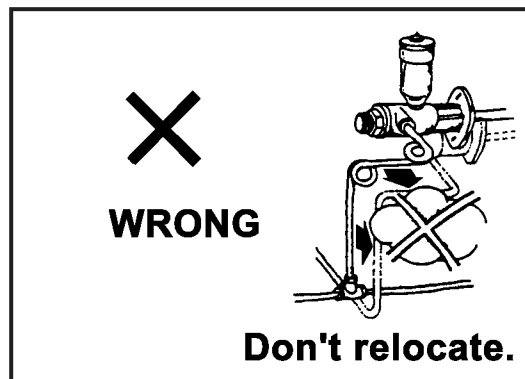
- BRAKE MASTER CYLINDER
- DISC BRAKE CALLIPER



[NOTE]

Tightening torque of air bleeding plug : 90 ~ 130kgf·cm
(78 ~ 113lb·in)

Don't relocate the brake-related parts or change the pipe shape.



Allow sufficient clearance between the brake pipes, hoses and mounted body or equipment. When mounting the body or equipment, make sure that body and equipment do not interfere with the brake system.

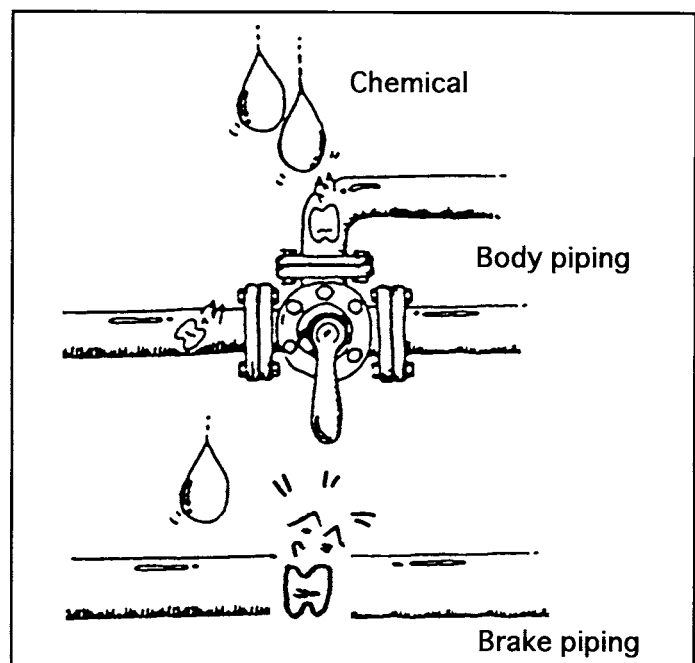
- Clearance with engine
- Clearance with brake component parts
(Pipes, hoses, devices of ABS, etc.)
- Clearance with hoses around axles
(Must be consider the maximum movement of axles)
- Clearances with rubber parts
(For more details of required clearances, see "PIPING CLEARANCE" here in after.)

Condensation and corrosion prevention of piping

Corrosion of brake piping for body applications such as, but not limited to liquid oxygen truck, vacuum tank truck, or tanker truck is promoted by condensation.

(Such as the liquid oxygen inlet/outlet.)

Keep the brake piping away from or cover it with a protective plate at portions where dew forms or water drops easily.



Precautions for Modification (Alteration)

Avoid piping modification(s) if possible.

If you modify piping, be sure to observe the following precautions.

PIPING

- When extending a pipe, do not join two pipes directly.
- When joining pipes, use the flare joint method and avoid twisting the pipes too much.

[NOTE]

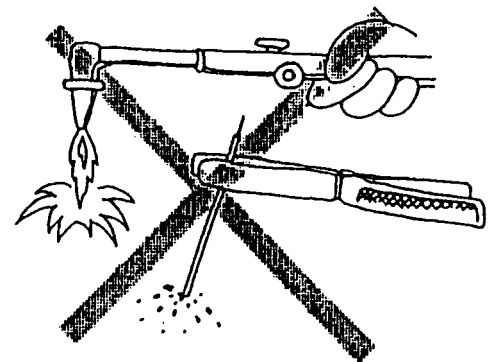
Tightening torque of flare nut

Unit: kgf·cm (lb·ft)

Pipe external diameter mm (in.)	Size of flare nut	Tightening torque
ø4.76 (ø0.19)	M10	150±25 (11±2)
ø6.35 (ø0.25)	M12	250±50 (18±4)

Most pipes are made of steel but have anti-corrosive plating on the inside and the outside. Never braze these pipes and never heat them to high temperatures.

