

2000-2006 Honda Insight Body Repair Manual

INTRODUCTION

How to Use This Manual

This manual covers the repairs of a 2000-2006 Honda Insight that has been involved in an accident, and it describes the work related to the replacement of damaged body parts.

Please read through these instructions and familiarize yourself with them before actually using this manual.

NOTE: Refer to the applicable 2000-2006 Honda Insight Service Manual for specifications, wire harness locations, safety stand support points, etc.

Special Information

⚠ WARNING

You CAN be KILLED or SERIOUSLY HURT if you don't follow instructions.

⚠ CAUTION

You CAN be HURT if you don't follow instructions.

NOTE: Gives helpful information.

⚠ CAUTION

Detailed descriptions of standard workshop procedures, safety principles and service operations are not included. Please note that this manual does contain warnings and cautions against some specific service methods which could cause PERSONAL INJURY, damage a vehicle, or make it unsafe. Please understand that these warnings cannot cover all conceivable ways in which service, whether or not recommended by Honda, might be done or of the possible hazardous consequences of each conceivable way, nor could Honda investigate all such ways. Anyone using service procedures or tools, whether or not recommended by Honda, must satisfy himself thoroughly that neither personal safety or vehicle safety will be jeopardized.

All information contained in this manual is based on the latest product information available at the time of printing. We reserve the right to make changes at any time without notice. No part of this publication may be reproduced, stored in retrieval system, or transmitted, in any form by any means, electronic, mechanical, photocopying, recording, or otherwise, without the prior written permission of the publisher. This includes text, figures and tables.

HONDA MOTOR CO., LTD.
Service Publication Office

1 General Info

2 Preparation of Work

3 *Replacement

4 Body Dimensional Drawings

5 Rust Prevention

6 Paints

Sections with an * include SRS components; special caution is required when servicing.

General Information

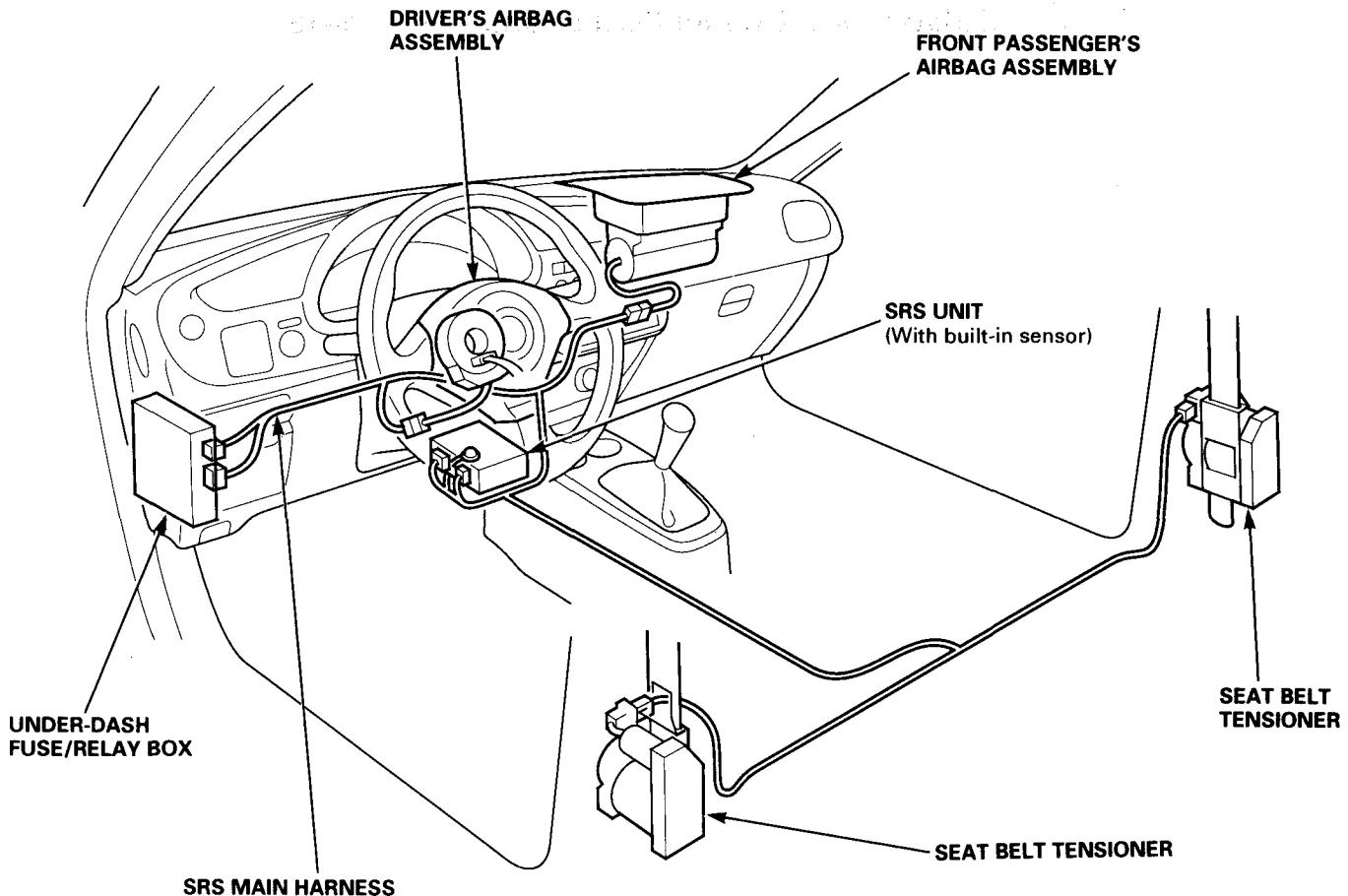
Supplemental Restraint System (SRS)

This model has an SRS which includes a driver's airbag in the steering wheel hub, a passenger's airbag in the dashboard above the glove box, and seat belt tensioners in the seat belt retractors. The SRS unit is separate from the airbag assembly and has built-in sensors.

The following precautions should be observed when performing sheet metal work, paint work, and repair work around the locations of the SRS components.

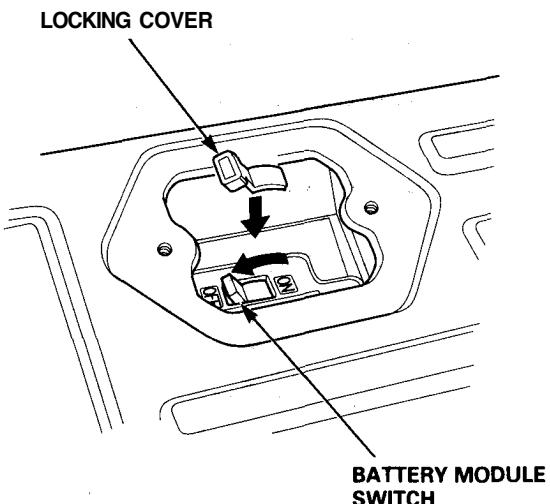
- ① The SRS unit (including safing sensor and impact sensor) is located under the dashboard. Avoid any strong impact with a hammer or other tools when repairing the front side frame and the lower part of the dashboard. Do not apply heat to these areas with a torch, etc.
- ② Take extra care when painting or doing body work in the area below the center pillar. Avoid direct exposure of the seat belt retractor with tensioner to heat guns, welding, or spraying equipment.
- ③ All SRS electrical wiring harnesses are located under the lower part of the dashboard below the dashboard panel. Care should be taken not to damage the harness when repairing this area.
- ④ Do not apply heat of more than 212°F (100°C) when drying painted surfaces anywhere around the locations of SRS components.
- ⑤ If strong impact or high temperature needs to be applied to the areas around the locations of SRS components, remove the components before performing the repair work.
- ⑥ If any of the SRS related components are damaged or deformed, be sure to replace them.

NOTE: Refer to the Restraints section of the Service Manual for removal and replacement of SRS related components.

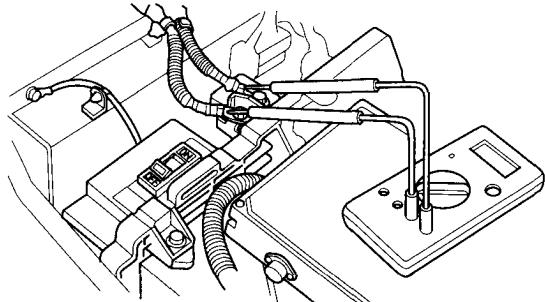


Integrated Motor Assist (IMA) System

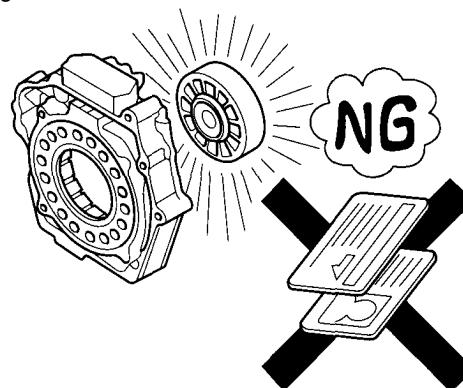
- The INSIGHT is equipped with the IMA (Integrated Motor Assist) system and high voltage (144 V) circuits are used in this system. Be sure to shut off the electric circuit and isolate the IMA system and related parts before servicing the IMA system.
- The high voltage cables and their covers are identified with orange color. The caution labels are attached to the high voltage and related parts, refer to the 2000 INSIGHT Service Manual, P/N. 61S3Y00. Be careful not to touch these cables and parts without adequate protection. The front floor under-cover protecting the high voltage cables is marked with .
- If the 12 V battery has been discharged or its cable has been disconnected, the IMA battery level indicator (BAT) does not indicate the state of charge when the engine is started. Drive the vehicle for approximately 30 minutes, and the IMA battery level indicator (BAT) will function properly.
- Observe the following instructions when inspecting or servicing the IMA system.
 - When the IMA system indicator lamp is on, perform the IMA system troubleshooting first.
 - Wear the insulated gloves whenever you inspect or service the IMA system. Be sure to check the gloves for pin holes, tear and other damages.
 - Turn the battery module switch OFF and hold the switch in the OFF position with the locking cover before servicing the IMA system.



- Wait for 5 minutes or more after turning the battery module switch OFF. (It takes approximately 5 minutes for the condenser to discharge.)
- Before disconnecting the high voltage cable terminals, make sure that the voltage between the terminals is 0 V by measuring with a voltmeter.



- When servicing the parts without the insulating sheath, be sure to use insulated tools to prevent short circuiting.
- The IMA system has high voltage parts and strong magnetic part (motor rotor). Do not put on the metal goods or magnetic recording media (for example, prepaid card, cash card, etc.) when servicing the IMA system, as they can cause short circuit or destroy the magnetic record of media. Anyone who wears the electronic medical instrument (for example, heart pacemaker, etc.) must not work on the IMA system. The electronic medical instrument will be influenced by the magnetic force, which is very dangerous.



(cont'd)

General Information

Integrated Motor Assist (IMA) System (cont'd)

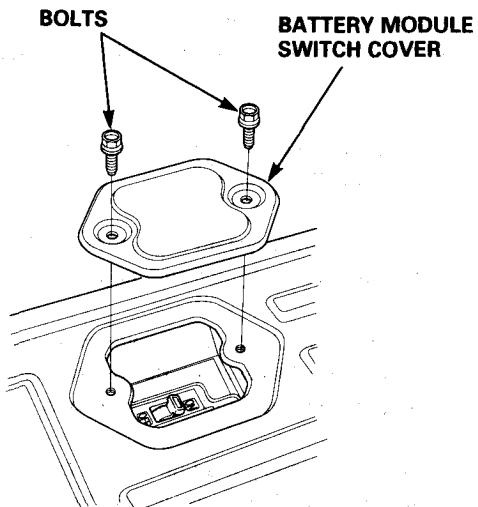
- After disconnecting the high voltage terminals, busbar, etc., insulate the parts with the insulating tape.
- Attach the indication of "WORKING ON HIGH VOLTAGE PARTS. DO NOT TOUCH!" to the steering wheel and set it at the work place as well to warn for safety.

How to Turn the Battery Module Switch OFF

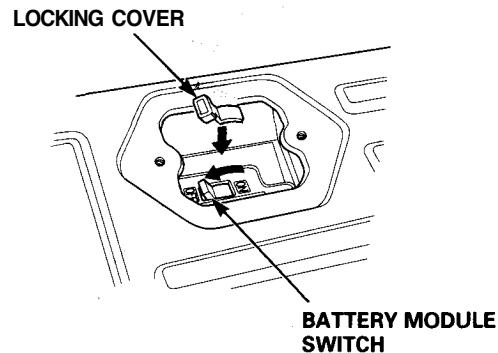
WARNING

Turn the battery module switch OFF and hold the switch in the OFF position with the locking cover to isolate the electric circuit before servicing the IMA system.

- Turn the ignition switch OFF.
- Remove the trunk floor mat.
- Remove the two bolts and the battery module switch cover.



- Remove the locking cover from the battery module switch.
- Turn the battery module switch OFF.
- Install the locking cover to hold the battery module switch in the OFF position.



Engine Compartment Inspection/Servicing

The Insight has an Auto-Stop system that shuts the engine off under certain conditions to improve fuel economy while the vehicle is at a stop. In Auto-Stop mode, driver input, such as pressing the clutch, will cause the engine to restart.

Before servicing the Insight, turn the ignition switch OFF and remove the key so the engine cannot be started.

Before performing any service on the Insight's IMA system, make sure to turn the battery module switch OFF and wait five minutes before working on the vehicle.

How to Handle a Collision Damaged Vehicle

The Insight's IMA system uses a high voltage battery pack. The battery electrolyte is potassium hydroxide, which is highly caustic. It can cause burns if it comes in contact with your skin or eyes.

The battery pack is located in the integrated power unit (IPU) compartment. It is well protected and not likely to be damaged in most collisions.

If the IPU compartment has been damaged in a collision, please contact American Honda TechLine at 800-824-6632 for handling information.

Required Materials

- Protection (insulated or rubber gloves, protective goggles, safety shoes)
- Saturated boric acid solution: 20 liters (purchase 800 grams of powdered boric at a pharmacy and liquefy it)
- Red litmus paper (purchase at a pharmacy)
- ABC fire extinguisher (applicable for both oil fires and electrical fires)
- Shop towels, cloths, etc. (to wipe up the electrolyte)
- Cloth adhesive tape
- Voltmeter

Handling Recommendations

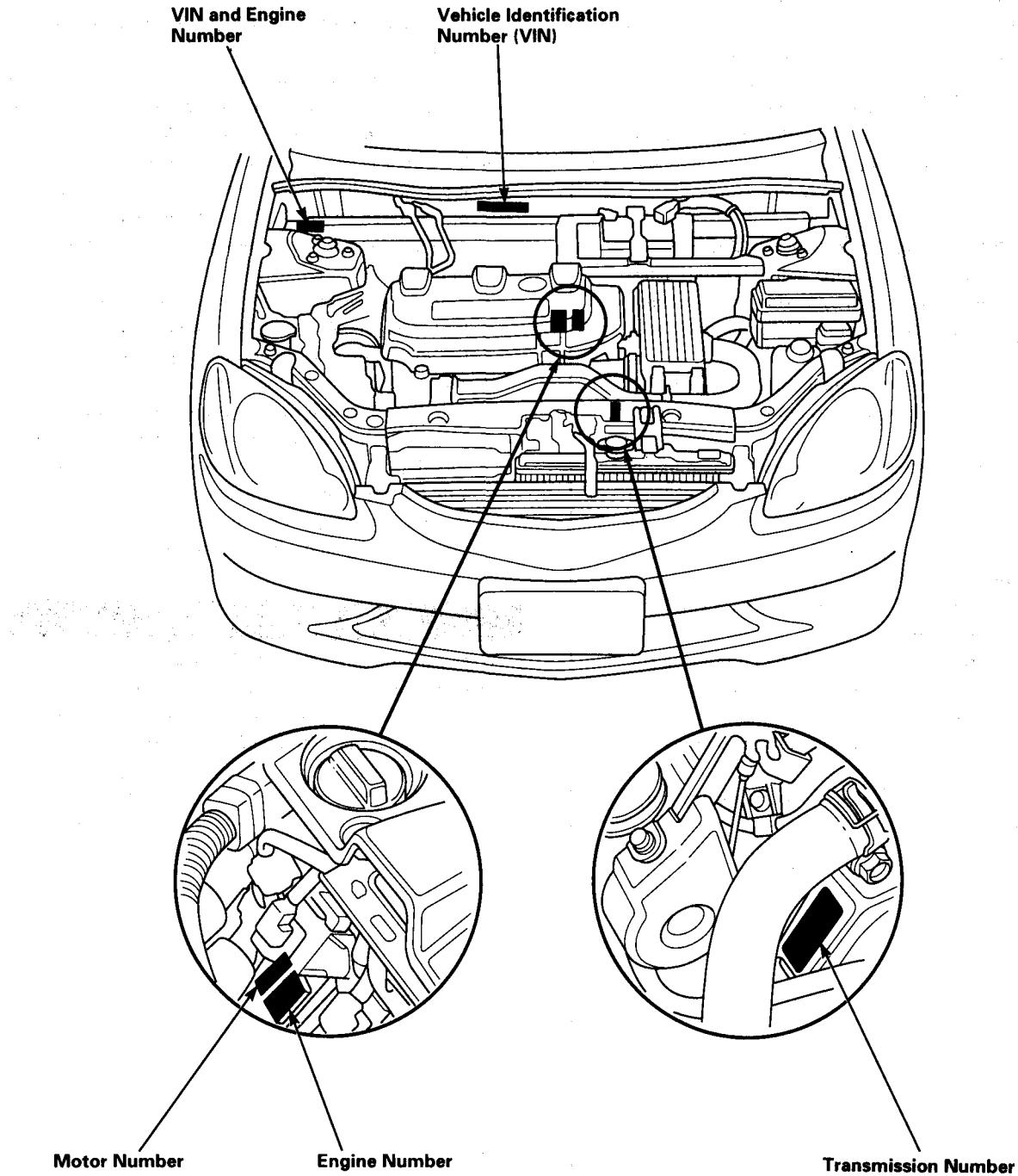
- Wear insulated or rubber gloves, protective goggles and safety shoes.
- Do not touch the bare wire especially if you are not sure whether the wire is a high voltage one.
If you must or may touch it, be sure to wear insulated gloves, measure the voltage to the body ground; and then insulate the part with cloth adhesive tape.
- If the vehicle catches on fire, extinguish it with an ABC fire extinguisher. Fighting the fire with a small amount of water can spread it. Pour a large quantity of water on a fire directly from a hydrant or wait for the arrival of the fire fighters.
- You can get shocked when servicing a vehicle in water. Do not touch the high voltage parts and wires. Remove the vehicle from the water before proceeding.
- Check the areas near the battery module for fluid leakage. Do not touch the leaking fluid as it may be the strong alkaline electrolyte. If you must touch it, wear rubber gloves and protective goggles, and neutralize it with the saturated boric acid solution. Make sure that the red litmus paper does not turn into blue, and wipe up the leaking fluid with shop towels or equivalent.

WARNING

Take extreme care not to let the electrolyte get in your eyes and on your skin as it cause loss of sight or other serious injury. If it gets in your eyes or on your skin, flush with a large quantity of water immediately and get medical care.

General Information

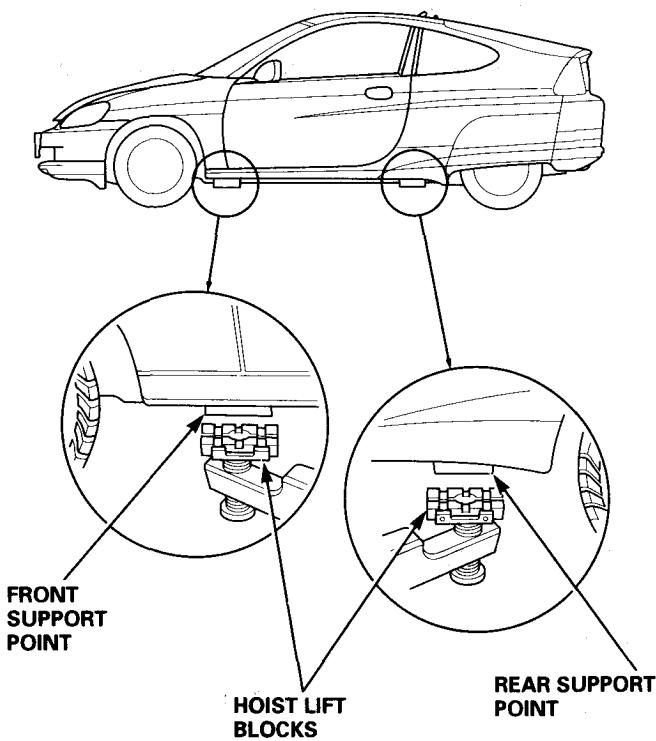
Identification Number Locations



Lift and Support Points

Frame Hoist

Position the hoist lift blocks, or safety stands, under the vehicle's front support points and rear support points.



1. Raise the hoist a few inches (centimeters), and rock the vehicle gently to be sure it is firmly supported.
2. Raise the hoist to full height, and inspect the lift points for solid contact with the lift blocks.

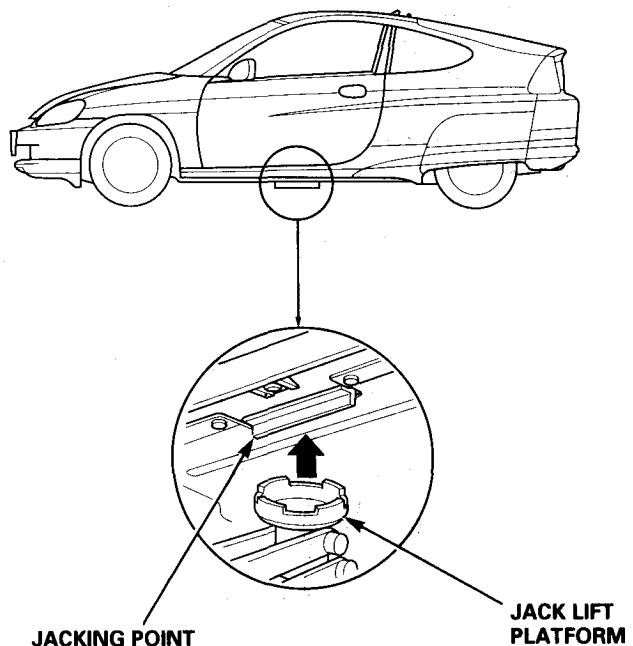
If you are going to remove heavy components such as the suspension or the fuel tank from the rear of the vehicle, first support the front of the vehicle with a tall safety stand. When substantial weight is removed from the rear of the vehicle, the center of gravity can change and cause the vehicle to tip forward on the hoist.

Safety Stands

To support the vehicle on safety stands, use the same front and rear support points as for a frame hoist. Always use safety stands when working on or under any vehicle that is supported only by a jack.

Floor Jack

1. Set the parking brake.
2. Block the wheels that are not being lifted.
3. Position the floor jack under the left or right jacking point, center the jack lift platform on the jacking point, and jack up the vehicle high enough to fit the safety stands under it.



4. Position the safety stands under the support points and adjust them so the vehicle will be level.
5. Lower the vehicle onto the stands.

General Information

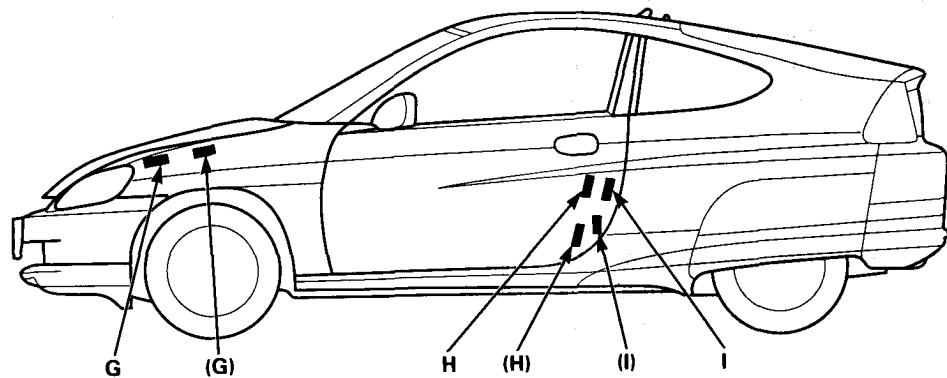
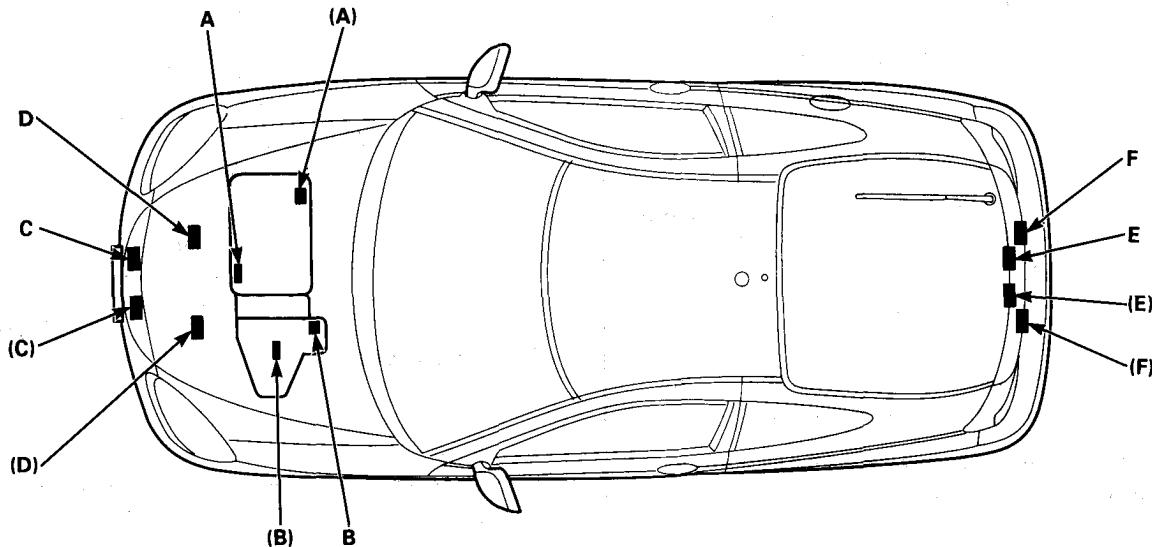
Parts Marking Locations

To deter vehicle theft, certain major components are marked with the vehicle identification number (VIN). Original parts have self-adhesive labels. Replacement body parts will have self-adhesive labels, and replacement engine and transmission will have the VIN plate attached with a break-off bolt.

NOTE: Be careful not to damage the parts marking labels during body repair. Mask the labels before repairing the part.

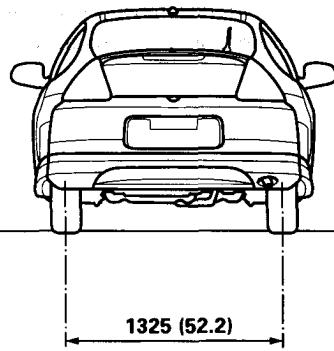
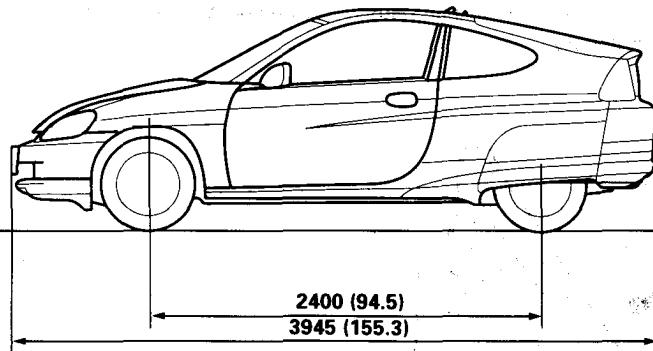
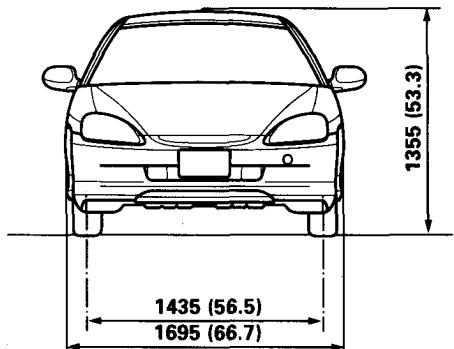
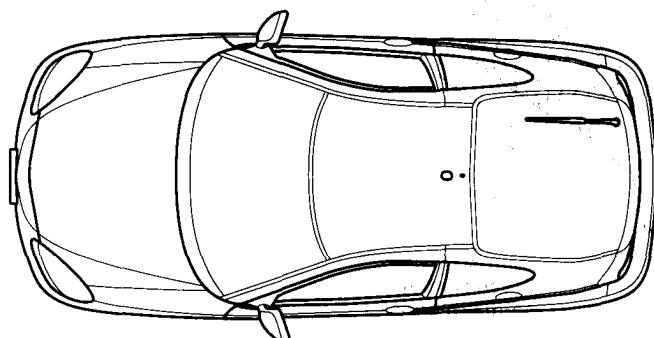
Label locations: Letters without parenthesis indicate locations on original parts. Letters with parenthesis indicate locations on replacement parts.

- A and (A): Engine
- B and (B): Transmission
- C and (C): Front Bumper
- D and (D): Hood
- E and (E): Hatch
- F and (F): Rear Bumper
- G and (G): Front Fender
- H and (H): Door
- I and (I): Rear Fender Panel



Body Specifications / Wheel Alignment

Unit: mm (in.)



Front wheel alignment:

| | | |
|---------------------|--------------|--------------------|
| Camber | 0°00'±1° | |
| Caster | 2°00'±1° | |
| Total toe | 0±2 (0±0.08) | |
| Wheel turning angle | in | 40°00'±2° |
| | out | 33°00' (Reference) |

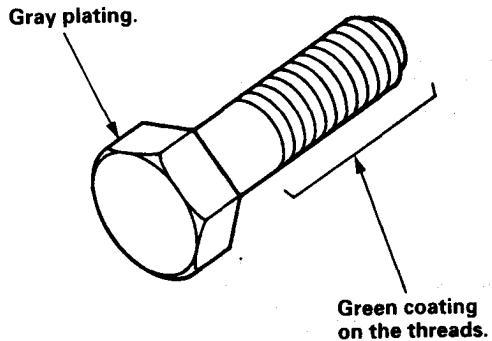
Rear wheel alignment:

| | |
|-----------|--------------------|
| Camber | -1°00'±1° |
| Total toe | IN 3±3 (0.12±0.12) |

General Information

Fasteners used on Aluminum Bodies

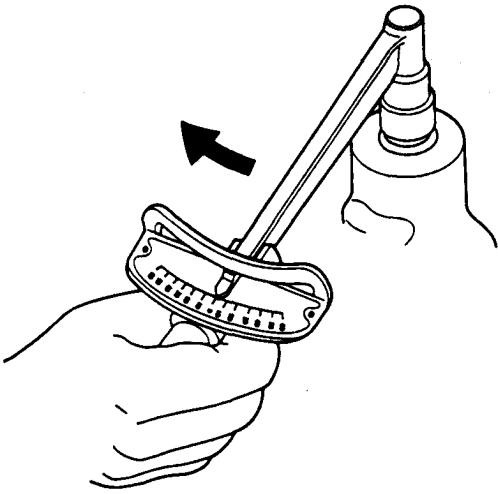
The Insight is built mostly out of aluminum alloys. Be sure to observe the following points:



Gray plating: "Dacrol" type

Gray plating + Green coating on the threads: "Torquer" type

2. Aluminum alloy parts are softer than conventional steel parts, so tightening torques must be strictly observed. A torque wrench must always be used on fasteners with designated torque values. Tightening by "feel" may result in loosening of threads or damage to parts from excessive tightening.



3. Clean all thread ridges thoroughly before tightening. If tightening is performed with foreign materials on the threads, the threads may be damaged, resulting in faulty connections.

Exterior Parts Removal / Installation

☆: Corrosion Resistant Bolt/Nut

Mounting bolts/nuts torque:

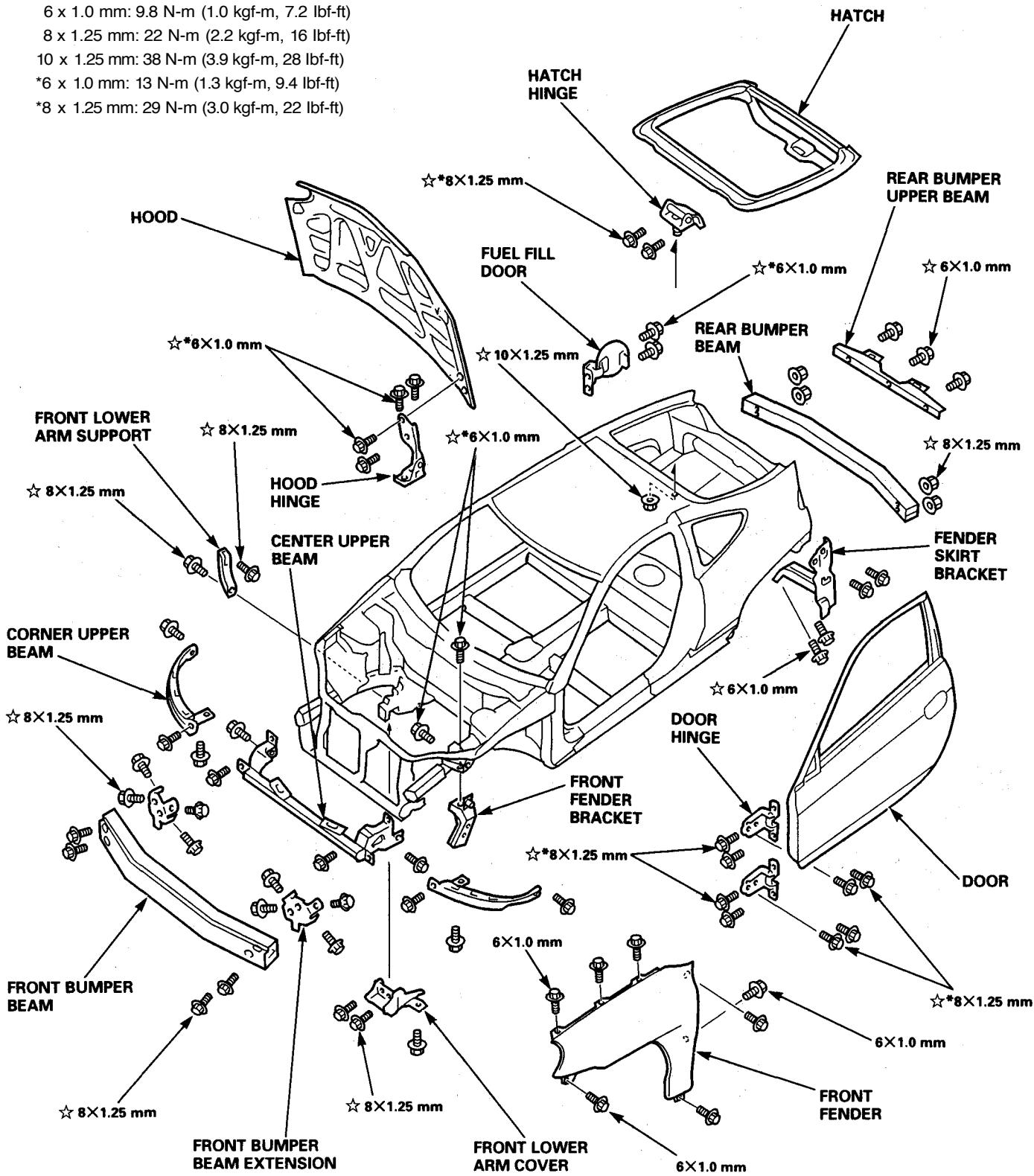
6 x 1.0 mm: 9.8 N·m (1.0 kgf·m, 7.2 lbf·ft)

8 x 1.25 mm: 22 N·m (2.2 kgf-m, 16 lbf-ft)

10 x 1.25 mm; 38 N·m (3.9 kgf·m, 28 lbf·ft)

* 6×10 mm: $13 \text{ N}\cdot\text{m}$ (1.3 kgf-m , 9.4 lbf-ft)

*8 x 1.25 mm: 29 N-m (3.0 kgf-m, 22 lbf-ft)



General Information

Engine and Passenger Compartment Parts Removal / Installation

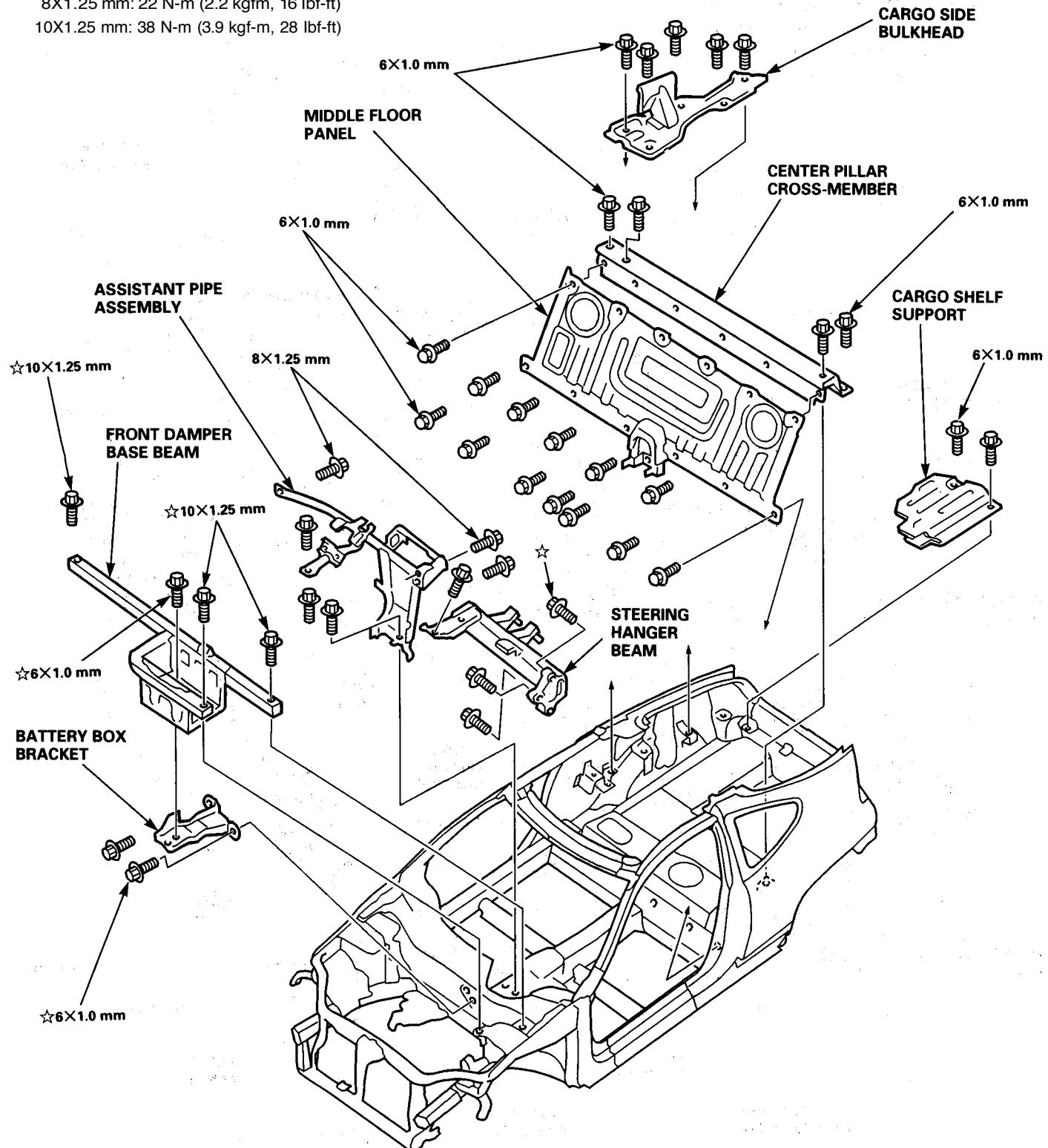
★: Corrosion Resistant Bolt

Mounting bolts/nuts torque:

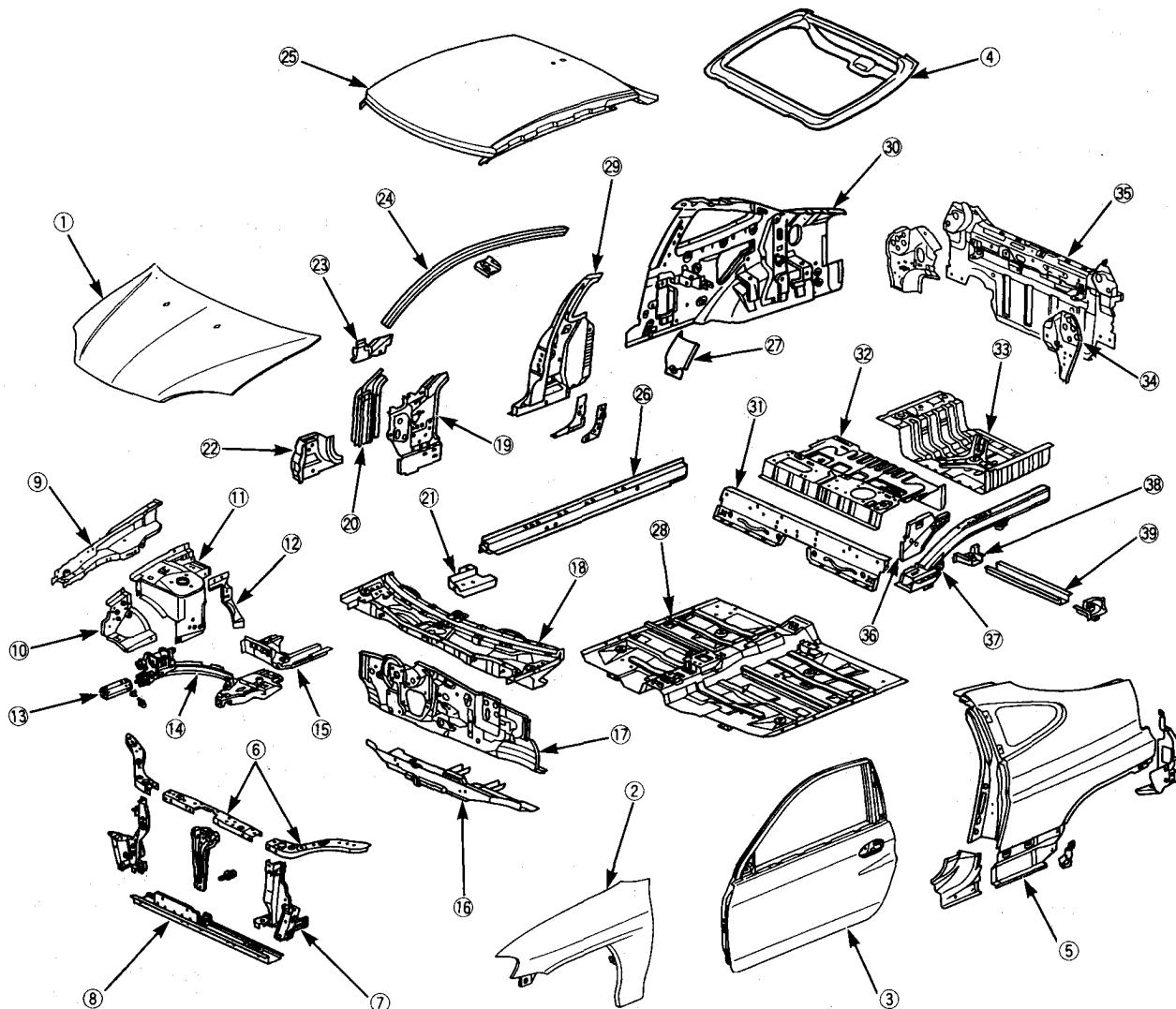
6X1.0 mm: 9.8 N·m (1.0 kgf-m, 7.2 lbf-ft)

8X1.25 mm: 22 N·m (2.2 kgfm, 16 lbf-ft)

10X1.25 mm: 38 N·m (3.9 kgf-m, 28 lbf-ft)



Construction

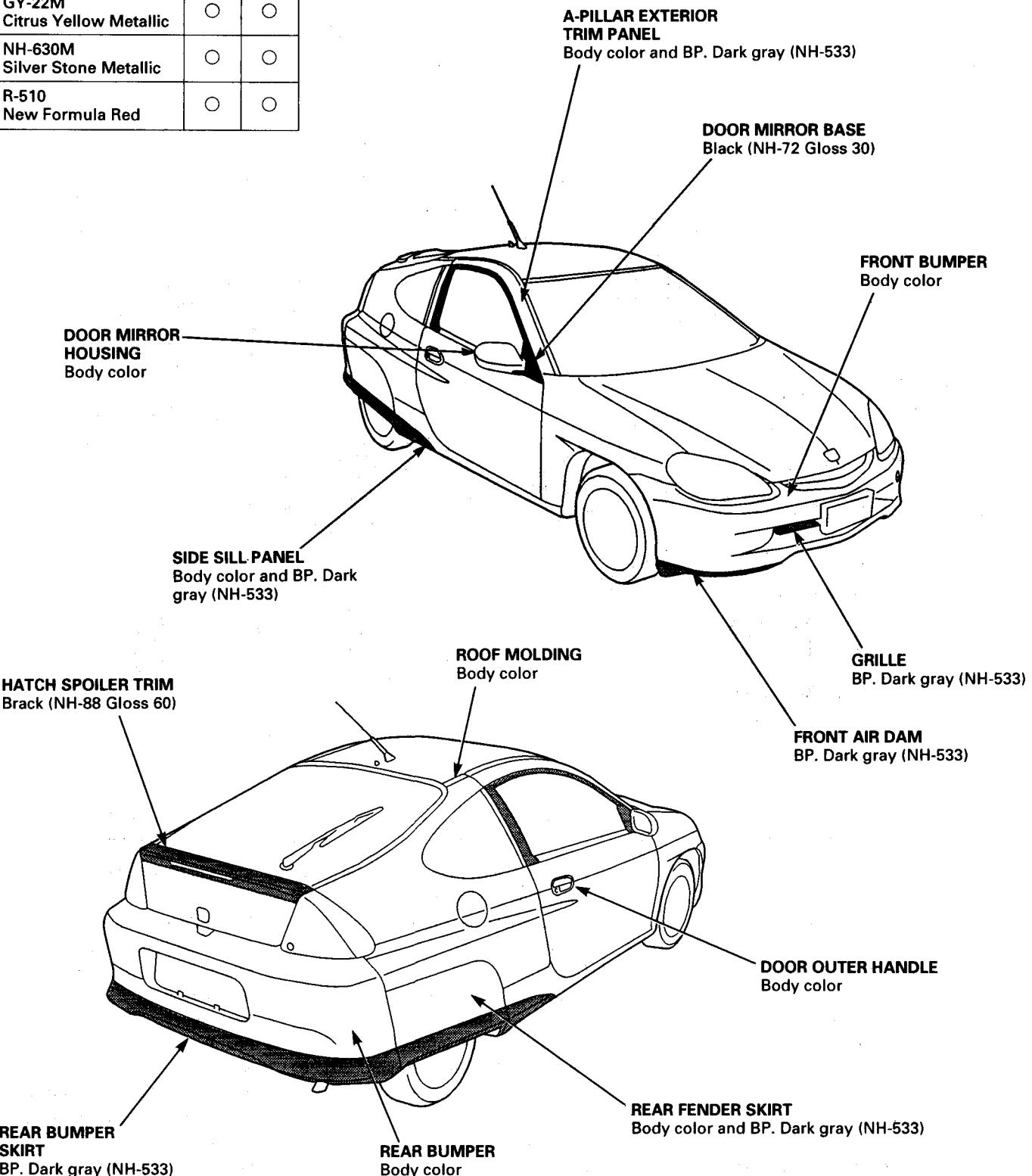


| No. | Part Name | No. | Part Name | No. | Part Name |
|-----|---------------------------------------|-----|--------------------------------------|-----|-----------------------------------|
| ① | Hood | ⑯ | Front Side Frame / Lower Arm Bracket | ㉗ | Side Sill Rear Plate |
| ② | Front Fender (Plastic Part) | ⑮ | Front Side Outrigger | ㉘ | Front Floor |
| ③ | Door Panel / Skin | ⑯ | Dashboard Lower Cross-member | ㉙ | Center Pillar Stiffener |
| ④ | Hatch | ⑰ | Dashboard Lower | ㉚ | Rear Inner Panel |
| ⑤ | Rear fender Panel | ⑱ | Dashboard Upper | ㉛ | Middle Floor Cross-member |
| ⑥ | Bulkhead Upper Center and Side Frames | ⑲ | Front Pillar Inner Lower | ㉜ | Middle Floor |
| ⑦ | Bulkhead Side Stay | ㉐ | Front Lower Pillar | ㉝ | Rear Floor |
| ⑧ | Bulkhead Lower Cross-member | ㉑ | Side Sill Lower Reinforcement | ㉞ | Rear Panel Side Stiffener |
| ⑨ | Wheelhouse Upper Member | ㉒ | Front Side Sill Reinforcement | ㉟ | Rear Panel |
| ⑩ | Front Wheelhouse | ㉓ | Front Pillar Lower Reinforcement | ㉟ | Rear Frame Outrigger Stiffener |
| ⑪ | Damper Housing | ㉔ | Front inner Pillar | ㉞ | Rear Frame Outrigger / Rear Frame |
| ⑫ | Wheelhouse B | ㉕ | Roof Panel | ㉘ | Rear Damper Base |
| ⑬ | Front Side Frame Extension | ㉖ | Side Sill | ㉙ | Rear Floor Cross-member |

General Information

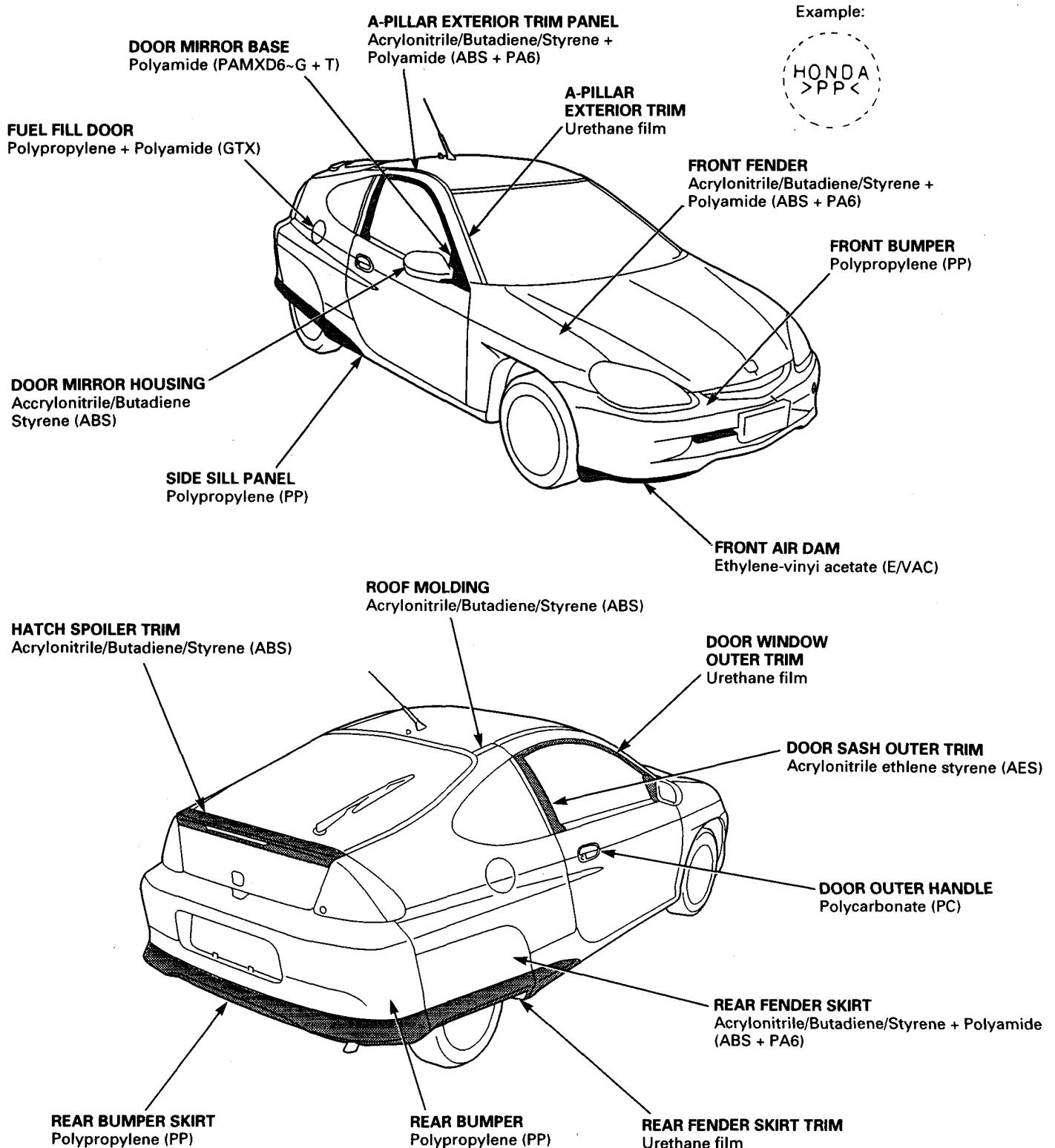
Color Chart Paint Specifications

| Paint Code Color Name | USA model | Canada model |
|----------------------------------|-----------------------|-----------------------|
| GY-22M Citrus Yellow Metallic | <input type="radio"/> | <input type="radio"/> |
| NH-630M Silver Stone Metallic | <input type="radio"/> | <input type="radio"/> |
| R-510 New Formula Red | <input type="radio"/> | <input type="radio"/> |



Types and Materials of Exterior Plastic Parts

NOTE: A standard symbol is stamped on the underside of each plastic part to show the type of material of used.



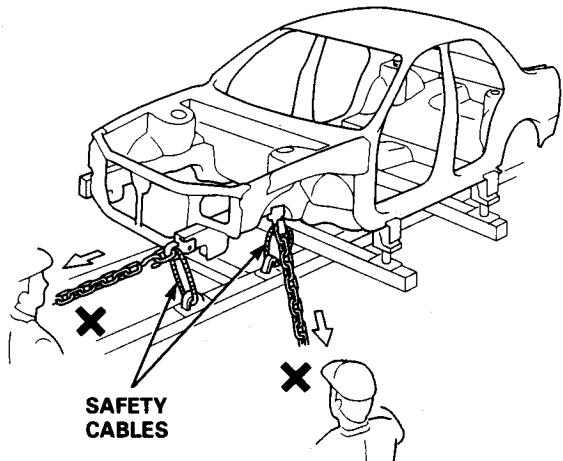
Outline of Body Repair

The contents described in this section are the basic processes of repair procedures needed to replace welded parts.
The table below shows information to this model.

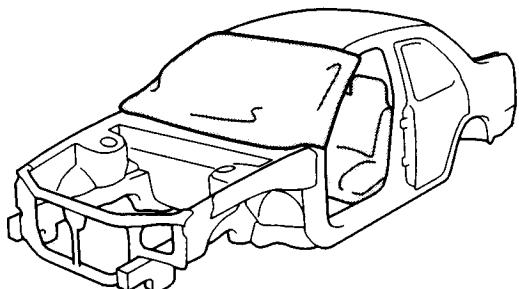
| Processes | Repair Procedures | Information | Reference |
|-----------------------------|---|--|--|
| | <ul style="list-style-type: none">• Accurate inspection of Damaged Parts. (Visual)• Measurement | <ul style="list-style-type: none">• Wheelbase• Wheel Alignment• Body Dimensional Drawings | see section 1 see section 1 see section 4 |
| Reshape | <ol style="list-style-type: none">1. Remove any related parts.2. Attach the frame straightener to the body.3. Pull out and straighten the damaged areas.4. Check the original position. | <ul style="list-style-type: none">• Body Dimensional Drawings | Service Manual see section 1 see section 4 |
| Replacement | <ol style="list-style-type: none">1. Cut off and separate the damaged area.2. Straighten any related part.3. Check the repair part installation and alignment with the body.4. Clean and degrease the welded surfaces.5. Weld in the repair part.6. Finish the welded areas. | <ul style="list-style-type: none">• Mass Production Body Welding Diagram• Removal• Body Dimensional Drawings• Installation | see section 3 see section 3 see section 4 see section 3 |
| Rust Prevention | <ol style="list-style-type: none">1. Apply the sealer.2. Apply the undercoating.3. Apply anti-rust agent to the inside of the outer panel and frames. | <ul style="list-style-type: none">• Cross Section of Body and Sealants.• Soft Chipping Guard Primer Coating Diagram• PVC Coating Diagram• Area to be Covered by Antirust Agents | see section 5 |
| Paint | Apply the paint | | see section 6 |
| Installation and Inspection | <ol style="list-style-type: none">1. Adjust the hood, door, and hatch.2. Measure the wheel alignment.3. Clean the body.4. Install related parts. | | Service Manual |

General Safety Precaution

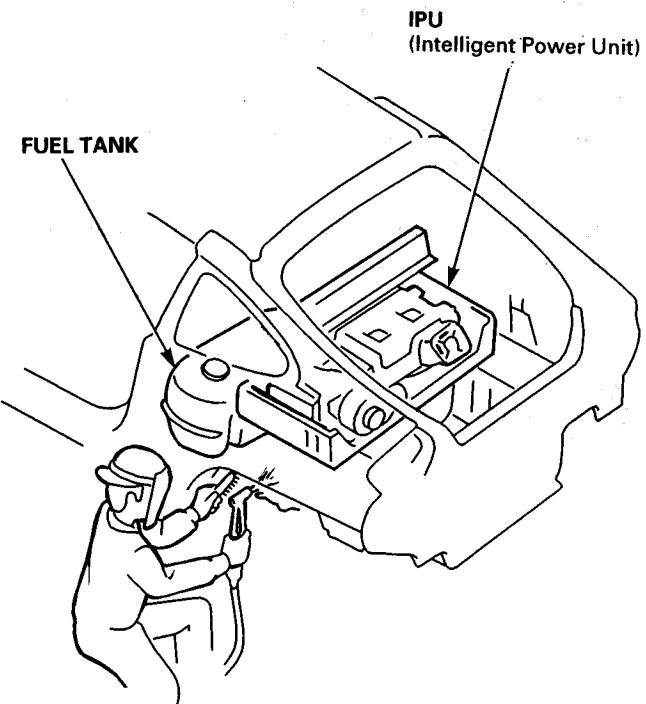
- The IMA is a high-voltage system. You must be familiar with the IMA system before working on or around it. Make sure you have read the IMA information in the General Information section before performing repairs or service (see pages 1-3, 1-4, 1-5).
- Disconnect the battery to reduce the possibility of damage caused by electrical shorts
- Check for fuel leaks and repair as necessary.
- Use standard safety equipment when spraying painting, welding, cutting, sanding, or grinding (see page 2-17).
- Always attach a safety cable when using a hydraulic ram or a frame straightening table; do not stand in direct line of the chains used on such equipment.



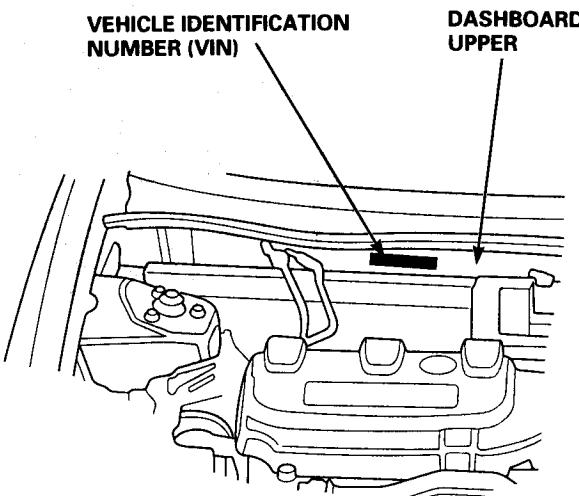
- Cover the exterior parts and the interior parts with a fire-proof cover and protect the vehicle when welding.
- Do not damage the passenger compartment parts when you heat the undercoat of the welded flange with a torch.



- Remove the fuel tank and / or fuel lines, and IPU and/or motor power cable if welding equipment is to be used near the fuel system and IMA system.



- The vehicle identification number is stamped on the dashboard upper panel and is registered with local authorities. If the dashboard upper panel must be replaced because of damage, check with local authorities first.



Accurate Inspection of Damaged Parts (Visual)

Description

Most monocoque bodies are composed as a single unit by welding together pressed parts made of steel plates, which come in a variety of different shapes and sizes. Each part is responsible for displaying a certain strength and durability in order that it may play its role in meeting the functions of the body.

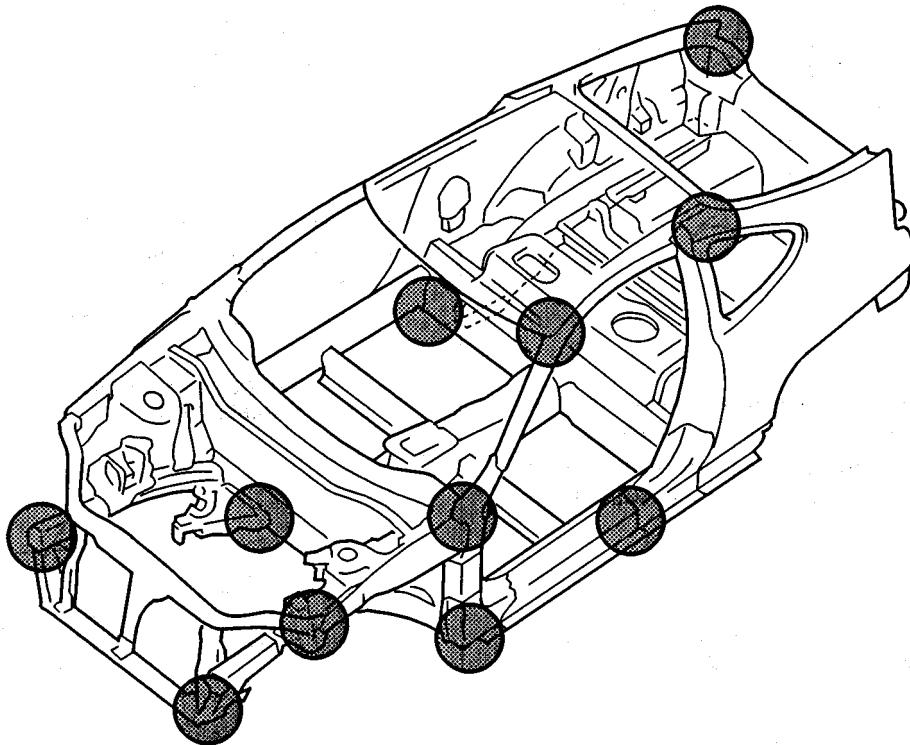
The Insight has a monocoque body made of aluminum alloy. Generally speaking, the collision damage of an aluminum alloy body is not much different from that of a steel body.

Damage to the exterior of the body can be visually inspected but where there has been external impact, it is necessary to inspect the extent of the damage. In some cases, the deformation may have spread beyond the actual areas that were in the collision so the deformation must be closely inspected.

Distortion to the vehicle, bends, inclines, and gaps between parts should be thoroughly checked. Also, check for paint peeling at welded areas corners and the sealing coat.



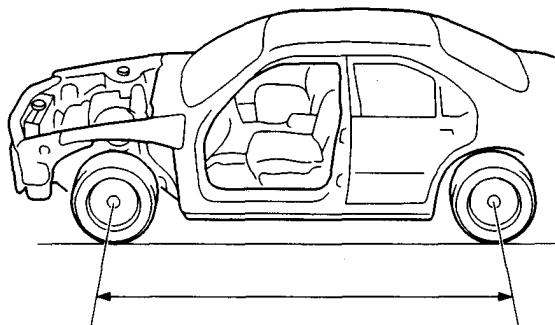
: Carefully checked.



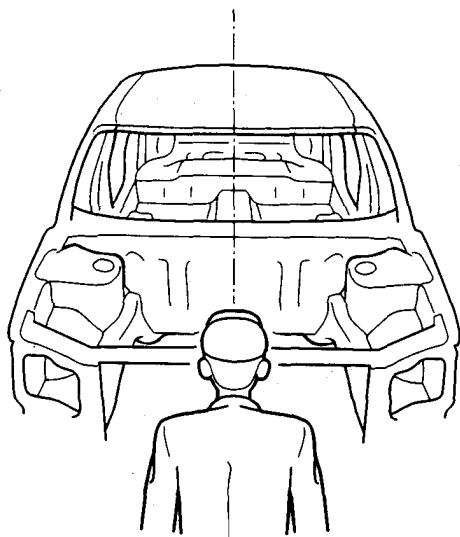
Measurement

Whenever possible, make judgements and conclusions based on measurements.

- Measure the wheel alignment to prevent uneven tire wear or incorrect steering wheel alignment.
- If there are any deviations, use a tram-tracking gauge and measure the body parts.

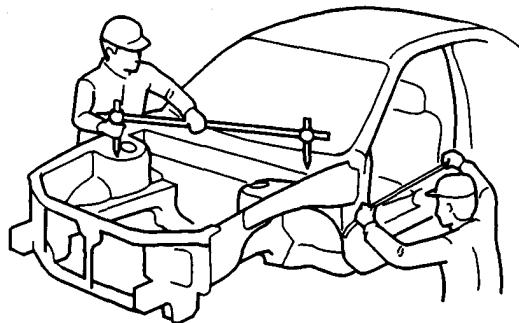


- If there is any twisting to the body, measure with a frame centering gauge.

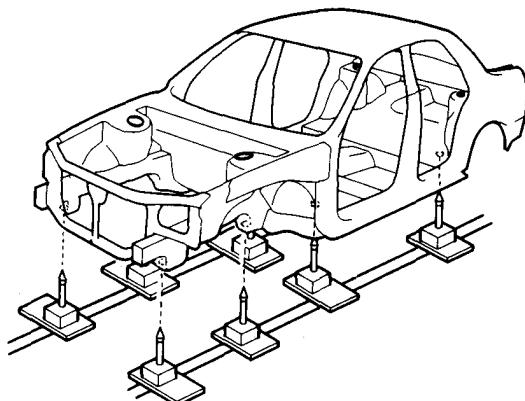


- To measure body dimensions, use a universal tram gauge and convex tool.

