

# Chapter 5

## CHASSIS MODIFICATION

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1. GENERAL CAUTIONS
2. CHASSIS FRAME PROPERTIES
3. CHASSIS FRAME DRILLING
4. FLANGE CUTTING
5. CHASSIS FRAME WELDING
6. REAR OVERHANG EXTENSION
7. STIFFENING OF SIDE RAILS
8. WHEELBASE MODIFICATIONS
9. PARKING BRAKE CONTROL CABLE MODIFICATION AND ALTERATION
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

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

Chassis frame modifications (including changes to the wheelbase and 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. CHASSIS FRAME PROPERTIES

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 < Day Cab >

Wheelbase designation		mm (in.)	G 3,861 (152)	J 4,445 (175)	L 4,750 (187)	M 5,207 (205)	N 5,385 (212)	P 5,512 (217)	R 5,969 (235)	S 6,147 (242)	T 6,426 (253)	V 6,883 (271)	Y 7,645 (301)
Model	NE	-	-	-	-	-	-	●	-	-	●	●	-
	NF	-	-	-	-	-	-	-	-	-	-	-	-
	NJ	-	-	-	-	-	-	●	-	-	●	●	-
	NV	-	-	-	-	-	-	-	-	-	-	-	-
	NH	-	-	-	-	-	-	-	-	-	-	-	-
Frame rail material	High tensile SAE J2340 (Grade 550X)												
Thickness	7.8 mm (0.307 in.)												
Minimum yield strength	56.2 kg/mm <sup>2</sup> (80000 PSI)												
Section modulus(one side)	2.133 x 10 x 5 mm <sup>3</sup> (13.02 in. <sup>3</sup> )												
Resisting bending moment (one side)	118.89 x 10 x 5 mm·kg (1031900 in·lbs)												
Width of frame assembly	863.4 mm (34 in.)												

Wheelbase designation		mm (in.)	G 3,861 (152)	J 4,445 (175)	L 4,750 (187)	M 5,207 (205)	N 5,385 (212)	P 5,512 (217)	R 5,969 (235)	S 6,147 (242)	T 6,426 (253)	V 6,883 (271)	Y 7,645 (301)
Model	NE	-	-	-	-	-	-	-	-	-	-	-	-
	NF	-	-	-	-	-	-	●	-	-	●	●	-
	NJ	-	-	-	-	-	-	-	-	-	-	-	-
	NV	-	-	-	-	-	-	●	-	-	●	●	-
	NH	-	-	-	-	-	-	-	-	-	-	-	-
Frame rail material	High tensile SAE J2340 (Grade 550X)												
Thickness	9.5 mm (0.374 in.)												
Minimum yield strength	56.2 kg/mm <sup>2</sup> (80000 PSI)												
Section modulus(one side)	2.64 x 10 x 5 mm <sup>3</sup> (16.11 in. <sup>3</sup> )												
Resisting bending moment (one side)	147.56 x 10 x 5 mm·kg (1280800 in·lbs)												
Width of frame assembly	866.8 mm (34.1 in.)												

Wheelbase designation		mm (in.)	G 3,861 (152)	J 4,445 (175)	L 4,750 (187)	M 5,207 (205)	N 5,385 (212)	P 5,512 (217)	R 5,969 (235)	S 6,147 (242)	T 6,426 (253)	V 6,883 (271)	Y 7,645 (301)
Model	NE	-	-	-	-	-	-	-	-	-	-	-	-
	NF	-	-	-	-	-	-	-	-	-	-	-	-
	NJ	-	-	-	-	-	-	-	-	-	-	-	-
	NV	-	-	-	-	-	-	●	-	-	●	●	-
	NH	-	-	-	-	-	-	●	-	-	●	●	-
Frame rail material	Hot Rolled High Manganese Boron Steel												
Thickness	9.5 mm (0.374 in.)												
Minimum yield strength	87.8 kg/mm <sup>2</sup> (120000 PSI)												
Section modulus(one side)	2.64 x 10 x 5 mm <sup>3</sup> (16.11 in. <sup>3</sup> )												
Resisting bending moment (one side)	231.79 mm·kg (1933200 in·lbs)												
Width of frame assembly	866.8 mm (34.1 in.)												

### 3. 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.

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

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

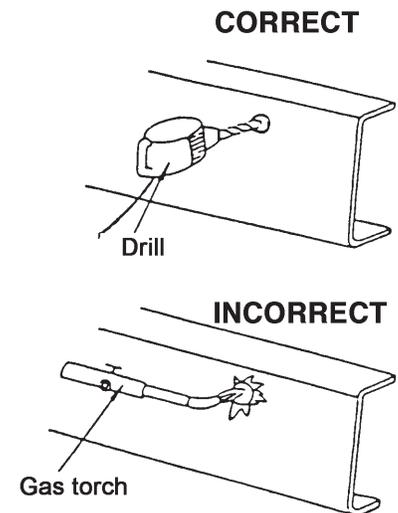
Drilling holes through the side rail changing the exterior shape, or changing the section modulus such as the inner stiffener is fitted, must be strictly avoided.

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.

When drilling holes, brake hoses or nylon tubes, 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.

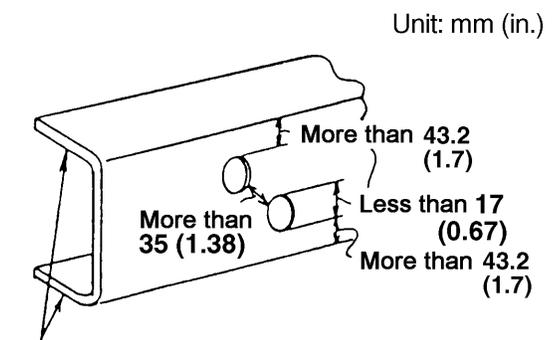


To avoid increasing the temperature of a drill, use an appropriate drill having a tip angle to suit the material drilled.

The diameter of the hole in a side rail must be less than 17 mm (0.67 in.). Hole diameters must not exceed bolt diameters by more than 1 mm (0.039 in.).

When drilling holes through the web, they should be more than 43.2 mm (1.7 in.) away from the upper or lower edge of the web. Distance between holes should be more than 35 mm (1.38 in.).

Holes should be deburred after drilling.



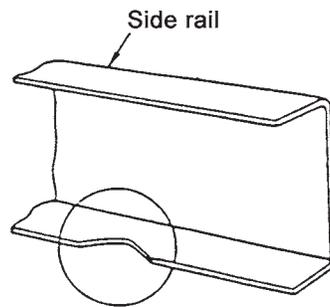
**CAUTION**  
Do not drill the upper or lower flanges.

## 4. FLANGE CUTTING

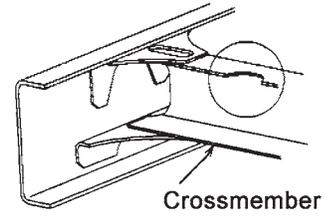
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Never cut off the side rail flange and crossmember for the reasons of a body mounting.

**INCORRECT**



**INCORRECT**



## 5. CHASSIS FRAME WELDING

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### General Warning

Welding the chassis frame greatly affects its strength, and if such operations are executed improperly, the chassis frame 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 chassis 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 Precautions.

## Welding Conditions

Consult the table below for welding conditions.

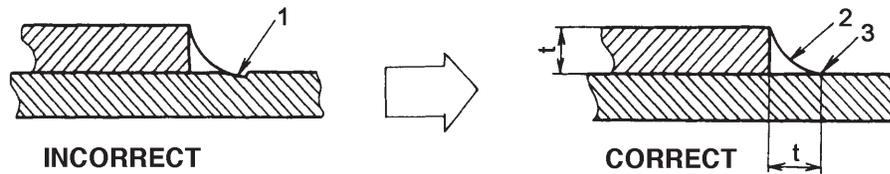
### WELDING CONDITIONS

		Electric current (Unit: A)					
Rod dia. $\phi$		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, 621 MPa {63 kgf/mm <sup>2</sup> , 89.605 lbf/in. <sup>2</sup> } Welding Rod Tensile strength: 539 MPa {55 kgf/mm <sup>2</sup> , 78.228 lbf/in. <sup>2</sup> } Illuminate type (JIS D8016 AWS E8018) Coated electrode	100 - 150	90 - 140	140 - 200	130 - 180	190 - 270	—
	Weld Metal (Hot roll plate) Tensile strength, 538 MPa {55 kgf/mm <sup>2</sup> , 78.228 lbf/in. <sup>2</sup> } Welding Rod Tensile strength: 490 MPa {50 kgf/mm <sup>2</sup> , 71.116 lbf/in. <sup>2</sup> } Illuminate type (JIS D4301 AWS E6019) 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 illustrated below.



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

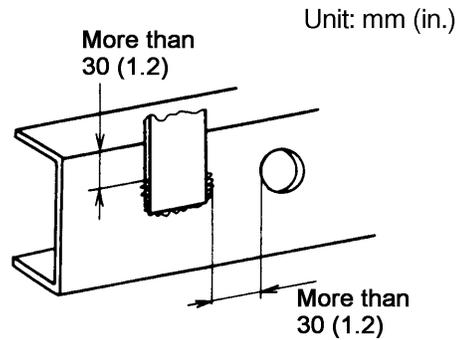
Avoid the following defects in welding beads:

<p>Deposited Metal Cracking</p>	<p>Toe Crack</p>	<p>Blow Hole</p>
<p>Slag Inclusion</p>	<p>Under cut</p>	<p>Poor Penetration</p>

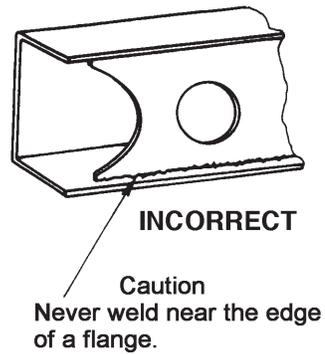
In order to reduce the stress caused by welding, the welding length should be as short as possible and the welding volume should be kept at a required minimum to secure the strength. Avoid concentration or proximity of welding joints as far as possible. Don't carry out the welding work on edges or bent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

## 6. REAR OVERHANG EXTENSION

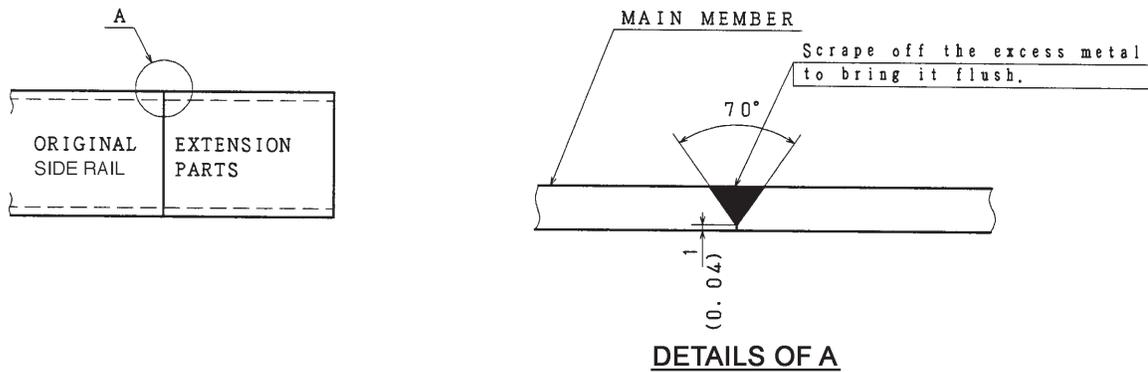
Rear overhang extension should be minimized since extension can reduce the service life of the vehicle and impair its safety.

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

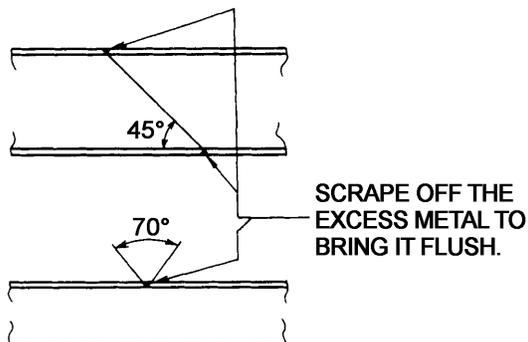
The extension rail should be aligned with the original side rail.

- Rear overhang extension  
(less than 200 mm (7.9 in.))

Unit : mm (in.)



- Rear overhang extension  
(more than 200 mm (7.9 in.))



## 7. STIFFENING OF SIDE RAILS

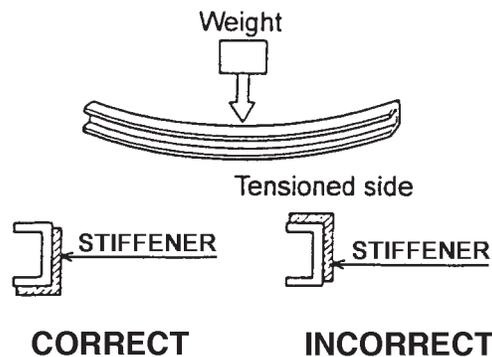
(WHEN STIFFENING OF SIDE RAILS EXCEPT ALTERATIONS OF THE WHEELBASE OR THE REAR OVERHANG)

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.

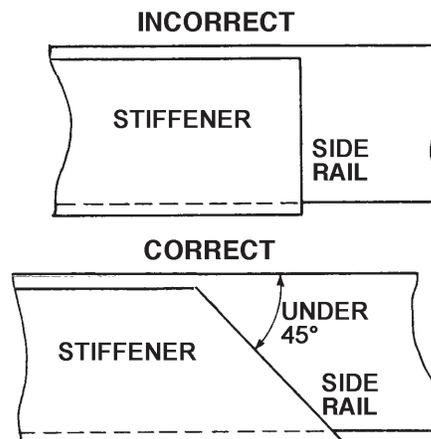
As □-shaped steel stiffener could not be strictly fitted to the main rail of side rail due to difficulty of machining accuracy, L-shaped stiffener is recommended.

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.

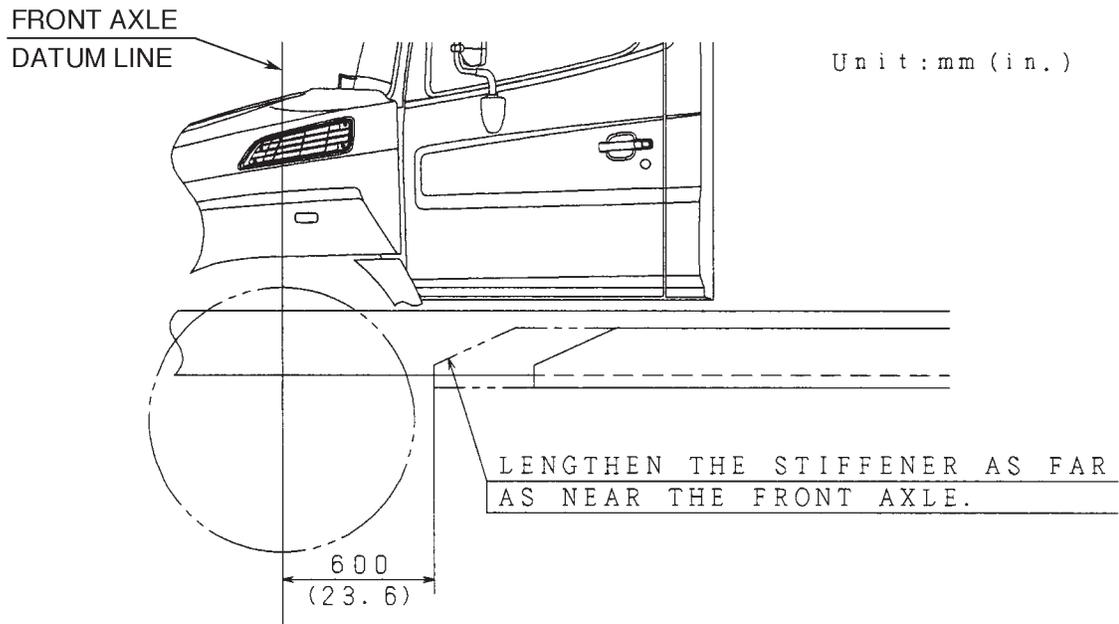
Do not cut off a stiffener at a sharp angle.  
It should be cut so that its end has an angle Max. 45° or less.



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 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.