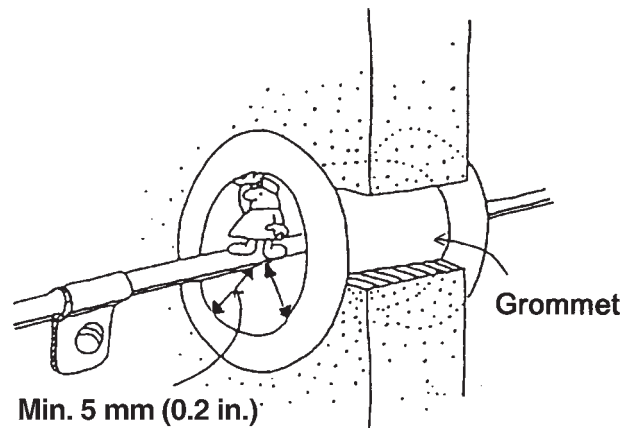
Do not weld or braze brake piping and do not heat to high temperatures.



Do not use copper pipes for high-pressure hydraulic brake piping.
Do not piping on axles.

Where pipes pass through the side rail, use a grommet in the hole and secure the pipe with clips close to the hole so that the pipe does not touch the hole or the grommet.

Use of Grommet.



When remove the transmission, it is necessary to pull the transmission assembly backwards in the line of the crankshaft.

Therefore, do not install piping in areas around the transmission
(The area is between transmission and No.2 crossmember.)

Where piping may be affected by the failure of other equipment, install the pipes inside the side rail or crossmembers, and do not allow them to protrude below the bottom flange surface of the side rail.

To prevent fires caused by oil leaks, do not install joints in hydraulic piping near to or over any parts of the exhaust system.

Do not install piping between the spring brackets of the front and rear suspensions (outside the lower flange surface of the side rail) or within the range of movement of the spring.

The piping located on the axle below the springs is carefully designed to prevent damage from the complex vibrations which arise in this area. Do not modify this piping.

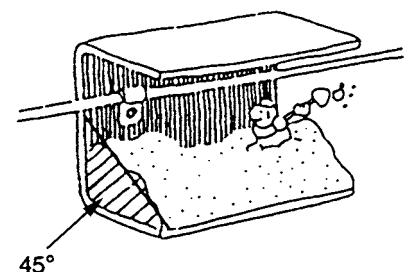
Do not install piping near to the moving parts of the chassis side such as propeller shaft and P.T.O. drive shaft.

Avoid making  shape bends in hydraulic brake piping as this makes air bleeding difficult.

Do not install piping in places where earth, sand, or water accumulate.

Avoid covering pipes with rubber or vinyl tubes as this tends to trap water.

Install pipes high enough so that they are not covered by any earth or sand that may accumulate on the lower flange.



To protect the piping locate inside of side rail or behind crossmember.
(Piping minimum clearance required = 5mm (0.2in.) from side rail and crossmember.)

Don't locate the piping behind the end of the exhaust tail pipe.

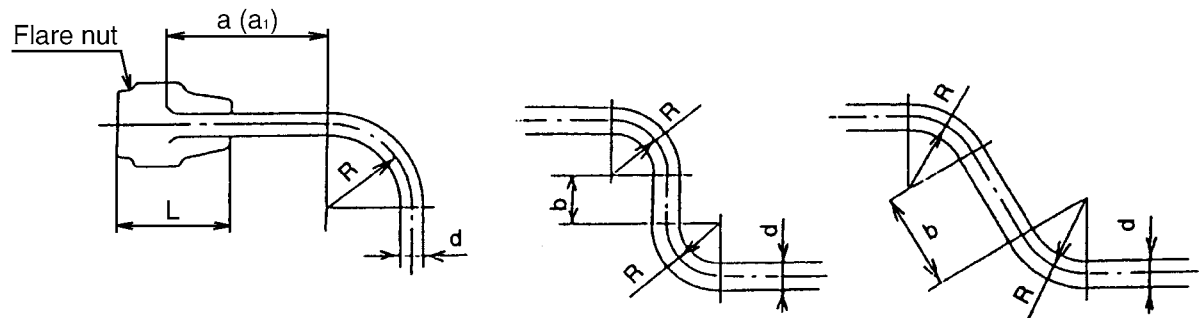
When bending pipes, observe the following precautions.

- Use a bender and do not heat the pipes in order to bend them.
- Observe the standard bending radiuses shown in the table below

Unit: mm (in.)