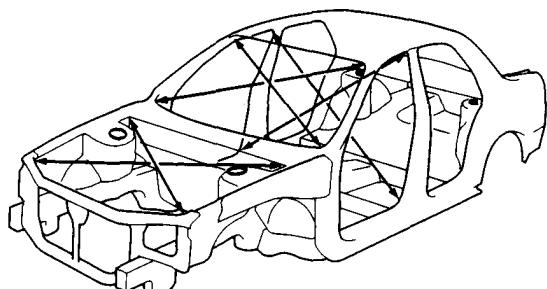
Body Measuring Dimension / Opening Repair Chart:



Frame Repair Chart:



Diagonal measurement:



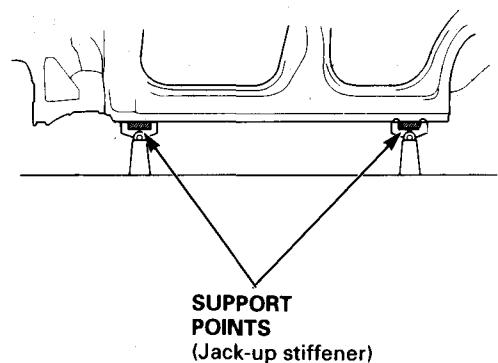
Reshape

Correction of the Damaged Area

1. Remove any related parts.

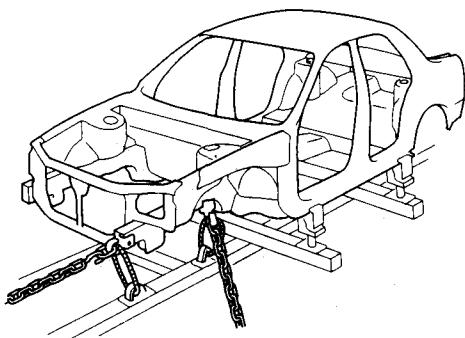
NOTE: See the Service Manual.

2. Connect the frame straightener to the vehicle body.
 - The side sill is flangeless to allow reshaping by pulling it out.
 - Use the horizontal pinch welds for anchoring the vehicle.

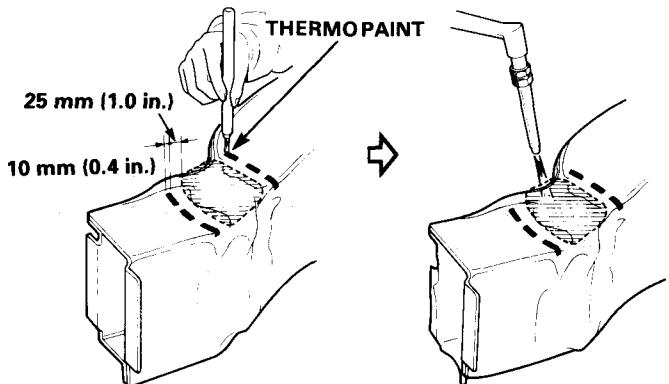
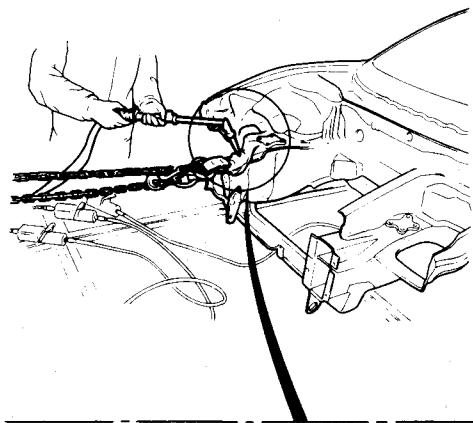


3. Pull out and straighten damaged areas.

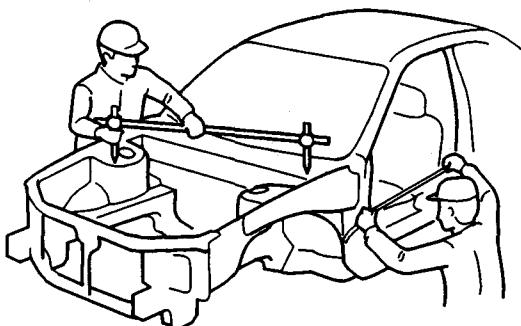
Apply load to the damaged section, and pull on it until the section is almost restored to its original shape. Do not pull out more than necessary.



NOTE: As work-hardening occurs to the buckled section of the aluminum alloy, it can crack easily. Heat up the damaged section with an acetylene torch, and pull it out to reshape it. The melting point of the aluminum alloy is 1184°F (640°C). Take care not to overheat it. Watch the heating temperature using a thermopaint or heat crayon (see page 2-41).



4. Check that the part of the body is more or less restored to its original shapes. Check the original positions using the body dimensional drawings.

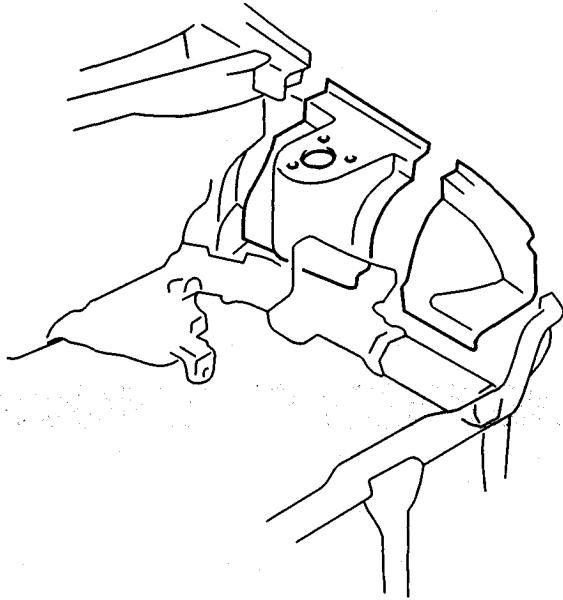


Replacement

Removal

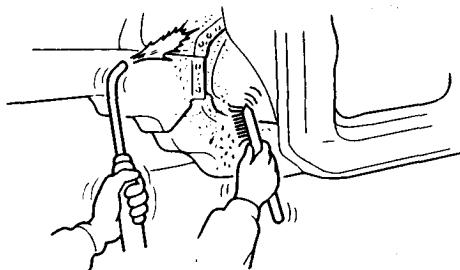
- Decide whether to replace or repair the affected parts.

NOTE: Parts which influence wheel alignment such as damper housing and side frame must be examined before installing any parts.



- Peel off the undercoat.

NOTE: Be careful not to burn the fittings inside the passenger compartment when heating.

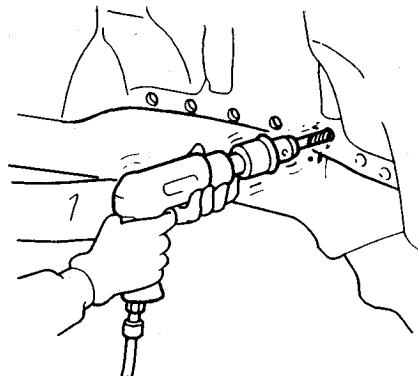


- Remove the damaged parts.

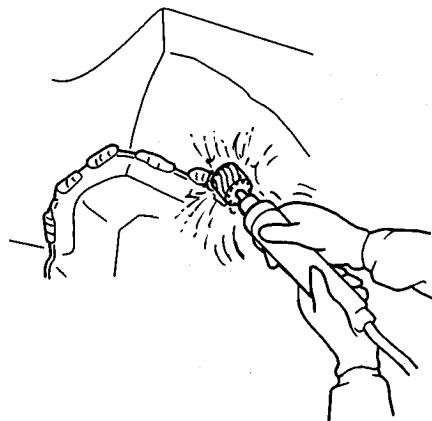
WARNING

To prevent eye injury, wear goggles or safety glasses whenever sanding, cutting or grinding.

- Center punch around the spot weld imprints on the welded flange and drill the spot welds using a 10 mm (0.4 in.) spot cutter.
- Drill the plug weld using a 15 mm (0.6 in.) spot cutter (hole saw type)



- Grind the fillet weld using a rotary cutter.



Replacement

Installation

- Straighten any damaged parts.

WARNING

To prevent eye injury and burns when welding, wear an approved welding helmet, gloves and safety shoes.

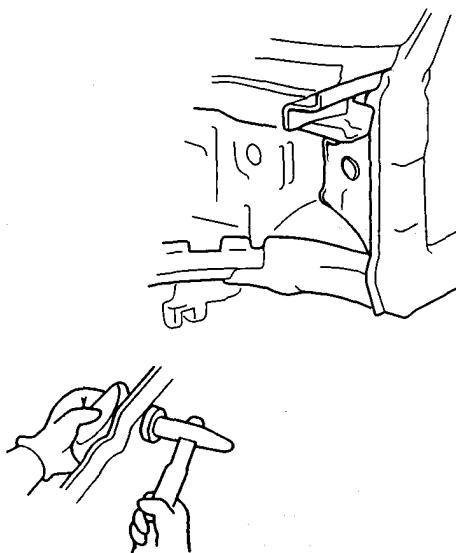
- Fill any holes by MIG welding and even out with a hammer and dolly.

WARNING

To prevent eye injury, wear goggles or safety glasses whenever sanding, cutting or grinding.

- Level and finish the burns on the welding flanges with a disc sander or belt sander.

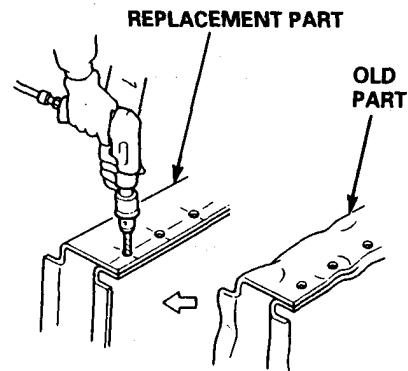
NOTE: Do not use the same sanding tools for both aluminum alloy sheets and steel plates.



NOTE: Check the reshaped parts for cracks
(see page 2-39).

- Prepare to install replacement parts.

- Drill the 8 ~ 10 mm (0.3 ~ 0.4 in.) holes for plug welding in the welding flange of the replacement parts.
 - To locate the area you need to drill holes, refer to old parts or to the Mass Production Body welding Diagram (see section 3).



- Sand and degrease the welded surfaces.

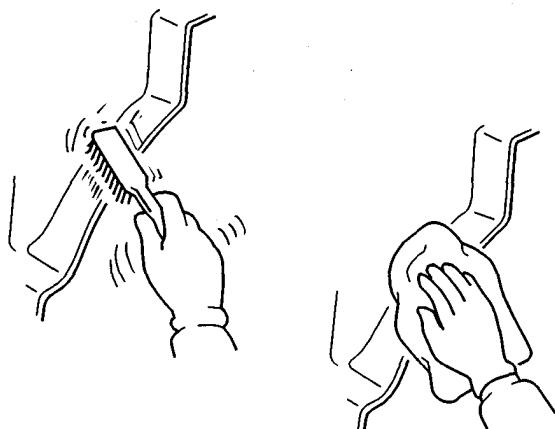
WARNING

To prevent eye injury, wear goggles or safety glasses whenever sanding.

- Remove the undercoat from both sides of the welding section and expose the aluminum alloy base using a disc sander.
- Remove the paint film from welding section of the body.

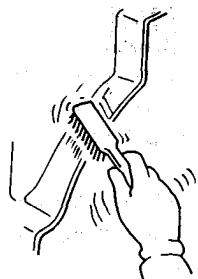
NOTE: Do not use the same sanding tools for both aluminum alloy sheets and steel plates.

- Clean any oil and any dirt from the welding surface with wax and grease remover.



3. Set the repair parts.

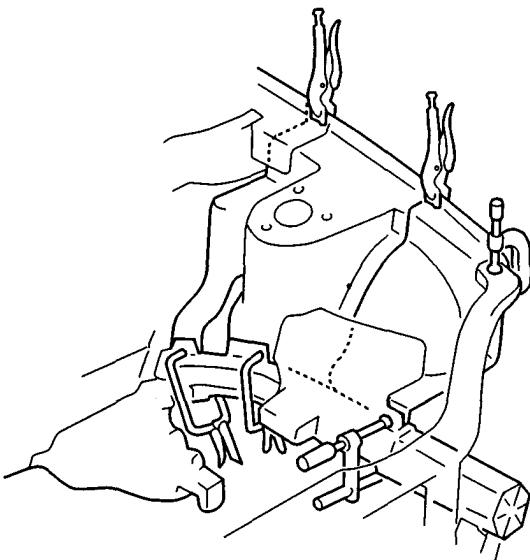
- Before setting the repair part, remove the oxide film from the welding surfaces of the repair parts and body using a stainless steel wire brush.



- Clamp the new part and check its position using the body dimensional drawings (see [section 4](#)).
- Tack weld the clamped section.

⚠ WARNING

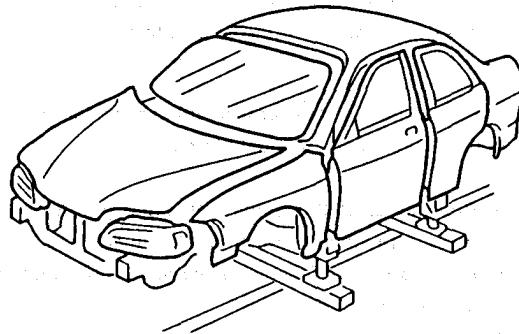
To prevent eye injury and burns when welding, wear an approved welding helmet, gloves and safety shoes.



4. Check the alignment of the exterior body parts.

- Temporary install the exterior body parts, windshield and rear window glass, and check for differences in level and clearances.

NOTE: Check the fit of the front fender, door and the rear fender, and make sure the body lines flow smoothly.



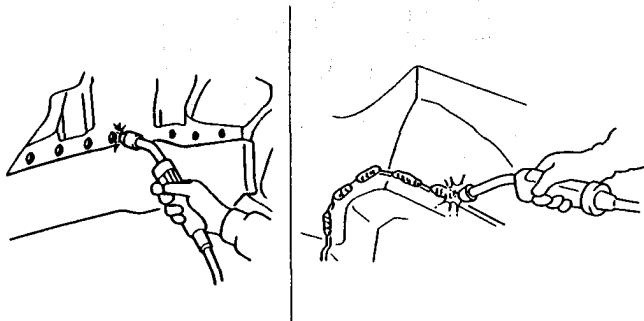
5. Main welding the repair parts.

- Use proper welding methods (see pages [2-23](#), [2-35](#)).

⚠ WARNING

To prevent eye injury and burns when welding, wear an approved welding helmet, gloves and safety shoes.

- Weld as much as possible with the jig still mounted.
- Before main welding, perform the trial welding following the welder manufacturer's instructions (see page [2-15](#)).
- Before welding, clean the welding surfaces with a stainless steel wire brush, and clean off any oil or dirt with wax and grease remover.



NOTE: Check the welding section for cracks (see page [2-39](#)).

(cont'd)

Replacement

Installation (cont'd)

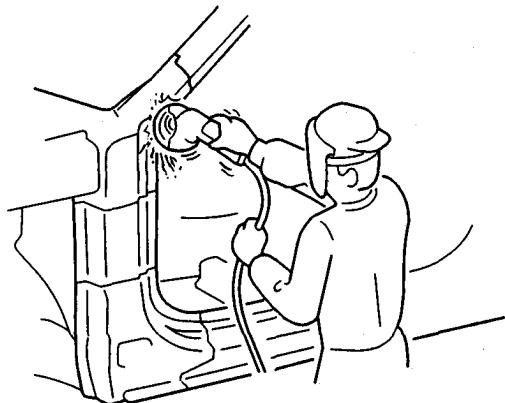
6. Finishing the welded areas (see page 2-38).

WARNING

To prevent eye injury, wear goggles or safety glasses whenever sanding, cutting or grinding.

NOTE: Do not use the same sanding tools for both aluminum alloy sheets and steel plates.

- Roughly grind the welds with a disc grinder. Be sure to leave a finishing allowance.
- Finish grind the finishing allowance with a disc sander until it is smooth.
- Take care not to grind the aluminum alloy base while grinding the welds.
- Do not press on the sanding tools excessively. If the disc face is clogged with aluminum alloy particles, replace it with a new disc.
- Smooth out welded door and hatch areas, and window opening flanges with a hammer and dolly.
- Fill the deformed area and smooth out the welded areas with body filler.



Replacement

Rust Prevention / Paint

1. Applying sealer. Seal overlapped areas of the outer panel, and the welded surfaces of the new parts. Seal gaps completely.
2. Applying paint.

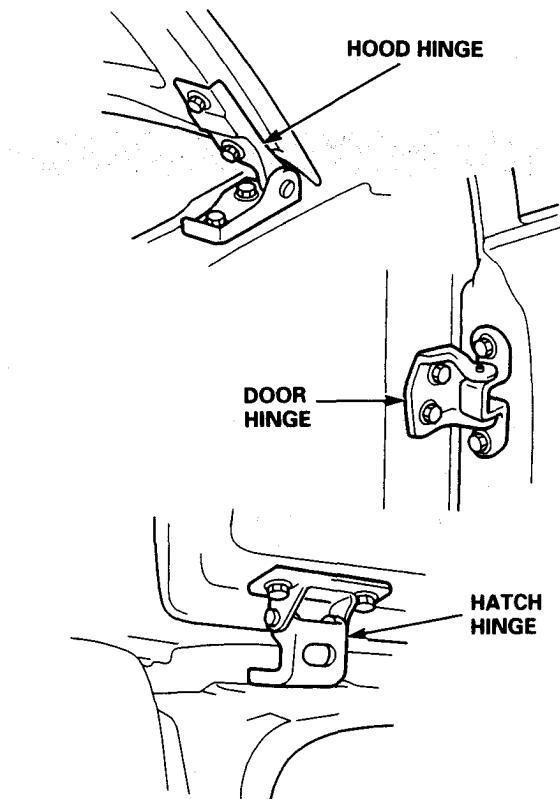
WARNING

- Ventilate when spraying paint. Most paint contains substances that are harmful if inhaled or swallowed. Read the paint label before opening the paint container.
- Avoid contact with skin. Wear an approved respirator, gloves, eye protection, and appropriate clothing when painting.
- Paint is flammable. Store it in a safe place, and keep it away from sparks flames, or cigarettes.

3. Apply undercoat to the wheelhouse and under-floor.
4. Apply the anti-rust agent to the inside of the outer panel and welded areas.

Installation and Inspection

1. Install the any related parts:
NOTE: Some parts are mounted with special "Dacro" type bolts and nuts. When replacing these fasteners, use only the same type of bolts and nuts (see page [1-10](#)).
2. Check the clearance of the door, hood, trunk lid or hatch, and adjust if necessary.
Check the operation of the parts, and make sure the doors lock securely.
3. Apply the sealer to the hinges of the hood, door, and hatch.



4. Adjust the wheel alignment.
5. Check the windows for water leaks.
6. Clean the passenger and cargo compartments.

Aluminum Alloy Repair

Repairing aluminum alloy parts can be challenging due to its unique properties. This section provides guidance on how to effectively repair aluminum alloy components.

Safety Precautions

Precautions for Ensuring Safety:

1. Although aluminum is non-toxic, it is lightweight, so fine particles of metal given off by sanding operations tend to float in the air. It is therefore vital that operators protect their lungs and eyes from this dust.
2. Small pieces of aluminum alloy spattered by MIG welding can be projected over considerable distance. It is therefore important to provide protection not only for the welder operators themselves, but also for anyone in the surrounding areas.
3. The sparks generated from the arc during inert gas arc welding are very bright and may hurt the eyes if viewed directly. A protective shield for the eyes must be worn at all times when welding.

Use of protective gear to ensure safety:

Work overalls with long sleeves, a cap, and safety shoes must be worn at all times. Depending on the job to be done, protective goggles, gloves, ear plugs, and dust-proof mask should also be worn (see page [2-17](#)).

CAUTION

- When aluminum alloys are heated, they melt without changing color.

Melting temperature

Aluminum alloys: Approx. 1184°F (640°C) (depends on alloy)

Steel plate: Approx. 2732°F (1500°C)

- Aluminum alloys can be repaired in virtually the same way as steel sheets, but it is important to have a good grasp of their properties and be thoroughly familiar with their limitations.
- Aluminum alloys tend to overheat during sanding. When they overheat, the metal tends to flake and clog the filing surface of the sanding tool. If a tool with a clogged surface is used, it will leave scratches and marks on the base metal.

Welding Methods

1. MIG (metal inert gas arc) welding

This type of welding uses consumable electrodes, with electrode wire serving as the electrode. Inert gas is passed through the torch and welding takes place when an arc is formed between the electrode wire and the base metal. The electrode wire is supplied automatically.

Although it is dependent on the proficiency of the welder himself, the minimum thickness of weldable aluminum alloy sheets has been 1.6 mm (0.06 in.). In most cases the sheets used have been over 3 mm (0.1 in.) thick. More recently, welders have been developed for handling sheets with a thickness of 1 mm (0.04 in.) or less.

2. TIG (tungsten inert gas arc) welding

This type of welding uses non-consumable electrodes, with tungsten rods serving as the electrodes. Inter gas is passed through the torch, an arc is formed between the electrode and the base metal, and welding takes place when the heat from the arc melts the base metal and hand-held welding rod. The minimum thickness of aluminum alloy sheets which can be welded is about 0.6 mm (0.02 in.), although this method is not suited to heat-treated alloys because there are many thermal effects.

3. Carbon dioxide gas arc welding (metal active gas arc welding)

In place of the high-cost inert gas, carbon dioxide gas or carbon dioxide gas mixed with argon gas is employed as the shielding gas in the metal active gas arc welders often used today in body shops. Carbon dioxide gas is not an inert gas in the full sense of the term so these welders are known by the acronym of "MAG" (metal active gas), rather than "MIG."

4. Gas (oxygen, acetylene) welding

Welding or brazing work must not be undertaken using these gases.

Since it is hard to concentrate the heat at the welding point, the thermal effects extend to the surrounding area and the strength of the aluminum alloy is reduced. Gas welding cannot be used for brazing since the joint strength is too low.

NOTE: Gas welders are used for heating work when aluminum alloys are shaped. (It is necessary to control the upper limit temperature.)

5. Spot welding

Aluminum alloys cannot be welded using the conventional spot welders which are used in body shops.

The capabilities of spot welders for steel plate are not sufficient for aluminum alloys which have high thermal conductivity. No matter how long the welding current is allowed to run, the heat escapes to the surrounding areas and the base metal does not melt, making welding impossible. It requires a very high current of several tens of thousands of amperes and high pressure to spot-weld an aluminum alloy.

(cont'd)

Aluminum Alloy Repair

Welding Methods (cont'd)

Comparison of spot welding for aluminum alloys and steel plate (one example)

| Material | Thickness | Current (A) |
|----------------|-------------------|----------------|
| Steel sheeting | 1.2 mm (0.05 in.) | Approx. 9300 |
| Aluminum alloy | 1.2 mm (0.05 in.) | Approx. 26,000 |

NOTE:

- Welding conditions may induce changes in the spot welding current given in the comparison above.
- See page 2-20 for the re-bonding procedure applied when spot-welds on an aluminum alloy body are repaired. MIG welding is used.
- A person proficient at carbon dioxide gas arc welding who has an adequate understanding of the properties of aluminum alloys will be able to master the technique after practicing for a short while. Practice is important for increasing one's competence.

▲ CAUTION

- Aluminum alloys melt without changing color when heated.
- It is difficult to judge the melting point when an alloy is heated.
- Aluminum alloys have a coefficient of thermal expansion which is approximately double that of steel plate and a coefficient of contraction during solidification which is approximately 1.5 times higher. They are therefore subject to strain more easily and welding cracks (bead cracks and crater cracks) develop.
- Cleaning the welding location greatly affects results.
Although the oxide film is destroyed by the cleaning action, it is important for all dirt to be removed, along with any oil and grease, prior to the welding.
- Tools used for welding aluminum alloys must be kept completely separate from those used for steel plate.
- Use a stainless steel wire brush.
- Use sanding tools which have been reserved especially for use only with aluminum alloys. If the same tools are used for steel plate as well, iron deposits will remain on the surface of the aluminum alloy and contaminate welds.
- Inert gas arc welding is a gas-shielded method and is therefore unfit for working in areas exposed to wind or breezes. It is important that the flow of the inert gas is not disturbed.

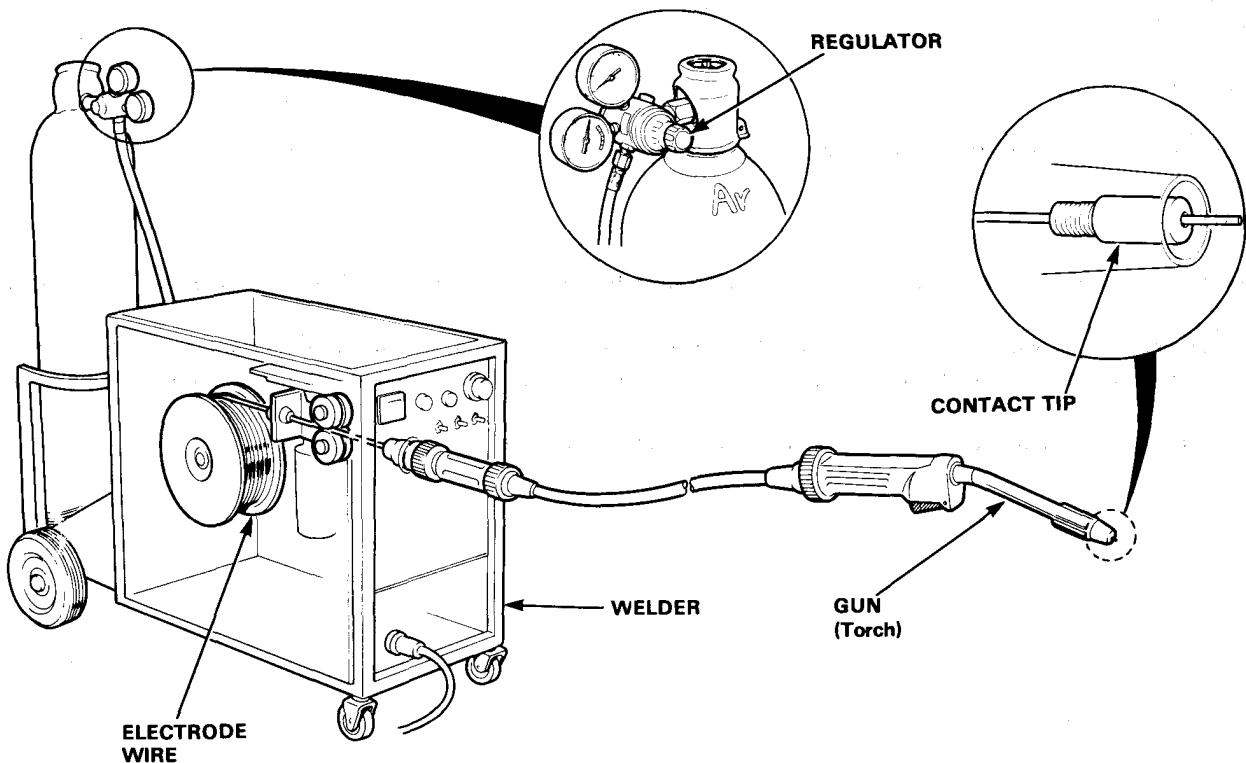
Welders

Performance of Welders:

1. Output current: Approx. 200 A at maximum output
2. Electrode wire diameter: Approx. 0.8~1.2 mm (0.031 in.)
(A5356WY) ~0.05 in.)
3. Shielding Gas: 100% Argon

- It is an added convenience if the welder can be set to seam, stitch and spot modes.
- A welder which can be used for both aluminum alloy MIG welding and steel plate carbon dioxide gas arc welding simply by changing some parts is economical and efficient.

NOTE: Follow the manufacturers' instructions.



Conditions:

| Material thickness unit: mm (in.) | Electrode wire diameter unit: mm (in.) | Electrode wire speed (A) | Welding voltage (V) | Volume 100% argon (L/min) |
|--------------------------------------|---|-----------------------------|------------------------|------------------------------|
| 1.6 (0.06) | 0.8 (0.031) | 50~70 | 10.0~11.0 | 15.0 |
| 2.0 (0.08) | 0.9~1.0 (0.035~0.04) | 60~110 | 12.0~15.0 | 15.0 |
| 2.5 (0.1) | 0.9~1.2 (0.035~0.05) | 80~120 | 13.0~16.0 | 17.0 |
| 3.0 (0.12) | 0.9~1.2 (0.035~0.05) | 100~140 | 15.0~18.0 | 20.0 |
| 5.0 (0.2) | 0.9~1.2 (0.035~0.05) | 120~170 | 17.0~20.0 | 20.0 |

Aluminum Alloy Repair

Filler Metals

When "filler metal" is mentioned in this text, it refers to welding rods for TIG welding and to electrode wire for MIG welding.

The selection of the filler metal affects the following items relating to the state of the welded joints:

- a) Flaws in joints (bead cracks)
- b) Strength of joints
- c) Toughness of joints (tenacity)
- d) Resistance of joints to corrosion

[A5356WY] is the filler metal best suited to aluminum alloys in the 5000 and 6000 series which are used for Honda aluminum alloy bodies.

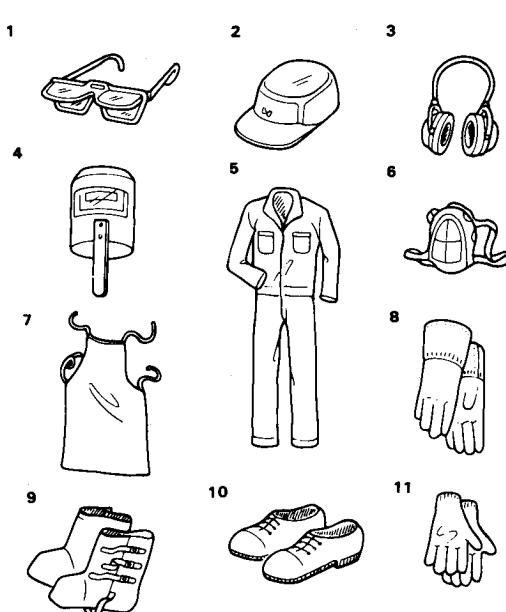
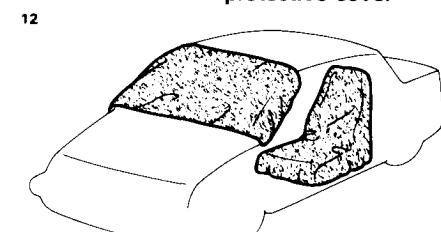
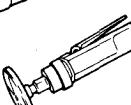
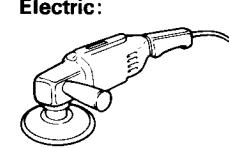
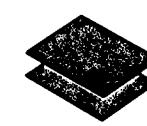
Filler metal storage

Proper storage of filler metals is important for best welding results.

NOTE:

- Store filler metals where they will not become dirty or scratched and where they will be free from contact with oils and greases.
- Use clean gloves when handling filler metals. Seal them in airtight vinyl bags, and store at a constant temperature in a location where they will be dry at all times. Before sealing the electrode wire, make sure that it is wound properly on its spool.
- Take steps to ensure that the seal cover is not opened until actual use.

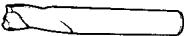
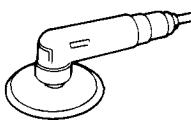
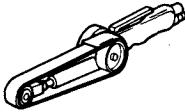
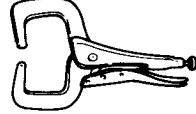
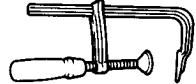
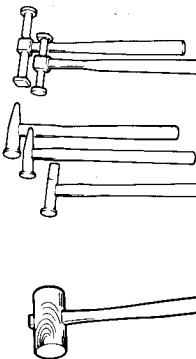
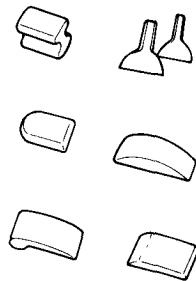
Examples of Repair Tools

| Item | Work | Tools, equipment used |
|----------------------|-------------------------|--|
| Protective equipment | Operator protection | <p>1. Protective goggles 7. Protective apron 2. Cap 8. Welding gloves 3. Ear plugs 9. Foot protectors 4. Shield for eyes 10. Safety shoes 5. Overalls with long sleeves 11. Work gloves 6. Dust-proof mask 12. Spatter guard</p>  |
| | Vehicle body protection | <p>Heat-resistant protective cover</p>  |
| Processing tools | Edge preparation | <p>DISC GRINDER, DISC SANDER.</p> <p>Air:</p>  <p>BELT SANDER</p>  <p>Electric:</p>  <p>SANDPAPER, FILES</p>  |

(cont'd)

Aluminum Alloy Repair

Examples of Repair Tools (cont'd)

| Item | Work | Tools, equipment used |
|------------------|--------------------|---|
| Processing tools | Plug hole drilling | DRILLING BLADE, DRILL, SPOT CUTTER   ROTARY CUTTER  PUNCH  |
| Sanding tools | Cleaning | STAINLESS STEEL WIRE BRUSH  DISC SANDER  BELT SANDER  |
| | Finishing | Disc grinder, Disc sander, Belt sander, Sandpaper. |
| Fixing tools | Base metal fixing | VICE-GRIPS   SCREW CLAMP  SQUILL VISES  |
| Shaping tools | Skin panel shaping | HAMMERS  DOLLIES/CHISELS  |

NOTE: Use a stainless steel wire brush and sanding tools reserved especially for aluminum alloys. Do not use the same tools for steel sheet.

Grain size for sanding/processing tools and jobs performed.

| Tool | Disc paper grain size | Job |
|----------------------------|-------------------------------|---|
| Disc grinder | A36P (grindstone for grinder) | <ul style="list-style-type: none">• Roughing of weld reinforcement areas.• Roughing of V-shaped edge preparation. |
| Disc sander | #80～#120 (sanding disc) | <ul style="list-style-type: none">• Roughing of paint film.• Sanding of aluminum alloy surface (oxide film)• Finishing of weld reinforcement areas.• Finishing of V-shaped edge preparation. |
| Belt sander | #80 or above | <ul style="list-style-type: none">• Sanding of narrow areas. |
| Stainless steel wire brush | | <ul style="list-style-type: none">• Sanding of aluminum alloy surface (oxide film) |

NOTE:

- Use a low-speed disc grinder or disc sander.
- If a low-speed air-powered disc grinder is not available, attach an air control valve to reduce grinder speed.
- A double-action sander may also be used.

Cleaning-oxide film removal:

Clean the welding locations thoroughly (both front and back surfaces).

- Use a wax and grease remover to clean off any dirt, oil or grease.
- Use a disc sander and stainless steel wire brush to remove paint and oxide films. Use a #80 sanding disc.

NOTE: Do not allow the sanding disc of the disc sander to become clogged. If the disc sander is pressed excessively hard, it will overheat due to friction and the aluminum alloy will tend to peel off, clogging the disc. The alloy surface will be scraped and scored if a clogged disc is used.

Aluminum Alloy Repair

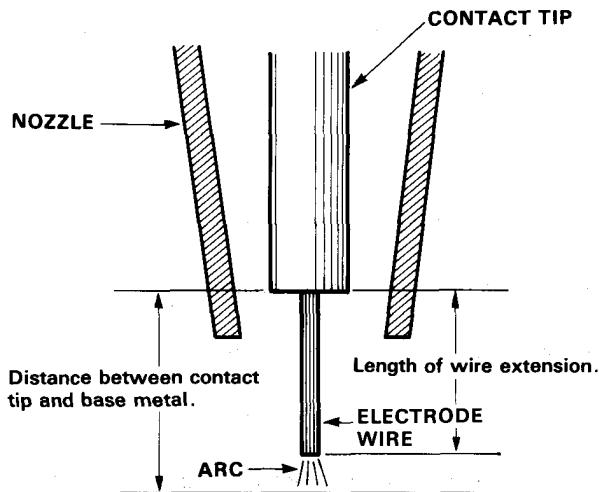
MIG Welding Conditions

MIG welding can be performed under virtually the same conditions as for the carbon dioxide gas arc welding of steel plate mentioned previously. The differences are outlined below.

The factors which affect deposition at the welding location and serve as the welding conditions for carbon dioxide gas arc welding of steel plates are:

- Welding current,
- Welding voltage (automatically adjusted for HTP MAXI MIG),
- Electrode wire speed,
- Distance between contact tip and base metal,
- Gun angle,
- Gun feed speed,
- Volume of shielding gas.

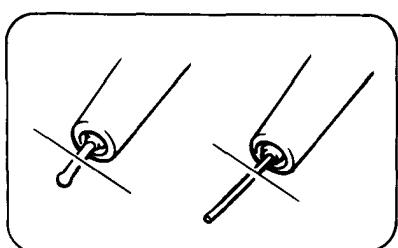
NOTE: Distance between contact tip and base metal: 8~15 mm (0.3 ~ 0.6 in.).



Arc generation

As with steel-plate welding, an arc is generated and welding starts once the torch switch is thrown.

- Welding startup is impaired if the electrode wire extends too far out or if the end is spherical. In such cases, cut off the end of the wire with a pair of wire cutters.



CAUTION:

- The torch switch must not be thrown with the electrode wire in contact with the base metal.
- When cutting the end of the electrode wire, point the torch downward and cut near ground level to protect the eyes from the cut end.

Sound of arc when welding under proper conditions:

- With aluminum alloy MIG welding, there is a quiet and continuous humming sound similar to that heard during carbon dioxide gas arc welding.
- A small amount of soot is formed along the bead during MIG welding. This is caused by magnesium contained in the electrode wires.

1. Differences in welding conditions

When comparing the welding of aluminum alloys and steel plate using the same welder, the thickness range of plates which can be welded is less for aluminum alloys. In other words, the welder setting conditions must be adjusted more finely for welding aluminum alloys.

- 1 .Welding current, electrode wire speed

Under the same welding current conditions, the electrode wire for aluminum alloys needs to be fed faster than that for steel plates.

-2. Distance between contact tip and base metal

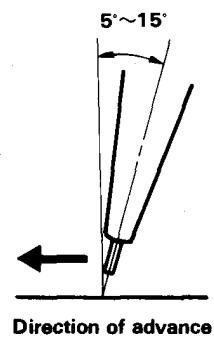
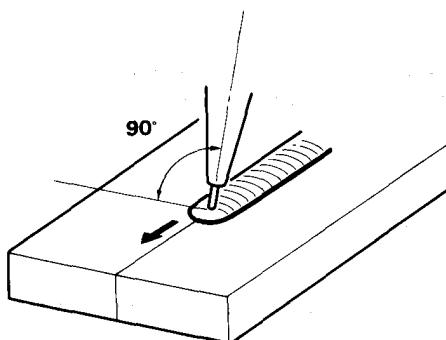
As for steel plate welding, the distance ranges from 8~15 mm (0.3 ~ 0.6 in.). The gas shielding effect is enhanced by positioning the gun closer to the surface.

-3.Gun angle

The gun is held perpendicular to the welding surface. It is tilted at a 5~15° angle in the direction of the welding advance. Compared with steel plate welding, the gun angle is slightly more vertical.

-4 Direction of gun advance

Either a straight sequence or back-step can be used when for welding steel sheets. With aluminum alloys, however, only the forehand welding method is used.



-5. Gun travel speed

Welding of aluminum alloys progresses at a much faster rate than for steel plate. The speed increases as the welding progresses.

-6. Volume of shielding gas

About 50% more gas is required than for steel sheet welding.

(cont'd)

Aluminum Alloy Repair

MIG Welding Conditions (cont'd)

2. Nozzle and contact tip

Compared with the carbon dioxide arc welding of steel plates, spattering adheres more readily at the end of the nozzle and the contact tip.

- Adhesion of spattering can be reduced by using an anti-spatter compound. This makes it easier to remove spatter as well.
- The nozzle and contact tip are subjected to greater wear than with steel plate welding.

3. Electrode wire setting

Since the cable inner liner is made of teflon, be sure not to mark or scratch it.

- Use sandpaper to smooth the edge of the end of the electrode wire before feeding it through by hand.

4. Adjustment of electrode wire drive roller tension

Tension is adjusted to a setting less than that for steel plate welding. When the electrode wire is held lightly at the contact tip area and the torch switch is on, the wire is set so that it will slip in the drive roller area. If the tension is set too high, the aluminum alloy electrode wire will be twisted. If it is set too low, the wire speed will not be constant.

NOTE:

- The tools used for aluminum alloy welding should be kept completely separate from those used for steel plate.
- Use a stainless steel wire brush.
- Use sanding tools which have been reserved especially for use with aluminum alloys, (If the same tools are used for steel plate as well, iron deposits will remain on the surface of the aluminum alloy contaminating the welding locations.)
- Proper storage of electrode wire is important for best welding results.
- Store electrode wires where they will not become dirty or scratched and where they will be free from contact with oils and greases.
- When electrode wire is being used, ensure that it is wound properly on its spool. Use clean gloves to seal wire in airtight vinyl bags and store at a constant temperature in a location where it will be dry at all times.
- Take steps to ensure that the covers sealing electrode wire containers are not opened until actual use.

Plug Welding Procedures

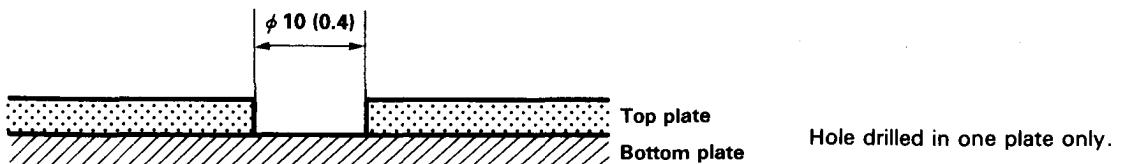
When removing or replacing plates bonded by spot welding, drill through the spot weld nugget and remove. The combinations shown in the figures below apply when plates are to be welded together. Drill the hole when the plates have been removed or drill the prepared hole, and proceed with plug welding.

1. Plate combinations and prepared holes

Diameter or drill (spot cutter) when removing plates: 10 mm (0.4 in.)
Drill the hole in the new part. Drill diameter: 8~10 mm (0.3 ~ 0.4 in.)

Unit: mm (in.)

Two stacked plates:



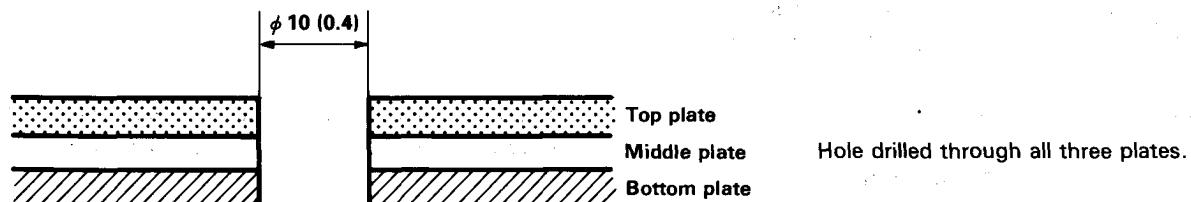
Hole drilled in one plate only.

Two stacked plates:



Hole drilled through both plates.

Three stacked plates:



Hole drilled through all three plates.

2. Adherence

Where the plug welding is to be performed, the aluminum alloy plates must adhere together firmly, otherwise the welding will be defective.

(cont'd)

Aluminum Alloy Repair

Plug Welding Procedures (cont'd)

3. Cleaning and sanding

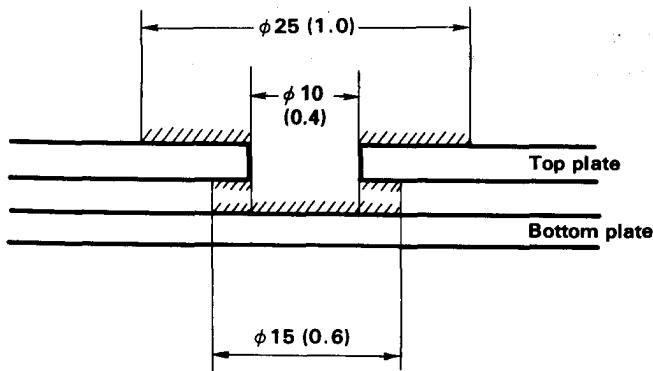
- Use a wax and grease remover to clean off any dirt, oil or grease prior to welding.
- If the aluminum alloy surface is coated with a paint film, use a disc sander and #80 sanding disc to remove the paint.
- Use a stainless steel wire brush to burnish the bare surface of the aluminum alloy immediately before the welding.

NOTE: Use a stainless steel wire brush to burnish the bare surface of the aluminum alloy immediately before welding.

Cleaning range

Unit: mm (in.)

When drilling a single-layer hole in two stacked plates:

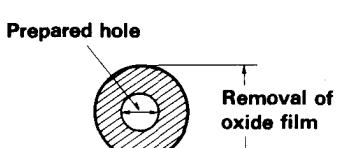
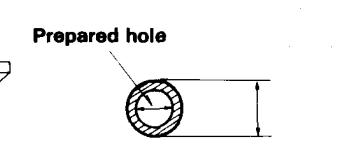
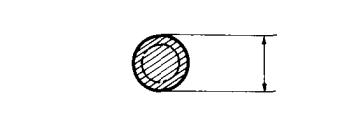


Sand the top and bottom surfaces of the top plate and the welding surface of the bottom plate.

Remove oxide film by sanding.

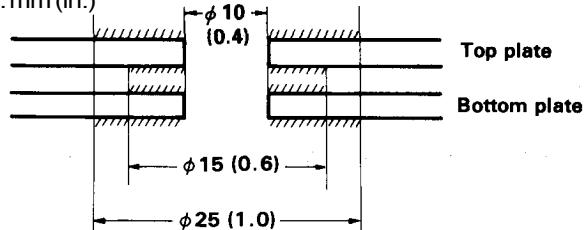
Prepared hole.

Oxide film removal by sanding

| | | |
|-------------------------------------|---|--|
| 1. Top surface of top plate. |  Prepared hole Removal of oxide film | 25 mm (1.0 in.) diameter area on top surface of top plate centering on plug hole. |
| 2. Bottom surface of top plate. |  Prepared hole Removal of oxide film | 15 mm (0.6 in.) diameter area on bottom surface of top plate and welding surface of bottom plate centering on plug hole. |
| 3. Welding surface of bottom plate. |  Prepared hole Removal of oxide film | |

When a hole is to be made through two stacked plates:

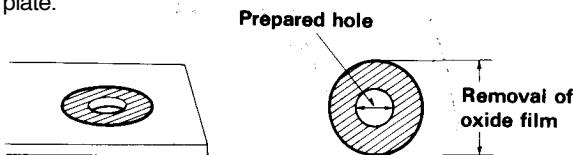
Unit: mm (in.)



Sand the top and bottom surfaces of both the top and bottom plates.

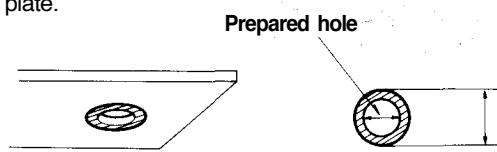
Range of oxide film removal by sanding.

1. Top surface of top plate and the bottom surface of bottom plate.



25 mm (1.0 in.) diameter area on top surface of top plate and bottom surface of bottom plate centered on the plug hole.

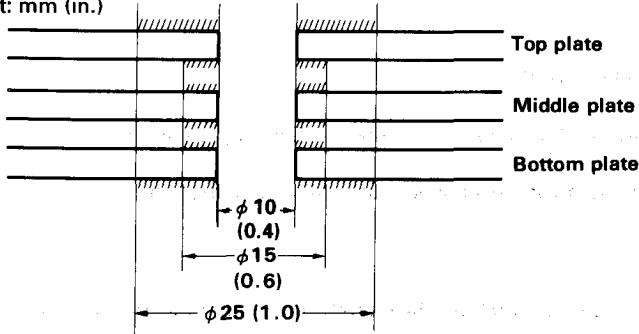
2. Bottom surface of top plate and the top surface of bottom plate.



15 mm (0.6 in.) diameter area on bottom surface of top plate and top surface of bottom plate centered on the plug hole.

When a hole is to be made through three stacked plates:

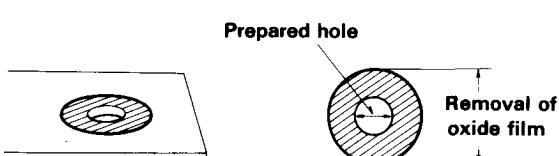
Unit: mm (in.)



Sand both surfaces of the top, middle and bottom plates as shown (////) to remove oxide film.

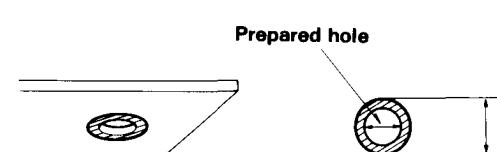
Range of oxide film removal by sanding.

1. Outer surfaces of top and bottom plates.



25 mm (1.0 in.) diameter area on outer surface of top and bottom plates centered on the plug hole.

2. Inner surface of top and bottom plates, both surfaces of middle plate.



15 mm (0.6 in.) diameter area on inner surfaces of top and bottom plates and on both surfaces of middle plate centered on the plug hole.

(cont'd)

Aluminum Alloy Repair

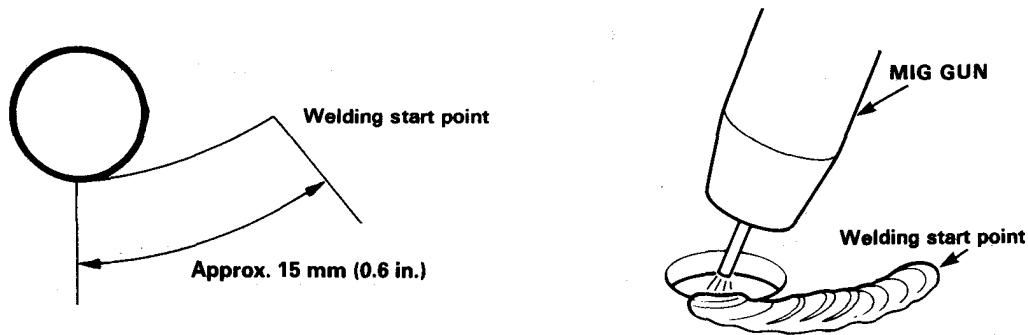
Plug Welding Procedures (cont'd)

4. Welding

Prepared hole diameter: 10 mm (0.4 in.)

Plug welding starts from the outside of all weld zones (outside start).

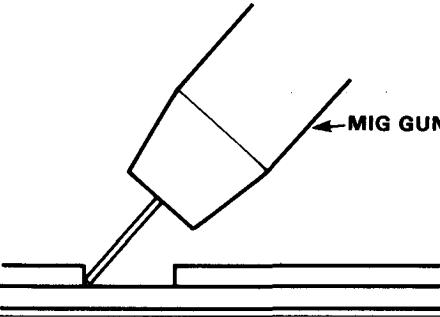
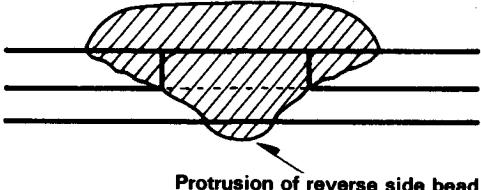
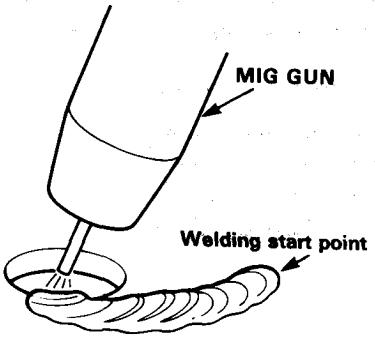
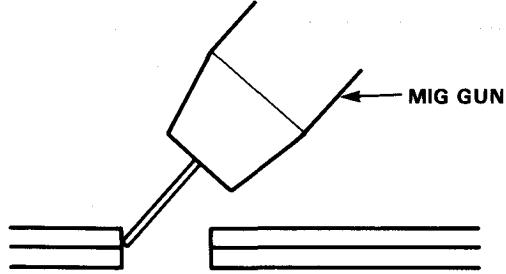
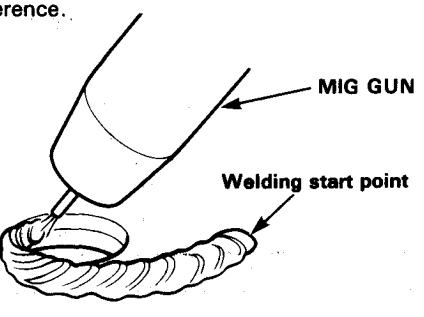
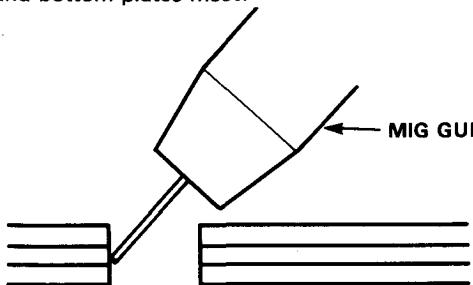
As shown in the figure, outside start welding commences at a position approximately 15 mm (0.6 in.) from the weld zone.



Advantages of outside start

- Penetration is enhanced by the preheating effect of the outside start.
- The initial penetration area is clearly visible in the light given off by the arc and working efficiency is improved.
- Outside start provides preheating to safeguard the aluminum alloy from inadequate initial penetration.

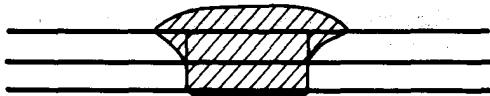
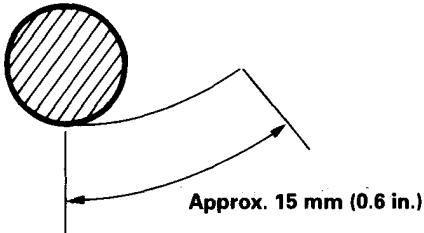
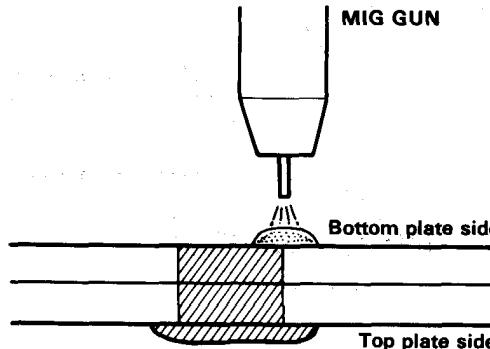
NOTE: Maintain a stable posture so that the torch does not move around but is held firmly and so that the weld zone is clearly visible.

| Welding | Procedure |
|---|--|
| <p>When drilling a single-layer hole in two stacked plates:</p> <p>Proceed with welding while aiming at the edge of the hole where the top and bottom plates meet.</p>   <p>NOTE: Melting of 1/3 to 2/3 of the bottom plate is the adequate for the weld.</p> | <ul style="list-style-type: none"> ● Proceed with welding while closely observing the melting condition of the weld zone. ● Until the operator is experienced in welding, take care not to increase the distance between the torch contact tip and base metal.  <ul style="list-style-type: none"> ● Ensure adequate penetration as far as the bottom plate. The reverse side bead on the bottom plate may protrude in the process. Keep the protrusion to a minimum. |
| <p>With a hole through two stacked plates:</p> <p>Proceed with welding while aiming at the joint where the top and bottom plates meet.</p>  | <ol style="list-style-type: none"> (1) First, proceed from the top. <ul style="list-style-type: none"> ● The plug hole is filled after welding to a distance equivalent to about one and half times the entire circumference.  |
| <p>With a hole through three stacked plates:</p> <p>Proceed with welding while aiming at the joint where the middle and bottom plates meet.</p>  | <ul style="list-style-type: none"> ● The plug hole is filled after welding to a distance equivalent to about twice the entire circumference. |

(cont'd)

Aluminum Alloy Repair

Plug Welding Procedures (cont'd)

| Grinding | Procedure |
|---|---|
| <p>Protrusion of reverse side bead. Hole through two stacked plates:</p>  | <p>(2) Use a disc grinder or disc sander to grind down the area where the bead on the reverse side protrudes until it is flush with the surface of the bottom plate.</p> |
| <p>Hole through three stacked plates:</p>  | <p>(3) Use a stainless steel wire brush to burnish the surface where the bead is ground down.</p> |
| Welding | |
| <p>View from bottom plate</p>  <p>Approx. 15 mm (0.6 in.)</p>  <p>MIG GUN</p> <p>Bottom plate side</p> <p>Top plate side</p> | <p>(4) Use an outside start to weld the bottom plate where the bead is ground down.</p> <p>(5) When welding the bottom surface, position the torch perpendicularly and weld around the edge of the plug hole.</p> |

Butt Welding Procedures

Reduce the clearance as shown in the figure below for butt welding thin plates or sheets. If the clearance is too wide, welding should be performed in the stitch mode.

1. Edge preparation

| | |
|---|--|
| <p>With plates less than 3 mm (0.12 in.) thick:</p> <p>0 ~ 0.5 mm (0 ~ 0.02 in.) max.</p> | <p>Weld with a square edge without special preparation.</p> <ul style="list-style-type: none"> Use a smooth-cut file to bring the the edge preparation surface to a smooth finish. |
| <p>With plates more than 3 mm (0.12 in.) thick:</p> <p>Approx. 60°</p> <p>0 ~ 0.5 mm (0 ~ 0.02 in.) max.</p> <p>0 ~ 0.5 mm (0 ~ 0.02 in.) max.</p> | <p>Proceed with V-shaped edge preparation.</p> <ul style="list-style-type: none"> Edge preparation is required for butt welding thick plates, as shown. Use a disc grinder and file (rough-cut or vixen file) for edge preparation. Use a disc sander with #80 sanding disc and a file (smooth-cut) to finish the prepared area. <p>● Reverse side beads often occur because of edge preparation in the above figure.</p> |

2. Cleaning and sanding

Use a wax and grease remover to clean off any dirt, oil or grease prior to welding.

If the aluminum alloy surface is coated with a paint film, use disc sander and #80 sanding disc to remove the paint.

NOTE: Use a stainless steel wire brush to brush the bare surface of the aluminum alloy. Do this on both the top and bottom surfaces.

Sanding range

| | |
|---|---|
| <p>For square edge preparation:</p> <p>20 mm (0.8 in.)</p> <p>10 mm (0.4 in.)</p> | <p>Sand the top to a width of approx. 20 mm (0.8 in.) and the bottom to a width of approx. 10 mm (0.4 in.).</p> |
|---|---|

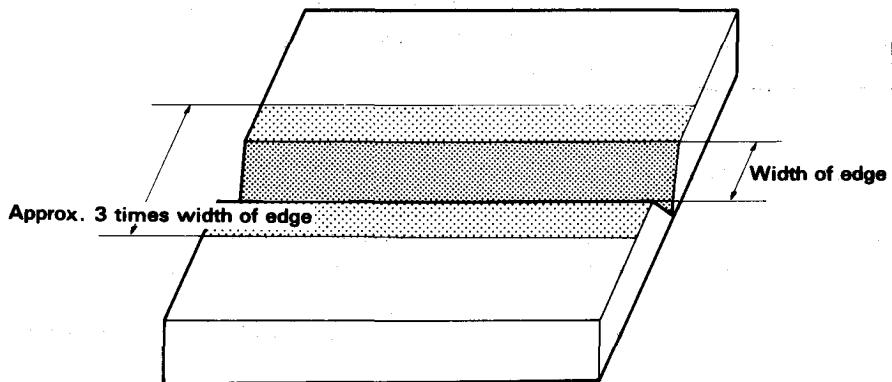
(cont'd)

Aluminum Alloy Repair

Butt Welding Procedures (cont'd)

Sanding range

For V-shaped edge preparation:



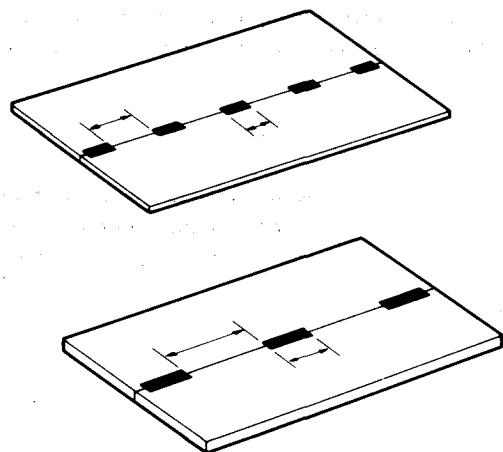
Sand the top to a width approximately 3 times the width of the edge and the bottom to a width approximately equivalent to the edge.

NOTE: Also sand the edge preparation area.

3. Tack Welding

Prior to finish welding, carry out tack welding to prevent strain and enhance joint precision. Weld the plates at several points with short beads.

NOTE: Use a stainless steel wire brush to clean the tack weld zones prior to finish welding.



- The thinner the sheet or plate, the shorter the tack welding pitch and bead.
- Avoid tack welding the ends and corners of the base metal.
- Since the beads left by tack welding are not ground down afterward, this process should be carried out with the same precision as finish welding.

4. Main welding

Maintain a stable posture so that the gun does not move around but is held firmly. The weld zone is clearly visible. Maintain the proper distance between the gun contact tip and the base metal, and maintain the proper gun angle. Adjust the gun feed speed while observing penetration.

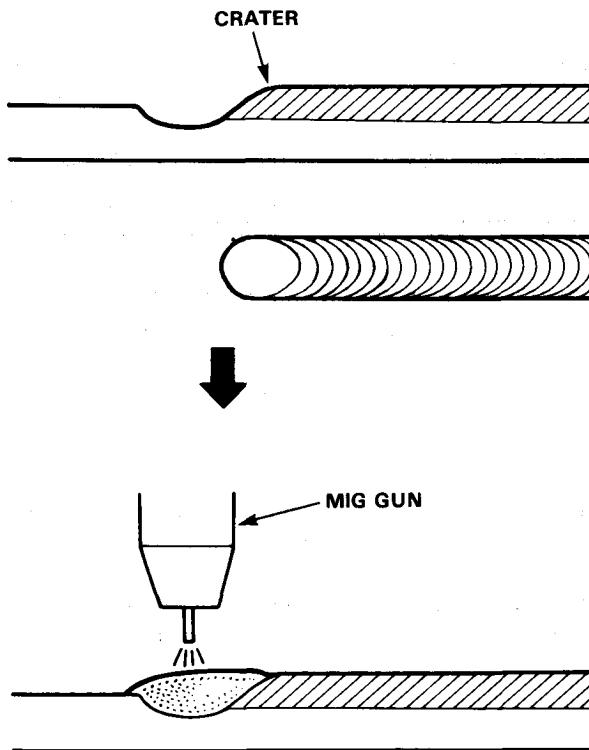
NOTE:

- Aluminum alloys are welded at a higher gun feed speed than steel plate.
- Use the forehand welding sequence for the gun advance direction in order to minimize the formation of black soot.
- Until the operator is experienced in welding, take care not to increase the distance between the torch contact tip and the base metal.
- When welding multiple layers of a thick material, brush the surface of the welded area thoroughly using a stainless steel wire brush after each pass.

5. Crater treatment

Craters may form when the welding bead is completed. They should be filled properly to avoid defects.

There are two ways of treating craters. Either stop the gun and fill the crater without switching off the arc suddenly when the welding bead is completed, or alternatively, switch the arc off and then back on again to fill the crater.



(cont'd)

Aluminum Alloy Repair

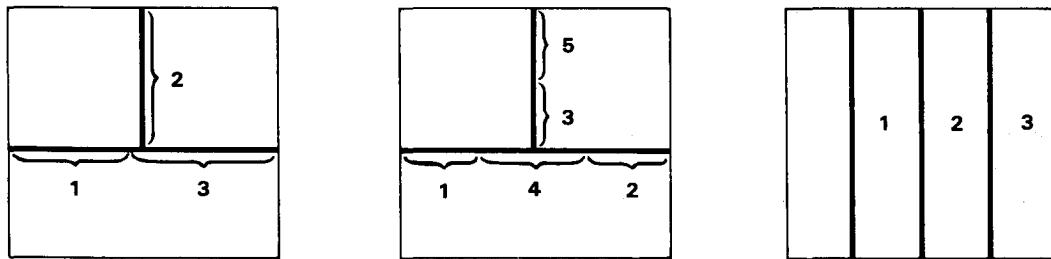
Butt Welding Procedures (cont'd)

6. How to weld without inducing strain

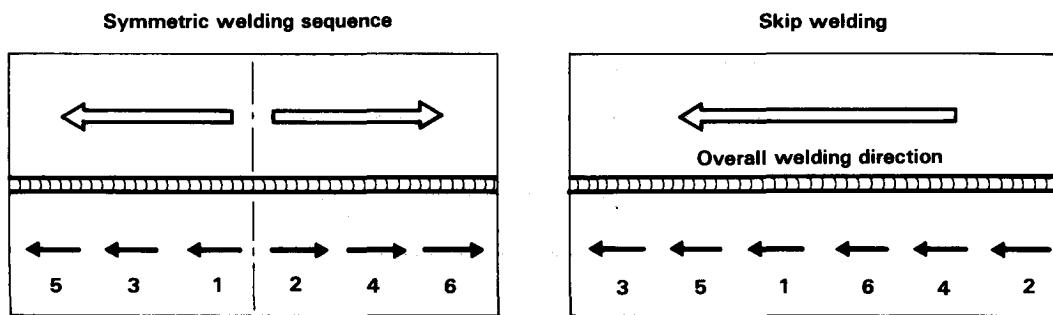
Tremendous strain results if the base metal is overheated during MIG welding.

- When many welding joints have been created, begin to weld from the center of the area or center of the joints to the outside.
- In direct proportion to the thickness of the plates, do not conduct lengthy welding operations at one time. Instead, divide the job up into shorter operations, as shown in the figure below.

Preventing strain by sequencing welding work:



Preventing strain by sequencing bead:

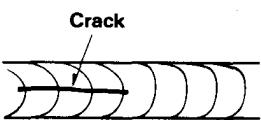
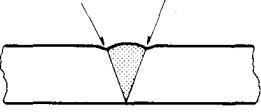
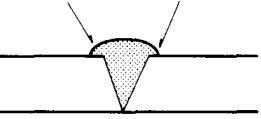
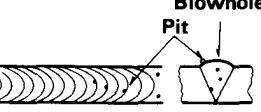


Welding procedure

- When an operator is experienced, the strain can be reduced by increasing the gun feed speed at higher power settings (current). This method reduces the amount of heat transmitted to the base metal.
- In the case of thin plates where there is a danger of melt-down, do not weld continuously without stopping, but weld short sections at a time. If the welder is provided with a stitch mode, set to this mode and perform stitch welding.

Butt weld zone defects:

The table below shows possible weld zone defects and their causes. Care must be taken to ensure that none of these defects occur. If a defect does develop, pinpoint the causes and consider the appropriate countermeasure, change the work method, and proceed in a way which will produce stable welding results.

| Defect | Appearance | Main causes |
|------------------------|---|--|
| Bead crack |  | Excessively high welding current. Unsuitable filler metal (welding wire). |
| Crater crack |  | Unsuitable crater treatment. |
| Undercut |  | Poor gun aim. Excessively high welding current. Excessively high welding speed. |
| Overlap |  | Insufficient welding current. Excessively low welding speed. |
| Incomplete penetration |  | Unsuitable edge preparation. Insufficient welding current. Excessively high welding speed. |
| Blowhole, pit |  | Dirt on base metal (inadequate cleaning). Use steel wire brush. Improper shielding (insufficient shielding gas, strong wind). Moisture on plate surface. Dirt on electrode wire. |

(cont'd)

Aluminum Alloy Repair

Butt Welding Procedures (cont'd)

| Defect | Appearance | Main causes |
|-------------------|---|---|
| Unaligned beads |  | Welding wire speed not constant. Gun travel speed not constant. |
| Melt-down |  | Excessively high welding current. Unsuitable edge preparation (too wide). |
| Formation of soot |  | Poor gun angle. Improper gun advance (forehand weld sequence). Improper shielding (insufficient shielding gas, strong wind). Dirt on base metal. |

Fillet Welding Procedures

Fillet welding is used on body parts that have different thicknesses and that need to be strong comparatively. It is important to have a thorough grasp of what follows.