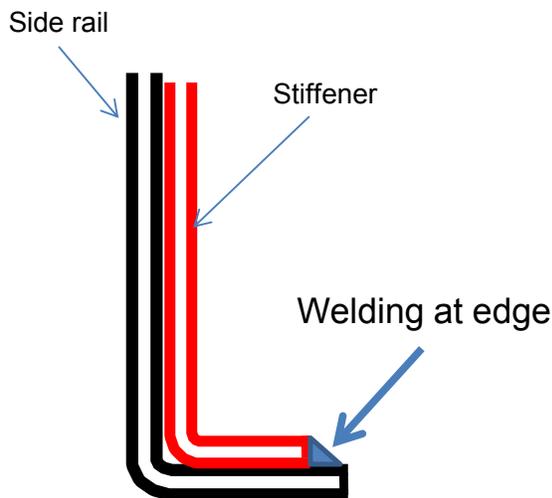
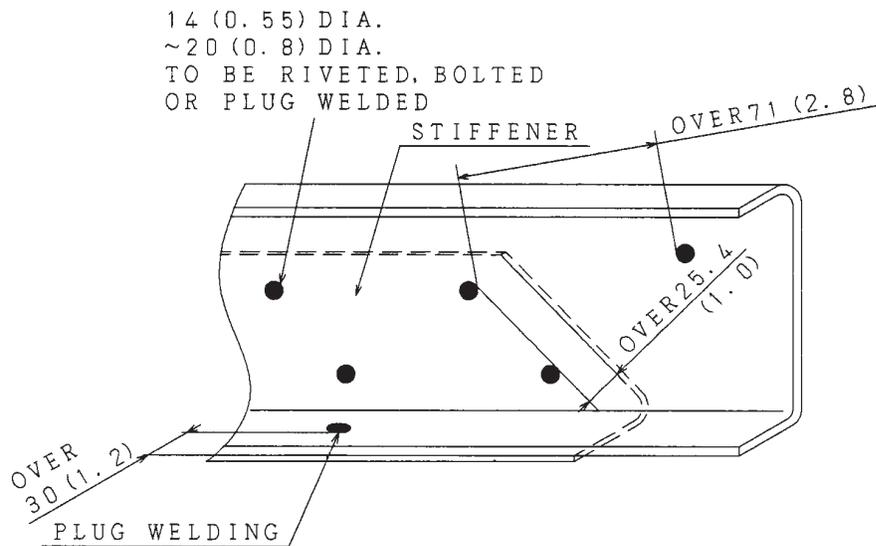
### How to fix stiffener to side rail

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.

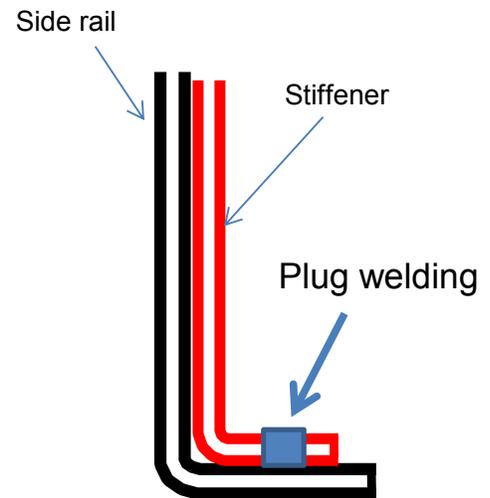
As a rule the plug welding method should be used in this case.

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

## 8. WHEELBASE MODIFICATIONS

### General cautions

Hino vehicles are equipped with an Anti-lock Brake System (hereinafter termed as ABS), strict adherence of the instructions given in paragraph “Electric Wiring Modification”, if modification of the ABS harness is required as a result of changing the wheelbase. Never modify or relocate equipment connected to the ABS, other than the harness.

All model when lengthening or shortening the wheelbase, that modification should be made between the maximum and minimum values in the wheelbase range established by Hino as shown in next page.

Wheelbase must not be modified exceeding the wheelbase range established by Hino since that would reduce the service life and impair the safety of the vehicle.

Wheelbase modifications are accompanied by corresponding modifications of side rails (including the detachment and addition of cross-members), propeller shafts, service brake lines, electrical lines, and so reference should be made to the respective sections of this book concerned.

Wheelbase modification by removing the rear axle and the rear suspension (without cutting side rails) should not be acceptable in all models.

When using bolts and nuts, tighten nuts to the specified tightening torque.

Unit : kg·cm (lb·ft)

Bolt dia.	Tightening torque
M12	910 - 1,490 (66 - 108)
M16	2,490 - 3,070 (180 - 222)

Any incomplete vehicle which has been modified to wheelbase, shall be conform to CMVSS 105 for hydraulic brake or CMVSS 121 for air brake system.

**WHEELBASE MODIFICATIONS**

< Day Cab >

Unit : mm (in.)

ORIGINAL VEHICLE		DESIRED WHEELBASE BY USER									
		WHEN CUTTING SIDE RAILS BETWEEN THE WHEELBASE									
MODEL	WHEELBASE	3861(152) G	4445(175) J	4750(187) L	5207(205) M	5385(212) N	5512(217) P	5969(235) R	6426(253) T	6883(271) V	7645(301) Y
NE/NJ/NV/NH	3861(152) G		*1*2 YES	NO	*1*2 YES	NO	*1*2 YES	NO	NO	NO	NO
NE/NF/NJ/NV/NH	4445(175) J	*1*2 YES		NO	*1*2 YES	*1 YES	*1*2 YES	NO	NO	NO	NO
NE/NF/NJ/NV/NH	4750(187) L	NO	NO		NO	NO	NO	*1*2 YES	*1*2 YES	*1*2 YES	*1*2 YES
NE/NF/NJ/NV/NH	5207(205) M	*1*2 YES	*1*2 YES	NO		*1 YES	*1*2 YES	NO	NO	NO	NO
NE/NJ	5385(212) N	NO	*1 YES	NO	*1 YES		*1 YES	NO	NO	NO	NO
NE/NF/NJ/NV/NH	5512(217) P	*1*2 YES	*1*2 YES	NO	*1*2 YES	*1 YES		NO	NO	NO	NO
NE/NF/NJ/NV/NH	5969(235) R	NO	NO	*1*2 YES	NO	NO	NO		*1*2 YES	*1*2 YES	*1*2 YES
NE/NF/NJ/NV/NH	6426(253) T	NO	NO	*1*2 YES	NO	NO	NO	*1*2 YES		*1*2 YES	*1*2 YES
NE/NF/NJ/NV/NH	6883(271) V	NO	NO	*1*2 YES	NO	NO	NO	*1*2 YES	*1*2 YES		*1*2 YES
NE/NF/NJ/NV	7645(301) Y	NO	NO	*1*2 YES	NO	NO	NO	NO	*1*2 YES	*1*2 YES	

(Marked\*1 : Only possible the SIDE RAIL thickness is equal.)

(Marked\*2 : Except 120kpsi SIDE RAIL series.)

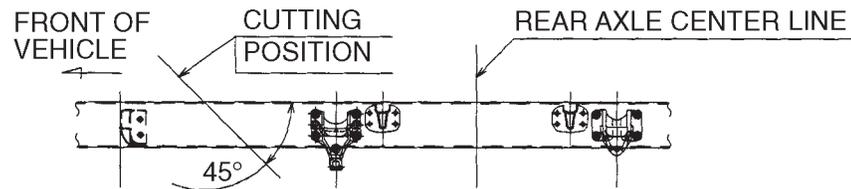
## Wheelbase Modification by Cutting of Side Rails

When cutting the side rails within the wheelbase with the rear axle and the rear suspension in their original position.

The crossmembers and their positions subsequent to the wheelbase change must correspond to those of a standard Hino vehicle with the same wheelbase as the new wheelbase. For details, refer to “Drawings of Side Rail Exterior Configurations” and “Drawing of Cross-member”.

When lengthening the wheelbase, cut the side rails at a 45-degree angle away behind the No.4 crossmember. Insert the extension rail between the cut ends and weld it after aligning all surfaces with the original side rail. (This figure shows an example of the NE, NJ, NF, NV & NH series except rear air suspension model)

### POSITION OF SIDE RAIL CUTTING



When shortening the wheelbase, cut the side rail at two places at 45-degree angle behind the No.4 crossmember. After cutting the side rails, weld together the cut ends after aligning all surfaces.

After the side rails have been welded in accordance with steps described the chassis frame welding section of this chapter, the welded areas must be sufficiently reinforced by welding and cold riveting or bolting stiffeners.

The reinforcing material should be bent to an angle of 90 degrees and the thickness of material is as following figure.

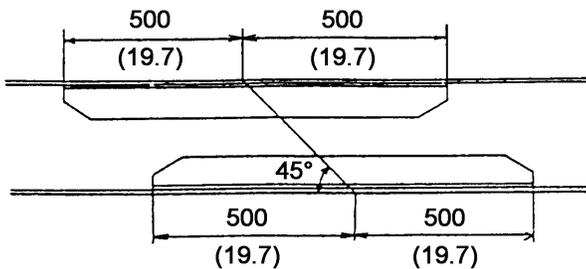
The bending radius should be 12 mm (0.47 in.) on the inside.

If this reinforcement is neglected, it will reduce the service life of the vehicle and impair its safety.

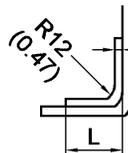
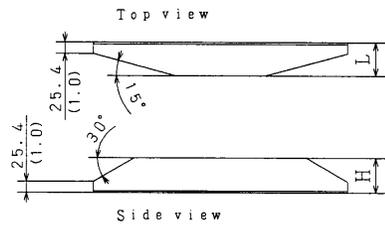
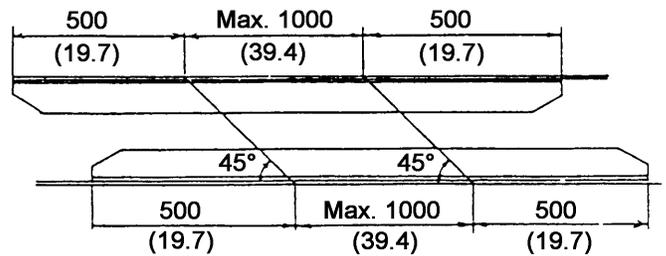
Unit: mm (in.)

Configuration of Reinforcing Material

- Wheelbase extension: more than 1000 mm (39.4 in.)



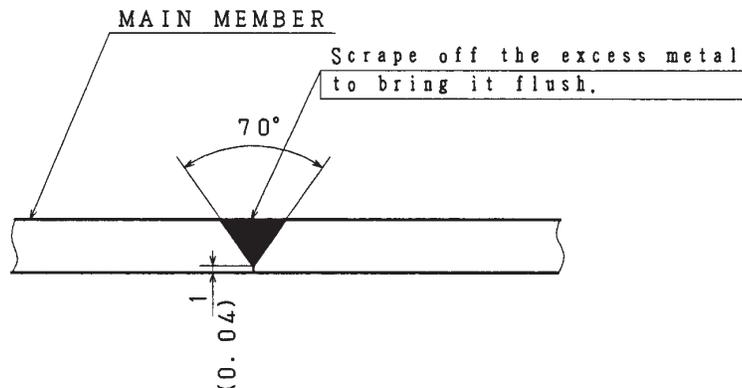
- Wheelbase extension: less than 1000 mm (39.4 in.)



6 (0.24) (NE except NE G, NJ except NJ G)  
7 (0.28) (NE G, NJ G, NF, NV, NH)

MODEL	H	L
ALL	105 (4.1)	52 (2.0)

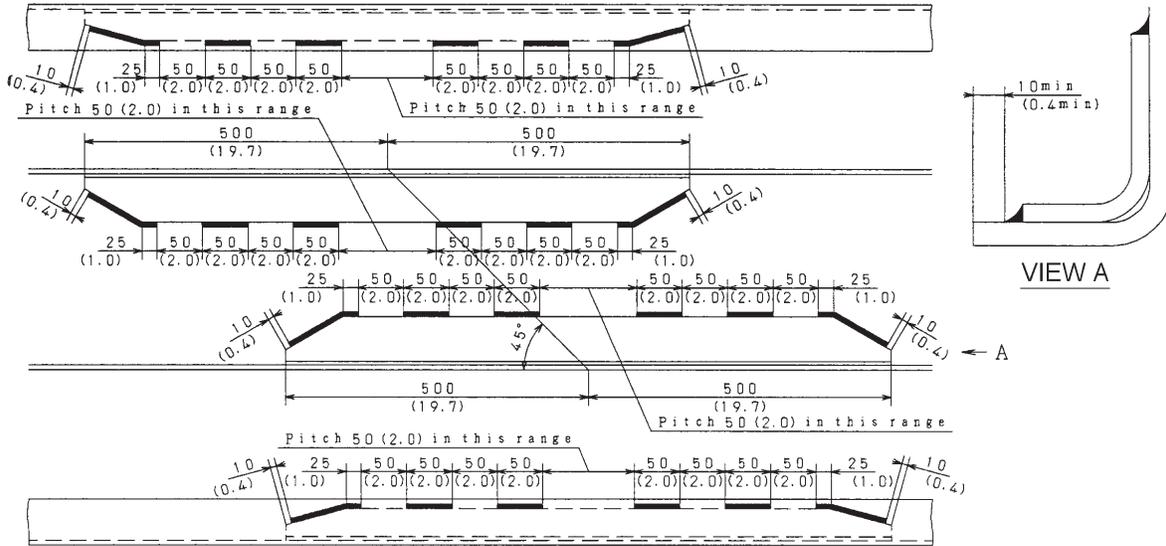
Detail of Groove



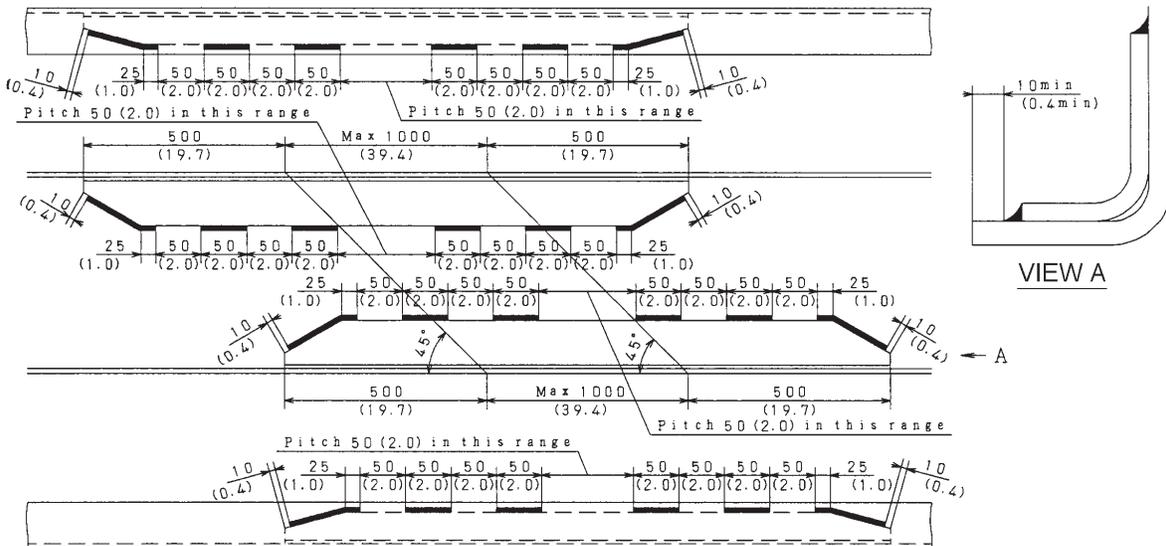
Welding Procedures

- Wheelbase extension more than 1000 mm (39.4 in.).

Unit: mm (in.)



- Wheelbase extension less than 1000 mm (39.4 in.).

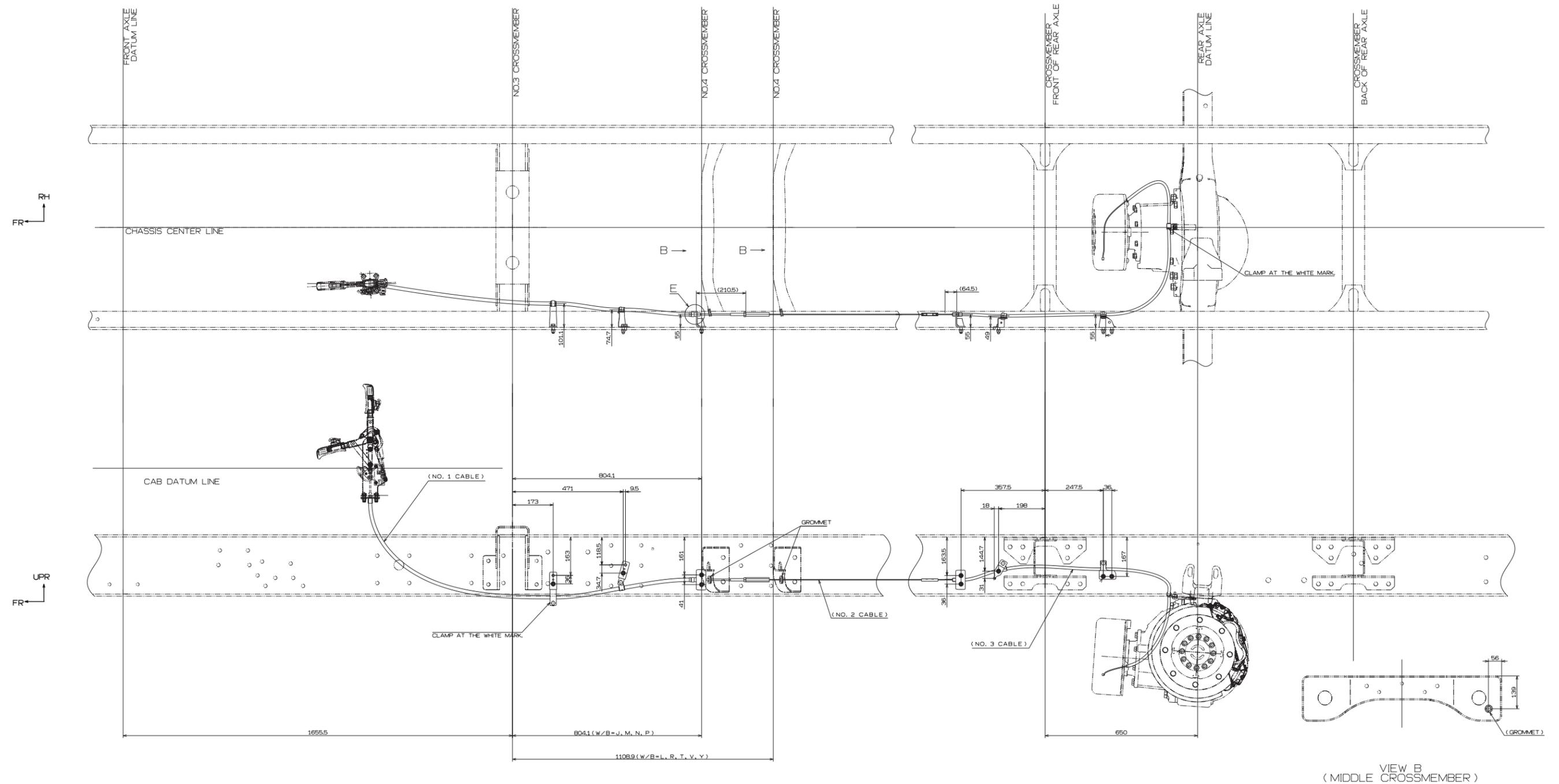


### 9. PARKING BRAKE CONTROL CABLE MODIFICATION AND ALTERATION

The parking brake of NE, NF is installed in the rear axle.  
 The parking brake operates with a cable, and the cable is divided into three parts.  
 (See the following figure.)  
 The length of the No.1 cable is set up suit each cab type set up now.  
 The length of the No.2 cable is set up suit each wheelbase set up now.  
 The length of the No.3 cable are common to all the wheelbase.

