SERVICE MANUAL SECTION

FRAME - MXT

Model: MXT

S01002

07/28/2006

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1. INTRODUCTION

This service manual is meant specifically for use with the International MXT Medium Duty Truck.

NOTE – Refer to Frame Service Manual, S01001, for complete Frame service information.

2. DESCRIPTION

The frame is the structure that carries and supports the rated load under anticipated driving conditions and secures the major components of a vehicle in their relative positions. The MXT frame assembly consists of two sidemembers and seven or more crossmembers.

The MXT vehicle has two major frame assemblies each with a different rear bumper/tailgate design to accommodate various vehicle applications. One frame assembly has a step rear bumper with a 90-degree swing-down tailgate. The other frame assembly has a non-step rear bumper with a 180-degree swing-down tailgate.

The MXT frame assembly is unique because the width measurements (Figure 1) and height measurements (Figure 2) change at two points.

WIDTH (Figure 1)

A. just in front of the back of the crew cab - the frame width is 37”
B. just behind the crew cab - the frame width is 34”, nominal

HEIGHT (Figure 2) (measured at the top of the frame)

The center section of the frame is:

A. 11.5” below the front section of the frame, and
B. 9” below the rear section of the frame.

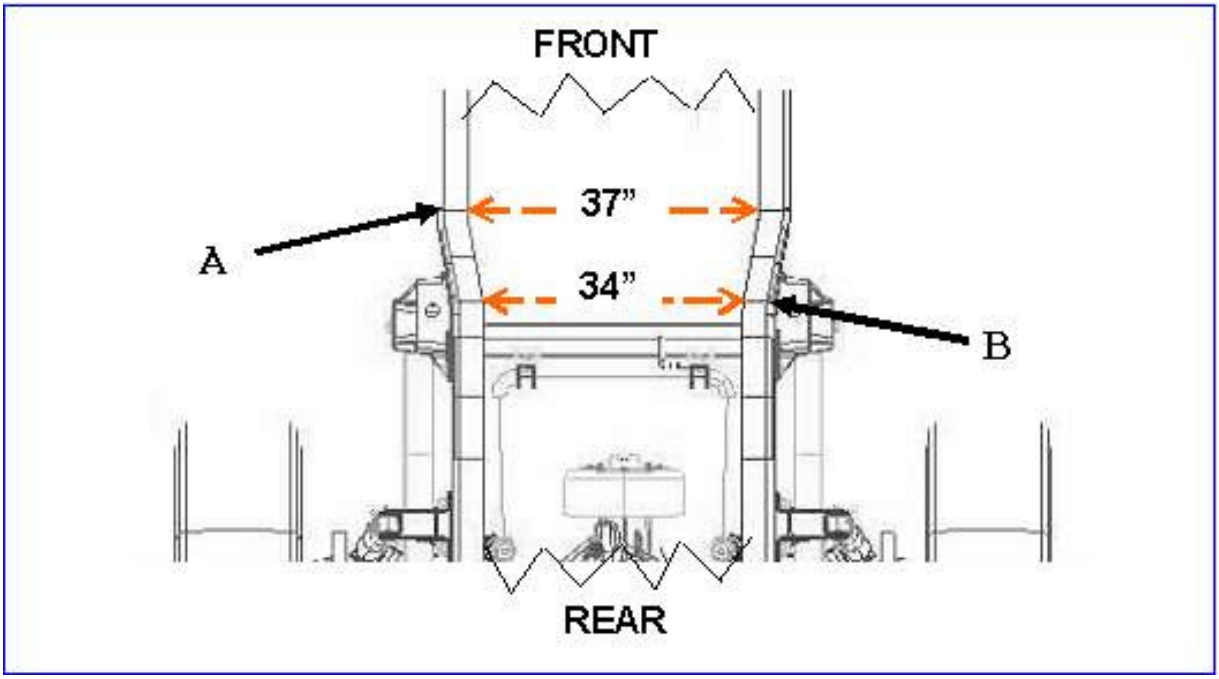


Figure 1 MXT Vehicle Frame Plan View Showing Frame Width Variations

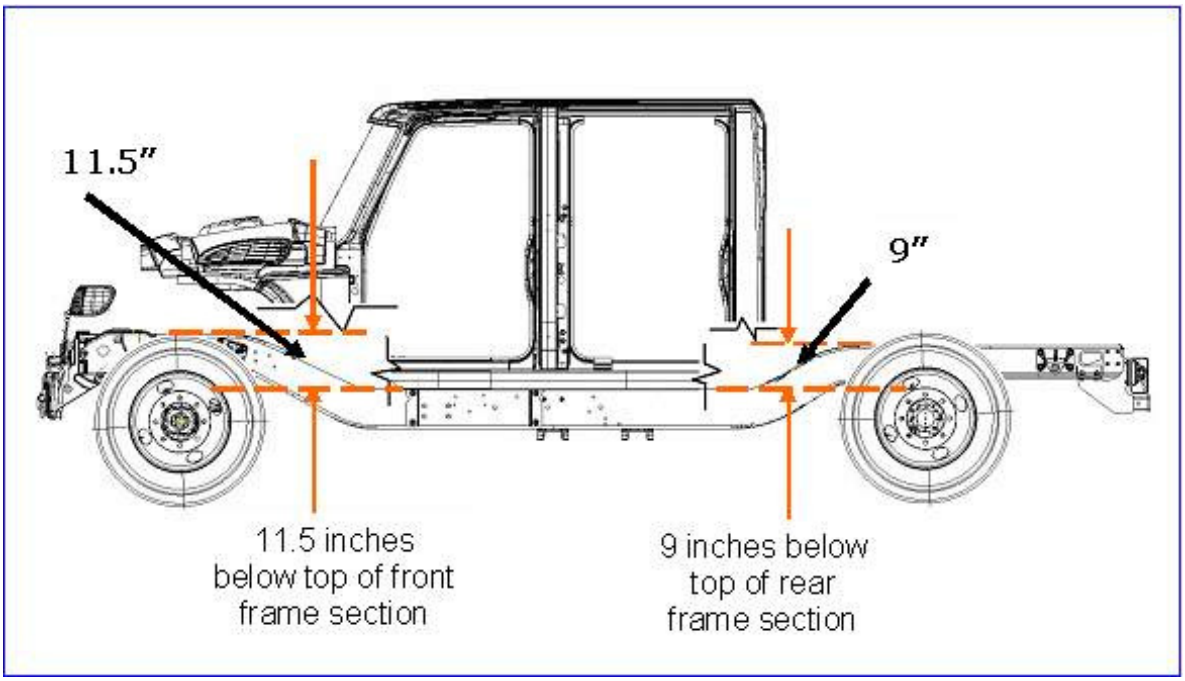


Figure 2 MXT Vehicle Frame Side View Showing Frame Height Variations

3. GENERAL FRAME RECOMMENDATIONS

It is very important that the frame be inspected periodically for cracks, buckling, crossmember loosening or other damage that may cause eventual failure of the frame. Additional inspections should be made whenever

the chassis has been overloaded or involved in an accident. An alignment check **is not sufficient** since local cracks, crossmember loosening or sidemember buckling will not necessarily cause misalignment.

On reinforced sidemember sections, when cracks exist in either of the sidemember sections, the members must be separated for repair. After separation follow the procedures for non-reinforced sections. The two sidemember sections **must not** be welded together. After the weld repairs, the sections should be reinforced with the appropriate section and re-assembled with mounting bolts tightened to SAE Grade 8 torque levels.

3.1. DRILLING OR NOTCHING

Sidemembers should not be drilled or notched without approval from International Engineering. The maximum allowable sidemember hole size in the unrestricted zones shown in Figure 12 (located in the DRILLING (See DRILLING, page 22) section of this service section) is 11/16 inch (17 mm).

3.2. WELDING OR FLAME CUTTING

Welding or flame cutting of the frame components is unacceptable because of the associated loss of fatigue strength. This restriction applies not only to the heat-treated components, but also the high strength low alloy (HSLA) and low carbon steel components.

Exceptions to this are cases with International Engineering approval or for repair operations as described in this service manual section.

3.3. REINFORCEMENT TO INCREASE CAPACITY

Reinforcement of the chassis frame to support either additional loading or concentrated loading does not increase vehicle load carrying capacity unless it has been fully verified that all other vehicle components, such as the brake system, steering system, suspension system, etc. can properly and safely support the increased loading.

3.4. INCREASE IN LOCAL STRESS

In any modification of the chassis frame, the addition of holes, reinforcements, welds, clamps, splices, etc., may cause an increase in the local stress in the frame at the point of the modification, **therefore causing a stress concentration in the frame sidemember(s).**

These local stress concentrations can significantly affect the life of the chassis frame. The specific effect which the stress concentrator will have on the life of the chassis frame is influenced by the location of the stress concentration, the frequency and severity of the loading, and the magnitude of stress concentration.

Deviation from the repair procedures in this section may void manufacturer’s warranty.