1. Adherence

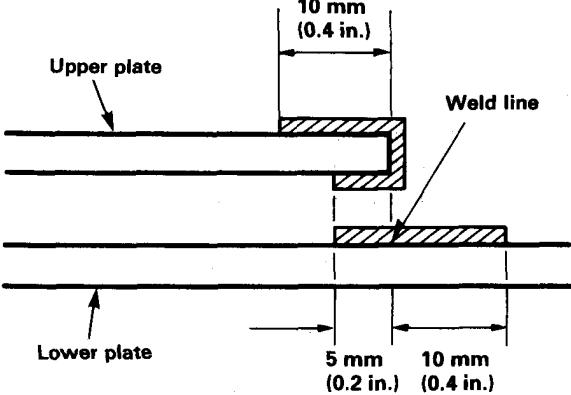
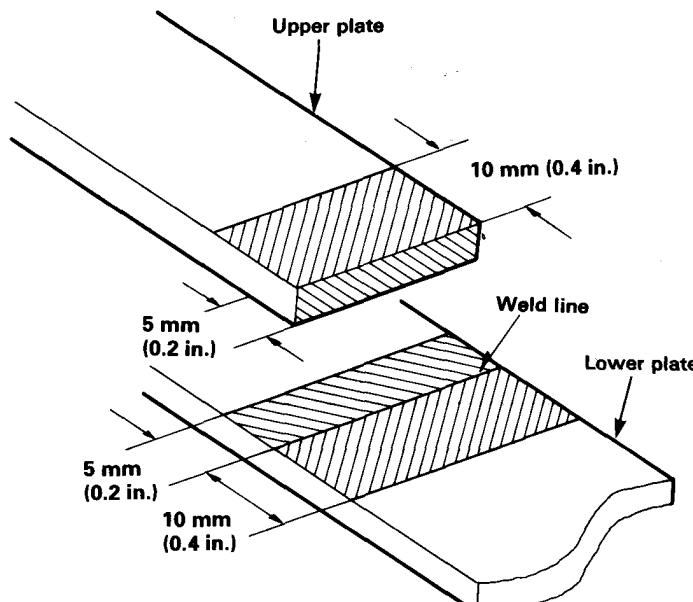
The aluminum alloy plates where the fillet welding is to be performed must fit together firmly. Otherwise, the weld will be defective.

2. Cleaning and sanding

Use a wax and grease remover to clean away any dirt, oil or grease prior to welding. If the aluminum alloy surface is coated with a paint film, use a disc sander with a #80 sanding disc to remove the paint.

NOTE: Use a stainless steel wire brush to burnish the bare surface of the aluminum alloy immediately before welding.

Sanding range:

| | |
|--|---|
|  <p>Upper plate</p> <p>Weld line</p> <p>10 mm (0.4 in.)</p> <p>5 mm (0.2 in.) 10 mm (0.4 in.)</p> <p>Lower plate</p> | Sand the top and bottom surfaces of the upper plate and the adhesion surface of the lower plate. |
|  <p>Upper plate</p> <p>10 mm (0.4 in.)</p> <p>5 mm (0.2 in.)</p> <p>Weld line</p> <p>Lower plate</p> <p>5 mm (0.2 in.)</p> <p>10 mm (0.4 in.)</p> | Sand to a width of about 10 mm (0.4 in.) on both the upper and lower plates on the outside of the weld line, and to a width of about 5 mm (0.2 in.) from the weld line for the inside surface which will be overlapped. Also sand the end of the upper plate. |

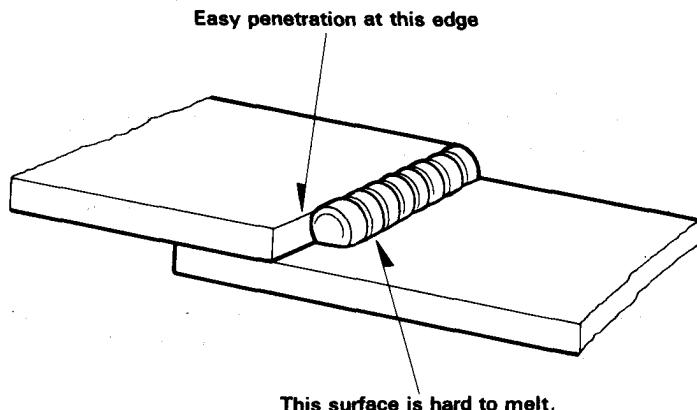
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Aluminum Alloy Repair

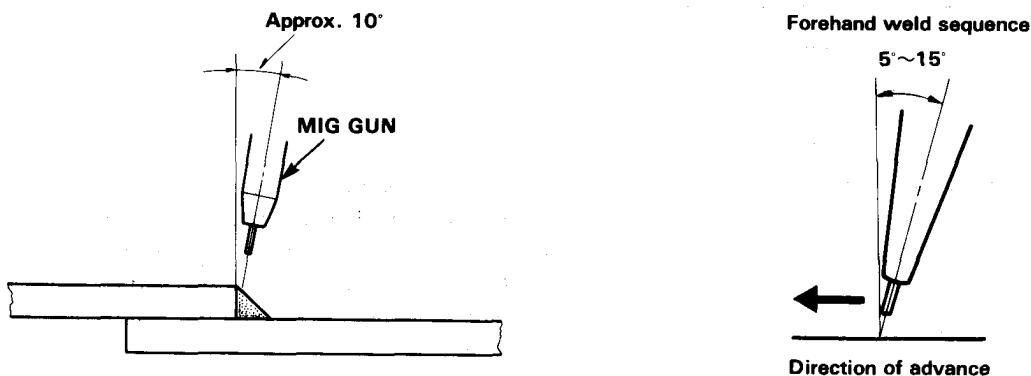
Fillet Welding Procedures (cont'd)

3. Welding

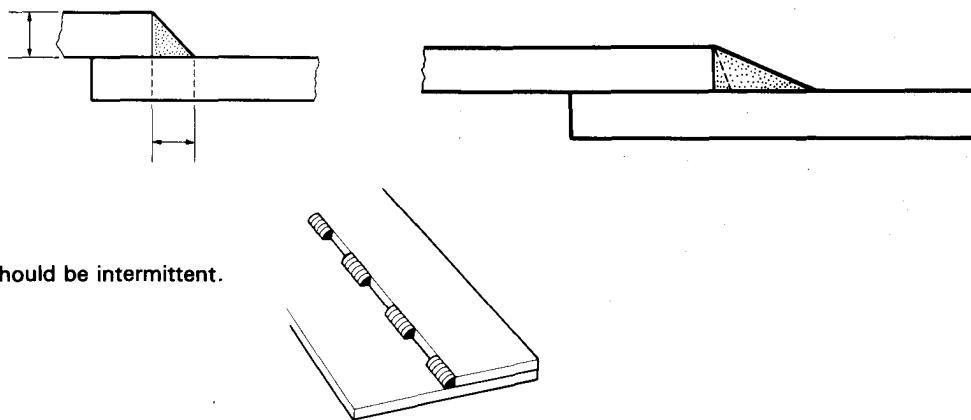
During actual welding, penetration will occur quickly for the top plate since the end of the plate is being welded. For the bottom plate, however, welding starts at the center of the plate, which is hard to melt. Proceed with the current slightly higher than for butt welding and closely observe bottom plate penetration.



Although in the case of butt welding the gun is positioned perpendicular to the base metal, in fillet welding it is used at an angle with the base metal surface which depends on the plate thickness. The operator should carefully observe the melting of the base metal and proceed. Special attention must be paid when the thicknesses of the top and bottom plates differ.

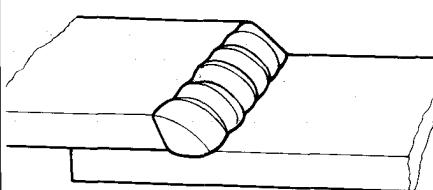
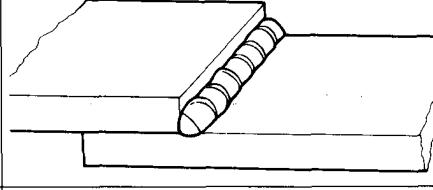
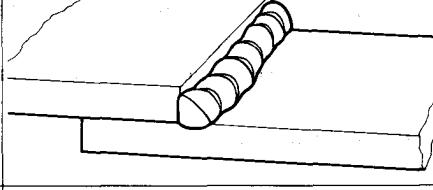
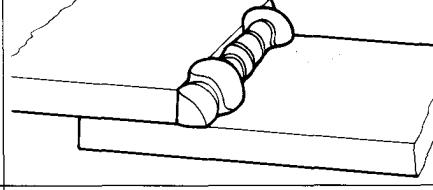
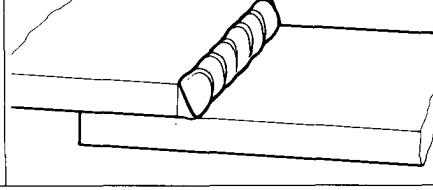


The ideal size of the bead in a cross-sectional view of fillet welding is identical to or slightly larger than the plate thickness. If the thickness of the plates differ, proceed to weld in alignment with the thin plate so as to minimize both the strain induced by welding the base metal and any changes in organization which may occur.



Fillet weld zone defects:

The table below shows frequent fillet weld zone defects and their causes.

| Defect | Appearance | Main causes |
|--|---|--|
| Excessive melting of upper plate |  | Poor gun angle. Poor gun position. Excessively high welding current. |
| Incomplete penetration |  | Insufficient welding current. |
| Poor adhesion position |  | Faulty gun feed position. |
| Unaligned beads |  | Improper gun feed speed. Poor gun height. |
| Incomplete penetration of lower plate. |  | Faulty gun feed position. Insufficient welding current. |

Aluminum Alloy Repair

Weld Area Finishing

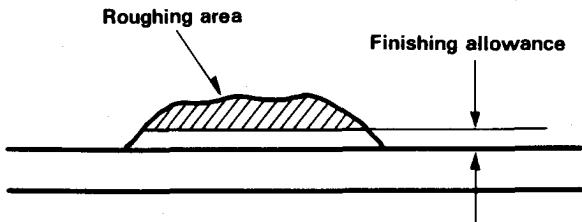
NOTE: Inspect for cracks before finishing the weld zones of aluminum alloys (see page 2-39).

When sanding weld zones

Use a disc grinder (A36P grindstone) for roughing and a disc sander for finishing (#80).

-1) Roughing

Use the disc grinder (A36P) for weld reinforcements, always leaving a finishing allowance.



-2) Finishing Cut Operation

Use the disc sander (#80 disc) to finish the area of the finishing allowance and to give the weld zone a smooth finish.

NOTE:

- Roughing applies only to weld reinforcements. Care should be taken to leave the surface of the aluminum alloy untouched.
- Take care not to remove too much material in the roughing process since this can cause a loss of strength.
- Take care not to press the sanding tool too forcefully against the surface.
- Replace the disc of the sanding tool with a fresh disc if the surface becomes clogged with aluminum alloy fragments.
- Weld zones that are hidden from view do not need to be finished.

Crack Inspection

An inspection for cracks must be conducted after the weld zones of the aluminum alloy have been welded and after any buckling in the aluminum alloy body or frame has been straightened out.

A color contrast penetrant examination method is used for crack inspection.

- The penetrant method utilizes the capillary phenomenon of liquids. The test itself uses a liquid with a powerful penetration capability to check out the location of minute defects that are not visible to the naked eye.
- The color contrast penetrant method is a type of penetrant test which uses a penetrant solution containing coloring. A penetrant solution that contrasts strongly with the color of the developing solution is used to enable the lighter locations to be observed.

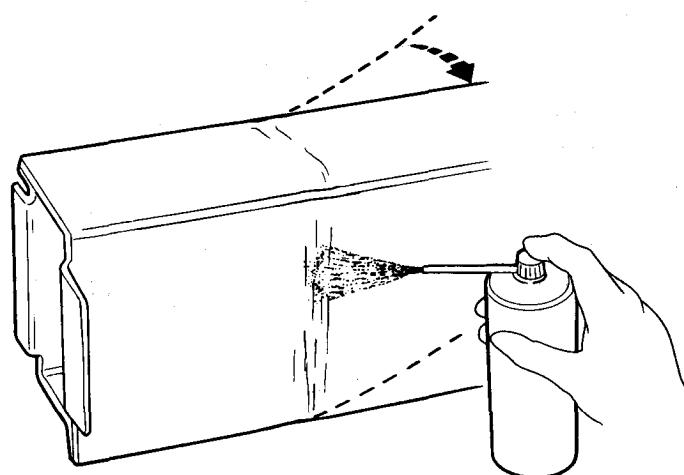
Method of application

Items used: penetrant solution, developing solution, washer

1. Wash the inspection surface with the washer.
2. Apply penetrant solution to the surface and allow the solution ample time to soak down inside the cracks.
3. Wash off any excess penetrant solution remaining on the surface.
4. Spread the developing solution and cracks will be clearly indicated.

NOTE:

- During these operations, be sure to follow the instructions provided by the manufacturer of the color contrast penetration agent.
- Use where there is adequate ventilation.

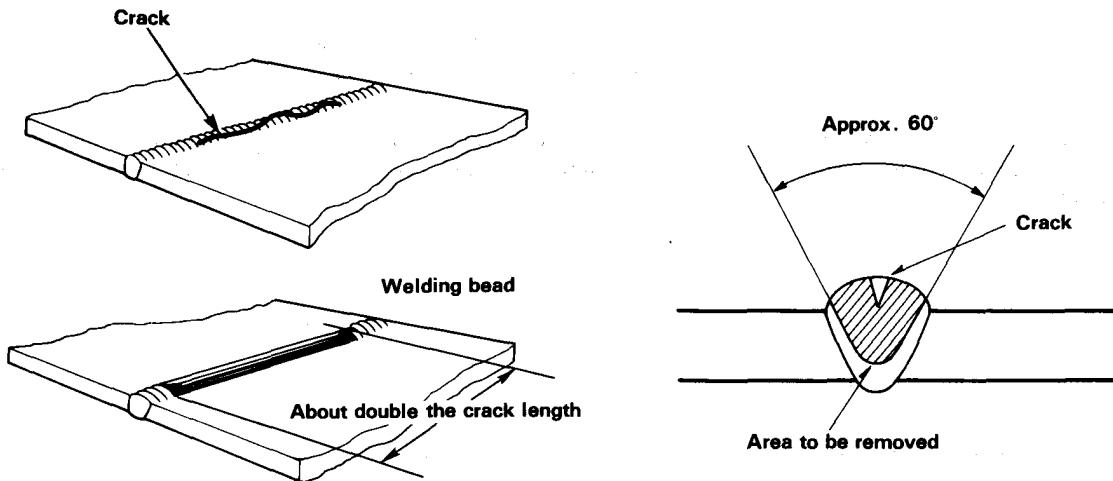


Aluminum Alloy Repair

Crack Repair

1. Weld zones

If a crack is detected in a weld, scrape off an area twice as long as the crack and reweld.

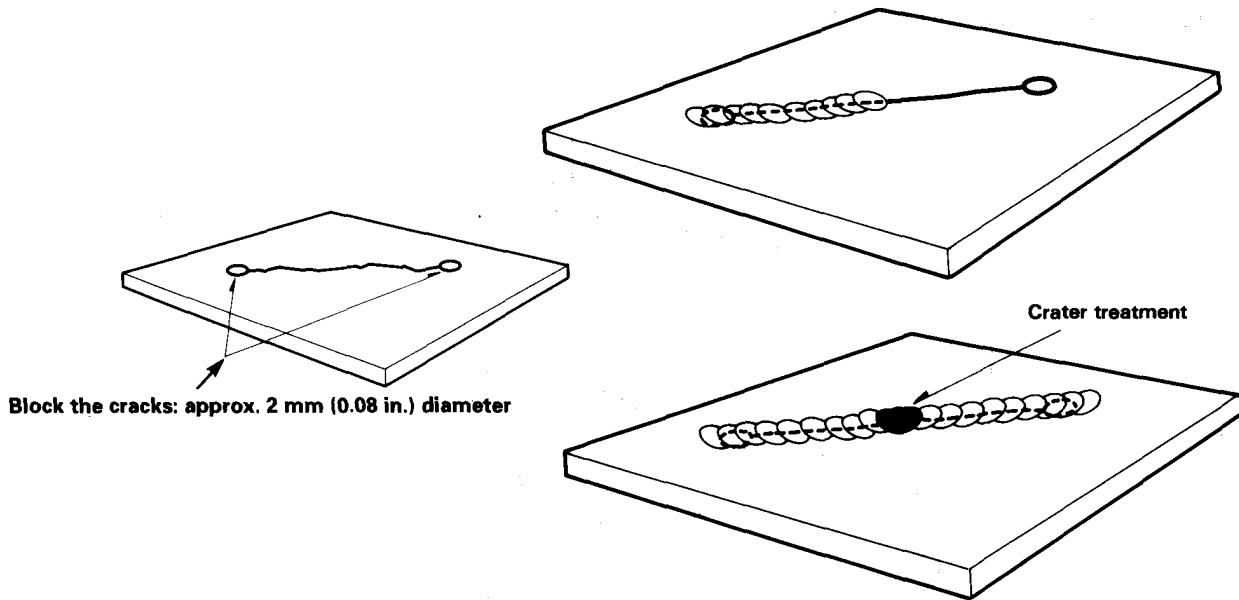


2. Shaping

CAUTION

If a crack is formed when the sheet metal is being straightened, replace the part, do not correct by welding.

NOTE: If, upon completion of the work, there are still very minute cracks which cannot be detected except with a color contrast penetrant, drill holes at both ends of the crack, and proceed with the welding.



Body, Frame Area Shaping

Body and frame areas made of aluminum alloys use plates which are between 1.5 and 2 times as thick as steel plates.

When deformations must be straightened out, aluminum alloys feel harder or stiffer to the touch than conventional steel plate.

In order to avoid inducing changes in the quality of steel plate, the use of a torch to heat up sheet plates is avoided whenever possible. In the case of aluminum alloys, however, work hardening occurs in buckled areas which makes it easy for cracks to form.

Do not use a frame straightener for straightening work without applying heat with an acetylene torch. At temperatures above 392°F (200°C) elongation characteristics are improved and work is facilitated.

Heating temperature control method

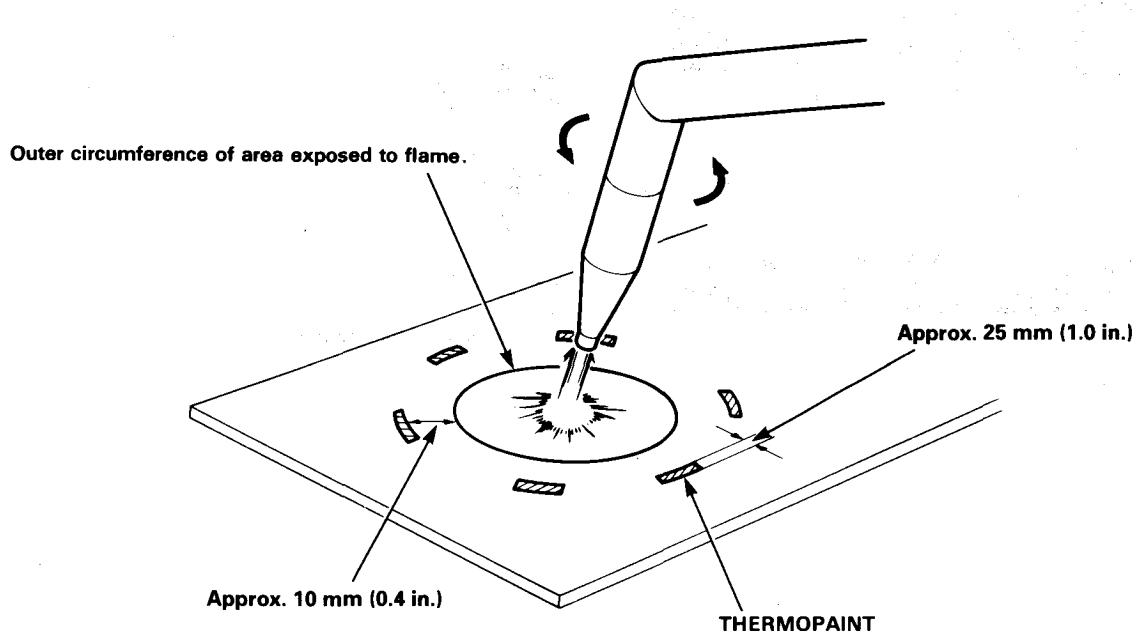
Since the melting point of aluminum alloys is approximately 1184°F (640°C) and since there is hardly any change in color, even when the temperature rises, there is a tendency to apply too much heat.

To check the degree of heating and keep it within limits, use thermopaint that changes color at 230°F (110°C).

Apply the thermopaint in a strip about 10 mm (0.4 in.) wide at a point approx. 25 mm (1.0 in.) from the outer circumference to be exposed to the torch flame. Stop heating when the color clearly changes in the surrounding area where the thermopaint was applied. The temperature of the heated at this time will be less than 752°F (400°C).

The time required for heating depends greatly on how the aluminum alloy is exposed to the torch flame and on the area covered by the heating.

As shown in the figure below, the upper temperature limit can be controlled and overheating prevented by applying thermopaint in places 25 mm (1.0 in.) away from the area to be heated.



(cont'd)

Aluminum Alloy Repair

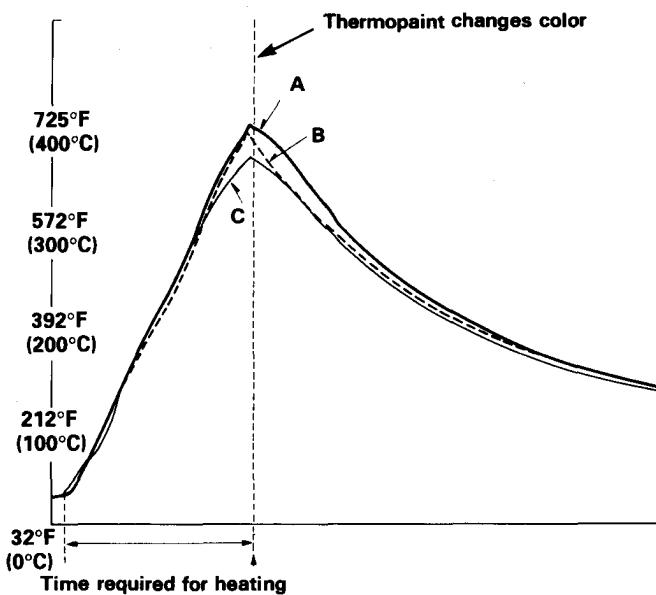
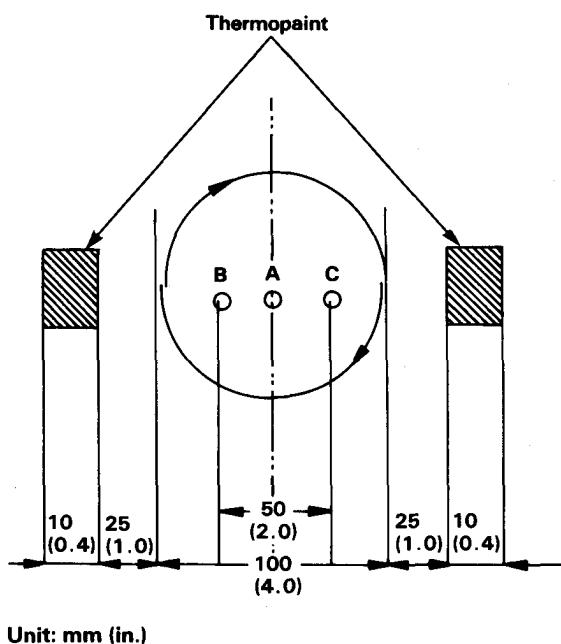
Body, Frame Area Shaping (cont'd)

NOTE:

- Thermopaint (temperature indicator which changes color at 230°F (110°C), must be used for temperature control to ensure that the aluminum alloy does not overheat.
- When heating an alloy, move the torch flame continually so that it does not focus on one particular spot.

CAUTION

- When heated, aluminum alloys melt without changing color.
- Since the front side frame, side sills, front inner pillar, and rear frame of aluminum alloy bodies are susceptible to bending and torsional stress, an extruded heat-treated material is used. If a side sill, front inner pillar and rear frame are damaged, they must be replaced.



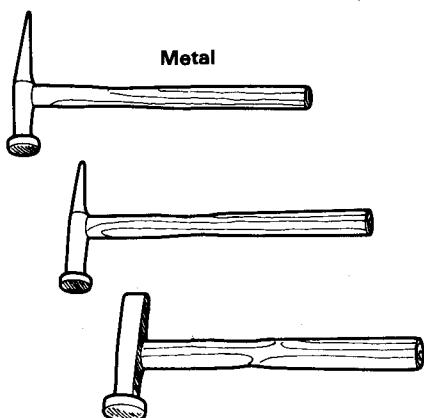
Skin Panel Area Shaping

1. Repairs using hammers and dollies

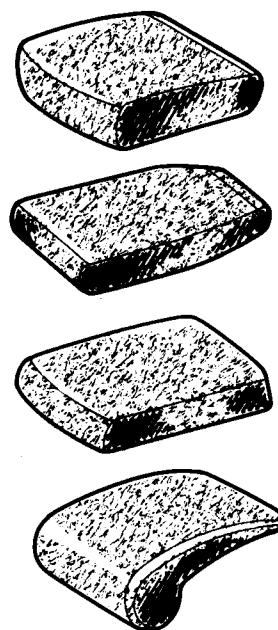
Hammering methods using hammers and dollies are basically the same as for steel plate.

The hammers and dollies shown below are used for aluminum alloys that have relatively high elongation properties.

HAMMERS



DOLLIES



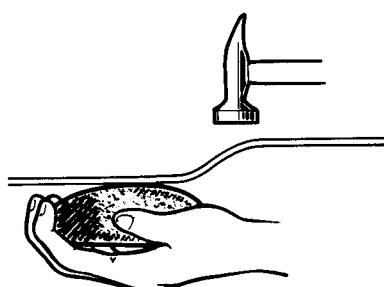
NOTE:

- The hammer head is rounded so the surface will not be dented.
- The resistance of aluminum alloy panels to corrosion is reduced when soldering is used to shape a panel. Also, since cracks sometimes form, soldering should not be performed.

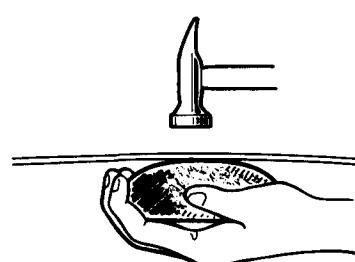
There are two ways of using a dolly when hammering:

"Hammer off dolly" where the hammer and dolly are positioned askew, and "hammer on dolly" where the panel is sandwiched between the hammer and the dolly, and the hammer is used above the dolly.

Hammer off dolly:



Hammer on dolly:



- The "hammer off dolly" method with its minimal elongation and work-hardening is frequently used for aluminum alloys. It is used to hammer down surfaces.

NOTE: Be careful that the surface does not fall below the contour.

- Aluminum alloys react quickly to hammering with the "hammer on dolly" method, and elongation results. When this method is used, the surface must be tapped very lightly.
- The contact surfaces of the hammer and dolly must be kept clean and polished at all times so that the base metal is not marked or scratched.

(cont'd)

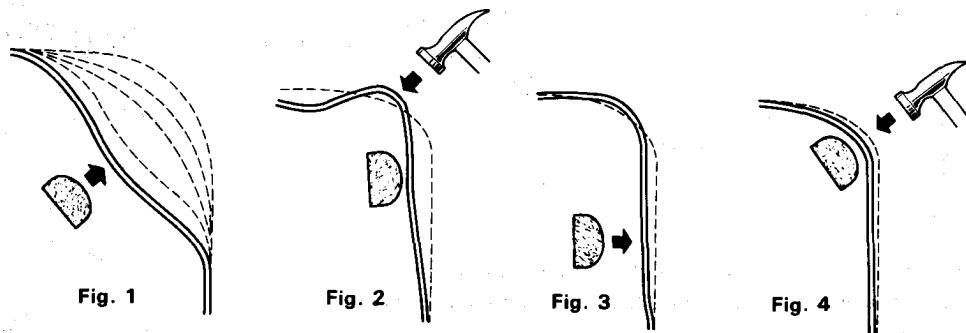
Aluminum Alloy Repair

Skin Panel Area Shaping (cont'd)

Hammering

To shape a deformed panel, use a hammer and dolly to smooth out unevenness. As shown in the figures below, first even out a large indentation close to the original shape.

Use this method to straighten sharp curves from inside. After the shape has been as shown in Fig. 1, use the hammer carefully to prevent panel elongation, then continue as shown in Fig. 2, 3 and 4.



Drawing

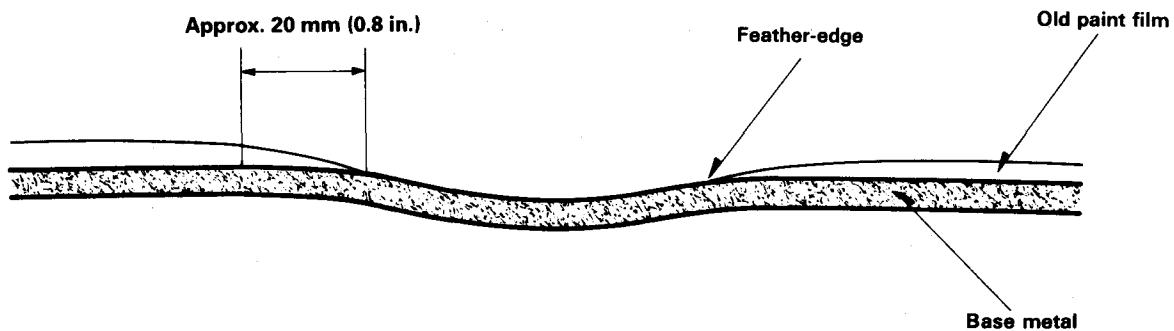
As with steel plates, a gas torch can be used to apply heat, then draw the surface area to correct panel warp.

Aluminum alloy does not change color when heated, so it is important for the temperature to be controlled by applying thermopaint so that the panel does not melt.

NOTE: A serrated face drawing hammer used for hammer finishing steel plate should not be used for aluminum alloy because it can cause cracking.

2. Paint film removal and cleaning

Use an #80 to #120 sanding disc to remove the paint film. Hold the disc plate lightly against the surface to avoid inducing strain. Proceed with feather-edging over a wide area bordering on the old paint film.



- 1. Grind down the old paint film using a #80 sandpaper pad over a wider area than the putty area.
- 2. When using #120 sandpaper to smooth the sanding marks from the #80 paper, leave an edge measuring between 20~30 mm (0.8 ~ 1.2 in.) and proceed with feather-edging.
- 3. Use compressed air to blow away any dust, dirt or moisture on the putty surface. Remove any oil or grease with a wax and grease remover.
 - If it is raining or if the humidity is high, warm up the base metal using an infrared lamp or heater to remove the moisture.
 - Similarly, warming up the base metal in cold weather (to about 68°F (20°C) also improves putty adhesion and speeds up the drying process).

(cont'd)

Aluminum Alloy Repair

Skin Panel Area Shaping (cont'd)

3. Finishing with putty

Unlike steel plate, putty cannot be applied directly to the bare surface of aluminum alloys. Apply an epoxy primer first, then add the putty. Putty reduces the amount of work time involved in panel repair. With its excellent restorative properties and workability, using putty is better than repairing a panel by hammering it or applying heat.

-1. Puttying

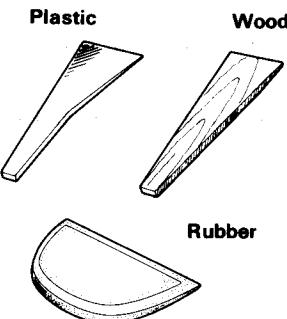
The basic instructions for applying putty are: clean the surface of the panel to be repaired, do not allow air to enter the putty, do not apply a thick layer at one time, and apply the putty to conform to the panel shape.



Main points in applying putty

- For flat surfaces, use a harder spatula; for gently curving surfaces, use a softer spatula; for sharply curving surfaces, use a flexible spatula made of rubber.

NOTE: Apply the putty from bottom to top, taking care not to reduce the height of the center area.

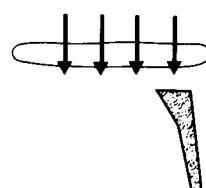


How to use a spatula:

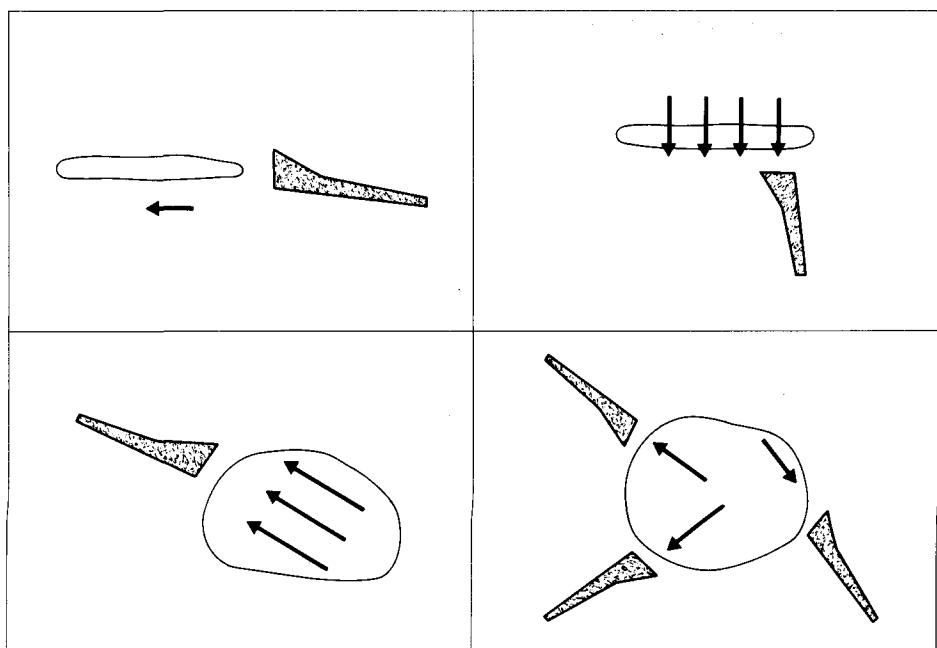
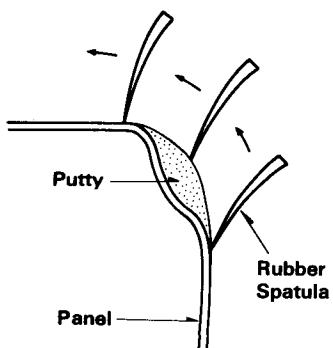
Good



No Good



How to use a spatula on curved areas:



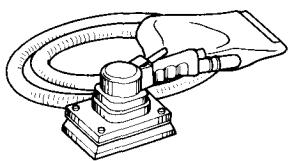
— 2. Putty sanding

There are three stages in putty sanding: roughing, leveling and border line flattening.

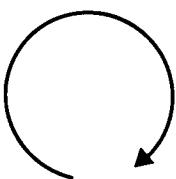
- Sand the putty in all directions.
- Always use an orbital sander or double-action sander.
- Operate a power-driven file by hand for finishing.

Sander motion:

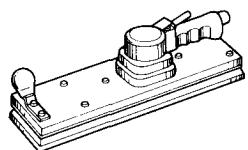
SHORT ORBITAL SANDER



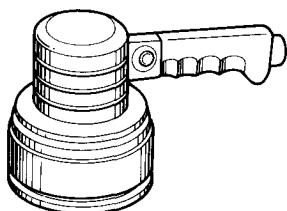
Movement of
single-action
sandpaper area:



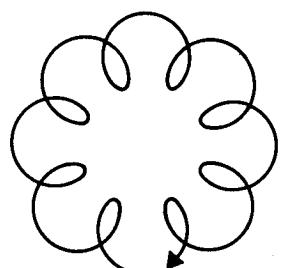
LONG ORBITAL SANDER



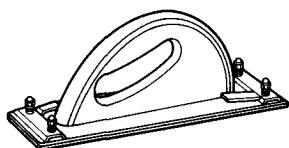
DOUBLE-ACTION SANDER



Movement of
double-action
sandpaper area:

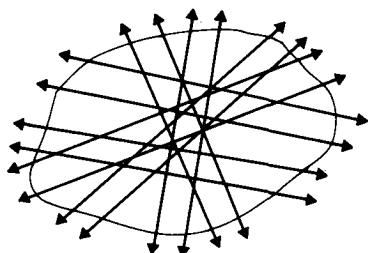


HAND FILE



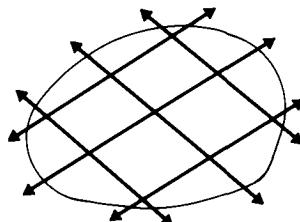
Sanding a flat surface:

Move in all directions over the surface of the putty.



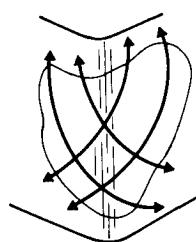
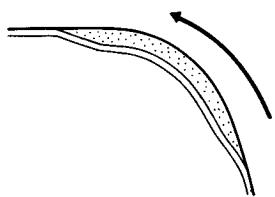
Sanding a gently curved surface:

Move the sander diagonally in a specific direction only.



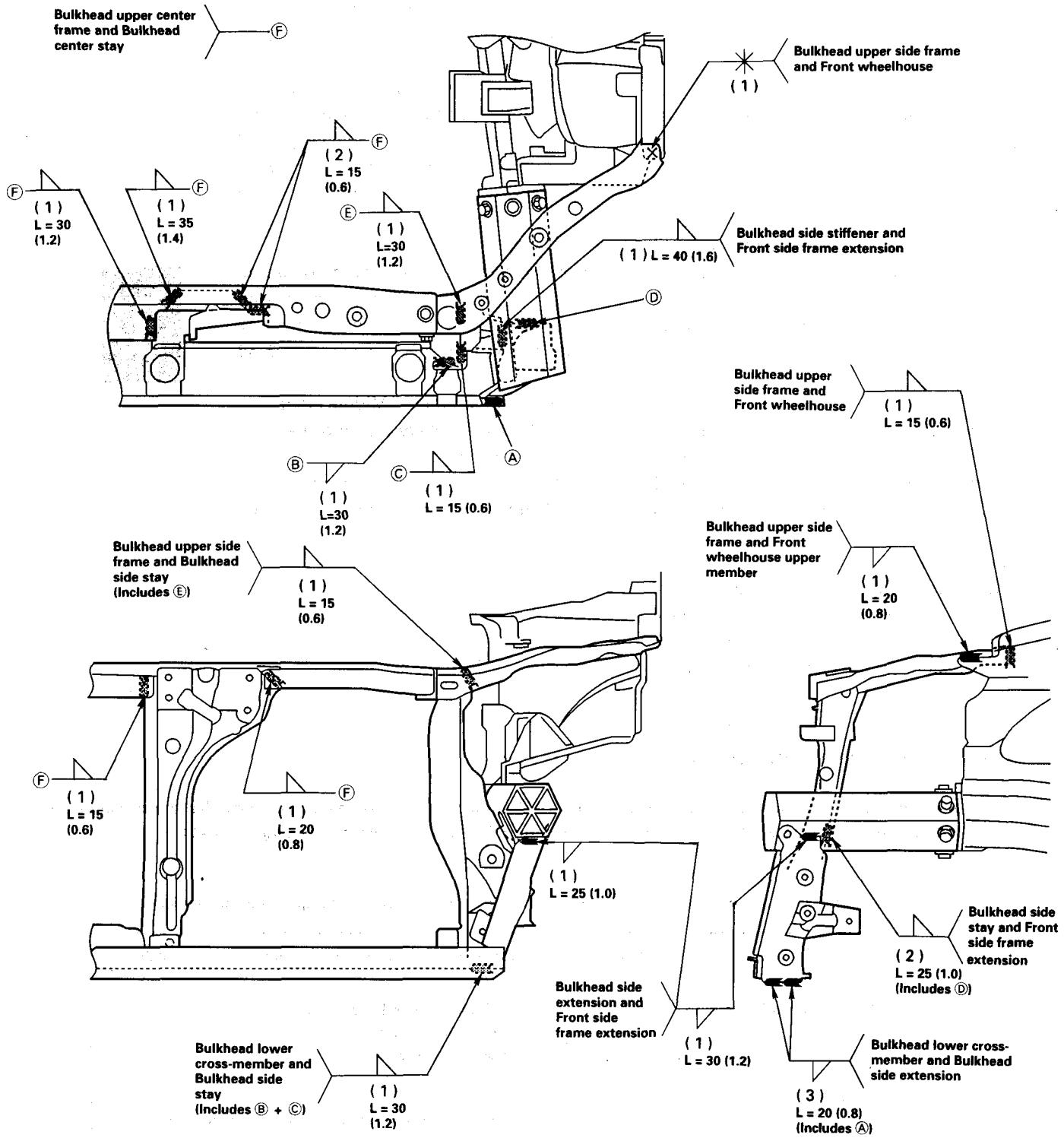
Sanding a sharply curved surface:

Move the sander smoothly to roll over the high-point of the curved surface.



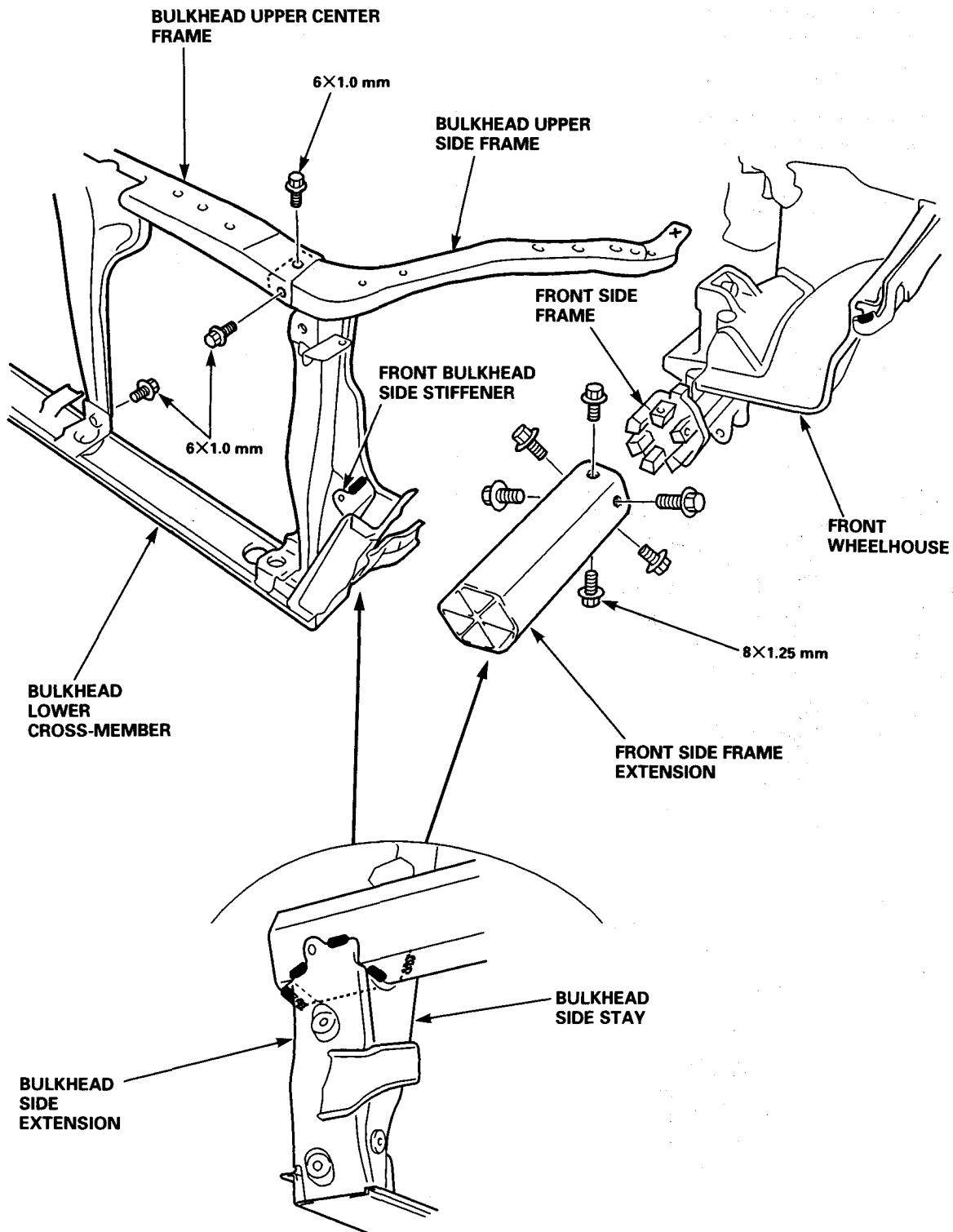
Front Bulkhead / Front Side Frame Extension

Mass Production Body Welding Diagram



Removal

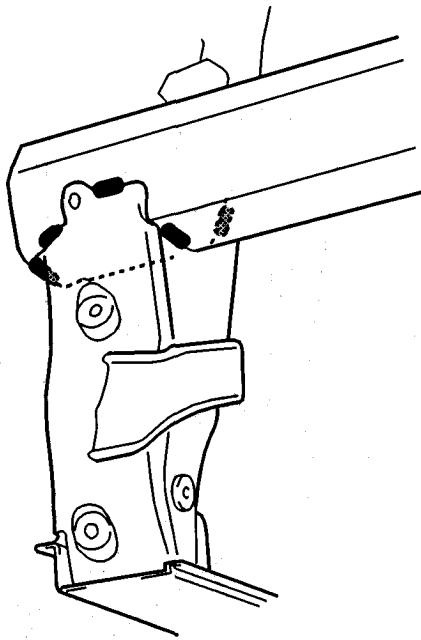
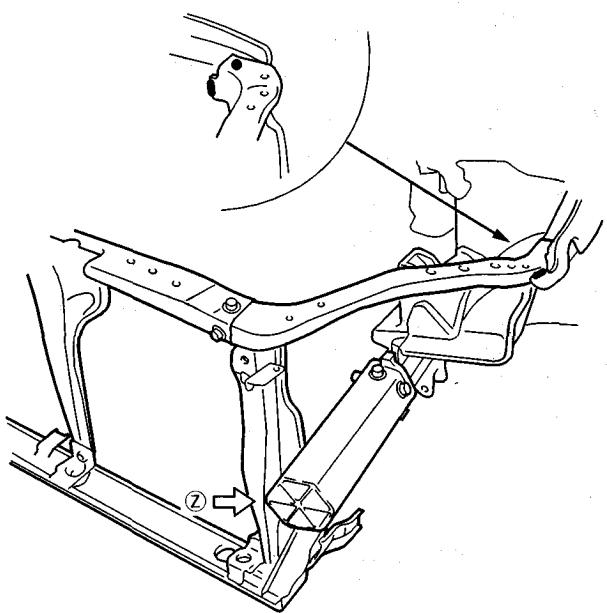
- Remove the front bulkhead, and check the front side frame extension position and for damage. If necessary, replace the front side frame extension.



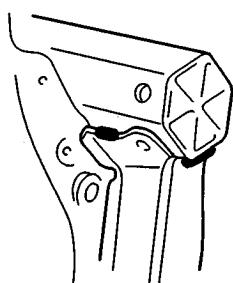
Front Bulkhead / Front Side Frame Extension

Installation

1. Install the new front side frame extension.
2. Set the new front bulkhead into position, and measure the front compartment diagonally.
Check the body dimensions (see [section 4](#)).
3. Tack weld the clamped position.
4. Temporarily install the hood, front fender, headlight, and front bumper, and check for differences in level and clearance.
5. Perform the main welding.

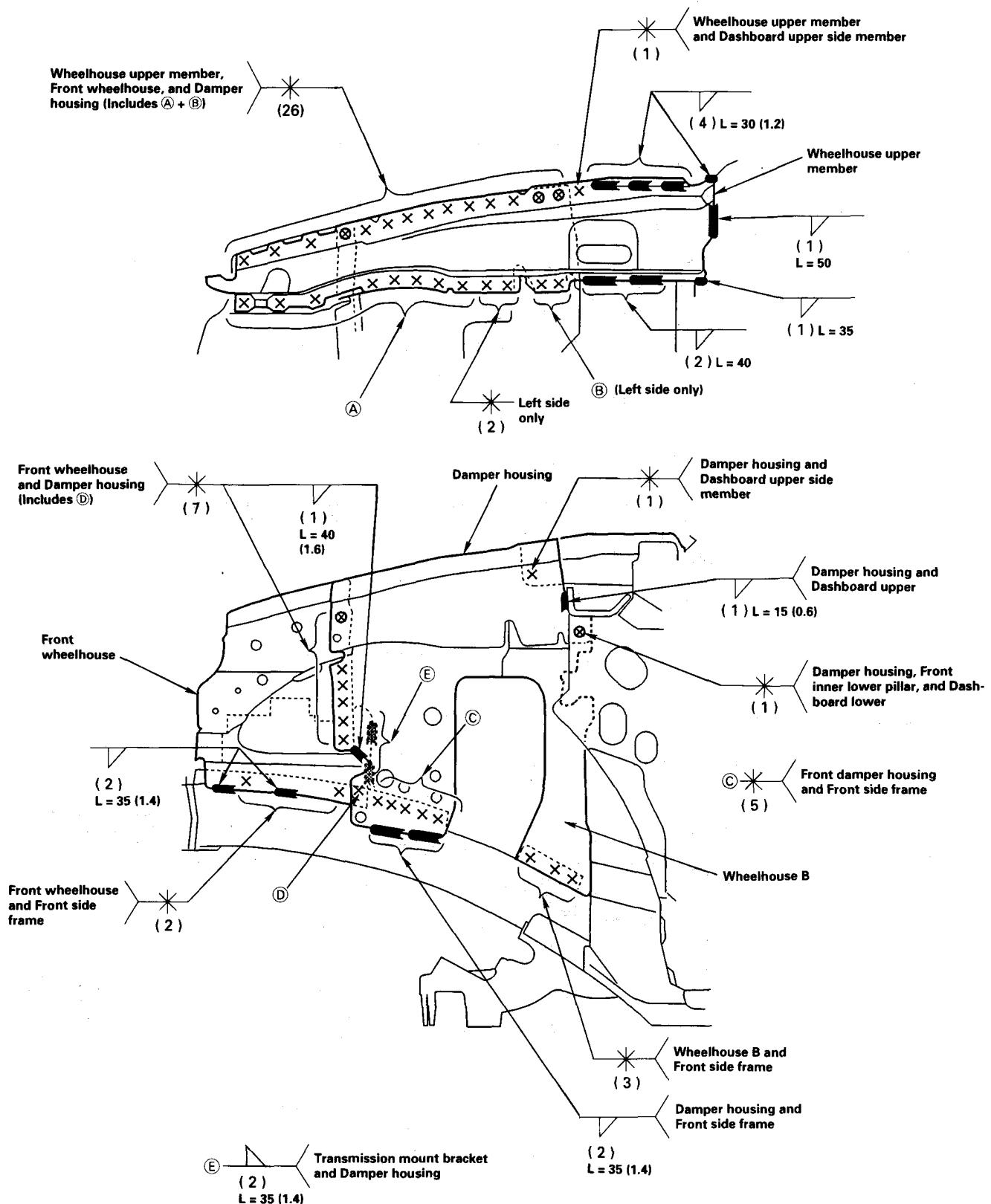


[VIEW Z](#)



Front Wheelhouse / Damper Housing

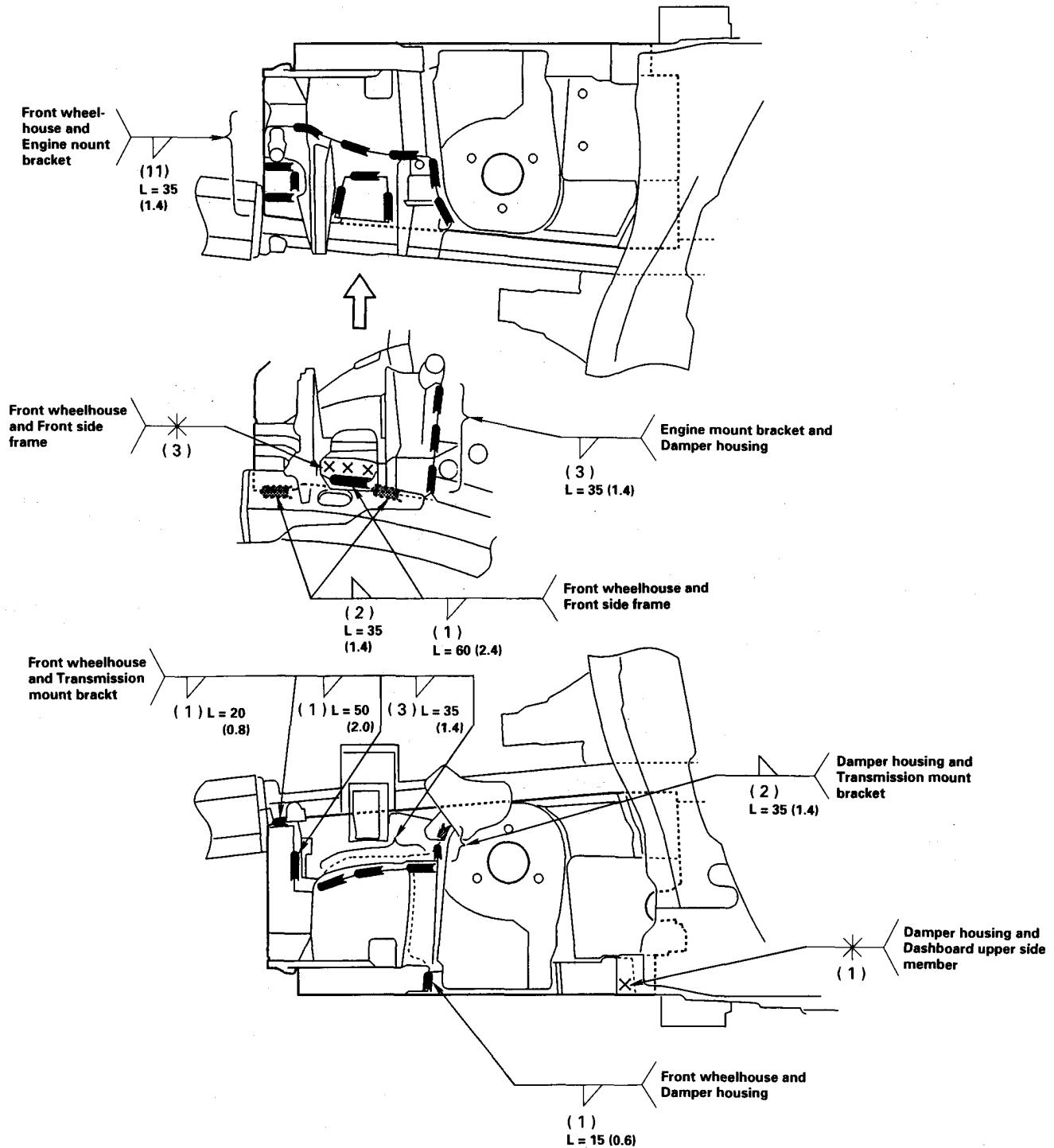
Mass Production Body Welding Diagram

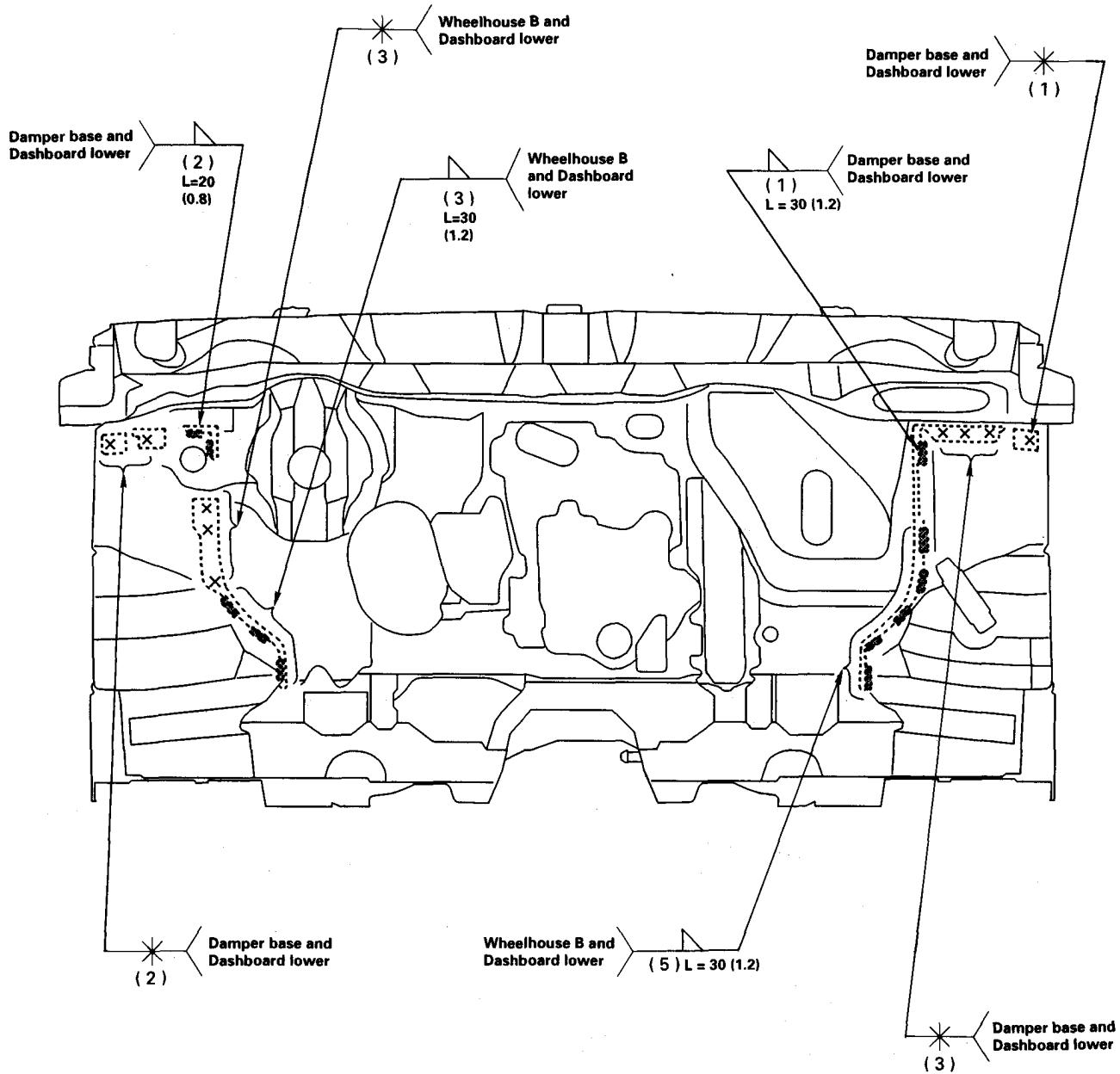


(cont'd)

Front Wheelhouse / Damper Housing

Mass Production Body Welding Diagram (cont'd)





〈Passenger Compartment〉

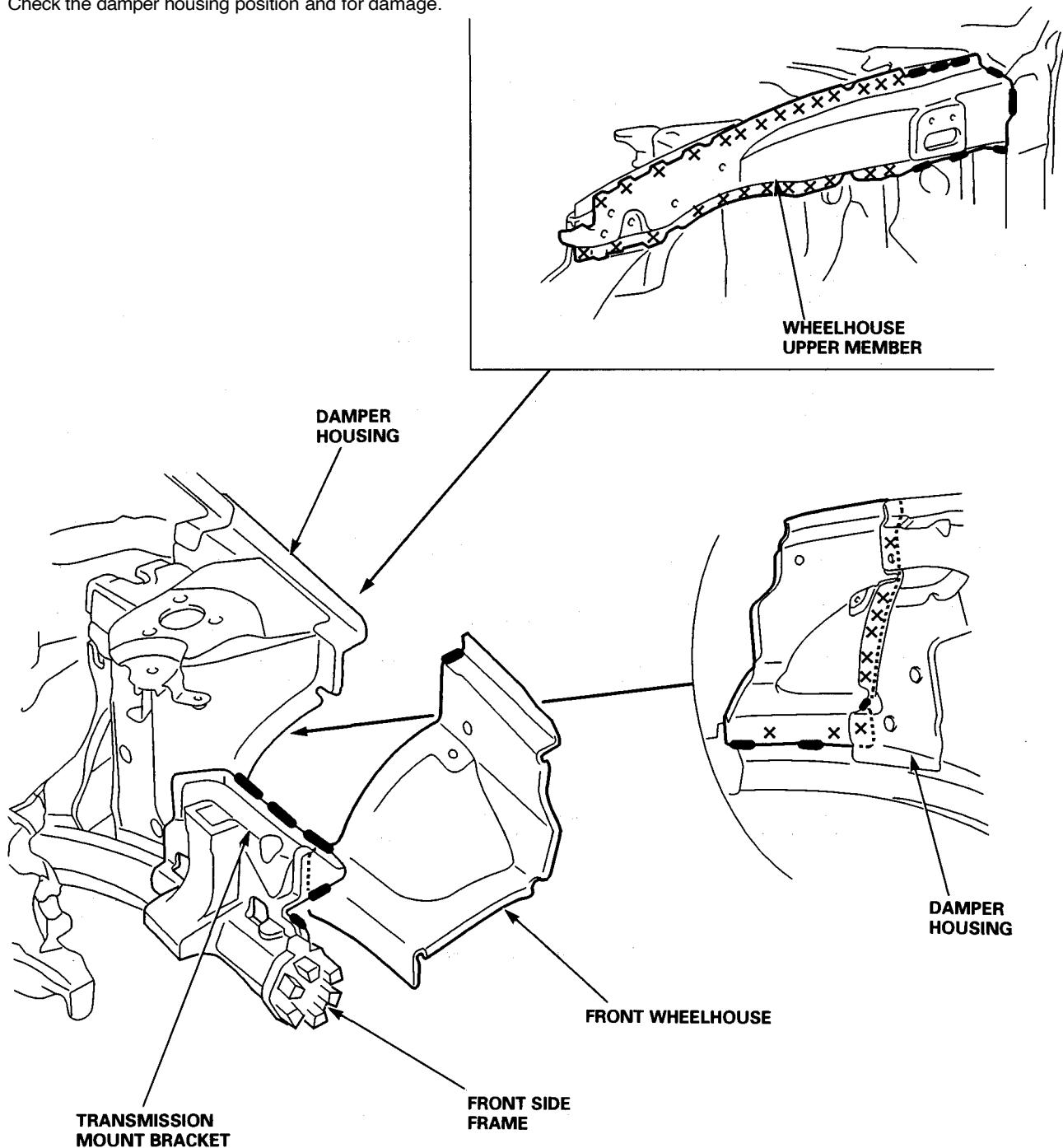
Front Wheelhouse / Damper Housing

Removal

- Remove the wheelhouse upper member, then replace the front wheelhouse

NOTE: Do not section the wheelhouse upper member; replacement must be made at the factory seams.

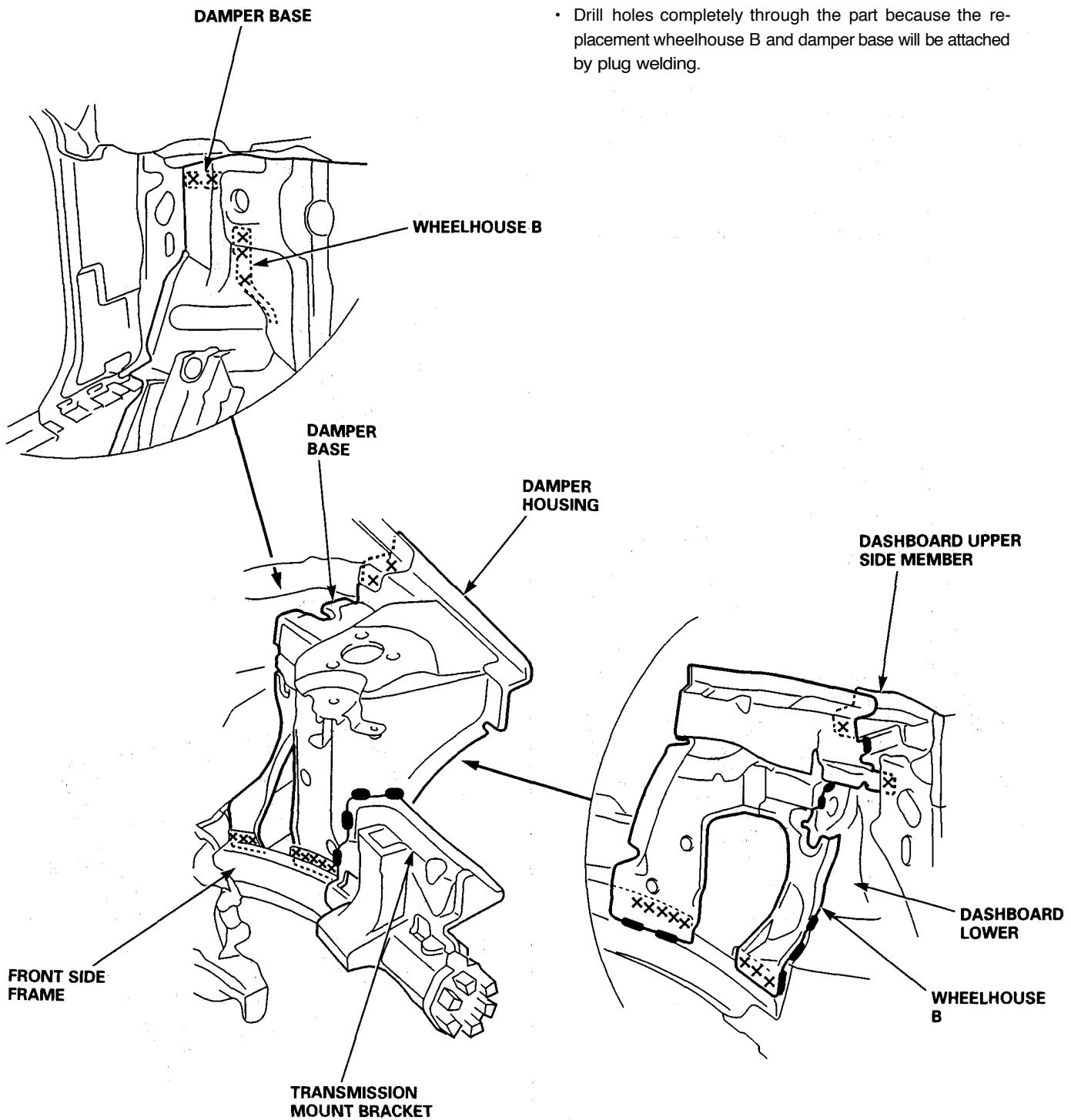
- Check the damper housing position and for damage.



Passenger Compartment Side:

- If necessary, replace the damper housing, damper base, and wheelhouse B as an assembly.