Nominal dia. of pipe	4.76 (0.19)	6.35 (0.25)
Standard bending R	30 (1.18)	

- The minimum and recommendable lengths of the straight section at the end of a pipe and of the straight section between two bends are shown in the drawing below.



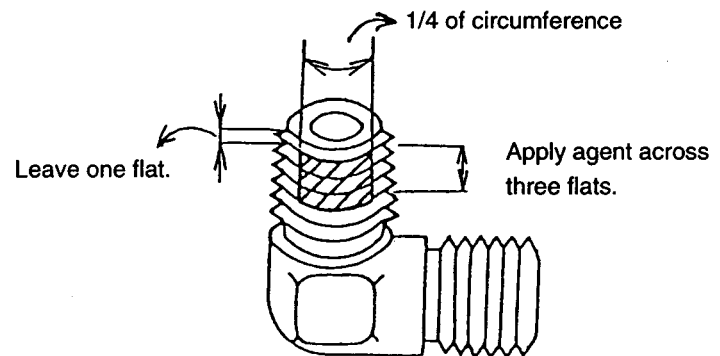
Unit: mm (in.)

Sign Diameter of pipe	a (with Flare nut)	a ₁ (without Flare nut)	b
	Min. L + 2d	Min. 3d	Min. 2d
4.76 (0.19)	30 (1.2)	30 (1.2)	15 (0.6)
6.35 (0.25)	30 (1.2)	30 (1.2)	15 (0.6)

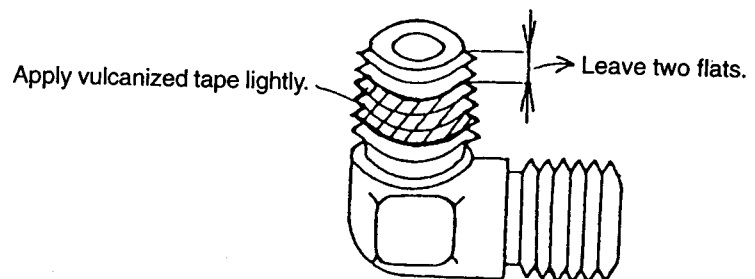
- Flush the inside of the pipe and remove any foreign matter before use. Use compressed air to flush the pipe.
- For details of pipe machining at the flare nut, see described in forward paragraph "Brake Piping Used in the Chassis".
After machining, remove any foreign matter by flushing the pipe with compressed air.

Using sealing agents on tapers

- If possible, use a strong anaerobic sealing agent (Genuine Hino product or locktight #575).
- Clean tapers with cotton waste and thinners before coating with sealing agent. If you intend to reuse joints which have been sealed with anaerobic sealing agent or vulcanized tape, make sure you remove all trace of the old sealing agent or tape before re-sealing.
- Always apply sealing agent starting at one flat from the tip of the male thread, and apply the agent across three flats over one quarter of the circumference of the thread. Apply approximately 0.1 g (0.04 oz.) of agent to each joint.



- When using vulcanized tape, make sure that the sealing agent does not penetrate any valve, etc. (If the sealing agent penetrates a valve, it may block the valve.) As a standard, leave two flats from the tip of the thread and apply 1.5 ~ 2 turns of vulcanized tape.



Inspection after fitting

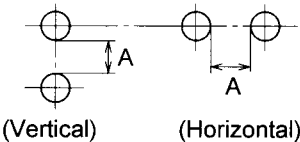
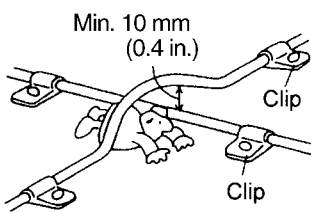
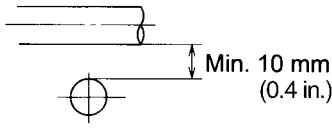
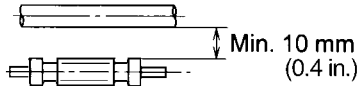
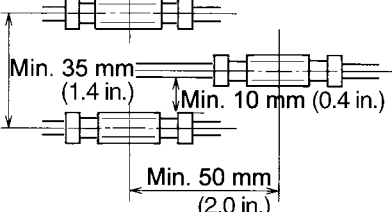
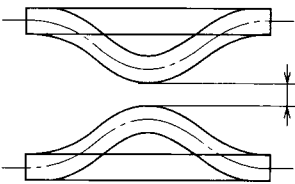
After tightening the joint,

- Make sure that there are no air or oil leaks.
- Make sure that the fitting does not place any strain on the pipe or hose (bending, distortion, etc.).