4. IDENTIFICATION OF FRAME RAIL MATERIAL

International chassis are manufactured with frame rails of different alloy steels and some are heat-treated. Each material must be handled in a specific manner to assure maximum service life; therefore, the frame material must be determined before attempting repair or modification.

International chassis are presently manufactured with frame rails of:

- Mild steel (36,000 PSI yield strength)
- High strength low alloy (HSLA) steel (50,000, 60,000 and 80,000 PSI yield strength)

- Heat treated steel (110,000 psi yield strength).

Each type has different repair procedures. The frame rail material can be determined by inspecting the frame and consulting the dealer vehicle linesetting ticket and the sales data book.

Heat-treated rails are marked on the inside of the section with a decal which cautions against welding, flame cutting or the addition of holes in critical zones. These practices are restricted for all frame rails, however, **heat-treated** rails are much more sensitive to these alterations.

5. FRAME DAMAGE

The major sources of frame damage are accidents, overloading the vehicle, and local overstressing due to a variety of causes. In accident cases, the reasons for the damage are readily apparent. Such damage may often be repaired by:

- Straightening and reinforcing the frame.
- Repairing the damaged area and reinforcing the frame sidemember.
- Replacing the frame sidemembers and crossmembers.

Damage to the chassis frame, such as a crack in the frame sidemember or crossmember, which is not associated with impact damage, may be an indication of overloading the vehicle. Damage to the chassis frame may also be an indication of the creation of locally high stresses due to operating conditions or equipment mounting practices. Examples of overloading are:

A. Exceeding either the gross vehicle weight rating (GVWR) or the gross axle weight rating (GAWR) (loading the frame beyond its design capacity).

B. Uneven load distribution.

C. Using the vehicle in operating conditions or with equipment it was not designed for.

Examples of creation of locally high stresses are:

A. Mounting bodies or equipment in a manner that causes stress concentrations and/or abrasive wear in either the flange or web portion of the sidemember.

B. Improper modification or repair of frame components.

C. Equipment which is susceptible to resonant vibration due to excess flexibility of its mounting.

Frame damage may also be caused by corrosion resulting from the contact between dissimilar metals.

Damage to the chassis frame, which is not associated with impact damage, should not be repaired until the cause of the damage has been determined and corrective actions taken to prevent re-occurrence of the non-impact damage.

6. WELDING AND REINFORCEMENT

The guidelines below deal with the general procedures for weld repair and reinforcement. Because of the many variables associated with these repairs, it is recommended that your field service representative be consulted prior to undertaking the repair. This will also help to determine whether a specific set of recommendations has already been developed for the case in question.

The essential elements of repairing the sidemembers are the restoring of **both** the shape and local strength so that the load capacity is at least as good as before the damage occurred. The sidemembers may *look* like new, but may have local strength reduction due to small cracks or material strength reduction. Even if the frame has acceptable alignment and there is no gross deformation, local deformations may reduce the strength in the area to be weld repaired. Examples of this are local bulges in the web (vertical portion) of the section and buckling of the flanges. These local deformations must be repaired by straightening before proceeding with the weld repair.

6.1. WELDING PRECAUTIONS

When welding on any vehicle, care must be taken to prevent damage to the electronic components. Vehicles with ELECTRONIC ENGINE CONTROL SYSTEMS require additional precautions.

> **CAUTION – On any vehicle, disconnect both the positive and negative battery cables from the battery before welding on the vehicle. Attach the welder ground cable as close as possible to the part being welded.**

With an electronic engine controller (such as Celect), do not connect the ground cable to the control module(s) or the cooling plate. To protect the control module(s), it is mandatory to remove all connectors going to the control modules.

The following is a general guideline for the steel frames (36,000, 50,000, and 110,000 PSI yield strength).

Welding and reinforcing the frame rails is a satisfactory repair method for mild steel (36,000 PSI yield strength) frame rails.

Welding of the HSLA (50,000, 60,000 and 80,000 PSI yield strength) steel side member and the heat-treated (110,000 PSI yield strength) steel sidemember involves a significant reduction in the strength of the frame in the heat affected zones of the weldment. This means that the frame in the welded region is no longer capable of carrying the same load or stress as the original section.

To restore the strength of the frame rails after welding, the welded area must be reinforced using reinforcements as indicated in REPAIR AND REINFORCEMENT RECOMMENDED PROCEDURES (See REPAIR AND REINFORCEMENT RECOMMENDED PROCEDURES, page 12).

Welding must be done properly to make an effective repair. Therefore, only those who are properly trained and qualified should perform the welding repairs in this section.

6.2. REINFORCEMENT

NOTE – There is no provision to provide chassis frame reinforcement for the MXT vehicle to accommodate exceeding either the gross vehicle weight rating (GVWR) or the gross axle weight rating (GAWR).

The MXT vehicle uses rear bumper mounting brackets on both the right and left rear side rails, running from the rear bumper to just in front of the fuel tank. Figure 3 shows a cross-section of the rear bumper mounting bracket.

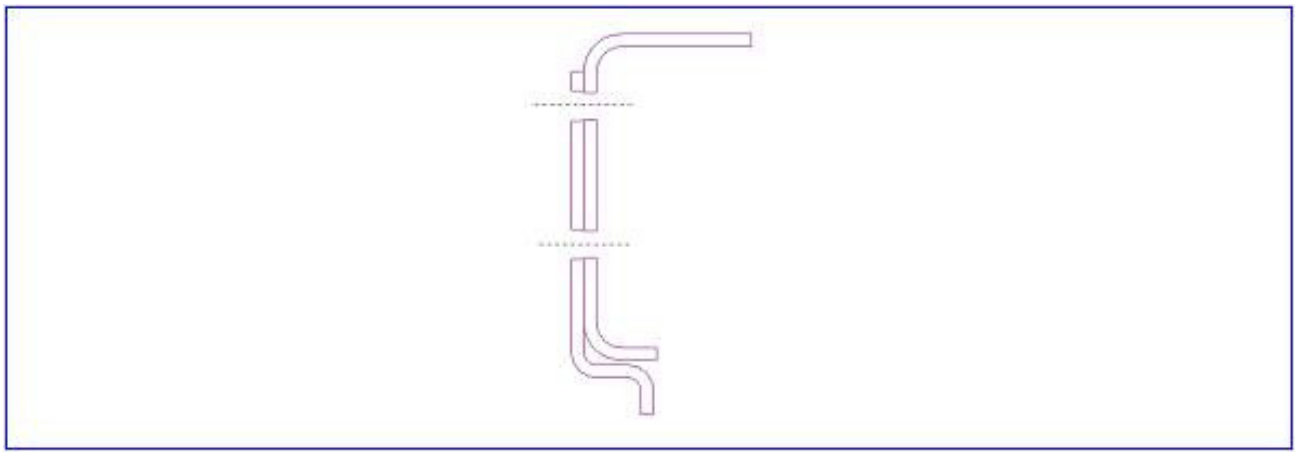


Figure 3 Left Side Rear Bumper Mounting Bracket Cross-Section

These rear bumper mounting brackets are placed around the side rail “cut-away” for a length of 1052.88mm (41.45 in.). Plan views of the rear bumpers and the side rail assemblies show where the rear bumper mounting brackets are placed. Figure 4 illustrates the frame with the step rear bumper. Figure 5 illustrates the frame with the non-step rear bumper.

The MXT vehicle also uses a rear bumper mounting plate welded to the rear bumper end of each rear bumper mounting bracket. These rectangular plates measure 152mm x 162mm (6 in. x 6-3/8 in.).