Unit : mm (in.)

< Day Cab >



## LIST OF COMPONENT PARTS

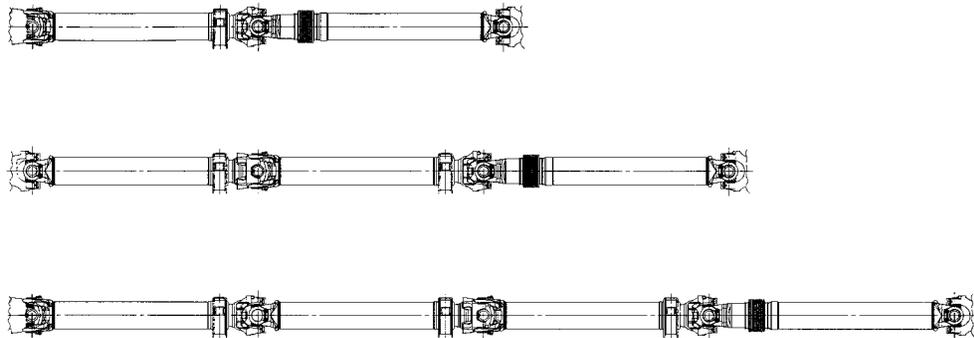
CAB TYPE	WHEELBASE DIMENSION Unit : mm (in.)	GROMMET	
		X	NO.2 CABLE PART NUMBER
		SN521-01804	
Day	G 3861(152)	1	-
	J 4445(175)	1	46420-E0860
	L 4750(187)	1	46420-E0870
	M 5207(205)	2	46420-E0880
	N 5385(212)	2	46420-E0890
	P 5512(217)	2	46420-E0A10
	R 5969(235)	<b>2</b>	46420-E0A20
	T 6426(253)	<b>2</b>	46420-E0A30
	V 6883(271)	3	46420-E0A40
	<b>Y 7645(301)</b>	<b>3</b>	<b>46420-EW050</b>

## 10. PROPELLER SHAFT MODIFICATION AND ALTERATION

Alteration of propeller shafts is not recommended.  
If such alteration is required follow the instructions below.

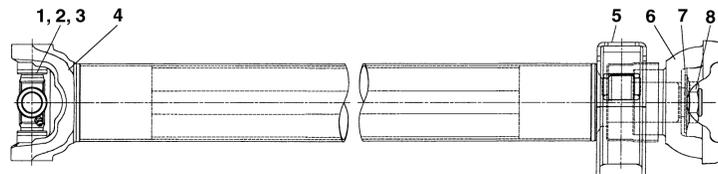
### Driveline Design Criteria

Typical installation showing yokes “In phase”. “In phase” means that the yokes at either end of a given propeller shaft assembly are in the same plane.

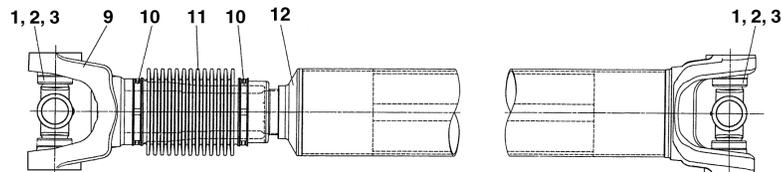


### Description of Propeller Shaft

FRONT FOR Eaton FS SERIES MANUAL TRANSMISSION  
ALLISON 2200RDS/2500RDS AND 3000RDS/3500RDS SERIES AUTOMATIC TRANSMISSION



REAR



1	Bearing assembly	7	Washer
2	Cross assembly	8	Nut
3	Snap ring / Spring and Bolt	9	Slip yoke assembly
4	Tube yoke	10	Clamp
5	Center bearing assembly	11	Boot
6	End yoke	12	Tube shaft assembly

## Cautions Dismounting and Mounting of Propeller Shafts

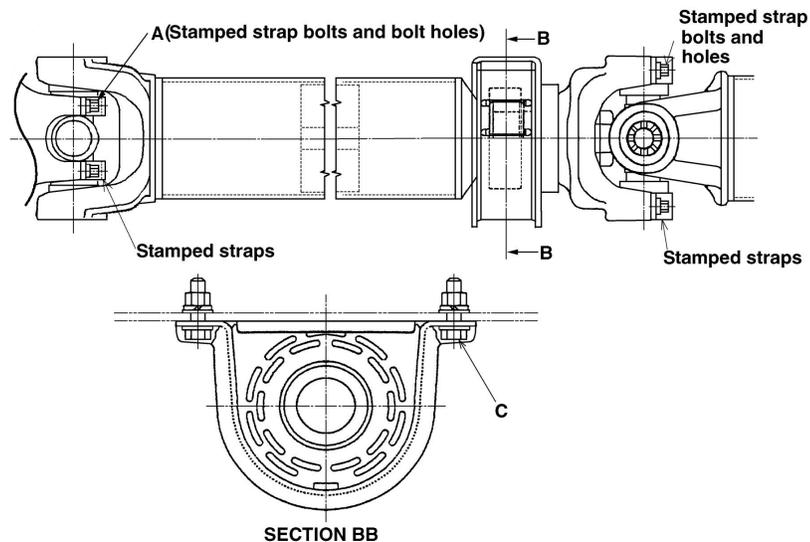
The following cautions should be strictly followed when dismounting and mounting the Propeller Shafts.

- Never allow grease and oil to adhere to stamped straps, stamped strap bolts and bolt holes.
- Do not reuse stamped straps and stamped straps bolts.
- Do not disassemble the universal joint assembly.
- Do not disassemble the yoke shaft and slip yoke assembly including boot of the rear propeller shaft.
- Do not disassemble the center bearing assembly.
- Should more detailed data or information be needed, please contact HMC or Hino authorized dealer.

## Component Location of each Propeller Shaft series

### Propeller Shaft series : SPL100

FOR Eaton FS5406 MANUAL TRANSMISSION  
AND ALLISON 2200RDS/2200HS/2500RDS/2500HS AUTOMATIC TRANSMISSION

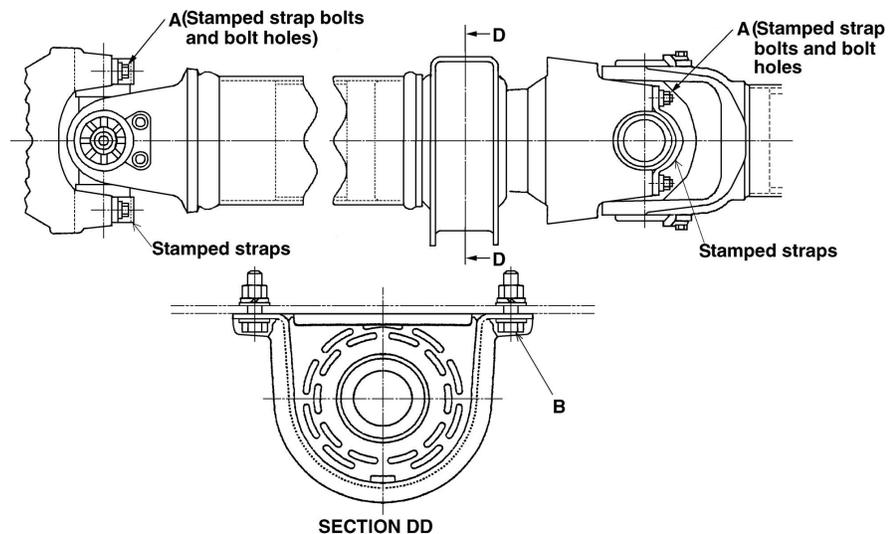


Tightening torque		Unit: N·m {kgf·cm, lbf·ft}	
A	61-81 {625-825, 45-60}	C	128-156 {1300-1600, 95-115}

**⚠ WARNING**  
Never allow grease and oil to adhere to stamped straps, stamped strap bolts and bolt holes. The grease and/or oil which adheres to the stamped retainer bolts, stamped straps, stamped strap bolts, damaged bearing retainers or use of inferior grade bolts can cause driveline failure, which can result in separation of driveline from the vehicle. A separated driveline can result in property damage, serious personal injury or death.

### Propeller Shaft series : SPL140

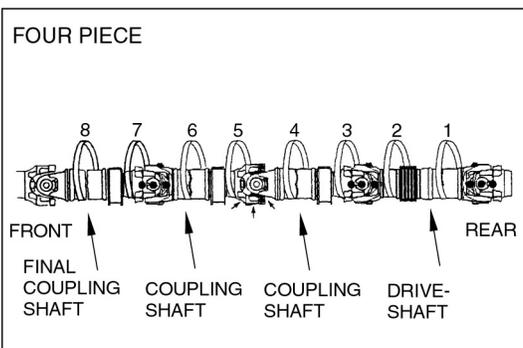
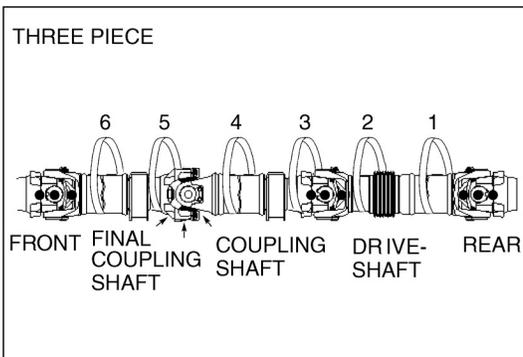
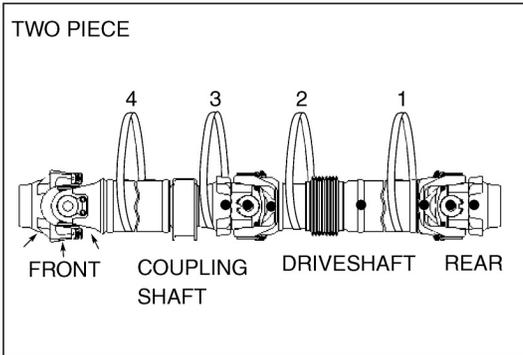
FOR Eaton FS6406 MANUAL TRANSMISSION  
AND ALLISON 2500RDS/2500HS/3000RDS/3500RDS AUTOMATIC TRANSMISSION



Tightening torque		Unit: N·m {kgf·cm, lbf·ft}	
A	143-169 {1457-1723, 105-125}	B	128-156 {1300-1600, 95-115}

**⚠ WARNING**  
Never allow grease and oil to adhere to stamped straps, stamped strap bolts and bolt holes. The grease and/or oil which adheres to the stamped retainer bolts, stamped straps, stamped strap bolts, damaged bearing retainers or use of inferior grade bolts can cause driveline failure, which can result in separation of driveline from the vehicle. A separated driveline can result in property damage, serious personal injury or death.

### Procedure Dismounting Propeller Shafts



**DISCONNECT THE PROPELLER SHAFT FROM ALL OF THE CONNECTING POINTS.**

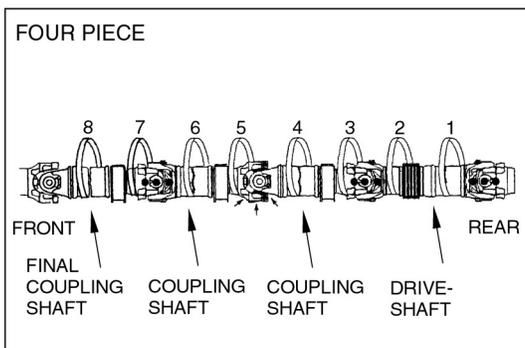
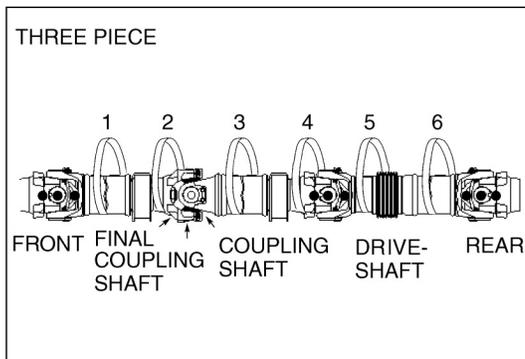
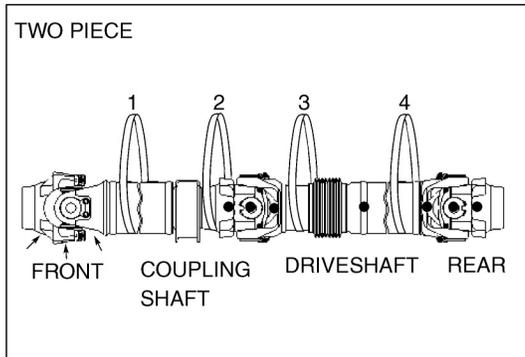
- Park the vehicle on level ground, apply the parking brake and apply wheel chocks at the front or rear tires.
- Make aligning marks on all bearing positions, spline positions, shaft locations and all bearing retainers.
- Working from the rear end, support the propeller shaft with support straps as illustrated in Figure. Be sure to support the shaft assembly at the rear, at the slip member, behind the center bearing end fitting and in front of center bearing, with support straps.

- Remove the bearing retainers or stamped straps and bolts at rear end. Discard bolts. Discard stamped straps (if applicable).

**⚠ WARNING**

- **Bearing retainers CAN be reused if there is no damage. If damaged, replace.**
- **DO NOT reuse bearing retainer bolts, stamped straps, stamped strap bolts, damaged bearing retainers, or use of inferior grade bolts. Reuse of bearing retainer bolts, stamped straps, stamped strap bolts, damaged bearing retainers or the use of inferior grade bolts can cause driveline failure, which can result in separation of driveline from the vehicle. A separated driveline can result in property damage, serious personal injury or death.**

### Procedure Mounting Propeller Shafts



#### CONNECT THE PROPELLER SHAFT TO ALL OF THE CONNECTING POINTS.

- Position support straps to make sure that the driveshaft will be properly supported at the slip member, behind the center bearing end fittings and in front of center bearing, with support straps.
- Working from the front end, use a soft-faced hammer to tap the universal joint into the front end yoke. Make sure to align the universal joint in the front end yoke, matching up phasing marks made during removal to ensure the driveshaft is reinstalled in its original orientation.
- Install the bearing retainers or new stamped straps and new bolts. Torque the bolts down evenly and to required specifications. Check to make sure the bearing cup assemblies are fully seated in yoke ears.

**⚠ WARNING**

Improperly seated bearing cup assemblies can cause driveline failure, which can result in separation of the driveline from the vehicle. A separated driveline could result in property damage, serious personal injury or death.

**⚠ WARNING**

Failure to install new stamped straps and new bolts and to torque bolts to specification can cause driveline failure, which can result in separation of the driveline from the vehicle. A separated driveline can result in death, serious personal injury or property damage.

BOLT SPECIFICATIONS				
SERIES	THREAD SIZE	HEAD SIZE	BOLT TORQUE	
			N.m	LB.FT.
SPL100	0.375in x24UNF	3/8in. 12point	61 - 81	45 - 60
SPL140	12mm x 1.25	1/2in. 12point	143 - 169	105 - 125

- Install proper center bearing bracket bolts.

**⚠ WARNING**

Failure to torque bolts to specification can cause driveline failure, which can result in separation of the driveline from the vehicle. A separated driveline can result in property damage, serious personal injury or death.

## Cautions for Modification and Alteration of Propeller Shafts

The length, the tube outside diameter, the tube thickness, and the material of propeller shafts for each model are shown in “Detail of Propeller Shafts”. When modifying or altering propeller shafts, refer to the table in the above mentioned section.