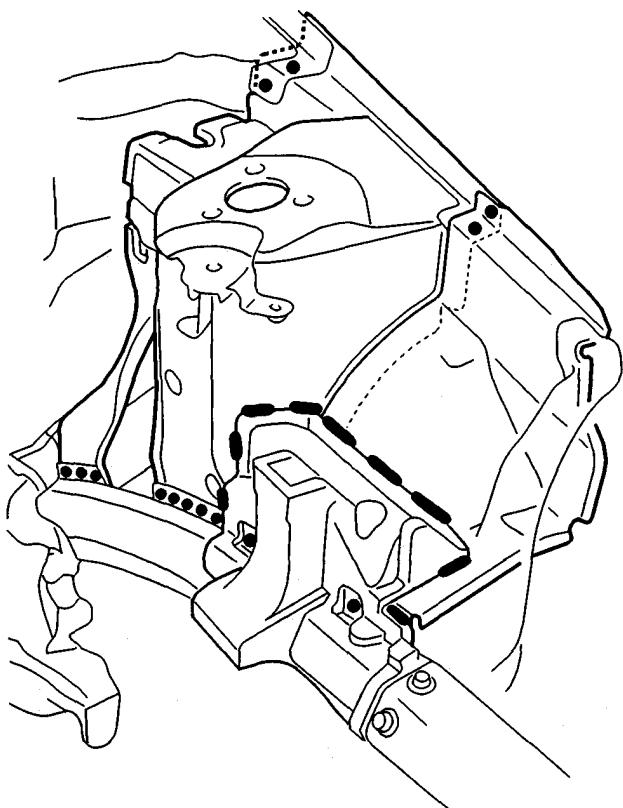
- Drill holes completely through the part because the replacement wheelhouse B and damper base will be attached by plug welding.



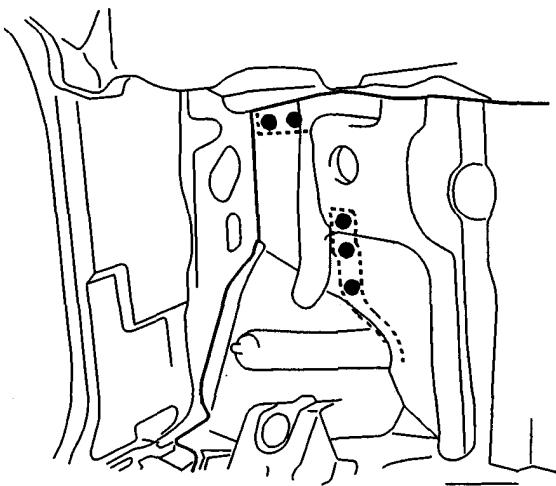
Front Wheelhouse / Damper Housing

Installation

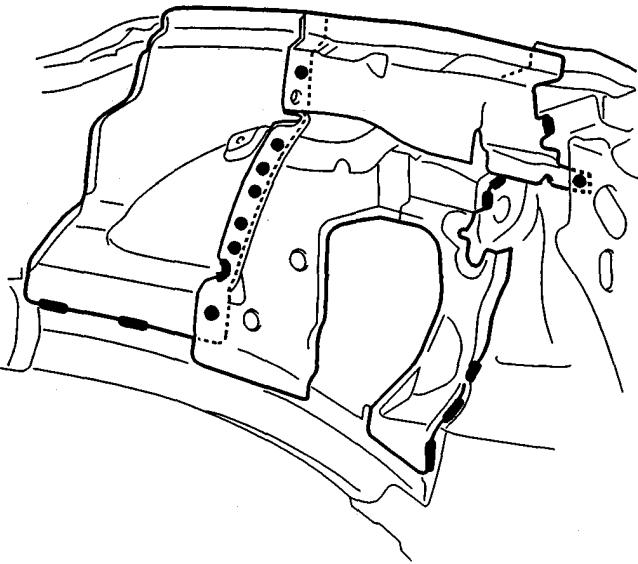
1. Set the new damper housing, and front wheelhouse into position, and measure the front compartment diagonally. Check the body dimensions (see [section 4](#)).
2. Tack weld the clamped position.
3. Check the front damper position. Temporarily install the hood, front fender, headlight, and front bumper, and check for differences in level and clearance. Make sure the body lines flow smoothly.
4. Perform the main welding
 - Weld the damper housing, wheelhouse B, and front damper base.



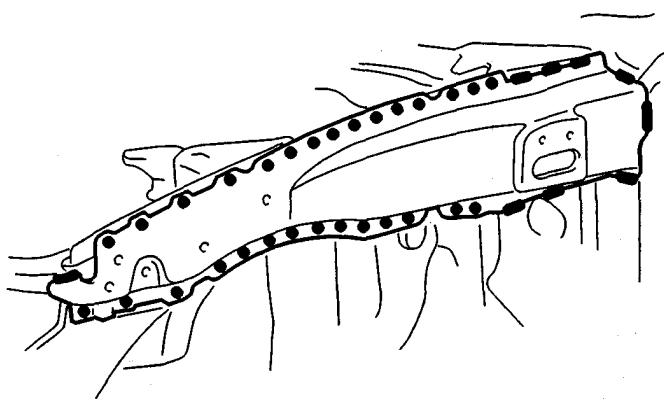
- From passenger compartment side, plug weld the holes in the dashboard lower, wheelhouse B and damper base.



- Weld the front wheelhouse.

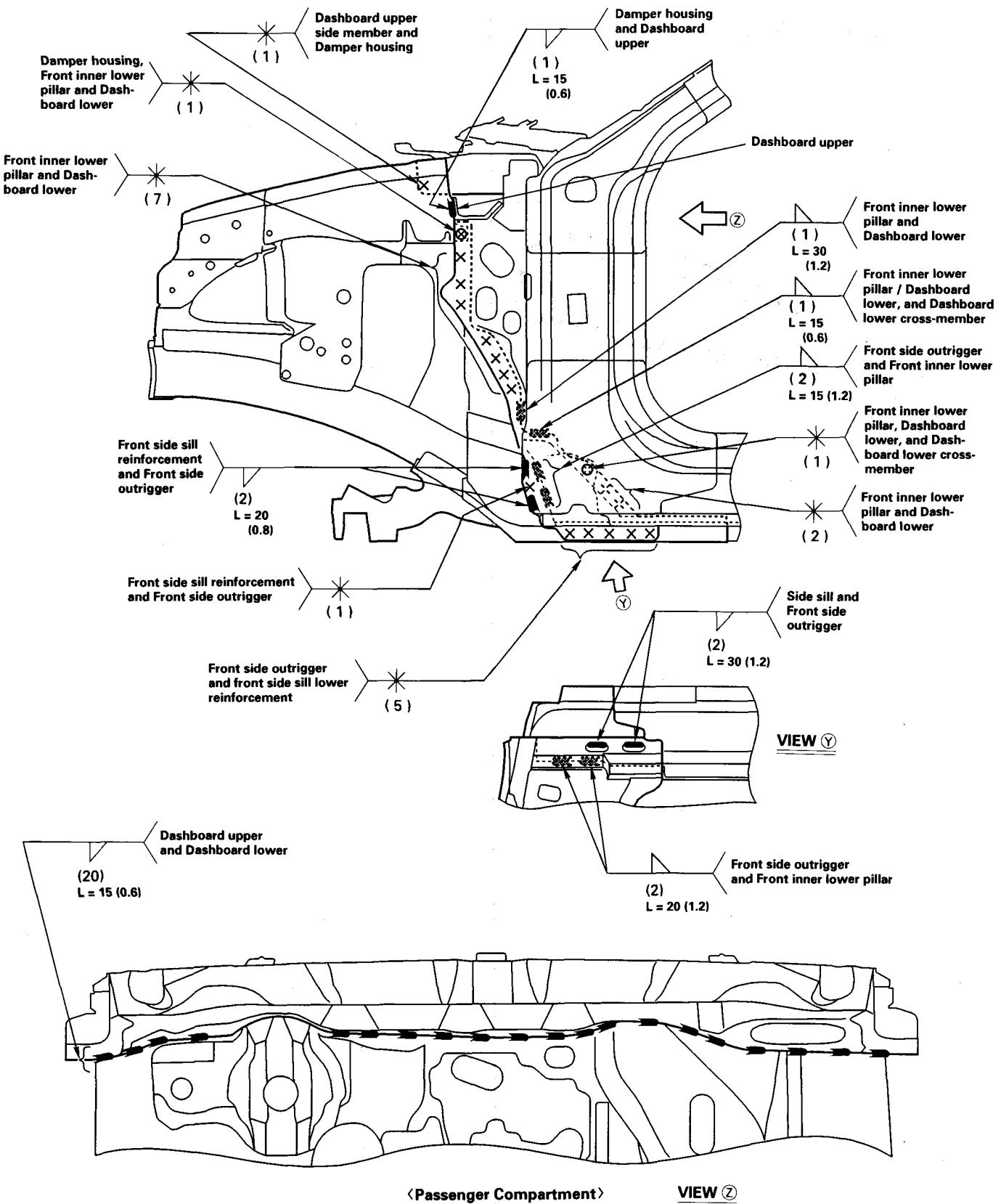


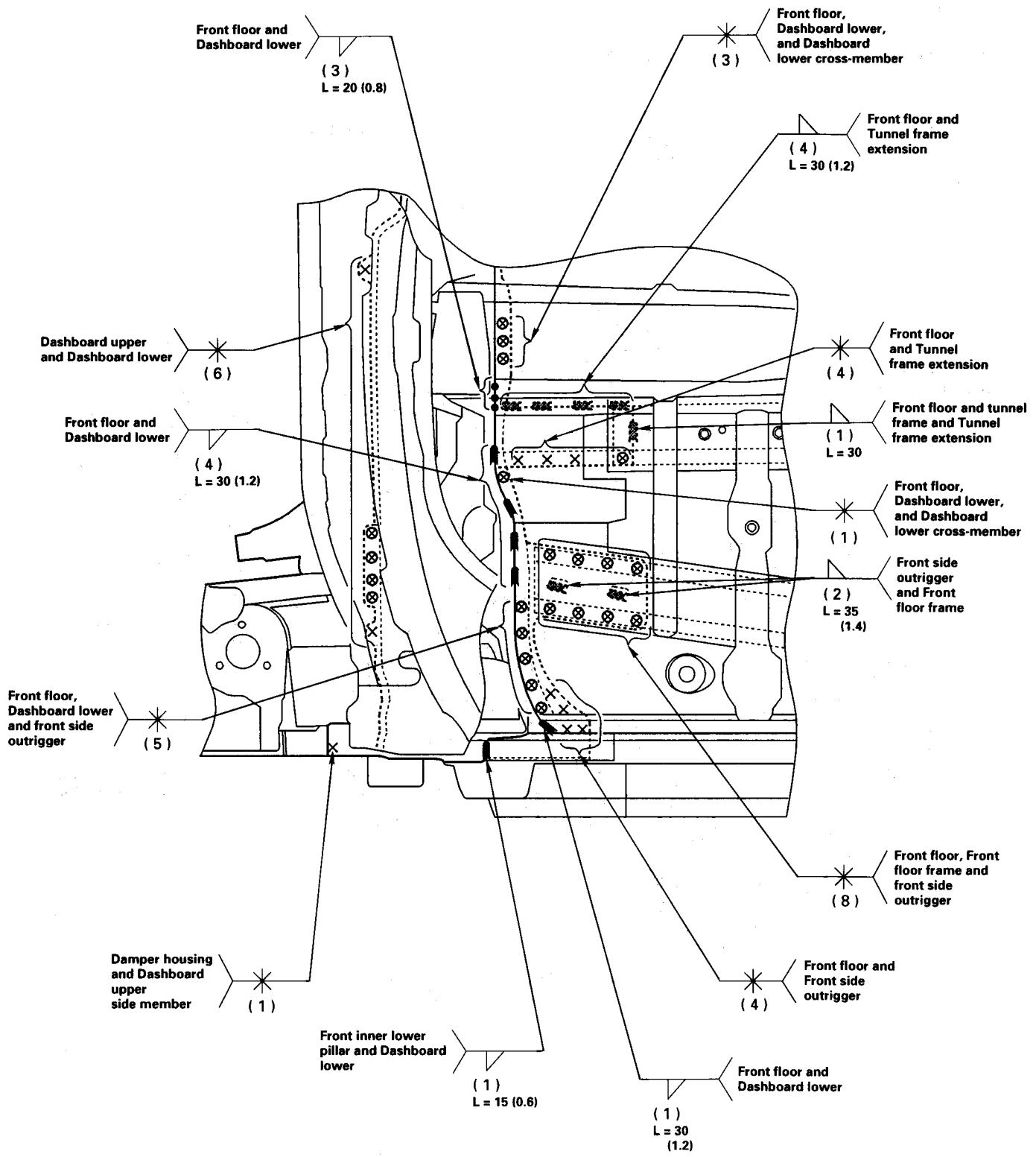
-
- Weld the wheelhouse upper member.



Front Bulkhead-Side Frame Assembly

Mass Production Body Welding Diagram



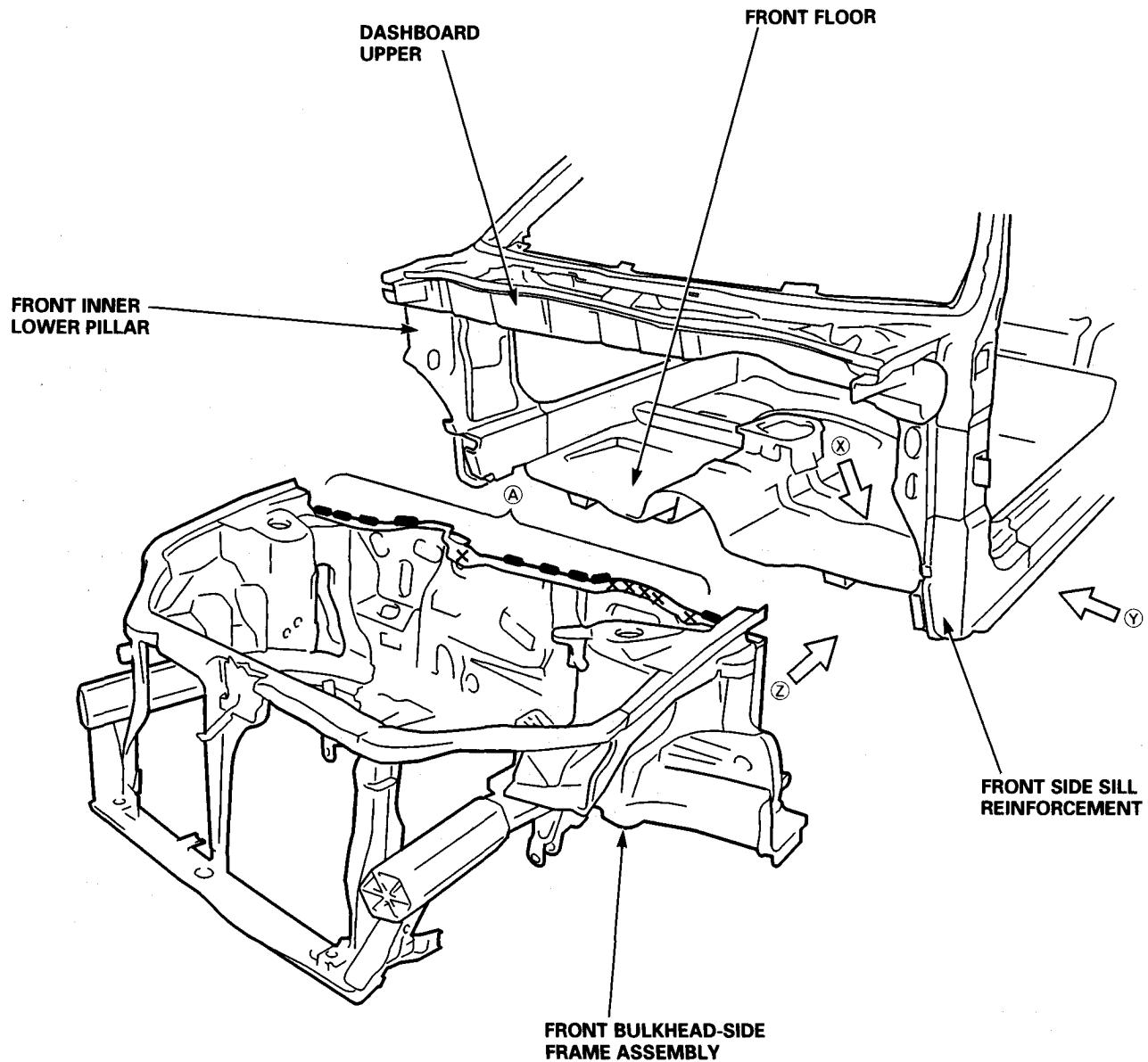


Front Bulkhead-Side Frame Assembly

Removal

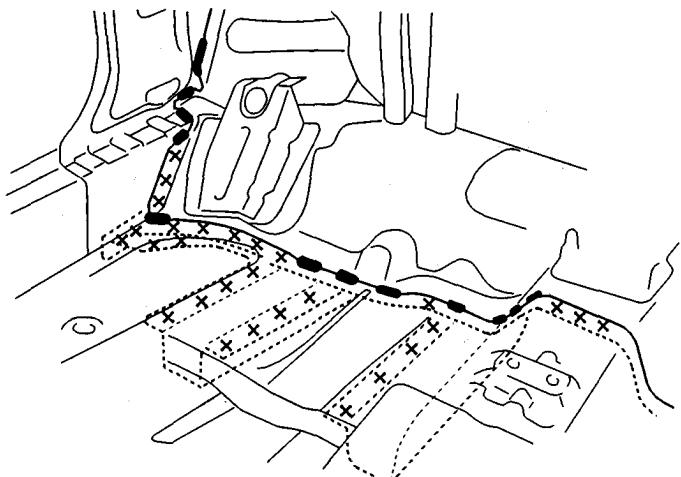
Cut and remove the front bulkhead-side frame assembly.

Ⓐ: Grind the fillet weld from the passenger compartment.

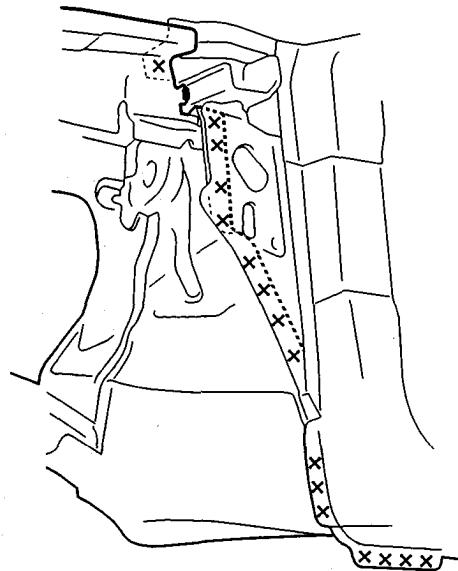


- Drill holes completely through the parts since the replacement front bulkhead-side frame assembly will be attached by plug welding.

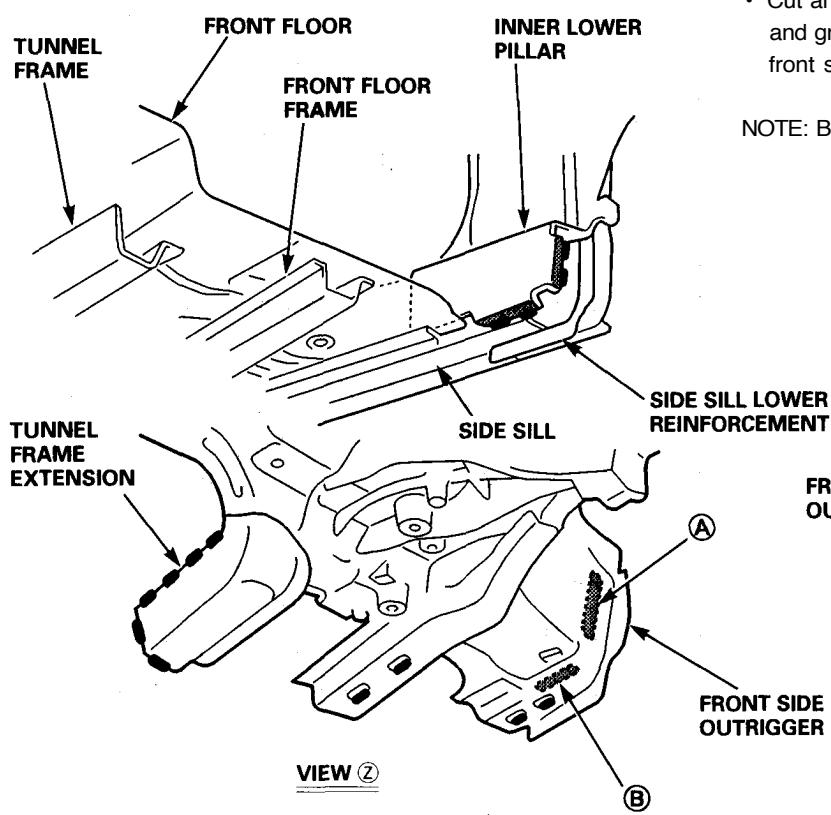
Passenger Compartment:



VIEW X



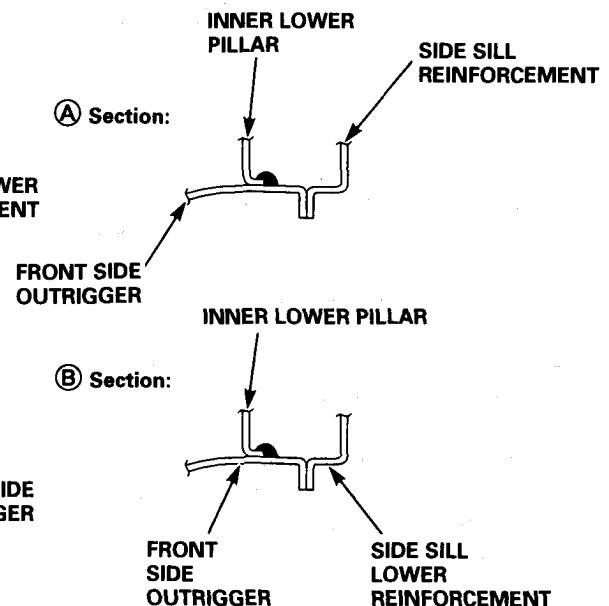
VIEW Y



VIEW Z

- Cut and pry off the front side outrigger (Ⓐ, Ⓑ positions), and grind the fillet welds of the front inner lower pillar and front side outrigger.

NOTE: Be careful not to damage the front inner lower pillar.

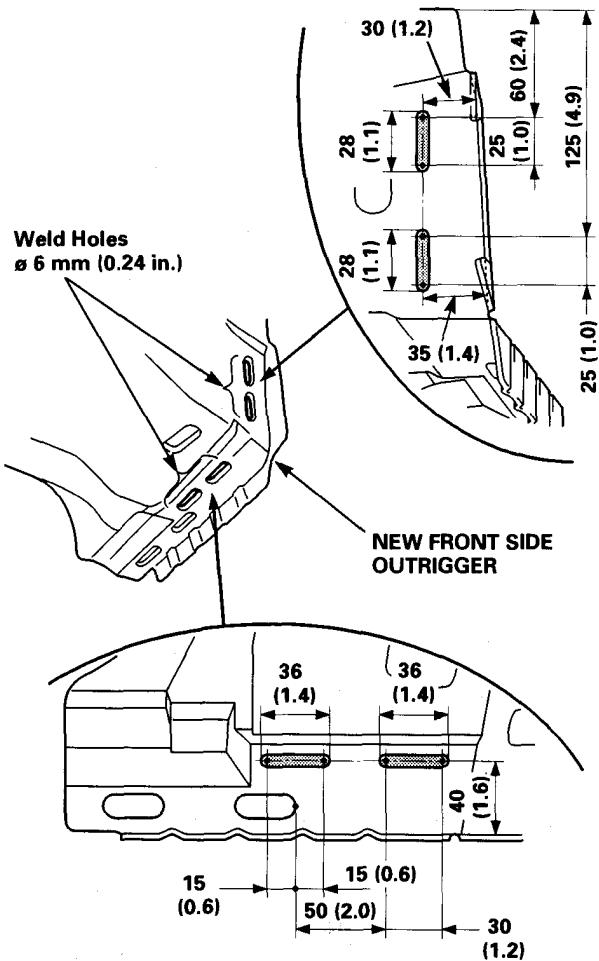


Front Bulkhead-Side Frame Assembly

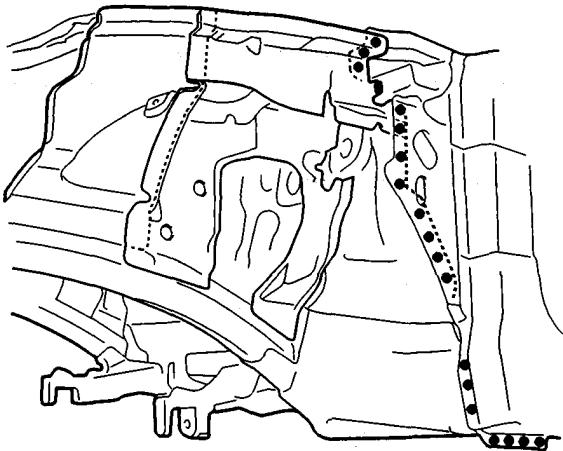
Installation

1. Drill the plug weld holes in the new front side outrigger for welding the front inner lower pillar.

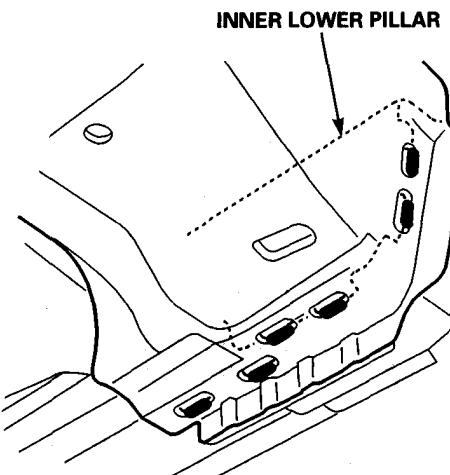
Unit: mm (in.)



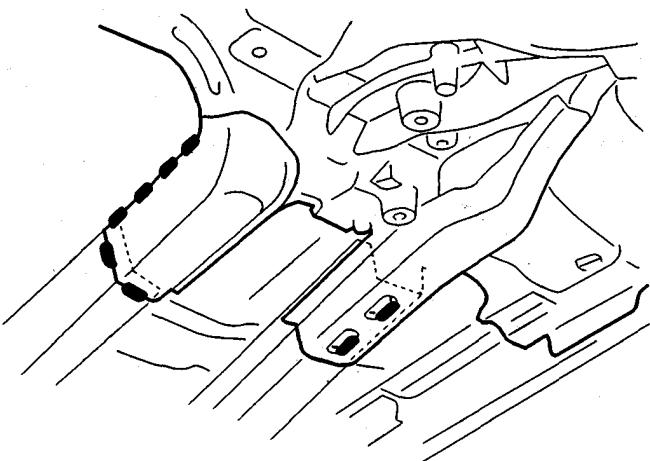
2. Set the new front bulkhead-side frame assembly into position, and check the body dimensions (see [section 4](#)).
3. Tack weld the clamped position.
4. Temporarily install the front fender, hood, and door, and check for differences in level and clearance.
5. Perform the main welding.
 - Weld the damper housing, dashboard lower, and outrigger to the dashboard upper and front inner lower pillar.



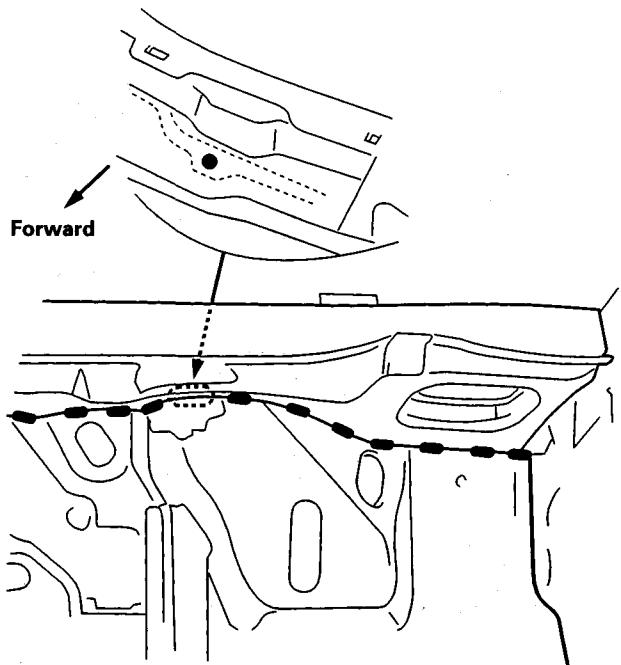
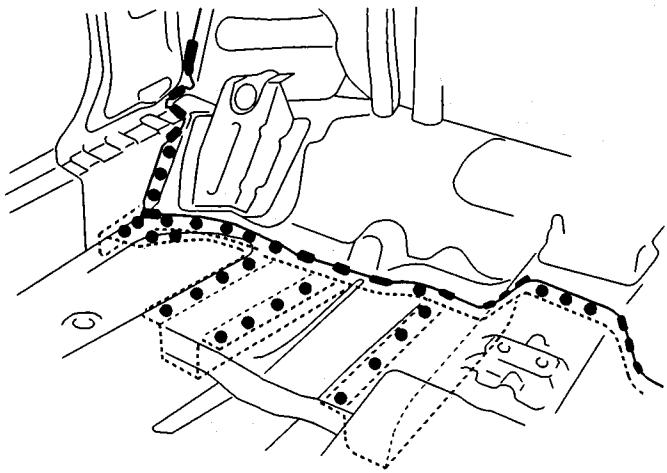
- Weld the the front side outrigger to the inner lower pillar and inside sill.



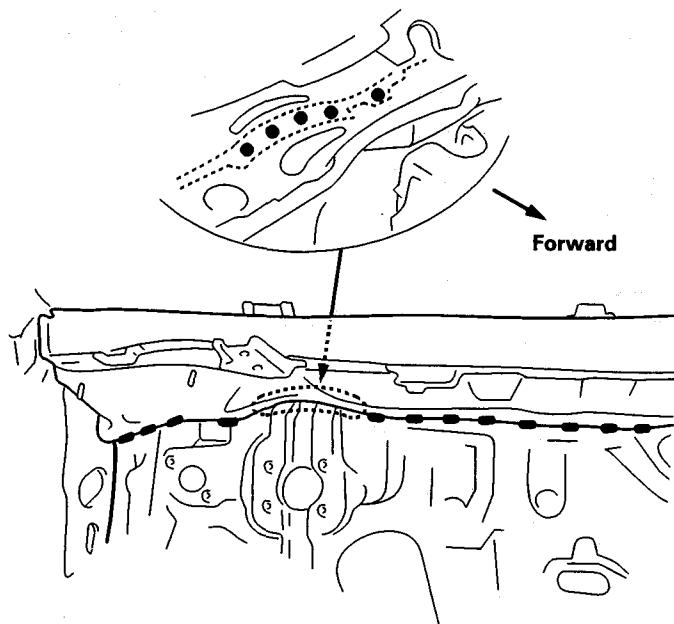
- Weld the tunnel frame and front floor frame.



- Weld the dashboard lower and front floor.

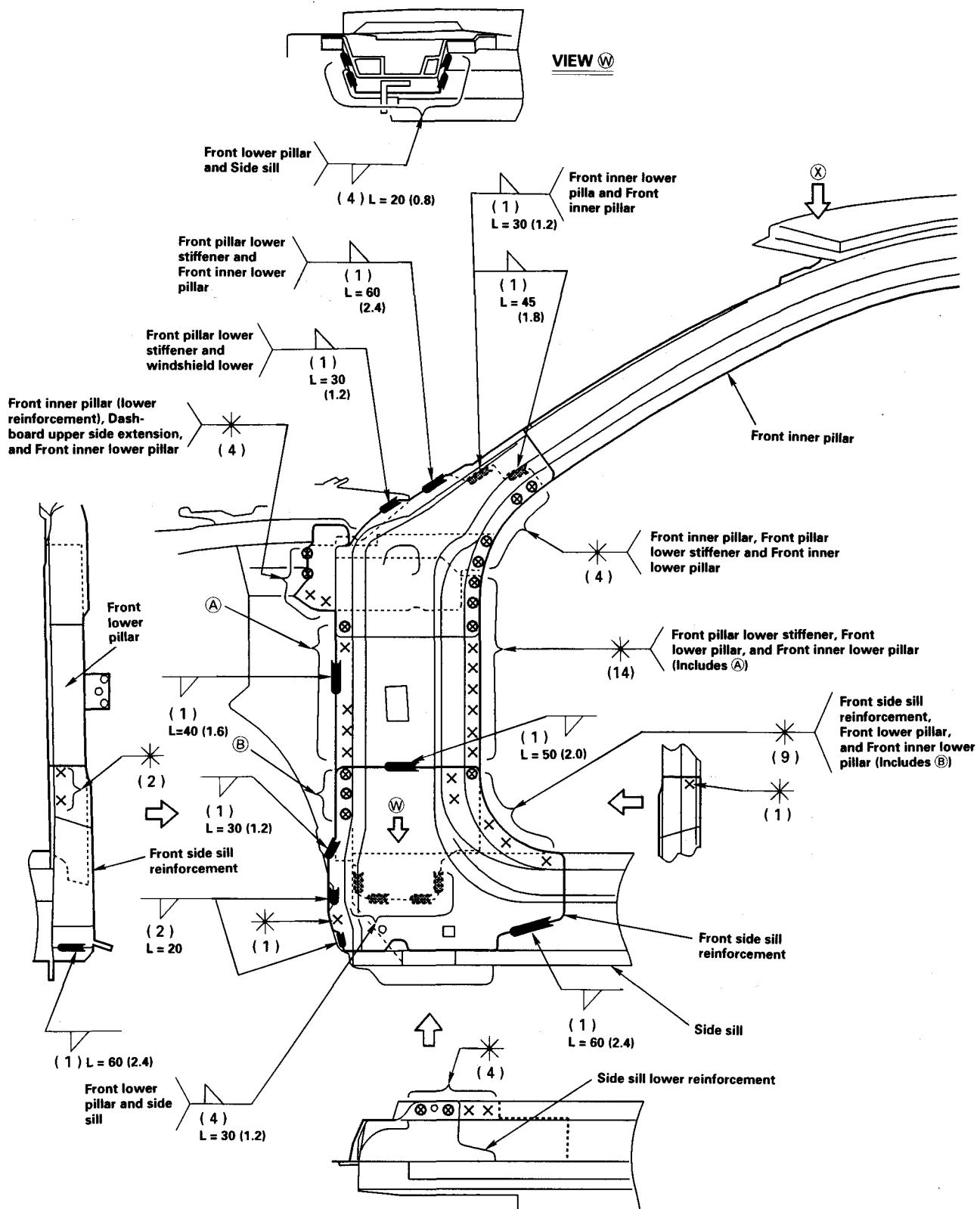


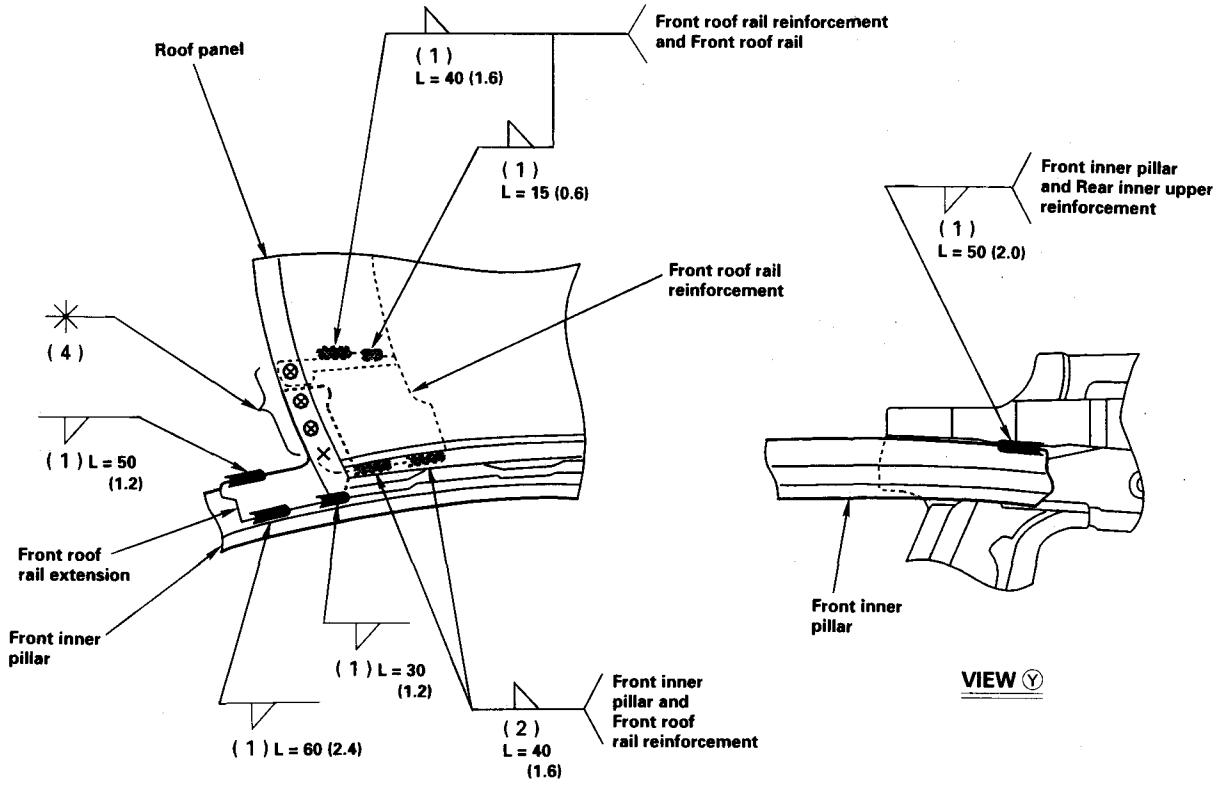
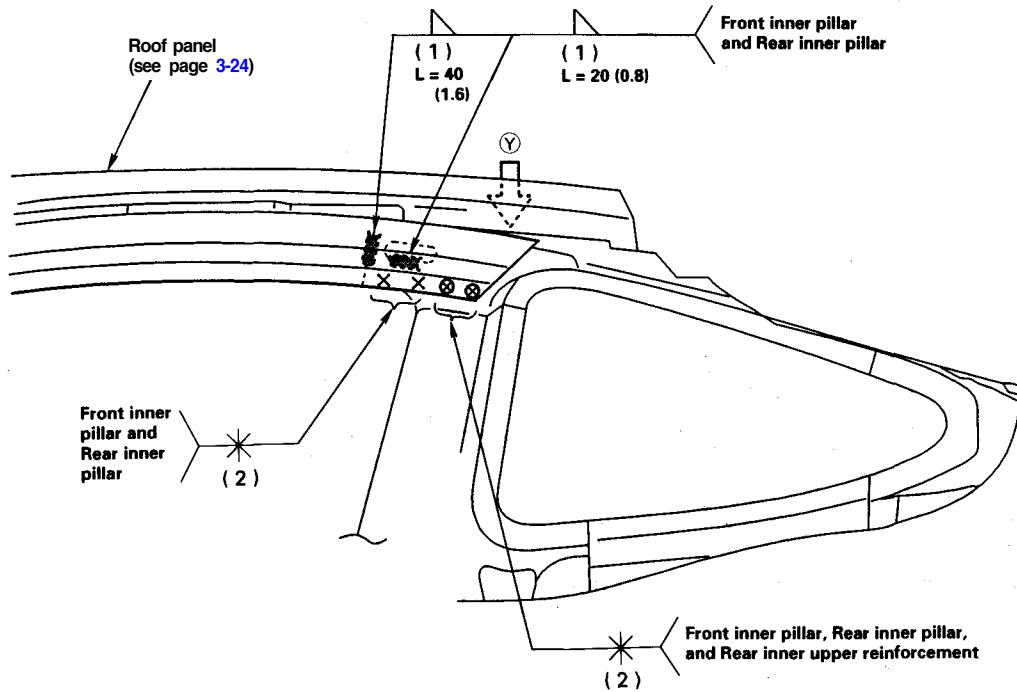
- Weld the dashboard lower and dashboard upper.



Front Pillar

Mass Production Body Welding Diagram

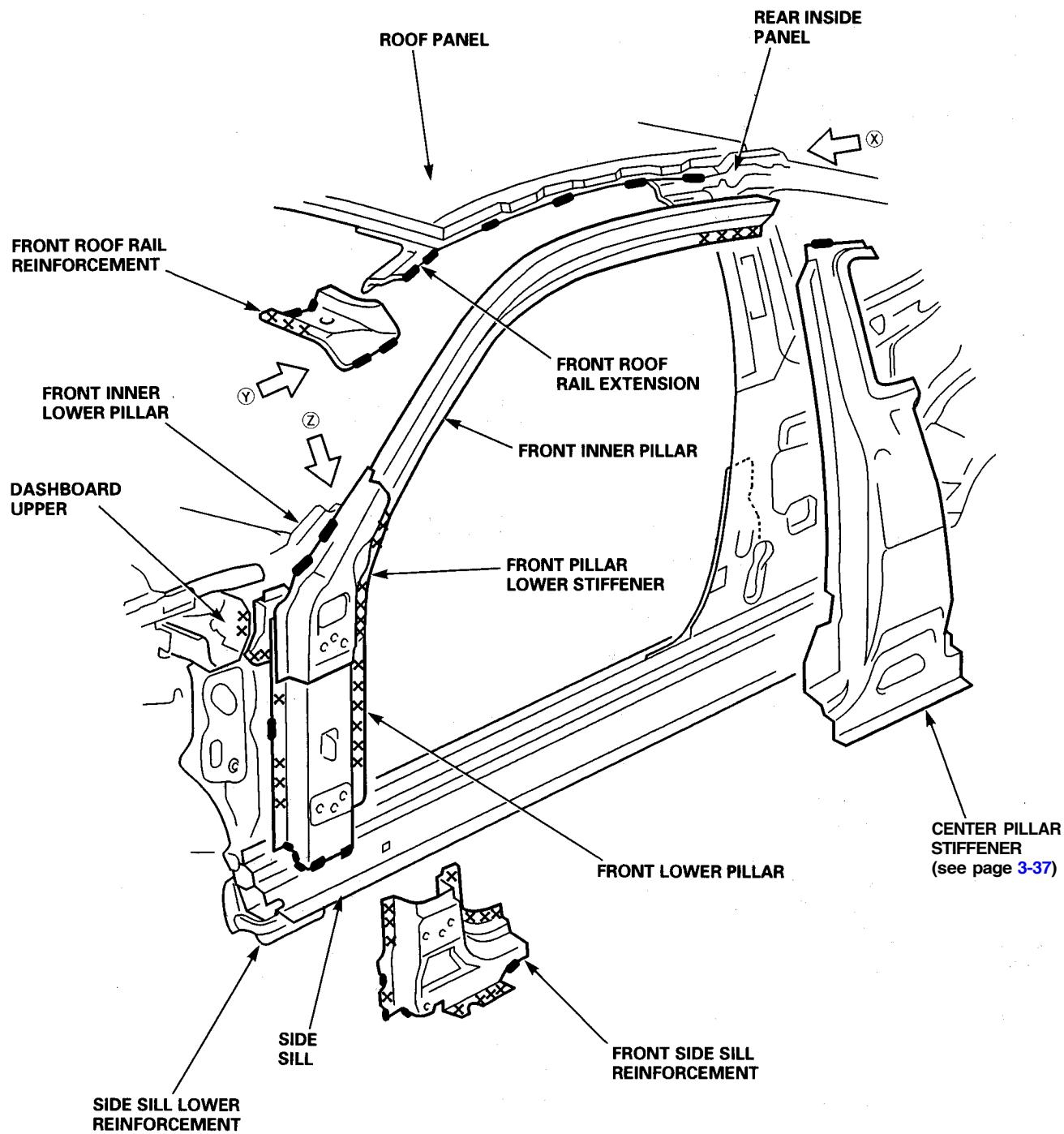


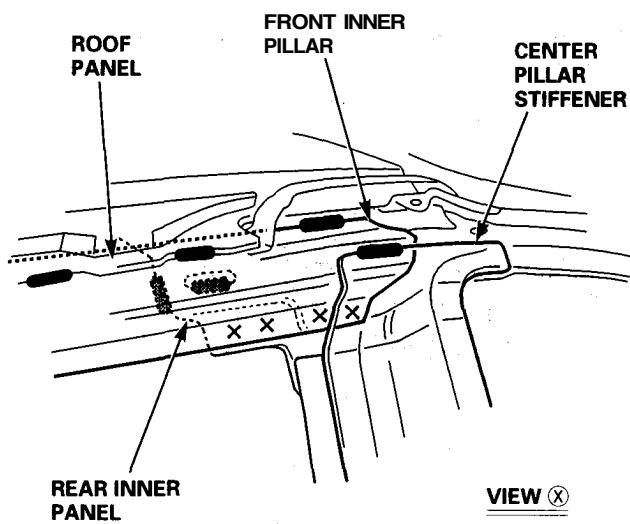


Front Pillar

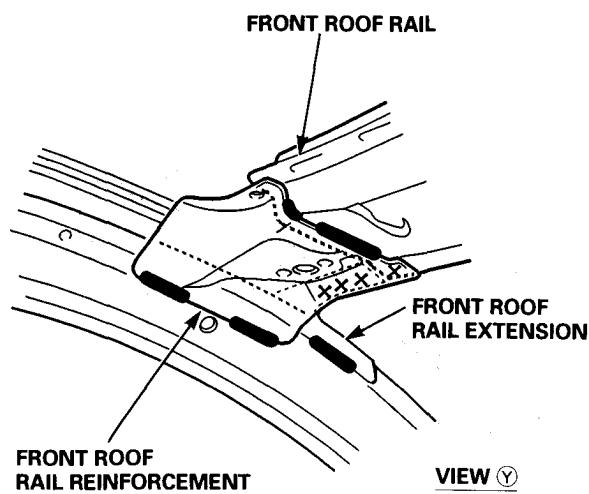
Removal

- Cut and remove the rear fender panel (see page 3-39).
- Remove the wheelhouse upper member (see page 3-8).
- When removing the front inner pillar, leave the front roof rail extension attached to the roof panel.

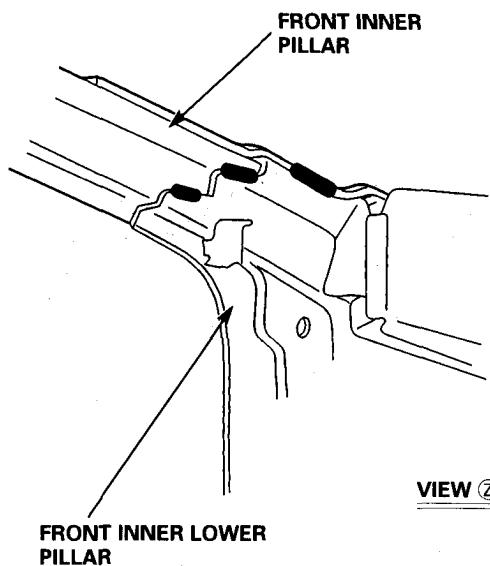




VIEW X



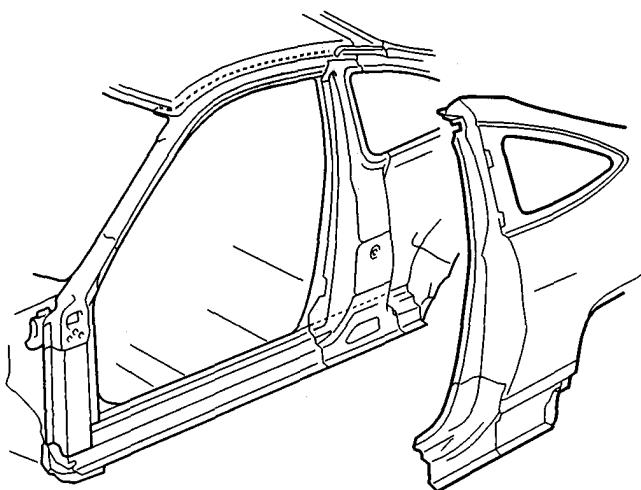
VIEW Y



VIEW Z

Installation

1. Set the new front pillar and center pillar stiffener, and check the body dimensions (see [section 4](#)).
2. Tack weld the clamped position.
3. Set the front side sill reinforcement and rear fender panel.



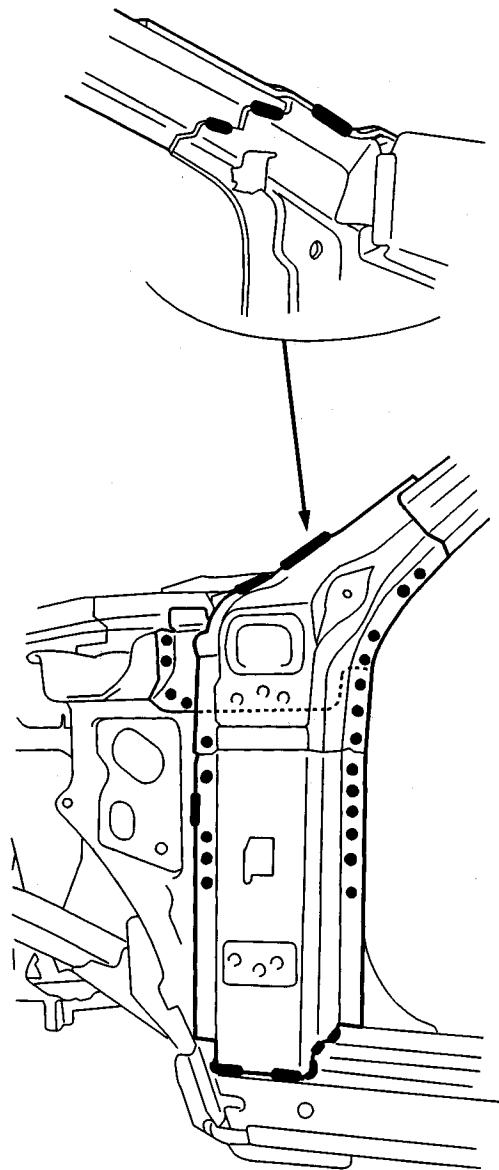
4. Temporarily install the door, front fender, windshield, and hood, and check for differences in level and clearance. Make sure the body lines flows smoothly.
5. Check the operation of the door.
6. Remove the front side sill reinforcement, rear fender panel and center pillar stiffener, and main weld the front pillar.

(cont'd)

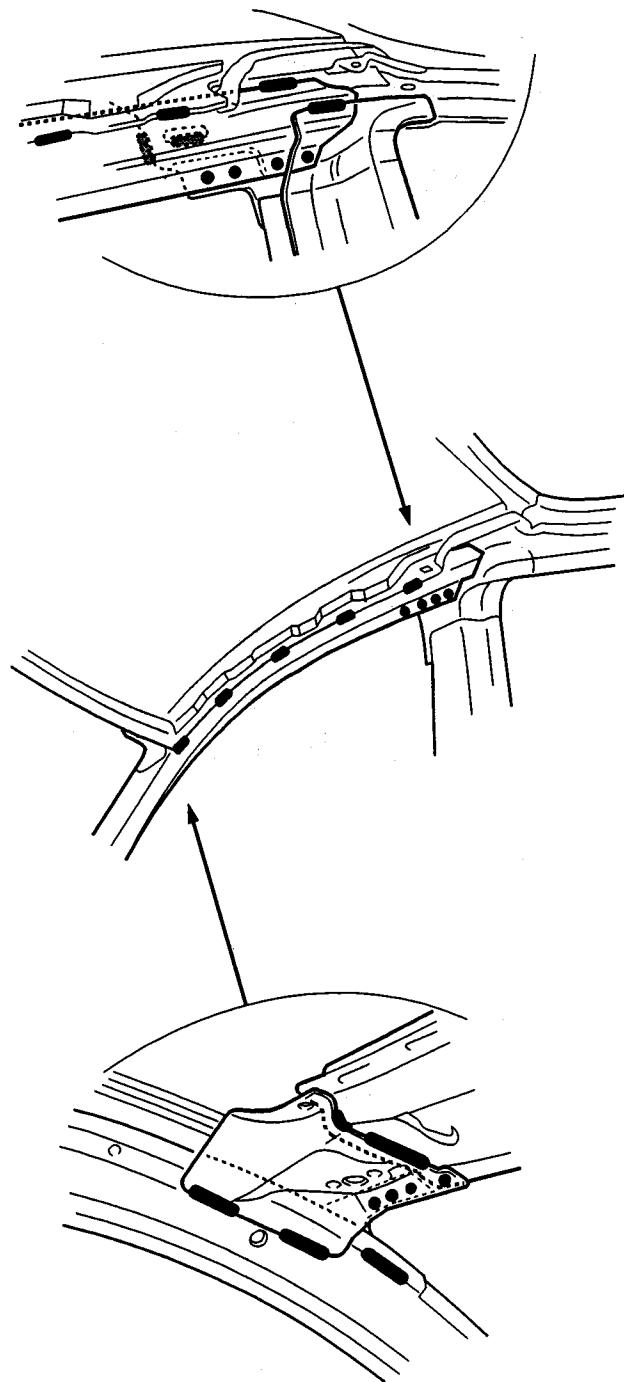
Front Pillar

Installation (cont'd)

- Weld the front inner pillar and front lower pillar to the front inner lower pillar, side sill, and dashboard upper.

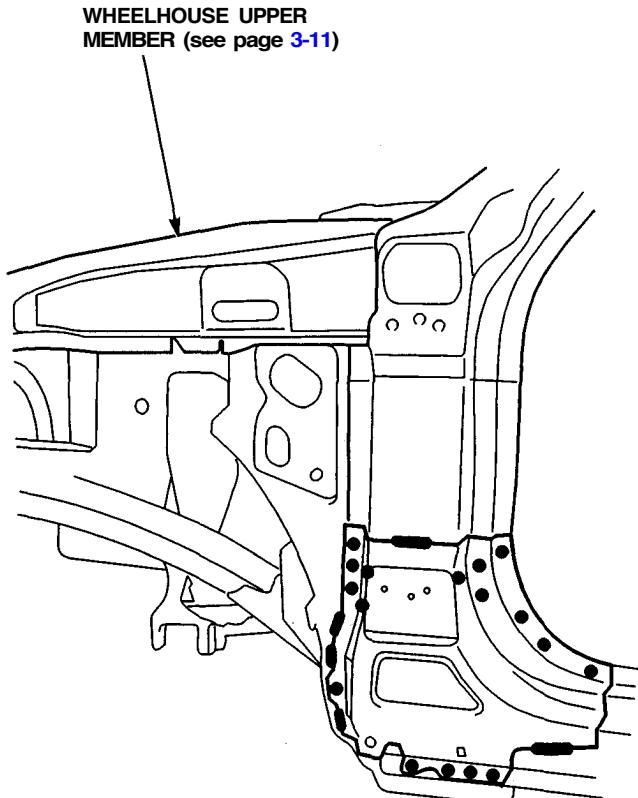


- Weld the front inner pillar to the rear inner pillar and roof panel.
- Weld the center pillar stiffener (see page 3-44).



- Weld the front roof rail reinforcement.

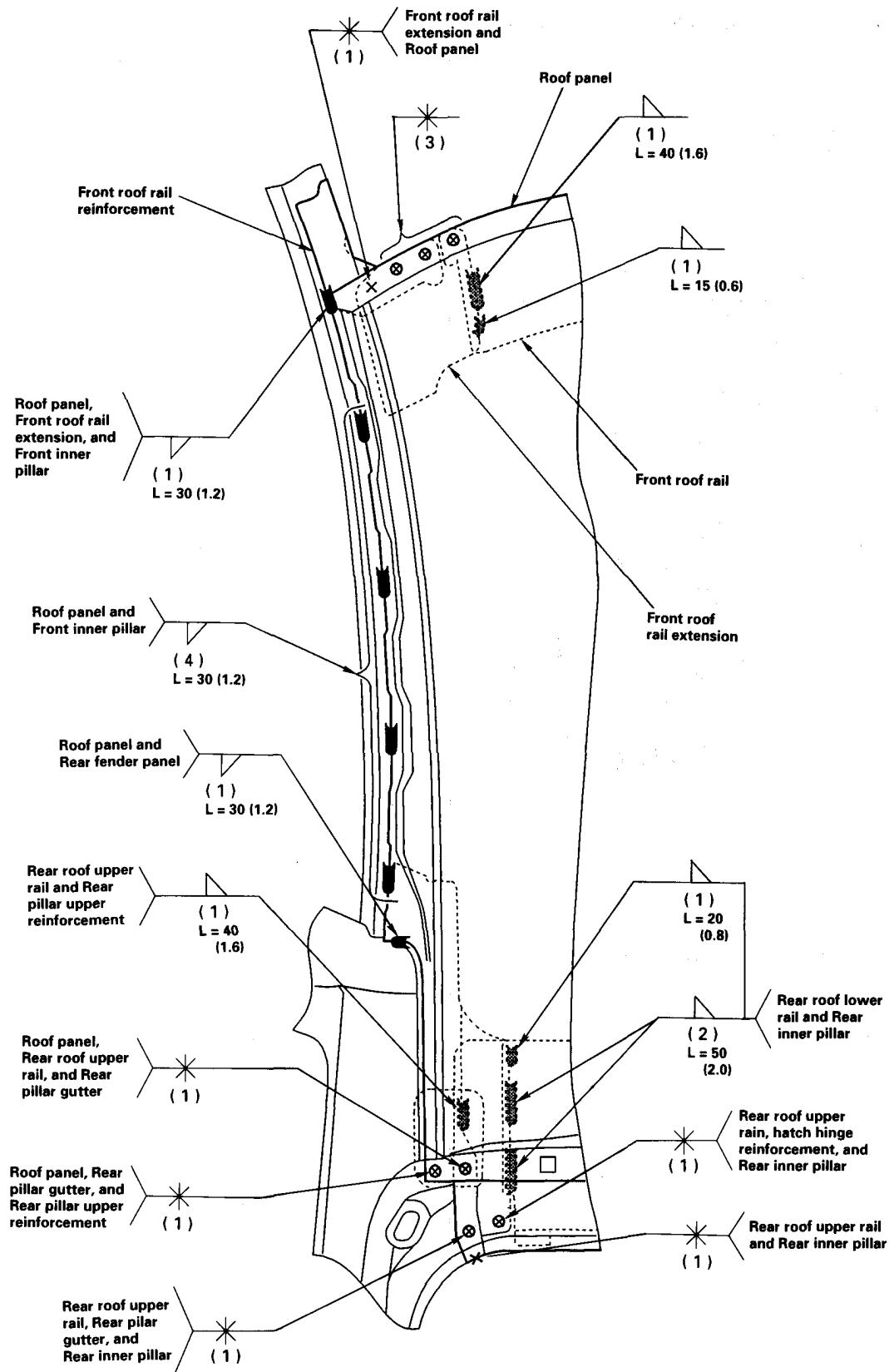
-
- Weld the front side sill lower reinforcement and wheelhouse upper member.



- Weld the rear fender panel (see pages 3-44, 3-45).

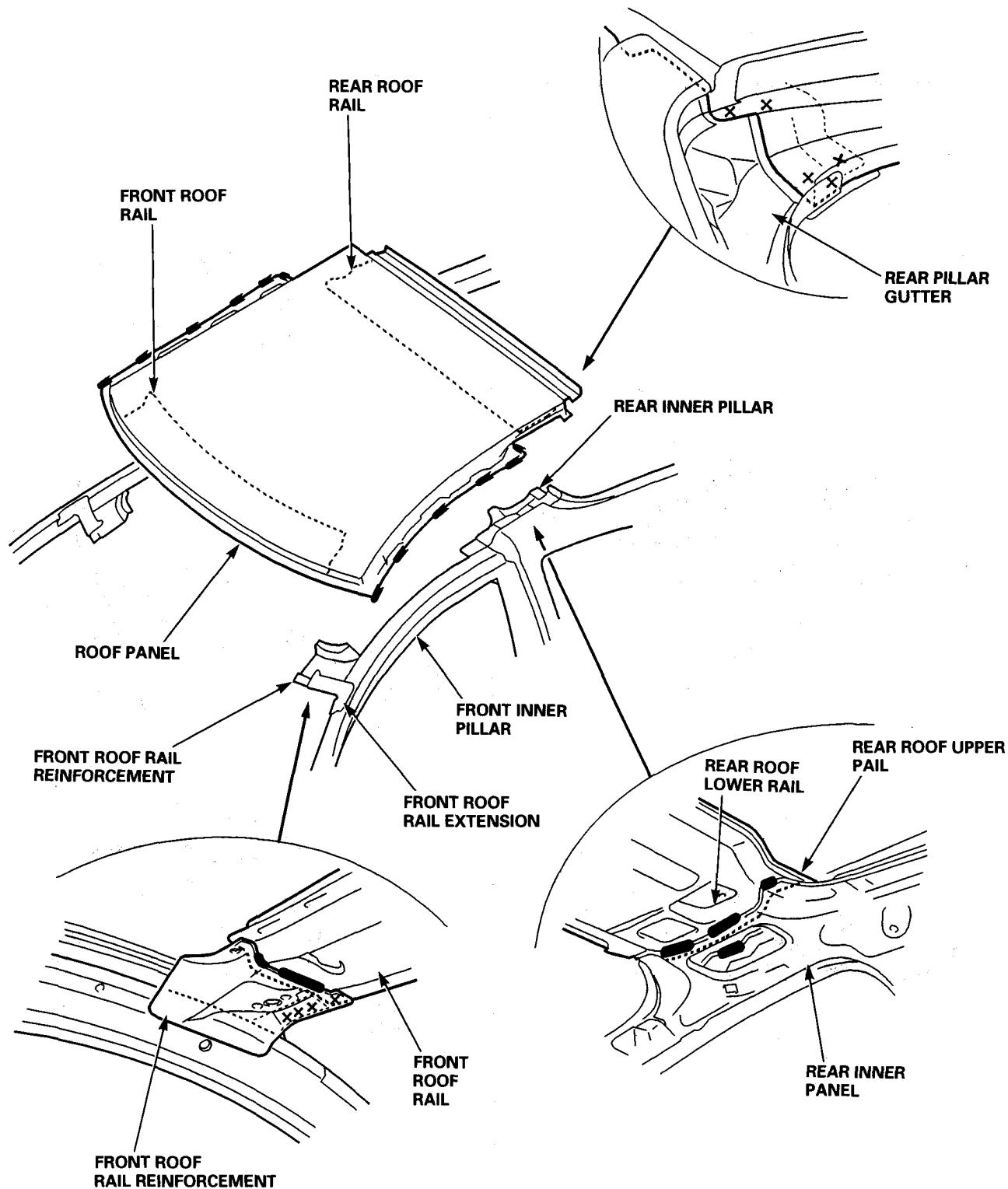
Roof Panel

Mass Production Body Welding Diagram



Removal

- When removing the roof panel, leave the front roof rail extension attached to the front pillar.

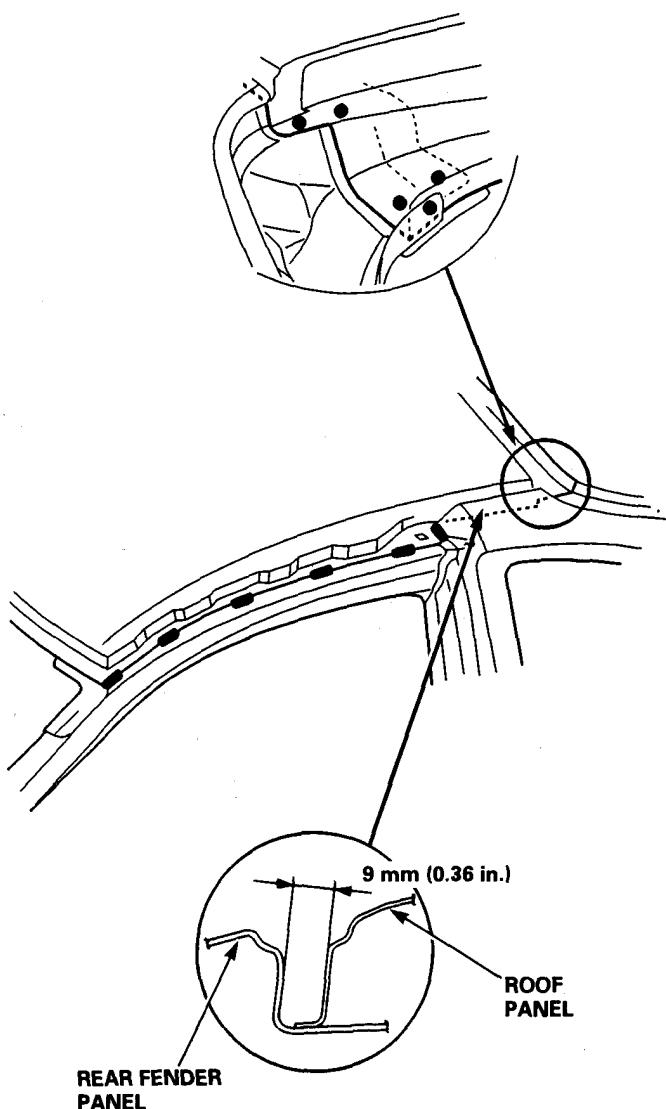
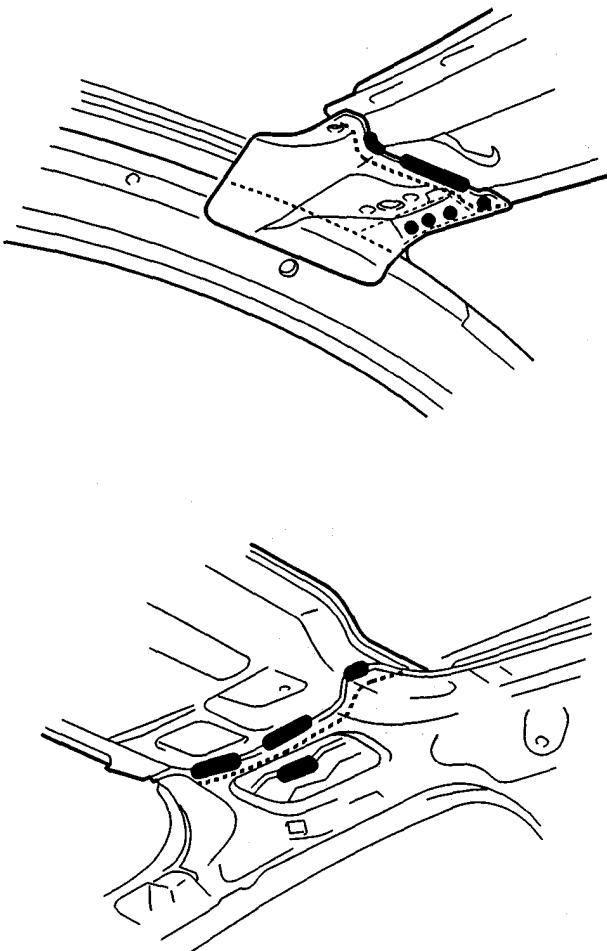


Roof Panel

Installation

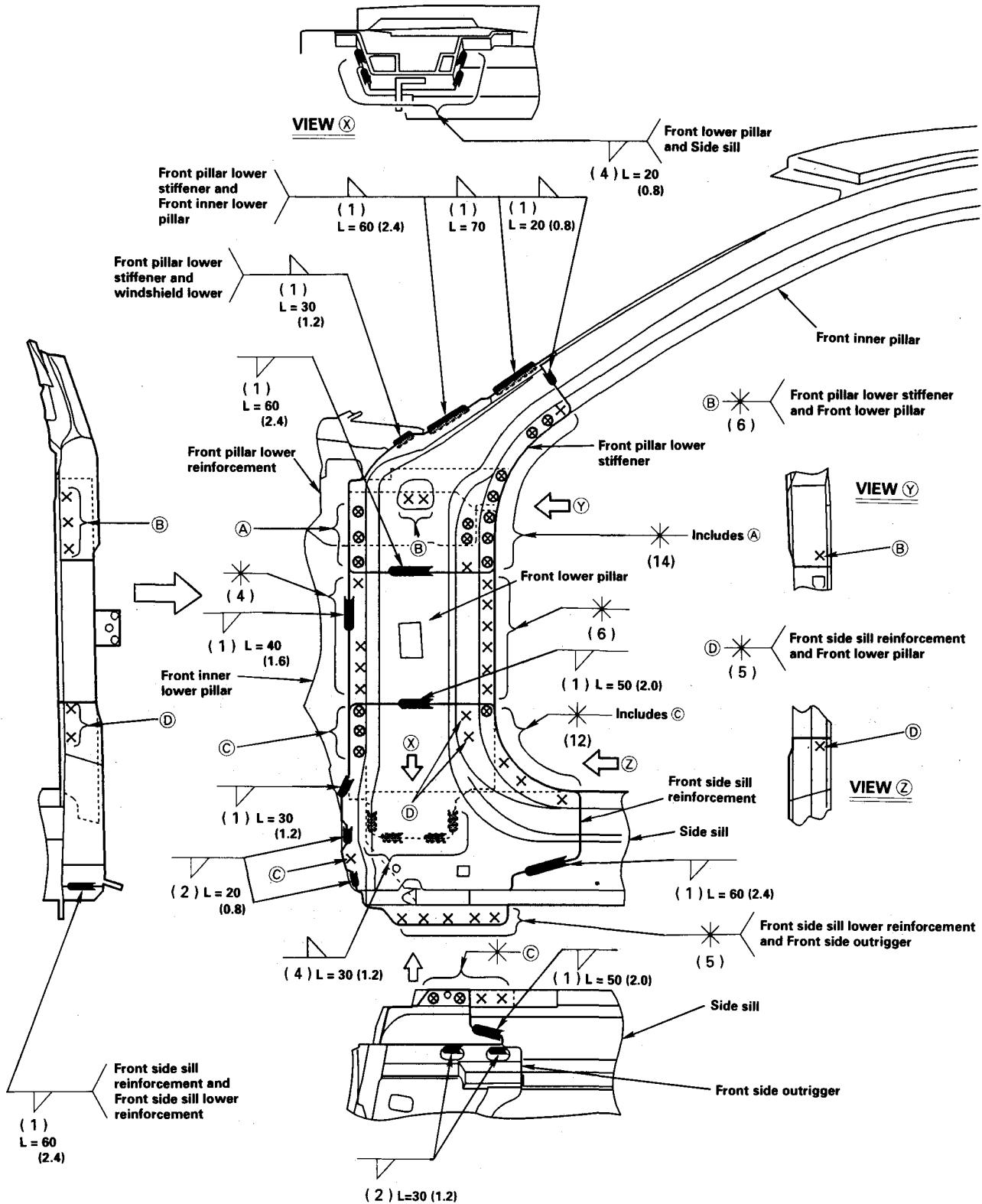
1. Set the new roof panel into position, and check the body dimensions (see [section 4](#)).
2. Tack weld the clamped position.
3. Temporarily install the windshield and hatch, and check for differences in level and clearance.
4. Check the operation of the hatch.
5. Perform the main welding.
 - Weld the front and rear roof rails.