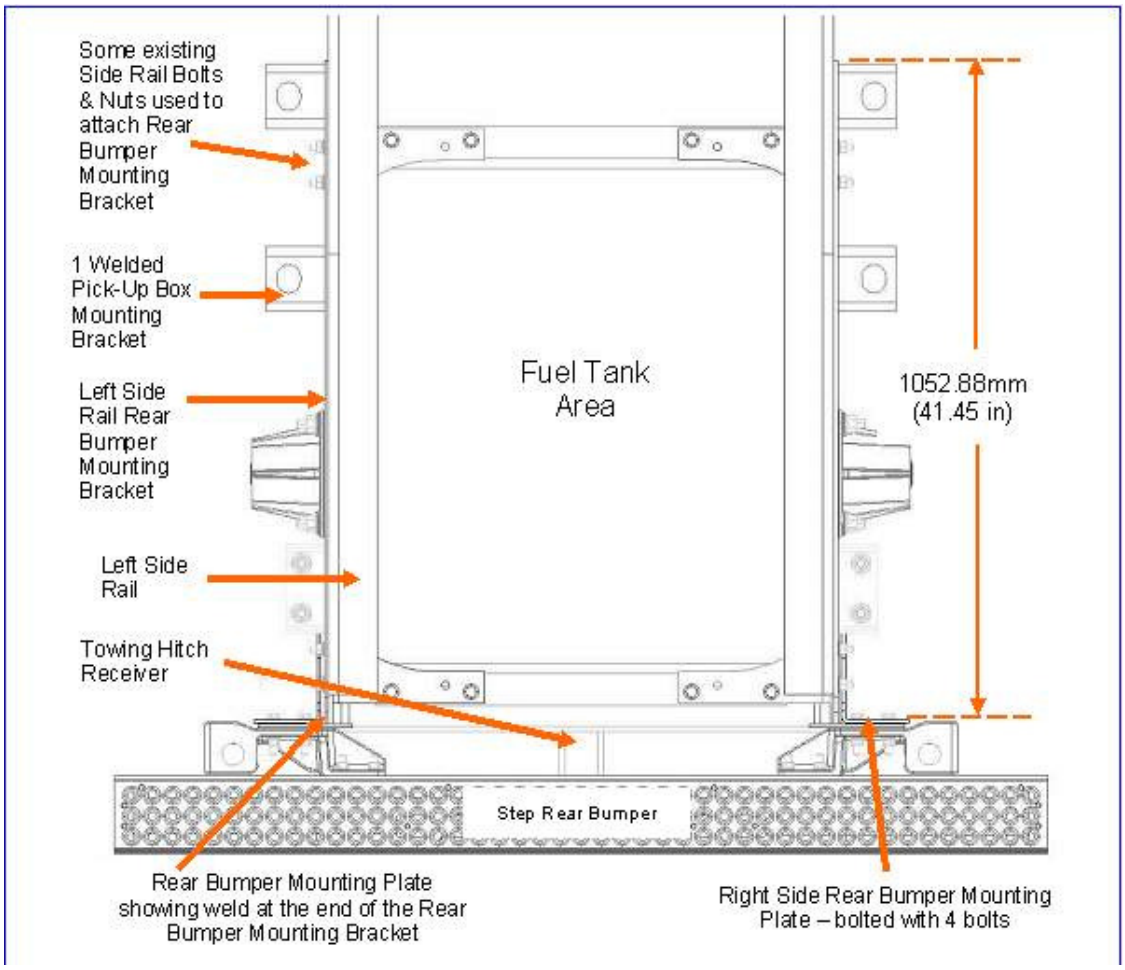


Figure 4 Plan View of Step Rear Bumper and Side Frame Rail Assemblies

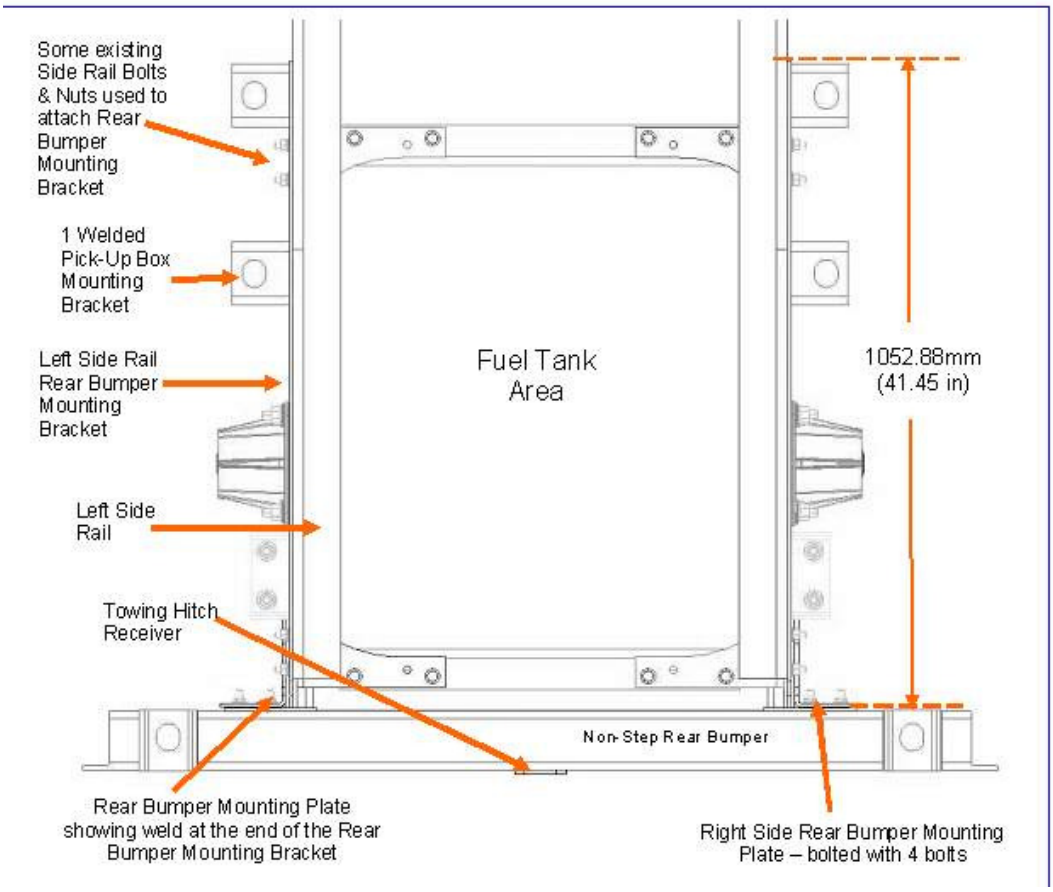


Figure 5 Plan View of Non-Step Rear Bumper and Side Frame Rail Assemblies

6.3. REINFORCEMENT ATTACHMENT

NOTE – There is no provision to provide chassis frame reinforcement for the MXT vehicle to accommodate exceeding either the gross vehicle weight rating (GVWR) or the gross axle weight rating (GAWR).

The MXT vehicle rear bumper mounting brackets are attached using existing side rail bolts and nuts.

The MXT vehicle rear bumper mounting plates (already welded to the ends of the rear bumper mounting brackets), are attached to the bumper using 4 M12 bolts and nuts per plate at placement.

7. CORROSION

If aluminum and steel are allowed to come into direct contact with each other, a galvanic cell can be formed. In order for the cell to form, the dissimilar metals must be in direct contact and an electrolyte, such as moisture, must be present. Aluminum is anodic with respect to steel and will corrode when in the presence of steel. Corrosion of aluminum frame crossmembers will reduce the load carrying capacity of the frame member and may eventually lead to the failure of the frame.

To prevent the formation of a galvanic cell, isolation techniques such as non-conductive or barrier type spacers or sealers must be used so that the steel and aluminum are not in direct contact.

It is recommended that a sealer, such as Tectyl 400C or equivalent, be painted onto the surface of both the aluminum and steel, as well as on the washers under the head of the bolts and nuts.

8. FRAME ALIGNMENT

The frame must be properly aligned as this affects body, axle and suspension mounting. If the vehicle has been involved in an accident or has been overloaded, it is recommended that the frame be checked for proper alignment.

8.1. PRE-ALIGNMENT INSPECTION

Before checking alignment, park vehicle on level ground and set parking brake. Inspect frame assembly for loose parts, welds, cracks and bends. Be sure to make all necessary repairs before attempting to check frame alignment.

8.2. METHOD OF CHECKING FRAME ALIGNMENT

A satisfactory method of checking the frame and axle alignment, particularly when a body and cab is on a chassis, is to:

A. Place a plumb bob against the point of measurement. All measurements must be taken with the plumb bob positioned against bare metal.

B. Tack or tape pieces of paper to the floor directly under each point of measurement on the chassis as indicated by the letter "K" in Figure 6.

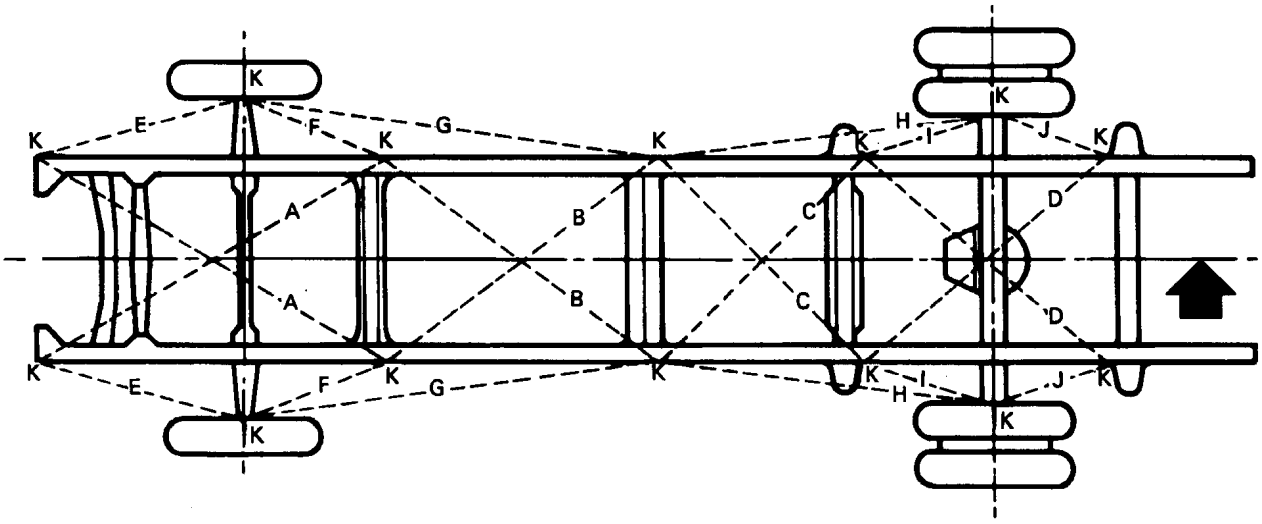


Figure 6 Centerline of Chassis

Method of Checking

After each measurement point has been carefully marked on the floor, proceed as follows:

1. Locate centerline of chassis by measuring front and rear end widths, using marks on floor.

If frame widths are within specification, draw centerline on floor, the full length of the chassis and continue with step 2.

