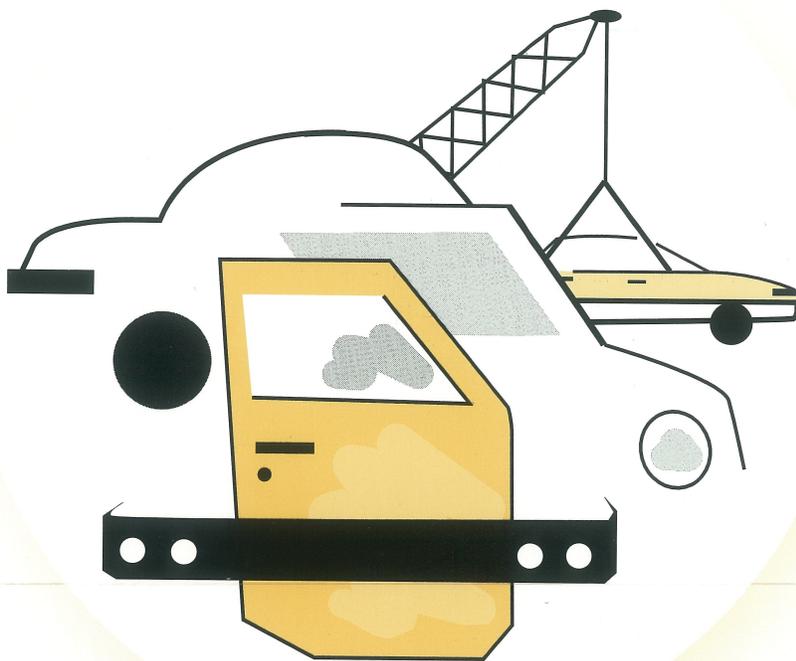


Salvage Vehicles

Salvage Vehicles

1999 INSPECTION HANDBOOK

Includes Recommended Procedures
for the United States and Canada



Published by the
American Association of Motor Vehicle Administrators

CCMTA • CCATM

In Partnership with the
Canadian Council of Motor Transport Administrators

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Introduction

The American Association of Motor Vehicle Administrators (AAMVA) in partnership with the Canadian Council of Motor Transport Administrators (CCMTA) is proud to offer this section of the new, expanded edition of the *Vehicle Inspection Handbook Set*, with recommended inspection procedures and standards for all types of vehicles in the United States and Canada including:

- Motorcycles,
- Passenger Vehicles & Light Trucks,
- Salvage Vehicles,
- Trucks, Buses & Trailers, and
- Emissions.

Each handbook section contains information compiled from multiple sources and is based on actual working systems and programs in the United States and Canada.

To order additional handbook sections, use the order form provided with this manual or contact AAMVA (703-522-4200). In Canada, contact CCMTA (613-736-1003).

Salvage Inspections Are Different

The *Salvage Vehicle Inspection Handbook* identifies major areas that should be inspected to confirm that a salvage vehicle has been repaired to a condition similar to what it was before it was damaged. A salvage vehicle is usually defined as a vehicle that was previously declared a total loss by an insurer as the result of damage.

Inspection procedures for salvage vehicles are different than those used in a standard vehicle inspection because the inspector also is looking for deficiencies in major components

that may have been caused as the result of a collision, fire, flood or other destructive occurrence. Not only should the salvage vehicle inspection ensure that any damage that could cause or contribute to an accident is repaired, but also that occupant protection features have been restored as well. (See the *Passenger Vehicles & Light Trucks Inspection Handbook* for minimum recommended inspection procedures.)

Note: Lighting devices, brakes, exhaust, mirrors, wipers, and glazing should be inspected in accordance with current standard inspection procedures, except as specifically noted.

Consumer Protection Benefits

Since some people try to profit from repairing salvage vehicles by using inferior materials or procedures, salvage vehicle inspections also help protect consumers from purchasing misrepresented vehicles that are not safe to operate.

Based on Information from U.S. and Canadian Experts

This handbook is based on the Saskatchewan and the Connecticut Salvage Vehicle Inspection Handbooks and was revised and expanded by members of AAMVA's Handbook Working Group, which is part of AAMVA's Engineering and Vehicle Inspection Committee, and by representatives from CCMTA, the Society of Collision Repair Specialists, and other auto body organizations.

The recommendations presented in this handbook reflect the majority view of the AAMVA Handbook Working Group, but every recommendation is not necessarily endorsed by each reviewer.

How To Use This Handbook

Designed for use by government officials, fleet operators, inspection managers and others who want to update or enhance existing procedures or develop new inspection programs, this handbook provides practical, up-to-date inspection procedures, recommendations and rejection criteria for salvage vehicles. It also is intended to serve as a useful teaching tool for inspection training programs and as a resource guide for maintenance programs.