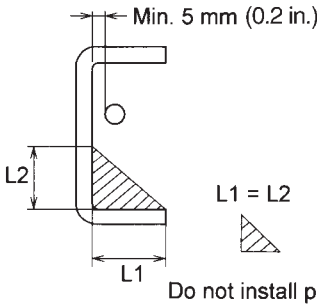
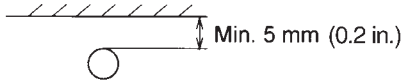
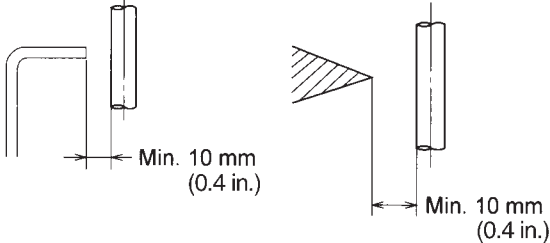
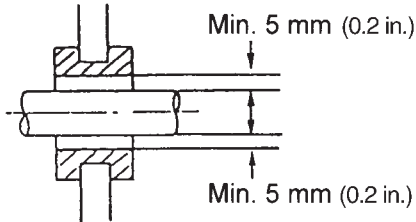
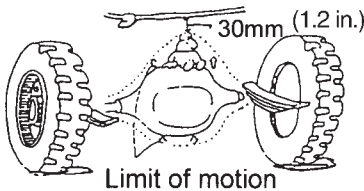
Piping Clearances

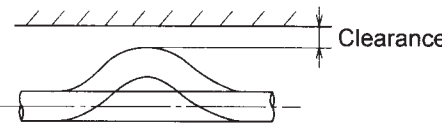
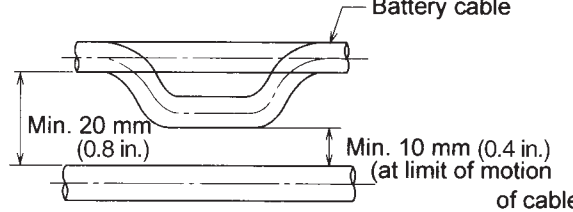
To prevent rust and damage from contact with other parts. When modifying piping, observe the following precautions.

Clearances Between Two Pipes

No.	Position	Clearances
1	Between two pipes.	 <p>A Min. 10 mm (Horizontal) (0.4 in.) 0 (Vertical)</p>
2	Pipe crossing points. 	 <p>Min. 10 mm (0.4 in.)</p> <p>Use clips to secure pipes near crossing points.</p>
3	Between a pipe and a joint.	 <p>Min. 10 mm (0.4 in.)</p>
4	Between two joints.	 <p>Min. 35 mm (1.4 in.) Min. 10 mm (0.4 in.) Min. 50 mm (2.0 in.)</p>
5	Between two hoses.	 <p>At maximum displacement min. 20 mm (0.8 in.)</p>

Clearances Between Pipes and Other Parts

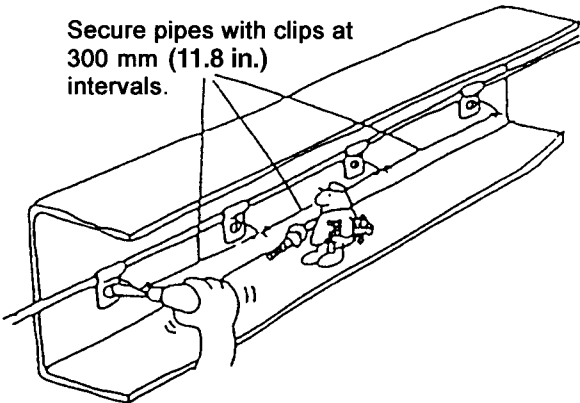
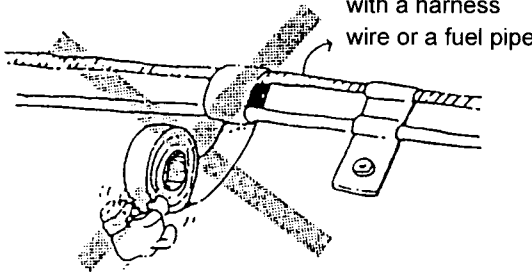
No.	Position	Clearances
1	Between pipes and side rail.	 <p>Min. 5 mm (0.2 in.)</p> <p>Do not install pipes in shaded area.</p> <p>$L1 = L2$</p>
2	Between a pipe and a flat metal surface.	 <p>Min. 5 mm (0.2 in.)</p>
3	Between a pipe and a metal corner or edge.	 <p>Min. 10 mm (0.4 in.)</p> <p>Min. 10 mm (0.4 in.)</p>
4	Between a grommet and a pipe.	 <p>Min. 5 mm (0.2 in.)</p> <p>Min. 5 mm (0.2 in.)</p>
5	Between pipes and metal structural parts. • Between a pipe and a moving part.	<p>Min. 10 mm (0.4 in.)</p> <ul style="list-style-type: none"> • But min. 30 mm (1.2 in.) clearance from limit of motion of moving part.  <p>30mm (1.2 in.)</p> <p>Limit of motion</p>

