BODY BUILDER'S DRAWINGS AND SUPPORTING DATA

FE.FG

LIT. No. LTE04001-A

JUNE 2004

3. CAUTION IN MODIFYING CHASSIS FRAMES

Modify the chassis frame according to the procedures described below.

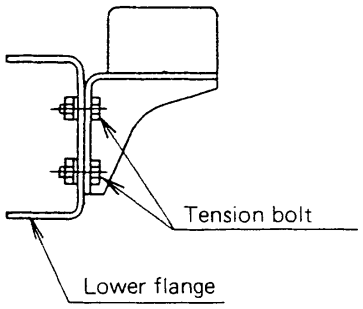
<table>
<tr><th>Modification</th><th>Cautions</th></tr>
<tr><td>3.1
Drilling frames
(General)</td><td>(1) Use proper drills. Do not use tools such as a cutting torch to drill holes.
(2) Always chamfer the edges after drilling.</td></tr>
<tr><td>3.2
Drilling side rails</td><td>(1) The hole diameters and center-to-center distance of holes should be as follows.
<table>
<tr><th></th><th>Hole diameter</th><th>Center-to-center distance of holes</th></tr>
<tr><td>Holes for tension bolt or shear bolt</td><td>11 mm (0.43 in.) max.</td><td>30 mm (1.18 in.)* min.</td></tr>
</table>
Note*: Maintain the dimensions of previously drilled holes.
<table>
<tr>
<td>Tension bolt
(Bolts subject to tension)
 

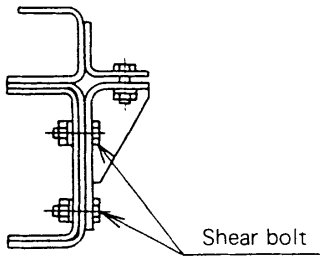
Fig. 3.1</td>
<td>Shear bolt
(Bolts subject to shearing force)
 

Fig. 3.2</td>
</tr>
</table>
(2) Do not drill holes in the upper flange.
(3) Do not drill holes in the lower flange within the wheelbase.
(4) Holes in the lower flange should be separated at least 200 mm (7.87 in.) from the crossmember, gusset end, and the spring hanger. (Refer to Fig. 3.4.)
(5) The number of holes to be drilled in the lower flange must be one in the lateral direction of the flange, and it must be more than 25 mm (0.98 in.) from the free edge of the flange.</td></tr>
</table>

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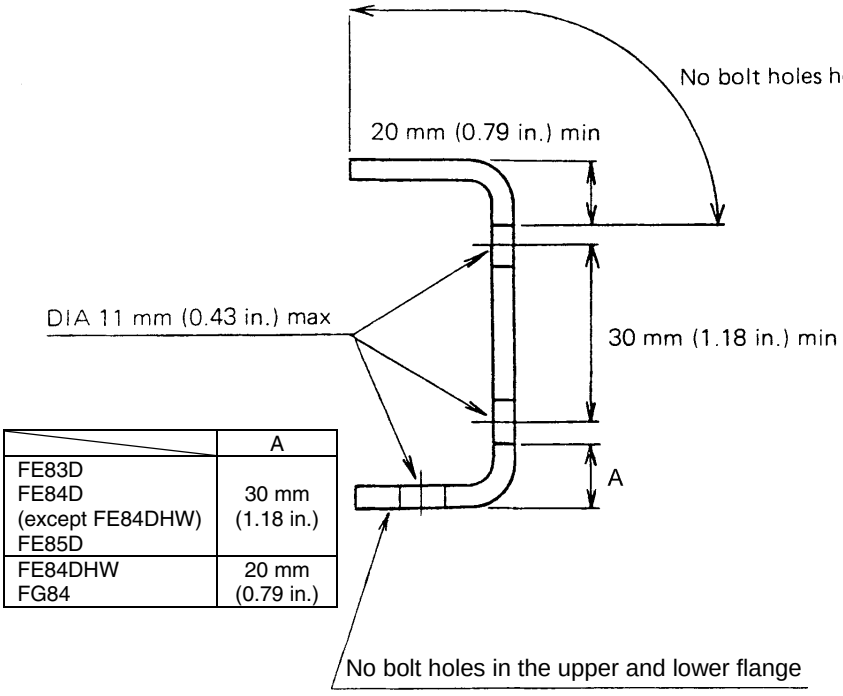
Modification	Cautions (Continued)
3.2 Drilling side rails (Continued)	(6) Do not drill holes within 20 mm (0.79 in.) from the curved part of the side rail, otherwise the bolt head may be within the radius of the curved surface of the channel.

UNIT: mm (in.)



	A
FE83D FE84D (except FE84DHW) FE85D	30 mm (1.18 in.)
FE84DHW FG84	20 mm (0.79 in.)

Fig. 3.3

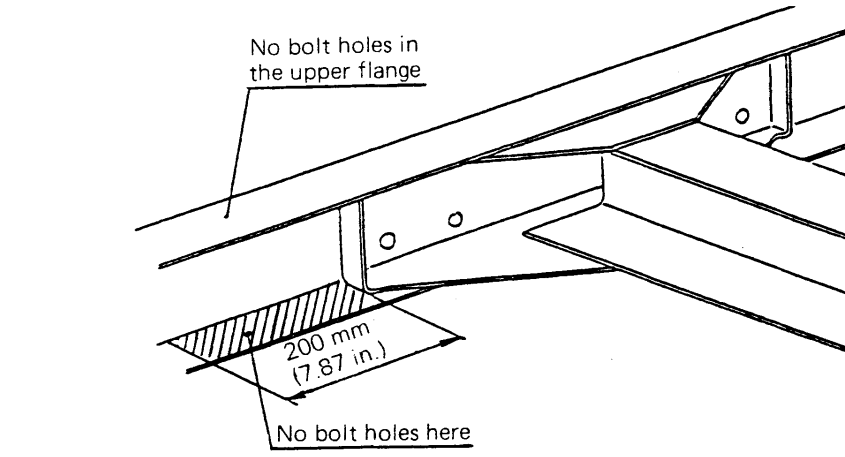


Fig. 3.4

Modification	Cautions (Continued)
3.3 Drilling crossmembers	(1) The holes and distances between the holes should conform to the values specified in the chart below.

Crossmember type	Hole diameter	Center-to-center distance of holes
○ Alligator type (see Fig. 3.5) ○ Channel type (see Fig. 3.6)	9 mm (0.35 in.) max.	30 mm (1.18 in.)* min.

Note*: Maintain the dimensions of previously drilled holes.

(2) Holes should be more than 100 mm (3.94 in.) away from the end of the side rail flange or the end of the gusset.

(3) Holes in the web of the channel type crossmember should be 50 mm (1.97 in.) min. from the end of the crossmember. (Refer to Fig. 3.6)

(4) Holes in the flange should be more than 25 mm (0.98 in.) from the end.

(5) Holes should be drilled more than 20 mm (0.79 in.) from the curved part of the flange.

Alligator type

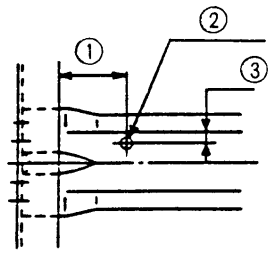


Fig. 3.5

Channel type

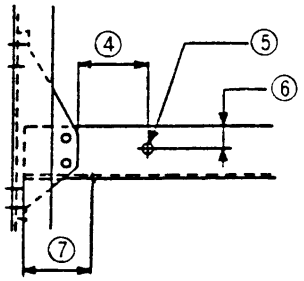


Fig. 3.6

① 100 mm (3.94 in.) min
② DIA 9 mm (0.35 in.) max
③ 25 mm (0.98 in.) min
④ 100 mm (3.94 in.) min
⑤ DIA 9 mm (0.35 in.) max
⑥ 25 mm (0.98 in.) min
⑦ 50 mm (1.97 in.) min (Web surface)

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Modification	Cautions (Continued)
3.4 Welding to frame	(1) Do not weld any part to the flange of the side rails. Welding on the lower flange within the wheelbase is strictly prohibited. (2) Do not weld anything within 20 mm (0.79 in.) of the curve in the side rail.