Every effort has been made to provide specific inspection recommendations except where jurisdictions vary widely on what is acceptable, or where there is a broad range of acceptable conditions depending on the type of vehicle that is being inspected. In those instances, recommendations in this handbook rely on and refer to recognized industry specifications and limits, directly or indirectly, through the use of terms such as “properly,” “adequate,” “inadequate,” “excessive,” “perceptible,” etc.

Differences between Canadian and United States minimum recommendations or procedures are clearly noted in the text by a maple leaf icon for Canada and a stars and stripes icon for the United States.

Also, please note that some jurisdictions may have more stringent requirements than the ones set forth in this handbook.

Handbook Reflects Experience and Cooperation

AAMVA has been involved in publishing vehicle inspection handbooks since the late 1980s, when AAMVA and the National Highway Traffic Safety Administration began working cooperatively to publish handbooks for passenger vehicles and trucks and buses with information provided primarily by the American Automobile Manufacturer’s Association.

In 1995, AAMVA published the first edition of the *Vehicle Inspection Handbook* for passenger vehicles. A year later, AAMVA’s Engineering and Vehicle Inspection Committee began developing this expanded edition of the handbook to provide inspection recommendations for all types of vehicles.

In 1997, CCMTA offered its manual, *Commercial Vehicle Inspections in Canada*, as the basis of the *Trucks, Buses & Trailers* section, and AAMVA and CCMTA agreed to collaborate on the publication of the entire handbook.

Because it includes recommendations for both the United States and Canada, the *Vehicle Inspection Handbook Set* is an important step toward the harmonization of standards in North America.

Hood, Bumpers & Doors

1. Hood

Procedure

Step 1: Operate and/or inspect the primary and secondary latches.

Reject the vehicle if:

- Primary latches are broken, missing, seized or insecurely mounted, inoperable or will not open or close easily or securely.
- Secondary latches are missing or do not operate properly.

Step 2: Operate and/or inspect the hinges.

Reject the vehicle if:

- Hinges are missing, broken, cracked, seized, inoperable or slotting has been added to the mounts.

Step 3: Operate and/or inspect the safety retainer pins.

Reject the vehicle if:

- Safety retainer pins are missing.

Step 4: Operate and/or inspect the hood reinforcement.

Reject the vehicle if:

- The hood is reinforced in a manner other than provided by the manufacturer.

Step 5: Operate and/or inspect the hood support rod.

Reject the vehicle if:

- The hood support rod is missing or inoperable.

2. Front and Rear Bumpers

Procedure

Step 1: Inspect and/or measure the condition and mounting of the front and rear bumpers.

Reject the vehicle if:

- The bumpers are missing or loose.
- A broken or torn portion is protruding and creating a hazard to pedestrians.
- Reinforcements are corroded, cracked or split.
- Excessive shims have been used to mount the bumper.

Step 2: Inspect the energy absorber (if so equipped).

Reject the vehicle if:

- The energy absorber has collapsed, has been welded to the rail, is not collapsible, or is visibly leaking.

Step 3: Measure the bumper height and dimensions.

Reject the vehicle if:

- The bumpers are not within an acceptable height from the ground. For cars, some part of the bumper face must be between 14 and 22 inches (360 mm and 560 mm) above the ground. For trucks less than 10,000 lbs. (4,500 kg) Gross Vehicle Weight Rating (GVWR), the bumper height must not exceed jurisdictional requirements.
- The width of the bumpers is less than track width (the distance between the center of two tires on the same axle) and the horizontal surface is less than 4 inches (100 mm).

3. Doors

Procedure

Step 1: Inspect the general operation of the doors.

Reject the vehicle if:

- The door binds, jams or does not close.

Step 2: Inspect the operation and condition of the buttons and handles.

Reject the vehicle if:

- Buttons and handles are missing, broken or inoperable.

Step 3: Inspect the operation and condition of the latches.

Reject the vehicle if:

- The primary and/or secondary latches are loose, worn, or damaged and do not catch.

Step 4: Inspect the operation and condition of the hinges.

Reject the vehicle if:

- Hinges are cracked, missing, bent or so loose that the door will not close properly.
- Hinges are seized.
- Hinges were originally bolted and are now welded.

Step 5: Inspect the operation and condition of the weather strip and seals.

Reject the vehicle if:

- Exhaust could enter the passenger compartment through the weather strip/seals that are cracked, torn, loose, crushed or missing, or the door is misaligned.

Step 6: Inspect the location of the exits.

Reject the vehicle if:

- There are no exits on each side of the vehicle, and the exits provided by the final manufacturer are not operational.

Windshield & Other Glazing

Procedure

Step 1: Check the adhesive sealant used on the windshield and other glazing.