If frame widths are out of specification, lay out centerline as follows:

Centerline can be drawn through the intersection of any one pair of equal diagonals (A-A, B-B, C-C, D-D) and center point of one end of frame or through points of intersection of any two pairs of equal diagonals.

2. Measure distance from centerline to opposite points marked over entire length of frame. Measurements should not vary more than 0.12 inch (3.0 mm) at any point.

3. Measuring diagonals (A-A, B-B, C-C, D-D) will indicate point where misalignment occurs. If diagonals in each pair are within 0.12 inch (3.0 mm), that part of the frame included between points of measurement may be considered in satisfactory alignment. These diagonals should intersect within 0.12 inch (3.0 mm) of the centerline.

If the diagonals are not within specification, try loosening and re-tightening all cross-members. Then re-check alignment. Refer to the TORQUE CHART (See TORQUE, page 25). If frame is still out of alignment, the vehicle must be taken to a suitable frame alignment establishment to confirm frame misalignment. If misalignment is confirmed, suitable measures must be taken to repair the damage.

NOTE – New MXT Plan Views of Frame Rails, Crossmembers (7 or more) and Pick-Up Box Mounting Brackets (8), and showing different Rear Bumpers: Figure 7, “with” Step, and Figure 8, “without” Step.

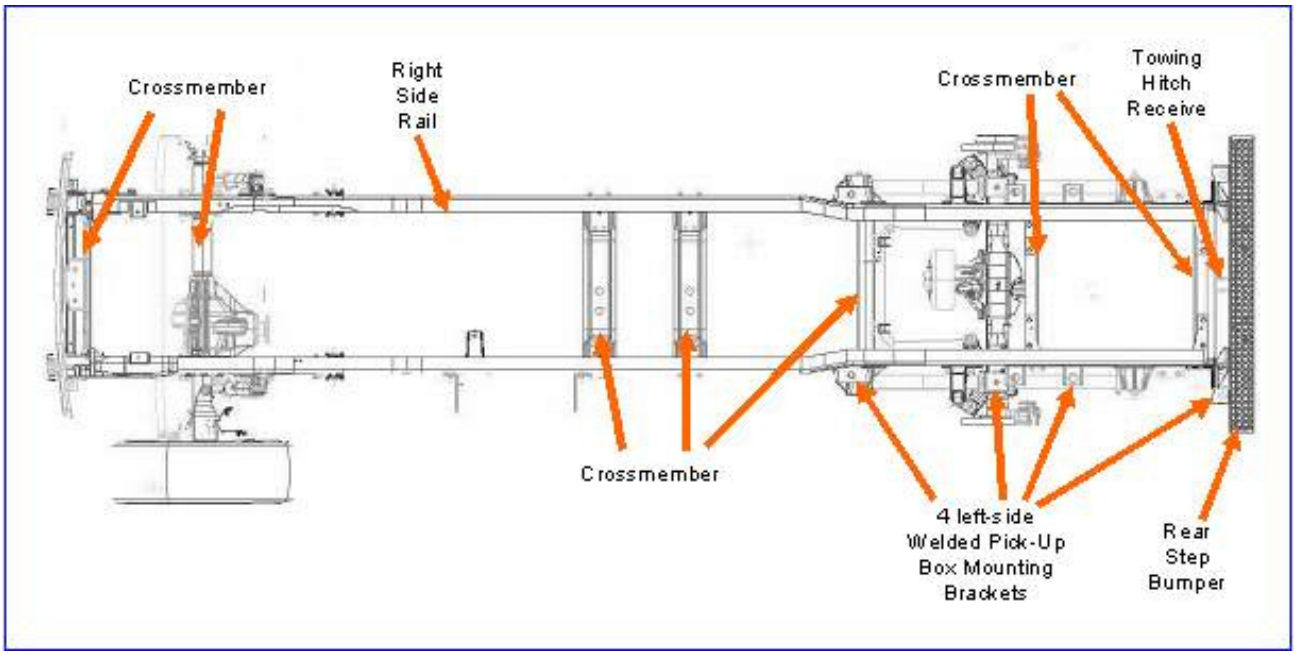


Figure 7 Plan View of Frame Rails, Crossmembers, and Pick-Up Box Mounting Brackets; with Rear Step Bumper

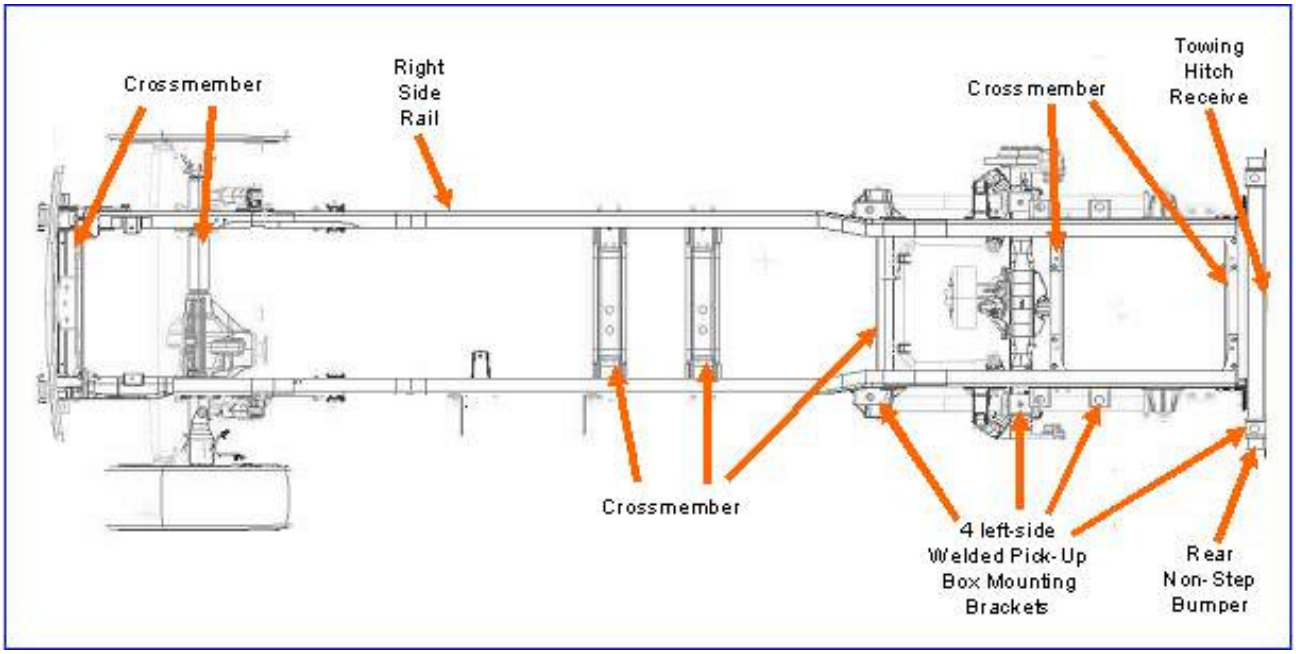


Figure 8 Plan View of Frame Rails, Crossmembers, and Pick-Up Box Mounting Brackets; with Rear Non-Step Bumper

Side Elevation Dimensions

Dimensions for side elevation of the frame should be checked at the points indicated and should not vary more than 0.12 inch (3.0 mm) from side to side. (They will differ fore and aft due to typical frame rake.)

8.3. AXLE ALIGNMENT WITH FRAME

After determining that the frame is properly aligned, the axle alignment with the frame should be checked by comparing diagonals.

If necessary, adjust axle-to-frame alignment. Refer to GROUP 03 — SUSPENSION in the Master Service Manual.

8.4. FRAME STRAIGHTENING

NOTE – Frame straightening should only be performed by a qualified frame alignment facility. Under no circumstance should frame alignment be performed by inexperienced or unqualified service personnel.

NOTE – Do not use heat to straighten.

Use of heat is not recommended when straightening heat-treated frame sidemembers. Heat will weaken these frame members, consequently, all straightening should be done at room temperature. Add reinforcement per section if heat straightening is done.