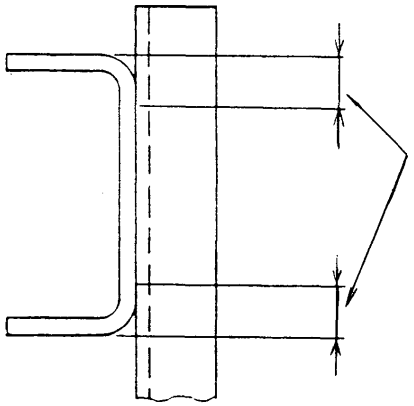


Fig. 3.7

(3) Do not weld any item to the frame to hold it temporarily.

(4) Clean parts thoroughly with a wire brush and dry them off before welding.

(5) Make sure the paint is completely removed, before welding a painted part.

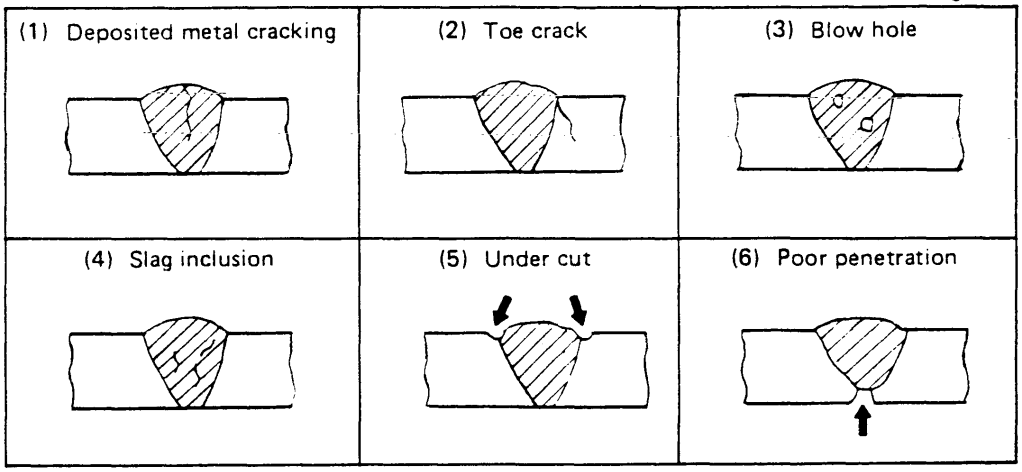
(6) Use a low hydrogen type welding electrode. The welding electrode absorbs moisture when it is used, so it is necessary to dry it thoroughly before use.

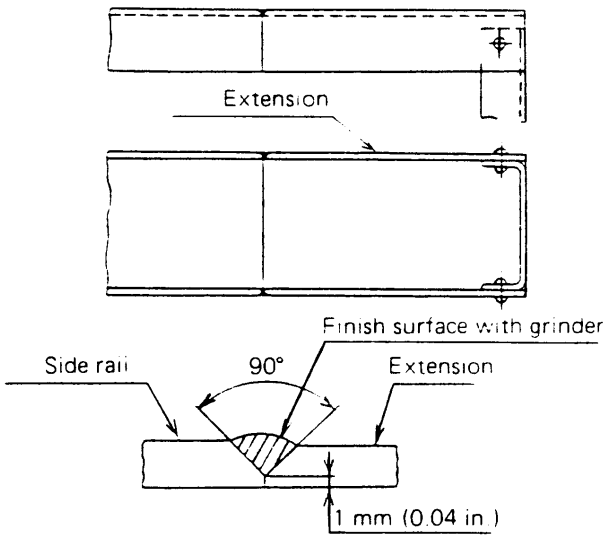
(7) When welding, maintain the optimum welding speed and conditions for the preservation of the welding electrode.

(8) Maintain the welding current at the optimum value for safety.

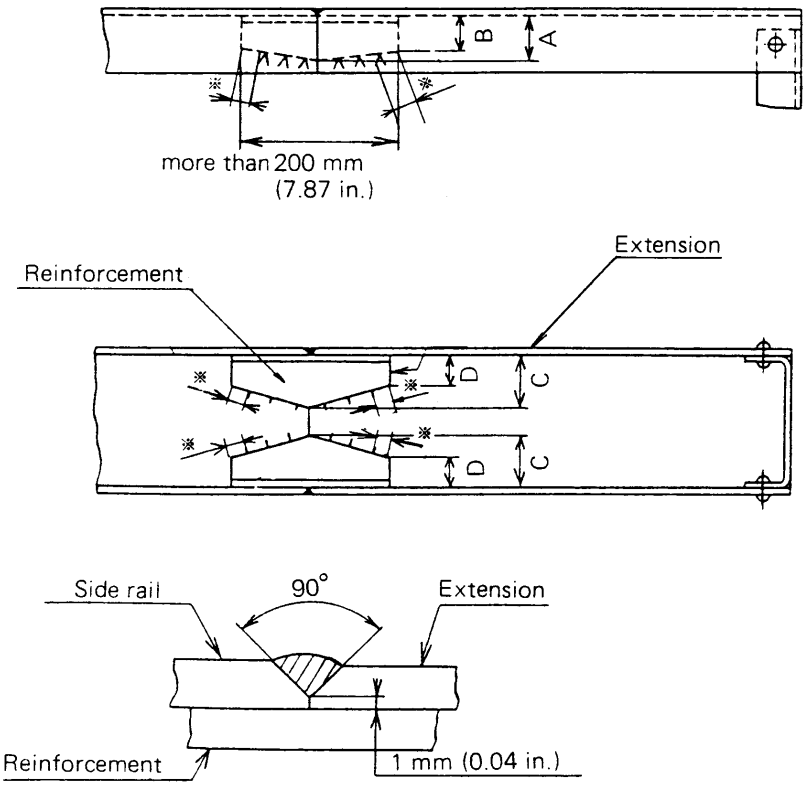
(9) Avoid defects such as deposited metal cracking, toe crack, blow holes, slag inclusion, under cut, poor penetration, etc.

Fig. 3.8



Modification	Cautions (Continued)
3.4 Welding to frame (Continued)	(10) When connecting the ground cable of the arc welder, make sure to disconnect the negative terminal from the battery. The ground of the welder should be connected to the side rail near the welded part. Never connect around the engine, transmission, propeller shaft, front and rear axles, etc. (11) When performing welding work on the chassis, take proper measures to prevent the tubes, harnesses, rubber parts, springs, etc. from heat or spatter. (12) Do not cool parts off with water after welding. **CAUTION ⚠** Before performing electric or arc welding as part of vehicle repair operation, disconnect the negative (–) cable from the battery and the connector from the ECU. The earth cable of the welding machine should be connected to a point as close to the welding area as possible.
3.5 Extension of rear overhang	Extension of the rear overhang may be required. Extension procedures are listed below. (1) Added material as an extension member. Use steel plates of SAPH440 (JIS) (SAE J410 950X or the equivalent) for the frame. The cross section form should be the same as that of the side rail rear end. The plate thickness should be 4.5 mm (0.18 in.) (2) Reinforcement material. Use the same SAPH440 (JIS) (SAE J410 950X or equivalent) for the frame. The plate thickness should be 3.2 mm (0.13 in.)–4.5 mm (0.18 in.). (3) Rear overhang extension (a) Added material length less than 300 mm (11.8 in.) Butt weld continuously from the outside as shown in Fig. 3.9, and finish the welded surface by grinding. No reinforcement is required for normal usage, but reinforcement should be added as shown in (3)-(b) in order to support heavy weights on the overhang extension.  **Fig. 3.9**

Modification	Cautions (Continued)
3.5 Extension of rear overhang (Continued)	(b) Added material length of 300 mm (11.8 in.) or more Attach reinforcement on the inside of the side rail as shown in Fig. 3.10. Butt weld the additional material and the side rail continuously, and then finish the welded surface by grinding.