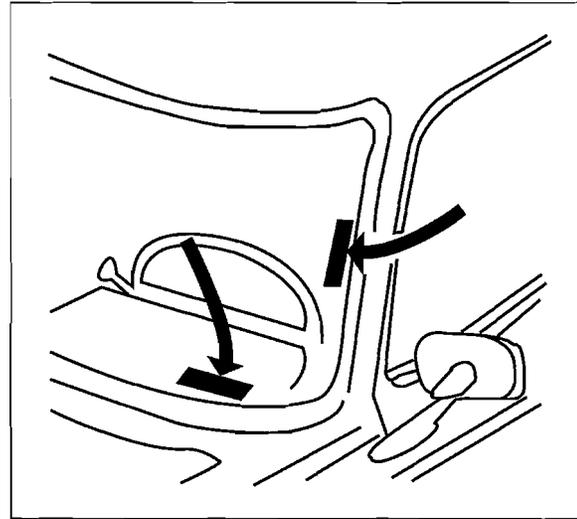
Reject the vehicle if:

- The sealant is obviously not a urethane type of adhesive such as silicon, or the sealant does not comply with the manufacturer's specifications.

Step 2: Inspect for the visible display and readability of the VIN (vehicle identification number). It should be located on the left side of the dash or instrument panel, or on the left windshield post.

Reject the vehicle if:

- The VIN is not readable through the glare strip of the windshield.



Public VIN Plate Locations

The vehicle identification number should be located on the left side of the dash or instrument panel, or on the left windshield post.

Air Bags & Safety Belts

1. Air Bags

Check all salvage vehicle VINs (vehicle identification numbers) to determine if the vehicle was equipped with air bags. Each manufacturer indicates in the VIN the type of restraint system installed in the vehicle when it was manufactured. If the vehicle was originally equipped with air bags, a technician or inspector trained on air bags and/or passive restraint systems must inspect or test the following items.

Procedure

Step 1: Confirm that all parts required by the manufacturer have been replaced and visually inspect all observable parts of the air bag system.

Reject the vehicle if:

- The required parts have not been replaced and/or there is no receipt for the air bag or parts.
- Any parts do not conform to the manufacturer's requirements.

Step 2: Test the system with a simulator, if possible.

Reject the vehicle if:

- The system test shows a fault.

Step 3: Check the dash lamp (if so equipped).

Reject the vehicle if:

- The dash lamp does not illuminate with the ignition on, and the engine off, or fails to extinguish within several seconds after the engine has been started.

2. Safety Belts

Procedure

Step 1: Check the condition of all safety belts.

Reject the vehicle if:

- Safety belts are missing, frayed, stressed, split, torn, or have burnt webbing.

Step 2: Check the condition of the safety belt anchors.

Reject the vehicle if:

- Anchors are missing, or the mounting is weak or improper.

Step 3: Check the condition and operation of the retractors or buckles.

Reject the vehicle if:

- A retractor fails to allow the belt to extend to its maximum length, or it does not release properly.

Step 4: Check the location of the safety belts.

Reject the vehicle if:

- A safety belt has been removed or is not available for each passenger position as originally installed by the manufacturer.

Step 5: Check the operation of the safety belts.

Reject the vehicle if:

- The safety belt warning system or motorized belts do not operate properly.

Seats

1. Mounting and Condition

Procedure

Visually inspect the mounting and condition of the seats.

Reject the vehicle if:

- The seat mounting to the vehicle or the positioning mechanisms are not secure, the frame is broken, or the material covering the seat is torn and any metal component is exposed.
- There is a tear in the seat greater than 3 inches (45 mm) or there is a damaged area 3 inches square (225 mm sq) or more, and deeper than 1/4 inch (6.5 mm).

2. Locks

Procedure

Inspect the adjustment locks and back locks.

Reject the vehicle if:

- The adjusting mechanism for the seat locks does not operate or will not lock into all positions.
- A folding seat back will not lock in all the positions of the original design.

3. Headrests

Procedure

Inspect the headrests on all seats.

Reject the vehicle if:

- The headrests are missing or do not operate properly.

Sun Visors & Rearview Mirrors

1. Sun Visors

Procedure

Visually and manually inspect the location, attachment and positioning of the sun visors.

Reject the vehicle if:

- A visor is missing on either the driver or passenger side.
- Parts used to attach the visors are broken, bent or loose.
- A visor will not remain in a set position.

2. Rearview Mirrors

Procedure

Inspect the location, mounting and condition of the rearview mirrors.

Reject the vehicle if:

- Mirrors are not located in the locations provided by the original manufacturer.
- Mounts are loose or insecure.
- The mirror cannot maintain a set adjustment or cannot be adjusted to the designed maximum settings.
- The glass is cracked, pitted or clouded in such a way that vision is obscured.

Windshield Wipers, Washers, Defroster & Interior Heaters

1. Windshield Wipers

Procedure

Inspect the condition and operation of the wipers, blades and wiper arms.