Frame members which are bent or buckled sufficiently to show cracks or weakness after straightening should be replaced or reinforced. **Heat-treated frame members must not be intermixed with non-heat-treated members.**

If one sidemember is to be replaced, the new member must match the former frame member in both cross-section and material strength.

9. REPAIR AND REINFORCEMENT RECOMMENDED PROCEDURES

NOTE – In some cases of frame damage, the sidemembers must be replaced rather than repaired. Examples of this are:

A. When sidemember cracks caused complete separation or a visible deformation of the section.

B. When the sidemembers are extensively deformed. Consult with your field service representative and frame repair specialists if in doubt.

9.1. PREPARATION OF FRAME FOR REPAIR

Bevel Crack to Weld

To assure complete weld penetration, bevel the crack from one side when welding from one side. Bevel the crack from both sides when welding from both sides. The existing crack in the sidemember must be entirely removed (Figure 9). Widen the crack its full length to 1/8 inch (3 mm). If required, a rubber backed disc grinder or high speed steel burr may be used.

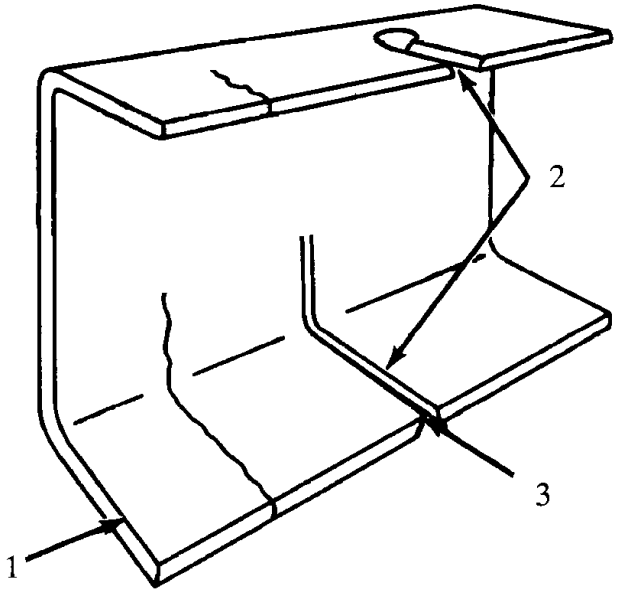


Figure 9 Preparing For Weld Repair

1. FRAME RAIL
2. WIDEN CRACK
3. BEVEL EDGES

Clean Surface to Weld

Surfaces to be welded and surfaces adjacent to the weld must be free of loose scale, slag, rust, grease, moisture, paint or other material that could contribute to poor quality welds.

9.2. WELDING

Electric arc-welding is recommended for repair of steel frames. The shielded arc method should be used because the heat generated during welding is localized and burning of material is minimized using this method. Additional advantages are that the finished weld can be ground flush and drilled as necessary.

Shielded metal arc welding (SMAW); gas metal arc welding (GMAW), also known as metal inert gas (MIG) welding; gas tungsten arc welding (GTAW), also known as tungsten inert gas (TIG) welding; or flux cored arc welding (FCAW) are recommended methods for repair of steel frame members.

General Recommendations

IMPORTANT – To properly perform the repair procedure, the following rules must be observed:

All Steel Sidemembers

1. Welding should not be performed when surfaces are wet or exposed to rain, snow, high wind or when repair personnel are exposed to inclement conditions. Frames exposed to inclement weather must be thoroughly cleaned and dried before the repair is made.

2. Surface areas and edges to be joined must be clean and free of oil, grease, loose scale, rust, moisture, paint or other material that could contribute to poor quality welds.

3. Always avoid craters, notching and undercutting.

4. Peen new welds prior to grinding to relieve stresses caused by shrinkage.

5. Grind all welds flush with the surrounding surfaces. Use a coarse grinder followed by smooth grind at 90 degrees to the crack direction to remove all of the coarse grind marks.

6. Inspect the weld repaired area carefully after grinding. Grind out any remaining cracks, notches or undercuts and repeat the finishing and inspections.

7. For welding cracks to the edge of the sidemember flange, locate a run-off block at the edge as in Figure 11 to obtain a continuous weld without undercuts. After welding, the run-off block should be cut off and the weld should be ground and inspected as in steps 5 and 6 above.

8. Weld to the edges of the holes. The weld should continue into the hole to form a plug weld with a copper chill block on the opposite side to help form the plug. The weld should then be finished as in steps 5 and 6 above and redrilled. Chamfer the hole edges. If the hole was open and unused, install a Grade 8 bolt to help attach the weld repair reinforcement.

> **WARNING – Invisible ultraviolet and infrared rays emitted in welding can injure unprotected eyes and skin. Protection such as welder's helmet with dark colored filter lenses of the proper density must be used. GTAW or TIG welding will produce intense radiation, therefore, filter plate lenses of the deepest shade providing adequate visibility are recommended. It is strongly recommended that persons working in the weld area wear flash safety goggles. Also wear protective clothing.**

9. Electrodes: Only low hydrogen electrodes should be used. These should be purchased in hermetically sealed containers or dried for two hours at a temperature between 450°F (232°C) and 500°F (260°C).

After drying, the electrodes should be stored in an oven at a temperature of at least 250°F (121°C). If exposed to the atmosphere for more than four (4) hours, the electrodes should be dried before use. **Any moisture introduced into the weld could develop porosity or embrittlement, leading to further cracking**. Welding procedures will vary among different frame materials. Outlined below are recommendations for welding of the various types of frames.

Mild Steel Frames (36,000 PSI Yield Strength)

Any of the electric arc methods described previously may be used to weld mild steel frame members. The choice of electrode or welding wire depends somewhat upon the equipment available for welding. However, the use of low hydrogen electrodes is recommended. Medium strength electrodes and wire, such as E6018, E70S-3 and E70S-6, are suitable for welding the mild steel frames.

Use methods shown in Figure 10.

1. Preheat the frame member along the prepared weld joint to 500 to 600°F (260 to 316°C). Insure the area is clean and any moisture present is eliminated.

   Permit heated area to cool to 200°F (93°C) or below before welding is started. The weld repair area must be clean before welding.

2. Either alternating current or direct current reversed polarity, combined with a short arc and beading or narrow weave technique, may be used. Direct current reversed polarity is recommended.

3. Slag should be removed after each pass and an interpass temperature of 200°F (93°C) should be maintained.

4. Grind smooth and flush with surrounding sidemember material. Grind the weld in a direction that is 90° to crack direction (Figure 10D).

5. Add reinforcement.

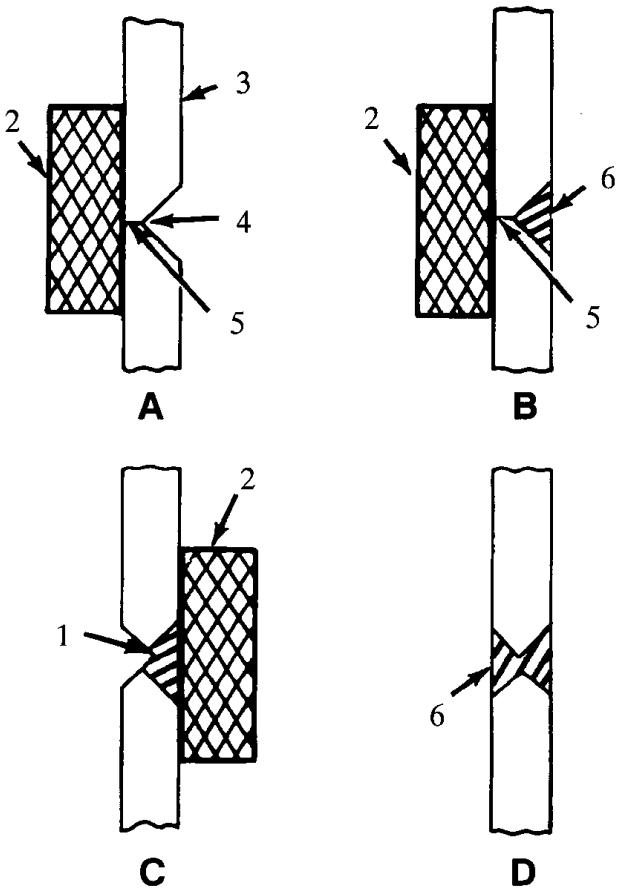


Figure 10 Use of Chill Strip

1. V-GROOVE INTO SOUND METAL
2. COPPER CHILL STRIP
3. FRAME RAIL
4. V-GROOVE
5. CRACK
6. WELD-GROUND FLUSH WITH FRAME, GRIND IN LONGITUDINAL DIRECTION OF SIDEMEMBER

High Strength Low Alloy Steel Frames (50,000, 60,000 and 80,000 PSI Yield Strength

Any of the electric arc methods previously described may be used. The choice of a suitable electrode or wire depends somewhat upon the equipment available for welding and the method selected.