- Weld the roof panel to the front inner pillar and rear pillar gutter.



Side Sill / Front Floor

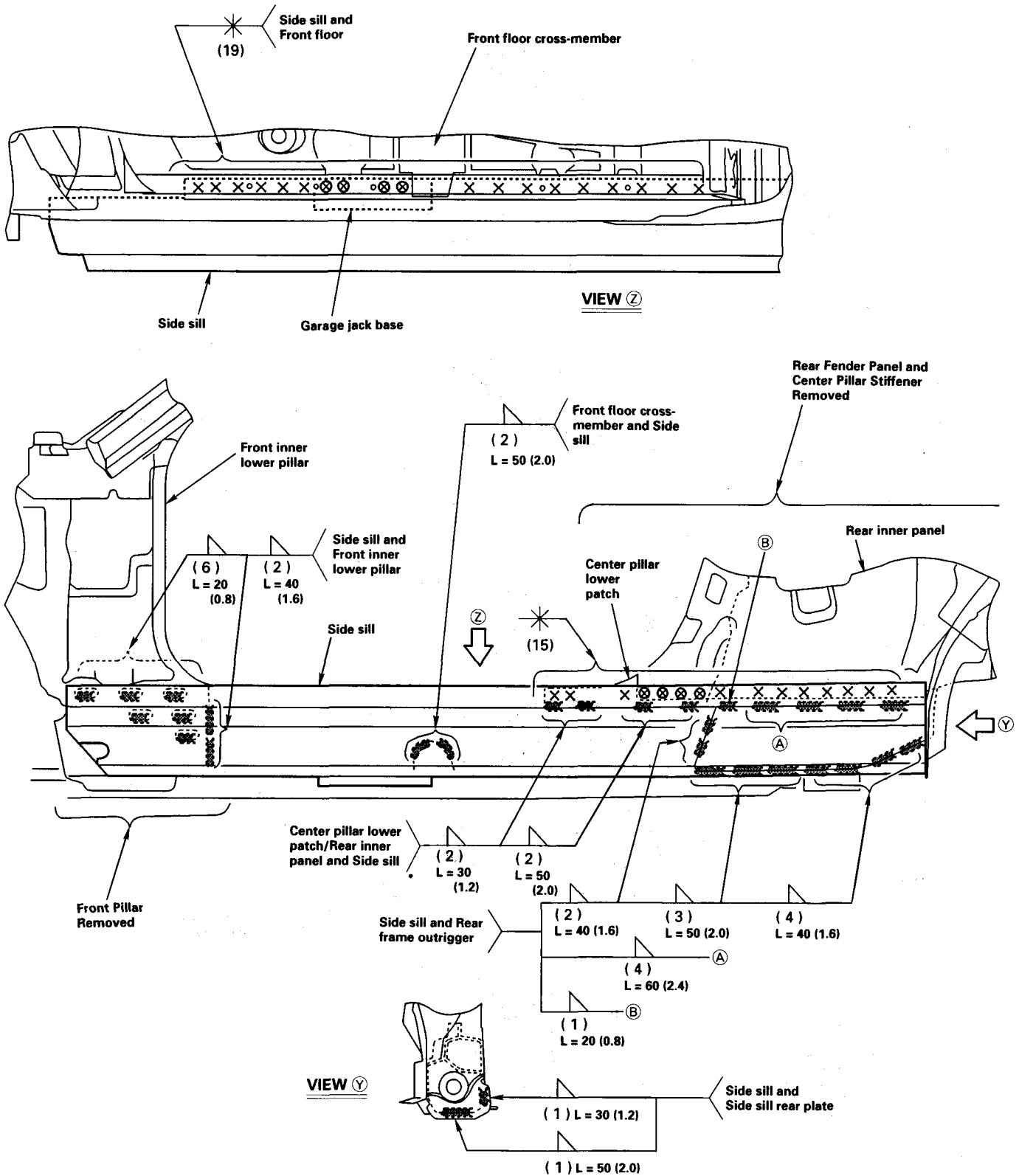
Mass Production Body Welding Diagram

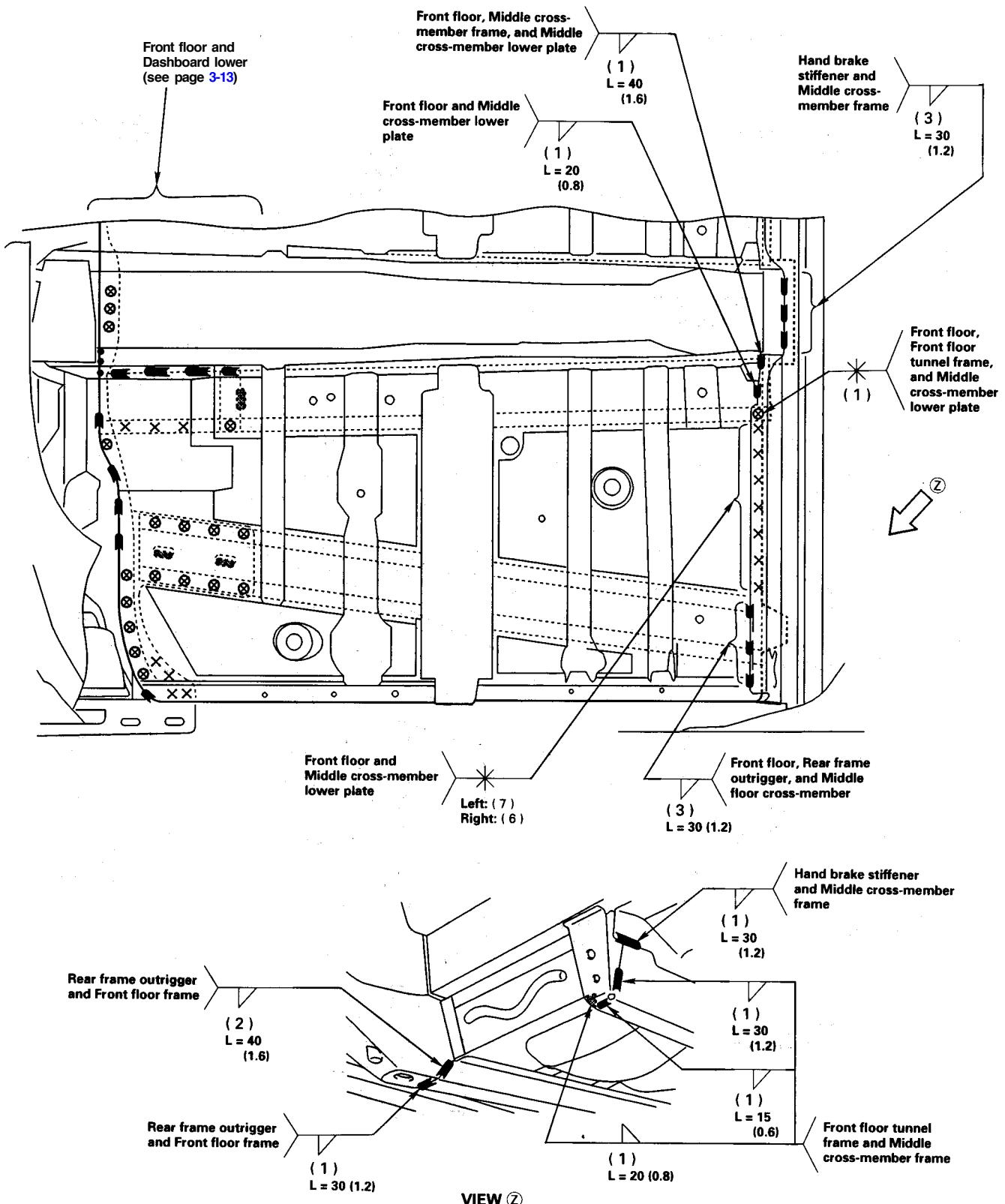


(cont'd)

Side Sill / Front Floor

Mass Production Body Welding Diagram (cont'd)

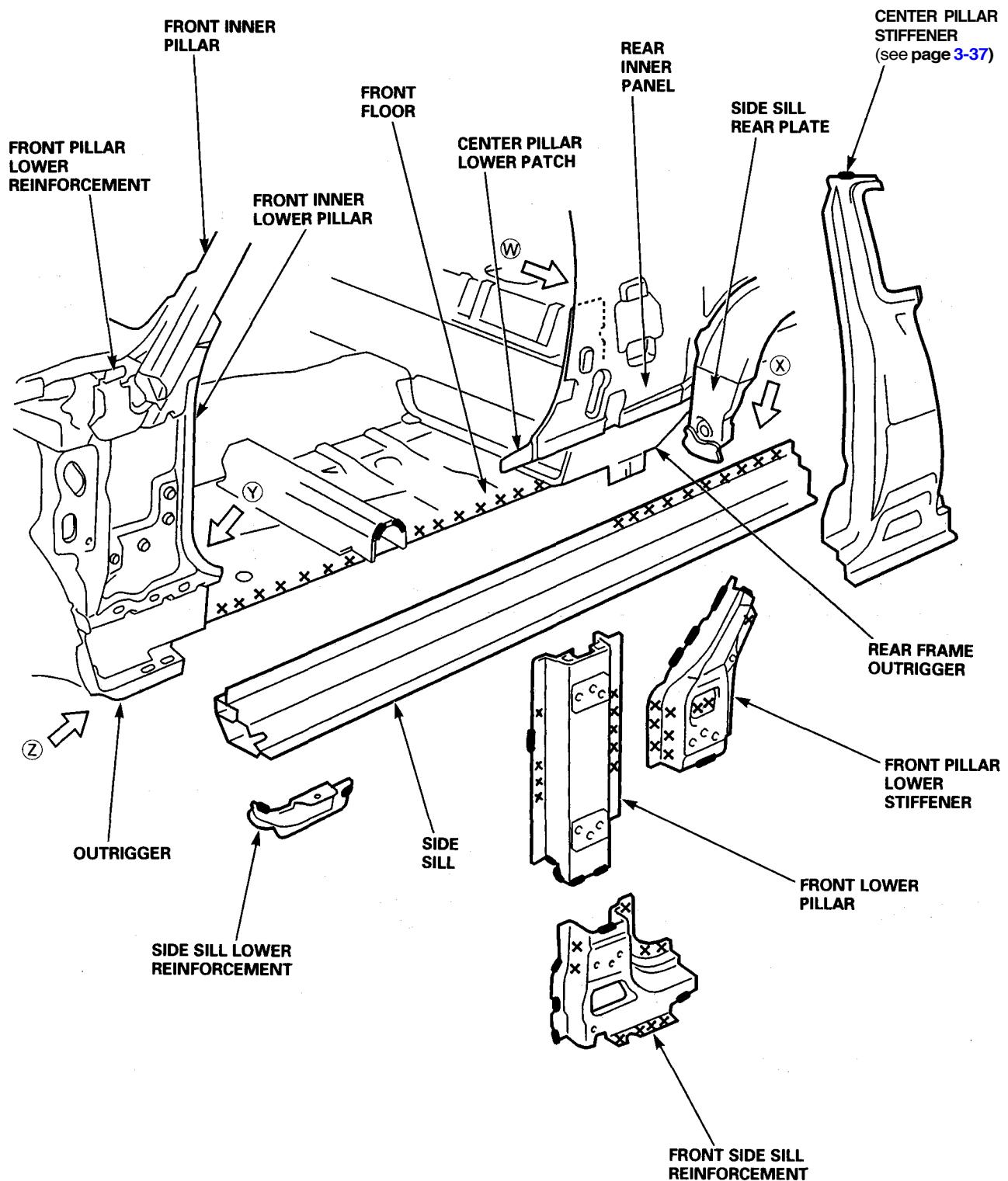


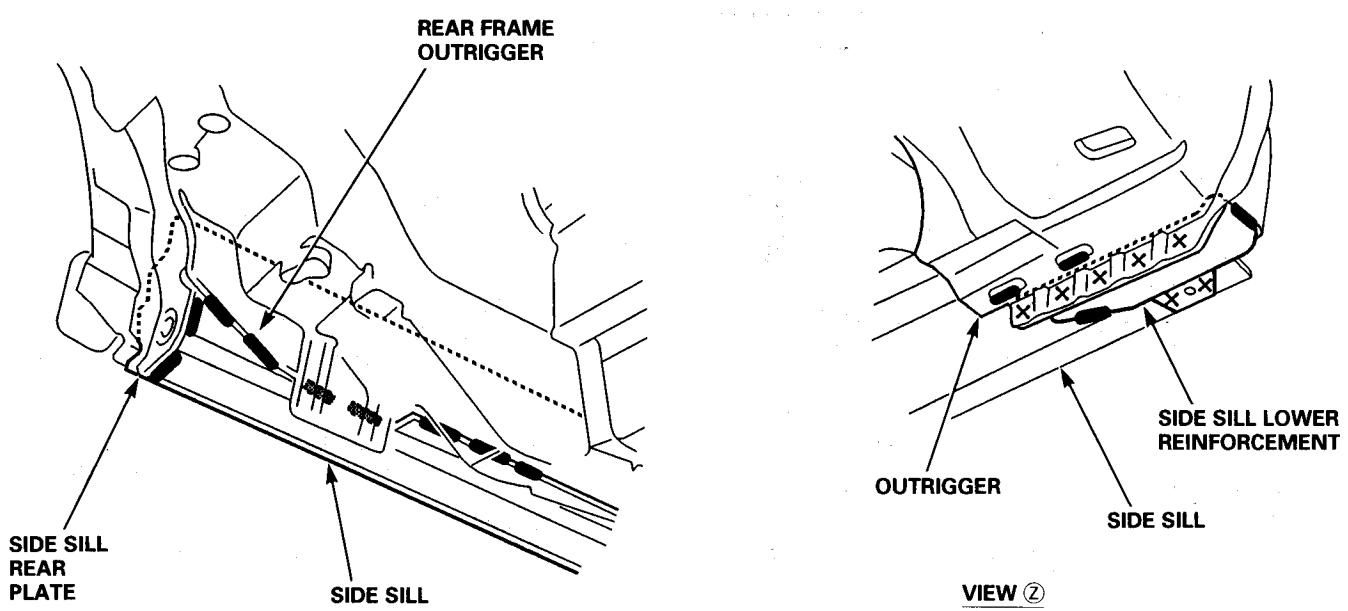
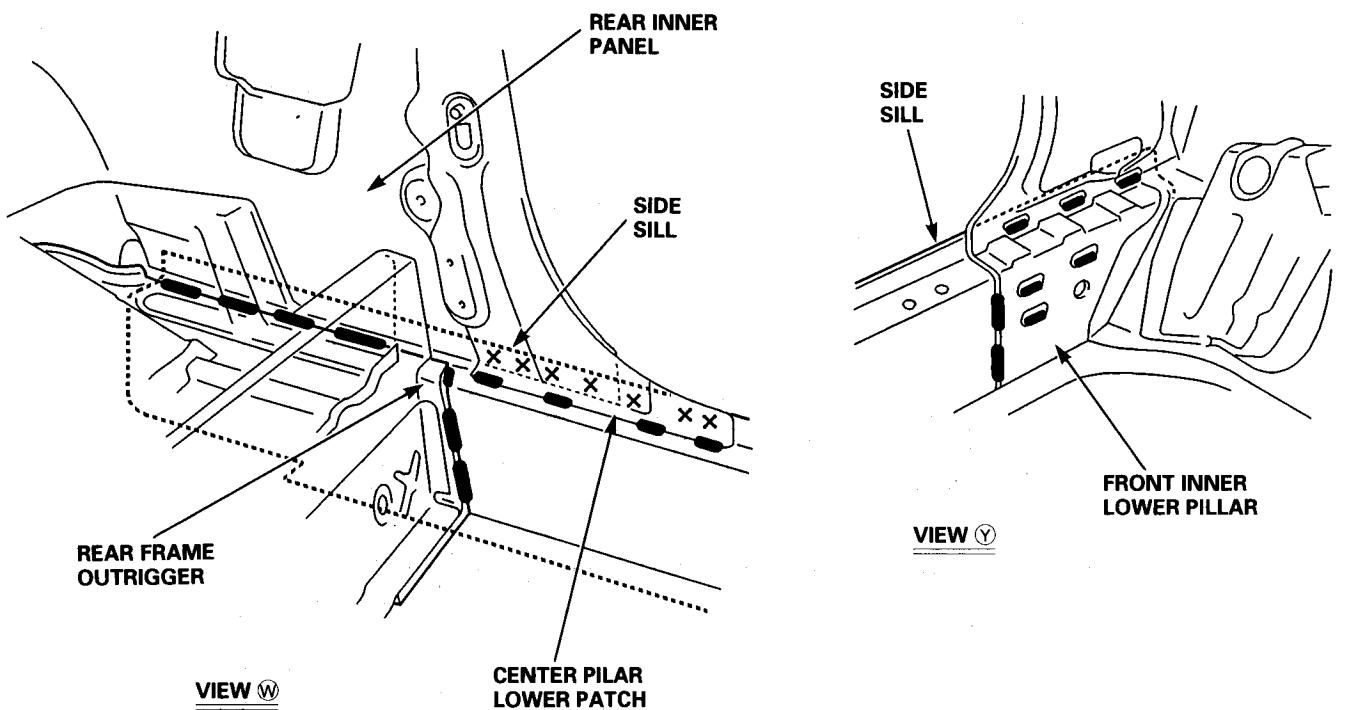


Side Sill / Front Floor

Removal

- The wheelhouse upper member, rear fender panel and center pillar stiffener must be removed before the side sill.





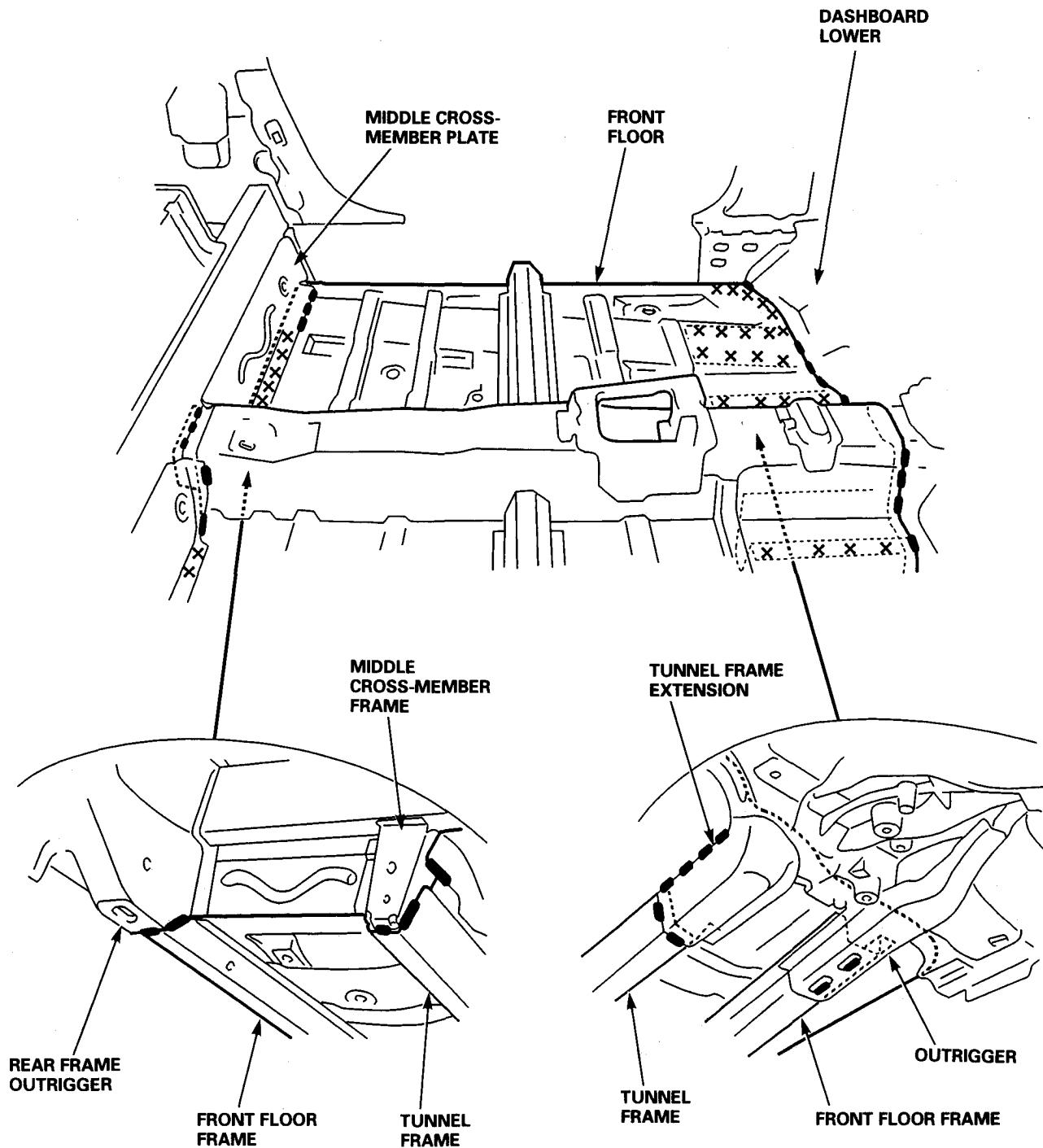
VIEW X

(cont'd)

Side Sill / Front Floor

Removal (cont'd)

- Check the front floor for damage.
If necessary, replace the front floor.



Installation

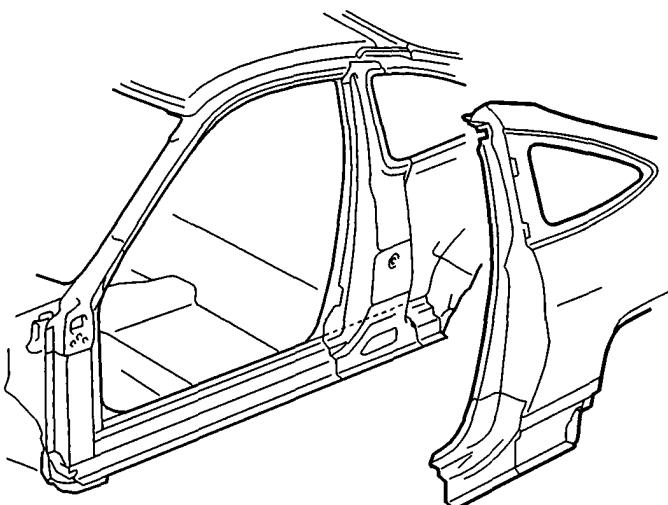
- Set the front floor, side sill, front lower pillar, front pillar lower stiffener, and center pillar stiffener.

Check the body dimensions (see [section 4](#)).

- Tack weld the clamped position

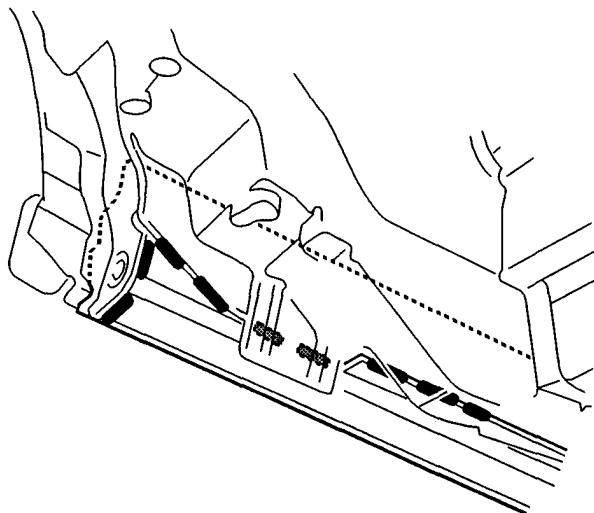
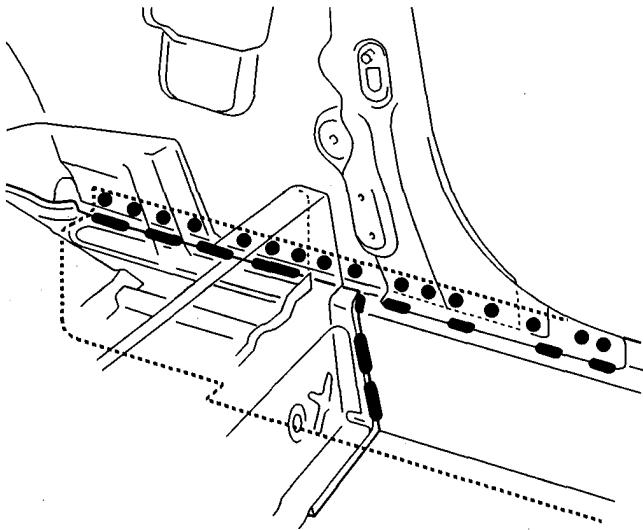
NOTE: Do not weld the center pillar stiffener.

- Clamp the rear fender panel, and temporarily install the door, front fender, side sill panel and rear fender skirt, and check for differences in level and clearance. Make sure the body lines flows smoothly.

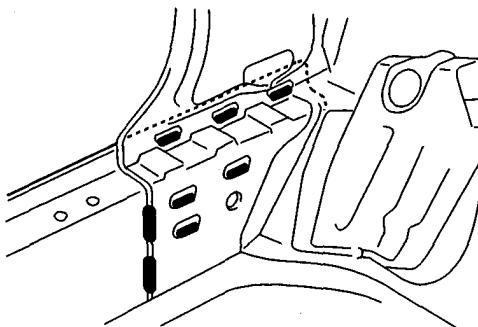


- Remove the rear fender panel and center pillar stiffener, and main weld the front floor, side sill, front lower pillar, and front pillar lower stiffener.

- Weld the side sill to the rear inner panel, rear frame outrigger, and center pillar lower patch.



- Weld the side sill to the front inner lower pillar.

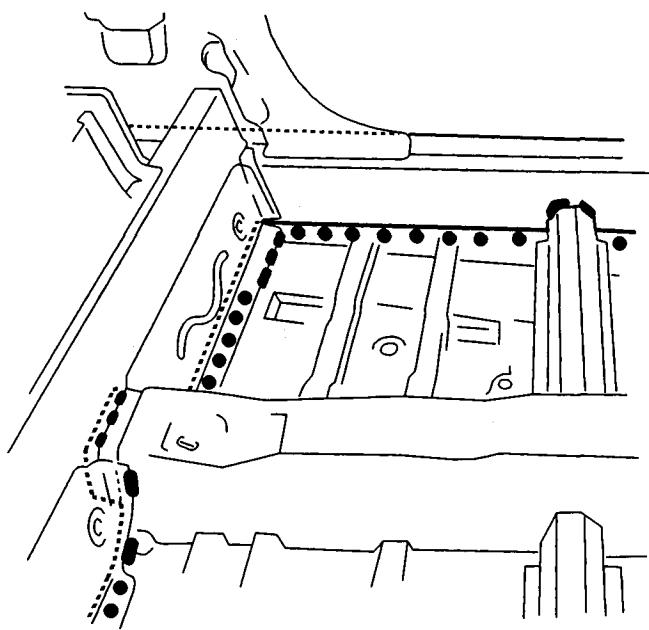


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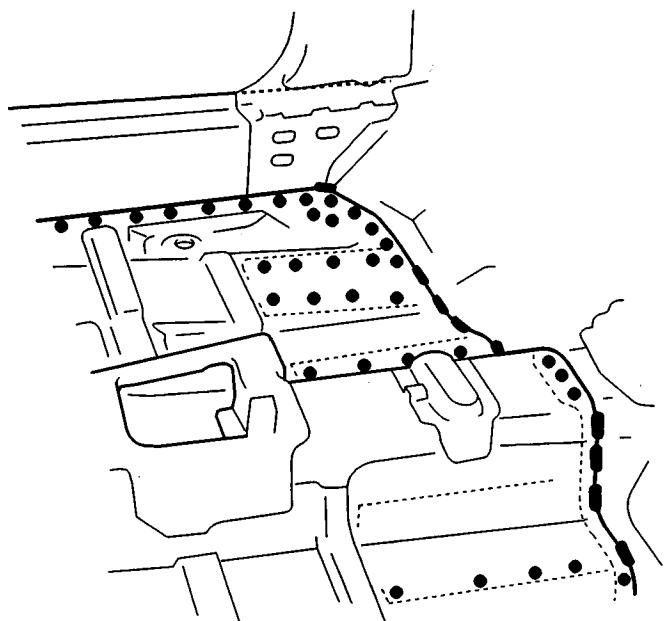
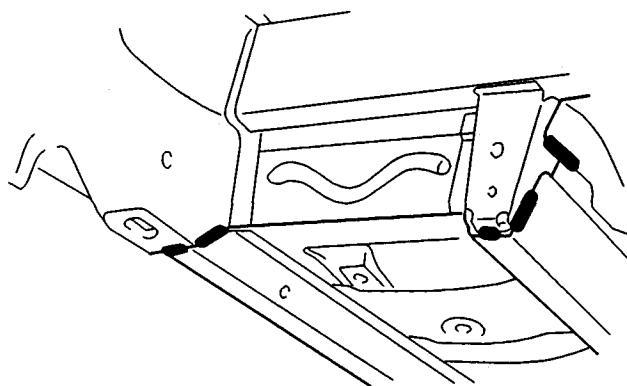
Side Sill / Front Floor

Installation (cont'd)

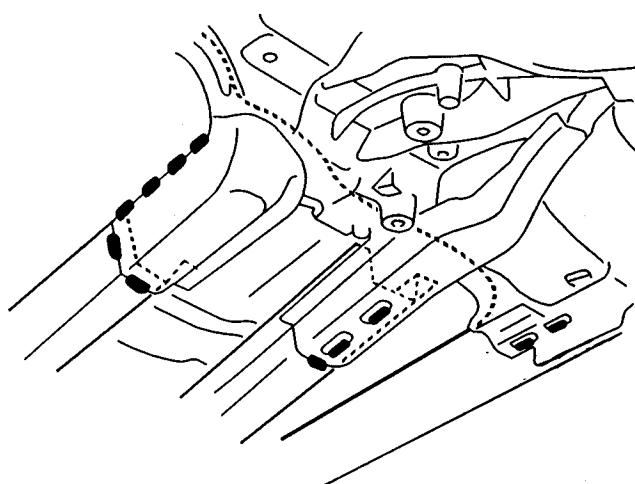
- Weld the front floor to the side sill, middle cross-member plate, and dashboard lower



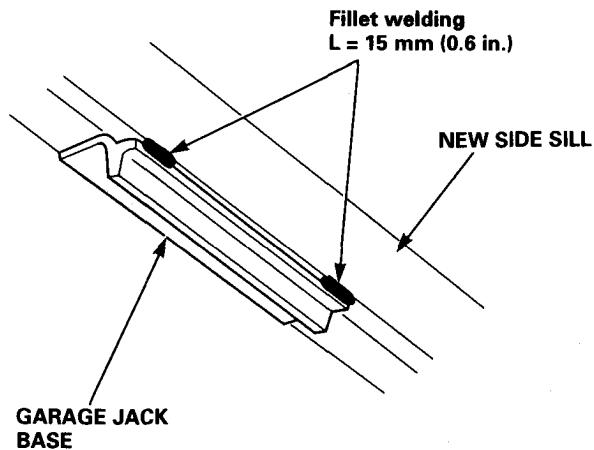
- Weld the front floor frame and tunnel frame of the front floor to the rear frame outrigger and middle cross-member frame.



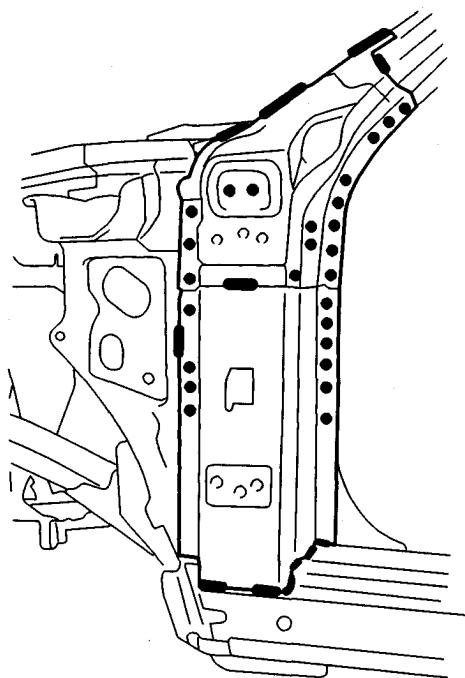
- Weld the tunnel frame extension, front side outrigger, and side sill.



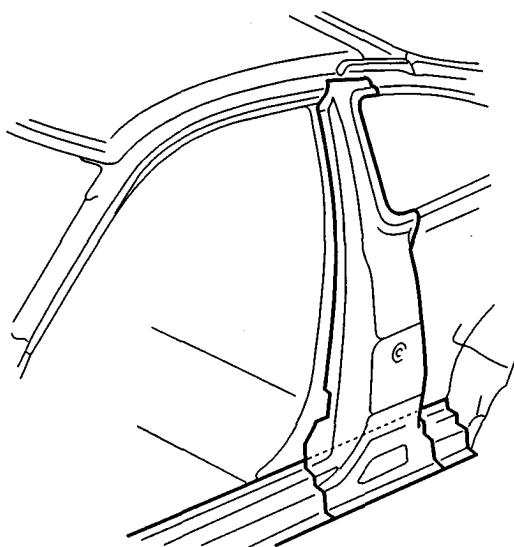
NOTE: When replacing the side sill, weld the garage jack base and side sill of the new part.



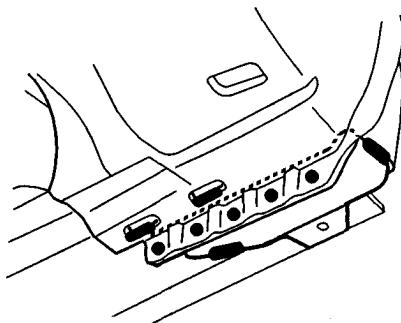
- Weld the front floor lower pillar and front pillar lower stiffener.



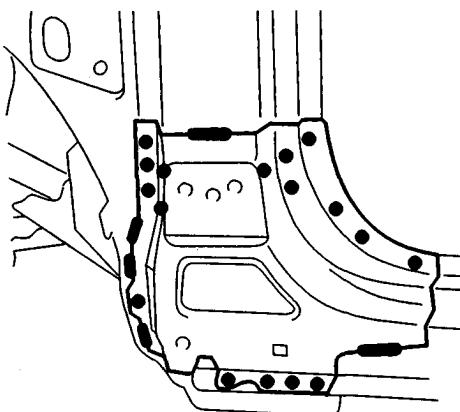
5. Tack weld the center pillar stiffener, and set the rear fender panel.



6. Check the operation of the door.
7. Remove the rear fender panel, and main weld the center pillar stiffener (see page 3-44).
8. Weld the side sill lower reinforcement.



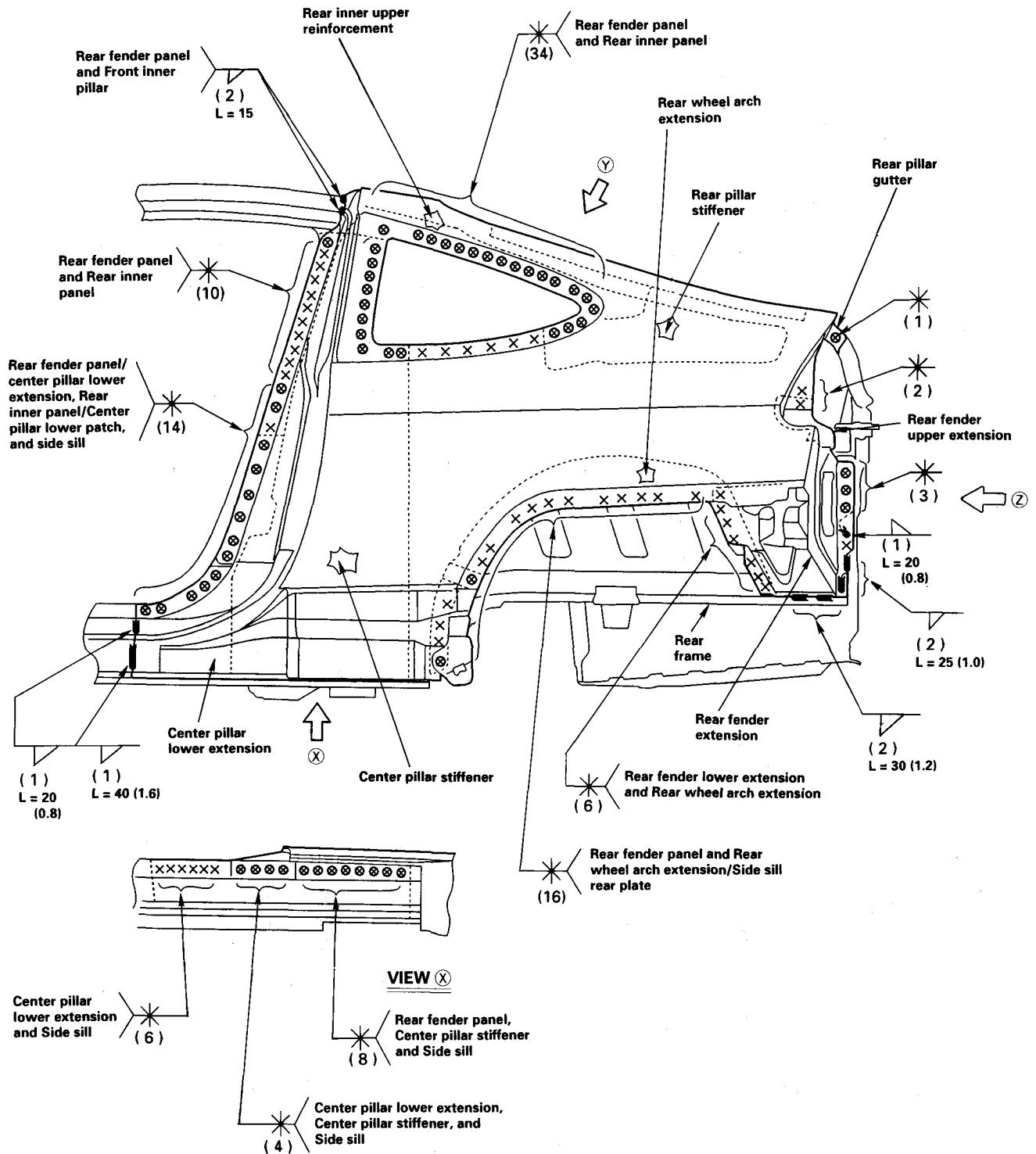
9. Weld the front side sill reinforcement.

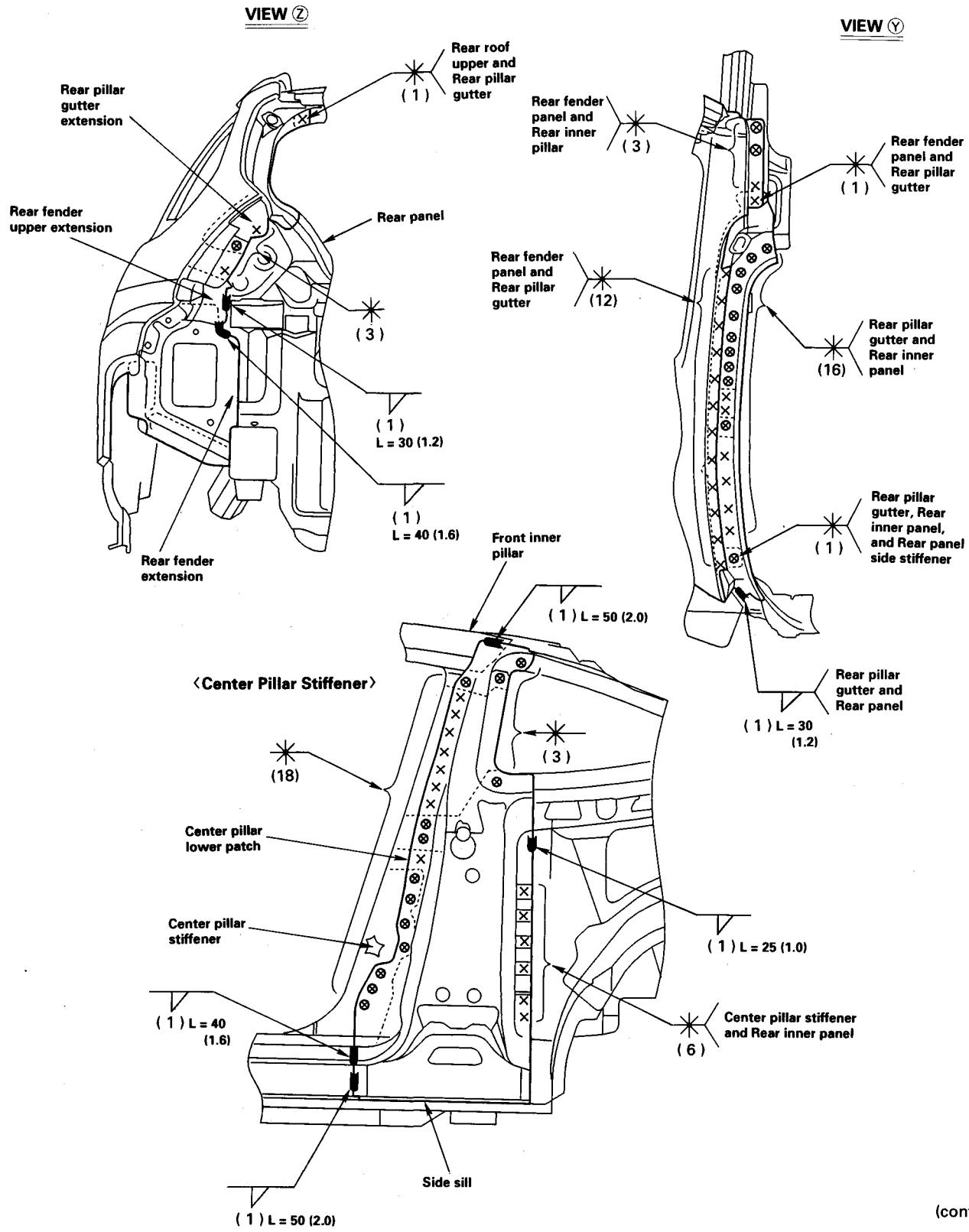


10. Weld the wheelhouse upper member (see page 3-11).
11. Weld the rear fender panel (see pages 3-44, 3-45).

Rear Fender Panel / Rear Inner Panel

Mass Production Body Welding Diagram

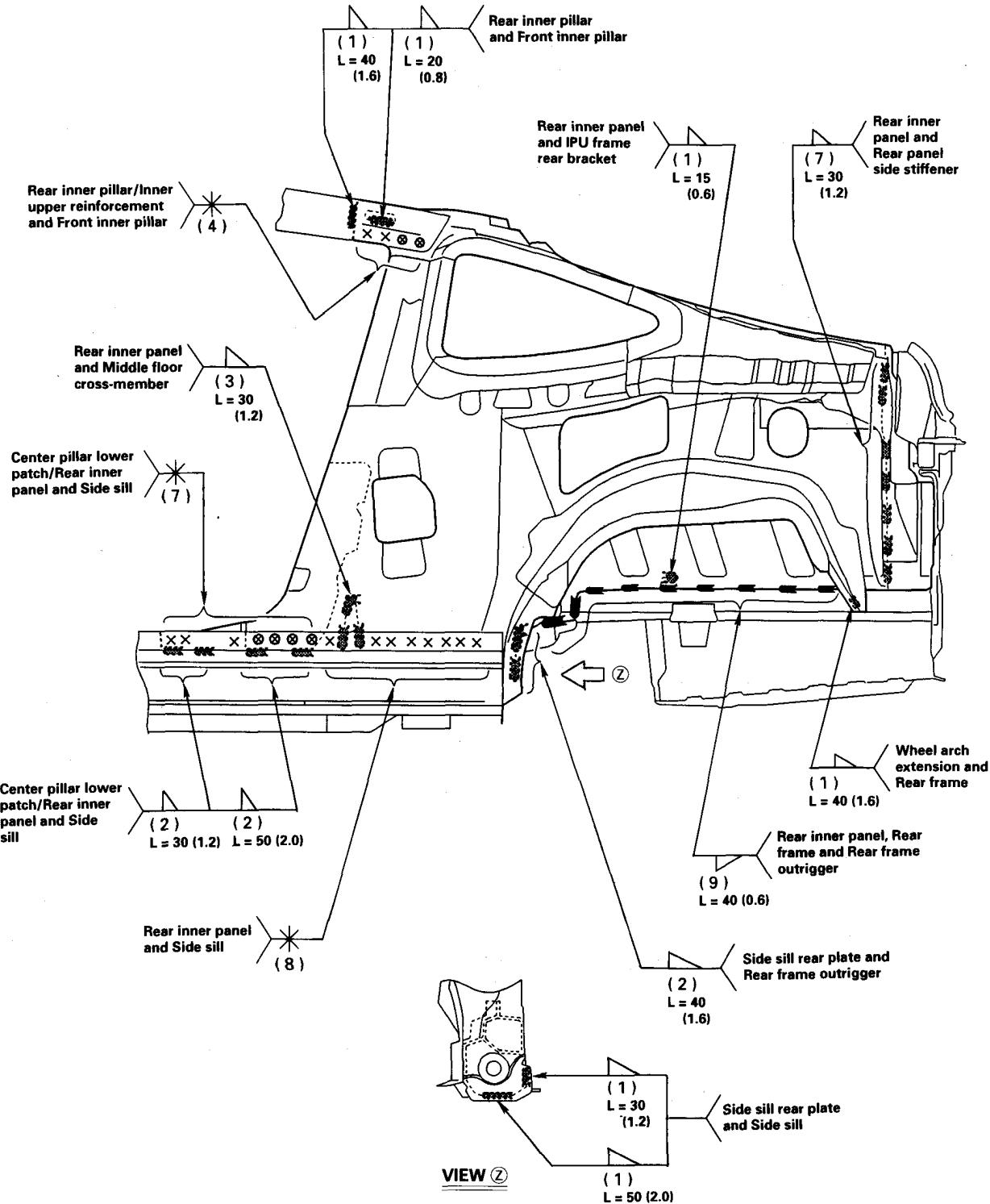




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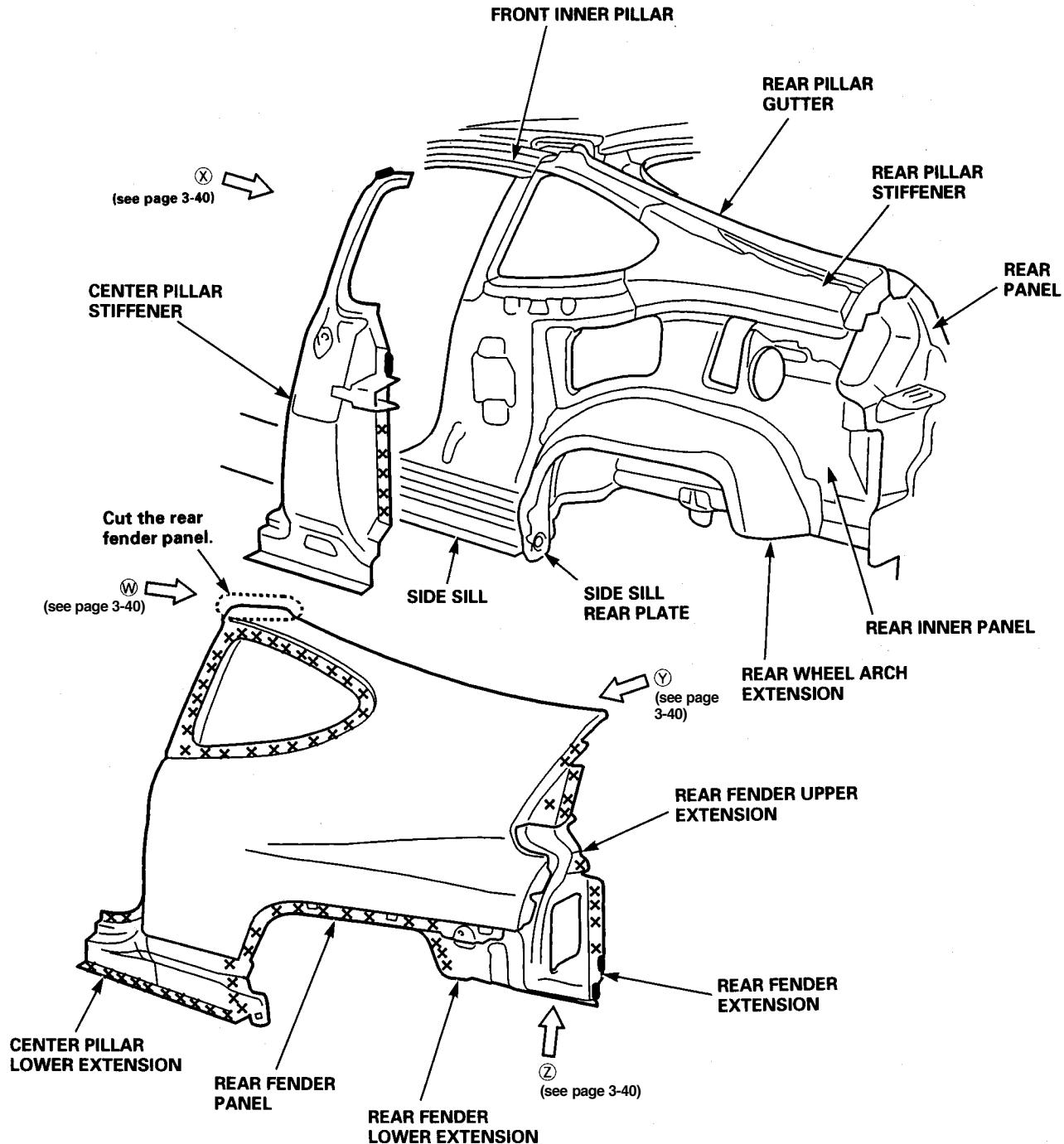
Rear Fender Panel / Rear Inner Panel

Mass Production Body Welding Diagram (cont'd)



Removal

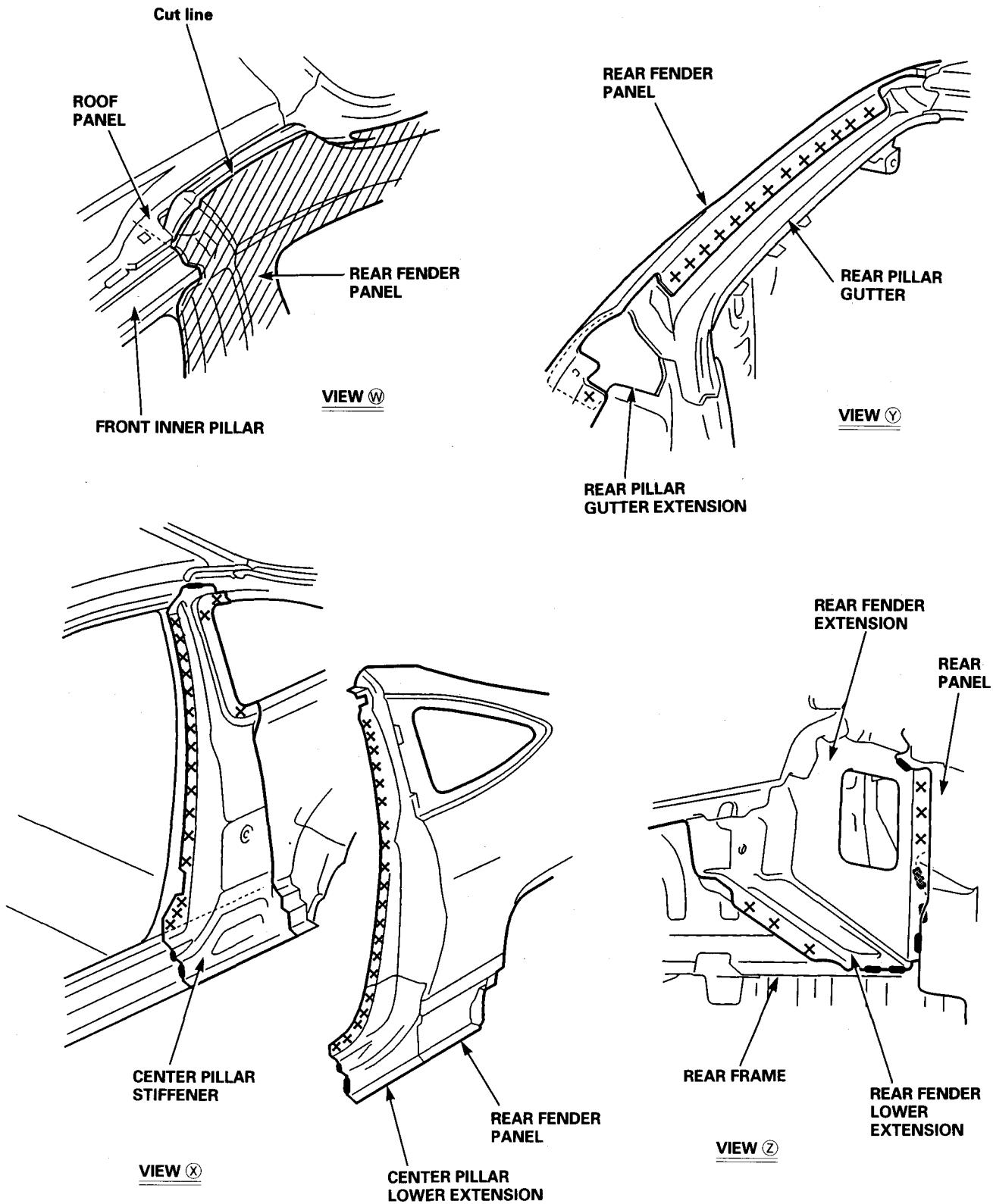
- Cut and remove the rear fender panel, and check the center pillar stiffener for damage.
- If necessary, replace the center pillar stiffener.
- Do not section the center pillar stiffener; repairs must be made at the factory seams.



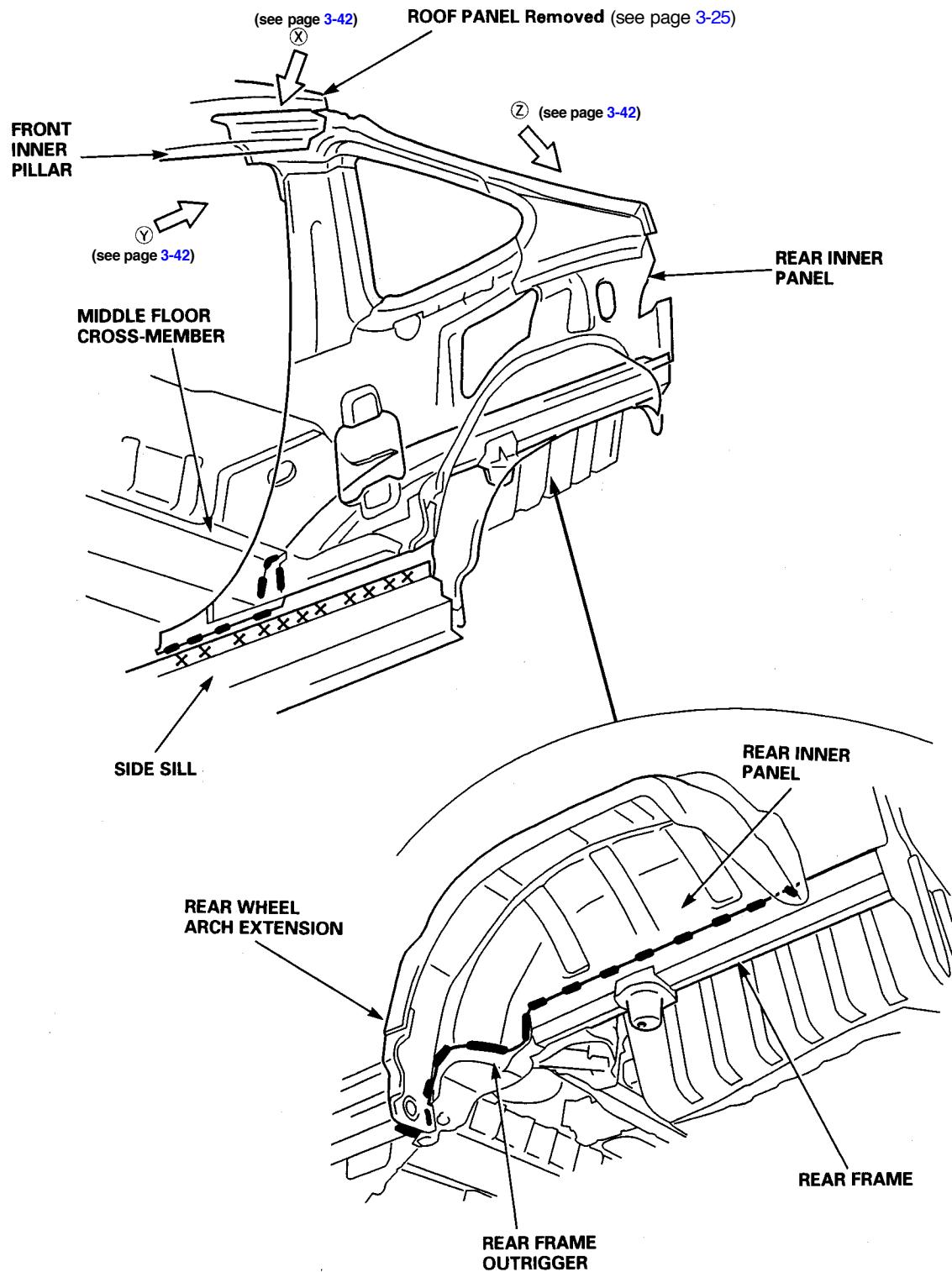
(cont'd)

Rear Fender Panel / Rear Inner Panel

Removal (cont'd)



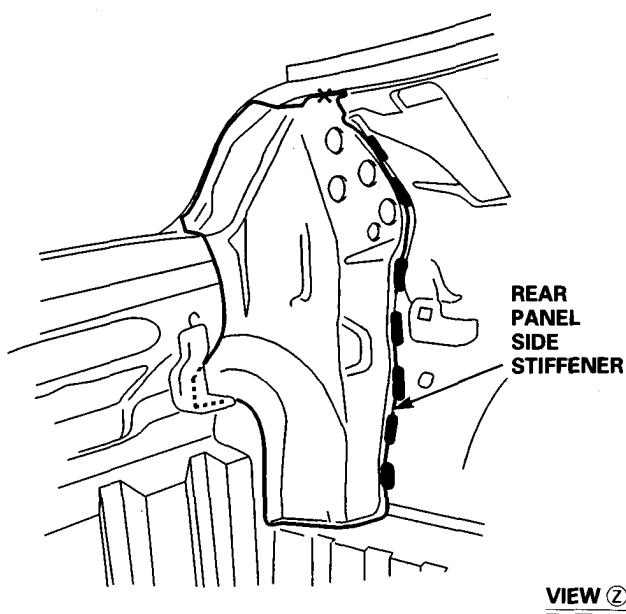
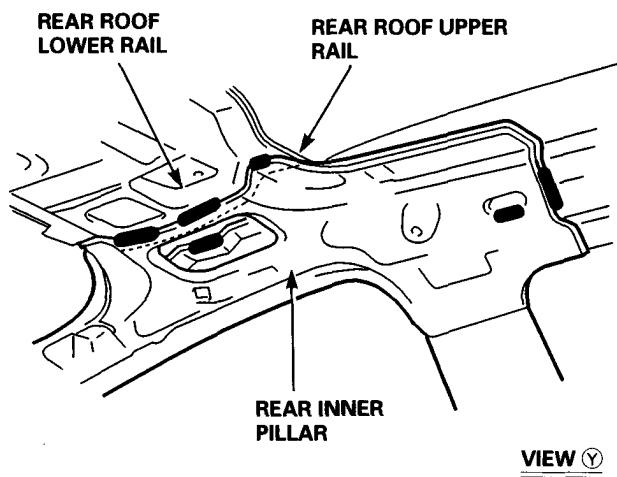
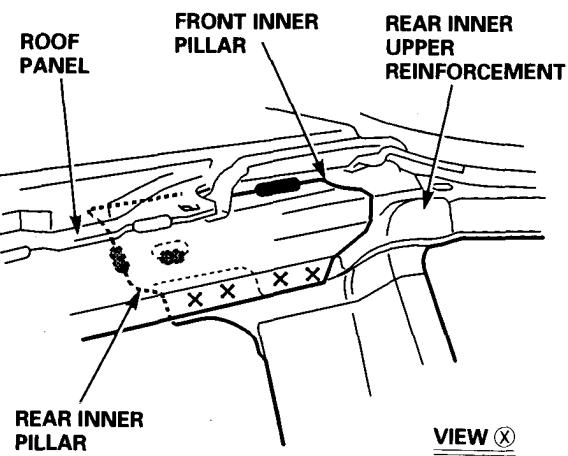
- Check the rear inner panel for position and damage.
- If necessary, replace the rear inner panel.