Reject the vehicle if:

- The wiper control has multiple functions, and the wipers fail to function in all positions.
- The length of the blade is more than 2 inches (50 mm) less than the length of the original blade provided by the manufacturer.
- The wiper arms are missing, bent, distorted or the nonreflective coating is missing.
- The wiper arms do not provide adequate pressure against the windshield.

2. Windshield Washers

Procedure

Inspect the operation of the windshield washers.

Reject the vehicle if:

- The washers are missing or do not operate properly.

3. Windshield Defroster

Procedure

Step 1: Turn on the defroster fan and feel for warm air coming out of the ducts.

Step 2: Inspect the fan operation, air flow and general condition of the defroster system. (A ribbon may be helpful for this.)

Reject the vehicle if:

- The fan fails to operate.
- Controls are stuck or inoperable.
- The defroster does not produce enough air to defrost the area swept by the wipers.
- There is evidence of coolant leaks that fog the windshield.
- No warm air is produced.

4. Interior Heaters

Procedure

Step 1: Turn on the fan and feel for warm air coming out of the heater duct.

Step 2: Inspect the operation and condition of the fan and controls.

Step 3: Check the type of system used and look for any coolant leaks.

Reject the vehicle if:

- The fan fails to operate.
- The controls are stuck or inoperable.
- The type of system is something other than a hot water system (except if supplied by the manufacturer on older model vehicles).
- Any coolant leaks are present.
- No warm air is produced.
- The controls do not direct the air flow as indicated.

Rear Hatch or Trunk

Procedure

Step 1: Inspect the trunk or deck lid.

Reject the vehicle if:

- The trunk will not open by using the key or factory release.
- The trunk will not close or latch.
- The trunk lid is misaligned or insecurely mounted.

Step 2: Inspect the trunk area for holes that could allow exhaust gases to enter the interior compartment of the vehicle.

Reject the vehicle if:

- There are any holes or seals that could allow exhaust gases to enter the passenger compartment.
- Any repaired areas of the floor, rear body or wheelhouse are not fully restored or any seams are separated.

Step 3: Inspect the weatherstripping and seals.

Reject the vehicle if:

- The weatherstrip or weatherseal is missing, crushed, torn, loose, cracked, or fails to seal because of hatch or trunk misalignment.

Steering & Suspension

1. Steering

Procedure

Step 1: Inspect the steering racks, mounts, linkage and any suspension component.

Reject the vehicle if:

- The steering racks, mounts, linkage or any suspension component is improperly mounted, binding, bent or loose, or if there is excessive looseness in tie-rod ends.

Step 2: Inspect and measure the front and rear alignment.

Reject the vehicle if:

- The camber or toe is obviously excessive or if any alignment specification exceeds the test equipment manufacturer's recommendations.

Step 3: Inspect the tracking by measuring the right- and left-side wheelbase at the ball joints. (See illustration on page 14.)

Reject the vehicle if:

- The difference between the right-side wheel base and the left-side wheelbase measured at the ball joints exceeds 1/4 inch (6 mm), unless otherwise specified by the manufacturer.