The SMAW and the GMAW methods are preferred for welding the HSLA frames. The use of low hydrogen electrodes is recommended. Refer to Table 1 for selection of recommended electrodes and wires, or refer to A.W.S. A.5 standard available from:

American Welders Society
2501 N. W. 7th Street
Miami, FL 33125

for equivalent strength electrodes, wires or rods and power leads to be used in the welding methods. The double V-notch weld preparation using the weld procedure shown in Figure 10 is the preferred welding method.

Table 1 Recommended Electrodes and Wires

Material Strength PSI	Recommended Electrode and Wire	
	SMAW	GMAW
50,000	E7018	E70S-3
60,000	-	E70S-1B
80,000	E8018	E80S-D2

Amperage and voltage recommendations for welding are shown in Table 2 and Table 3.

Table 2 SMAW Method (HSLA Frames)

Position	Electrode Sizes Inch	Welding Current		Speed (Inch/Min.)
		Amperes	Volts	
Flat	.125	-	-	-
Horizontal and Vertical	.125	110/140	20/14	24

Table 3 GMAW Method (HSLA Frames)

Position	Electrode Sizes Inch	Welding Current		Speed (Inch/Min.)
		Amperes	Volts	
Flat	.035	-	-	350/400
Horizontal and Vertical	.035	190/220	20/30	350/400

1. Preheat frame rail along the weld joint to 500 to 600°F (260 to 316°C) to insure any moisture present is eliminated and to prevent too rapid cooling of weld metal.

2. Direct current, reversed polarity is preferred. Weld using a short arc and a beading or narrow weave technique.

3. Slag should be removed after each pass and an interpass temperature of 200°F (93°C) should be maintained.

4. Grind smooth and flush with surrounding sidemember material. Grind the weld in a direction that is at 90° to crack direction (Figure 10D).

5. Add reinforcement.

Heat Treated Frames (110,000 PSI Yield Strength)

When welding Heat Treated Frames (110,000 PSI Yield Strength), use low hydrogen electrodes which have superior crack resistance and notch toughness similar to AWS-E-11018. This type electrode should be stored in a moisture-free container to avoid porosity during welding.

Amperage and voltage recommendations for welding are shown in Table 4.

Table 4 SMAW Method (Heat-Treated Frames)

Position	Amperes	Voltage
Downhand	130/140	21/23
Overhead	130/140	21/23
Vertical Up	110/120	22/24

A heavy copper "chill" strip should be clamped to the rail side away from the groove to help control the temperature and cooling rate during welding (Figure 10). Short lengths of discarded heavy copper electrical bus bars make suitable chill strips.

Preheat the frame rail along the crack area to 500-600°F (260-316°C). Either alternating current or direct current reversed polarity, combined with a short arc and a beading or narrow weave technique may be used. Direct current reversed polarity is recommended.

Slag should be removed after each pass and an interpass temperature of 200°F (93°C) should be maintained. Grind smooth and flush with surrounding sidemember material, in a direction that is parallel to the longitudinal axis of the sidemember (Figure 10D).

A V-groove is ground from the side opposite the repair and the procedure outlined above repeated. "Chill" strips should be used whenever possible. The V-groove ground on the opposite side of the repair should be deep enough to enter the sound metal of the first weld repair as shown in (Figure 10C).

9.3. REINFORCEMENT

The strength of the sidemember in the weld joint repair region has been reduced by welding and this region must be reinforced sufficiently to insure that the service life of the frame is not shortened. Reinforcement of the frame after welding is intended to reduce the stresses in the weld repair region to a lower level than was previously permitted. Improper drilling will also reduce the strength of the sidemembers. Refer to DRILLING (See DRILLING, page 22).

The type, length, material and attachment techniques for reinforcements vary with the type and location of the crack and with the loading conditions associated with the crack. It is not practical to give specific recommendations for all cases of frame cracking, therefore the various types of reinforcements are identified with general descriptions of their applications and installation procedures. To aid in making the distinctions between the more critical flange area and the less critical web area, critical zones are defined as shown (Figure 11D).

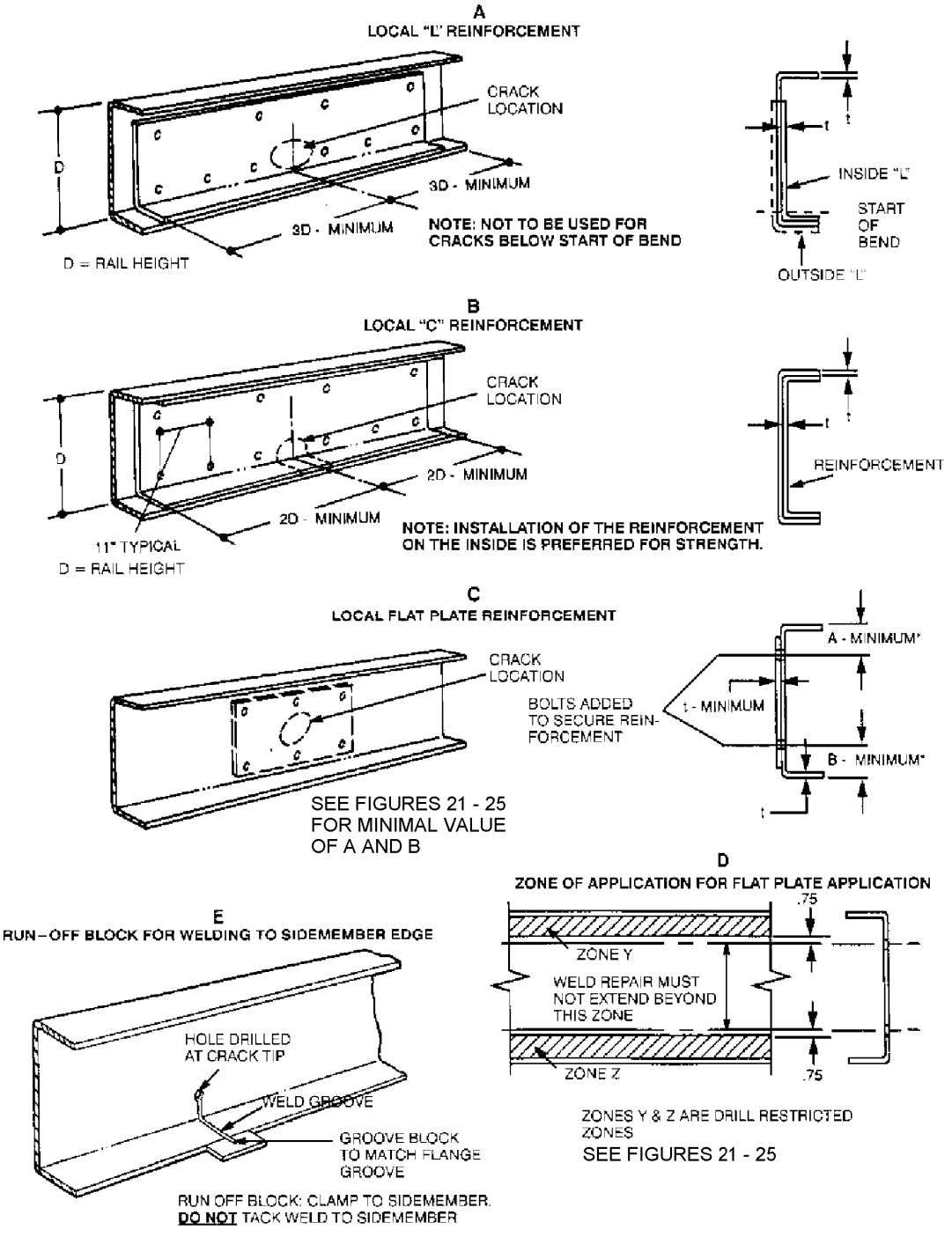


Figure 11 Reinforcement Application

Cracks which occur in the critical zones have a greater probability of growing vertically through the section, and the reduced strength after weld repair necessitates a more substantial reinforcement.

These guidelines potentially affect the structural integrity of the frame assembly and are intended for those who have the equipment and experience required to qualify as frame repair specialists.

9.4. GENERAL WELD REPAIR REINFORCEMENT PROCEDURES

1. The thickness and material strength of the local plate, "L" and channel reinforcements should match the section being reinforced.

2. The corners of the reinforcements which will be in contact with the sidemember along the reinforcement edges must be chamfered to prevent damage to the sidemember.

3. All sidemember reinforcements must be bolted to the web section within the zone shown in Figure 12 . The bolts must be of SAE Grade 8 or better, with integral flanges or with hardened flat washers and must be tightened to Grade 8 levels.

4. Crossmember modification or replacement may be required if the reinforcement is on the same side as the crossmember.

5. Consider the potential effects of the reinforcements on the various components mounted to the frame. Check clearances for suspension, wiring, plumbing and other controls.

6. For attachment of reinforcements, use existing bolts wherever this is practical.

7. The weld repaired area of the sidemember and all of the reinforcement should be primed and painted before reinforcement installation. For corrosive environments, additional treatment of the interface may be needed.

9.5. FULL LENGTH CHANNEL WELD REPAIR REINFORCEMENTS

"Full length" channel reinforcements are available through International dealers for most models. The actual length, starting location and ending location vary from model to model. Different length reinforcements may also be available.