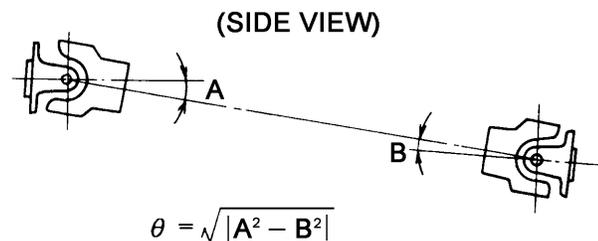
As the maximum length of propeller shafts is shown in “Maximum Length of Propeller Shafts”, adhere strictly to the maximum length. If a propeller shaft exceeds the upper limit (maximum length), add more propeller shafts and also more center bearing supports. When installing a center bearing, observe the allowable tolerance described in the “Allowable Tolerance Between the Center Line of a Center Bearing and of Center Bearing Holder” and also refer to the “Installing of Center Bearing Bracket”.

Before mounting the propeller shaft, be sure to balance it to the following specifications in the table below. These limits are per one end of the propeller shaft. Make certain that both ends of the propeller shafts are balanced.

LIMIT OF UNBALANCE				Unit : g-cm (in-oz)	
SHAFT SERIES	SPL100 (FRONT)	SPL100 (REAR)	SPL140 (FRONT)	SPL140 (REAR)	
TEST RPM	2500	2500	2500	2500	
MAX. LIMIT	CENTER BEARING 72 (1.00)	144 (2.00)	CENTER BEARING 72 (1.00)	200 (2.78)	
	TUBE YOKE 144 (2.00)		TUBE YOKE 205 (2.85)		

Align the yoke phase at both ends of the shaft.

U-joint setting angles shown as  $\theta$  in the equation below should be less than  $3^\circ$  as shown in below. In case of the center bearing is fitted to the vehicle, may set the center bearing to any position which is free from the vibration of propeller shaft.

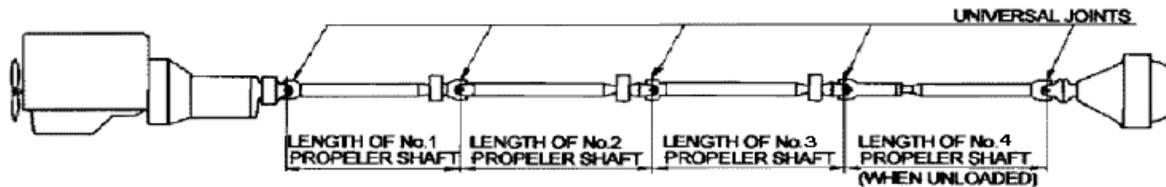


## Detail of Propeller Shafts

(The length of No.2, No.3 and No.4 propeller shafts is that when unloaded.)

Explanation of propeller shaft length

(This drawing shows when 4-piece propeller shafts are used.)



### • Rear Leaf Suspension

Unit : mm (in.)

Model	Cab	W/B	Suspension	P/S	Tube outside diameter	Tube thickness	Material	No.1	No.2	No.3	No.4	R/A	T/M	
NE	DAY	5512 (217)	LEAF19K	SPL100	101.6 (4.00)	2.41 (0.095)	SAE1017	1255 (49.4)	1070 (42.1)	-	-	1376 (55.2)	MS17/19/21 -14X	ALLISON 2200HS/RDS 2500HS/RDS
	DAY	6426 (253)	LEAF19K	SPL100	101.6 (4.00)	2.41 (0.095)	SAE1017	1560 (61.4)	1680 (66.1)	-	-	1376 (55.2)		
	DAY	6883 (271)	LEAF19K	SPL100	101.6 (4.00)	2.41 (0.095)	SAE1017	1560 (61.4)	765 (30.1)	1375 (54.1)	1376 (55.2)			
NF	DAY	5512 (217)	LEAF21K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1292 (50.9)	1071 (42.2)	-	-	1340 (53.6)	MS17/19/21	ALLISON
NF	DAY	6883 (271)	LEAF21K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1597 (62.9)	762 (30)	1372 (54)	1340 (53.6)	MS17/19/21	2500HS/RDS	

• Rear Air Suspension

Unit : mm (in.)

Model	Cab	W/B	Suspension	P/S	Tube outside diameter	Tube thickness	Material	No.1	No.2	No.3	No.4	R/A	T/M	
NE	DAY	5512 (217)	AIR19K/21K	SPL100	101.6 (4.00)	2.41 (0.095)	SAE1017	1255 (49.4)	1070 (42.1)	-	1376 (55.2)	MS17/19/21	ALLISON 2200HS/RDS 2500HS/RDS	
NE	DAY	6426 (253)	AIR19K/21K	SPL100	101.6 (4.00)	2.41 (0.095)	SAE1017	1560 (61.4)	1680 (66.1)	-	1376 (55.2)	MS17/19/21		
NE	DAY	6883 (271)	AIR19K/21K	SPL100	101.6 (4.00)	2.41 (0.095)	SAE1017	1560 (61.4)	765 (30.1)	1375 (54.1)	1376 (55.2)	MS17/19/21		
NJ	DAY	5512 (217)	AIR19K/21K	SPL100	101.6 (4.00)	2.41 (0.095)	SAE1017	1255 (49.4)	943 (37.1)	-	1496 (58.9)	MS17/19/21-14X		
NJ	DAY	6426 (253)	AIR19K/21K	SPL100	101.6 (4.00)	2.41 (0.095)	SAE1017	1499 (59)	1679 (66.1)	-	1526 (60.1)	MS17/19/21-14X		
NJ	DAY	6883 (271)	AIR19K/21K	SPL100	101.6 (4.00)	2.41 (0.095)	SAE1017	1560 (61.4)	765 (30.1)	1375 (54.1)	1496 (58.9)	MS17/19/21-14X		
NJ	DAY	5512 (217)	AIR19K/21K	SPL100	101.6 (4.00)	2.41 (0.095)	SAE1017	1255 (49.4)	1070 (42.1)	-	1461 (57.5)	MS17/19/21-13X		
NJ	DAY	6426 (253)	AIR19K/21K	SPL100	101.6 (4.00)	2.41 (0.095)	SAE1017	1560 (61.4)	1680 (66.1)	-	1461 (57.5)	MS17/19/21-13X		
NJ	DAY	6883 (271)	AIR19K/21K	SPL100	101.6 (4.00)	2.41 (0.095)	SAE1017	1560 (61.4)	765 (30.1)	1375 (54.1)	1461 (57.5)	MS17/19/21-13X		
NE	DAY	5512 (217)	AIR19K/21K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1292 (50.9)	1071 (42.2)	-	1340 (53.6)	MS17/19/21		ALLISON 2200HS/RDS 2500HS/RDS
NJ	DAY	5512 (217)	AIR19K/21K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1292 (50.9)	1071 (42.2)	-	1425 (56.1)	MS17/19/21-14X		
NJ	DAY	5512 (217)	AIR19K/21K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1292 (50.9)	1071 (42.2)	-	1397 (55)	MS17/19/21-13X		ALLISON 2500HS/RDS
NF	DAY	5512 (217)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1292 (50.9)	1071 (42.2)	-	1340 (53.6)	MS17/19/21		
NF	DAY	6426 (253)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1597 (62.9)	1677 (66)	-	1340 (53.6)	MS17/19/21		
NF	DAY	6883 (271)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1597 (62.9)	762 (30)	1372 (54)	1340 (53.6)	MS17/19/21		
NV	DAY	5512 (217)	AIR19K/21K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1292 (50.9)	1071 (42.2)	-	1425 (56.1)	MS17/19/21		
NV	DAY	5512 (217)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1292 (50.9)	1071 (42.2)	-	1425 (56.1)	MS17/19/21		
NV	DAY	5512 (217)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1292 (50.9)	1071 (42.2)	-	1375 (54.1)	RS23/25		
NV	DAY	5512 (217)	AIR23K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1292 (50.9)	1071 (42.2)	-	1375 (54.1)	RS23/25		
NV	DAY	6426 (253)	AIR19K/21K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1597 (62.9)	1677 (66)	-	1425 (56.1)	MS17/19/21		
NV	DAY	6426 (253)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1597 (62.9)	1677 (66)	-	1425 (56.1)	MS17/19/21		
NV	DAY	6426 (253)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1597 (62.9)	1677 (66)	-	1375 (54.1)	RS23/25		
NV	DAY	6426 (253)	AIR23K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1597 (62.9)	1677 (66)	-	1375 (54.1)	RS23/25		
NV	DAY	6883 (271)	AIR19K/21K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1597 (62.9)	762 (30)	1372 (54)	1425 (56.1)	MS17/19/21	ALLISON 3000HS	
NV	DAY	6883 (271)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1597 (62.9)	762 (30)	1372 (54)	1425 (56.1)	MS17/19/21		
NV	DAY	6883 (271)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1597 (62.9)	762 (30)	1372 (54)	1375 (54.1)	RS23/25		
NV	DAY	6883 (271)	AIR23K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1597 (62.9)	762 (30)	1372 (54)	1375 (54.1)	RS23/25		
NV	DAY	5512 (217)	AIR19K/21K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1282 (48.5)	1071 (42.2)	-	1425 (56.1)	MS17/19/21		
NV	DAY	5512 (217)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1282 (48.5)	1071 (42.2)	-	1425 (56.1)	MS17/19/21		
NV	DAY	5512 (217)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1282 (48.5)	1071 (42.2)	-	1375 (54.1)	RS23/25		
NV	DAY	5512 (217)	AIR23K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1282 (48.5)	1071 (42.2)	-	1375 (54.1)	RS23/25		
NV	DAY	6426 (253)	AIR19K/21K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1587 (62.5)	1677 (66)	-	1425 (56.1)	MS17/19/21		
NV	DAY	6426 (253)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1587 (62.5)	1677 (66)	-	1425 (56.1)	MS17/19/21		
NV	DAY	6426 (253)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1587 (62.5)	1677 (66)	-	1375 (54.1)	RS23/25		
NV	DAY	6426 (253)	AIR23K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1587 (62.5)	1677 (66)	-	1375 (54.1)	RS23/25		
NV	DAY	6883 (271)	AIR19K/21K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1587 (62.5)	762 (30)	1372 (54)	1425 (56.1)	MS17/19/21		
NV	DAY	6883 (271)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1587 (62.5)	762 (30)	1372 (54)	1425 (56.1)	MS17/19/21		
NV	DAY	6883 (271)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1587 (62.5)	762 (30)	1372 (54)	1375 (54.1)	RS23/25		
NV	DAY	6883 (271)	AIR23K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1587 (62.5)	762 (30)	1372 (54)	1375 (54.1)	RS23/25		
NE	DAY	5512 (217)	AIR19K/21K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1177 (46.3)	1071 (42.2)	-	1340 (53.6)	MS17/19/21	ALLISON 3000RDS/ 3500RDS	
NJ	DAY	5512 (217)	AIR19K/21K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1177 (46.3)	1071 (42.2)	-	1425 (56.1)	MS17/19/21		
NV	DAY	5512 (217)	AIR19K/21K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1177 (46.3)	1071 (42.2)	-	1425 (57.4)	MS17/19/21		
NV	DAY	6426 (253)	AIR19K/21K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1482 (58.3)	1677 (66)	-	1425 (57.5)	MS17/19/21		
NV	DAY	6883 (271)	AIR19K/21K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1482 (58.3)	762 (30)	1372 (54)	1425 (57.4)	MS17/19/21		
NH	DAY	5512 (217)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1177 (46.3)	1071 (42.2)	-	1375 (54.1)	RS23/25		
NH	DAY	5512 (217)	AIR23K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1177 (46.3)	1071 (42.2)	-	1375 (54.1)	RS23/25		
NH	DAY	6426 (253)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1482 (58.3)	1677 (66)	-	1375 (54.1)	RS23/25		
NH	DAY	6426 (253)	AIR23K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1482 (58.3)	1677 (66)	-	1375 (54.1)	RS23/25		
NH	DAY	6883 (271)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1482 (58.3)	762 (30)	1372 (54)	1375 (54.1)	RS23/25		
NH	DAY	6883 (271)	AIR23K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1482 (58.3)	762 (30)	1372 (54)	1375 (54.1)	RS23/25		

• With Option 23,000 lbs Rear Axle

Unit : mm (in.)

Model	Cab	W/B	Suspension	P/S	Tube outside diameter	Tube thickness	Material	No.1	No.2	No.3	No.4	R/A	T/M
NV	DAY	5512 (217)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1292 (50.9)	1071 (42.2)	-	-	1425 (56.1)	MS17/19/21
NV	DAY	5512 (217)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1292 (50.9)	1071 (42.2)	-	-	1375 (54.1)	RS23/25
NV	DAY	5512 (217)	AIR23K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1292 (50.9)	1071 (42.2)	-	-	1375 (54.1)	RS23/25
NV	DAY	6426 (253)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1597 (62.9)	1677 (66)	-	-	1425 (56.1)	MS17/19/21
NV	DAY	6426 (253)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1597 (62.9)	1677 (66)	-	-	1375 (54.1)	RS23/25
NV	DAY	6426 (253)	AIR23K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1597 (62.9)	1677 (66)	-	-	1375 (54.1)	RS23/25
NV	DAY	6883 (271)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1597 (62.9)	762 (30)	1372 (54)	1425 (56.1)	MS17/19/21	
NV	DAY	6883 (271)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1597 (62.9)	762 (30)	1372 (54)	1375 (54.1)	RS23/25	
NV	DAY	6883 (271)	AIR23K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1597 (62.9)	762 (30)	1372 (54)	1375 (54.1)	RS23/25	
NV	DAY	5512 (217)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1282 (48.5)	1071 (42.2)	-	-	1425 (56.1)	MS17/19/21
NV	DAY	5512 (217)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1282 (48.5)	1071 (42.2)	-	-	1375 (54.1)	RS23/25
NV	DAY	5512 (217)	AIR23K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1282 (48.5)	1071 (42.2)	-	-	1375 (54.1)	RS23/25
NV	DAY	6426 (253)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1587 (62.5)	1677 (66)	-	-	1425 (56.1)	MS17/19/21
NV	DAY	6426 (253)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1587 (62.5)	1677 (66)	-	-	1375 (54.1)	RS23/25
NV	DAY	6426 (253)	AIR23K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1587 (62.5)	1677 (66)	-	-	1375 (54.1)	RS23/25
NV	DAY	6883 (271)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1587 (62.5)	762 (30)	1372 (54)	1425 (56.1)	MS17/19/21	
NV	DAY	6883 (271)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1587 (62.5)	762 (30)	1372 (54)	1375 (54.1)	RS23/25	
NV	DAY	6883 (271)	AIR23K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1587 (62.5)	762 (30)	1372 (54)	1375 (54.1)	RS23/25	
NV	DAY	5512 (217)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1177 (46.3)	1071 (42.2)	-	-	1425 (56.1)	MS17/19/21
NV	DAY	5512 (217)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1177 (46.3)	1071 (42.2)	-	-	1375 (54.1)	RS23/25
NV	DAY	5512 (217)	AIR23K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1177 (46.3)	1071 (42.2)	-	-	1375 (54.1)	RS23/25
NV	DAY	6426 (253)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1482 (58.3)	1677 (66)	-	-	1425 (56.1)	MS17/19/21
NV	DAY	6426 (253)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1482 (58.3)	1677 (66)	-	-	1375 (54.1)	RS23/25
NV	DAY	6426 (253)	AIR23K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1482 (58.3)	1677 (66)	-	-	1375 (54.1)	RS23/25
NV	DAY	6883 (271)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1482 (58.3)	762 (30)	1372 (54)	1425 (56.1)	MS17/19/21	
NV	DAY	6883 (271)	AIR21K/23K SD	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1482 (58.3)	762 (30)	1372 (54)	1375 (54.1)	RS23/25	
NV	DAY	6883 (271)	AIR23K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1482 (58.3)	762 (30)	1372 (54)	1375 (54.1)	RS23/25	

ALLISON  
2500HS/RDS

ALLISON  
3000HS

ALLISON  
3000RDS  
3500RDS

## • With Option 19,000 lbs Rear Axle

Unit : mm (in.)

Model	Cab	W/B	Suspension	P/S	Tube outside diameter	Tube thickness	Material	No.1	No.2	No.3	No.4	R/A	T/M	
NV	DAY	5512 (217)	AIR19K/21K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1292 (50.9)	1071 (42.2)	-	-	1425 (56.1)	MS17/19/21	ALLISON 2500HS/RDS
NV	DAY	6426 (253)	AIR19K/21K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1597 (62.9)	1677 (66.1)	-	-	1425 (56.1)	MS17/19/21	
NV	DAY	6883 (271)	AIR19K/21K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1597 (62.9)	762 (30)	1372 (54)	1425 (56.1)	MS17/19/21		
NV	DAY	5512 (217)	AIR19K/21K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1282 (48.5)	1071 (42.2)	-	-	1425 (56.1)	MS17/19/21	ALLISON 3000HS
NV	DAY	6426 (253)	AIR19K/21K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1587 (62.5)	1677 (66)	-	-	1425 (56.1)	MS17/19/21	
NV	DAY	6883 (271)	AIR19K/21K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1587 (62.5)	762 (30)	1372 (54)	1425 (56.1)	MS17/19/21		
NV	DAY	5512 (217)	AIR19K/21K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1177 (46.3)	1071 (42.2)	-	-	1425 (56.1)	MS17/19/21	ALLISON 3000RDS 3500RDS
NV	DAY	6426 (253)	AIR19K/21K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1482 (58.3)	1677 (66)	-	-	1425 (56.1)	MS17/19/21	
NV	DAY	6883 (271)	AIR19K/21K	SPL140	107.2 (4.22)	3.5 (0.138)	SAE1026	1482 (58.3)	762 (30)	1372 (54)	1425 (56.1)	MS17/19/21		

## Maximum Length of Propeller Shafts

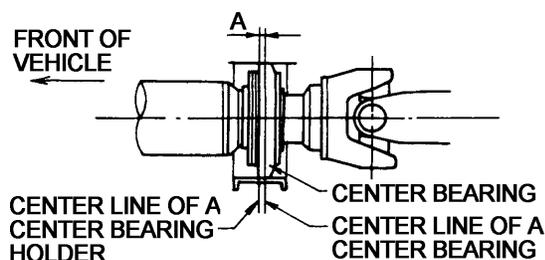
Unit: mm (in.)