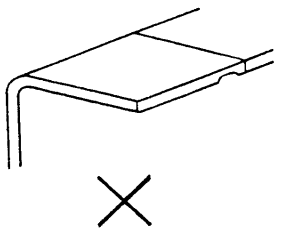
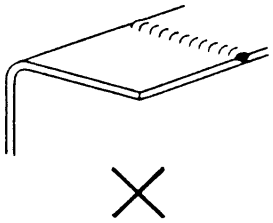
Note: There should be no contact within 10 mm (0.39 in.) of the asterisk ※ mark.

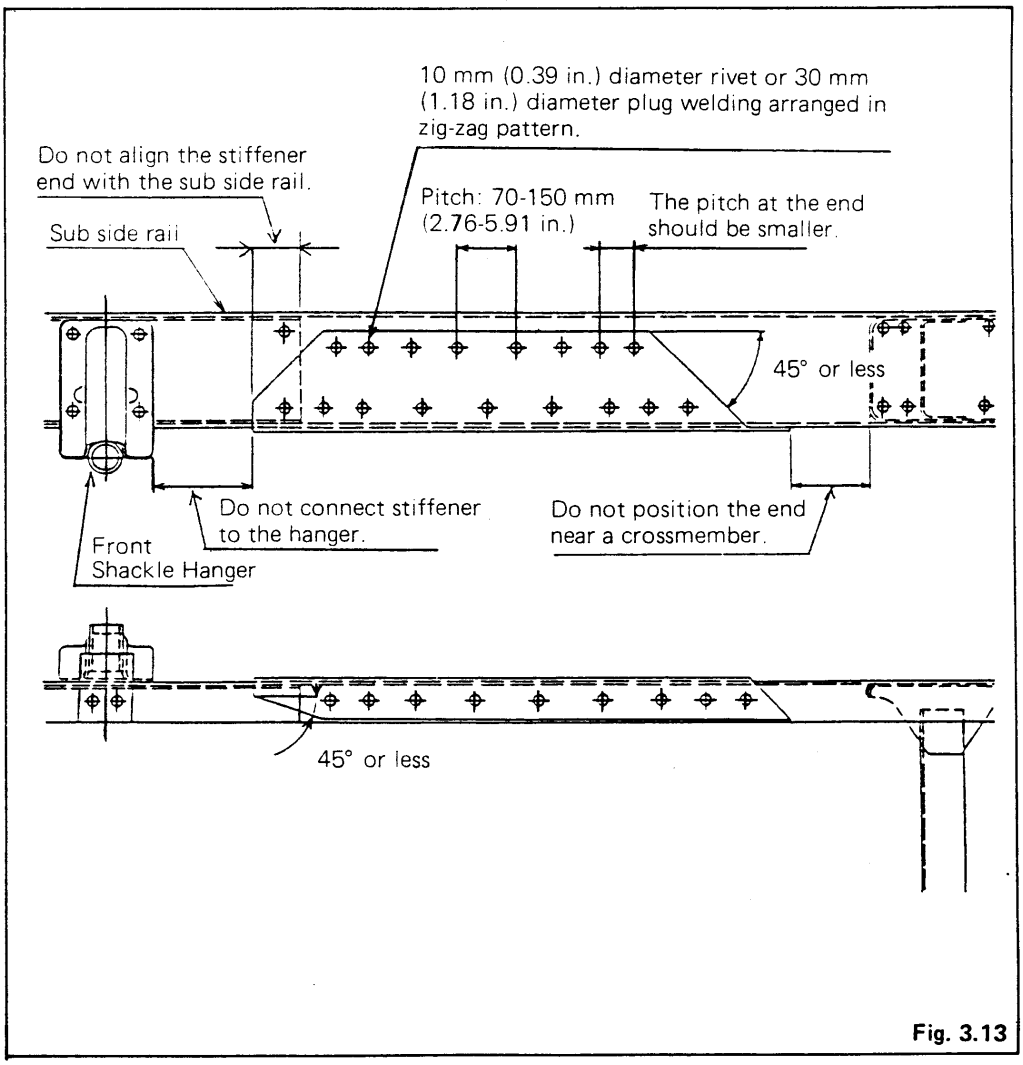
UNIT: mm (in.)

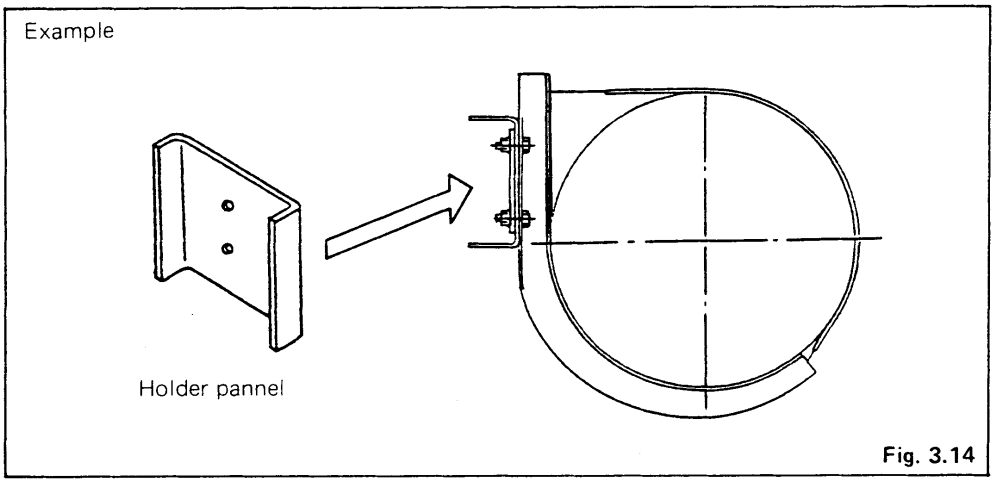
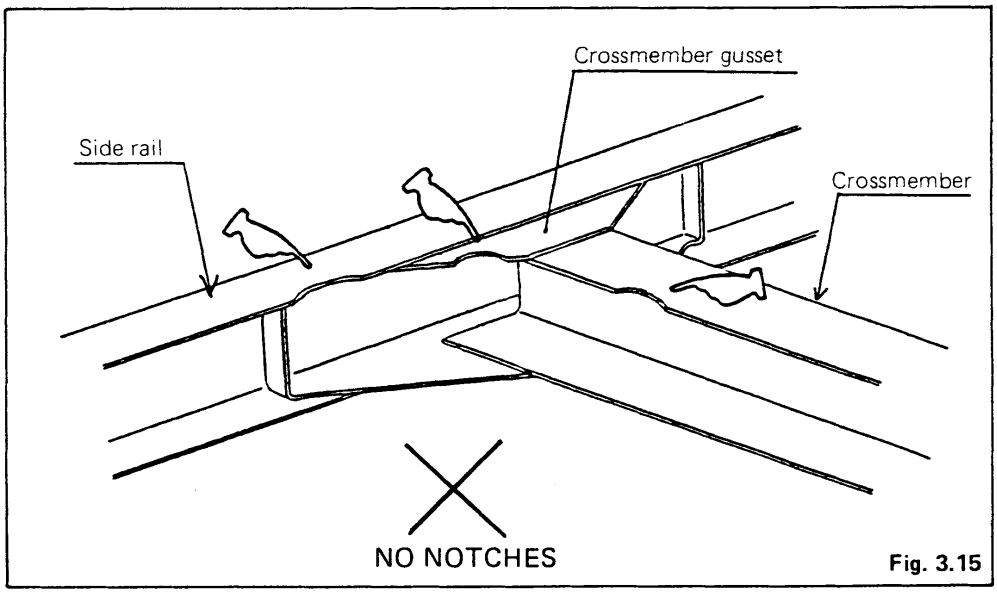
A	B	C	D
50 (1.97)	35 (1.38)	50 (1.97)	35 (1.38)