When applied as a repair reinforcement, these reinforcements **do not** increase the load capacity of the vehicle. Their advantage in this case is their availability. A disadvantage of this type is that it is likely to affect more of the components which mount to the frame. In some cases this disadvantage may be offset by cutting the full length reinforcement to create a local reinforcement.

Recommended Applications

1. Cases of repair of vertical cracks in either the top or bottom flanges at very low mileage.
2. Cases in which the weld repair is accompanied by extensive straightening of heat treated sidemembers.

9.6. FULL LENGTH "L" WELD REPAIR REINFORCEMENTS

Steps 1 and 2 above also apply to the full length "L" reinforcements available from International. All of these are the inverted "L" type and are designed for installation on the outside of the sidemember section (except 9000 Series) (Figure 11A).

Recommended Applications

This type of reinforcement is recommended for cases of cracking at very low mileage where a web crack has extended beyond the range for a flat plate reinforcement but ends short of the bend radius. It is also applicable to cases in which the cracking is accompanied by flange buckling.

Application Procedures

1. For custom-fabricated full length "L" reinforcements, the section should be oriented up or down so that the flange is on the same side as the damaged area.

2. For maximum strength the flange should be on the outside of the section.

3. Follow the general recommendations above for attachment of the reinforcement.

9.7. LOCAL CHANNEL WELD REPAIR REINFORCEMENTS

This type of reinforcement must be custom-fabricated either by cutting lengths from "full length" reinforcements or by forming from flat stock (Figure 11B).

Recommended Applications

1. Cases in which the weld repair extends into the sidemember flange after substantial service life.

2. Cases accompanied by extensive abrasive wear of the sidemember section. In these cases the length of the wear area should be added to the length recommendations below.

Application Procedures

1. The channel should be installed on the outside of the section for greater strength.

2. Figure 11B gives recommended dimensional data and attachment specifications for a typical installation. Holes drilled for the attachment must be within the guidelines of Figure 12.

9.8. LOCAL "L" OR INVERTED "L" WELD REPAIR REINFORCEMENTS

This type of reinforcement is also generally custom-fabricated. It has a greater tendency to loosen than a channel reinforcement because, for vertical deflections of the frame assembly, it tends to bend about an axis different from that of the main sidemember section. Because of this its length and/or attachment specifications are typically greater than for the channel type.

Recommended Applications

This type of reinforcement is recommended for cases in which the weld repair is confined to the web of the section but extends beyond the application zone of the flat plate reinforcements shown in Figure 11D.

Application Procedures

1. Figure 11A shows a typical installation for an "L" reinforcement on the inside of a sidemember section along with minimum recommended dimensions.

2. The flange of the reinforcement should be oriented up or down so that flange is on the same side as the damaged area.

3. For maximum strength the reinforcement should be installed on the outside of the sidemember section.

9.9. FLAT PLATE WELD REPAIR REINFORCEMENTS

This reinforcement is intended for the less critical, web portion of the sidemember section where typical cracking is due to local stresses which tend to "diaphragm" or "dish" the web without creating appreciable stresses for overall bending of the section. Typical crack patterns radiate out from the edge of a mounting bracket or crossmember or from a hole in the web. Cracks which radiate from a web hole occupied by a fastener are frequently an indication of a defective joint, whether by the loosening of the fastener or poor joint design (Figure 11C).

Recommended Applications

The flat plate reinforcements are recommended for weld repairs in which the weld does not extend beyond the zone defined in Figure 11D.

Application Procedures

1. A typical installation is shown in Figure 11C. The length and height of the plate will vary with the size of the weld repair area. In general it should be such that it will accommodate an array of reinforcement attachment bolts at a typical 3 to 5 inch (76 to 127 mm) spacing all around the weld repair area.

2. The plate should generally be installed on the side opposite the component which transferred the local bending load into the web.

3. The edges of the plate should be staggered with respect to the edges of other relatively stiff web mounted components to avoid the creation of stress concentrations.

10. BOLT AND TORQUE INFORMATION

Bolts of high strength material conforming to SAE Grade 8 bolts should be used on all frames. For installation of reinforcements, 0.5 inch (13 mm) diameter flange head bolts are recommended. The SAE Grade 8 bolt is identified by six radial line markings on the head of the bolt.

In bolted joints, the majority of the load is transferred by frictional force or clamping force between the members of the joint. The bolts must be properly tightened to develop and maintain the desired clamping force. Operation of the joint with loose or improperly tightened bolts can lead to failure of the joint. The bolts and nuts should be inspected periodically to insure that proper torque is maintained.

These bolts, 0.5 inch (13 mm) diameter flange head type, should be tightened to 110 to 120 ft-lbs. (149 to 163 Nm) based on new bolts and nuts lubricated with engine oil. Whenever possible, hold the bolt and tighten the nut.

If frame components are aluminum, flange head bolts and nuts, or bolts with hardened flat washers must be used. If modification or repair requires replacement of existing bolts with new bolts or bolts of a greater length, the old flange head nuts should not be used with new standard bolts.

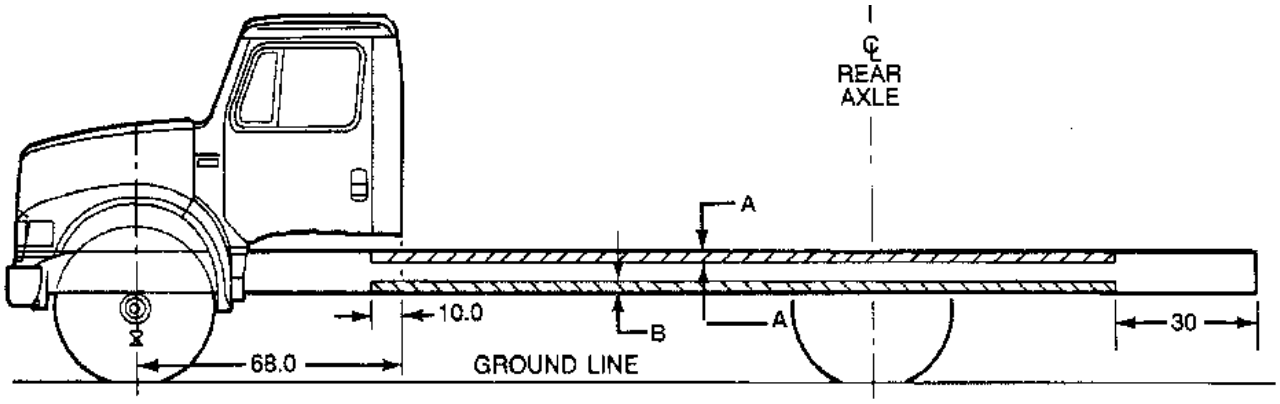
Careful consideration is given to the number, location and sizes of frame bolt holes in the design of a vehicle. The number, location and sizes of additional bolt holes put in the frame subsequent to manufacture of the vehicle can adversely affect frame strength. The adverse effect of additional bolt holes can be minimized by following the guidelines.

11. DRILLING

The drilling of the frame sidemember presents no unusual difficulty. Standard high speed steel drills of good quality will serve provided they are sharpened properly and not overheated during sharpening or use.

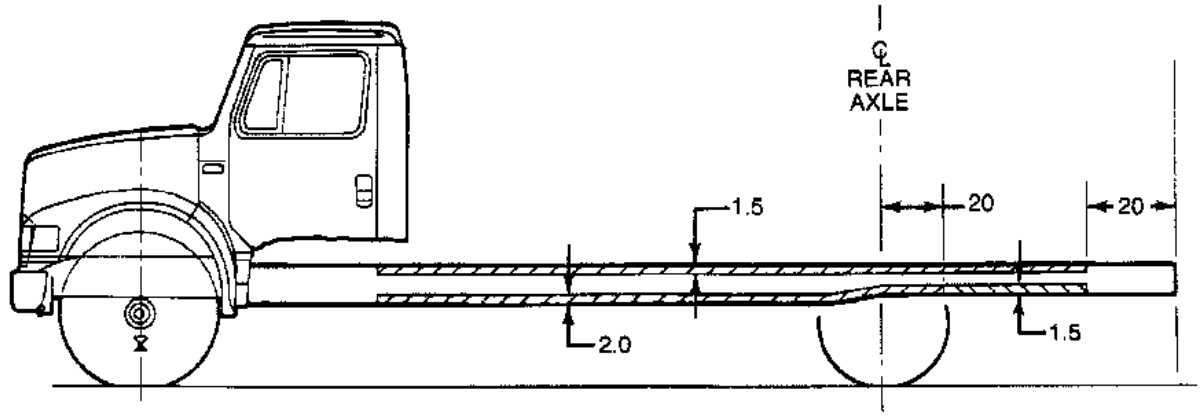
11.1. HOLE LOCATION GUIDELINES

1. Never drill holes into the restricted areas of the frame rails. Refer to Figure 12.
2. Use existing holes whenever possible.
3. Maintain a minimum of 0.75 inch (19 mm) of material between holes.
4. There should not be more than three holes located on a vertical line.
5. Bolt holes should be no larger than is required for the size of bolts being used, in no instance larger than 11/16 (.688 inch).
6. If reinforcements are used, avoid drilling holes closer than 2.0 inches (51 mm) from the ends of the reinforcement.
7. Bolts must be periodically checked to insure that the proper torque and clamping force is maintained.