(cont'd)

Rear Fender Panel / Rear Inner Panel

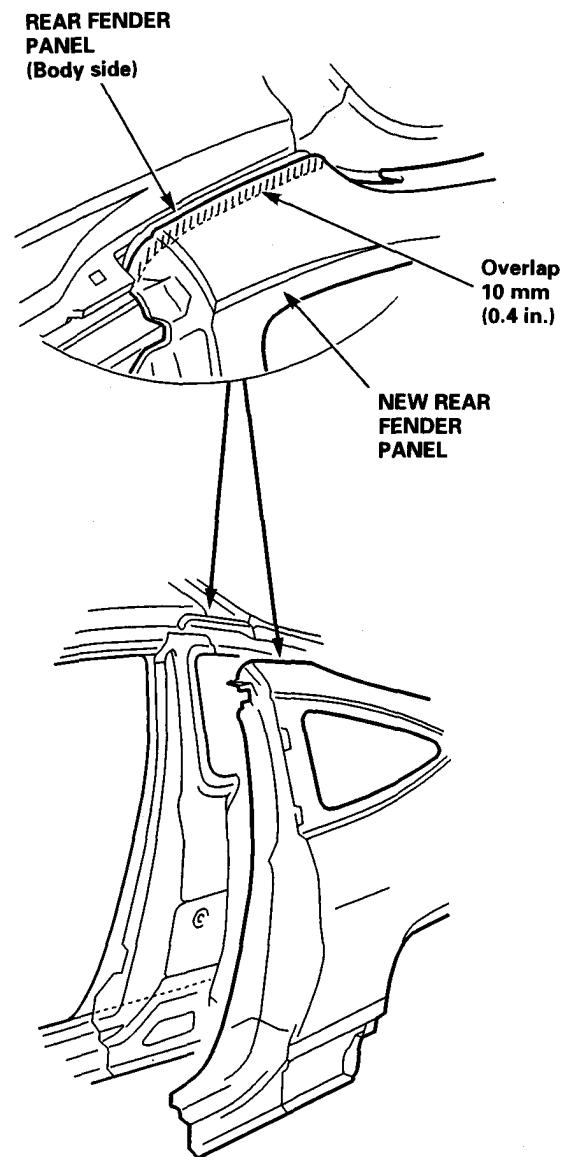
Removal (cont'd)



Rear Fender Panel / Rear Inner Panel

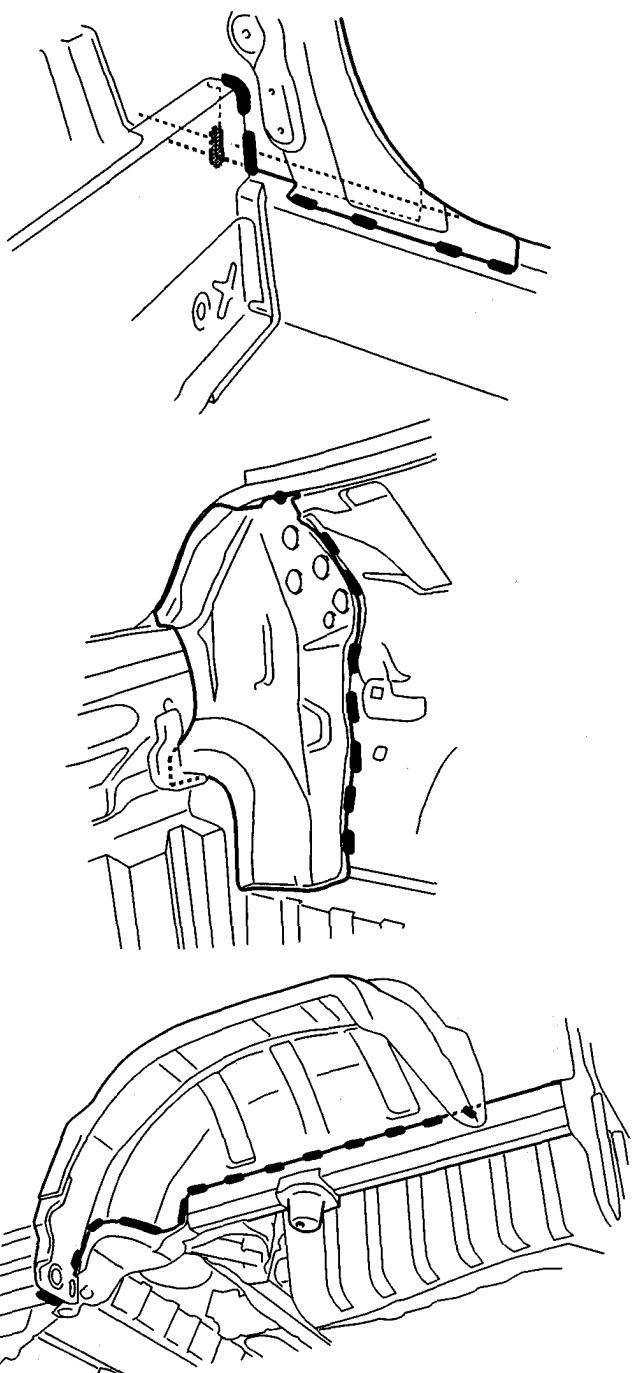
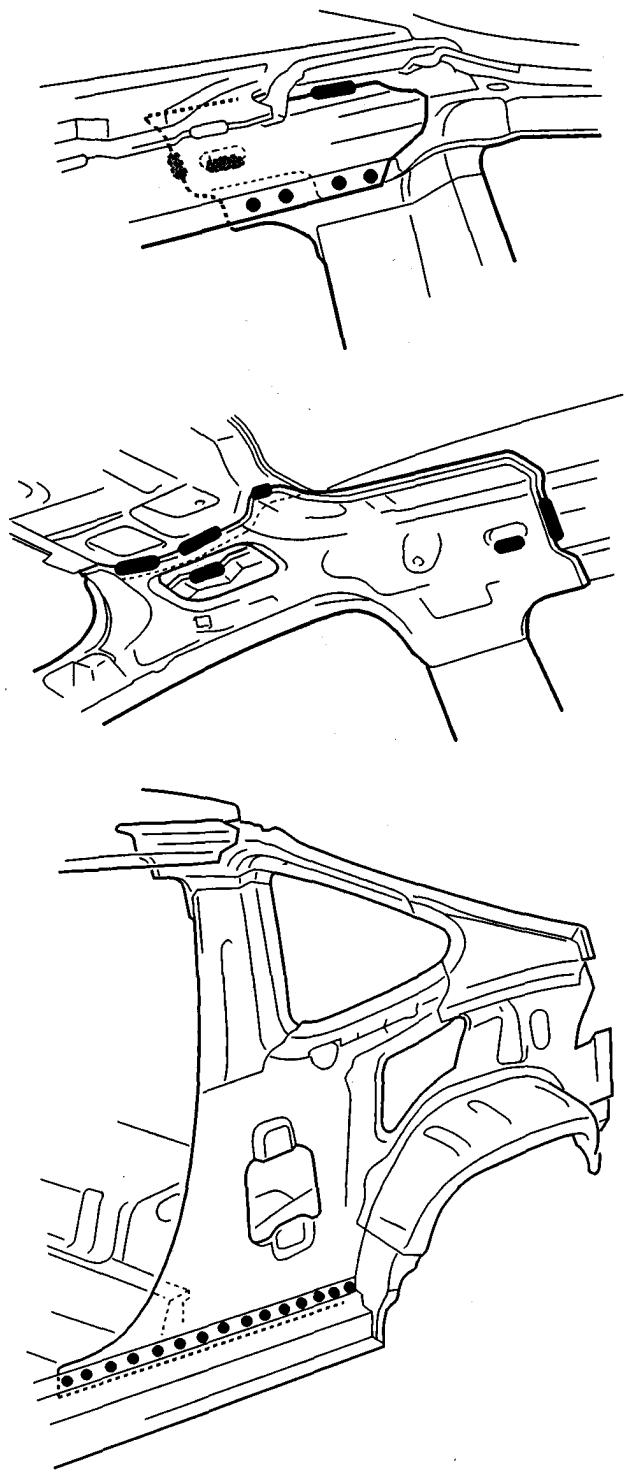
Installation

1. Set the new rear inner panel and center pillar stiffener.
2. Set the new rear fender panel, and check the body dimensions (see [section 4](#)).
3. Tack weld the rear inner panel.
4. When replacing the rear fender panel and center pillar stiffener, cut the new rear fender panel so it overlaps the body side rear fender panel by approximately 10 mm (0.4 in.).



5. Temporarily install the hatch, and check the operation and rear panel position.

6. Weld the rear inner panel.



7. Tack weld the center pillar stiffener, and set the new rear fender panel.

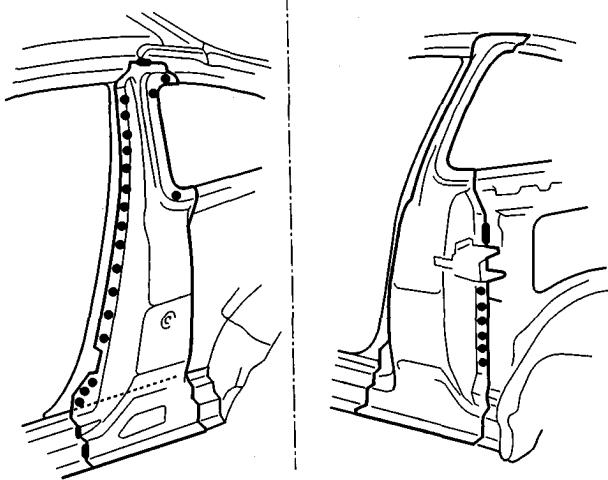
Temporarily install the door, side sill panel, rear fender skirt and rear bumper, and check for differences in level and clearance. Make sure the body lines flow smoothly.

(cont'd)

Rear Fender Panel / Rear Inner Panel

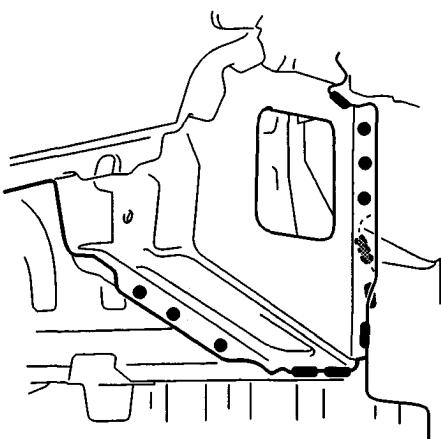
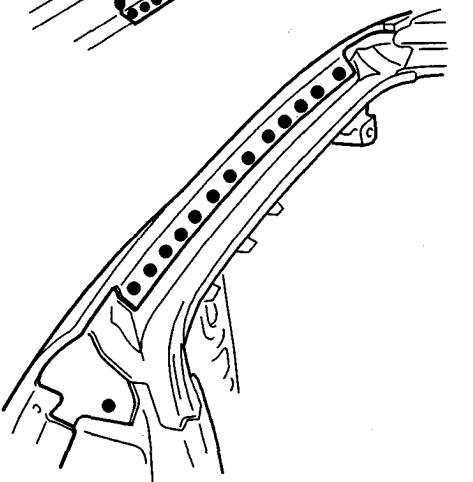
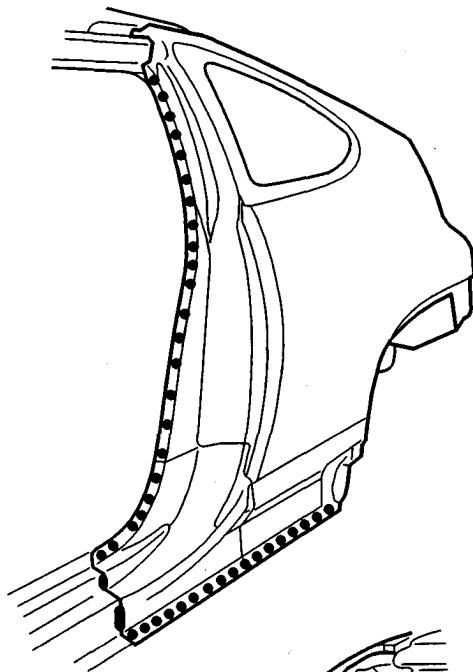
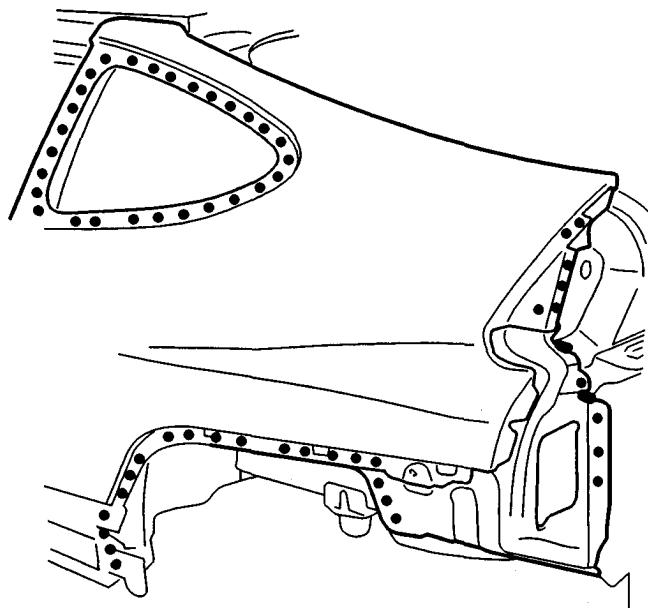
Installation (cont'd)

8. Main weld the center pillar stiffener.



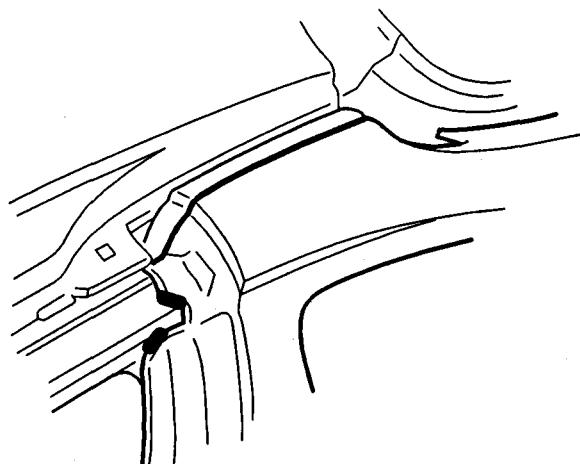
9. Tack weld the new rear fender panel, and recheck the alignment of the door and front fender.

10. Perform the main welding.



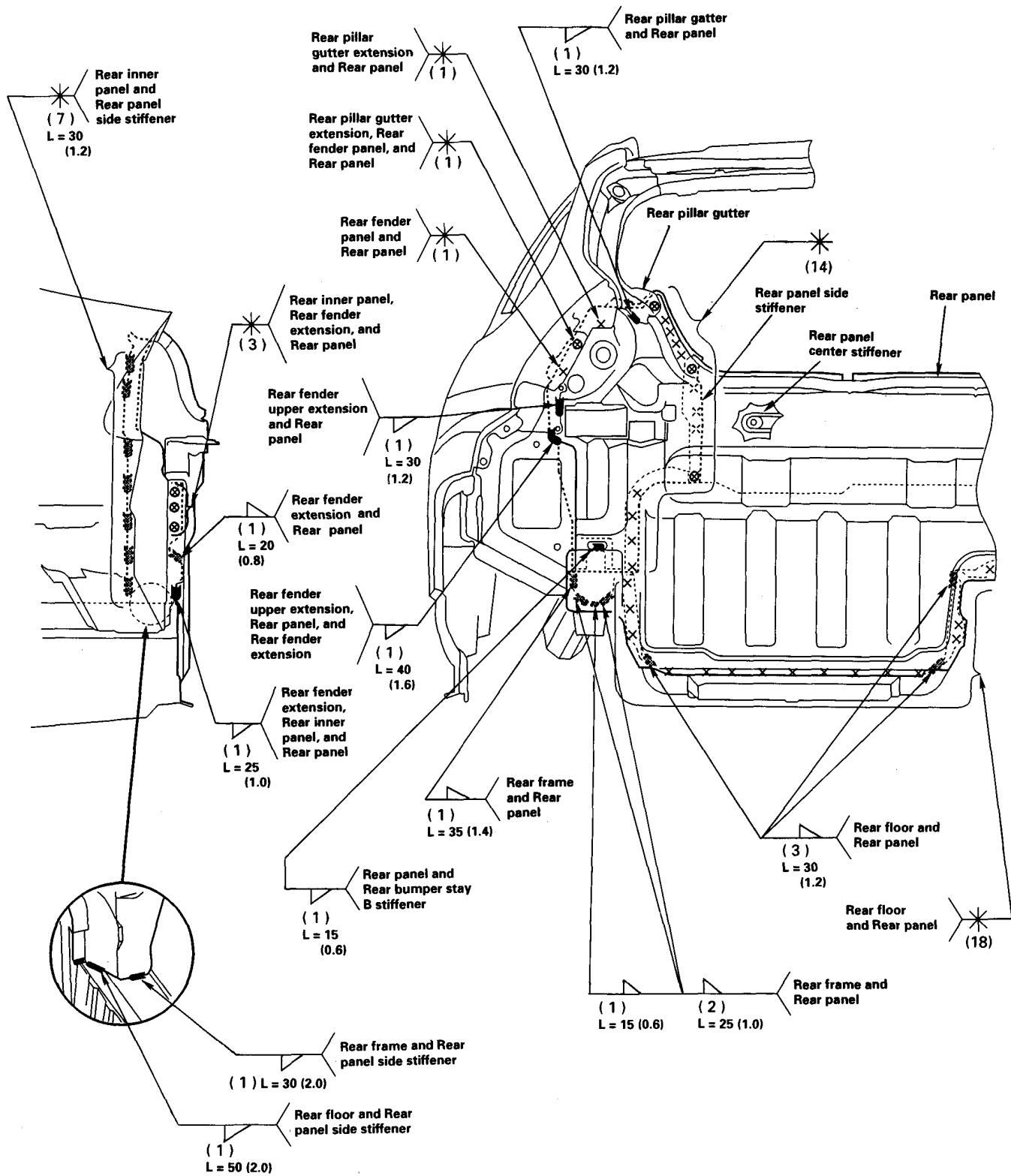
-
- Finish the joint of the rear fender panel with fillet weld, and grind the finishing allowance with a disc sander until it is smooth.

NOTE: Take care not to grind excessively.



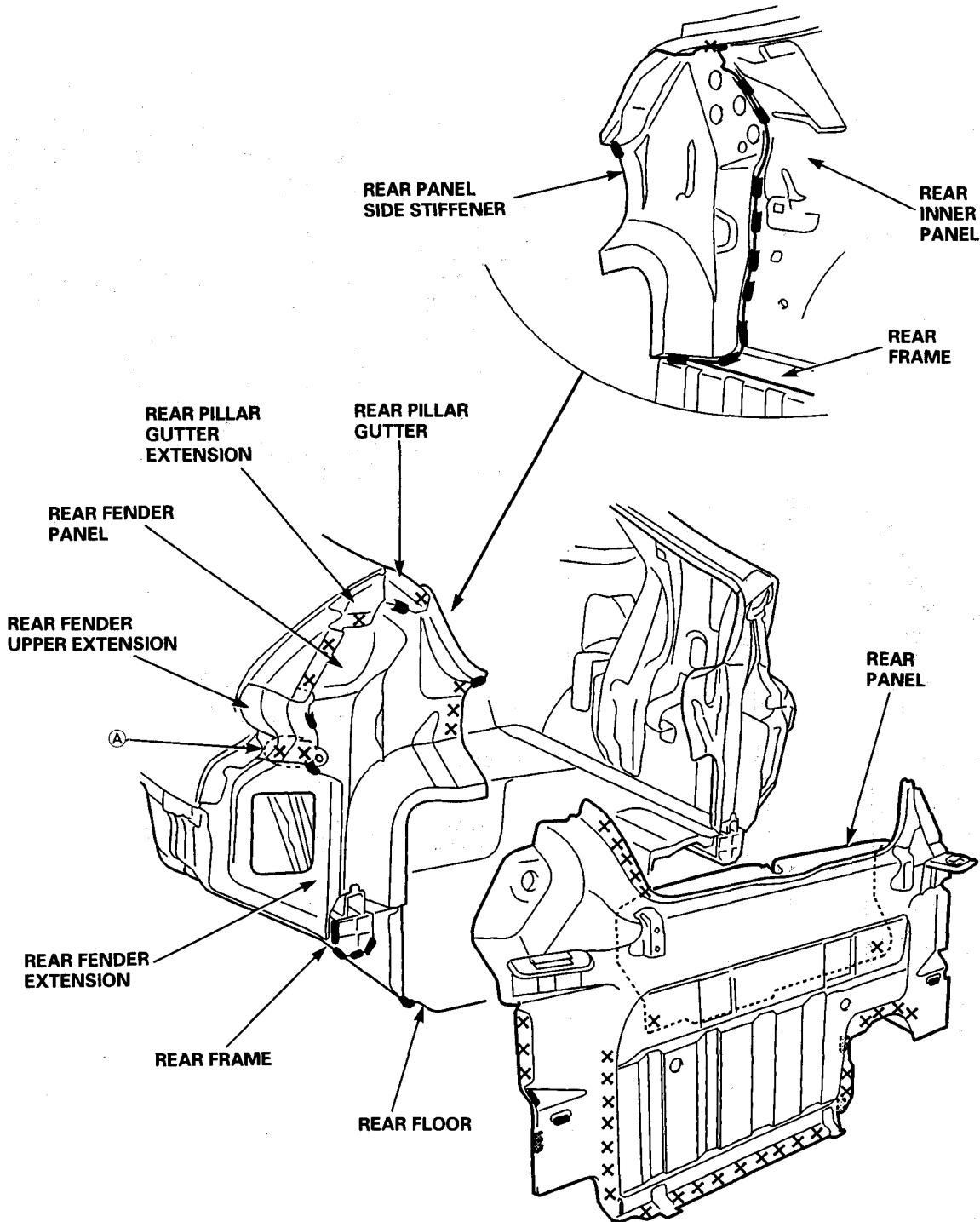
Rear Panel

Mass Production Body Welding Diagram



Removal

- Remove the rear panel, and check the rear panel side stiffener for damage.
If necessary, replace the rear panel side stiffener.
- Drill the spot welds (Ⓐ position) of the rear fender upper extension.

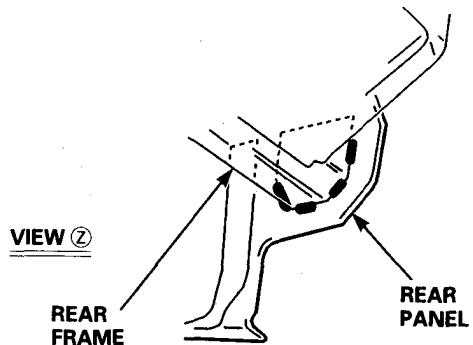
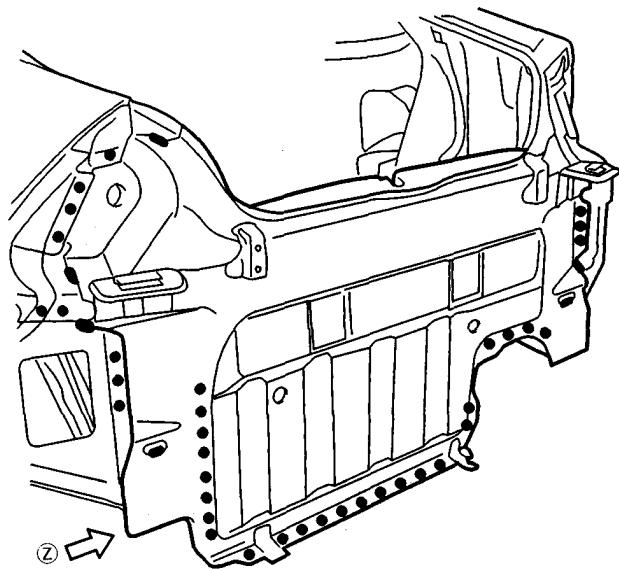
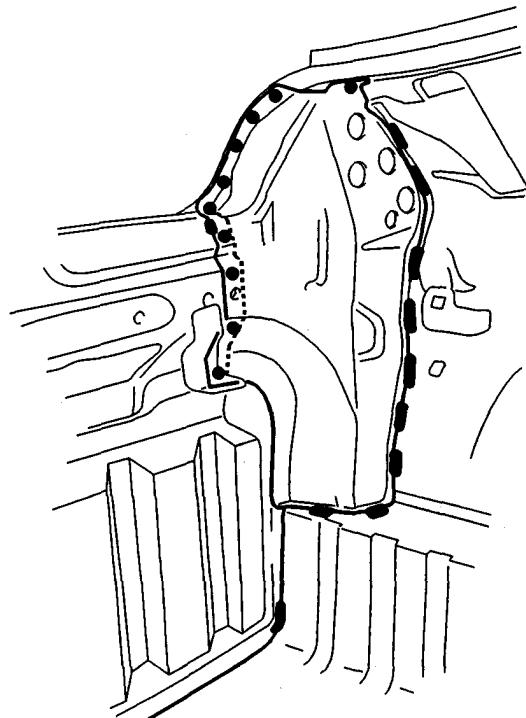


Rear Panel

Installation

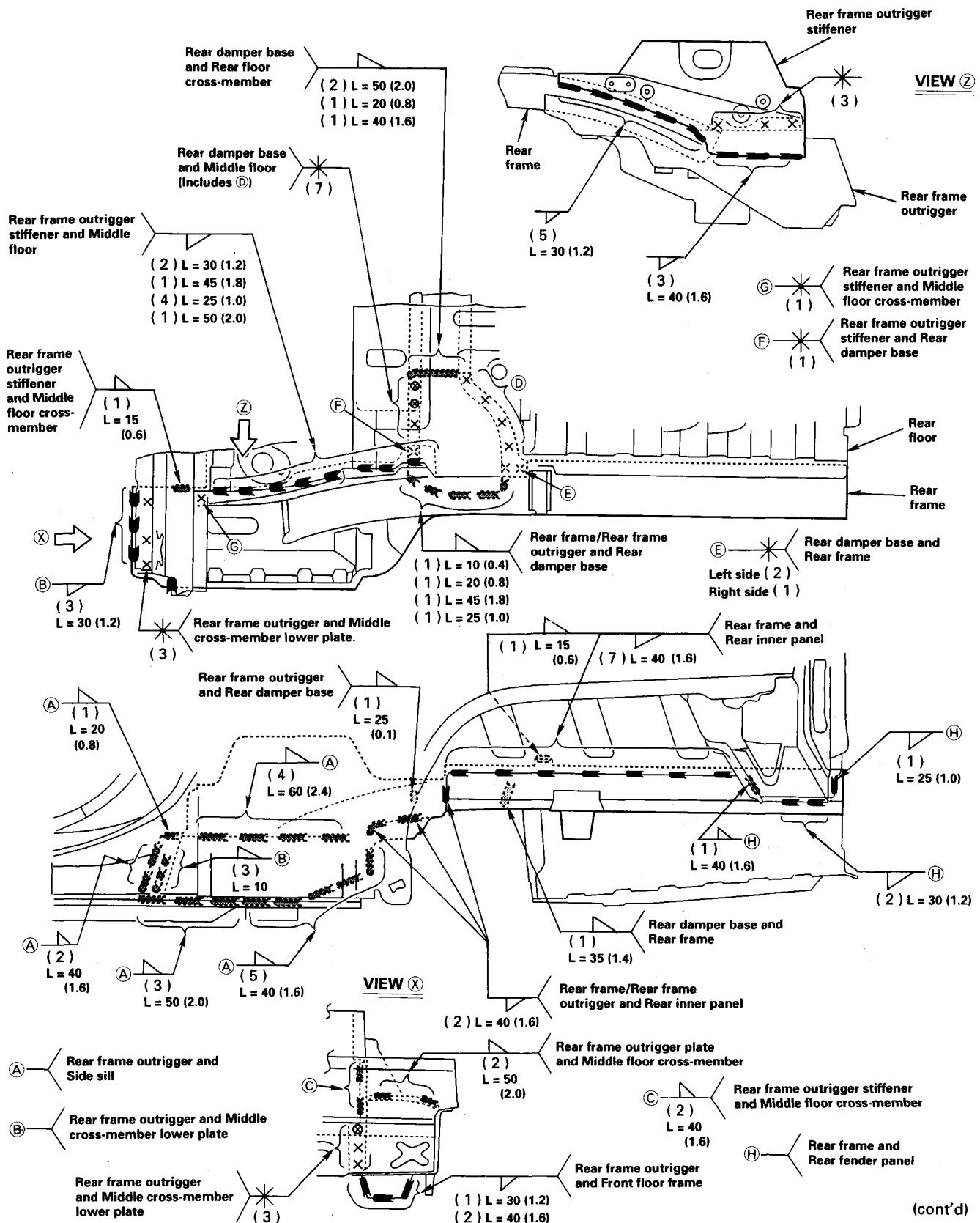
1. Set the new rear panel side stiffener and rear panel, and check the body dimensions (see [section 4](#)).
2. Tack weld the clamped position.
3. Temporarily install the hatch, taillight, and rear bumper, and check for differences in level and clearance.
4. Check for operation of the hatch.
5. Perform the main welding.
 - Weld the rear panel side stiffener.
 - Weld the rear panel.

- Weld the rear panel.



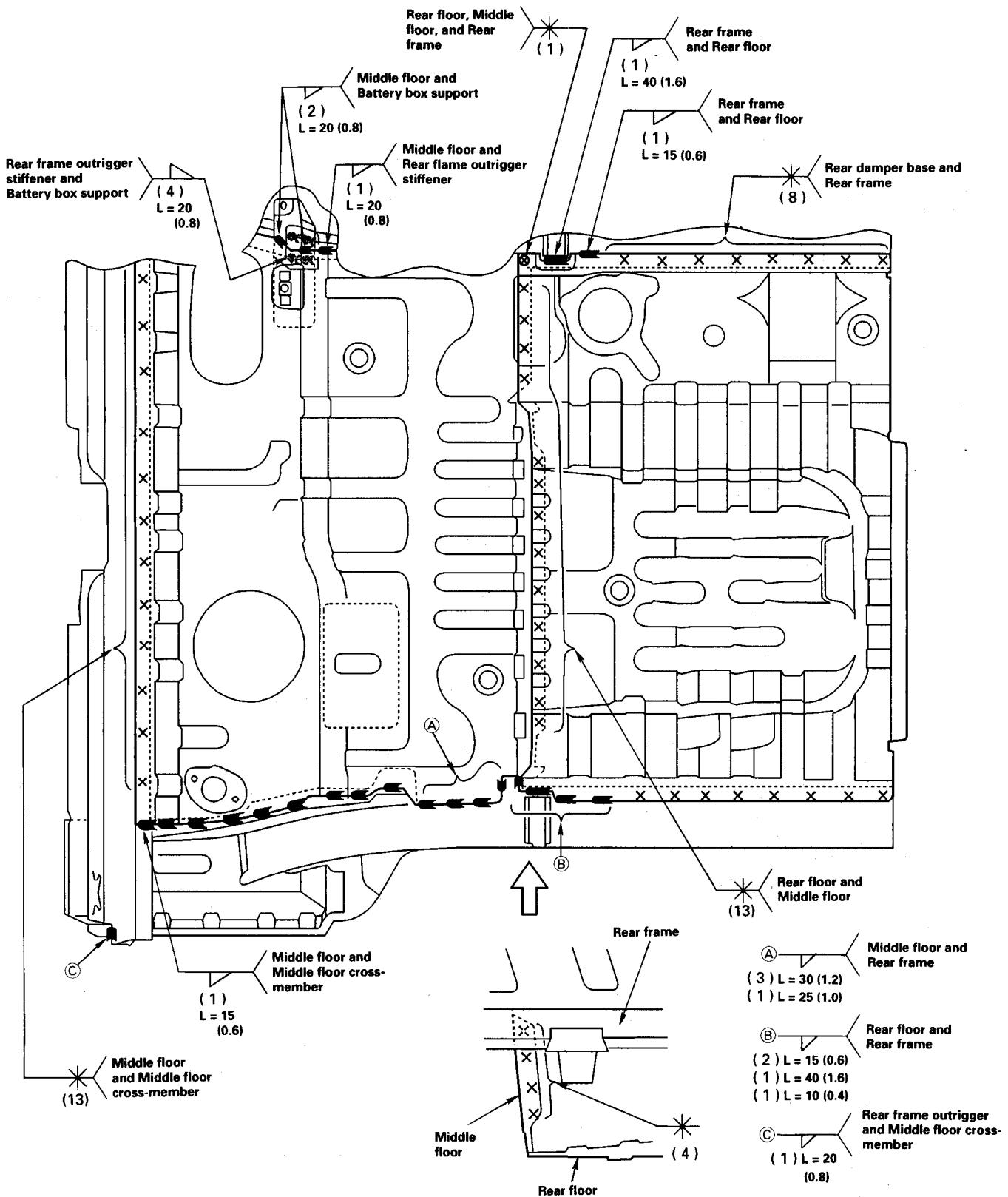
Rear Floor, Rear Frame / Middle Floor

Mass Production Body Welding Diagram



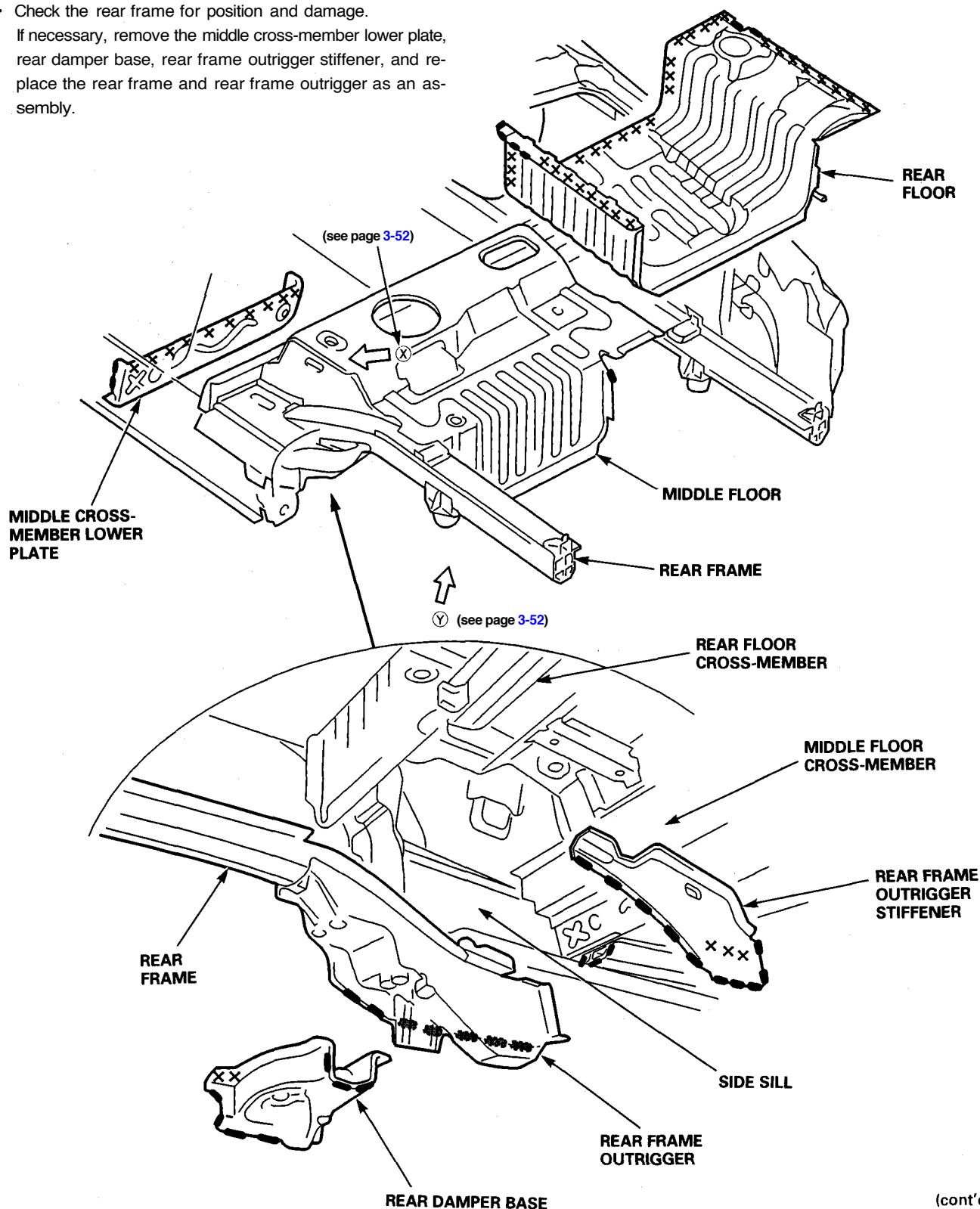
Rear Floor, Rear Frame / Middle Floor

Mass Production Body Welding Diagram (cont'd)



Removal

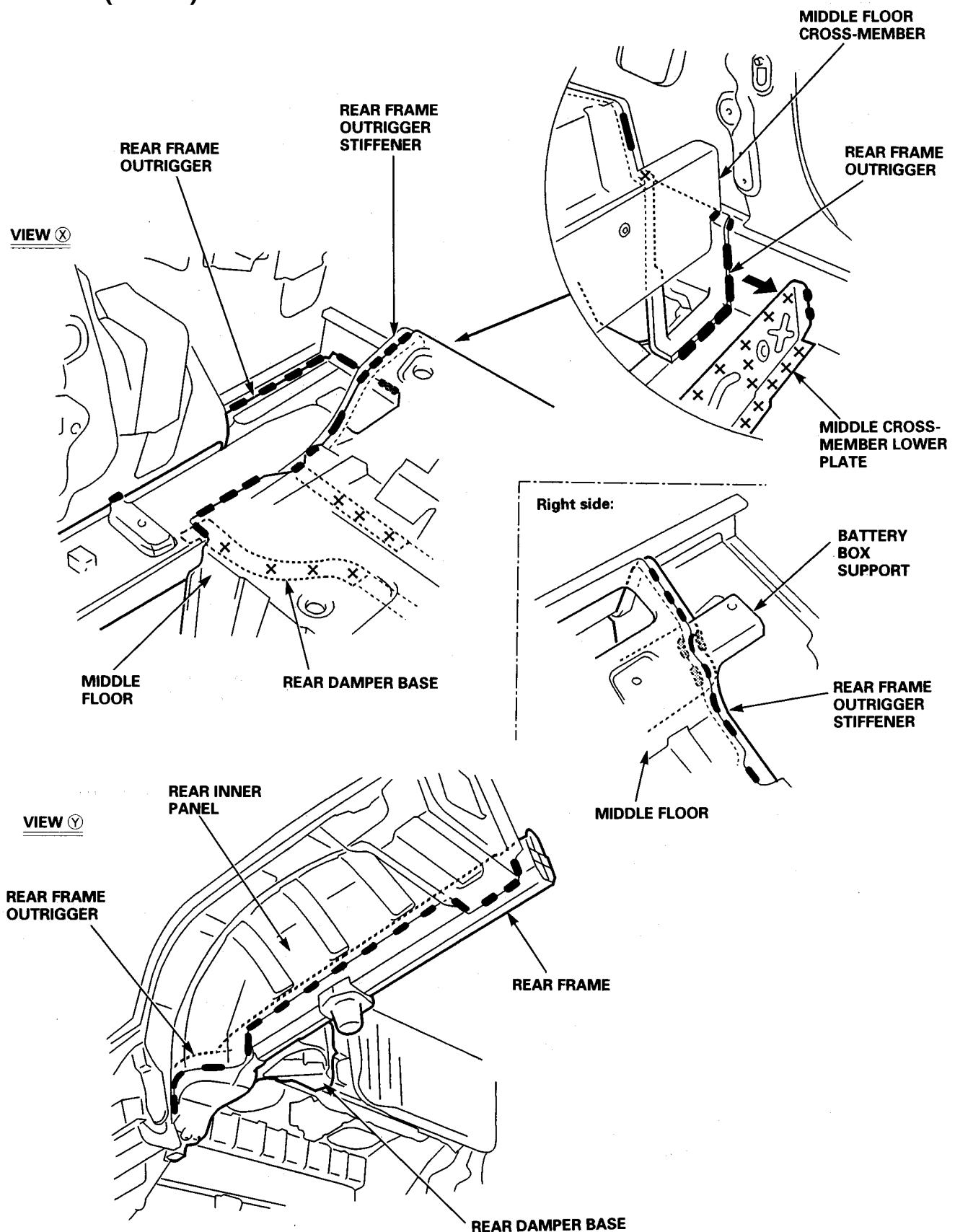
- Remove the rear floor.
- Check the rear frame for position and damage.
If necessary, remove the middle cross-member lower plate, rear damper base, rear frame outrigger stiffener, and replace the rear frame and rear frame outrigger as an assembly.



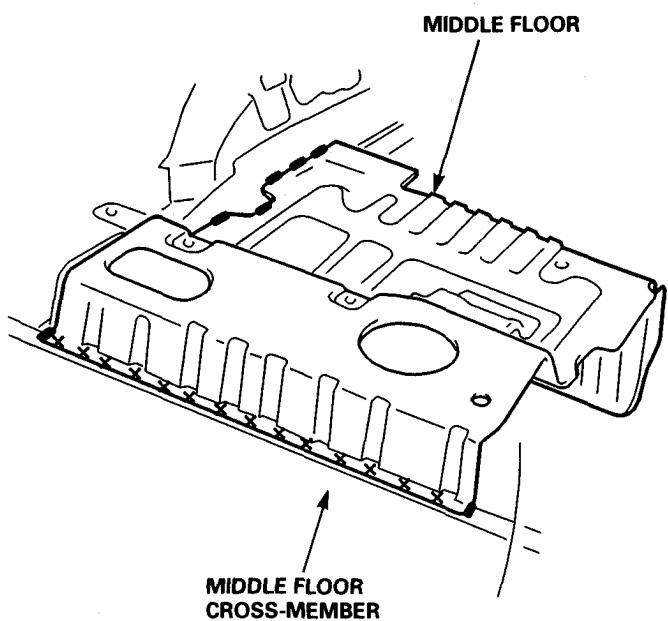
(cont'd)

Rear Floor, Rear Frame / Middle Floor

Removal (cont'd)

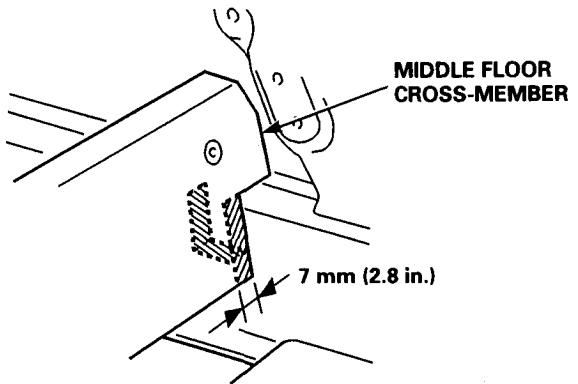


-
- Check the middle floor for damage.
If necessary, replace the middle floor.



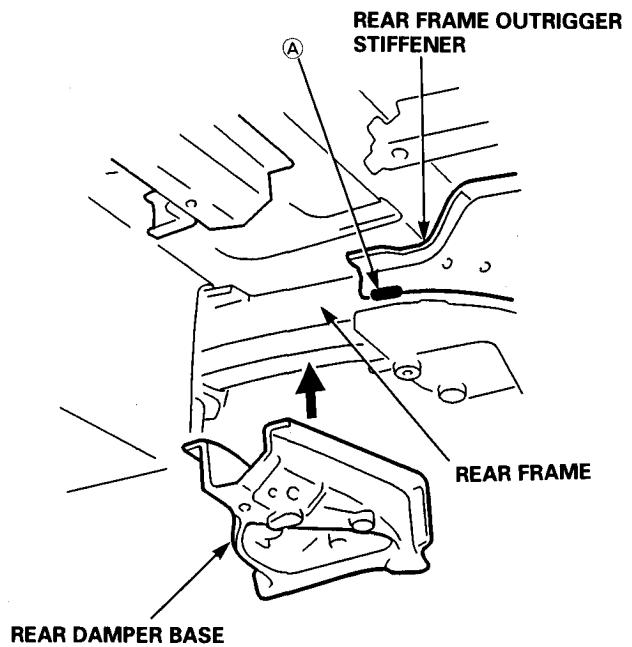
Installation

1. Before setting the rear frame, cut the middle floor cross-member as shown.



2. Set the new rear frame and rear frame outrigger stiffener.
3. Set the new middle floor and rear floor.
4. Set the new damper base.
5. Check the body dimensions (see [section 4](#)).
6. Tack weld the new parts.

NOTE: First weld position **(A)** of the rear frame outrigger stiffener, and weld the rear damper base.

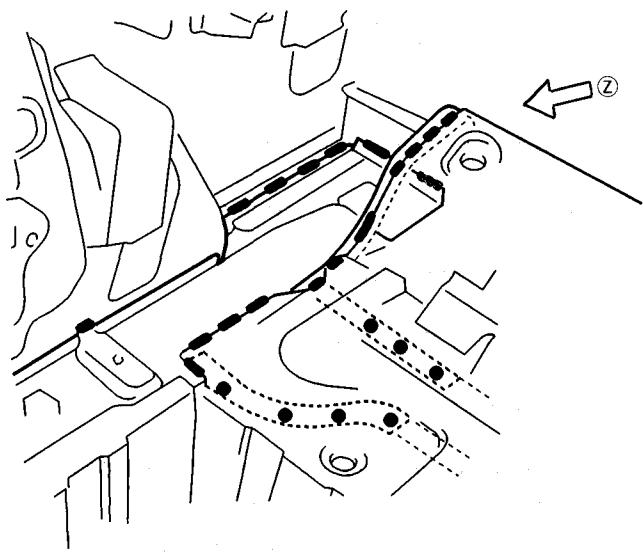


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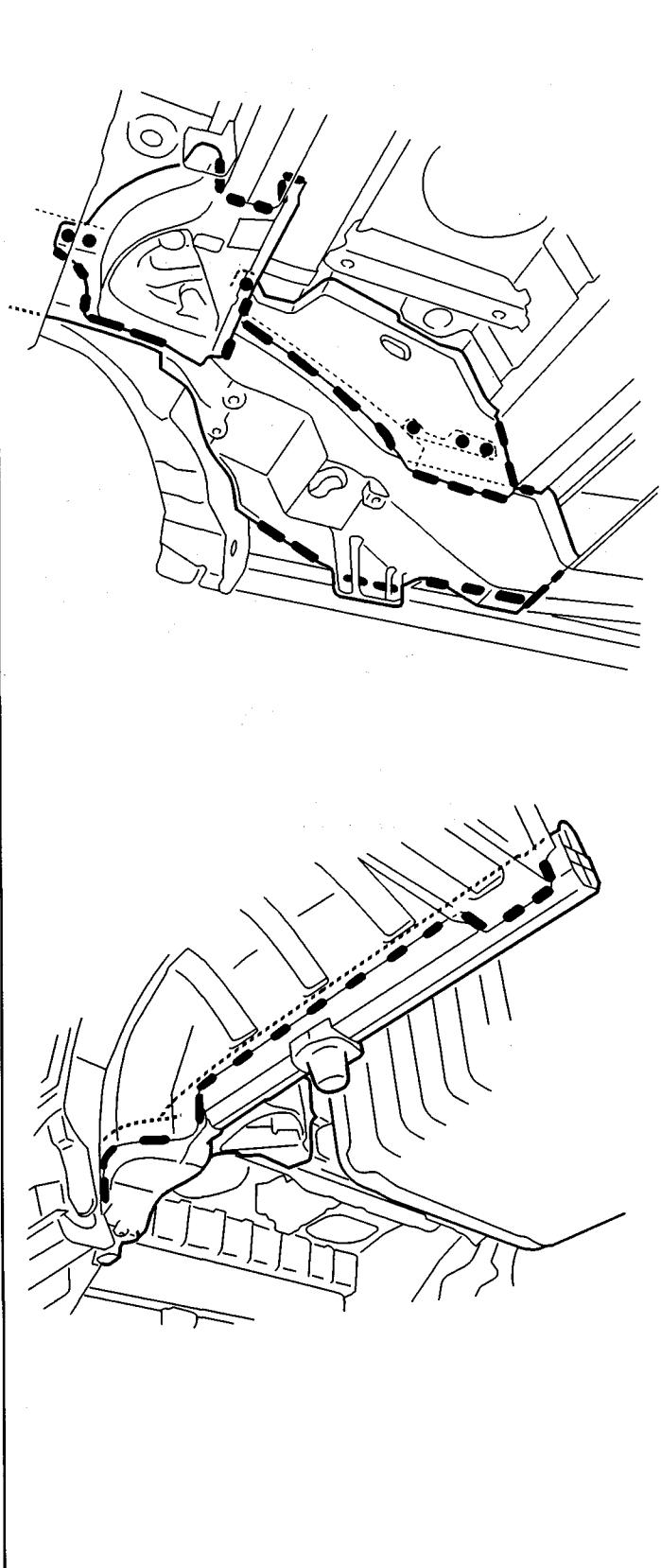
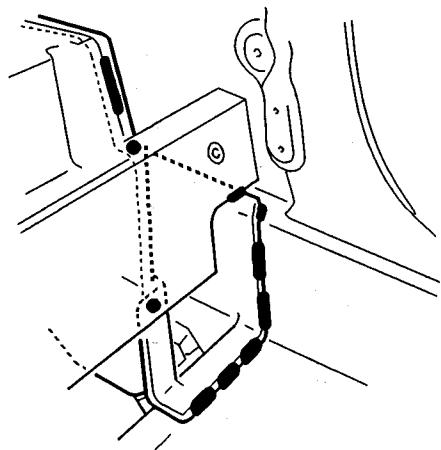
Rear Floor, Rear Frame / Middle Floor

Installation (cont'd)

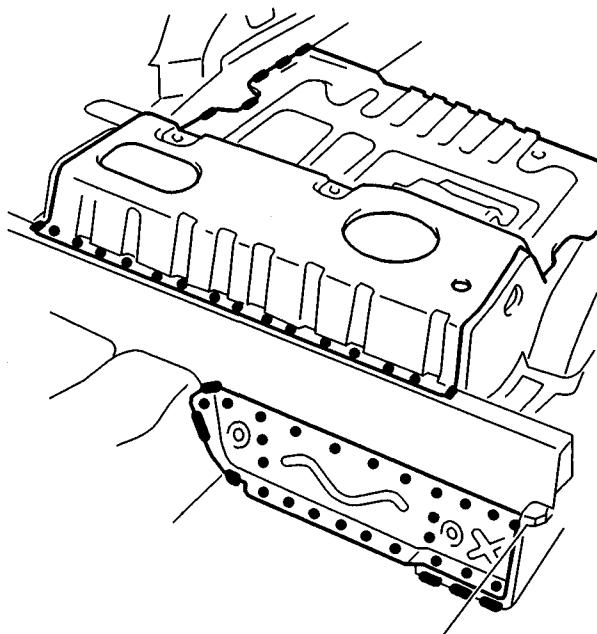
7. Check the position of the rear suspension.
8. Check the rear panel side stiffener and rear panel positions.
9. Perform the main welding.
 - Weld the rear frame outrigger, rear frame outrigger stiffener, and rear damper base.



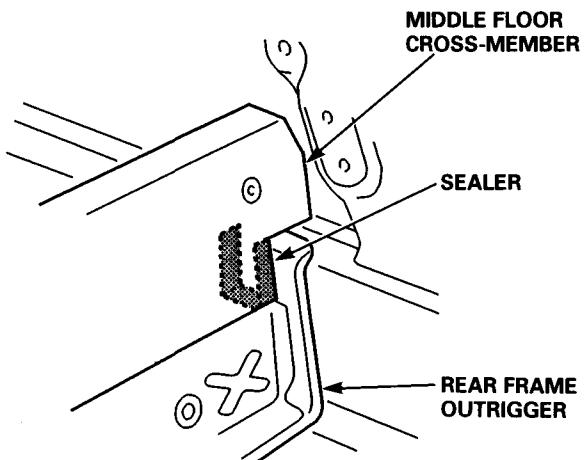
VIEW Z



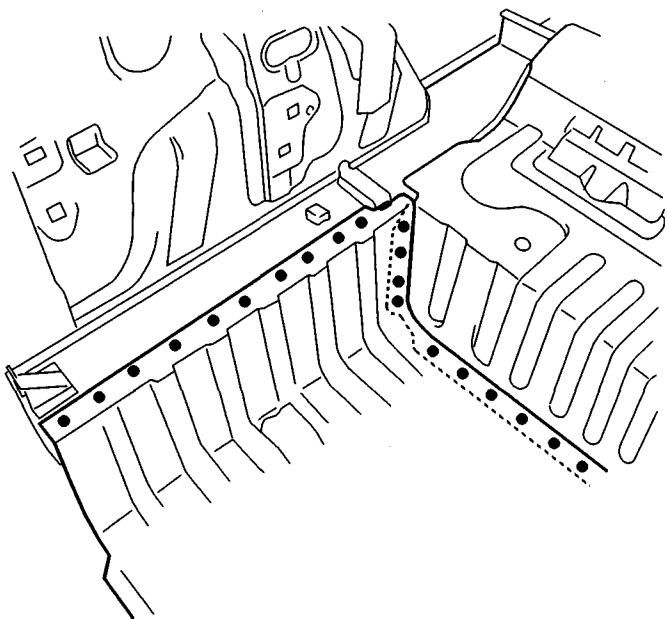
- Weld the middle cross-member lower plate, middle floor, and rear floor.



10. Seal the middle floor cross-member and rear frame outrigger.



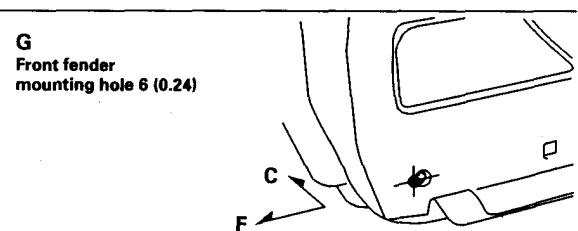
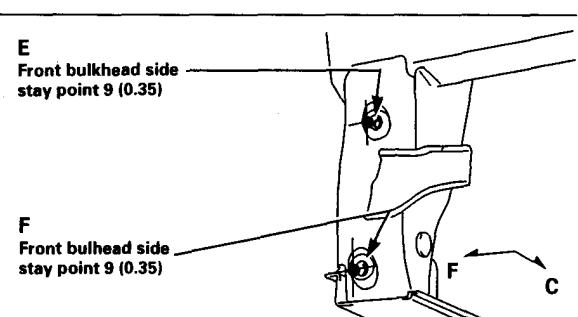
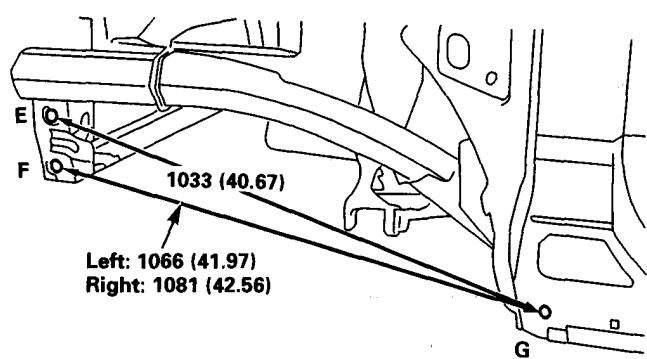
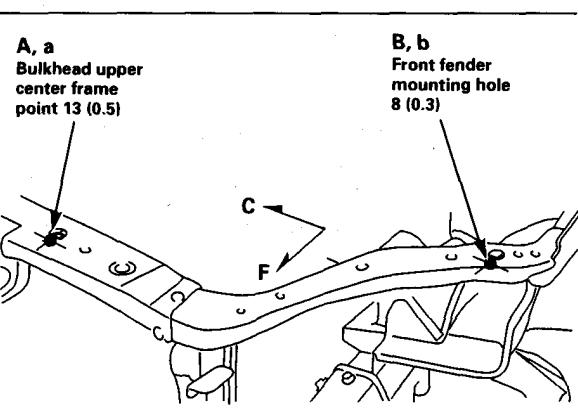
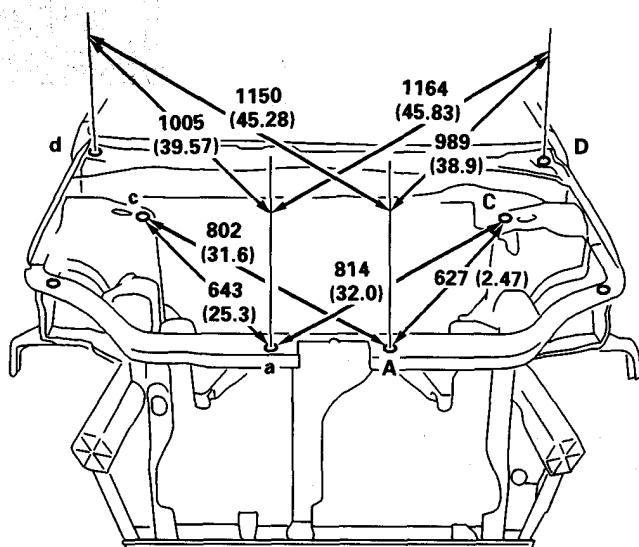
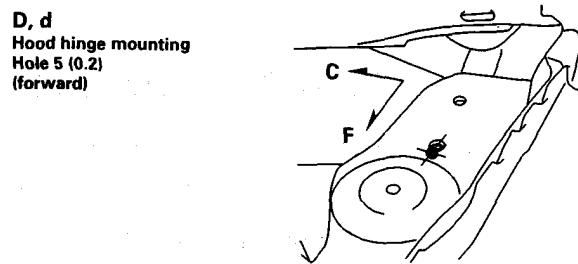
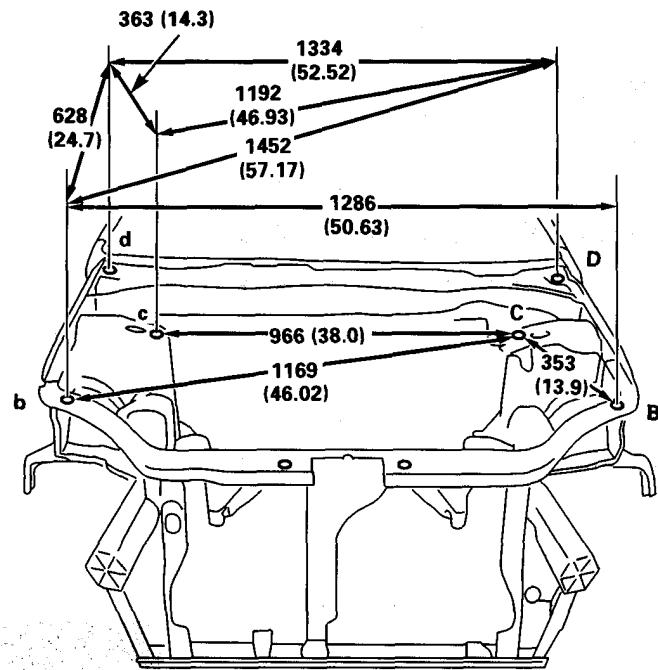
11. Weld the rear panel (see page [3-48](#)).



Upper Body Measuring Dimensions

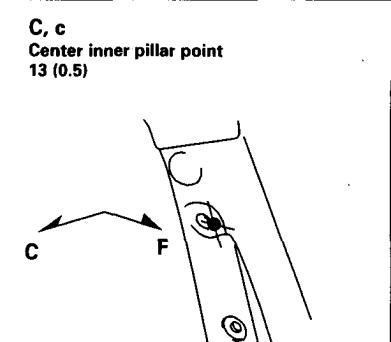
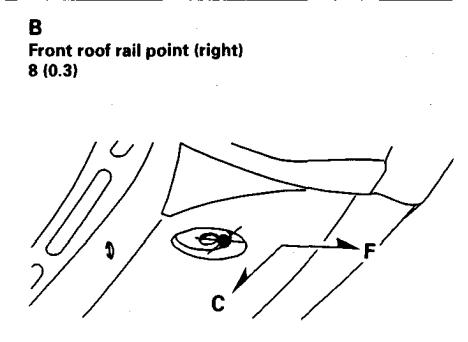
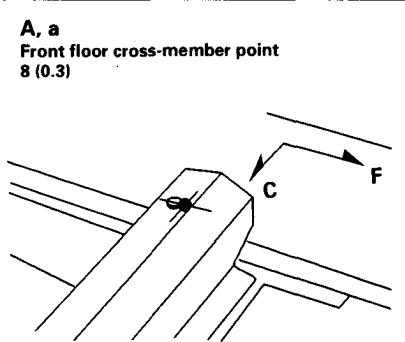
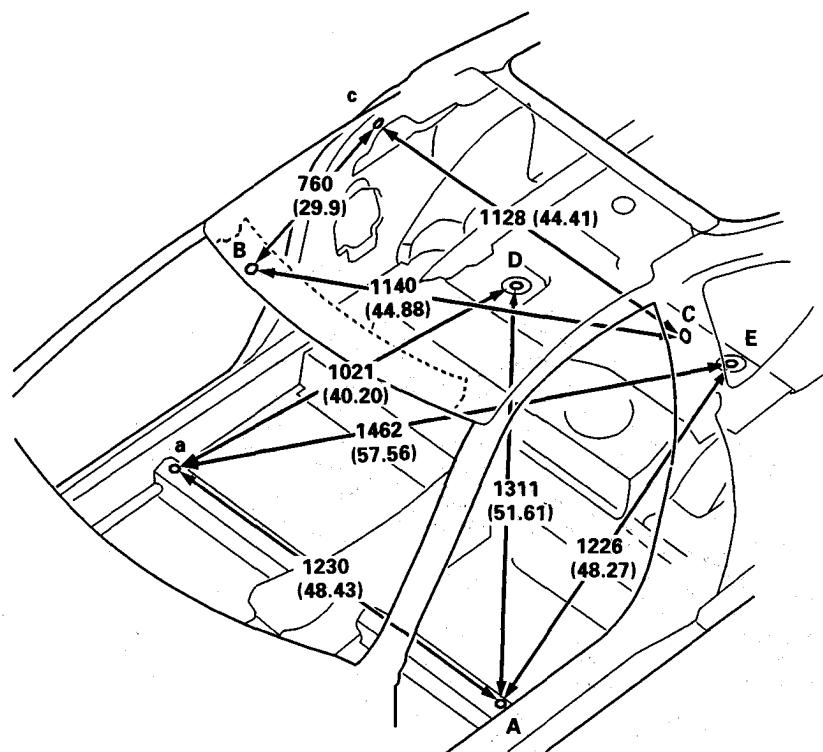
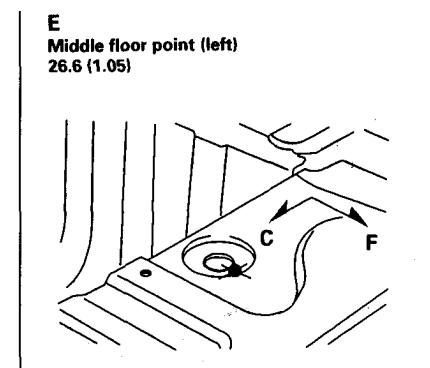
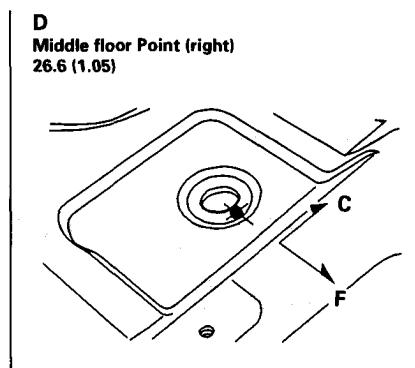
Engine Compartment

Unit: mm (in.)



Passenger Compartment / Roof Rail Positions

Unit: mm (in.)

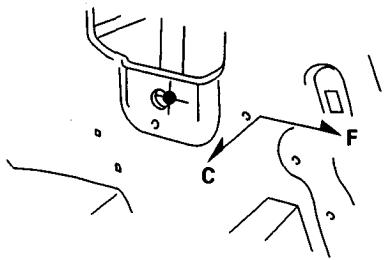


Upper Body Measuring Dimensions

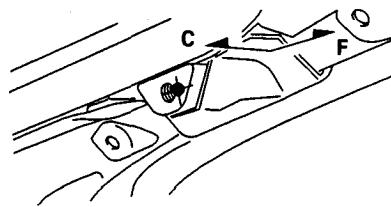
Rear Compartment

Unit: mm (in.)