Fig. 3.10

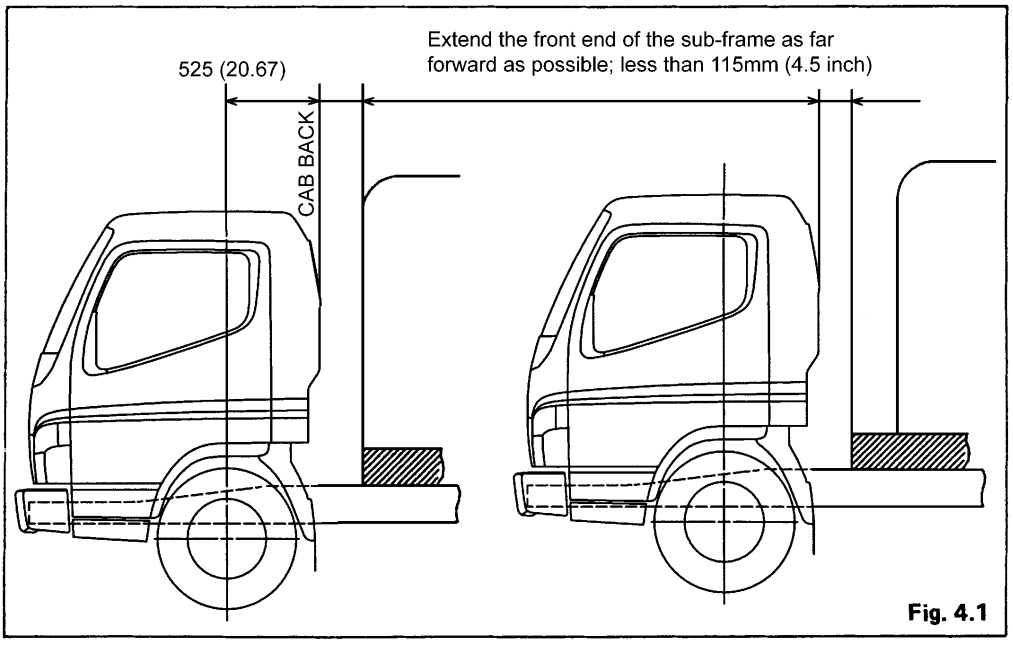
(4) Exercise great care in welding the reinforcement to the lower face of the rear side rail where it is tapered.

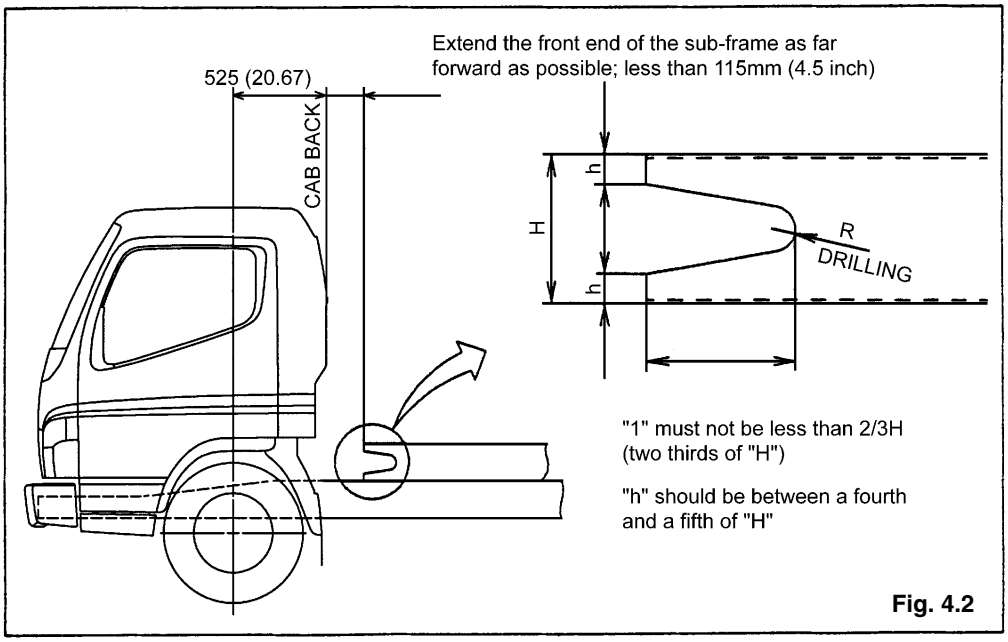
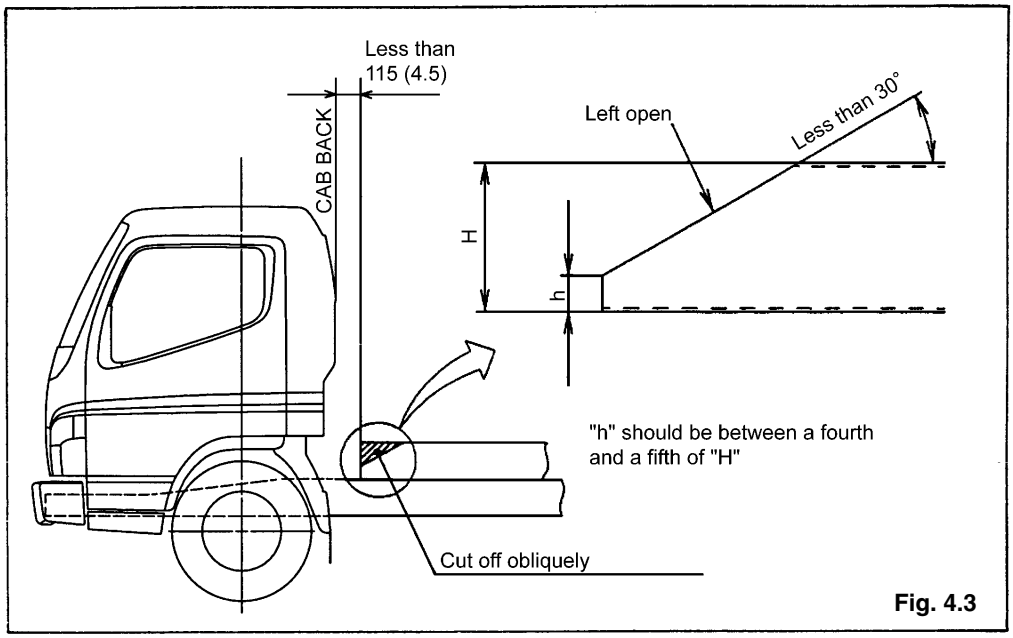
Modification	Cautions (Continued)
3.5 Extension of rear overhang (Continued)	(5) Cautions for finishing the side rails Be especially careful when finishing the flange end of the butt-welded side rails. Ensure a clean finish by grinding the weld so it is free of undercut, pileup or convexed bead. Under cut  Fig. 3.11 Pile up  Fig. 3.12
3.6 Shortening or extending the frame within the wheelbase	Frames should not be extended or shortened within the wheelbase because considerations for the propeller shaft length, balancing, position of center bearings, brake piping and harness length are required. If this is unavoidable, contact MFTA for advice.
3.7 Reinforcement on side rail	Avoid adding outside reinforcement to the side rail, as this can actually produce stress concentrations which cause cracks in the frame. If additional reinforcement is absolutely necessary, perform the procedures described below. (1) An L-shaped stiffener is recommended. The channel type stiffener should not be used as it produces a gap with the side rail flange. (2) Position the L-shaped stiffeners so the flange will be on the side of the side rail stress that receives the tension (the lower surface within the wheelbase and the upper side for the overhang). (3) Do not align the stiffener ends with the ends of the sub side rail that have already been installed. (Refer to Fig. 3.13) (4) Do not position the ends of the stiffener near stress concentration locations such as the rear surface of the cab, spring hangers, crossmember ends, etc. (5) Do not cut the outer stiffener ends vertically. They should be cut at an angle of less than 45°. (Refer to Fig. 3.13) (6) Attach the stiffeners and the side rail by riveting or plug welding on the web. (7) When drilling rivet holes, the outer stiffeners and side rails should be processed together. The difference between the rivet and hole diameters should be less than 0.7 mm (0.03 in.). The rivet holes should be separated from the side rail corners by 20 mm (0.79 in.).