Model	Engine	Maximum length	
		Connection by two or more shafts between transmission and rear axle (per shafts)	
		FRONT	REAR
ALL	B6.7	1,755 (69.09)	1,530 (60.24)

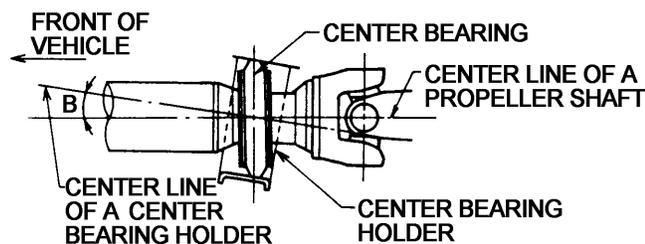
### Allowable Tolerance Between the Center Line of a Center Bearing and a Center Bearing Holder

When installing a center bearing and a center bearing holder, be sure to observe the following allowable tolerance.

Front and rear direction



Up and down, and left and right direction



Model	Allowable tolerance (A) of front and rear direction	Allowable tolerance (B) of up and down, and left and right direction
NE & NJ	Max. ±3 mm (±0.118 in.)	Max. ±3 degrees
NF, NV & NH	Max. ±3 mm (±0.118 in.)	

## Installing the Center Bearing Bracket

When modifying propeller shaft according to wheelbase modifications described in the proceeding section, additional brackets that are necessary to attach center bearing holder are shown in the following table.

Brackets are unnecessary except relevant models shown below because center bearing holder can directly attach on web surface of the crossmember.

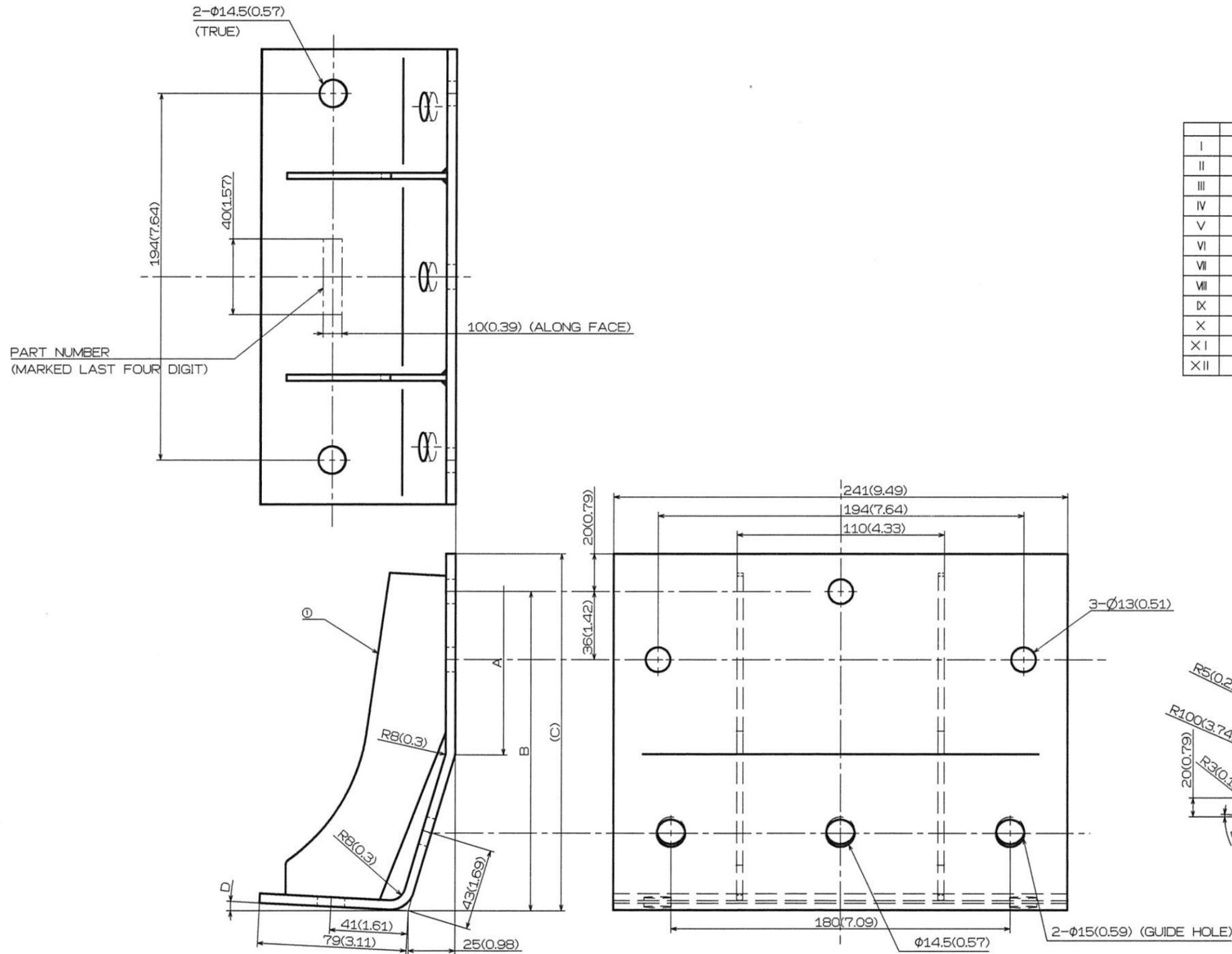
<Day Cab>		Unit : mm (in)		
Wheelbase	Position	No.1 Center Bearing bkt	No.2 Center Bearing bkt	No.3 Center Bearing bkt
G	3,861 (152)	51504-EW251	-	-
J	4,445 (175)	51504-EW161	-	-
L	4,750 (187)	51504-EW171	-	-
M	5,207 (205)	51504-EW151	51504-EW191	-
N	5,385 (212)	51504-EW141	51504-EW291	-
P	5,512 (217)	51504-EW141	51504-EW201	-
R	5,969 (235)	51504-EW151	51504-EW211	-
T	6,426 (253)	51504-EW161	51504-EW221	-
V	6,883 (271)	51504-EW141	51504-EW300	51504-EW221
Y	7,645 (301)	51504-EW141	51504-EW191	51504-EW231

### Cautions when mounting bracket

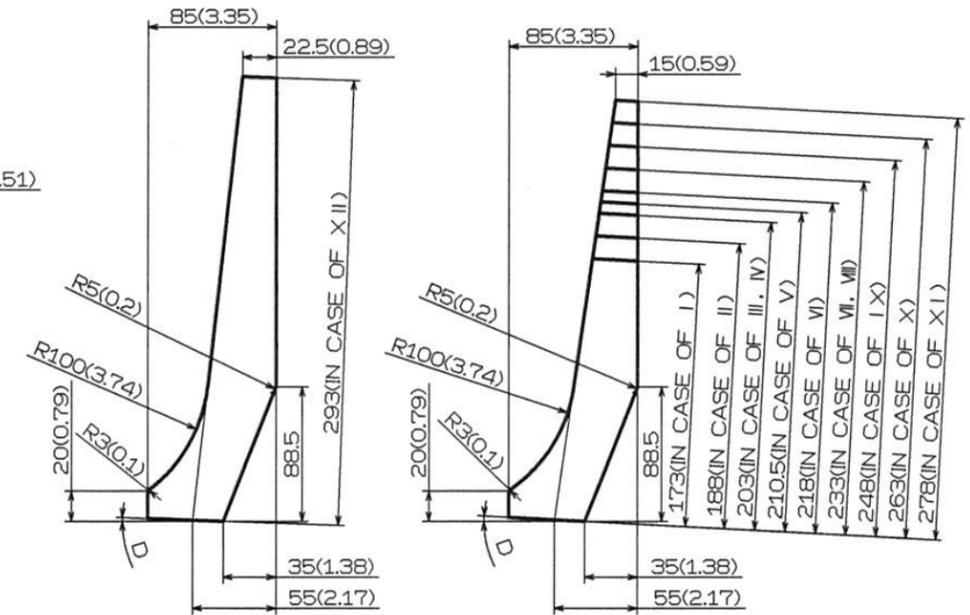
When mounting brackets, use cold head rivets or bolts in compliance with SAE J1199 class 10.9 and nuts corresponding to them.

Drawing of center bearing bracket

Unit: mm (in.)



	Part No.	A	B	C	D
I	51504-EW141	86.5 (3.41)	169 (6.65)	189 (7.44)	3°
II	51504-EW151	101.5 (4.0)	184 (7.24)	204 (8.03)	3°
III	51504-EW161	116.5 (4.59)	199 (7.83)	219 (8.62)	4°
IV	51504-EW300	116.5 (4.59)	199 (7.83)	219 (8.62)	2°
V	51504-EW251	124 (4.88)	206.5 (8.13)	226.5 (8.92)	5°
VI	51504-EW171	131.5 (5.18)	214 (8.43)	234 (9.21)	5°
VII	51504-EW191	146.5 (5.77)	229 (9.02)	249 (9.8)	2.8°
VIII	51504-EW291	146.5 (5.77)	229 (9.02)	249 (9.8)	3°
IX	51504-EW201	161.5 (6.36)	244 (9.61)	264 (10.39)	3.3°
X	51504-EW211	176.5 (6.95)	259 (10.2)	279 (10.98)	3°
XI	51504-EW221	191.5 (7.54)	274 (10.79)	294 (11.57)	3°
XII	51504-EW231	206.5 (8.13)	289 (11.38)	309 (12.17)	2°



## 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 121, Air Brake Systems or 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 1778mm (70in.) for all models, and no alteration is made to any brake system component.

## General Points of Brake System

### Brake System Specifications

Hino vehicles 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.

MODEL	BRAKE SYSTEM
NE, NF	HYDRAULIC BRAKE
NJ, NV & NH	FULL AIR BRAKE

If body equipment design means that you need to take power from the brake system such as 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 Air Supply from the Brake System

- As a general rule, the taking of air to power a body or equipment from the brake system is prohibited.
- If you must take 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 air supply and safety considerations, and consult HMC or Hino authorized dealer beforehand.
- When you install 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;

When taking off an air line, or installing check valves, do not position them

- on the main brake line (front and rear brake line), and on the charge line (between the compressor and air tank).

Install a pressure protection valve to the circuit to protect the main brake line. (part number of protection valve is S4750-E0010 for reference.)

And adjust the control air pressure to min. 5 kg/cm<sup>2</sup> (71.1 lb/in.<sup>2</sup>) in order to keep the air pressure on main brake circuit when breakdown (occurred air leakage, e. g.) the taking off line of an air.

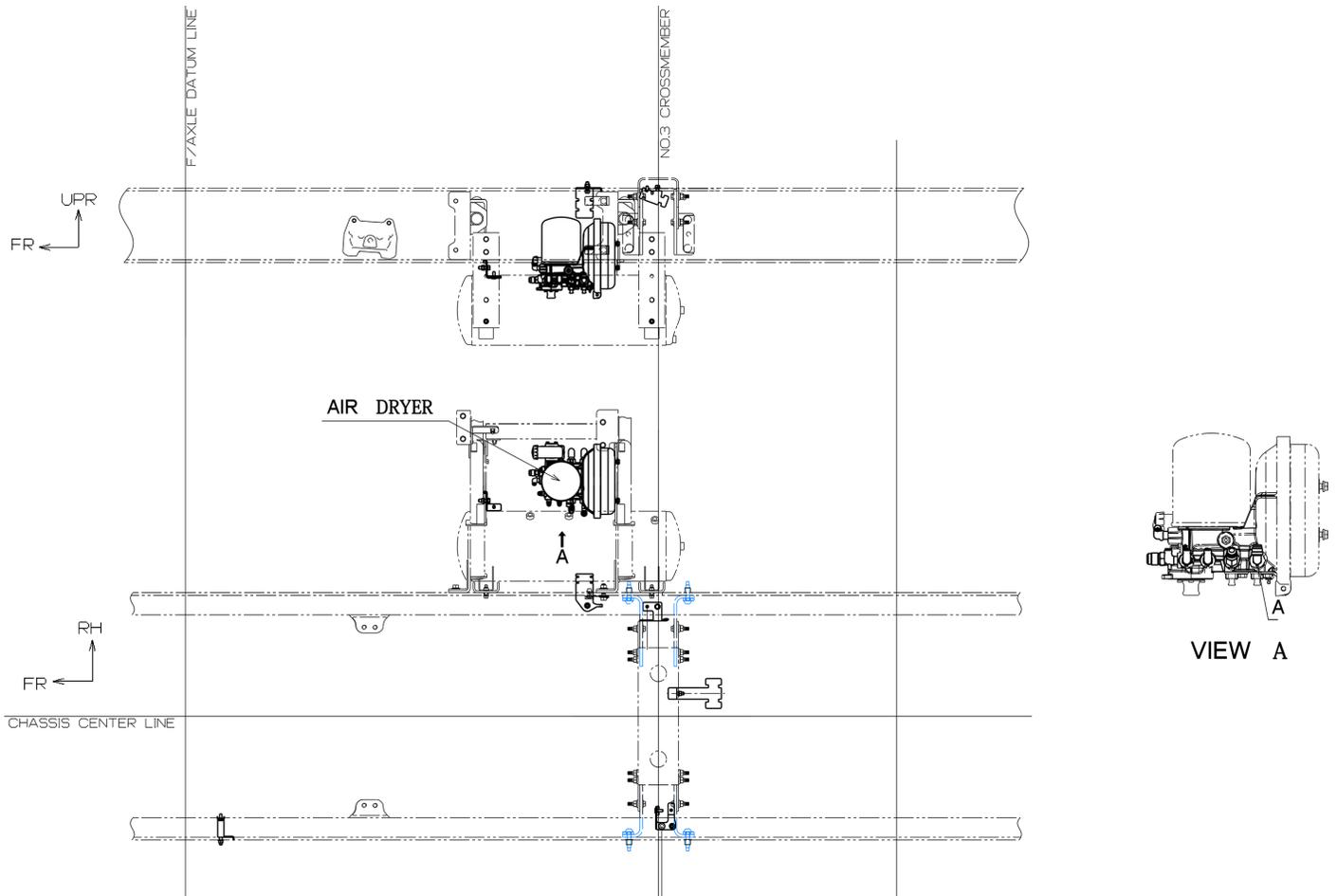
Location of origin for circuit addition guidelines below.  
Taking an air line from another position is strictly prohibited.

### MODEL : ALL MODEL

It takes out from the A port of the air dryer.

Refer to the following figure.

Be sure to install a protection valve in the added air line.



### Procedure

#### Rr LEAF SPRING SUSPENSION model

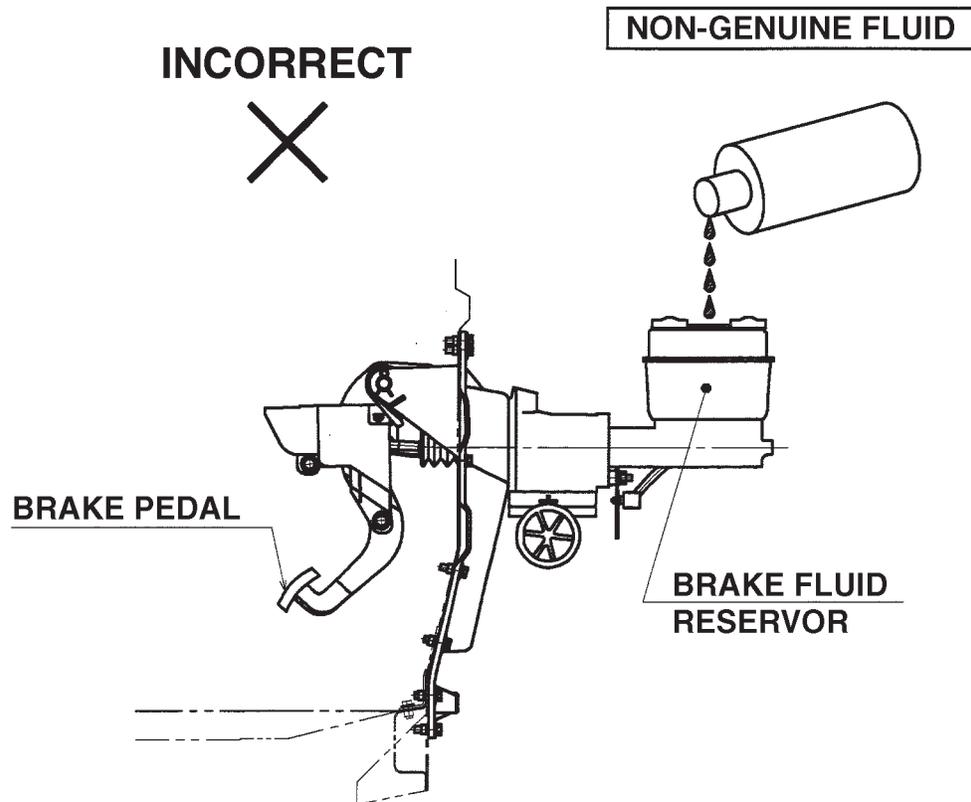
- Remove the plug.
- Install the connector (NPTF 1/4in ).