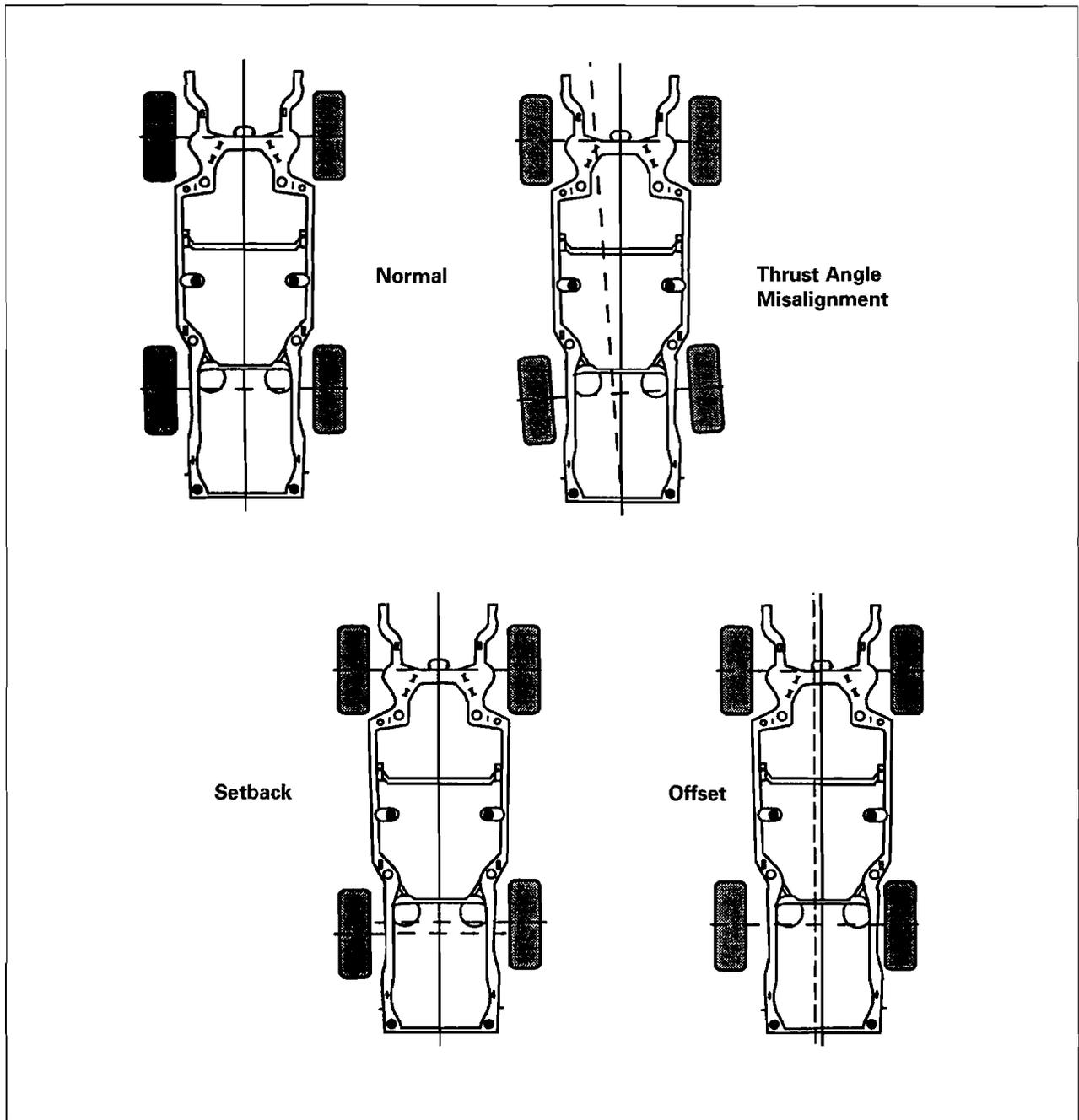
2. Suspension

Procedure

Inspect the suspension components including shocks or struts, springs and mountings, control arms, axle positioning parts, stabilizer bars, spindles, wheels and tires.

Reject the vehicle if:

- Suspension components are bent, broken, loose, out of position, improperly mounted or binding.



Tracking Examples

Engine Compartment

Procedure

With the wheels chocked and with your foot on the brake, put the vehicle in drive or a forward gear to torque the engine. Then, with your foot still on the brake, put the vehicle in reverse to torque the engine. Observe the movement of the engine and the mounts.

Step 1: Inspect the engine and transmission.

Reject the vehicle if:

- Any mounts are broken, loose or not attached.

Step 2: Inspect the throttle control linkage.

Reject the vehicle if:

- The throttle control linkage is not connected or supported properly, or the linkage is binding.

Step 3: Inspect the transmission linkage.

Reject the vehicle if:

- The transmission linkage is not connected or supported properly, or the linkage is binding.

Step 4: Inspect the steel or flexible brake lines.

Reject the vehicle if:

- The brake lines are damaged or not supported.

Step 5: Inspect all accessories on the engine assembly and engine compartment.

Reject the vehicle if:

- The accessories are not properly secured or mounted.

Step 6: Inspect the axles, drive shafts and axle boots.

Reject the vehicle if:

- The axles, drive shafts or axle boots are worn or damaged.
- The axle boots are torn or not installed properly.

Anti-lock Braking Systems

Procedure

Step 1: Visually inspect or test the sensors, wiring, electronic control unit and booster pump, modulator, accumulator, or control valve, etc. as applicable.

Reject the vehicle if:

- Any part of the system is improperly secured, mounted, installed, or components are damaged or missing.
- The hydraulic lines are blistered, leaking, dented or kinked.

Step 2: Check the dash lamp operation.