Modification	Cautions (Continued)
3.7 Reinforcement on side rail (Continued)	(8) Use rivets which have a 10 mm (0.39 in.) diameter. Arrange them in a zig-zag pattern. (9) Separate rivets and bolts at least 70 mm (2.76 in.) to prevent heat damage or distortion when they are plug welded. (10) Holes for plug welding should be at least 30 mm (1.18 in.) dia and arranged in a zig-zag pattern. (11) Position the end of the stiffeners 25 mm – 30 mm (0.98 in. – 1.18 in.) from the holes for rivets or plug welds. (12) The pitch for rivets and plug welds should be 70 mm – 150 mm (2.76 in. – 5.91 in.). Keep the pitch small near the edge of the stiffener. (13) Do not drill any additional holes in the side rail flange. Only use the holes which have been already drilled in the flange.  Fig. 3.13

Modification	Cautions (Continued)
3.8 Mounting equipment on the side rail	(1) Attach a stiffener to the inside of the side rail as shown in Fig. 3.14 when installing bolts to support heavy components on the side rail overhang. This will prevent cracks in the frame due to resonance of the component if the static load caused by the weight of the component exceeds 100 kg. (220.5 lbs.) of force for each bolt.  Fig. 3.14 (2) As a rule, avoid attaching additional equipment together with components (fuel tank, battery, etc.) which are already installed to the frame side. When this is absolutely necessary, increase the size of the bolts, or the number of bolt locations, to decrease the stress on each bolt.
3.9 Others	Never drill or grind any notches in the side rail, crossmember flange, or crossmember gusset.  Fig. 3.15

4. CAUTIONS IN MOUNTING A REAR BODY

Location	Cautions
4.1 General cautions	(1) To ensure vehicle safety, reliability and maintenance, do not perform any of the following modifications or alterations to the chassis. (a) Cutting any part of the cab or welding anything to the cab. (b) Modyfing any part related to the axle, steering, brake or propeller shaft. (c) Modyfing brake hoses or vacuum lines. (Use MFTBC replacement parts only.) (d) Making any modification to the chassis other than those described in this manual. (2) Make an effort to minimize the weight of the body mounting so that it will not jeopadize the strength or rigidity of the frame. (3) Be sure to install a sub-frame securely on the chassis frame so as to evenly distribute the load on the vehicle. (4) Do not modify the engine cooling system components, such as blocking the air intakes in the front bumper, or removing the radiator seal rubber, as it may result in decreased performance or engine damage. (5) Always observe any applicable law when modifying parts related to noise suppression, such as the muffler to exhaust pipes.
4.2 Sub-frame	(1) Install the sub-frame as shown in Fig.4.1 to gradually reduce the stress concentrations in the front end. The front end of the sub-frame should be installed as close to the rear of the cab as possible. Extend the sub-frame as far toward the cab as possible when the rear body is installed far from the cab. UNIT: mm (in.)  Fig. 4.1

Location	Cautions (Continued)
4.2 Sub-frame (Continued)	(2) Examples of front-end shape of sub-frames (a) Install the sub-frame having the shape as shown in Fig. 4.2 to gradually reduce the stress concentrations in the front end. UNIT: mm (in.)  Fig. 4.2 (b) The shape of the sub-frame front end as shown in Fig. 4.2 is highly desirable. However, if there is enough room behind the cab, the shape as shown in Fig. 4.3 is also acceptable.  Fig. 4.3

Location	Cautions (Continued)
4.2 Sub-frame (Continued)	(c) If it is difficult to shape the front end of the sub-frame as described in Fig. 4.2 and Fig. 4.3, cut it to the shape as shown in Fig. 4.4 before installation.