No.	Position	Clearances
6	Between a hose and a structural part.	<p>Make sure that clearances of brake and air hoses linked to wheels are at least 50 mm (2.0 in.) during driving.</p> <p>Take account of vibrations(e. g. when steering is at full lock). Clearances for other hoses at the limit of motion must be:</p> <ul style="list-style-type: none"> • at least 10 mm (0.4 in.) from flat surfaces • at least 30 mm (1.2 in.) from corners and edges 
7	<p>Between hoses or pipes and heated parts (exhaust system, etc.).</p> <ul style="list-style-type: none"> • Vacuum pipe • Brake hoses • Hydraulic pipe 	<p>Min. 100 mm (3.9 in.)</p> <p>Min. 200 mm (7.9 in.) at limit of motion. If this is not possible, protect the hose with heat absorbing plates.</p>
8	<p>Between hoses or pipes and electrical parts.</p> <ul style="list-style-type: none"> • Between a pipe and a battery cable. • Between pipes and electric terminals. • Between pipes and harness wires. 	 <p>Min. 20 mm (0.8 in.)</p> <p>Min. 10 mm (0.4 in.) (at limit of motion of cable)</p> <p>Min. 30 mm (1.2 in.)</p> <p>Between parallel pipes/wires at limit of sag : Min. 10 mm (0.4 in.)</p> <p>At crossing points : Min. 20 mm (0.8 in.)</p>

Piping Retention

Pipes must be secured with clips to prevent them from swinging due to the motion of the vehicle.

Use vinyl-coated or rubber-coated clips and follow the rules given in the table below.

No.	Item	Notes
1	<p>Clip spacing</p>  <p>Secure pipes with clips at 300 mm (11.8 in.) intervals.</p>	<p>However, at bends, crossing points, joints, and where pipes and wires, etc. are installed in parallel, and are subject to movement, and where two copper pipes are installed, reduce the spacing of clips to prevent any vibration.</p>
2	<p>Clipping two items with one clip. Never bind two pipes together with tape.</p>  <p>Never clip a pipe with a harness wire or a fuel pipe.</p>	<p>Never clip a pipe and a harness wire together with one clip. Fuel pipes may only be clipped together with copper pipes. Never clip fuel pipes together with vinyl hoses or rubber hoses.</p>
3	<p>Maximum number of pipes clipped together.</p>	<p>A maximum three pipes.</p>

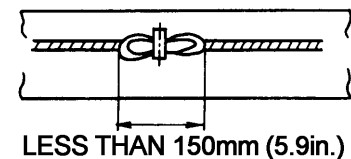
12. ELECTRIC WIRING MODIFICATIONS

Precautions for modifying chassis harness

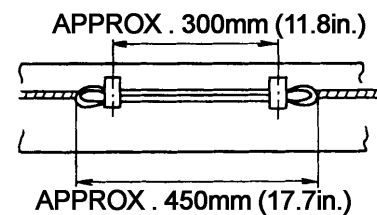
- When fitting the harness wires, refer to the cautions described in Chapter 7.
- Before starting the operation, turn the starter switch to "LOCK" position for modifying chassis harness, wait 10 minutes and remove the connectors of the computer main unit as well as the terminal connectors of the batteries.
- When shortening the harness, do not cut it but bundle the surplus portion of the harness and securely fix it to the frame by means of a clip, etc.
- Never attempt to apply the following modifications to the harness:
 - Extension or of shortening by cutting off the harness.
 - Connection by soldering or caulking.

When the bundled harness wires are not fitted to the original clips, the original clips must be changed to other clips corresponded with the thickness of the bundled harness wires. Under no circumstances wires must be cut and connected at any place.