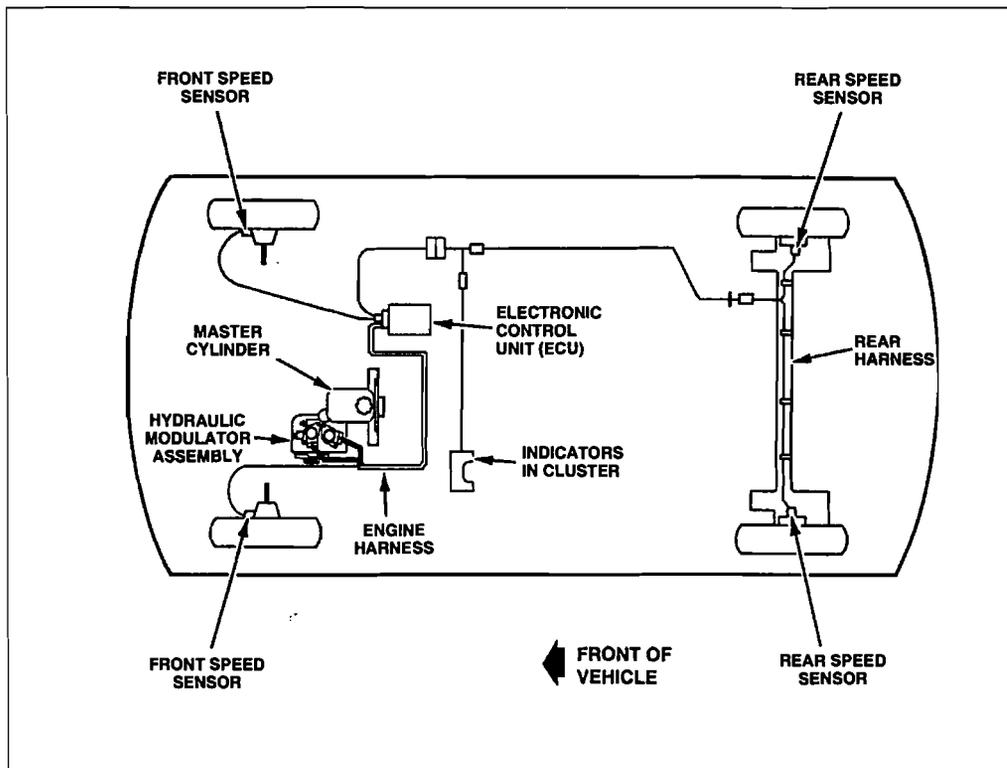
Reject the vehicle if:

- The bulb does not light.
- The bulb stays lit or continuously flashes after the self test.

Step 3: Conduct a road test to inspect the brakes.

Reject the vehicle if:

- Any abnormal system operation is detected.



Typical Anti-lock Brake System (ABS)—Electronic Controls and Sensors

Body Panels

Procedure

Step 1: Visually inspect the body panels for torn or badly deformed metal or plastic.

Reject the vehicle if:

- Any torn metal or sharp edges protrude in such a manner that could be hazardous to passengers, pedestrians and/or cyclists.

Step 2: Inspect the molding.

Reject the vehicle if:

- Any molding is loose or protrudes in such a manner that could be hazardous to passengers, pedestrians and/or cyclists.

Step 3: Inspect the front fenders.

Reject the vehicle if:

- A front fender is fitted so that it could cause interference with the steering mechanism.
- A front fender causes rubbing of tires when the suspension and steering are moved from stop to stop.

Step 4: Inspect the rear fender or quarter panels.

Reject the vehicle if:

- The rear fender or quarter panel is damaged in such a manner that factory lamps cannot be secured as per factory installation, or the lamps are missing.
- A section of the quarter panel or mud flap is torn away or missing.
- The mud flap or fenders do not cover the full width of the tire.

Step 5: Inspect all body lines, door and panel gaps for uniformity.

Reject the vehicle if:

- Body panels do not fit or are aligned so that they interfere or bind with other panels, doors or hinged covers.

Step 6: Inspect the floor and body panels.

Reject the vehicle if:

- The floor is rusted through, forming a hole that allows exhaust gases to enter the vehicle.
- The floor is rusted or deteriorated in such a way that reduces the strength of the seat mountings.
- The body or floor panels are perforated or dented in excess of 2 inches (50 mm) from the original body design. **Note:** Not acceptable on stamped structural shapes. (See *Chapter 12, Step 2.*)

Step 7: Inspect the inner fender panels.

Reject the vehicle if:

- The inner fender panels are missing or incomplete.

Frame and/or Structural Undercarriage Components

Procedure

With the vehicle raised, visually inspect and tap the frame and/or the structural undercarriage components with a ball peen hammer.

Additional Information About Inspecting Unibody Vehicles:

The unibody design uses nearly every part of the vehicle as a stress- and weight-bearing element. To maintain proper steering and handling all tolerances must be held within 1/8 inch (3 mm) of the manufacturing dimensions. All fits and alignments are determined by the accuracy of the welded structural panels. (See the Control Points of a Typical Unibody Structure illustration on page 19.)

Step 1: Inspect for corrosive deterioration of structural components such as frame assemblies or stamped structural shapes in floor pans.

Reject the vehicle if:

- The frame rails or cross members are perforated due to corrosion anywhere between the front and rear suspension mountings, and near the frame-to-body mountings on vehicles with frames and subframes.
- Structural components are perforated or flaking in an area near the suspension component mounting, or where structural shapes have been stamped into the floor pan.
- Tapping with the hammer causes indentations indicating extensive corrosive weakening of metal in structural shapes.
- The rear edge of the door to “B” pillar clearance changes significantly during jacking.