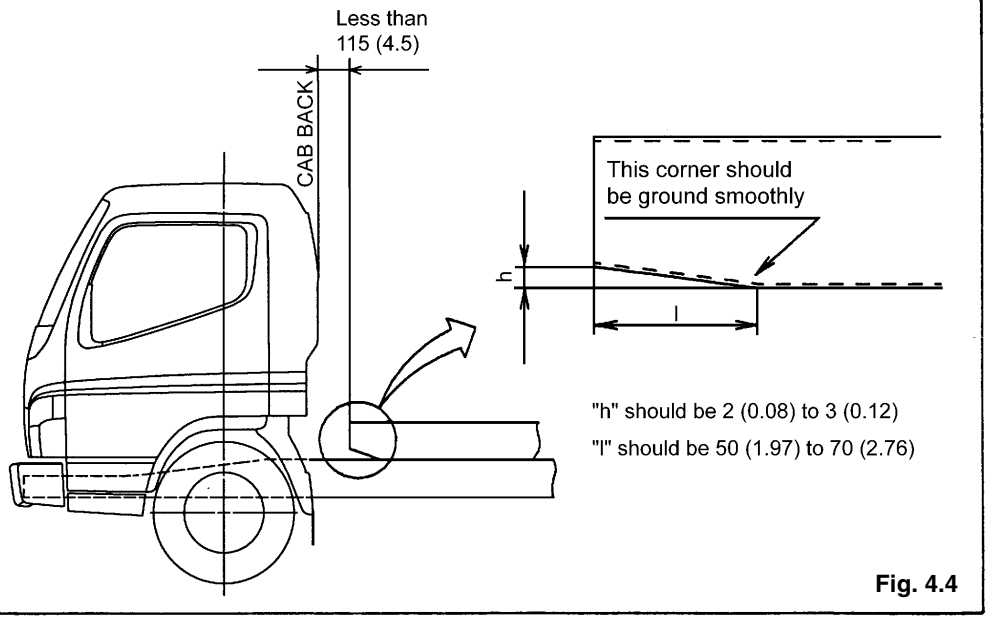
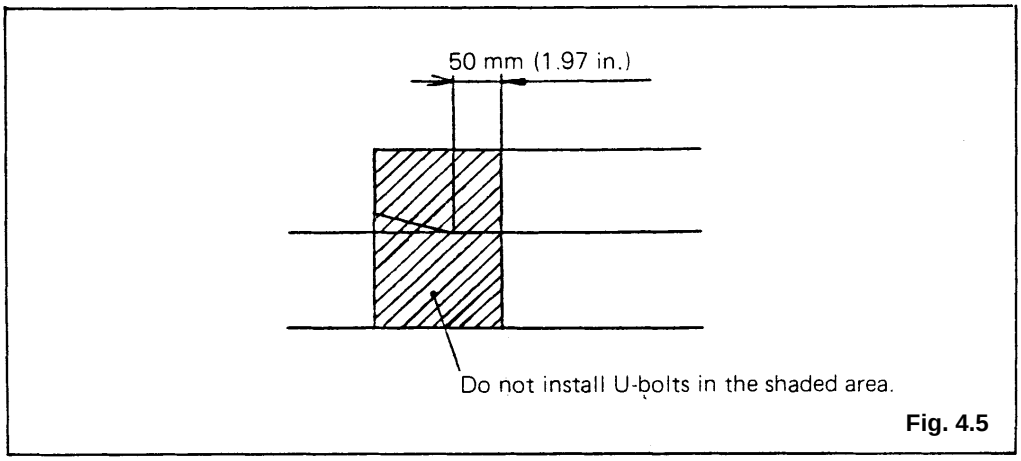
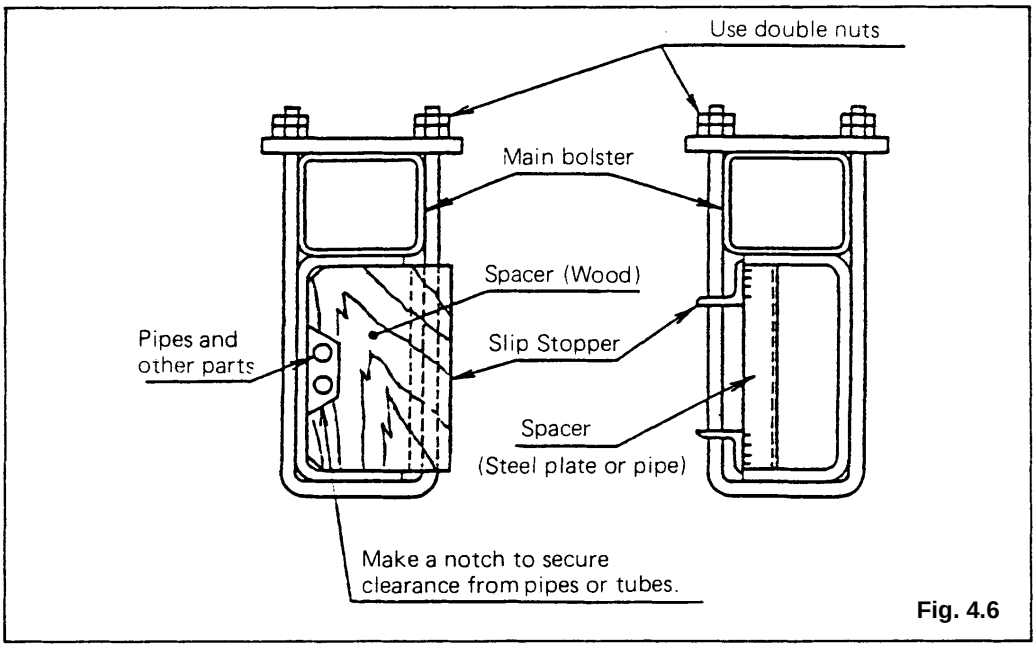
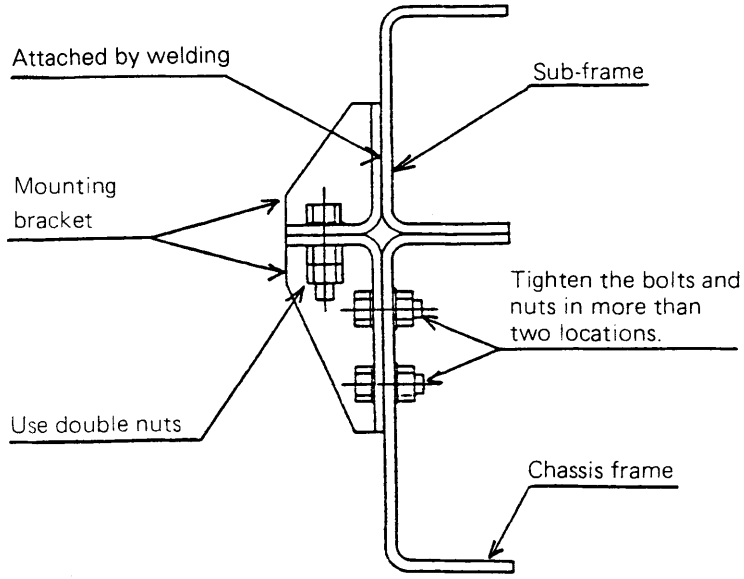
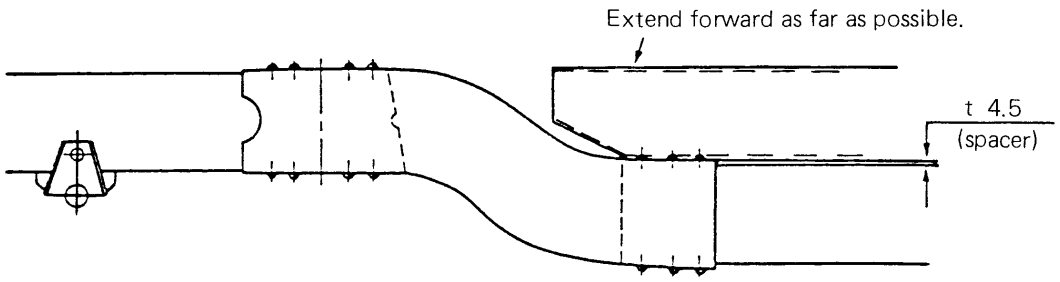
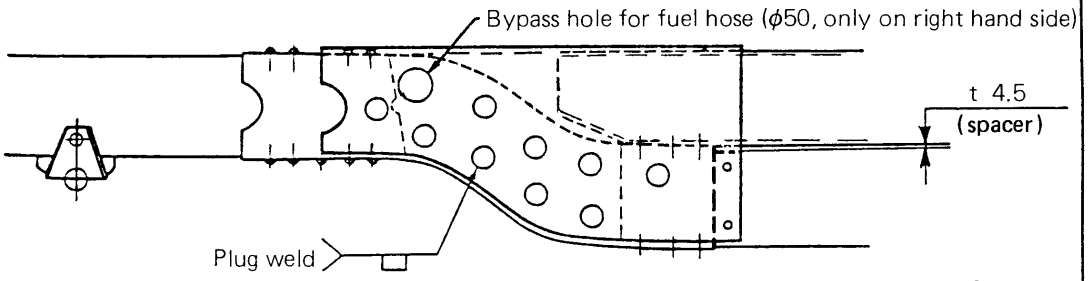
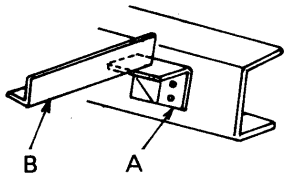
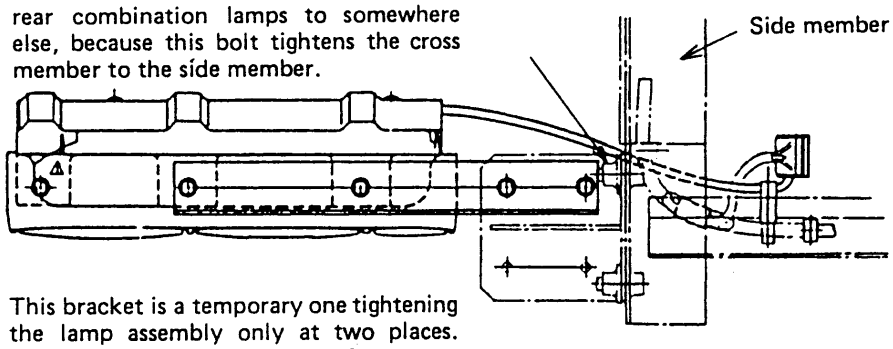
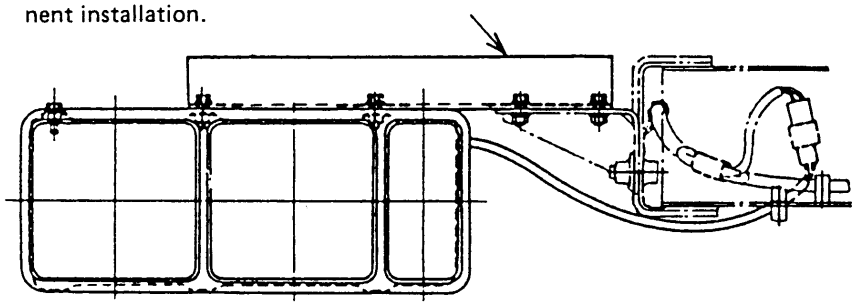