#### Rr AIR SPRING SUSPENSION model

- Remove the connector and nylon tube which are installed.
- The removed nylon tube is an air suspension circuit, and the nominal diameter is 3/8in.
- Don't alter the removed nylon tube.
- It changes to the forked (ex. T-shape) connector which is the nominal diameter 3/8in of a tube.
- Install the removed nylon tube in the connector.
- The vacant one is used for body or equipment.

**Refilling Brake Fluid (For HYDRAULIC Brake only)**

- When changing brake fluid, use only genuine Hino brake fluid. For details of brake fluid, see the appropriate workshop manual or owner's manual.
- Do not use old brake fluid.  
Do not use mineral oil or mix Hino products with other brands.

**Avoiding Effect of Exhaust Heat**

Locate the brake hose, pipes, nylon tubes 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 Hino Chassis

#### Steel Piping Used in the Hino Chassis

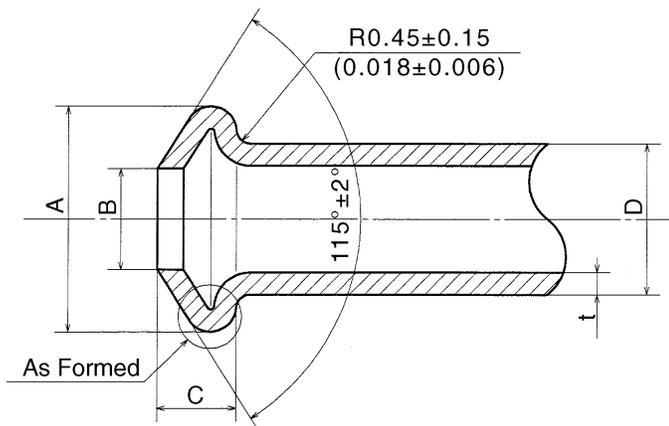
The table below shows the material of the piping used in the Hino chassis and the configuration of the flare of each type of pipe.

Unit: mm (in.)

Nominal diameter D	Flare configuration					Remarks
	A	B	t	C	S	
4.76 (0.19)	7.1 (0.28)	3.2 (0.13)	0.7 (0.03)	2.5 (0.10)	—	ISO standard pipe
6.35 (0.25)	8.77 (0.35)	—	0.83 (0.03)	—	1.02 (0.04)	SAE standard pipe
12 (0.47)	15.3~16.3 (0.60~0.64)	9.5~10.5 (0.37~0.41)	0.9 (0.04)	1.8 (0.07)	1.6 (0.06)	JASO standard pipe
15 (0.59)	18.0~19.0 (0.71~0.75)	12.5~13.5 (0.49~0.53)	1.0 (0.04)	2.0 (0.08)	1.6 (0.06)	

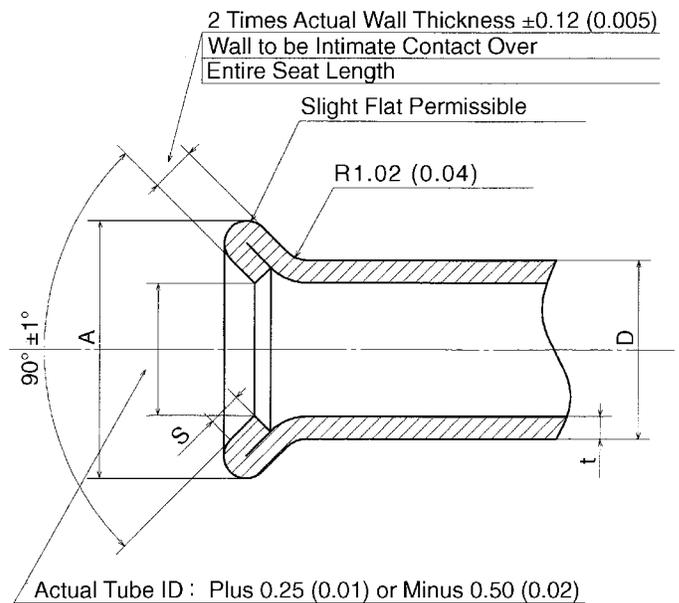
#### ISO STANDARD PIPE

Flare shape is as follows, ISO 4038.



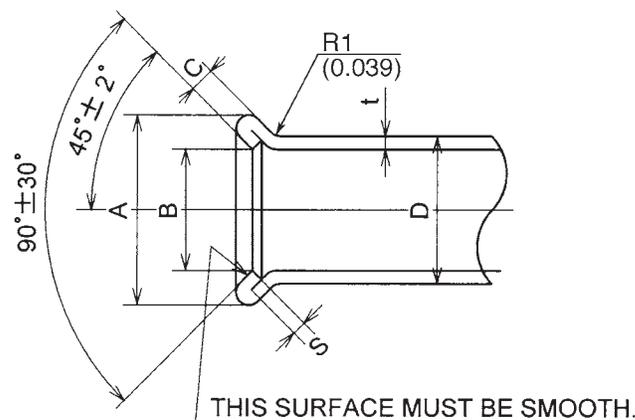
#### SAE STANDARD PIPE

Flare shape is as follows, SAE J53.



#### JASO STANDARD PIPE

Flare shape is as follows.



## [DETAILS OF MATERIAL]

Unit : mm (in.)

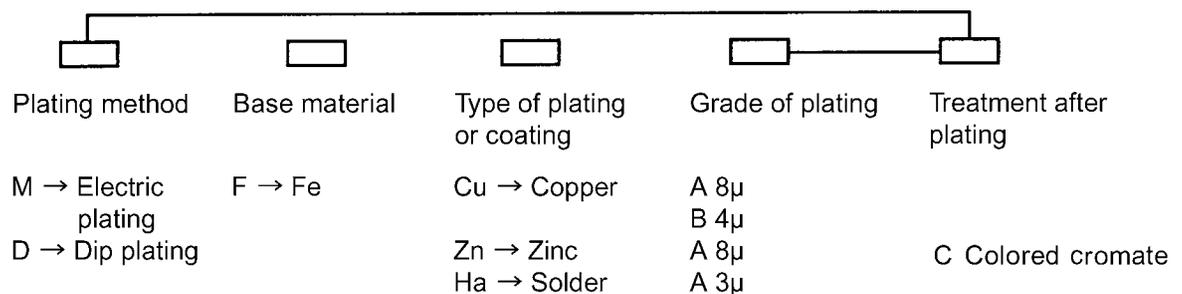
Pipe dia.	Type	1) Pipe	2) Plating Code	
			Inside	Outside
4.76~10 (0.19~0.39)	Double-wound plated steel pipe	HSTD2	MFCuB	MFZnA-C++Plastic
10 (0.39)		HSTD3	MFCuA	MFZnA-C++Plastic
6.35~15 (0.25~0.59)	Plated carbon steel pipe for mechanical structures	HSTKM3	MFCuB	MFZnA-C++Plastic
10~15 (0.39~0.59)		HSTKM1	MFCuA	MFZnA-C++Plastic

## [Notes]

- Chemical composition and mechanical properties

Pipe	Chemical composition %						Mechanical properties					
							Tensile strength			Beding test		
	C	Mn	P	S	Si	Cu	Tensile strength kg/mm <sup>2</sup>	Yield point kg/mm <sup>2</sup>	Elongation (%)	Applicable pipe dia. mm	Bending angle	Inside dia. (D=pipe dia.)
HSTD2	≤ 0.12	≤ 0.50	≤ 0.04	≤ 0.045	—	—	≥ 30	—	≥ 25	≤ 8	360°	1.5D
HSTD3	↑	↑	↑	↑	—	—	↑	—	↑	≤ 10	↑	3D
HSTKM1	≤ 0.25	0.30 ~0.90	≤ 0.04	≤ 0.04	≤ 0.35	—	≥ 38	≥ 22	≥ 25	≥ 12	90°	6D
HSTKM3	↑	↑	↑	↑	↑	—	↑	↑	↑	≤ 10	↑	↑

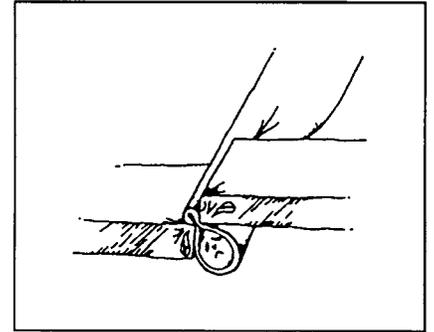
- Plating code



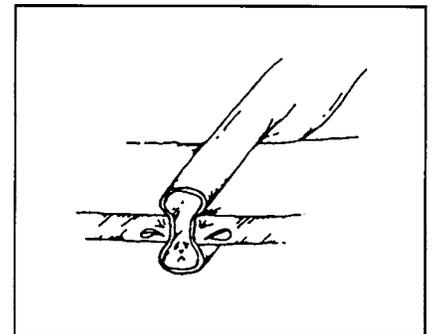
## Precautions when Mounting a Body or Equipment

### Avoiding Interference with Piping

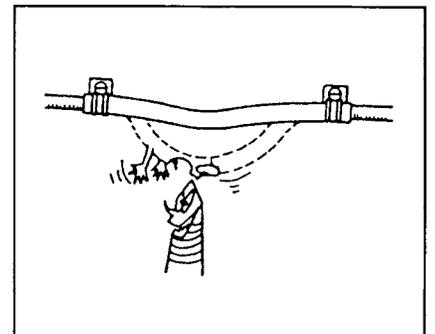
Take care that the piping is not caught by other parts.



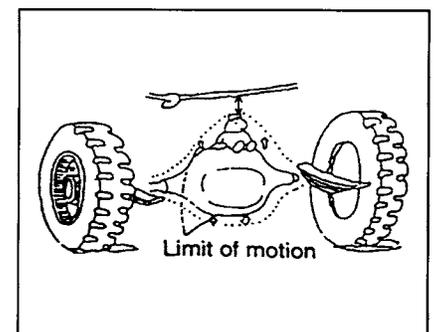
Be sure that the piping is not flattened.



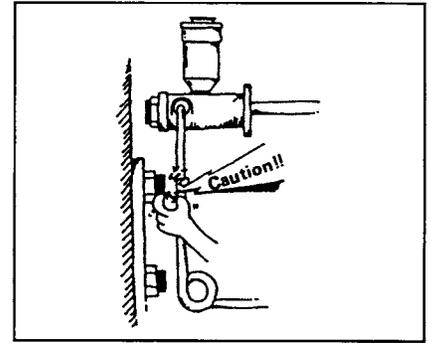
See to it that the piping is not in contact with the sharp-angle portion of other parts.



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.

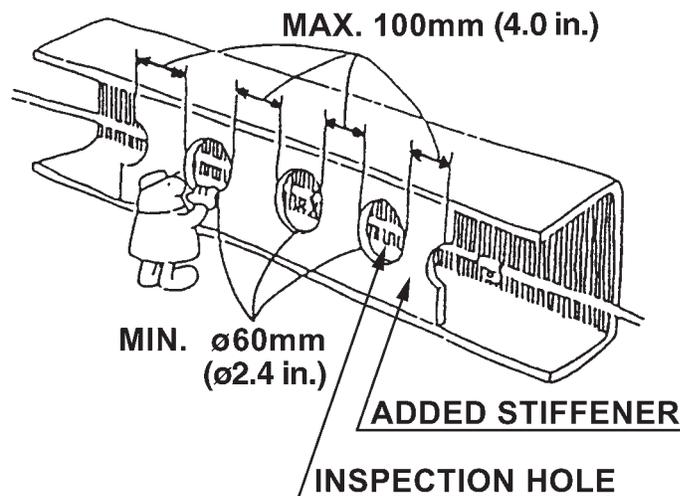


The joints of pipes and hoses must be accessible to allow tightening and so that pipes and hoses can be removed.

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.

- Drains are fitted under the air tank and relay valve. When mounting a body or equipment, make sure that the drains are easily accessible.
- Make sure that the following parts are easily accessible for maintenance and replacement:
 

Air dryer	Pressure regulator	Double check valve
Relay valve	Safety valve	Spring brake control valve
Hydro master	ABS valve	ABS modulator
- In vehicles with hydraulic brake, make sure that the air bleeders of caliper are easily accessible for air bleeding.

Allow sufficient clearance between the brake pipes, hoses, nylon tubes and mounted body or equipment.

When mounting the body or equipment, make sure that body and equipment do not interfere with the brake system.

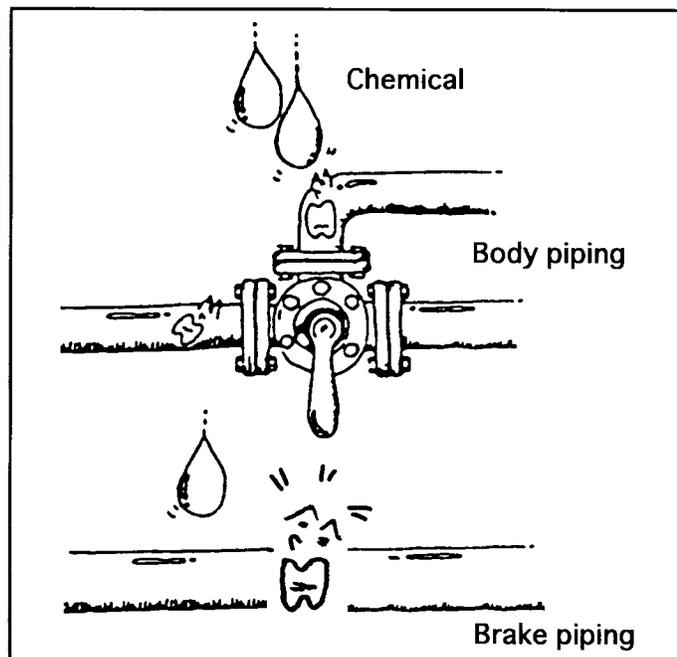
- Clearance with engine
- Clearance with brake component parts  
(Pipes, hoses, nylon tubes, devices of ABS, etc.)
- Clearance with hoses around axles  
(Must be consider the maximum movement of axles)
- Clearances with rubber parts  
(For more details of required clearances, see "PIPING CLEARANCE" here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

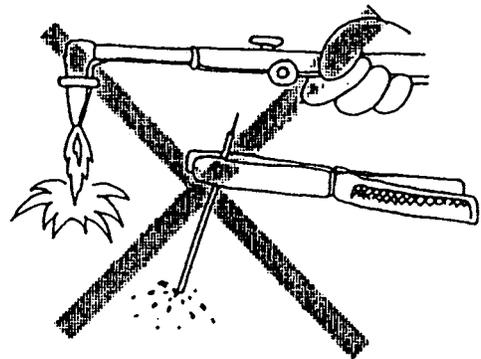
Tightening torque of flare nut.

Unit: kgf-cm (lb-ft)

Pipe external diameter mm (in.)	ø4.76 (ø0.19)	ø6.35 (ø0.25)	ø12 (ø0.97)	ø15 (ø0.59)
Steel	150±50 (11±4)	250±50 (18±4)	680±70 (49±5)	900±80 (65±6)

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.

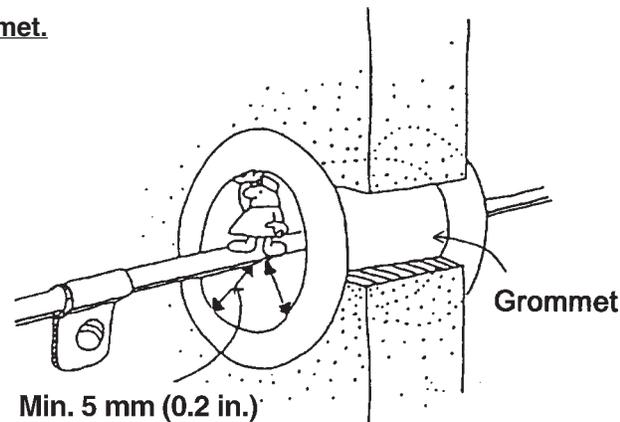
**Do not weld or braze brake piping and do not heat to high temperatures.**



Do not use copper pipes for high-pressure hydraulic brake piping and for piping in areas below unsprung parts as on axles.

Where pipes pass through the chassis frame, 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.3 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 chassis frame.

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.