SIDEMEMBER SECTION	A	B
WITHOUT REINFORCEMENT	1.6	2.0
W/INVERTED "L" REINF.	1.9	2.0
W/OUTER "C" REINF.	1.9	2.4

4600 LP, 4700 LP, 1452 & 1652



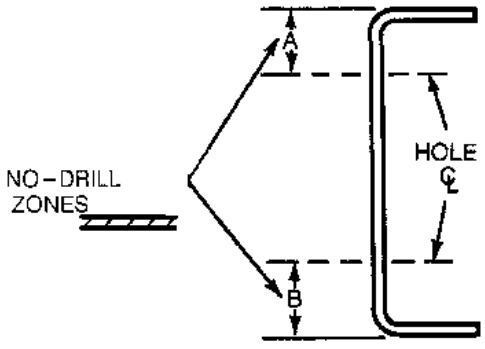


Figure 12 Drilling Restrictions for 1000, 2000, 4000 Series Frames

New MXT Side View of Frame Rails and Crew Cab. Figure 13 shows a view of the MXT vehicle with a Non-Step Rear Bumper.

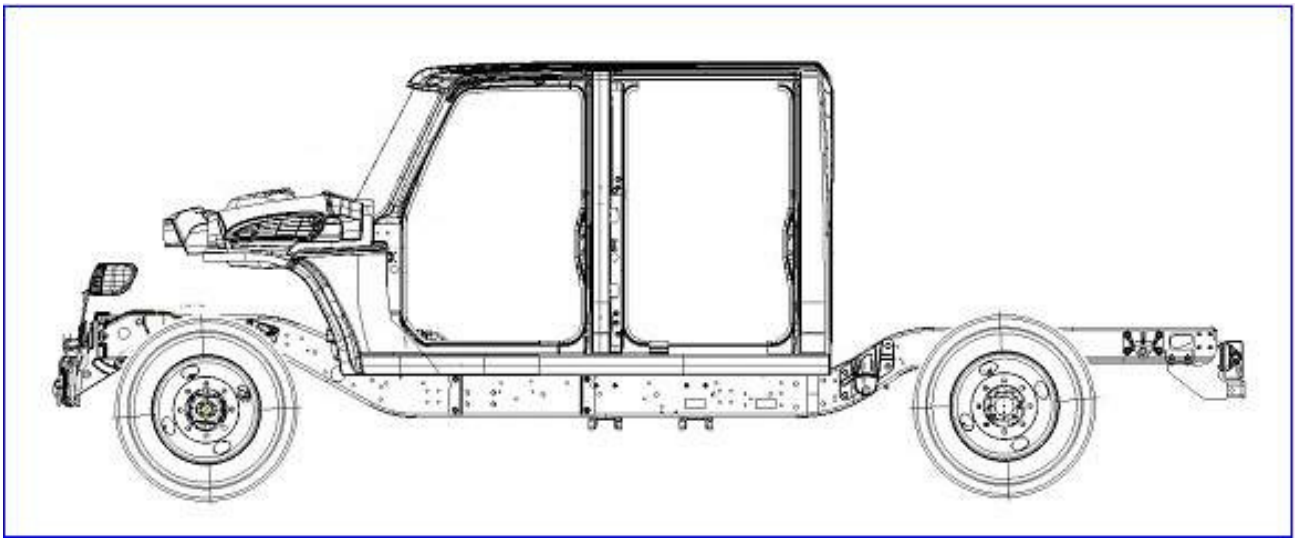


Figure 13 Side View of Frame Rails and Crew Cab

12. AFTERMARKET MODIFICATIONS

Cutting the frame behind the rear axle to shorten the frame is acceptable. Mechanical cutting or sawing is preferred to torch cutting. Whenever it is necessary to cut the frame, the sidemember should be cut at an angle of 90 degrees to the longitudinal axis.

For information on cutting of the frames to lengthen the frames or modify the wheelbase, refer to WHEELBASE ALTERATIONS below.

NOTE – Where mounting angles are to be welded to fifth wheel assemblies, refer to fifth wheel manufacturer's recommendations.

In some cases, specialized equipment such as hoists, winches, lifts, snowplows, pusher and tag axles are added to the vehicle by distributors, installers or dealers. Unless otherwise specified by the customer at the time of assembly, the vehicle is generally equipped with a standard chassis frame and the manufacturer has not made special allowances for the special equipment which is being added.

The addition or installation of this special equipment on the vehicle can significantly affect the loading of the chassis frame. In some cases, it may be necessary to reinforce the frame. Care must be exercised to insure that the gross vehicle weight rating (GVWR) and/or the gross axle weight ratings (GAWR) are not exceeded.

Installation of this special equipment may involve State and Federal requirements which affect vehicle certification for noise emissions, exhaust emissions, brake requirements, lighting system requirements, etc. The specialized equipment installer is responsible for the safety and durability of their product and, in addition, is responsible to insure that the equipment and its installation comply with all applicable State and Federal Department of Transportation requirements and OSHA regulations.

Addition of specialized equipment may have a significant effect on other vehicle components, such as the brake system, steering system, suspension system, etc. Simple reinforcement of the chassis frame may not be adequate to provide safe operation of the vehicle.

In any modification of the chassis frame, the addition of holes, reinforcements, welds, clamps, splices, etc. may cause an increase in the local stress in the frame at the point of the modification. These local stress

concentrations can significantly affect the life of the chassis frame. The specific effect which the stress concentrator will have on the life of the chassis frame is influenced by the location of the stress concentration, the frequency and severity of the loading, and the type of stress concentration. Any modification of the frame may void the manufacturer's warranty.

12.1. ALUMINUM SIDEMEMBERS OR CROSSMEMBERS

To prevent the formation of a galvanic cell, isolation techniques such as non-conductive or barrier type spacers or sealers must be used. It is recommended that a sealer, such as Tectyl 400C or equivalent, be painted onto the surface of both the aluminum frame and steel reinforcement. Steel bolts passing through the aluminum frame and the steel reinforcement, as well as the washers under the head of the bolts and nuts, should be sealed also.

13. WHEELBASE ALTERATIONS

Shortening or lengthening a wheelbase is an added expense for the customer. Therefore, it is often to the customer's benefit to order a chassis from the factory with the desired wheelbase rather than to alter the wheelbase of the chassis on-site.

The preferred method for altering the wheelbase is to slide the rear axle forward or rearward as required. Invariably, this requires the lengthening or shortening of air lines, brake lines, electrical lines, and driveline. Extreme care should be taken in the modification of the air lines, brake lines, electrical lines and driveline to insure that they operate as reliably as those with which the vehicle was manufactured.

If the wheelbase is lengthened, a reinforcement may be required. Consult your International dealer before lengthening the wheelbase.

In those instances when it is necessary to cut and weld the frame to alter the wheelbase, the frame must be reinforced with a channel-type reinforcement of the same strength as the original frame material in the area where the frame has been cut, extending at least two feet on either side of the cut.

If the frame was built with both a main frame and a reinforcement, the reinforcement should be removed before cutting the main frame. **It is essential that a new one-piece outer channel reinforcement be obtained rather than cutting and re-using the original reinforcement.** The original frame should also be reinforced with an inner channel reinforcement, extending at least two feet beyond the cut(s) on either side of the cut(s). The reinforcement must be of the same material as the original frame. Blank and pre-punched chassis channel reinforcements are available through your dealer parts department.

On both medium and high strength aluminum frames, re-welding to lengthen the frame is not recommended. Refer to REINFORCEMENT (See REINFORCEMENT, page 5) and REINFORCEMENT ATTACHMENT (See REINFORCEMENT ATTACHMENT, page 8) for additional information.

TORQUE

Table 5 BOLT TORQUE CHART (PHOSPHATE AND OIL COATED)

Bolt Size (Types 8 and 10)	Specified Torque			
	Flange Head		Hex Head	
	Ft-Lb.	N·m	Ft-Lb.	N·m
5/8	200-240	271-325	145-175	197-237
3/4	300-370	406-502	250-300	339-406

Table 6 METRIC BOLT TORQUE CHART (PHOSPHATE AND OIL COATED)

Bolt Size (Types 8 and 10)	Specified Torque			
	Flange Head		Hex Head	
	Ft-Lb.	N·m	Ft-Lb.	N·m
M10	45 — 50	61 — 68	38 — 43	52 — 58
M12	90 — 99	122 — 135	71 — 80	97 — 108
M16	217 — 239	294 — 325	158 — 175	215 — 237
M20	412 — 460	560 — 625	—	—