Fig. 4.4

Location	Cautions (Continued)
4.3 Attaching with U-bolts	(1) Allow sufficient clearance so that the U-bolts for tightening sub-frames or main bolsters do not come in contact with pipes, hoses, wires and harnesses. (2) Do not install U-bolts at the taper-cut position of the sub-frames or main bolster.  **Fig. 4.5** (3) Place a wooden spacer inside the flange of the side rail to avoid bending when tightening the U-bolts. (4) Use metal spacers in locations subject to heat, such as near the muffler, or other places where it is difficult to place wooden spacers.  **Fig. 4.6**

Location	Cautions (Continued)
4.4 Mounting bracket	When U-bolts cannot be used with a particular body, use mounting brackets in those positions to attach it to the sub-frame. Use the following bracket locations and installation procedures. (a) Attach the mounting brackets to the chassis frame with bolts whenever possible, and follow the procedures described in Section 3, "CAUTION IN MODIFYING CHASSIS FRAMES". Be especially careful not to damage any pipes, hoses, and wiring harnesses attached to or around the frame. (b) Do not attach brackets close to the ends of crossmembers, gussets or stiffeners. Brackets should be installed at least 200 mm (7.87 in.) away from the end of these parts.  **Fig. 4.7**

Location	Caution (Continued)
4.5 Mounting of rear body (FG only)	(1) When mounting a subframe on the 4WD frame, follow the instructions below. (a) For general uses  **Fig. 4.8** (b) For cases where there may be stress concentration on the chassis frame or excessive input. Reinforce the frame using an L-shaped stiffener as shown in the figure below. Be sure to tighten the plug weld (ϕ30), existing battery, fuel tank, spare-tire hanger, etc. at the same time.  **Fig. 4.9** (2) For installing a dump body, install a float control valve in the hydraulic system to avoid an abrupt dump action with heavy cargo loaded.

Location	Cautions (Continued)
4.6 Attaching of the rear comb. lamps	Don't remove bracket A. Don't keep the rear comb. lamps on the bracket B. Please install them securely.  **Fig. 4.10** Never remove this bolt when moving the rear combination lamps to somewhere else, because this bolt tightens the cross member to the side member.  This bracket is a temporary one tightening the lamp assembly only at two places. Use a more sophisticated one for permanent installation.  **Fig. 4.11**

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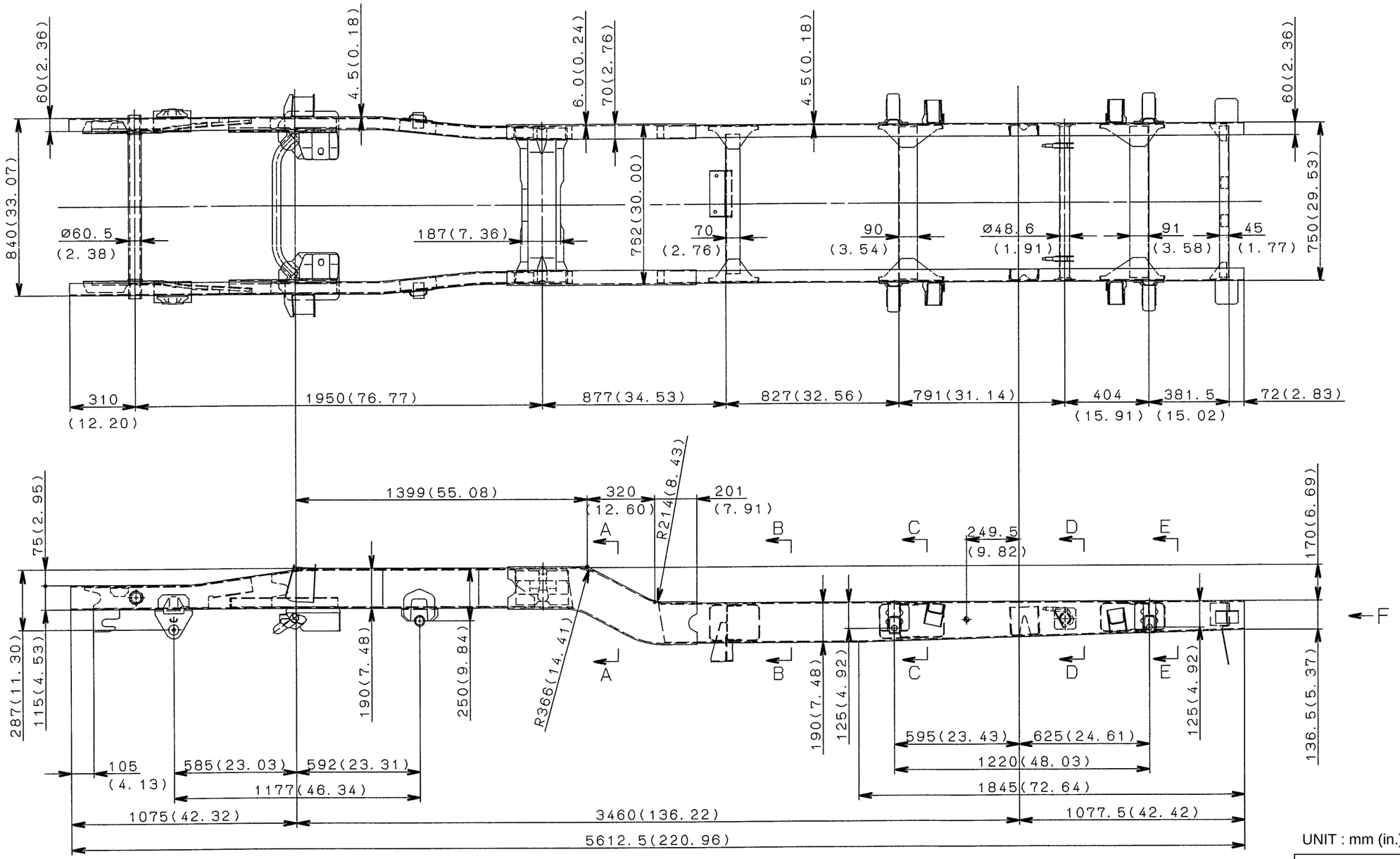
BODY BUILDER'S DRAWINGS AND SUPPORTING DATA

FE.FG

LIT. No. LTE04001-A

JUNE 2004

4.8 FG84DE6



UNIT : mm (in.)