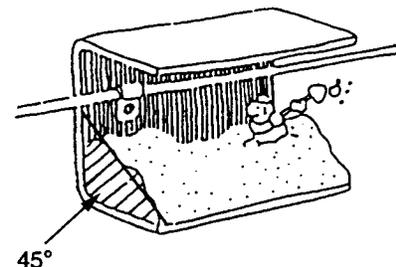
Do not install piping near to the moving parts such as propeller shaft and P.T.O. drive shaft.

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.

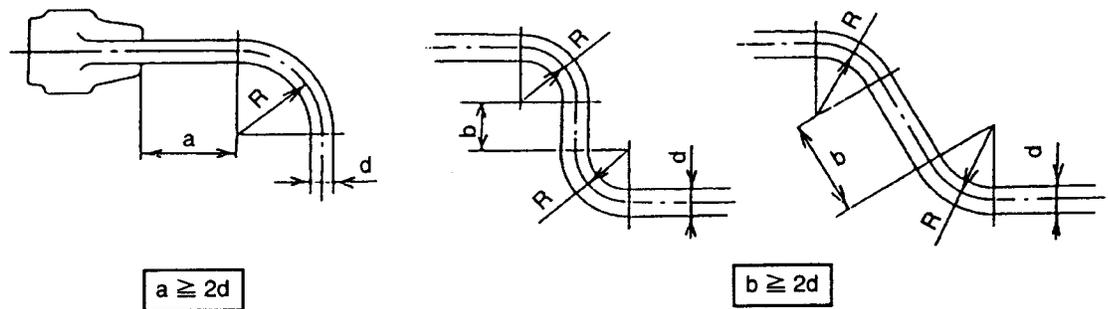
### When bending pipes, observe the following precautions.

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

Unit: mm (in.)

Nominal dia. of pipe	4.76 (0.19)	6.35 (0.25)	12 (0.47)	15 (0.59)
Standard bending R	20 (0.79)	20 (0.79)	30 (1.18)	40 (1.57)

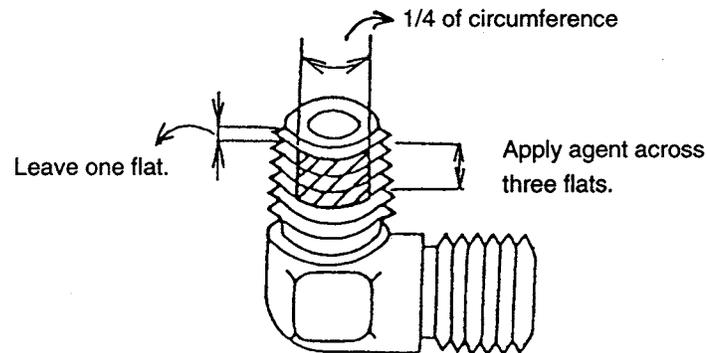
- The minimum lengths of the straight section at the end of a pipe and of the straight section between two bends are shown in the drawing below.



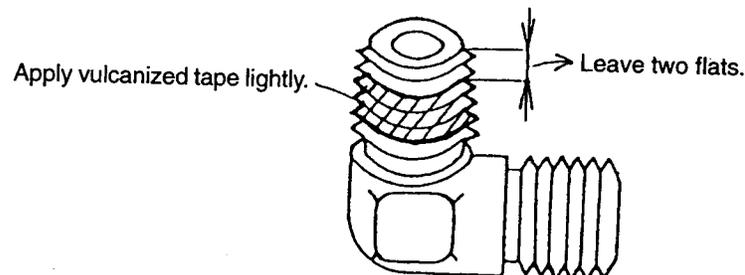
- Flush the inside of the pipe and remove any foreign matter before use. Use compressed air to flush the pipe.
- For details of pipe machining at the flare nut, see described in forward paragraph "Brake Piping Used in the Chassis".  
After machining, remove any foreign matter by flushing the pipe with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

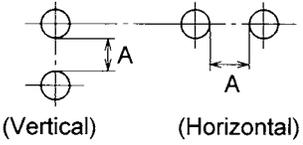
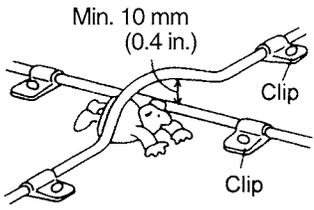
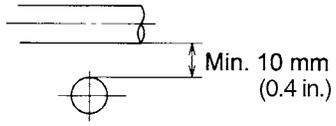
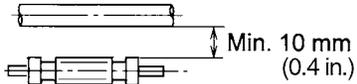
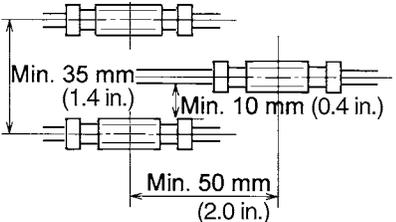
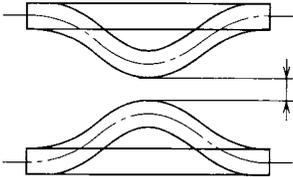
After tightening the joint,

- 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.).

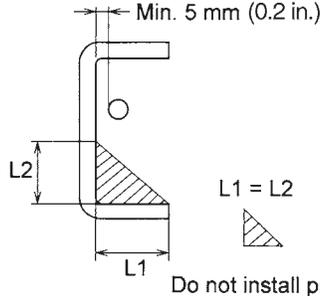
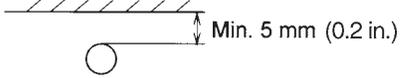
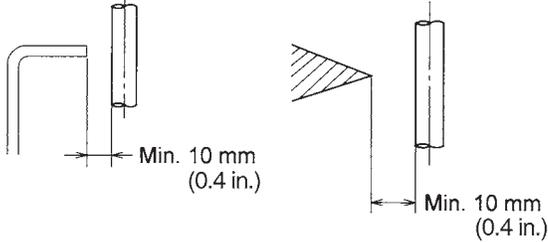
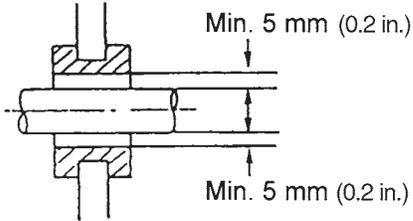
### Piping Clearances

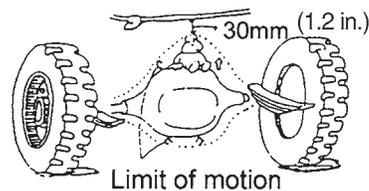
To prevent rust and damage from contact with other parts. When modifying piping, observe the following precautions.

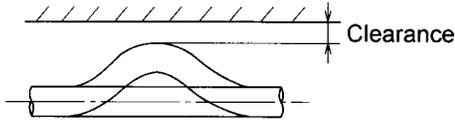
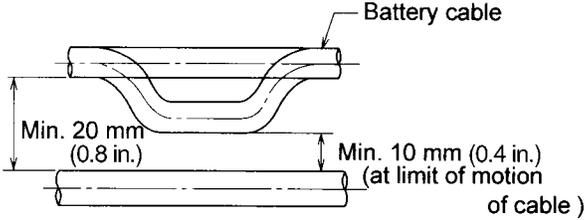
#### Clearances Between Two Pipes

No.	Position	Clearances
1	Between two pipes.	 <p>A Min. 10 mm (0.4 in.) (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>L2</p> <p>L1 = L2</p> <p>Do not install pipes in shaded area.</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.	Min. 10 mm (0.4 in.) • But min. 30 mm (1.2 in.) clearance from limit of motion of moving part.

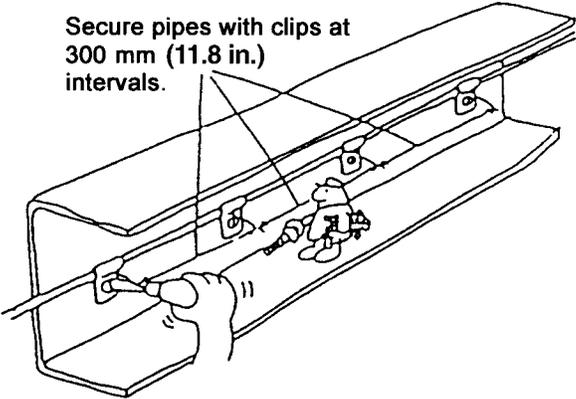
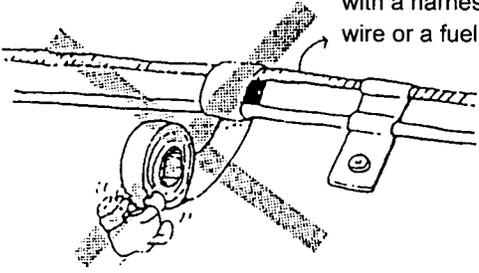


No.	Position	Clearances
6	Between a hose and a structural part.	<p>Make sure that clearances of brake and air hoses linked to wheels are at least 50 mm (2.0 in.) during driving.</p> <p>Take account of vibrations(e. g. when steering is at full lock). Clearances for other hoses at the limit of motion must be:</p> <ul style="list-style-type: none"> <li>• at least 10 mm (0.4 in.) from flat surfaces</li> <li>• at least 30 mm (1.2 in.) from corners and edges</li> </ul> 
7	<p>Between hoses or pipes and heated parts (exhaust system, etc.).</p> <ul style="list-style-type: none"> <li>• Air pipe</li> <li>• Hydraulic pipe</li> <li>• Brake hoses</li> </ul>	<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"> <li>• Between a pipe and a battery cable.</li> <li>• Between pipes and electric terminals.</li> <li>• Between pipes and harness wires.</li> </ul>	 <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>

## Precautions to Take when Handling Nylon Tubes for Brakes

Nylon tubes are used in the air braking system. Caution should be exercised against heating when welding.

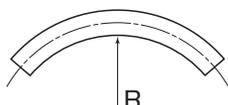
If welding is required, nylon tubes need to be protected against welding spatter, etc..

For other general precautions, refer to the instructions shown on the following table.

When dismantling and remounting the piping for the reason of facilitating the maintenance, inspection of the brake and air line as well as of body or equipment mounting, make sure to put matching marks (using paint, tape, tag, etc.) on the equipment side as well as on the piping side to prevent incorrect connections.

Incorrect connections and/or mounting of equipment and piping can cause a serious functional damage to the system using brake line and air line.

## Precautions to take for handling nylon tubes when mounting the body

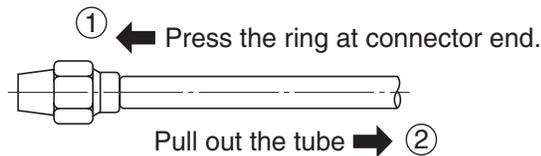
	Point to pay attention for handling	Contents		Influence on the performance								
1	Protection of nylon tube when welding or grinding with a sander.	Fit a protecting cover on the nylon tube or remove it according to the necessity.		If welding sparks, etc are projected on the nylon tube, the tube may melt and cause air leakage sometimes.								
2	Protection of nylon tube when a body or equipment interfere with nylon tube.	Securely fix a body or equipment with a clamp to the nylon tube protected with corrugated tube existing around it.		If nylon tube keeps on interfering with a body or equipment, the tube may break and cause air leaking sometimes.								
3	Prevention of introduction of foreign matters into the nylon tubes and connectors.	When dismounting and remounting the nylon tubes and the connectors, cover them with vinyl sac, etc (sac producing fiber dust is not suitable) to prevent sticking and / or introduction of foreign matters.		Biting of foreign matters by valves and connectors may sometimes cause air leakage or malfunctioning of valves.								
4	Protection against interference of nylon tubes.	Matching parts	Gap	Holes may sometimes appear on the tubes and pipes due to rubbing and wear and may result in air leakage.								
		Chassis parts (fixing position)	5mm (0.2 in.)									
		Engine, transmission, cab, etc (relative moving position)	30mm (1.2 in.)									
		Tires, propeller shaft, etc (rotating position)	50mm (2.0 in.)									
		Components for upper structures	Equivalent to the above									
5	Securing gaps with exhaust system.	Secure gaps of more than 200mm (7.9 in.) between the nylon tubes and the exhaust system (exhaust pipe, muffler, etc) or protect the tubes by covering them with insulators, etc. Also, be sure to fit insulators on the flange section of the exhaust system.		High temperature due to the heat of the exhaust system may cause sometimes melting of the tubes and may result in air leakage.								
6	Prevention of swinging of the nylon tubes.	Provide appropriate clip bands to the nylon tubes to avoid swinging of the tubes after mounting. : <ul style="list-style-type: none"> <li>• Gaps of the clip bands should have pitches less than 400mm (15.7 in.).</li> <li>• Clip band to use : S4783-71230</li> </ul>		If the clip gap is too big, tubes may swing to rub against other parts and may cause contact wear, this leading sometime to occurrence of air leakage.								
7	Securing of bending "R" for nylon tubes.	The minimum bending "R" for the nylon tubes should be as indicated on the following table. Avoid bending the tubes with the bending "R" smaller than the one indicated in the table.  <table border="1" data-bbox="592 1701 990 1837"> <thead> <tr> <th>Outside diameter of nylon tube</th> <th>R mm (in.)</th> </tr> </thead> <tbody> <tr> <td>1/4"</td> <td>41 (1.6)</td> </tr> <tr> <td>3/8"</td> <td>74 (2.9)</td> </tr> <tr> <td>1/2"</td> <td>88 (3.5)</td> </tr> </tbody> </table>		Outside diameter of nylon tube	R mm (in.)	1/4"	41 (1.6)	3/8"	74 (2.9)	1/2"	88 (3.5)	If a tube is bent with the bending "R" less than the minimum bending "R" ,the air may be clogged by broken tube and air leakage may occur by the end position of the connector.
Outside diameter of nylon tube	R mm (in.)											
1/4"	41 (1.6)											
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1/2"	88 (3.5)											

	Point to pay attention for handling	Contents	Influence on the performance																																						
8	Prevention of adherence of acidic liquid.	As nylon tubes are weak against acid, be careful so that they might not be caught by battery liquid. Don't use waste cloth or cotton work gloves contaminated with battery liquid.	Sticking of acidic liquid such as battery liquid melts the tube and risks to cause air leakage.																																						
9	Prevention of water penetration at the time of high pressure washing.	Secure the distance minimum of 300mm (11.8 in.) (and above between the connector and the injection port when performing high pressure washing.	If the distance between the connector and the injection port is not sufficient, water may penetrate into the piping, thus causing rusting, freezing, and malfunctioning of valves.																																						
10	Protection of nylon tubes when performing forced drying of paint.	As the temperature service limit of the nylon tube is from -40 to 100°C (104 to 212°F), remove the nylon tube when using a drying booth whose service temperature exceeds this limit.	If this service limit is exceeded, air tightness of the tube will be reduced and may cause air leakage sometimes.																																						
11	Spare parts.	<p>Never fail to use genuine Hino spare parts. Otherwise, the nylon tube may be damaged.</p> <ul style="list-style-type: none"> <li>Connectors for intermediate connection of nylon tubes</li> </ul> <table border="1"> <thead> <tr> <th>Outside diameter of tube</th> <th>Part No.</th> <th rowspan="4"></th> </tr> </thead> <tbody> <tr> <td>1/4"</td> <td>S3480-14750</td> </tr> <tr> <td>3/8"</td> <td>S3480-14760</td> </tr> <tr> <td>1/2"</td> <td>S3480-14770</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>Sleeve connectors</li> </ul> <table border="1"> <thead> <tr> <th></th> <th>1/4"</th> <th>1/2"</th> <th rowspan="4"></th> </tr> </thead> <tbody> <tr> <td>Nut</td> <td>SZ179-11003</td> <td>SZ179-17001</td> </tr> <tr> <td>Sleeve</td> <td>S4938-41040</td> <td>S4938-41030</td> </tr> <tr> <td>Insert</td> <td>S4485-41130</td> <td>S4485-41110</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>Nylon tubes</li> </ul> <table border="1"> <thead> <tr> <th>Outside diameter of tube</th> <th>Part No. L = 6m (20 ft.)</th> </tr> </thead> <tbody> <tr> <td>1/4"</td> <td>SM415-07600</td> </tr> <tr> <td>3/8"</td> <td>SM415-09600</td> </tr> <tr> <td>1/2"</td> <td>SM415-13600</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>Corrugates tubes</li> </ul> <table border="1"> <thead> <tr> <th>Outside diameter of tube</th> <th>Part No. L = 1.2m (4 ft.)</th> </tr> </thead> <tbody> <tr> <td>1/4"</td> <td>SR291-07120</td> </tr> <tr> <td>3/8"</td> <td>SR291-10120</td> </tr> <tr> <td>1/2"</td> <td>SR291-13120</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>For one-touch type connectors, kindly contact authorized Hino distributor nearest to you.</li> </ul>	Outside diameter of tube	Part No.		1/4"	S3480-14750	3/8"	S3480-14760	1/2"	S3480-14770		1/4"	1/2"		Nut	SZ179-11003	SZ179-17001	Sleeve	S4938-41040	S4938-41030	Insert	S4485-41130	S4485-41110	Outside diameter of tube	Part No. L = 6m (20 ft.)	1/4"	SM415-07600	3/8"	SM415-09600	1/2"	SM415-13600	Outside diameter of tube	Part No. L = 1.2m (4 ft.)	1/4"	SR291-07120	3/8"	SR291-10120	1/2"	SR291-13120	
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### Dismounting and remounting procedures for one touch type connectors

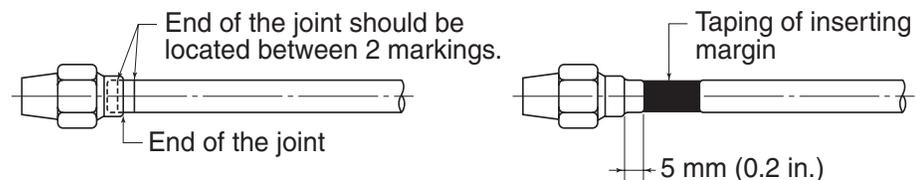
#### Procedure for dismounting

- Before performed dismounting, drain the air from all air tank.
- Confirm that there is no dust nor dirt around the ends of the connector. If any dust or dirt is found sticking there, eliminate it completely by air blowing. etc.
- Keeping the end portion of the connector pressed, pull out the nylon tube by hand without break in the middle along the axial direction of the connector.