Step 2: Inspect the structural undercarriage for appropriate repairs. **Note:** On a unibody, the structural components include the floor pan, rocker panels, “K” frames, subframes or engine cradles, lower rails, and luggage compartment floors.

Reject the vehicle if:

- The frame rails, cross members, subframe assemblies and unibody or monocoque stamped structural shapes are separated, distorted or bent, or if cracking is visible.
- Structural components are misaligned.
- There are signs that heating has been used to straighten a heat-sensitive unibody structure or component.
- Improper or inadequate welding techniques or poor quality welds are observed.

Step 3: Inspect the frame and/or structural undercarriage components to ensure that appropriate repairs have been made. (See illustration on page 20.)

Reject the vehicle if:

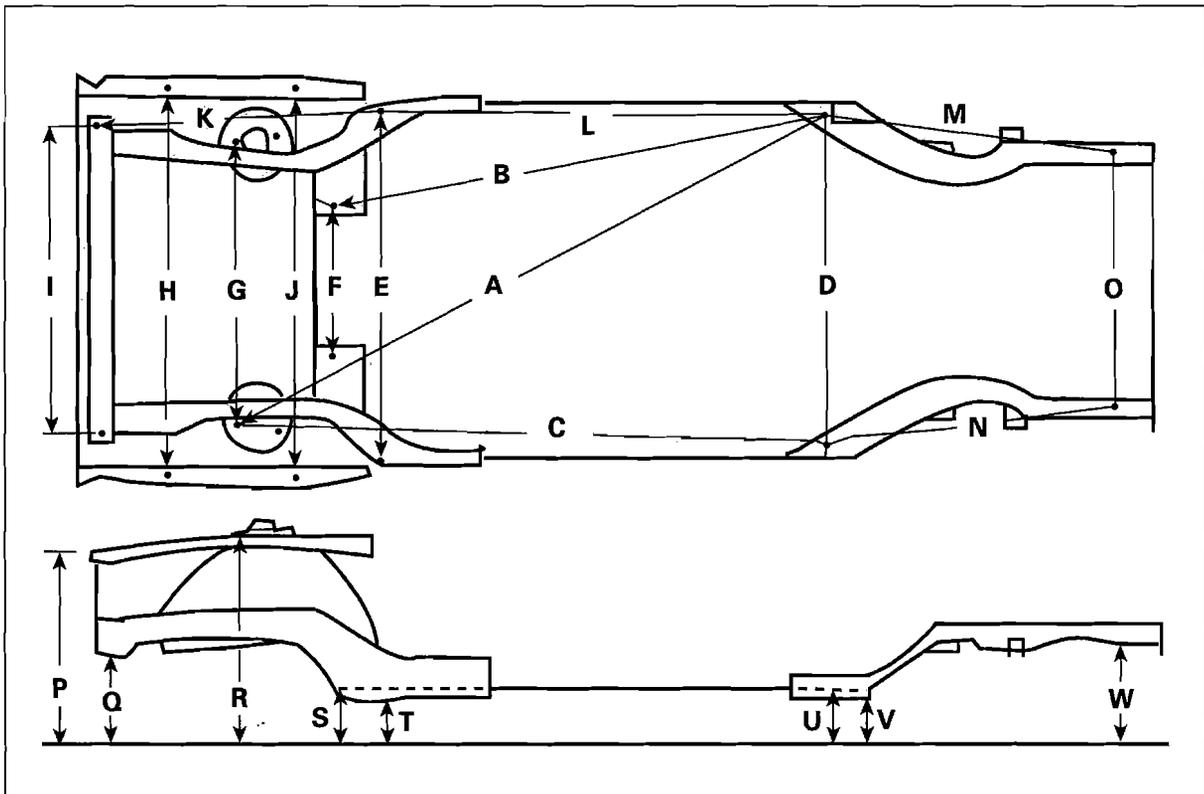
- The full frame structure control points exceed the manufacturer’s dimensions by more than 1/4 inch (6 mm) or the unibody structure control points exceed the manufacturer’s dimensions by more than 1/8 inch (3 mm).
- Structural components are oxy-acetylene welded or brazed.
- Corrosion protection has not been restored on welded or heated areas.
- Cross members are cracked, broken, bent, loose or misaligned.

- Structural components have been sectioned at places other than the factory seams unless proof that the technician who performed the work was trained in industry recognized standards for sectioning is provided.
- Structural components have been sectioned in or near suspension, engine or drive train mounting locations, at compound shapes or structures, or in collapse or crush zones.

Step 4: Inspect the body mounts.