FG84DE6 (1:30)
Frame Layout

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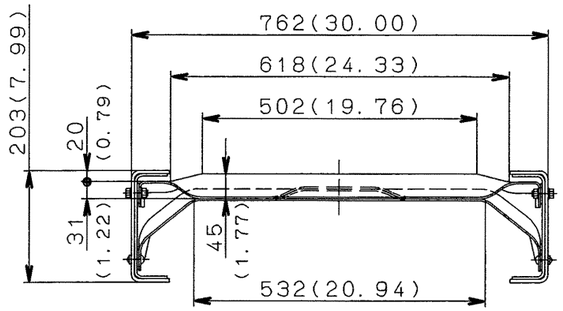
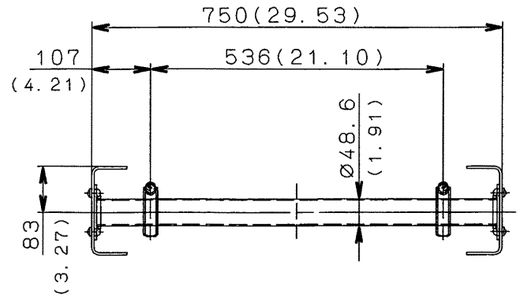
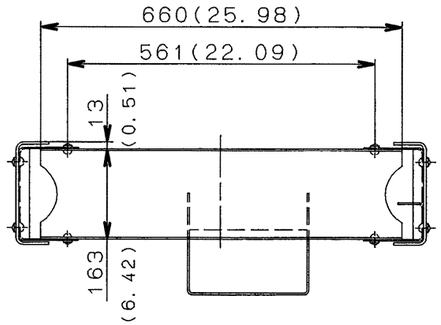
5.3 FG Series



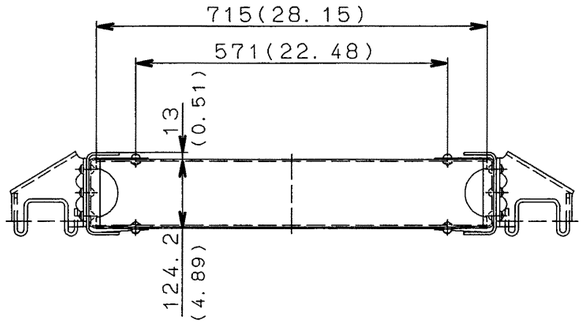
SECT A-A



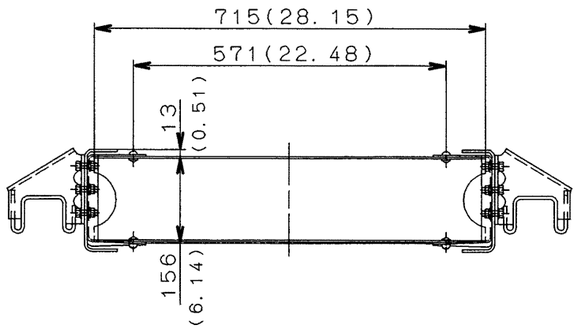
SECT D-D



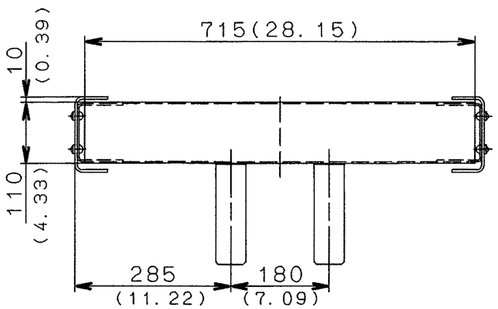
SECT B-B



SECT E-E



SECT C-C



SECT F-F

UNIT : mm (in.)

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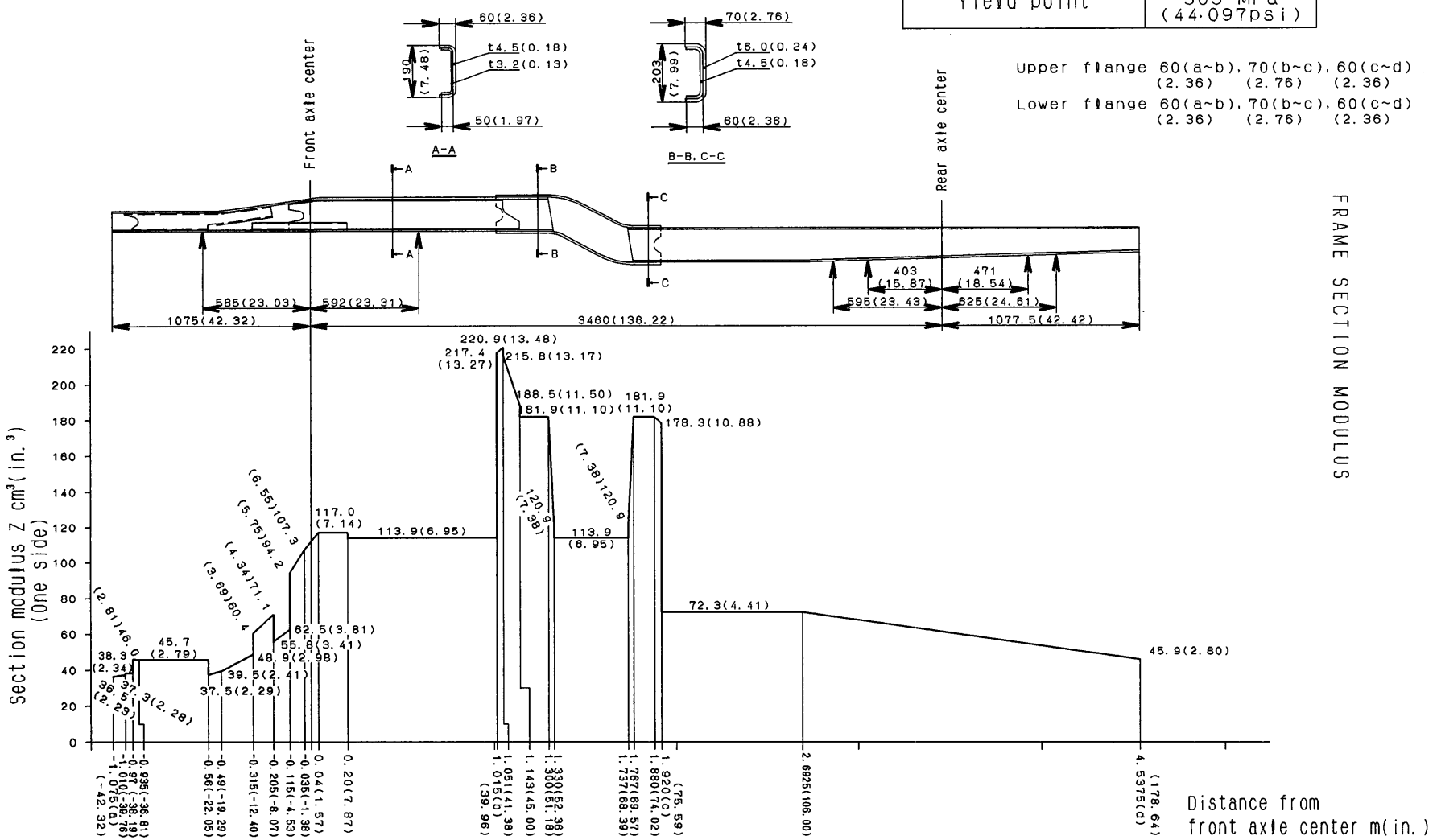
6.8 FG84DE6

Frame material	SAPH440(JIS)
Tensile strength	440 MPa (64.011psi)
Yield point	305 MPa (44.097psi)

Model FG84DE6 Chassis frame section modulus(one side)



Upper flange 60(a~b), 70(b~c), 60(c~d)
(2.36) (2.76) (2.36)

Lower flange 60(a~b), 70(b~c), 60(c~d)
(2.36) (2.76) (2.36)

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