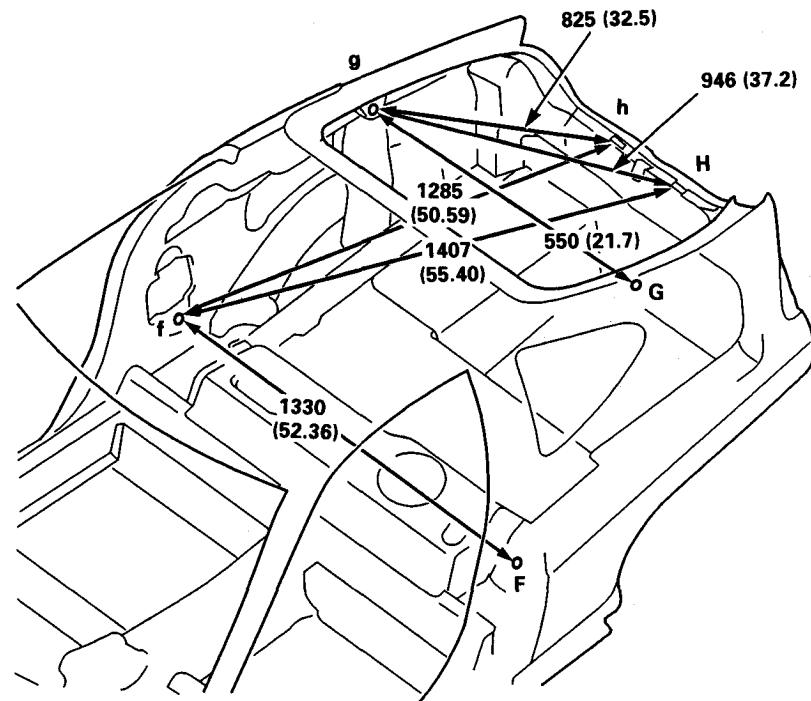
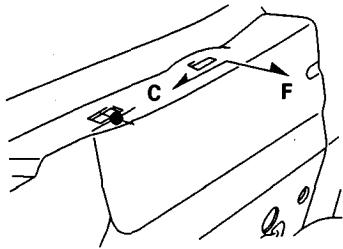
F, f
Seat belt retractor
mounting hole 14 (0.55)



G, g
Support strut M10 (0.39)



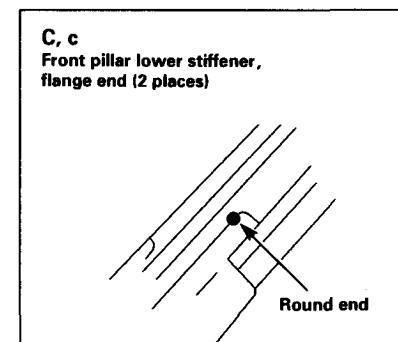
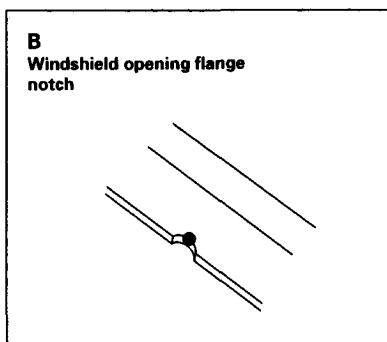
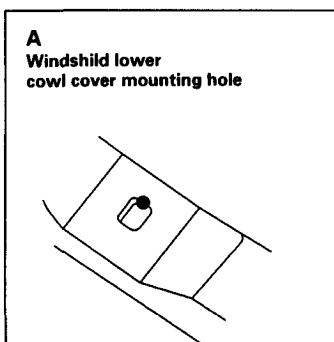
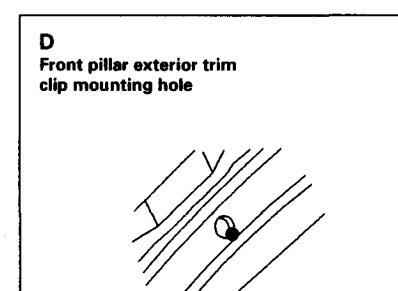
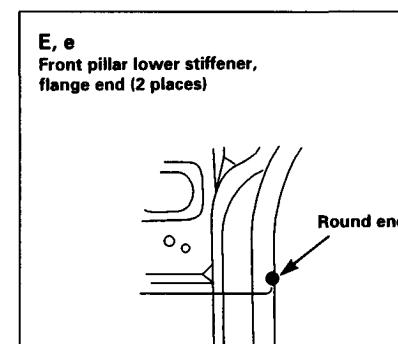
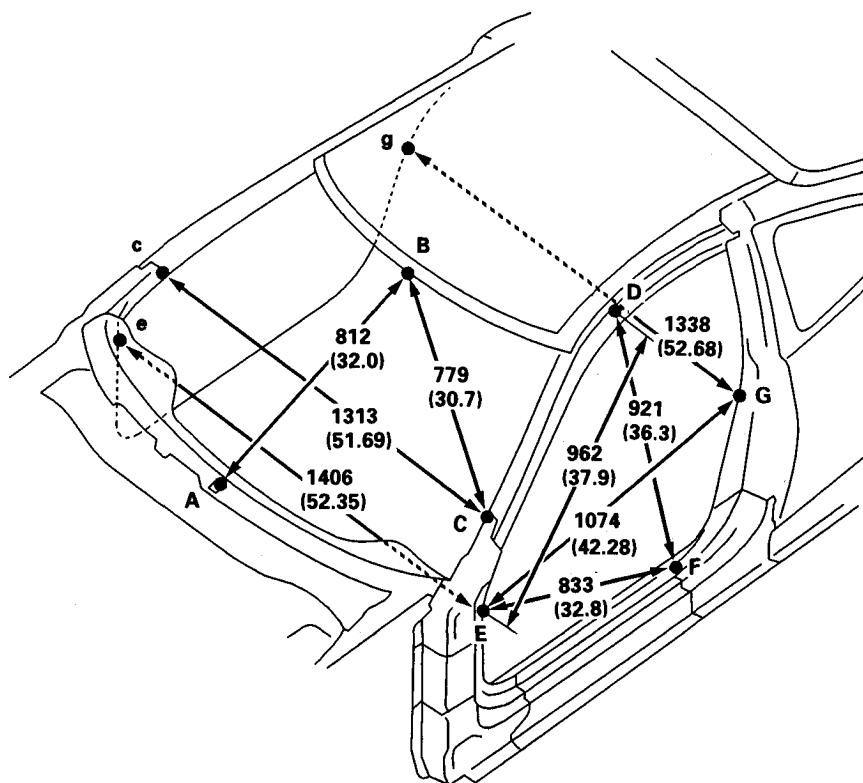
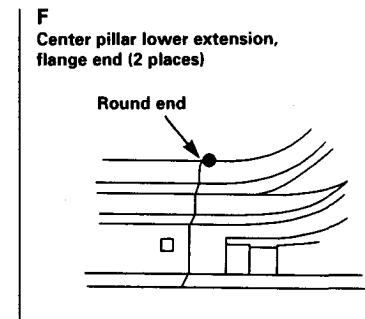
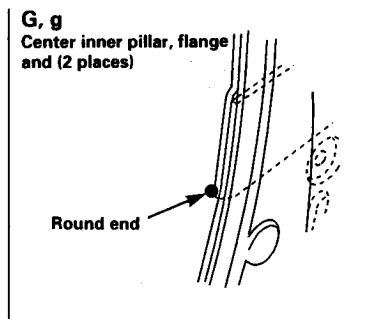
H, h
Rear panel, trim panel
clip mounting hole
20 (0.8) x 6 (0.24)



Opening Repair Chart

Windshield / Door Opening

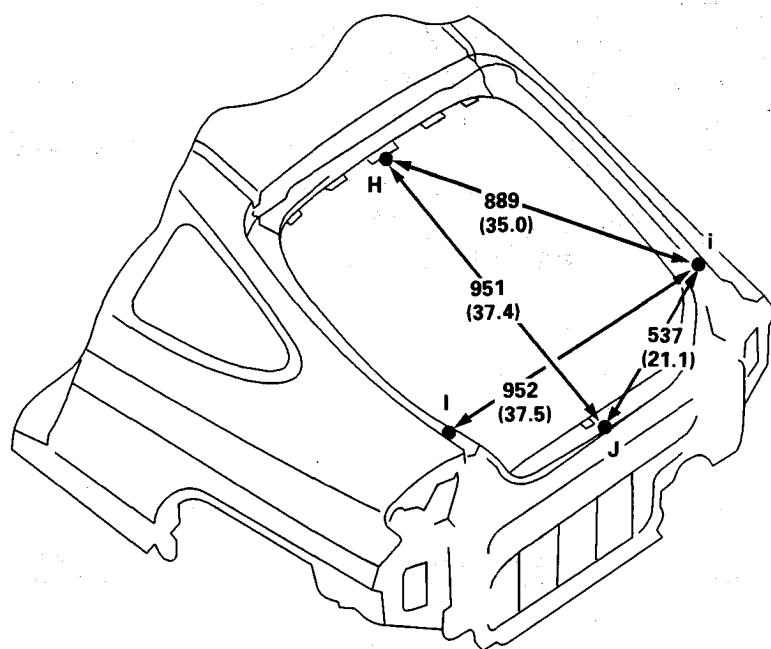
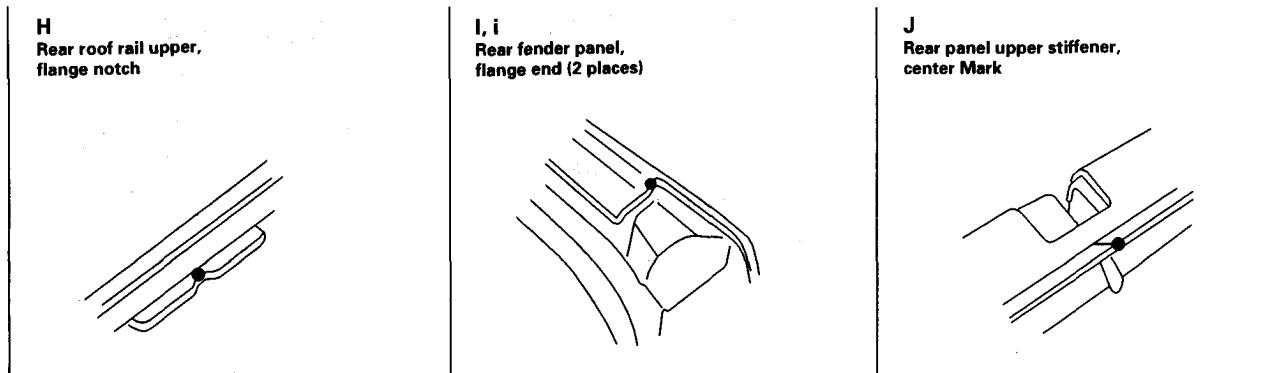
Unit: mm (in)



Opening Repair Chart

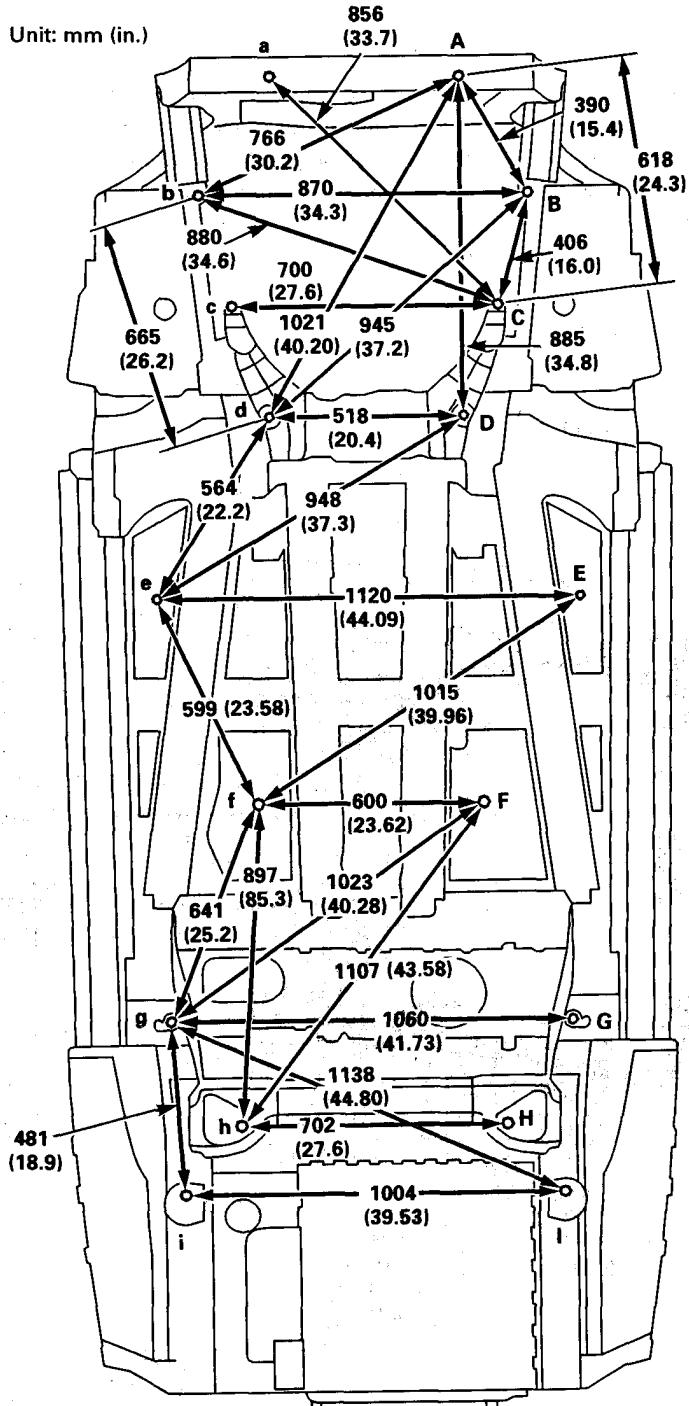
Hatch Opening

Unit: mm (in.)

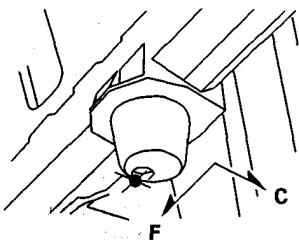


Under Body Measuring Dimensions

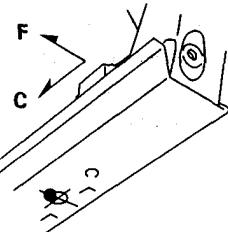
Under View



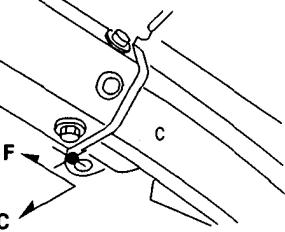
I, i
Rear suspension spring
base point 15 (0.6)



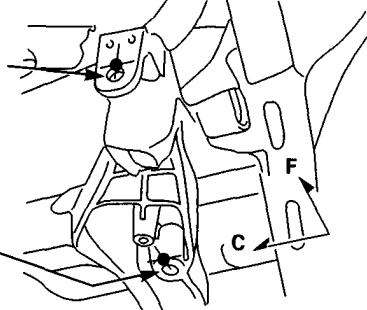
A, a
Bumper face mounting
hole 8 (0.3)



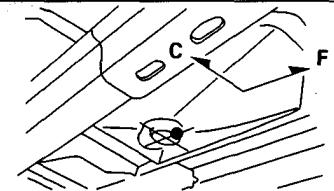
B, b
Engine hanger
mounting hole M12 (0.47)



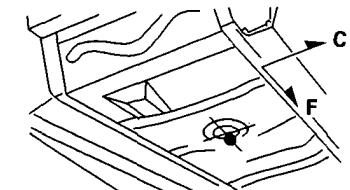
C, c
Lower arm
mounting hole
12.2 (0.48)



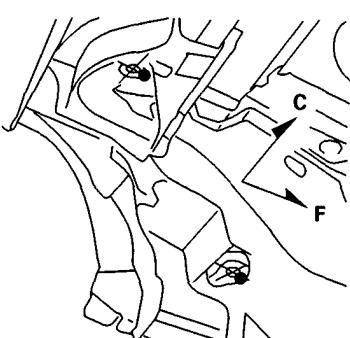
D, d
Front lower arm
bracket point
20 (1.0)



E, e
Front floor point
25 (1.0)



F, f
Front floor point
25 (1.0)



H, h
Rear suspension
damper bracket
mounting hole
10 (0.4)

G, g
Rear suspension
damper bracket
mounting hole
10 (0.4)

Frame Repair Chart

Top View

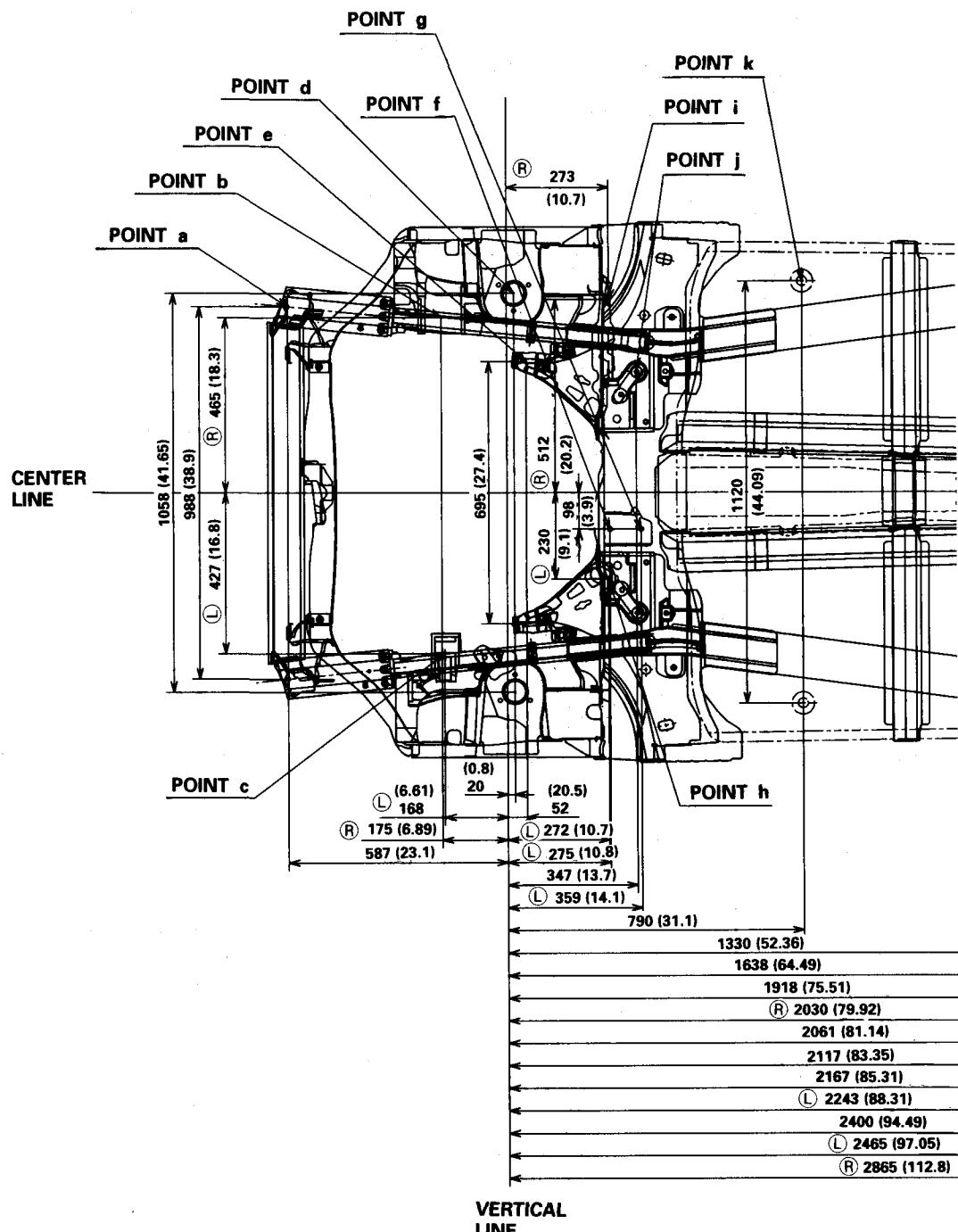
Unit: mm (in.)

\varnothing : Inner diameter

(L): Left side

(R): Right side

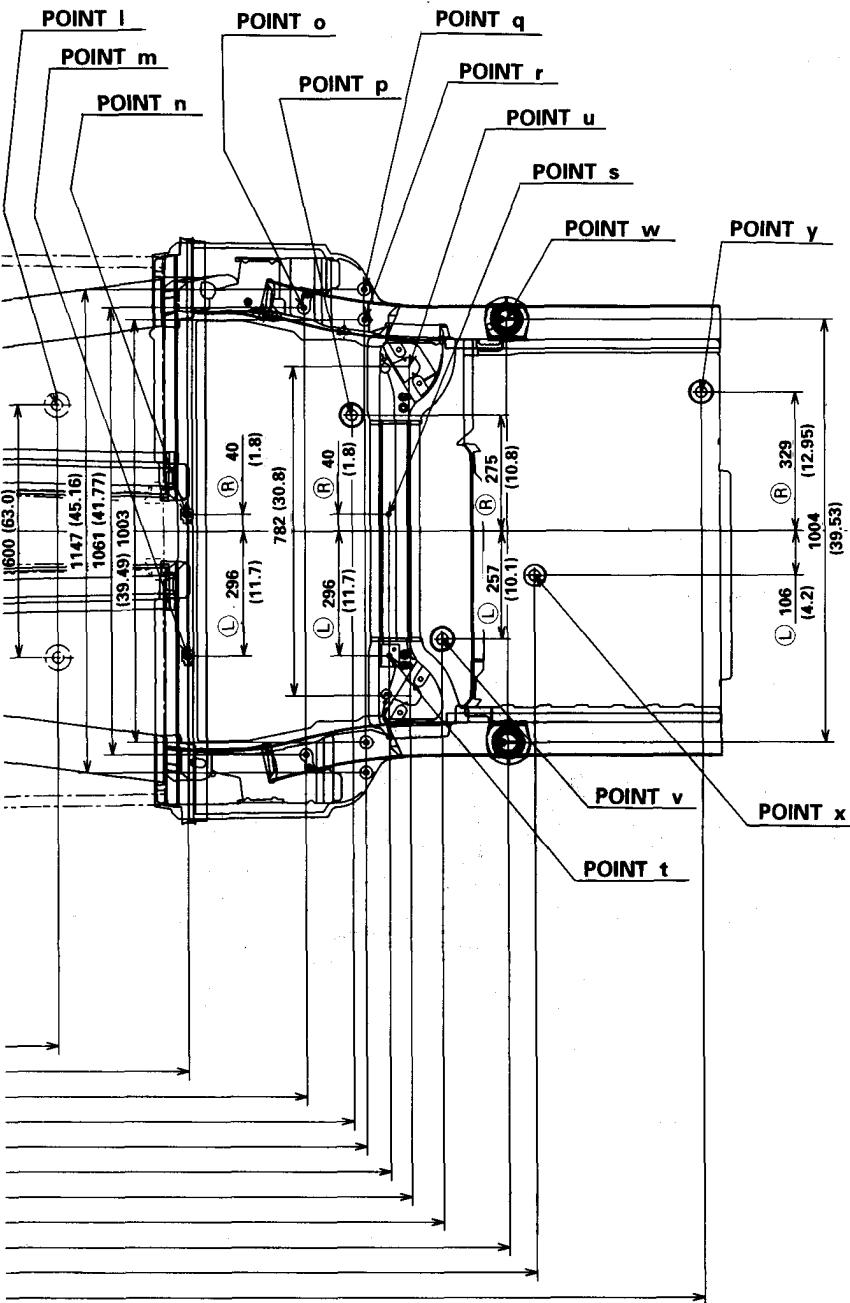
| POINT | POINT |
|--|---|
| a Locate hole \varnothing 10.5 (0.41) | g For engine rear mount \varnothing 12.2 (0.48) |
| b Engine mount center | h Steering gear box \varnothing 11 (0.43) |
| c For transmission mount \varnothing 10.5 (0.41) | i Steering gear box \varnothing 9 (0.35) |
| d Front damper center \varnothing 57 (2.2) | j For lower arm bush \varnothing 12.2 (0.48) |
| e Lower arm bush center | k Locate hole \varnothing 26.8 (1.06) |
| f For engine rear mount \varnothing 12.2 (0.48) | |



POINT

- I Locate hole ø26.8 (1.06)
- m For fuel tank strap ø12 (0.476)
- n For fuel tank strap ø12 (0.476)
- o For trailing arm bracket ø12 (0.476)
- p Locate hole ø26.6 (1.05)
- q For trailing arm bracket ø12 (0.476)
- r For trailing arm bracket ø12 (0.476)
- s For fuel tank strap ø11 (0.433)
- t For fuel tank strap ø12 (0.476)
- u Rear damper bush center
- v Locate hole ø26.6 (1.05)
- w Coil spring base center
- X Locate hole ø26.6 (1.05)
- Y Locate hole ø26.6 (1.05)

POINT



Frame Repair Chart

Side View

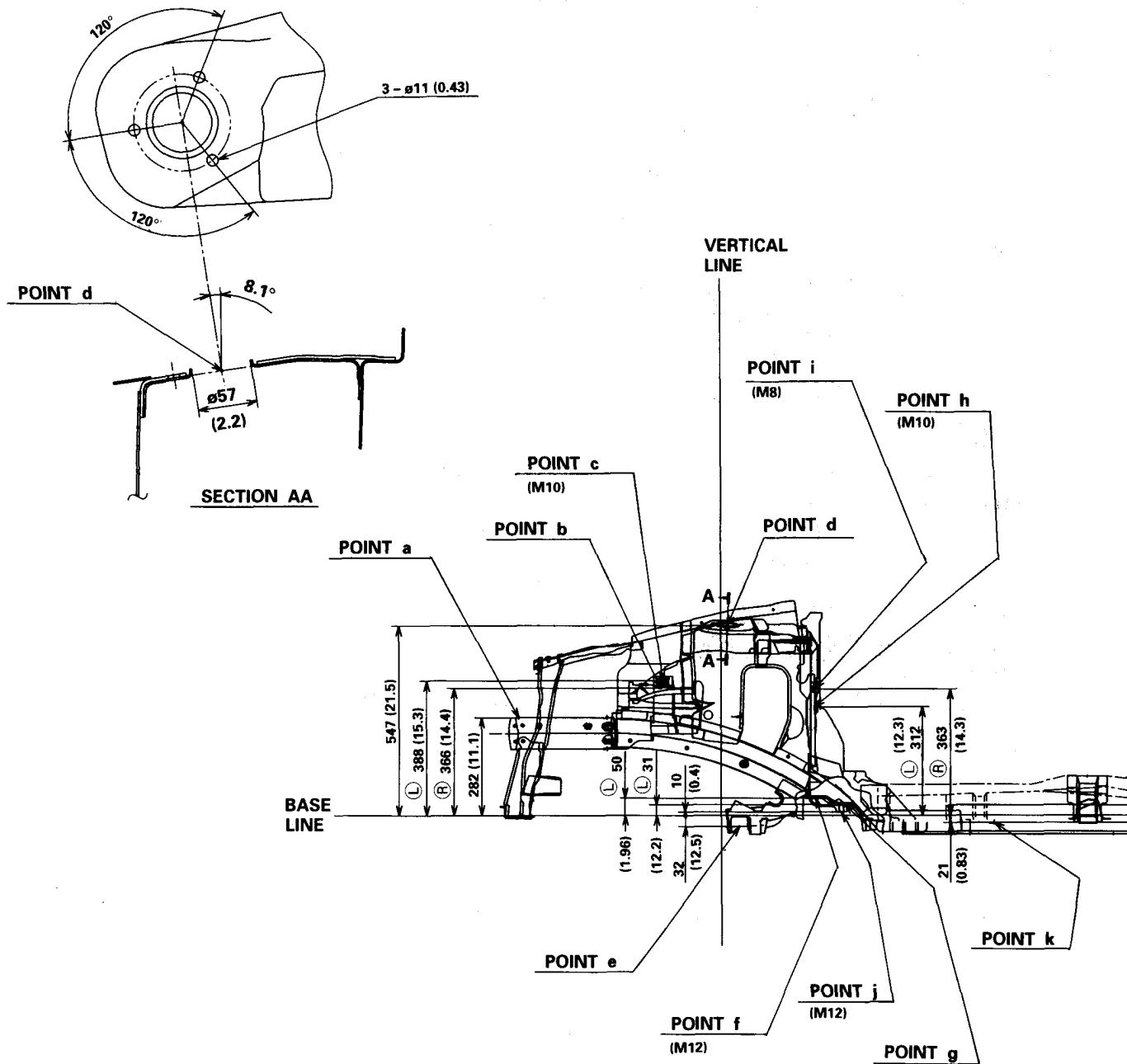
Unit: mm (in.)

\varnothing : Inner diameter

(L): Left side

(R): Right side

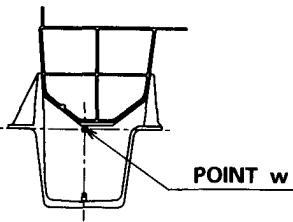
| POINT | POINT |
|--|---|
| a Locate hole $\varnothing 10.5$ (0.41) | g For engine rear mount $\varnothing 12.2$ (0.48) |
| b Engine mount center | h Steering gear box $\varnothing 11$ (0.43) |
| c For transmission mount $\varnothing 10.5$ (0.41) | i Steering gear box $\varnothing 9$ (0.35) |
| d Front damper center $\varnothing 57$ (2.2) | j For lower arm bush $\varnothing 12.2$ (0.48) |
| e Lower arm bush center | k Locate hole $\varnothing 26.8$ (1.06) |
| f For engine rear mount $\varnothing 12.2$ (0.48) | |



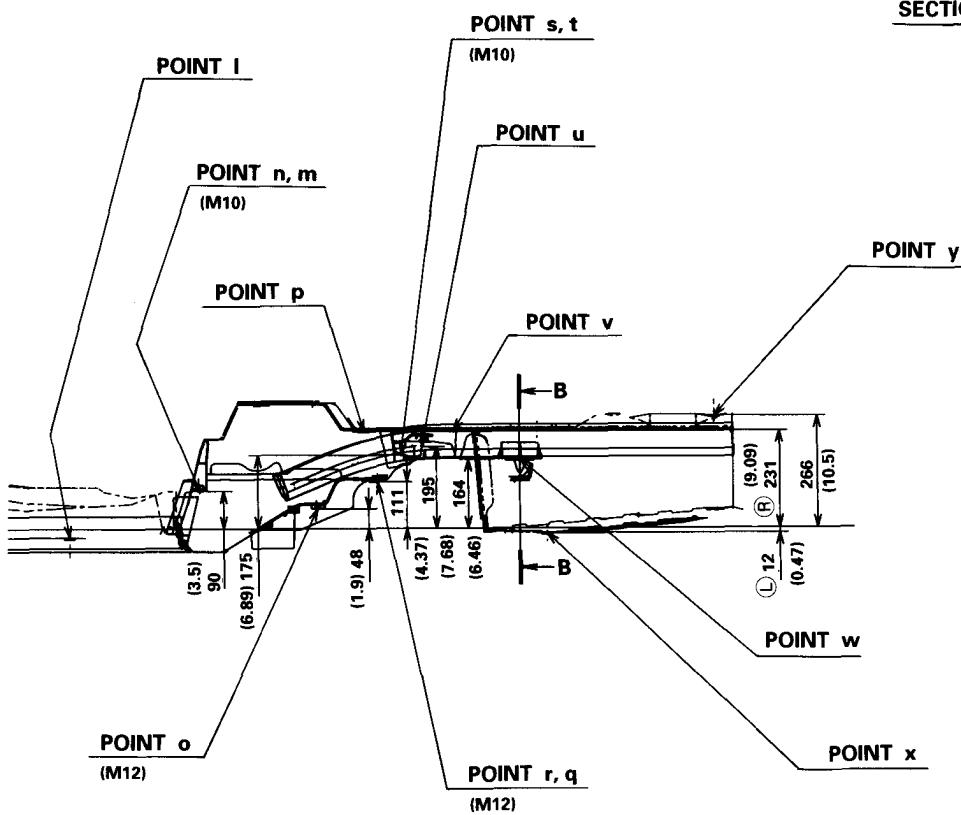
POINT

POINT

- | | | | |
|---|--------------------------------------|---|---------------------------------|
| I | Locate hole ø26.8 (1.06) | s | For fuel tank strap ø11 (0.433) |
| m | For fuel tank strap ø12 (0.476) | t | For fuel tank strap ø12 (0.476) |
| n | For fuel tank strap ø12 (0.476) | u | Rear damper bush center |
| o | For trailing arm bracket ø12 (0.476) | v | Locate hole ø26.6 (1.05) |
| p | Locate hole ø26.6 (1.05) | w | Coil spring base center |
| q | For trailing arm bracket ø12 (0.476) | X | Locate hole ø26.6 (1.05) |
| r | For trailing arm bracket ø12 (0.476) | Y | Locate hole ø26.6 (1.05) |



SECTION BB

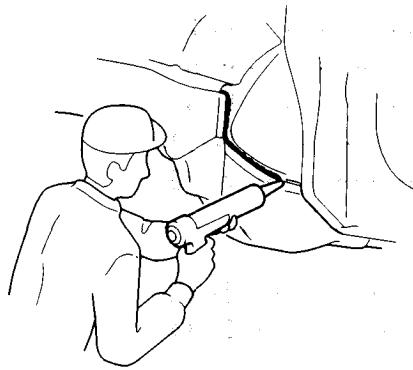


Cross Section of Body and Sealants

General

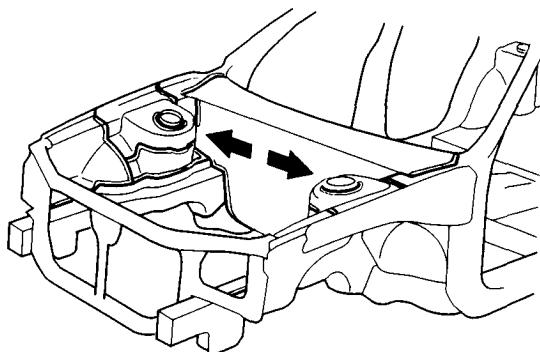
NOTE: Follow the sealer manufacturer's instructions.

1. Clean the areas to be sealed with wax and grease remover.
2. Wipe off any excess spot sealer with thinner. After the primer is sprayed, sealer will fill to the area where spot sealer was wiped off.
3. Make sure you can see the sealant when the sealed parts in its proper location. Refer to pages **5-3, 5-4, 5-5, 5-6, 5-7, 5-8, 5-9, 5-10, 5-11, 5-12** of this manual.

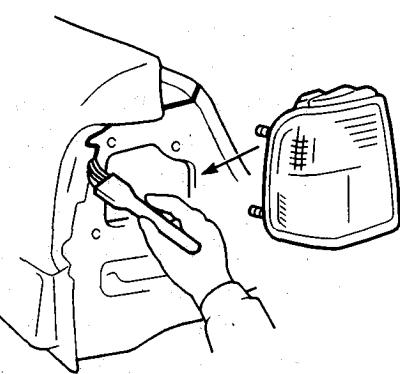


4. Finish up the engine compartment, the door opening, and the hatch gutter.

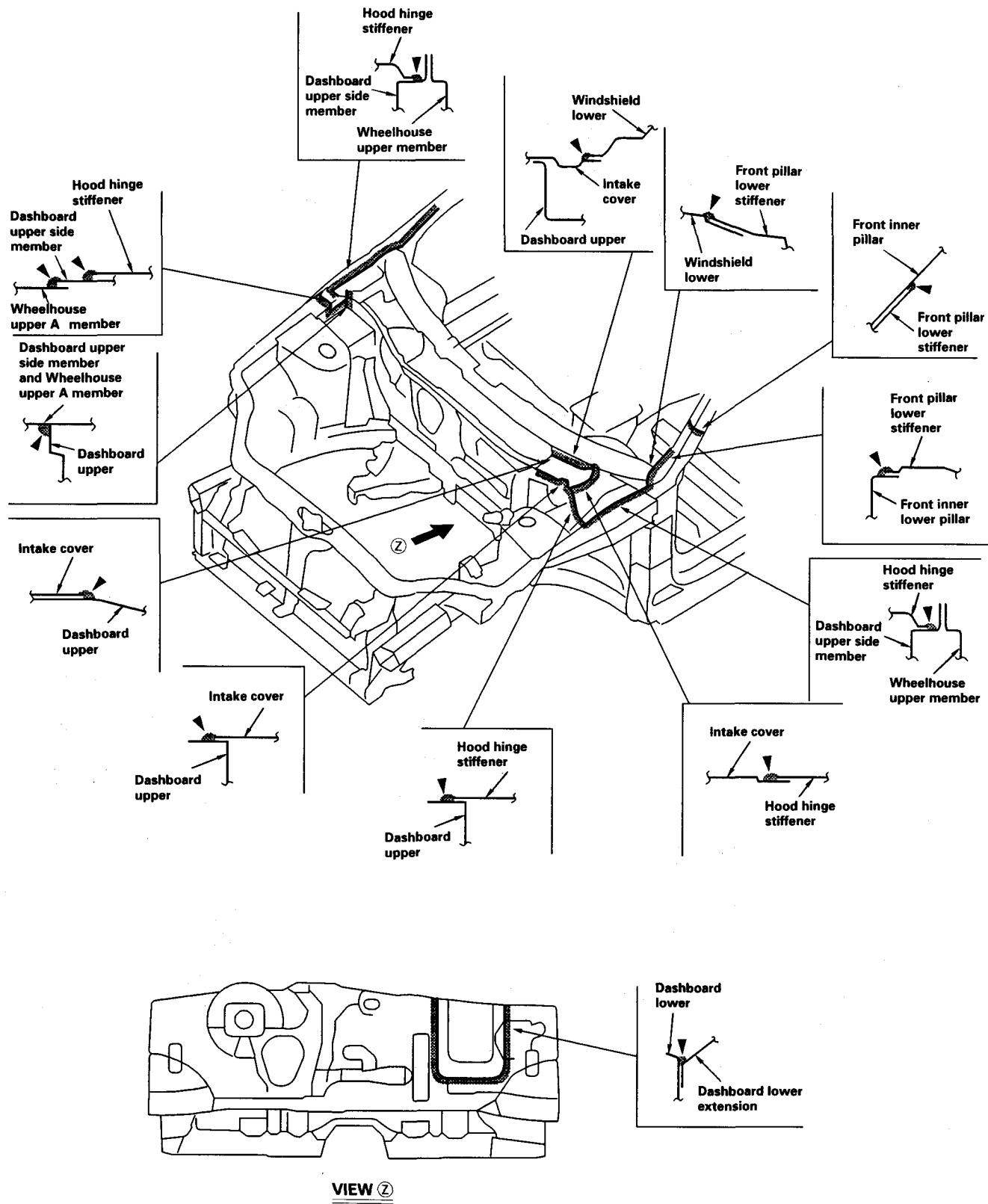
Wipe off the excess sealer.



5. Apply sealer on any area that the replacement part will cover. Smooth the sealer with a brush if necessary.

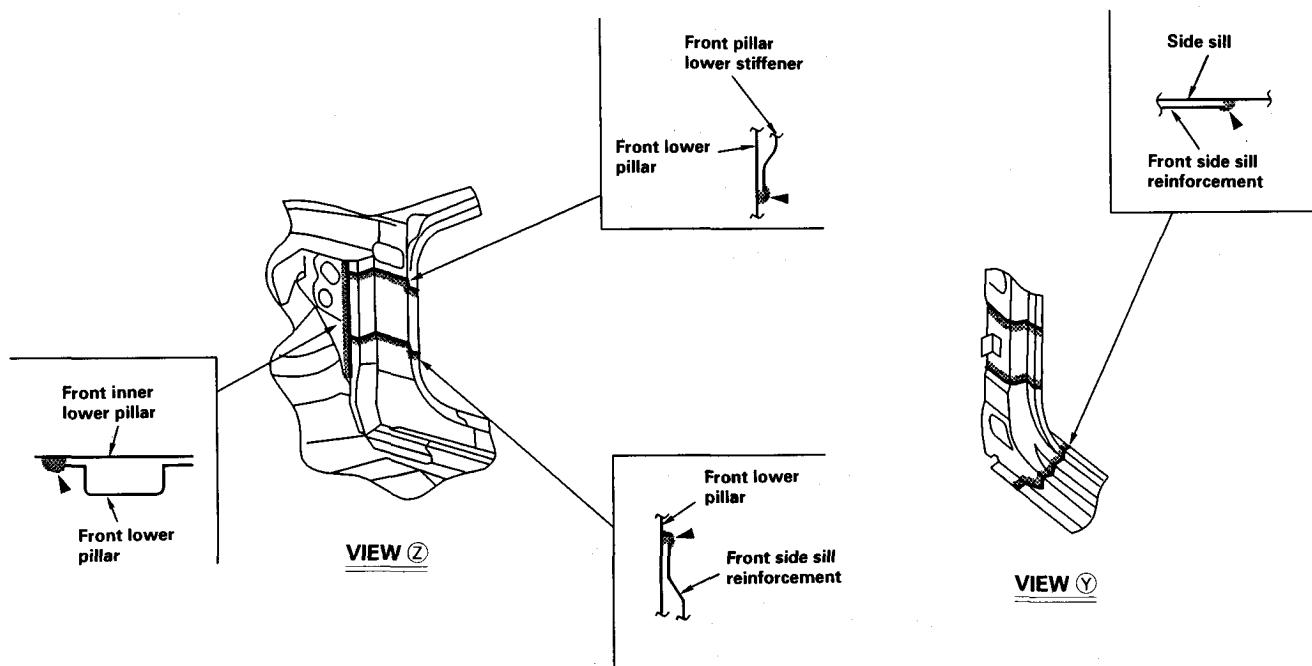
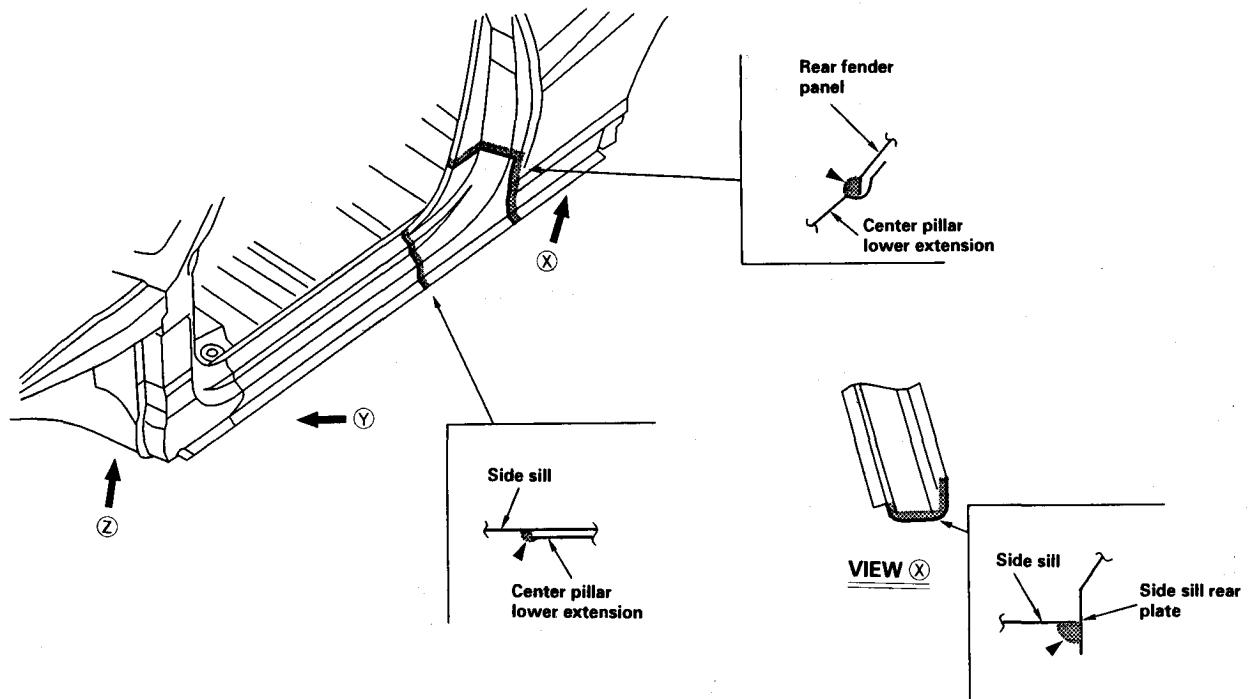


Engine Compartment

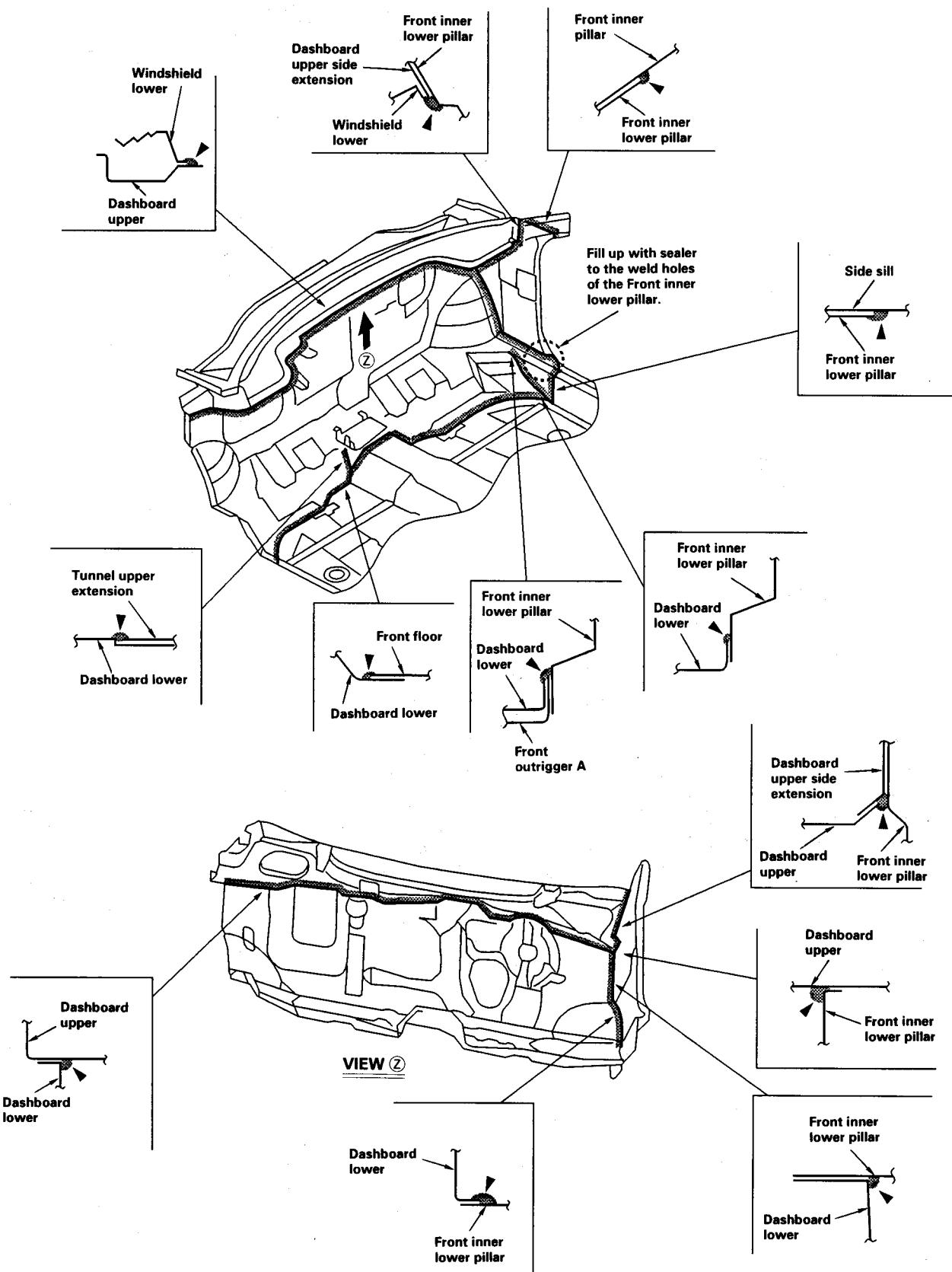


Cross Section of Body and Sealants

Front Pillar, Side Sill and Center Pillar Lower

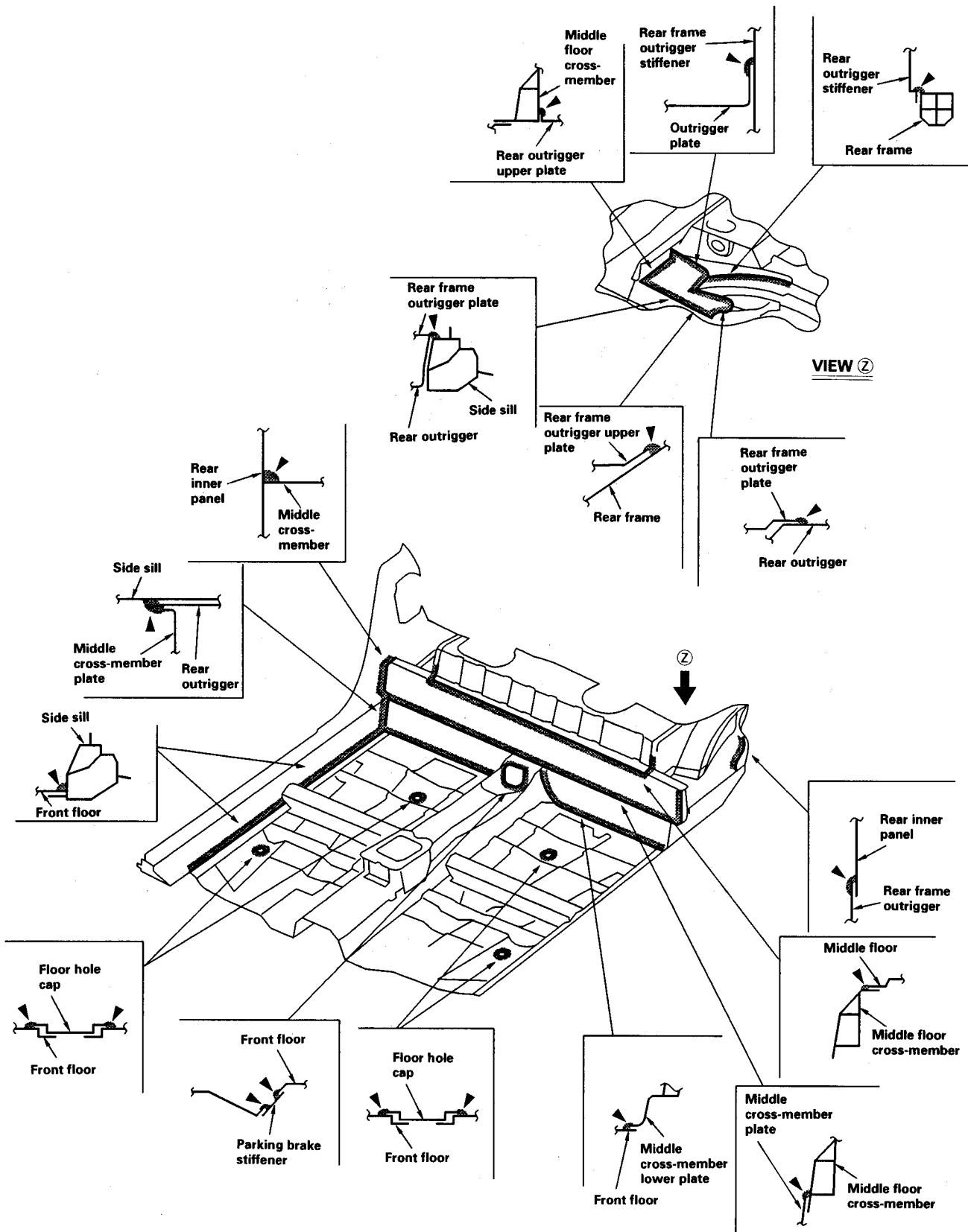


Dashboard Upper, Dashboard Lower and Front Inner Lower

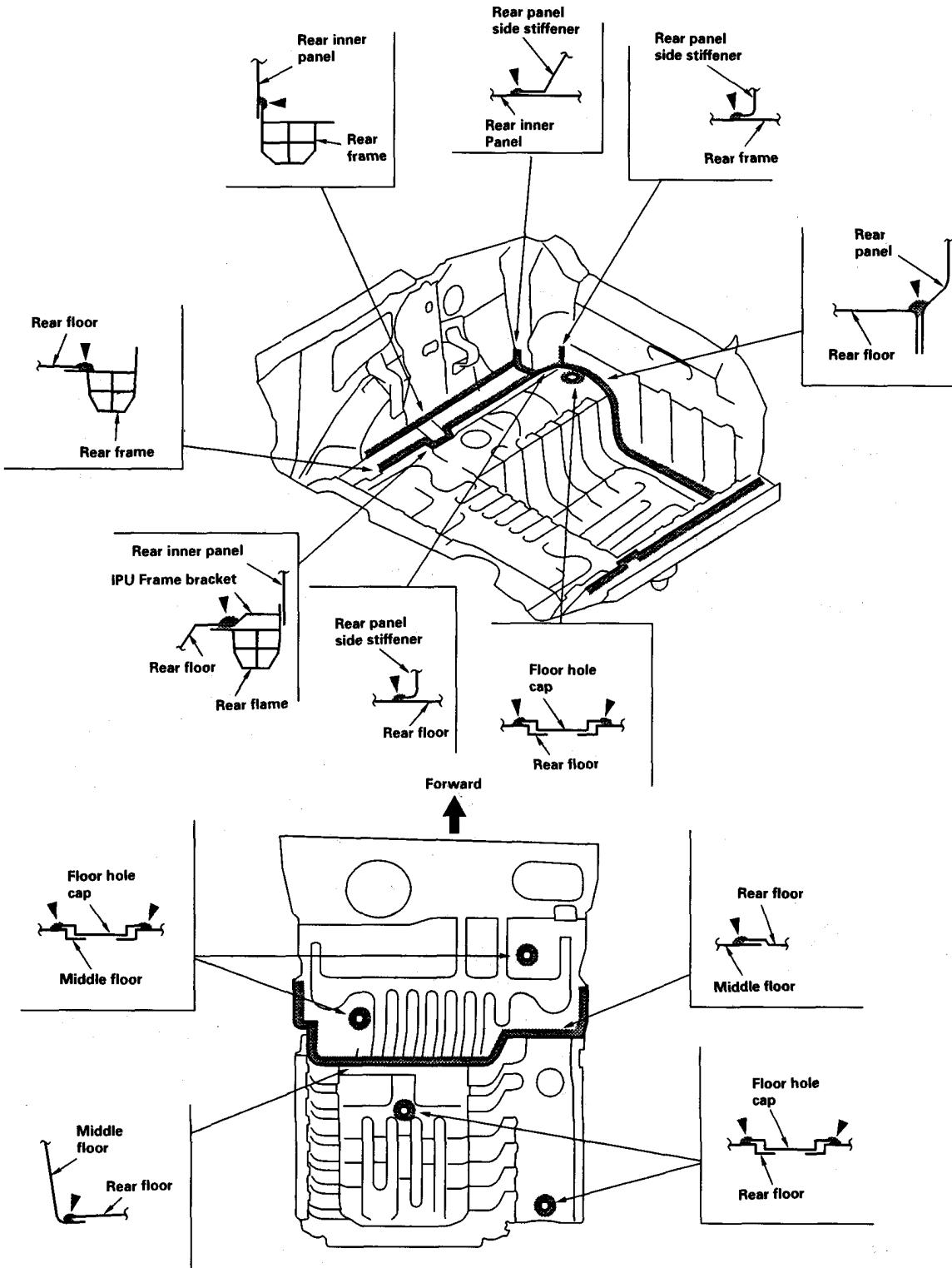


Cross Section of Body and Sealants

Front Floor / Middle Floor

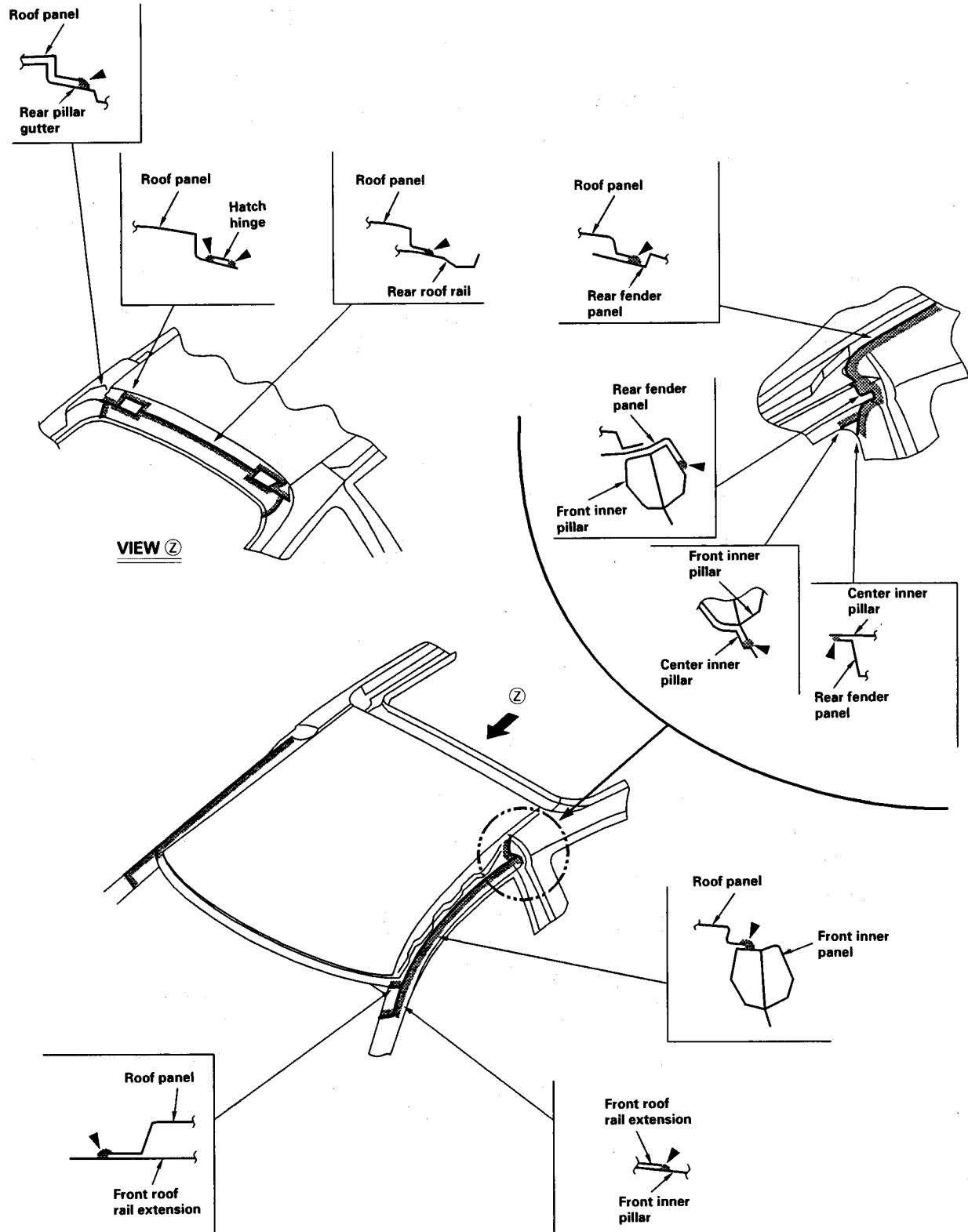


Rear Floor

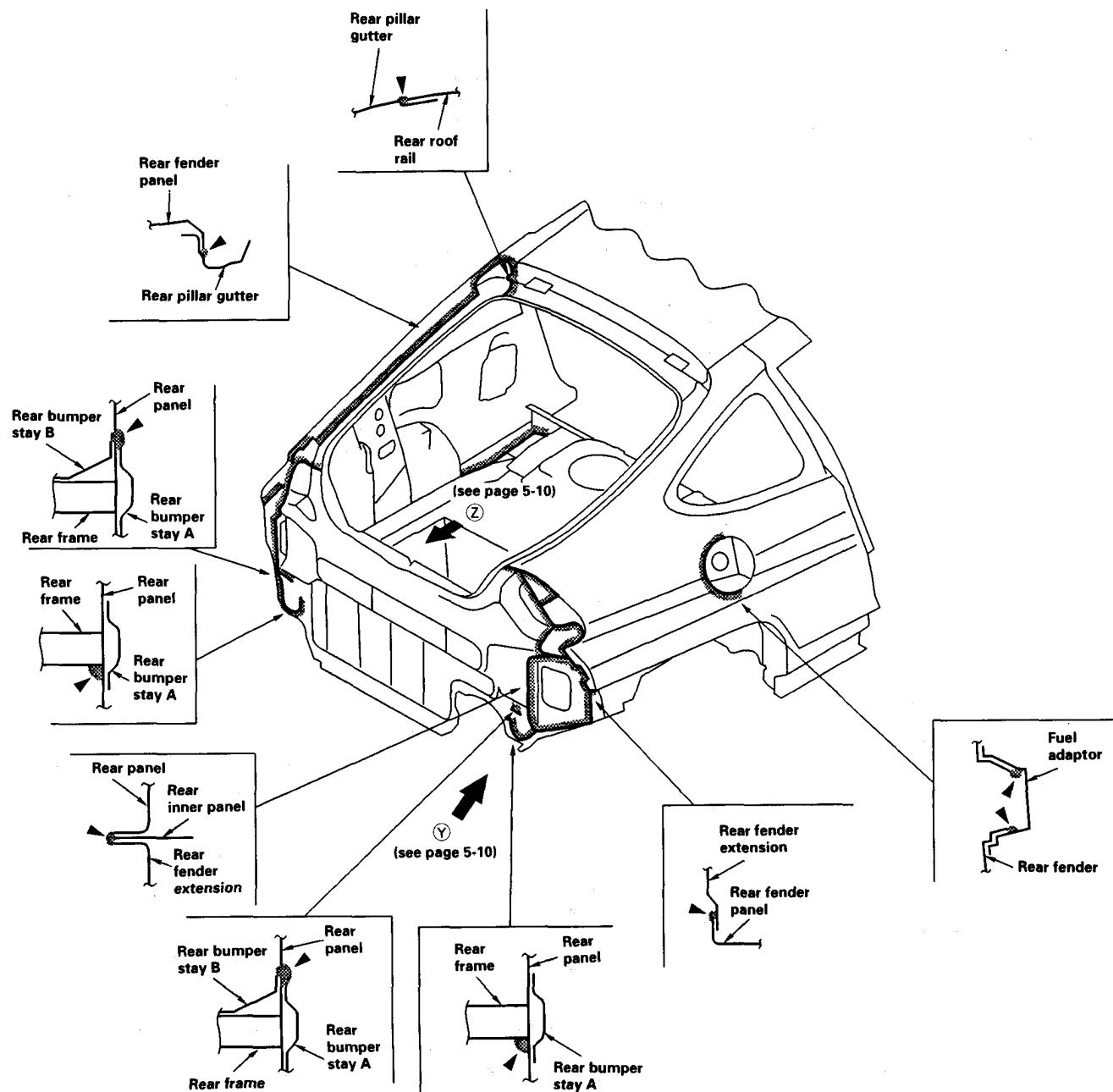


Cross Section of Body and Sealants

Roof Panel



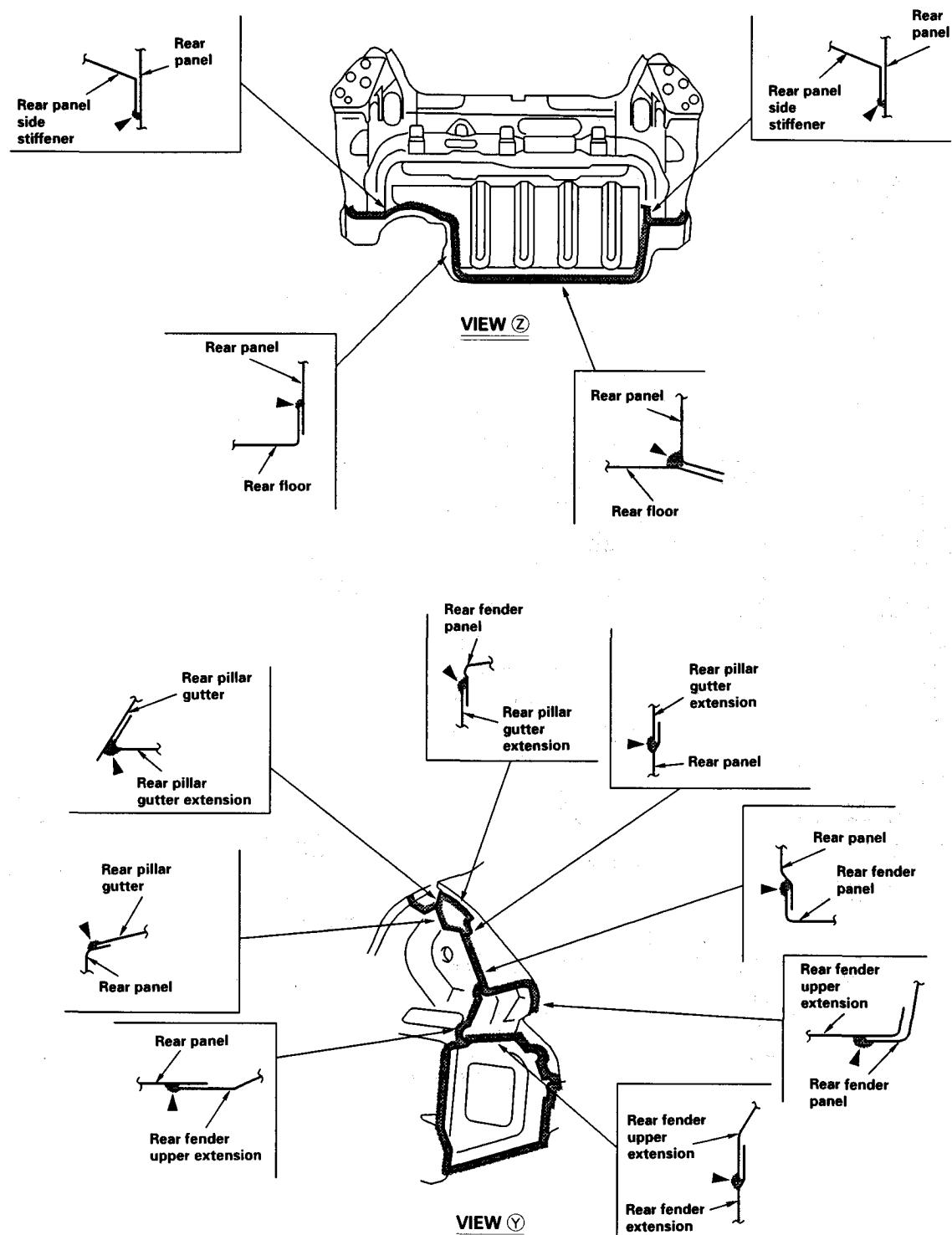
Rear Pillar Gutter and Rear Panel



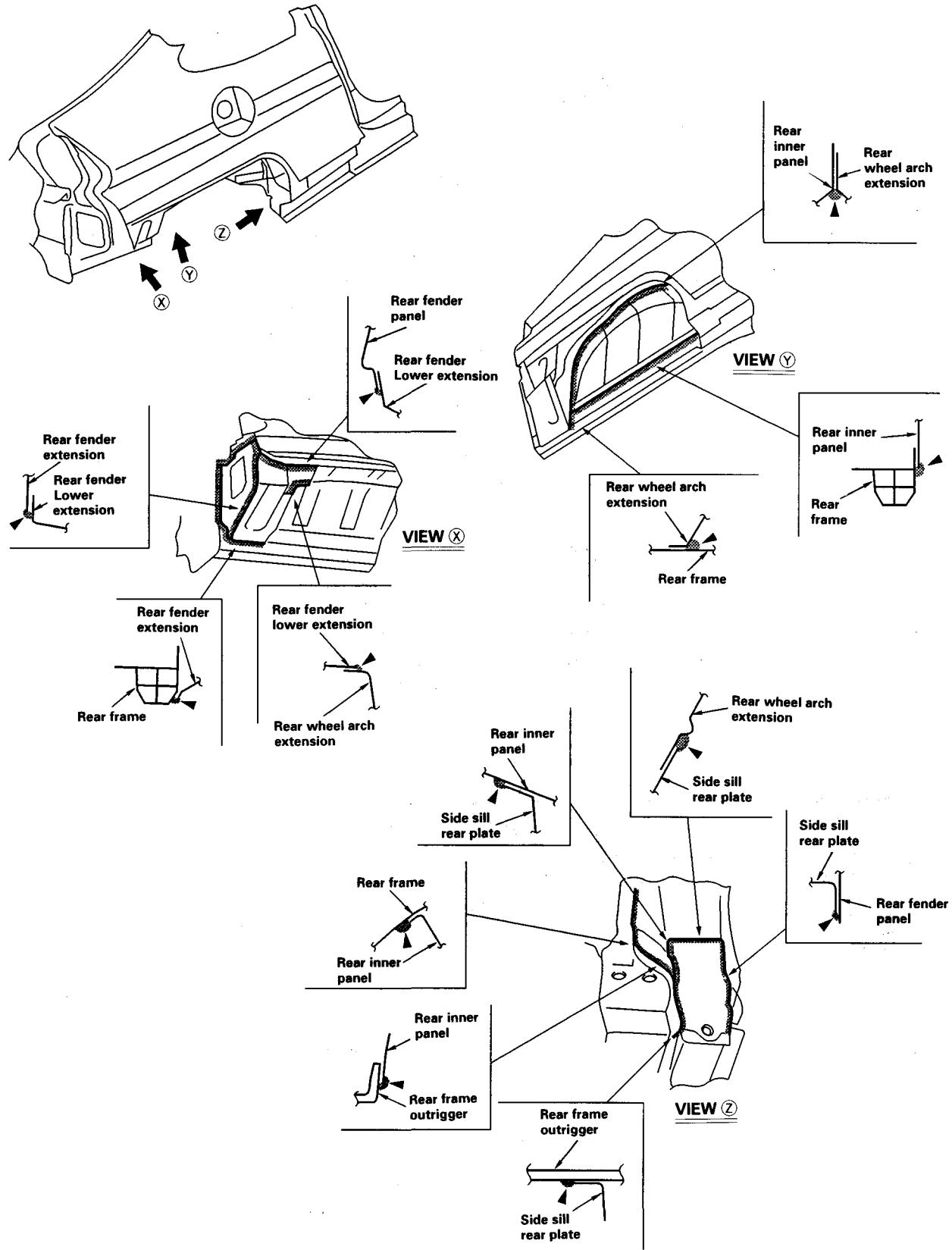
(cont'd)

Cross Section of Body and Sealants

Rear Pillar Gutter and Rear Panel (cont'd)

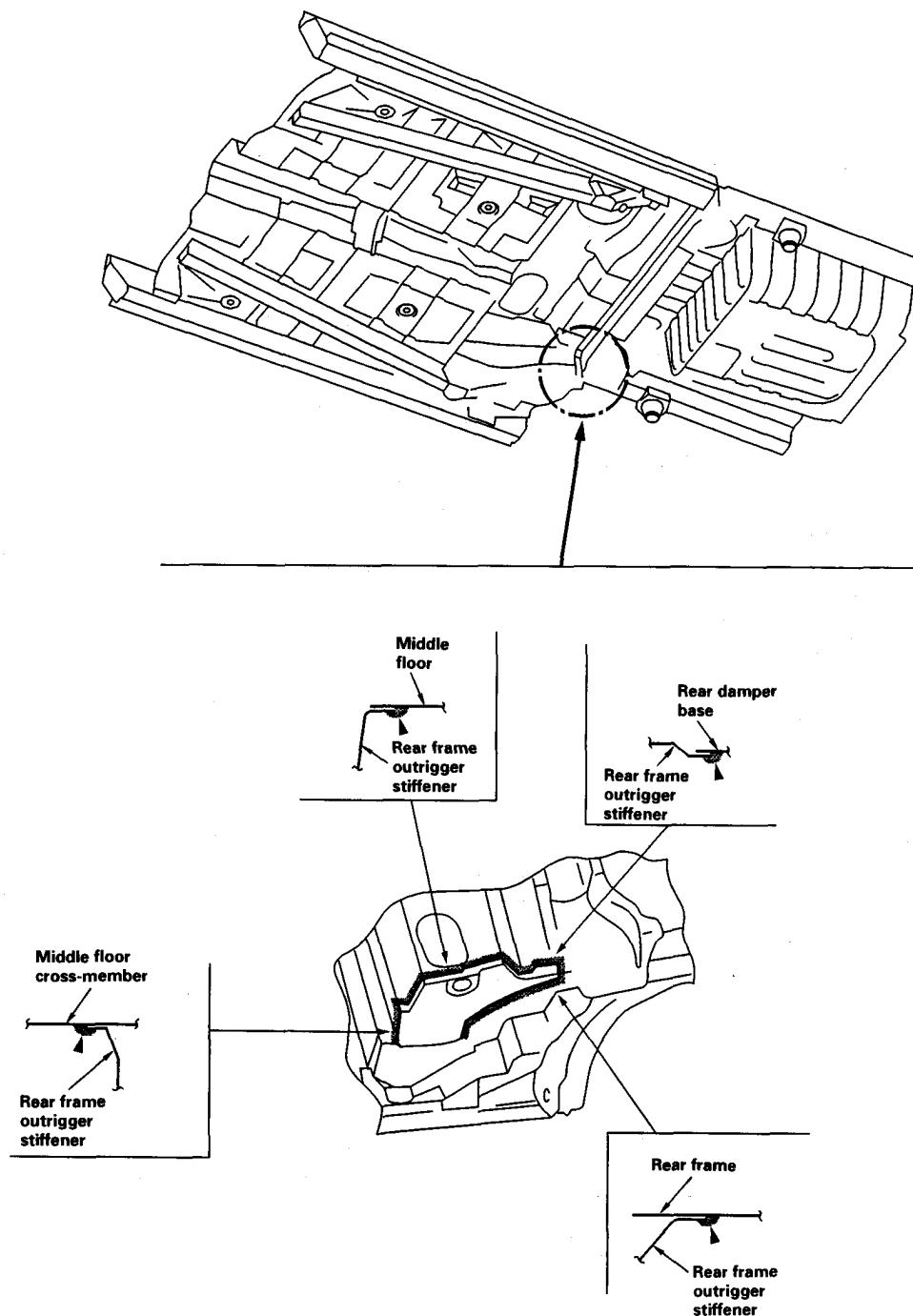


Rear Wheelhouse



Cross Section of Body and Sealants

Under Floor



Soft Chipping Guard Primer Coat

General

The removal of paint and undercoating by stones chips immediately exposes metal to the atmosphere, causing it to oxidize. The thickness of this oxidation increases if the process continues unchecked. The soft chipping guard primer protects against damage due to the impact of such objects.