#### Procedure for remounting

- Confirm that there is no flaw, crush, dirt, burr nor dust, etc around the inserting position of the nylon tube. If a flaw or a crush is found out, follow the instruction for repair described here in after.
- Match the axis of the nylon tube with that of connector and insert the tube all the way without break until it stops. At this moment, be careful not to touch the inserting portion with fiber cloth such as cotton work globes, etc.
- After mounting, pull the nylon tube by hand to check if the nylon tube has been securely connected.
- After pulling, check if the end of the joint terminal is located between the 2 markings of the nylon inserting margin and that the gap between the end of the connector and of the end of the nylon tube inserting margin is less than 5mm (0.2 in.) when the nylon tube has been repaired.



- With the condition that the air is filled in the piping, check if there is any leakage of air by applying soapy water to the connecting position.  
If any air leakage is found out, follow the instruction for modification described here in after.

### Dismounting and remounting procedures for nylon tubes for sleeve type connectors

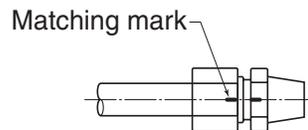
The sleeve type connector consists of a connector, nut, sleeve and an insert and the nut, sleeve and the insert are supplied as assembled by the manufacturer.

The nut, sleeve and insert are not reusable once they are disassembled.

If repair is required, carry out the work according to the following procedure.

#### Procedure for dismounting

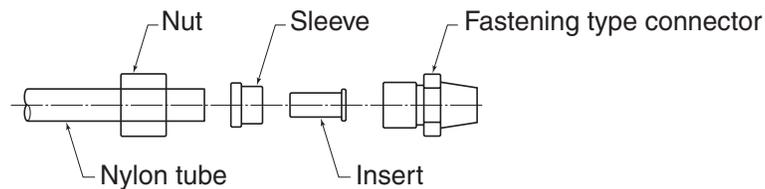
- Before loosening the nut, put the matching mark between the connector and the nut so that the position can be visible. (marking by a magic ink is acceptable.)



- Loosen the nut and pull out the tube by hand in the axial direction while paying attention so that the sleeve and the insert may not fall off.

#### Procedure for remounting

- Put the nut and the sleeve onto the tube and put the insert into the tip of the tube. (Pay attention to the remounting direction.)



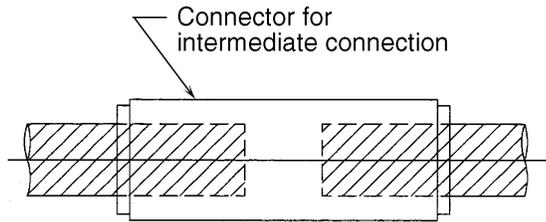
- Drive the insert until the tip of the insert hits the connector while paying attention so that the nut, sleeve and the insert may not fall off and, under this condition, fully tighten the nut by hand.
- Hold the tube so that it may not move (comes off), tighten the nut up to the position before dismounting (matching mark) and retighten it by 60°. Further tighten the nut using the tool until the prescribed torque is obtained.
- Check the air leakage with a soapy water, etc. If any air leakage has been found out, retighten the nut until the air leakage stops.
- If the leakage does not stop, replace the tube, sleeve and the insert. If in spite of such replacement, the leakage does not stop, replace the nut and the connector in addition.

	1/4"	1/2"	
Nut	SZ179-11003	SZ179-17001	
Sleeve	S4938-41040	S4938-41030	
Insert	S4485-41130	S4485-41110	

**Procedure for repairing the nylon tube**

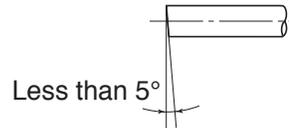
When repair becomes necessary due to appearance of harmful defects such as breakage, crush, perforation, etc., carry out the repair according to the following instruction. (applicable only to the position which is not apparent such as the inside of the frame, etc.)

- Prepare a nylon tube having the same size as that of the nylon tube to repair and a connector for intermediate connection (exclusively for repair).

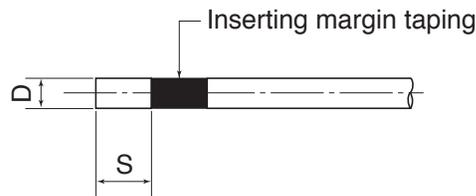


Outside diameter of tube	Part No.	
1/4"	S3480-14750	
3/8"	S3480-14760	
1/2"	S3480-14770	

- Confirm the position of the defect on the nylon tube and decide the cutting position to such place where the connector is mountable. Use a cutter for cutting.
- Check if the cutting face of the nylon tube is smooth without any burr and that the cutting face is  $90^{\circ} \pm 5^{\circ}$  to the axis of the nylon tube.

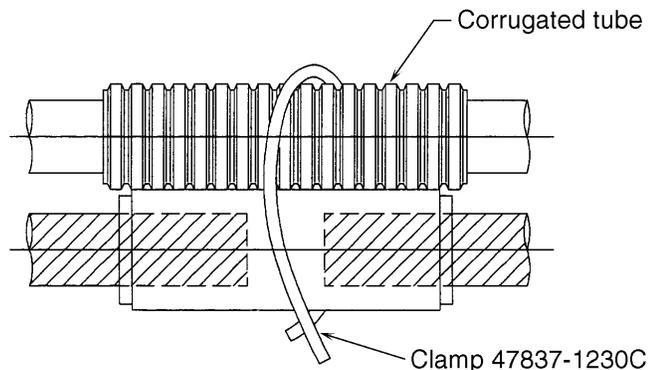


- Wind the inserting margin taping according to the following table. (In the same way as in the case of one-touch type connector )



D (Outside diameter of tube)	S (Inserting margin) mm (in.)
1/4"	18±1 (0.71±0.04)
3/8"	22.5±1 (0.89±0.04)
1/2"	25.5±1 (1.00±0.04)

- Remount the connector according to the dismounting and remounting procedures of the nylon tube.
- Securely fix the repair connector with a clamp to the nylon tube protected with corrugated tube existing around it. If this does not exist around it, add the corrugated tube.
- In the event that such repair work is difficult to carry out for the reason of layout or for the reason of influencing on the external appearance such as on the air tank or that the tube is relatively short and its replacement can be done easily, replace the nylon tube with a new one.



In the event that an air leakage has occurred after remounting of the nylon tube, take the following measure (applicable only when the nylon tube has enough surplus length).

- Remove the parts of the nylon tube that suffers from the air leakage together with the connector according to the dismantling procedure.  
After dismantling, keep the outside and the inside of the connector free from any adhesion of dust or dirt.
- Cut the nylon tube over the range of 15 to 20 mm (0.6 to 0.8 in.) from its end. Also, if any flaw is found out within this range, cut the tube at the position where the flaw is no more recognized. In the event that it is impossible to define the cutting position, replace the nylon tube with a new one.
- Eliminate those matters sticking to the inside of the dismantled connector by air-blowing. If any damage or heavy sticking of foreign matters is found out, replace the connector with a new one.
- Wind an insert margin tape around the nylon tube (in the case of one-touch connector), Mount the tube according to the remounting procedure. In the case of a nylon tube of single parts or the case of the tube whose overall length is less than 500 mm (20 in.), piping becomes difficult. In such a case, replace it with a new parts.

### Tightening torques

Tightening torque for tapered joint

Unit: kgf·cm (lb·ft)

Thread dia. (in.)	1/8	1/4	3/8	1/2
Material				
Steel	200±50 (15±4)	500±100 (36±7)	650±150 (47±11)	
Aluminum Brass	200±50 (15±4)	250±50 (18±4)	350±50 (25±4)	450±50 (32±4)

Tightening torque for sleeve type connector

	ø1/4	ø3/8	ø1/2
kgf·cm (lb·ft)	235±30 (17±2)	410±50 (30±4)	560±50 (41±4)

Tightening torque for flare nut of female flare joint and male flare joint

Dia. mm (in.)	ø4.76 (ø0.19)	ø6.35 (ø0.25)	ø10 (ø0.39)	ø12 (ø0.47)	ø15 (ø0.59)
Torque for steel pipe kgf·cm (lb·ft)	150±50 (11±4)	250±50 (18±4)	530±70 (38±5)	680±70 (49±5)	900±80 (65±6)

Tightening torque for bolt and nut

	M6	M8	M10	M12	M16	M20	M22
4T kgf·cm (lb·ft)	55±11 (4±1)	175±30 (13±2)		490±100 (35±7)	980±195 (70±14)	1230±370 (90±27)	1350±300 (98±22)
7T kgf·cm (lb·ft)	90±18 (7±1)	225±40 (16±3)	525±100 (38±7)	930±185 (67±13)			

The conventional units in the parenthesis ( ) in the table as well as the figures connected therewith are shown as reference.

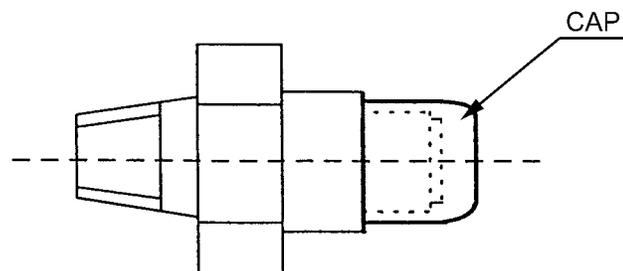
[ NOTE ] Hino reserves the right to modify the parts connected with nylon tubes for brakes without notice.

When placing your order for spare parts, kindly consult HMC or Hino authorized dealer.

## Precautions for handling one-touch type connector

	Precaution to take when handling	Contents	Description
1	Assurance of quality for parts in stock.	<ul style="list-style-type: none"> <li>Do not use the joint without cap or with cap detached but burn it down.</li> <li>In such case, securely crash the one-touch type connector with a hammer.</li> </ul>	<ul style="list-style-type: none"> <li>The cap is fitted in order to avoid deformation, flaw, introduction of dust and dirt.</li> <li>If the one-touch type connector is used without cap, this may sometimes cause air leakage or detaching of the tube.</li> </ul>
2	Assurance of quality during the transport.	<ul style="list-style-type: none"> <li>Do not attempt a rough handling which will cause detaching or deformation of the cap.</li> </ul>	<ul style="list-style-type: none"> <li>If the one-touch type connector receives a strong external force through the cap by falling it down or due to a rough handling, air leakage or detaching of tube may occur sometimes.</li> </ul>
3	Assurance of quality when assembling a new one-touch type connector on the vehicle.	<ul style="list-style-type: none"> <li>Be sure to mount the one-touch type connector with cap fitted.</li> <li>Carry out removal of the cap at the time of insertion of the nylon tube.</li> </ul>	<ul style="list-style-type: none"> <li>Presence of deformation or flaw may cause sometimes air leakage or detaching of the tube.</li> </ul>

[ Protection cap of one-touch type connector ]



## 12. ELECTRIC WIRING MODIFICATIONS

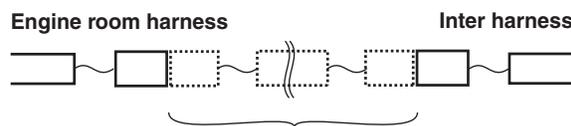
### Precautions for modifying chassis harness

- 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 at least 10 minutes, and remove the connectors of the computer main unit as well as the terminal connectors of the batteries.
- When extending the harness, use a genuine Hino harness for the extension in order to avoid occurrence of various troubles.



Optional Extension Cable  
for chassis harness

### IN CASE OF LENGTHENED WHEELBASE



Use a genuine Hino optional extension cable described in following table.

### EXTENSION CABLE PART NUMBERS

Part No.	Length: mm(in.)
82164-EW770	802 (31.6)
82164-EW780	1732 (68.2)
82164-EW790	2545 (100.2)
82164-EW800	3358 (132.2)
82164-EW810	4222 (166.2)

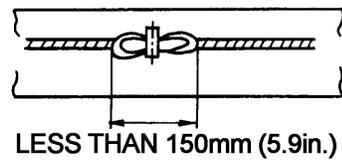
- When shortening the harness, bundle the surplus portion of the harness and secure it to the frame by means of a clip, etc.
- Never attempt to apply the following modifications to the harness:
  - Extension or of shortening by cutting off the harness.
  - Connection by soldering or caulking.

### Other precautions for modifying chassis harness.

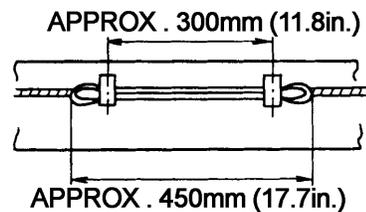
- Before proceeding with the electrical work, be sure to turn the starter switch to “LOCK” position, wait at least 10 minutes, and disconnect the battery negative terminal.
- When the wheelbase is lengthened or shortened, the harness wire removal must be minimized in the required range by the work.  
The care must be taken not to damage the harness wires during the work.
- When the wheelbase is shortened, the excessive harness wires on the original vehicle must be bundled as shown in the figure below, and then they must be clipped securely by using original clip holes on the side rails.

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.

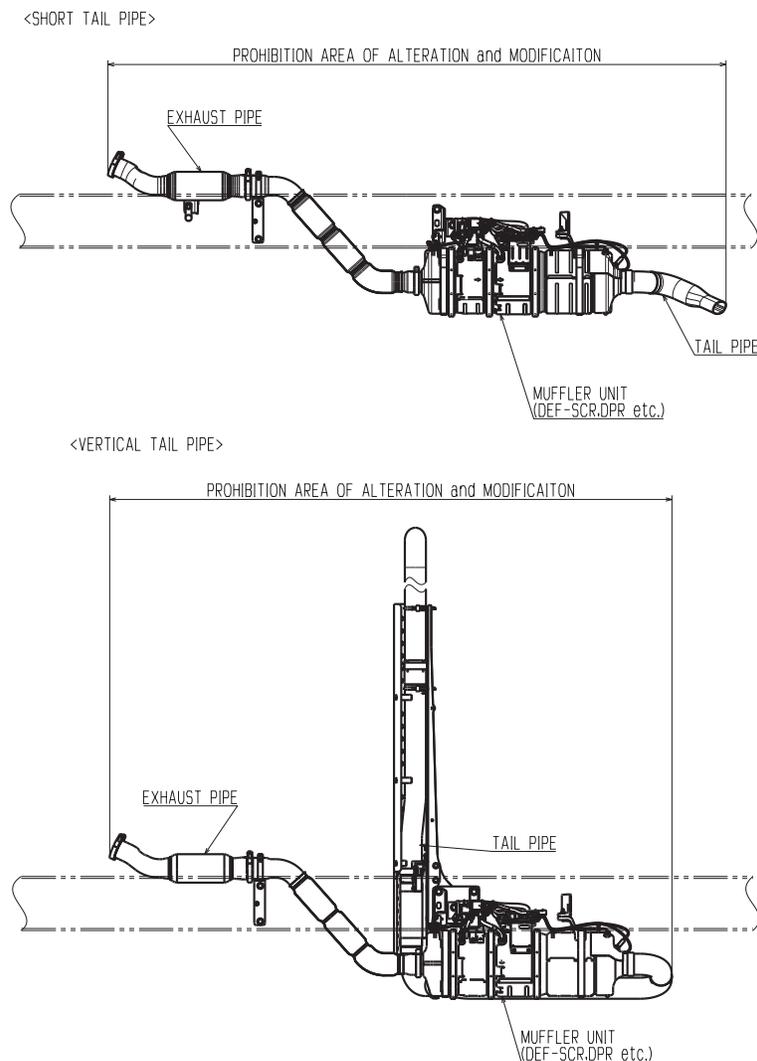
## 13. ALTERATION OF EXHAUST SYSTEM

- The body builder “Must” not modify or relocate any devices included in the emissions system. It is also the case that there should not be any modifications made to the exhaust piping from turbo outlet to aftertreatment inlet. Doing so may result in the voiding of all warranties and the occurrence of an emissions noncompliance event that may be considered tampering and punishable by the assessment of penalties by the EPA and ARB as well as the need for remedial measures.
- Modification of the emissions system can only be done with the preapproval of Cummins and chassis OEM. Body builders’ first point of contact concerning emissions systems modifications “Must” be the chassis OEM. The chassis OEM will notify Cummins of the potential modification of any engine component. If an emissions systems modification is preapproved, the chassis OEM “Must” supply the necessary information and kits (if available from the OEM) to properly perform the modification.

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

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

### Prohibition Area of Alteration and Modification



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

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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.