When the harness wires are bundled at one place.



When the harness wires are bundled at two places.



- The lengthened portion of the wires must be clipped at a 300 mm (11.8 in.) to 400 mm (16 in.) pitch in the same way as for the original vehicle.

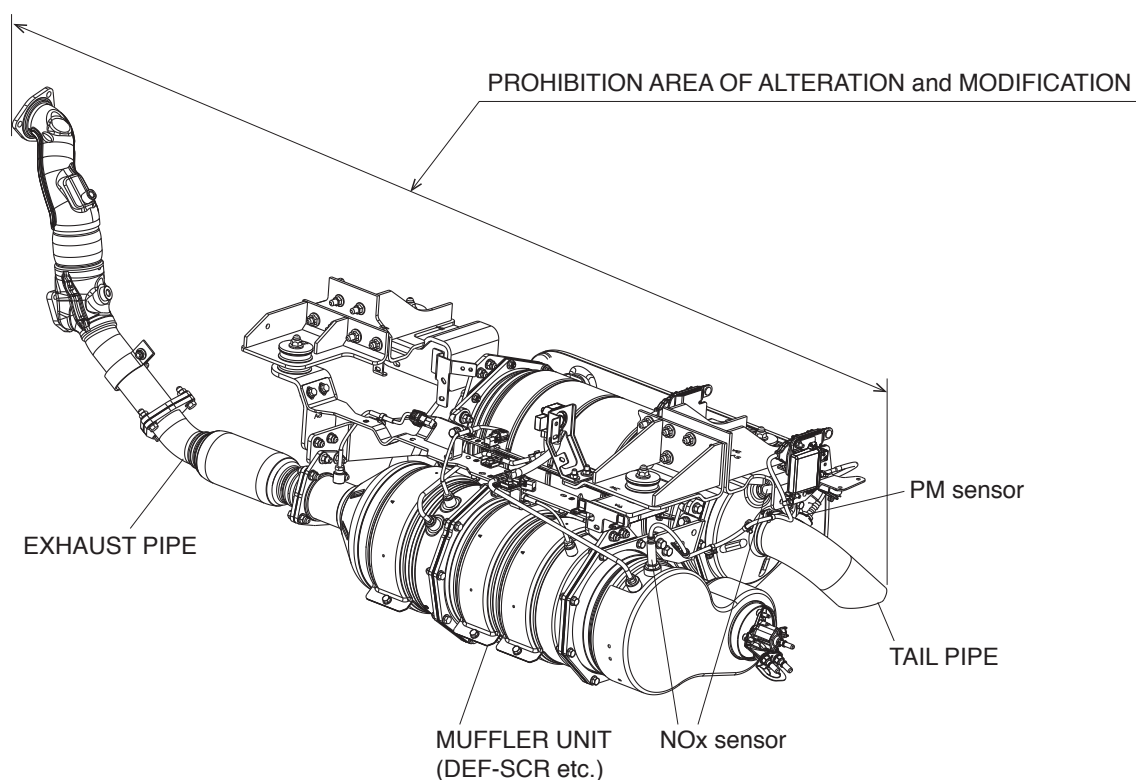
13. ALTERATION OF EXHAUST SYSTEM

ALTERATION OF EXHAUST SYSTEM MAY REQUIRE EMITTED NOISE AND PARTICULATE MATTER FOUND IN EXHAUST GAS TESTING TO DETERMINE COMPLIANCE TO FEDERAL AND/OR LOCAL NOISE EXHAUST GAS STANDARDS.

Since the exhaust pipe is a thermal parts, when other parts of vehicle are mounted above it, follow the instructions given Chapter 4, for preventing a fire hazard.

Any alteration to the exhaust pipe is undesirable, for it will affect the engine performance, exhaust fume density, fire hazard prevention.

Prohibition Area of Alteration and Modification



Modifying the Tail Pipe

Modifying the tail pipe has a major effect on external noise, internal noise and strength of exhaust parts. As a rule, the tail pipe must not be modified.

14. CAUTIONS NEEDED IN ADDITIONAL MACHINING AND ALTERATION OF THE CAB

When the cab floor has been drilled or notched in order to install the P.T.O. control lever and the like, appropriately stiffen around the hole or notch, since the floor is reduced in strength by making holes or notches. Where the lever and the like passes through the floor, use a rubber boot and the like to seal off the gap to shut off a draft and noise.

In case of cab alteration, pay attention to rust prevention.

Considerations are needed not to hamper the accessibility to the heater cover and other parts for service.