Sectional View of Paint Coats:

| |
|-----------------------------|
| Top coat |
| Intermediate coat + |
| Chipping guard primer |
| Electrodeposition of primer |
| Base metal |

- The soft chipping guard primer coat is applied over the E.D. (Electrostatically Deposited) primer. It is followed by guide coating and top coating.
- The soft chipping guard primer produces a smooth surface when dry. It should be sprayed so the thickness of the protective film is 20 microns.

Basic Rules for Repairing a Soft Chipping Guard Primer Coat:

- Soft chipping guard primer coat is then applied to the most susceptible area (see page 5-14).
- Spray the primer surface (2-part urethane primer surfacer) on the soft chipping guard primer coating areas when you replaced parts using soft chipping guard primer coat.

WARNING

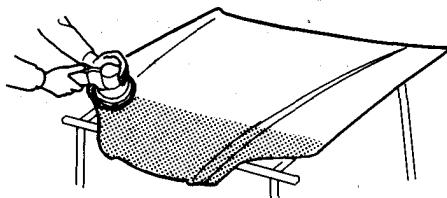
- Wear goggles or safety glasses to prevent eye injury.
- Ventilate when spraying undercoat.

- Sanding the replacement part.

NOTE:

- Do not oversand the edges of corners of the part.
- Do not expose base metal.

Use the double action sander and #400~#600 disc paper.



- Air blowing/degreasing

Use alcohol, wax and grease remover.

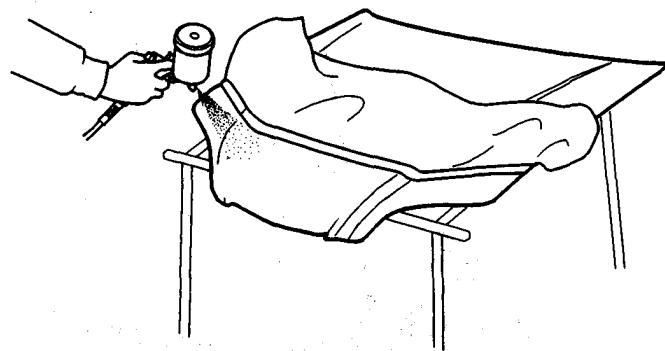
- Masking

Use masking tape and paper.

- Spraying primer surfacer

- Spray coat 4~5 coats get 20 microns of thickness, as one coat deposits 5~7 microns.
- Do not try to cover the surface with one heavy coat.
- Apply several thin coats.

- Use the 2-part urethane primer surfacer and spray gun.
- Mix the primer surface with the additive and solvent, and in the correct ratio.
- Follow the primer surface manufacturer's instructions.



- Drying

After spraying primer surface, allow for 7~10 minutes drying time, then force dry it with infrared lamps or other industrial dryer.

- Polishing

Check the primer surfacer has dried thoroughly, then sand the primer surfacer.

Use the double action sander and #400~#600 disc paper.

- Intermediate coating and top coating

Refer to pages 8~10 of this body repair manual (section 6) for the painting procedure.

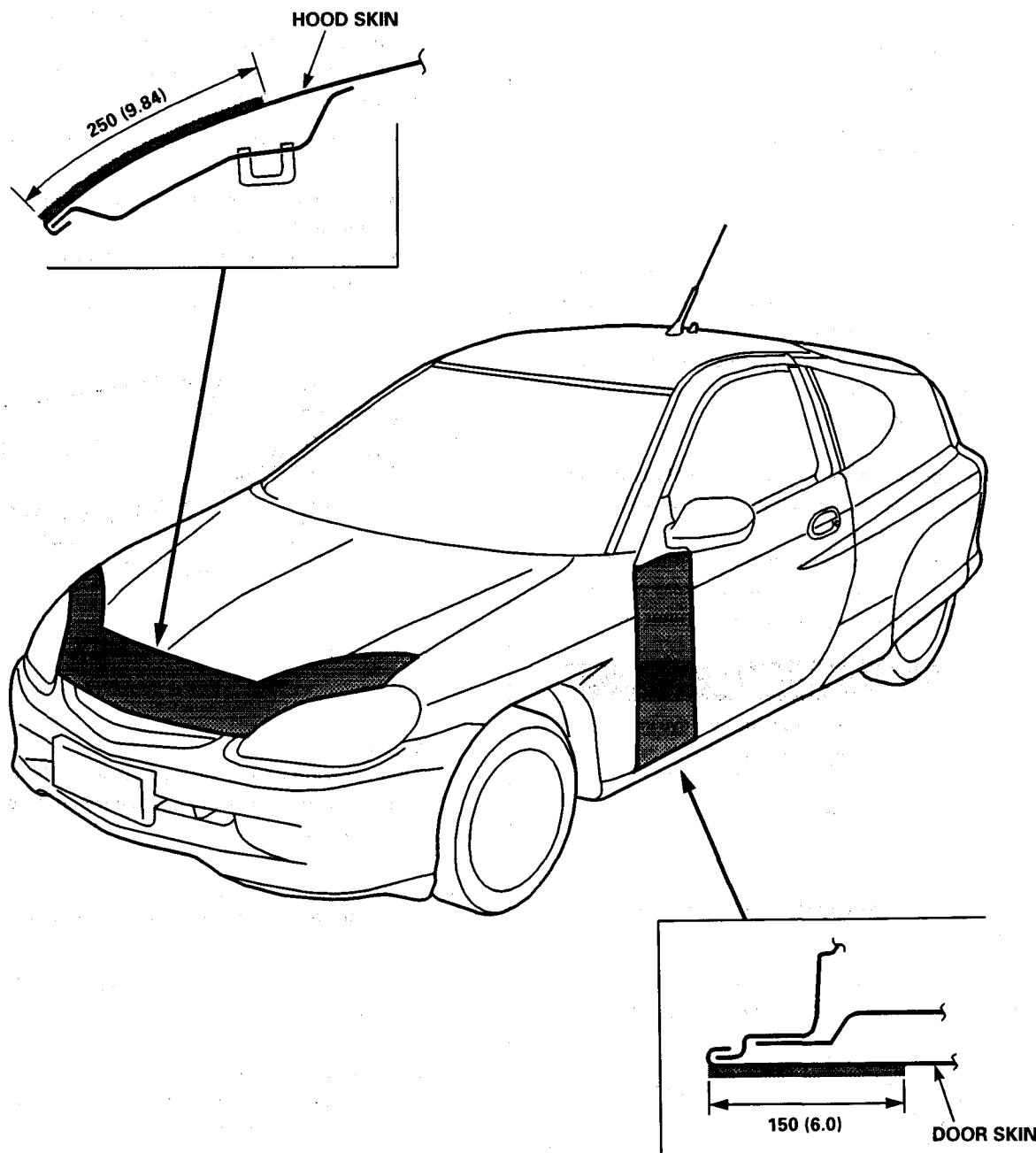
Soft Chipping Guard Primer Coat

Coating Diagram

██████████ Indicates chipping guard primer coating area.

NOTE: Make sure to coat the flange on the front and rear wheel arches.

Unit: mm (in.)



Rust-preventive Treatments

General

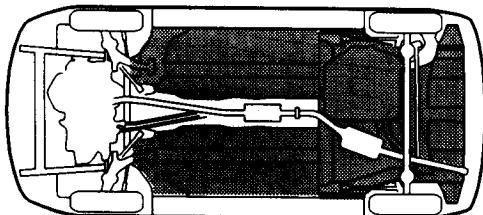
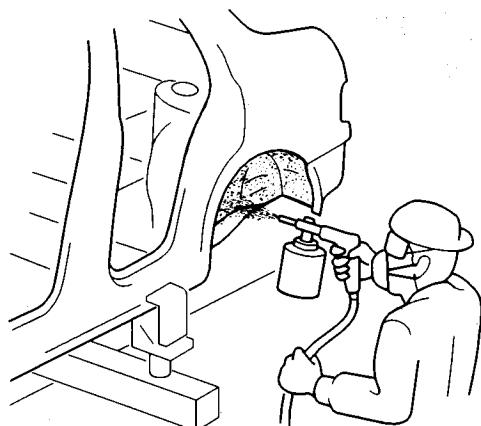
Undercoat:

WARNING

- Wear goggles or safety glasses to prevent eye injury.
- Ventilate when spraying undercoat.

NOTE:

- Mask the exhaust system, oxygen sensors, and suspension mount areas to prevent overspread from the undercoat.
 - Follow the undercoat materials manufacturer's instructions.
1. The body is cleaned with the white gasoline before undercoat is sprayed.
 2. Apply the undercoat to the front wheelhouse, rear wheelhouse, and under sides of the front floor and rear floor (see page 5-16).
 3. Coat the bottom of the fuel tank.



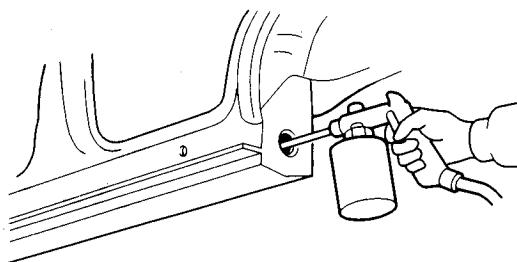
Anti-rust Agents:

WARNING

- Anti-rust agents contain substances that are harmful if you breathe or swallow them, or get them on your skin. Wear coveralls, gloves, eye protection, and an approved respirator while using such agents.
- Ventilate when spraying an anti-rust agent since it contains a small amount of organic solvent. Keep sparks, flames and cigarettes away.

NOTE:

- Do not spray an anti-rust agent on the bake system, exhaust system and its related parts, emission control devices in the engine compartment, ball joint cover, fuel strainer, and exterior and interior parts.
 - Wipe the excess agent with a clean rag dampened with light oil.
 - Follow the anti-rust agent manufacturer's instructions.
1. Before applying an anti-rust agent, thoroughly clean the area to be coated with a steam cleaner, etc., and let dry. Waxoyl may be applied to wet surface.
 2. Apply anti-rust agent from the installation hole and the access hole of parts in the outer panel and the frame (see page 5-17). Spray an anti-rust agent sufficiently until the excess amount oozes out when filling the side sill.



Rust-preventive Treatments

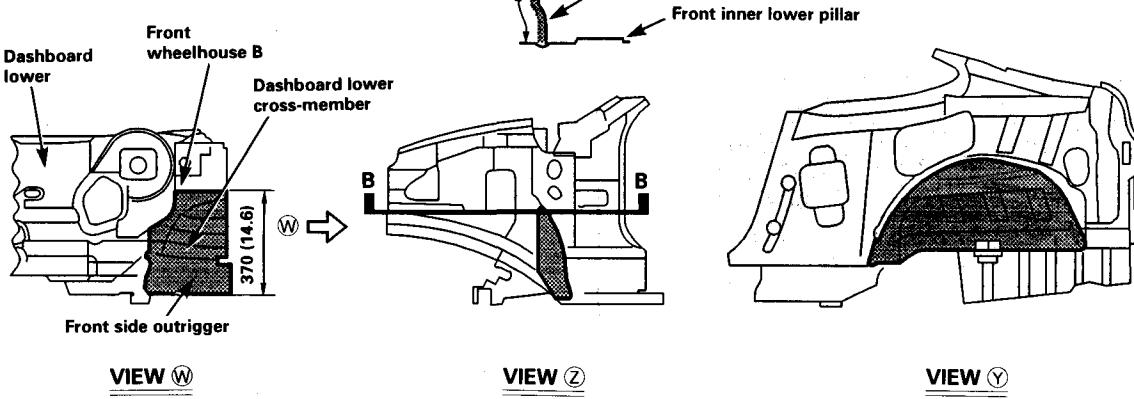
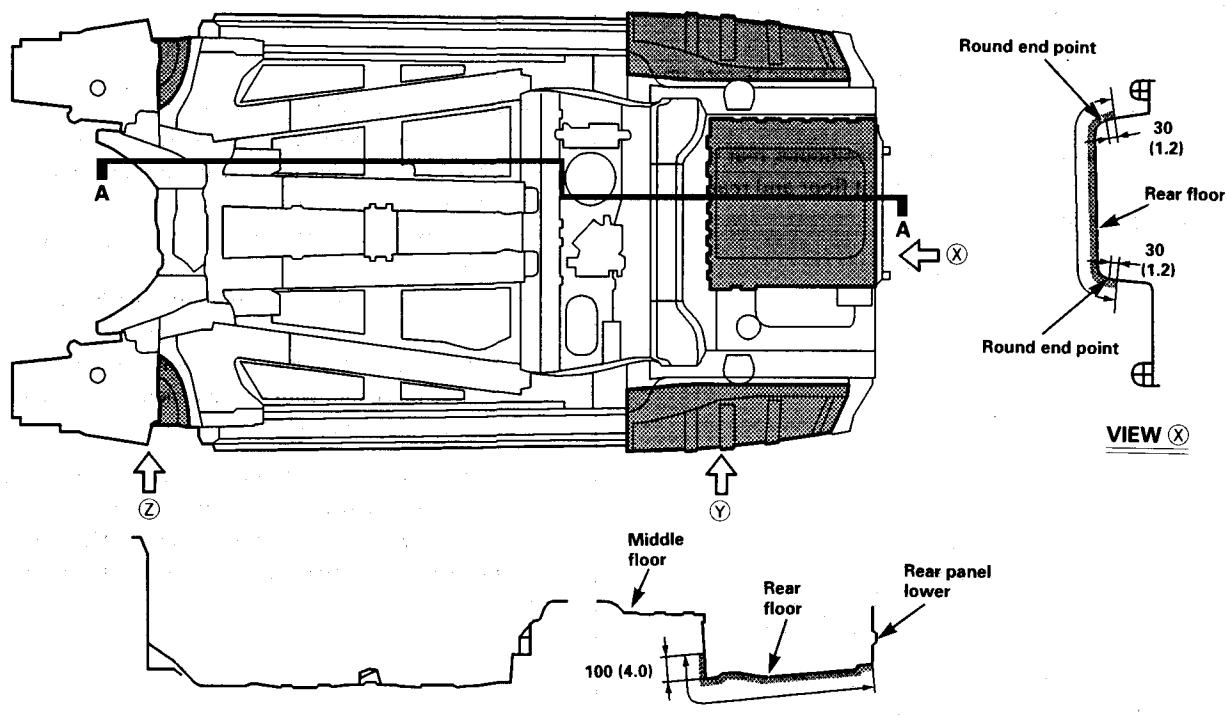
Undercoating Diagram

 Indicates PVC coating area.

NOTE:

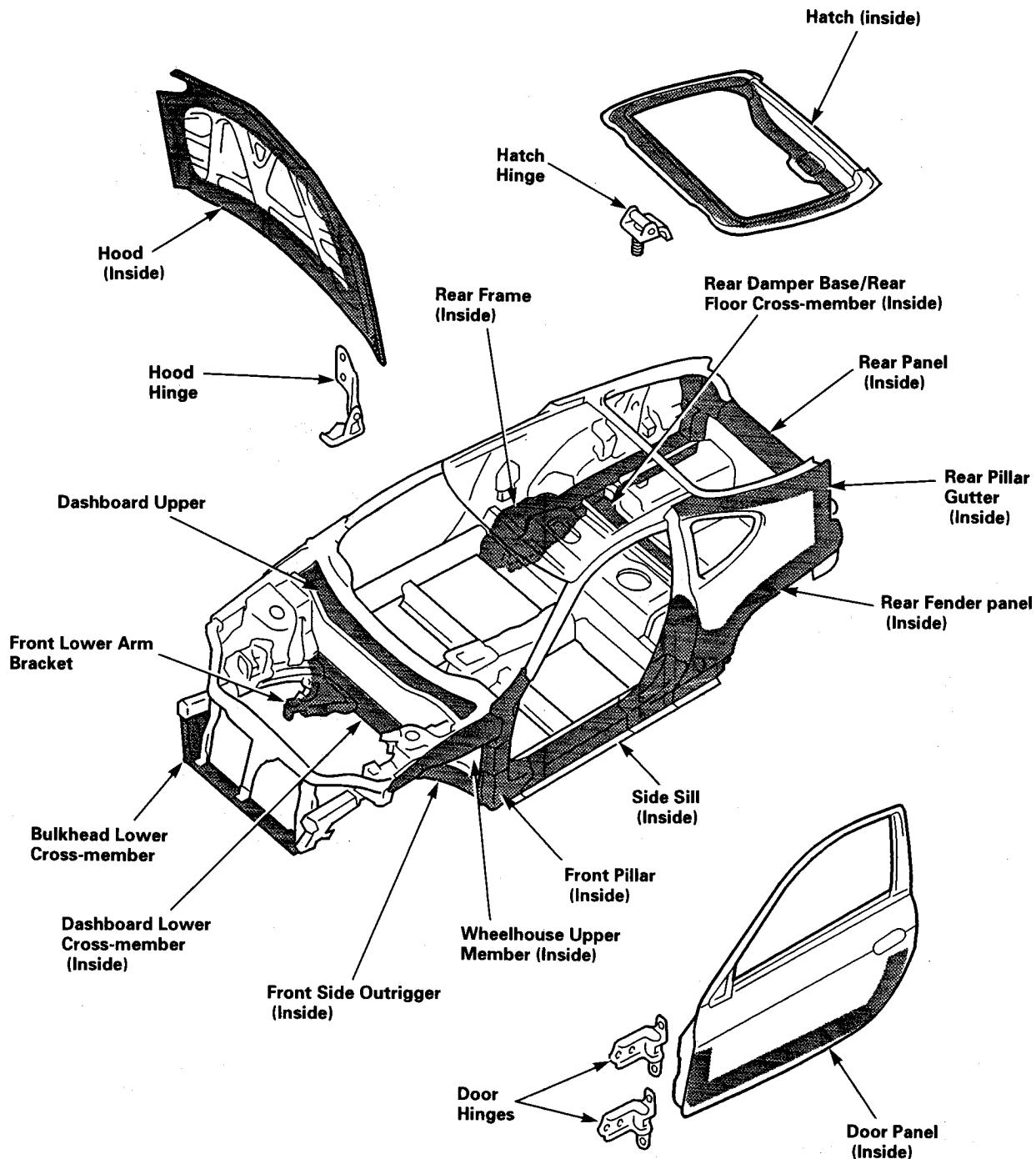
- Coating thickness: 0.4 mm (0.016 in.) MIN.
- Front wheelhouse, rear wheelhouse and dashboard lower on the important control areas, and coating thickness 0.5 mm (0.02 in.)

Unit: mm (in.)



Area to be Covered by Anti-rust Agents

Indicates anti-rust agents.



Materials and Tools

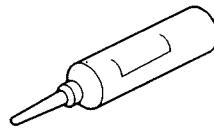
SEALER

Use urethane sealer.

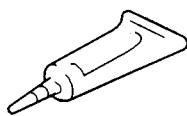
- 3M #08892 (internal)
 - 3M #08893 (external)
- or equivalents.

TOOLS

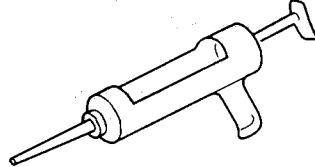
- Cartridge type



- Tube type



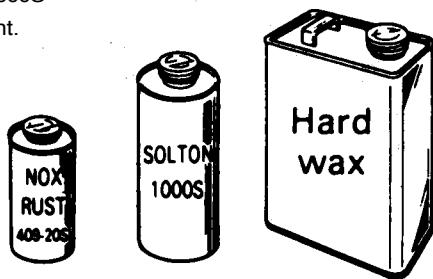
- Sealing gun



UNDERCOAT

To be applied to under-floor and wheelhouse.

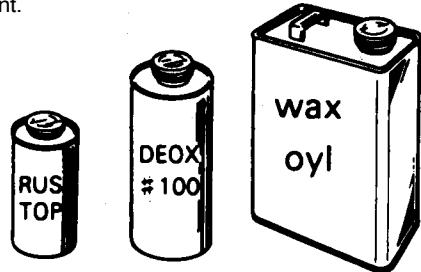
- Nox-rust 409-20S
 - Solton 1000S
- or equivalent.



ANTI-RUST AGENT

To be applied to weld joints inside the body panel.

- Rustop
 - Deox #100
 - Waxoyl
- or equivalent.

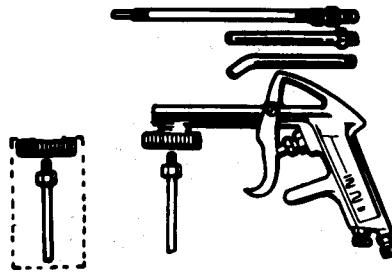


SPRAY GUNS

Use the correct gun for the agent being used.

Use of a pressure type spray gun is recommended when work involves a considerable number of vehicles.

- For noxruxt 409-20S / solton 1000S



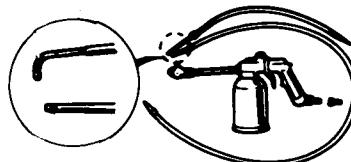
- For rustop



- For deox #100



- For waxoyl



General Safety Precaution

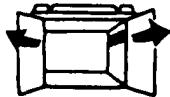
- Most paints contain substances that are harmful if inhaled or swallowed.
 - The following precautions are important items in order to maintain safe painting work.
1. Wear an approved respirator, eye protection when painting.



2. Wear approved gloves, appropriate clothing when painting. Avoid contact with skin.



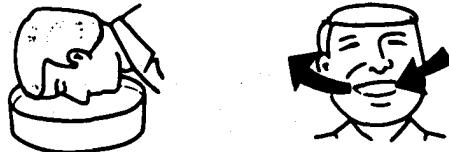
3. Spray paint only in a well ventilated area.



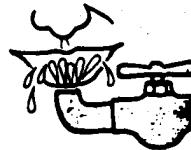
4. Read the paint label before opening the container. Cover spilled paint with sand, or wipe it up at once.



5. If paint gets in your mouth or your skin, rinse or wash thoroughly with water. If paint gets in your eyes, flush with water and get prompt medical attention.



6. After the painting work is finished, wash face and gargle with water.



7. Paint is flammable. Store it in a safe place, and keep it away from sparks, flames, or cigarette.

Body Paint

General

The 3-coat-3-bake (3C•3B) paint finishes give the Insight a deep gloss and stunning finish. This manual provides information on paint defect, repair, and refinishing. Throughout, the objective is to explain in a simple yet comprehensive manner the basic items you should know about paint repairs. Select the correct material for the defect and repaint or refinish in the correct manner as described in this manual.

⚠ WARNING

- Most paints contain substances that are harmful if inhaled or swallowed. Read the paint label before opening the container. Spray paint only in a well ventilated area.
- Cover spilled paint with sand, or wipe it up at once.
- Wear an approved respirator, gloves, eye protection, and appropriate clothing when painting. Avoid contact with skin.
- If paint gets in your mouth or on your skin, rinse or wash thoroughly with water. If paint gets in your eyes, flush with water and get prompt medical attention.
- Paint is flammable. Store it in a safe place, and keep it away from sparks, flames, or cigarettes.

Basic Rules for Repairing a Paint Finish

To repair paint damage, always use the 2-part acrylic urethane paints designated; polish and bake each of the three coats, as in production, to maintain the original film thickness, and to assure the same quality as the original finish.

Outline of Factory Painting Process:



Features in Each Work Process

1. Pretreatment and Electrodeposition

In the pretreatment process, the entire body is degreased, cleaned, and coated with zinc phosphate by dipping.

After the body has been cleaned with pure water, it is placed in an electrolytic bath of soluble primer (Cationic Electrodeposition). This produces a thorough corrosion inhibiting coating on the inner surface and corners of the body, pillars, sills, and panel joints. Chipping primer is then applied to the most susceptible areas (see page 5-14).

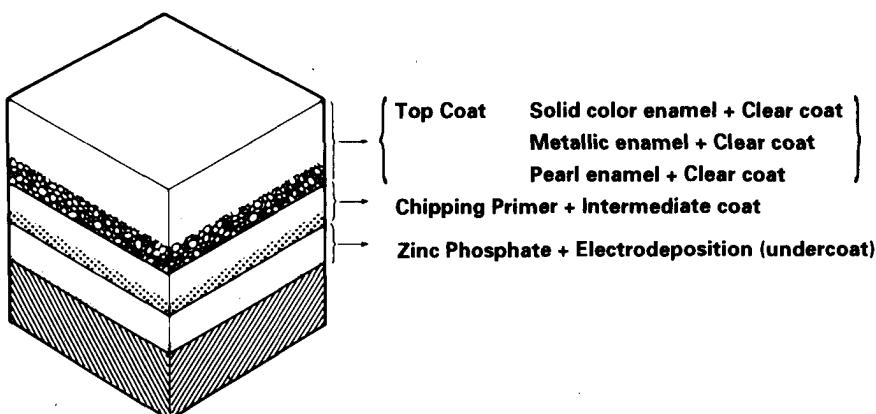
2. Intermediate coat

The intermediate coat is applied to the prepared surface for further protection against damage.

3. Top Coat

Enamel paint and either polyester or acrylic resin paint are used in the top coat for higher solidity, smoothness, brightness, and weather resistance.

Sectional View of Paint Coats:



Body Paint

Refinishing Processes

Paint damage can appear in any form. Before making a repair, check the damaged area carefully, and determine the best procedure for repairing the damage. The following shows you refinishing methods for various types of paint damage or defects.

| Processes | Procedures | Damage | | | Replacement Parts | |
|-------------------------------|--|------------------|-----------------------------------|-------------|-------------------|-------------|
| | | To metal surface | To undercoat / intermediate coats | To top coat | Welded part | Single part |
| 1. Preprocessing of Painting | <ul style="list-style-type: none">● Featheredging● Preparation of metal surface● Air blowing / degreasing | ↑ | | | ↑ | |
| 2. Treatment of Metal Surface | <ul style="list-style-type: none">● Filling / drying● Polishing● Air blowing / degreasing | ★ | | | ↑ | |
| 3. Undercoating | <ul style="list-style-type: none">● Masking● Spraying primer surfacer● Drying● Polishing● Air blowing / degreasing | ↑ | ↑ | | | |
| 4. Intermediate Coating | <ul style="list-style-type: none">● Masking● Spraying top coat enamel● Drying● Polishing● Air blowing / degreasing | ↓ | ↓ | | ↑ | ↑ |
| 5. Top Coating | <ul style="list-style-type: none">● Masking● Spraying top coat enamel / clear coat● Drying● Polishing / buffing | ↓ | ↓ | ↑ | ↓ | ↓ |

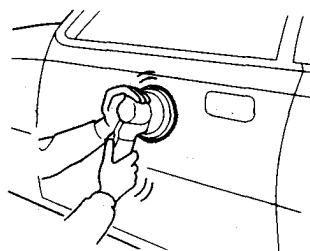
★: Indicates the best method depending on the degree of damage.

Preprocessing of Painting

1. Featheredging

NOTE:

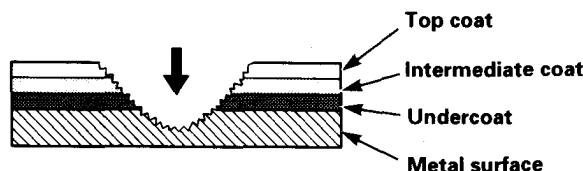
- The paint film damaged area should be sanded flat and smooth.
- If this is not done correctly the end results will not be acceptable.



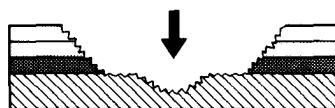
Damage to metal surface:

- Sand the damaged area flat and smooth.

Use the disc sander and #60~#80 disc paper.

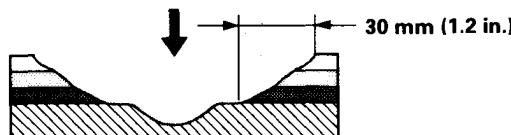


Use the double action sander and #60~#80 disc paper.



- Sand the area larger than the damaged area.

Use the double action sander and #180~#240 disc paper.

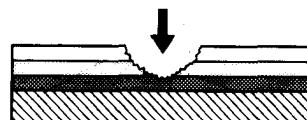


- If a double action sander is not available, use a rubber pad and wet or dry sandpaper.

Use the flexible block and #280, #340, #400, #600 sandpaper.

Damage to undercoat, intermediate coat and top coat:
Sand the damage area flat and smooth

Use the double action sander and #180~#240~#320 disc paper.



2. Preparation of metal surface

Remove all corrosion from the damaged area.

Use a product that removes corrosion.



3. Air blowing / degreasing

Use alcohol, wax, and grease remover.

Body Paint

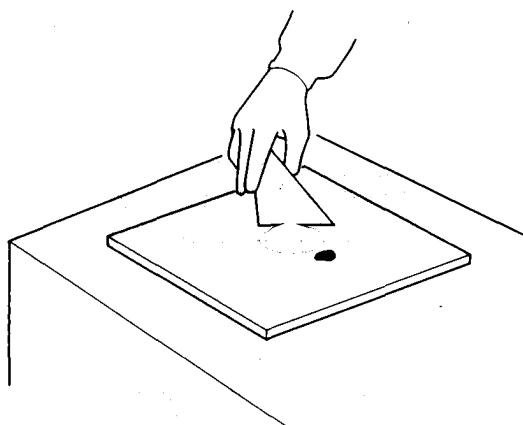
Treatment of Metal Surface

1. Filling / drying

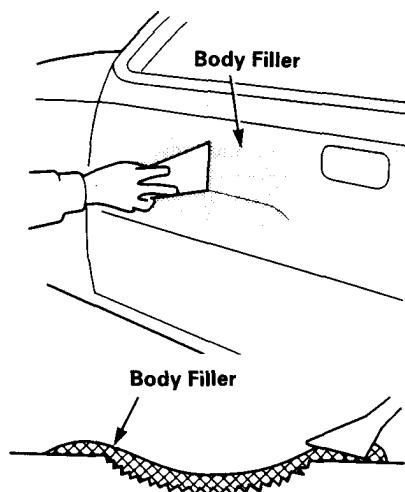
Small cracks or pinholes in the sheet metal should be repaired with a body filler and sanded flat and smooth.

- Use the 2-part polyester resin putty.
- Mix the putty with the hardener in the correct ratio.
- Follow the body filler manufacturer's instructions.

- Mix the body filler and hardener quickly.



- Apply the body filler in several thin coats, without air bubbles.
- Do not try to cover the surface with one heavy coat.
- Apply the body filler over the damaged area with a putty knife using light pressure.



- After applying the body filler, allow 5~6 minutes of normal drying time, then force dry it with infrared lamps or other industrial dryer at 122°F(50°C) ~ 140°F(60°C).

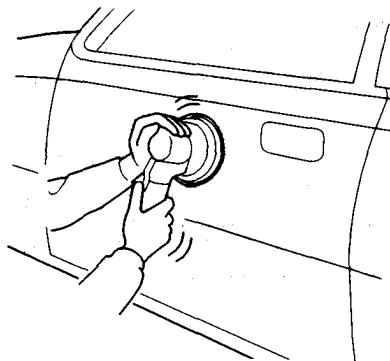
NOTE: Follow the body filler manufacturer's instructions for drying time.

2. Polishing

The body filler is dry a white mark appears when the surface is scratched with your finger nail.

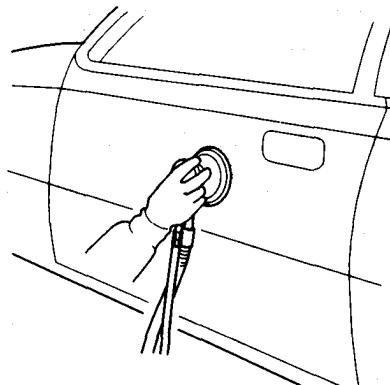
- 1 Throughly sand the body filler surface.

Use the double action sander and #80~#120 disc paper.



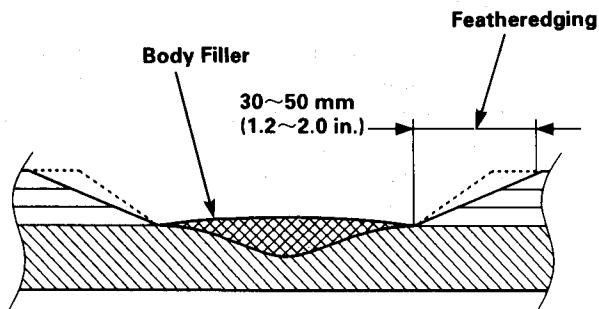
- 2 Sand the surface evenly, particularly the area that was filled.

Use the flexible block and #120~#180 sandpaper.



- 3 Featheredge the paint coat.
Sand the body filler surface until the proper dimension are met.

Use the double action sander and #240~#320~#400 disc papers.



3. Air blowing / degreasing

Use the alcohol, wax and grease remover.

Also clean and degrease the surfaces where masking tape will be attached.

Undercoating

1. Masking

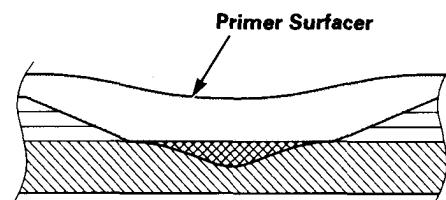
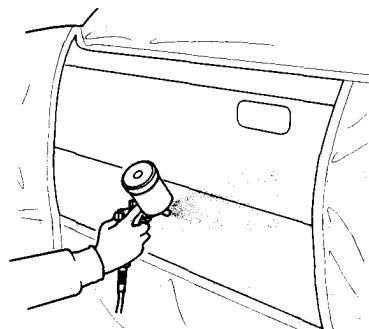
Mask the area surrounding the damage to prevent overspray from the primer surfacer.

Use the masking tape and paper.

2. Spraying primer surfacer

- Spray the primer surfacer over a wider area than the body filler and the exposed surface of the paint film.
- Spray 2~3 coats to get 30 microns of thickness.

- Use the 2-part urethane primer surfacer and a spray gun.
- Mix the primer surfacer with the additive and solvent, and in the correct ratio.
- Follow the primer surfacer manufacturer's instructions.



3. Drying

After spraying primer surfacer, allow for 5~10 minutes of normal drying time, then force dry it with infrared lamps or other industrial dryer.

NOTE: Follow the primer surfacer manufacturer's instruction for drying time.

(cont'd)

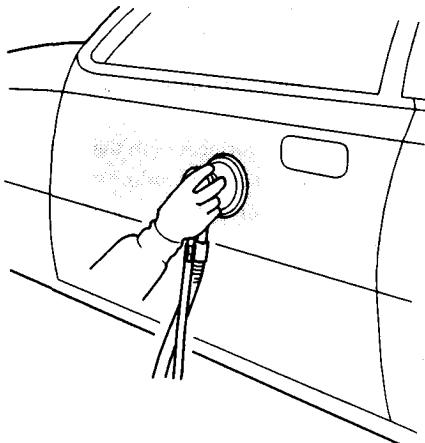
Body Paint

Under Coating (cont'd)

4. Polishing

Check that the primer surfacer has dried thoroughly, then sand the primer surfacer.

Use the double action sander and #320~#400~#600 disc papers.



5. Air blowing/degreasing

Use the alcohol, wax and grease remover.

Also clean and degrease the surfaces where the masking tape will be attached.

Body Paint

Intermediate Coating

1. Masking

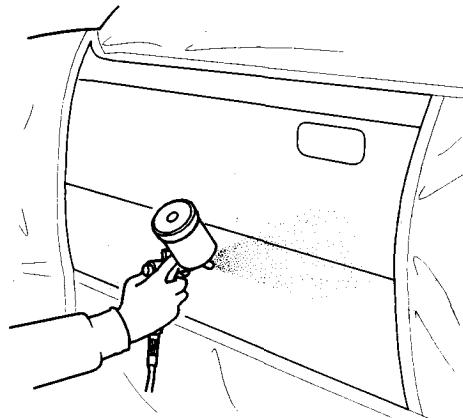
Mask the area surrounding the damage to prevent overspray from the intermediate coat.

Use masking tape and paper.

2. Spraying top coat enamel

Spray the top coat enamel over the surface until the primer surface is fully covered.

- Use the 2-part polyester urethane top coat enamel and a spray gun.
- Mix the top coat enamel with the additive and solvent, and in the correct ratio.
- Follow the top coat manufacturer's instructions.



3. Drying

After spraying top coat enamel, allow for 5~10 minutes of normal drying time, then force dry it with infrared lamps or other industrial dryer.

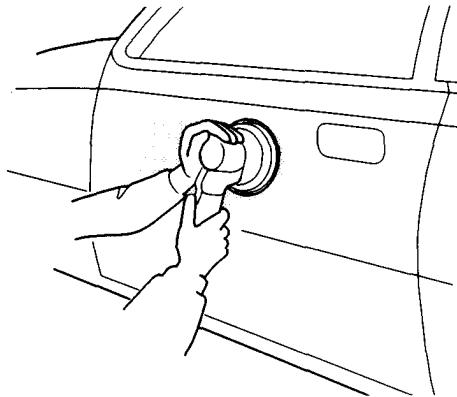
NOTE: Follow the top coat manufacturer's instruction for drying time.

4. Polishing

Check that the top coat enamel has dried thoroughly, then sand the top coat enamel.

Use the double action sander and #600~#800 disc papers.

NOTE: Be careful not to polish down to the primer sur-facer.



When the painting repair is almost done, polish the area that will be top coated.

Use the #2000 sandpaper and compound.

5. Air blowing /degreasing

Use alcohol, wax, and grease remover.

Also clean and degrease the surfaces where the masking tape will be attached.

Top Coating

1. Masking

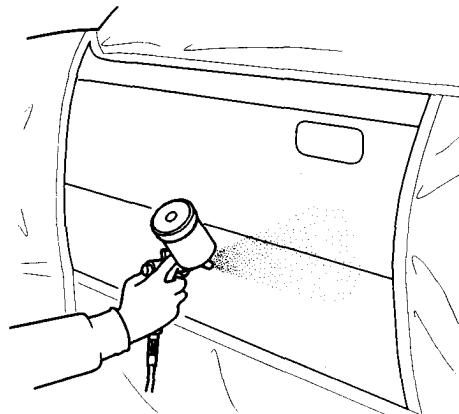
Mask the area surrounding the damage to prevent overspray from the top coat.

Use masking tape and paper.

2. Spraying top coat enamel / clear coat

Spray 2~3 double coat until the intermediate coat is fully covered.

- Use the 2-part polyester urethane top coat enamel and a spray gun.
- Mix the top coat enamel with the additive and solvent, and in the correct ratio.
- Follow the top coat manufacturer's instructions.



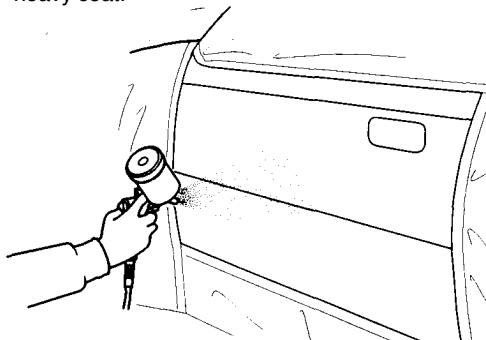
Drying

After spraying the top coat enamel, allow it to air dry, then force dry it with infrared lamps or other industrial dryer.

NOTE: Follow the top coat manufacturer's instructions for drying time.

Spraying clear coat

Spray the top coat clear evenly over the surface of the top coat enamel. Do not try to cover the surface with one heavy coat.



(cont'd)

Body Paint

Top Coating (cont'd)

Drying

After spraying the clear c6at, allow it to dry for 10 minutes, then force dry it with infrared lamps or other industrial dryer.

NOTE: Follow the top coat manufacturer's instructions for drying times.

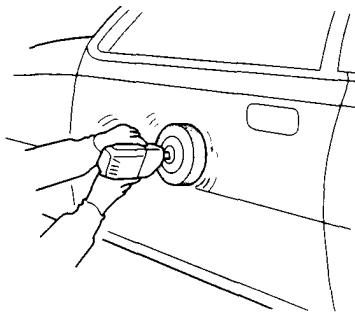
3. Polishing / buffing

Check that the clear coat has dried thoroughly.

The clear coat is cooled.

- 1 Any adhesion or roughness on the top coat should be wet sanded and repaired.

Use the #1200~#2000 and crystal block.



- 2 Polish any roughness caused by sanding.

NOTE: Clean the top coat surface frequently so you don't damage the clear coat with the polishing particles.

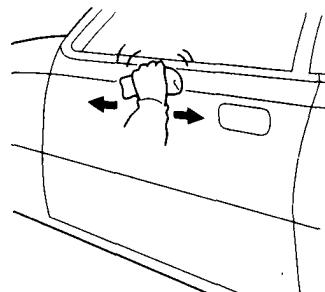
Use a buffering towel, buffering wool, and compound.

- 3 Finishes up with buffering.

NOTE:

- Do not use a power buffer.
- Don't polish too much; use light hand pressure.

Use the buffering sponge, fine compound, very fine compound, then ultra fine compound.



- 4 After buffering, remove the masking paper and tape, and thoroughly wash the entire vehicle.

Plastic Parts Paint

Features of Plastic Material

- Check each of the plastic arts for solvent resistance and heat resistance temperatures before you do any repair work.
- Select the repair material according to materials of the plastic parts.

| Standard Symbol | Name | Heat Resistance Temperature °F (°C) | Solvent Resistance | Note |
|-----------------|---|-------------------------------------|--|--|
| AAS | Acrylonitrile acrylic styrene | 176 (80) | A small amount of alcohol is acceptable for a short time. (Degreasing) | An organic solvent such as gasoline is not recommended. An aroma product is not recommended. |
| ABS | Acrylonitrile butadiene styrene | 176 (80) | A small amount of alcohol is acceptable for a short time. (Degreasing) | An organic solvent such as gasoline is not recommended. An aroma product is not recommended. |
| AES | Acrylonitrile ethylene styrene | 176 (80) | A small amount of alcohol is acceptable for a short time. (Degreasing) | An organic solvent such as gasoline is not recommended. An aroma product is not recommended. |
| A/EPDM/S | Acrylonitrile / ethylene propylene diene rubber / styrene | 176 (80) | A small amount of alcohol is acceptable for a short time. (Degreasing) | An organic solvent such as gasoline is not recommended. An aroma product is not recommended. |
| ASA | Acrylonitrile styrene acrylate | 176 (80) | A small amount of alcohol is acceptable for a short time. (Degreasing) | An organic solvent such as gasoline is not recommended. An aroma product is not recommended. |
| CAB | Cellulose acetate butylate | 176 (80) | A small amount of alcohol is acceptable for a short time. (Degreasing) | An organic solvent such as gasoline is not recommended. An aroma product is not recommended. |
| E/VAC | Ethylene-vinyl acetate | 176 (80) | A small amount of alcohol and gasoline are acceptable for a short time. (Degreasing) | Soaking with an organic solvent such as gasoline and alcohol is not recommended. |
| PA | Polyamide | 176 (80) | Alcohol and gasoline are acceptable. | Battery acid (sulfuric acid) is not recommended. |
| PBT | Polybutylene terephthalate | 320 (160) | Alcohol and gasoline are acceptable. | Solvent is not recommended. |
| PC | Polycarbonate plastics | 248 (120) | A small amount of alcohol is acceptable for a short time. | Bbrake fluid, and wax and grease remover is not recommended. |
| PE | Polyethylene | 176 (80) | Alcohol and gasoline are acceptable. | Solvent is not recommended. |
| PF | Phenol form aldehyde | 176 (80) | A small amount of alcohol is acceptable for a short time extremely. (Degreasing) | Soaking with an organic solvent such as gasoline and alcohol is not recommended. |
| PMMA | Polymethyl methacrylate | 176 (80) | A small amount of alcohol is acceptable for a short time. (Degreasing) | Soaking with an organic solvent such as gasoline and alcohol is not recommended. Wash remover off with water thoroughly. |
| POM | Polyoxymethylene polyacetal | 212 (100) | Alcohol and gasoline are acceptable. | Solvent is not recommended. |

(cont'd)

Plastic Parts Paint

Features of Plastic Material (cont'd)

| Standard Symbol | Name | Heat Resistance Temperature °F (°C) | Solvent Resistance | Note |
|-----------------|--|-------------------------------------|---|--|
| PP | Polypropylene | 176 (80) | Alcohol and gasoline are acceptable. | Solvent is not recommended. |
| PPO (PPE) | Polyphenylene oxide | 212 (100) | A small amount of alcohol is acceptable in a short time. | Soaking with an organic solvent such as gasoline and alcohol is not recommended. |
| PS | Polystyrene | 140 (60) | A small amount of alcohol is acceptable in a short time. | Soaking with an organic solvent such as gasoline and alcohol is not recommended. |
| PUR | Polyurethane | 176 (80) | A small amount of alcohol is acceptable for a short time (Degreasing) | Soaking with an organic solvent such as gasoline and alcohol is not recommended. |
| PVC | Polyvinyl chloride | 176 (80) | A small amount of alcohol and gasoline are acceptable for a short time. (Degreasing) | Soaking with an organic solvent such as gasoline and alcohol is not recommended. |
| SAN | Styrene acrylonitrile | 176 (80) | Wiping alcohol off in a short time can be allowed. | Soaking with an organic solvent such as gasoline and alcohol is not recommended. |
| SMC | Sheet molding compound | 356 (180) | Alcohol and gasoline are acceptable. | Solvent is not recommended. |
| TPE | Thermoplastic polyester elastomer | 176 (80) | Alcohol is acceptable and wiping gasoline for a short time can be allowed. (Degreasing) | Soaking with an organic solvent such as gasoline and alcohol is not recommended. Wash remover off with water thoroughly. |
| TPS | Thermoplastic styrene elastomer | 176 (80) | A small amount of alcohol and gasoline are acceptable for a short time. (Degreasing) | Soaking with an organic solvent such as gasoline and alcohol is not recommended. Wash remover off with water thoroughly. |
| TPO | Thermoplastic olefin / elastomer | 176 (80) | Alcohol is acceptable and wiping gasoline for a short time can be allowed. (Degreasing) | Soaking with an organic solvent such as gasoline and alcohol is not recommended. Wash remover off with water thoroughly. |
| TPU | Thermoplastic / urethane / elastomer | 176 (80) | A small amount of alcohol and gasoline are acceptable for a short time. (Degreasing) | Soaking with an organic solvent such as gasoline and alcohol is not recommended. Wash remover off with water thoroughly. |
| UP | Polyester | 230 (110) | Alcohol and gasoline are acceptable. | Alkali is not recommended. |
| ABS + PA6 | Acrylonitrile butadiene styrene/ Polyamide | 176 (80) | A small amount of alcohol is acceptable in a short time. (Degreasing) | An organic solvent such as gasoline is not recommended. An aroma product is not recommended. |

Use of the Repair Material (reference)

NOTE: Follow the materials manufacturer's instructions.

The use of a special polyester putty for PP bumper is described here:

1. Filler

Mixing Ratio:

| Putty | Hardener |
|-------|----------|
| 100 | 2~3 |



Hardening starts immediately after mixing.

Available time: 6~9 minutes / 68°F (20°C)



Almost hard: 15 minutes



Completely hard: More than 30 minutes

Drying Time:

| | |
|------------------------|------------|
| Air dry 68°F (20°C) | 3 hours |
| Force dry 140°F (60°C) | 30 minutes |

2. Sanding filler

Spray the bumper primer (see page 6-15) on the area where the PP material was used.

3. Primer surfacer

The primer surfacer is used to protect the PP resin surface and fill cavities or flaws before the intermediate coat and top coat.

Use the 2-component type primer surfacer (gray).

Mixing Ratio:

| Primer Surfacer | Hardener |
|-----------------|----------|
| 10 | 1 |



30~60% is diluted with thinner.

4. Intermediate coat and top coat

Use the 2-part polyester urethane top coat.

Top coat is also used for an intermediate coat.

Mixing Ratio:

| Top coat | Softener |
|----------|----------|
| 10 | 1 |



| Top coat + Softener | Hardener |
|---------------------|----------|
| 10 | 1 |



30~60% is diluted with thinner.

NOTE: Use a spray gun to apply the paint. Do not use a brush.

Drying Time:

| | |
|---------------------|---|
| Air dry 68°F (20°C) | 6~10 minutes Touching by the finger. |
| Almost hardened | 12~24 hours |
| Thoroughly hardened | 96 hours |

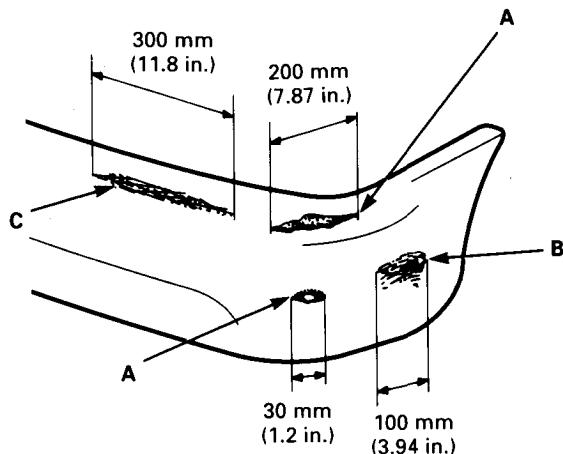
Force dry the intermediate coat and top coat.

NOTE: Mix only an amount that can be used before it hardens.

Plastic Parts Paint

Refinishing Processes

- The following shows refinishing methods to various types of paint damage or defects.
- Be careful not to deform and damage the parts when force drying.



A: Hole / Deep Gouge

B: Deep Abrasion 3 mm (0.12 in.) approx.

C: Shallow Scratch 1 mm (0.04 in.) approx.

| Processes | Procedures | PP | | Other plastics | | | | ABS + PA6 | |
|------------------------------|---|--------|---|----------------|-------------------|---|---|-----------|--|
| | | Damage | | Damage | | C | | | |
| | | A / B | C | ABS / PC | Nylon / polyester | B | C | | |
| 1. Preprocessing of Painting | <ul style="list-style-type: none"> Sanding Air blowing / degreasing | | ↑ | ↓ | ↓ | ↑ | ↓ | ↑ | |
| 2. Undercoating | <ul style="list-style-type: none"> Spraying primer Drying Filling / Sanding Air blowing / degreasing Spraying primer surfacer Drying Sanding Air blowing / degreasing | | | | | ↑ | | ↑ | |
| 3. Intermediate Coating | <ul style="list-style-type: none"> Masking Spraying top coat enamel Drying Polishing Air blowing / degreasing | | | | | | | | |
| 4. Top Coating | <ul style="list-style-type: none"> Masking Spraying top coat enamel / clear coat Drying Polishing / buffing | | ↓ | ↓ | ↓ | ↑ | ↑ | ↓ | |

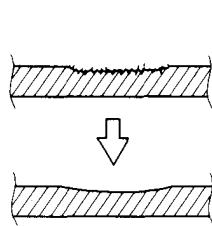
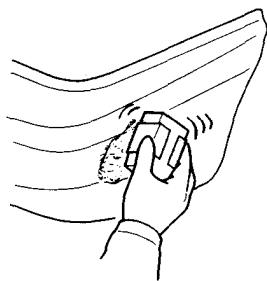
Preprocessing of Painting

1. Sanding

Sand the damage area flat and smooth.

Shallow Scratch:

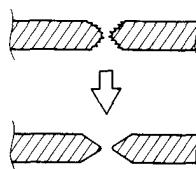
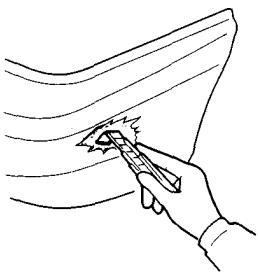
Use a flexible block and #240~#400~#600 sandpaper.



Hole / Deep Gouge:

Cut out and make any torn or burred area flat.

Use a knife, flexible block, and #180~#240 sandpapers.



2. Air blowing/degreasing

Clean the damaged area thoroughly.

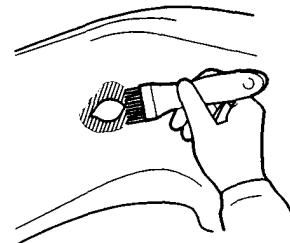
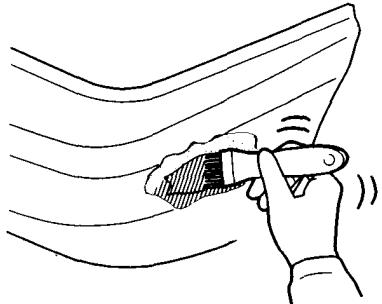
Use alcohol and wax and grease remover.

Undercoating

1. Spraying primer

Primer is used to fill cavities in the putty and primer surface.

- Spray primer on the exposed area.
 - Spray the 2~3 coats of primer on 2~3 coats over the area you applied putty.
 - Apply primer to the back of the bumper if the damage is a tear or hole.
- Bumper primer (Reference)
 - Warm the primer if the ambient temperature is below 50°F (10°C).
 - Follow the bumper primer manufacturer's instructions.
 - Use the spray gun and brush.



Drying

NOTE: Take care not to let the heat lamp deform the bumper during the drying process.

Dry the bumper primer thoroughly with an infrared dryer or other suitable method.

Drying Time:

| | |
|------------------------|------------|
| Air dry 68°F (20°C) | 20 minutes |
| Force dry 140°F (60°C) | 10 minutes |

(cont'd)

Plastic Parts Paint

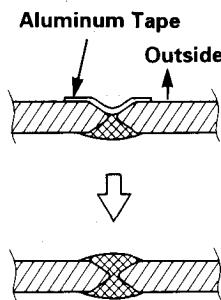
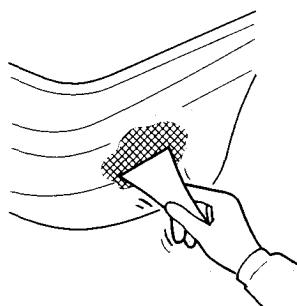
Under Coating (cont'd)

2. Filling /Sanding

Apply putty to repair any holes or deep gouges.

- Apply the putty on the damaged area in 2~3 steps.
- Glue aluminum tape on the outside of the bumper, and apply putty from the other side of the bumper.
- Remove the aluminum tape after the putty dries, apply putty from the outside, and fill the hole.

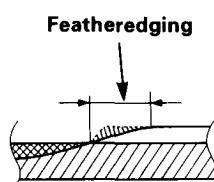
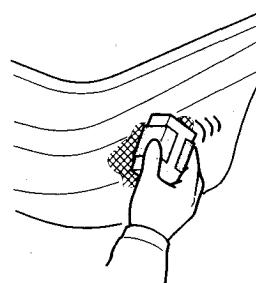
Use a special polyester putty (Reference) and a putty knife.



3. Sanding

Sand the surface evenly, particularly at the area where the PP material and putty meet.

Use a flexible block and #240~#400~#600 sandpaper.



4. Air blowing /degreasing

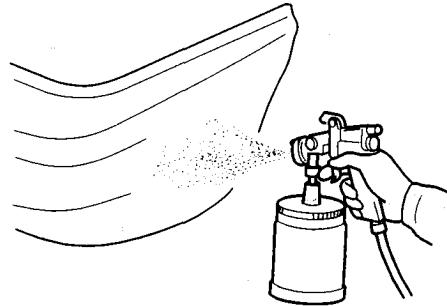
Use alcohol, a tack cloth, and wax and grease remover.

5. Spraying primer surfacer

NOTE: Spray the bumper primer (see page 6-13) on the area where the PP material was exposed and the around the putty.

- Spray the primer surface wider than the putty and painted surfaces of bumper primer.
- Spray 2~3 coats to get 20~30 microns of thickness.

• Use the 2-component type primer surfacer (gray) and a spray gun.
• Follow the materials manufacturer's instructions.



Drying

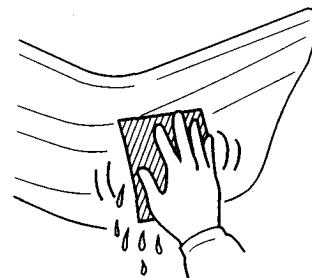
NOTE: Take care not to let the heat lamp deform the bumper during the drying process.

6. Sanding

After drying, wet sand the area of the intermediate coat.

Use the #600 sandpaper.

NOTE: Do not use #600 or less.



7. Air blowing /degreasing

Use alcohol, a tack cloth, and wax and grease remover.

Also clean and degrease the surfaces where the masking tape will be attached.

Intermediate Coating

NOTE: You must do this procedure on the PP parts of the bumper and side sill panel.

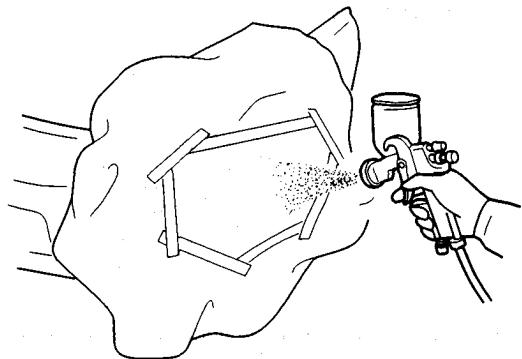
1. Masking

Mask the area surrounding the damage to prevent overspray from the intermediate coat.

Use masking tape and paper.

2. Spraying top coat enamel

- Spray the top coat enamel over the surface until the primer surfacer is fully covered.
- Spray 2~3 coats to get 15~25 microns of thickness.
 - Use the 2-part polyester urethane top coat enamel and a spray gun.
 - Mix the top coat enamel with the additive and solvent, and in the correct ratio.
 - Follow the top coat manufacturer's instructions.



Drying

NOTE: Take care not to let the heat lamp deform the bumper during the drying process.

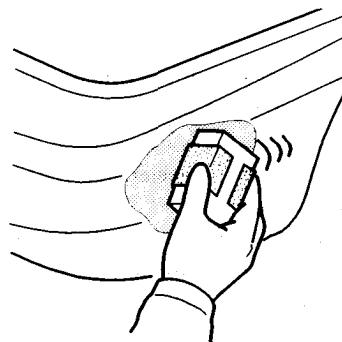
After spraying top coat enamel, allow for 5~10 minutes of normal drying, then force dry it with infrared lamps or other industrial dryer.

3. Polishing

Check the top coat enamel has dried thoroughly, then sand the top coat enamel.

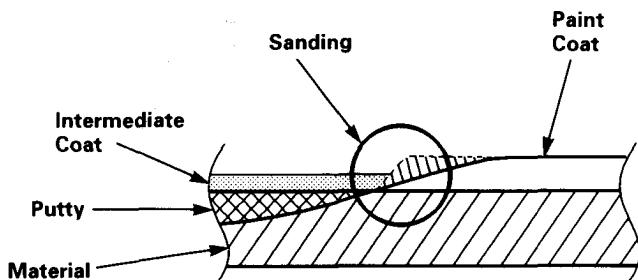
Use a flexible block and #600~#800~#1000 sandpaper.

NOTE: Be careful not to sand down to the primer surfacer.



When the painting repair is almost complete, polish the top coat.

Use #1500 sandpaper and compound.



4. Air blowing/degreasing

Use alcohol, a tack cloth, and wax and grease remover.

Clean and degrease the surfaces where the masking tape will be attached.

Plastic Parts Paint

Top Coating

1. Masking

Mask the area surrounding the damage to prevent overspray of the top coat.

Use masking tape and paper.

2. Spraying top coat enamel / clear coat

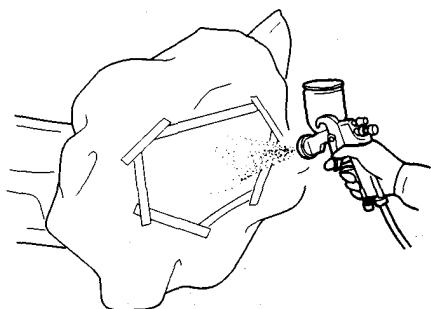
Spray 2~3 coats in double coat until the intermediate coat is fully covered.

NOTE:

- Do not cover the surface with one heavy coat.
- Apply several thin coats.

- Use the 2-part polyester urethane top coat enamel and a spray gun.
- Mix the top coat enamel with the additive and solvent, and in the correct ratio.
- Follow the top coat manufacturer's instructions.

After spraying the top coat enamel, allow for 5~10 minutes drying time before you spray the clear coat.



Drying

NOTE: Take care not to let the heat lamp deform the bumper during the drying process.

After spraying the clear coat, allow for 5~10 minutes drying time before you force dry it with infrared lamps or other industrial dryer.

3. Polishing / buffing

- Check that the clear coat has dried thoroughly.
- Wet sand to remove any imperfections.

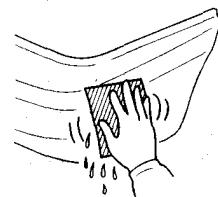
Use a flexible block, soap, and #2000 sandpaper.

- Using a buffer and compound, remove any polishing marks made from the sandpaper.

Use a buffering sponge, and buffering wool and compounds.

Finish up with buffering:

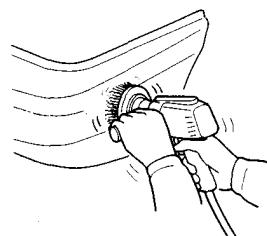
- 1 Wet sands with #2000 sandpaper and soapy water.



- 2 Remove moisture using compressed air.

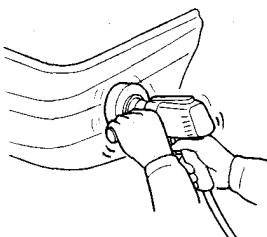
- 3 Finish using fine compound and very fine compound. Do not polish with an electric polisher.

NOTE: Polish lightly.



- 4 Check the finished area at an angle, and make sure there are no polishing marks.

- 5 Polish with ultra fine compound and a buffering sponge.



- 6 Wax the finished area.



Glossary

| | |
|------------------------------------|---|
| All paint | Painting of complete surface. |
| Block paint | Painting a section only, such as a door. |
| Clear paint (clear coat) | Clear paint without dye (pigment). |
| Compressed air | Use compressed air to blow away dust and debris. |
| Double coat | Application of two paint coats. |
| Dry coat | Paint which left the spray gun and dried partially before it reached the surface, thereby making the painted surface rough. Dry coating is caused by too little paint being fed, too high an air pressure, too much distance between the painted surface and the gun, or moving the gun too fast. |
| Dry film | Paint which has dried completely. |
| Dust coat | Paint is applied thinner than a dry coat. Painted surface becomes rough. |
| ED painting | Electrostatic discharge painting. |
| Enamel | Finishing paint pigmented with dye. |
| Featheredging | Smoothing off the edges of painted surfaces. |
| Flash off | Evaporation of the paint solvent. (Flash off time is the period between paint coat applications.) |
| Ford cup | A type of viscosity meter . |
| Gun stroke | Movement of the paint gun. |
| Hardener | Hardening agent of two-liquid type paint or fillers. Polycyanates and oxides are used for hardeners. |
| Heat-hardening acrylic resin paint | Composed of acrylic resin and meramine resin, and hardened (forms a paint film) by baking. |

Glossary

| | |
|---------------------|---|
| Lacquer | A type of paint that uses cellulose nitrate or other chemicals, and which dries by evaporation of its solvent agent. |
| Meramine resin | Used as component for aminoalkyd resin paint and heat-hardening acrylic resin paint. |
| Metallic-base paint | Paint with aluminum powder for metallic tone. |
| Mist coat | Painting for fade-in sections. A small amount of paint may be dissolved with slow-evaporating thinner, or thinner alone may be applied with low pressure. 150-200kPa (1.5-2.0 kgf/cm ² , 21.3-28.4psi) |
| Mixing scale | Color mixing device. |
| Overlap | Blending of spray patterns. |
| Overspray | Spraying other than the area that needs painting. |
| Paddle | A tool to mix paint. |
| Paint dust | Dust of paint formed by spraying. |
| Paper dispenser | A paper posting device (masker) that combines tape and paper. |
| Scrapes | Traces of scratches. |
| Scuffing | Particles on the painted surface are lightly polished with fine emery paper (#600 or over). |
| Set (setting) | Evaporation time of solvent in the paint, before drying the layer forcefully or by baking. (May be considered the same as flash-off time.) |
| Single coat- | Application of paint in single layer. |
| Spot paint | Painting of small section, such as for touch-up. |
| Undercoat | Undercoat paint (such as primer and surfacer). May be applied to lower section of car for noise prevention and rustproofing. |

| | |
|-------------|--|
| Wet coat | Paint is applied with an excess of solvent, thereby producing a painted surface that's smooth, glossy, and has a wet look. |
| Wet film | Paint which has not dried completely. |
| Wet on wet | Application of the next coat of paint before the preceding layer has dried completely. |
| Wool bonnet | Wool grinder for compound polishing. |

General Information

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The symbols in the mass production body welding diagrams and in the replacement illustrations carry the following meanings:

(Mass Production Body Welding Diagram)

- ★ : Spot welding
- ▽ : MIG welding
- × : 2-plate welding
- ⊗ : 3-plate welding
- ⊗ : 4-plate welding
- P= : Spot welding pitch
- L= : MIG welding length
- Unit: mm (in.)
- () : The number of spot welds.

(Replacement Illustration)

- X : Spot welding
- : MIG welding

NOTE: The welding symbols in the illustrations don't show exact welding locations. For exact welding locations, refer to the mass production body welding diagrams.

Body Dimensional Drawings

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| | |
|---|-----|
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| | |
|---------------------------------|-----|
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| Hatch Opening | 4-6 |

Under Body Measuring Dimensions

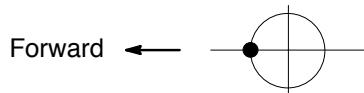
| | |
|------------------|-----|
| Under View | 4-7 |
|------------------|-----|

Frame Repair Chart

| | |
|-----------------|------|
| Top View | 4-8 |
| Side View | 4-10 |

Note: Measuring dimensions show the distance between the forward or upper edge of positioning bosses and /or holes shown in the detail sketches.

Measuring point (Black dots)



F: Forward

C: Center

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| | |
|--|-------------|
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