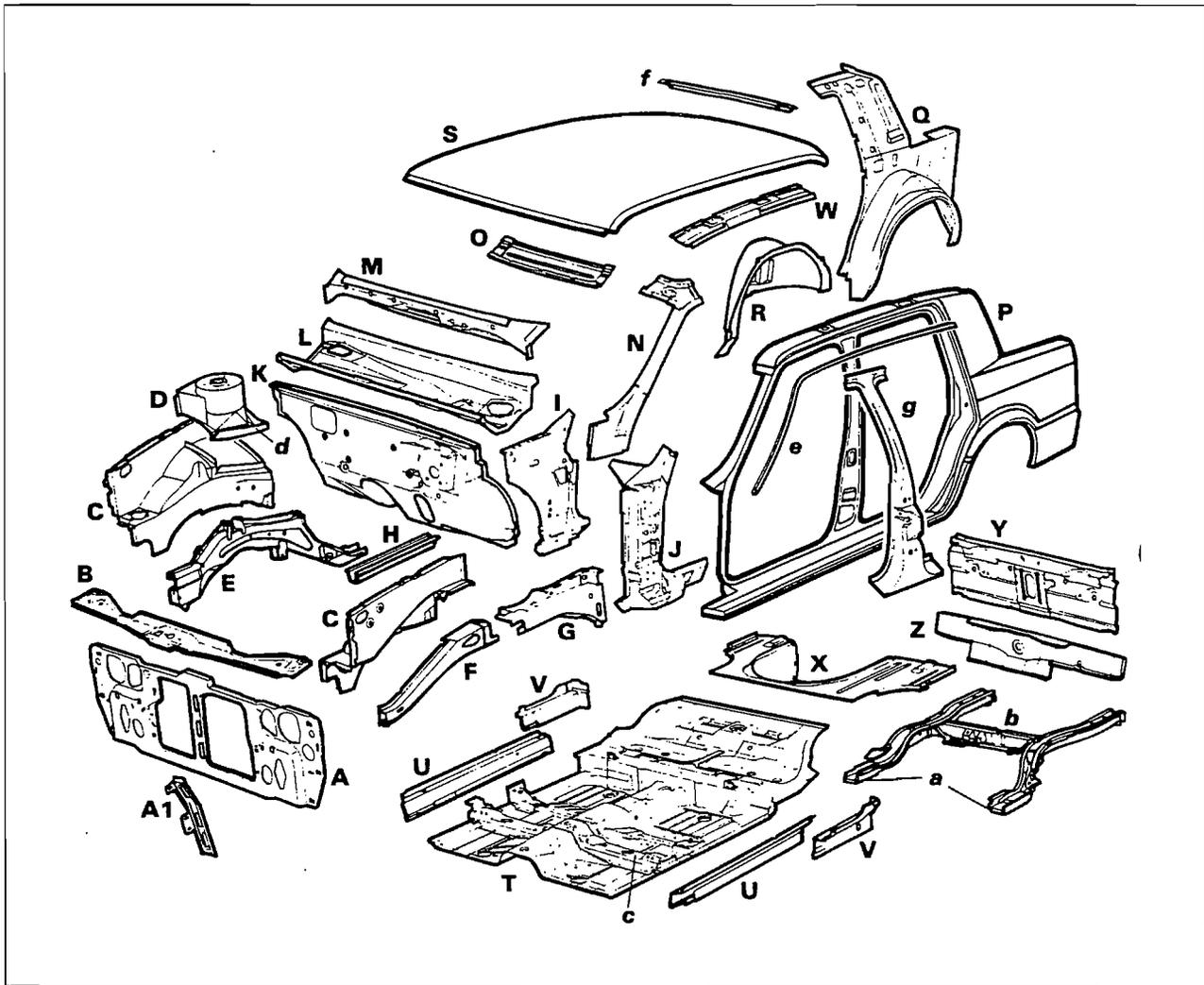
Reject the vehicle if:

- Body mounts are perforated as a result of corrosion.
- Body mounts are split, broken or missing.
- There are missing bolts.



Control Points of a Typical Unibody Structure

Manufacturers provide dimensions for measurements shown by lines A–W.



Example of Unibody Structural Components

- | | |
|----------------------------------|---|
| A. Radiator Support | Q. Inner Quarter/Outer Wheelhousing |
| A.1 Radiator Center Support | R. Inner Wheelhousing |
| B. Tie Bar Panel | S. Roof Panel |
| C. Inner Fender Shield | T. Front Floor Pan |
| D. Strut Tower Reinforcement | U. Inner Sill Pan |
| E. Front Side Rail | V. Side Sill Panel Extension |
| F. Upper Splash Shield Beam | W. Inner Roof Rail |
| G. Hinge Pillar Extension | X. Rear Floor Pan |
| H. Front Side Rail Extension | Y. Tail Panel |
| I. Cowl Side Rail | Z. Lower Tail Panel |
| J. Front Hinge Pillar | a. Rear Side Rails |
| K. Dash Panel | b. Rear Side Rail Cross Member |
| L. Cowl Plenum | c. Front Floor Pan Cross Member, Seat Mount |
| M. Cowl Top | d. Strut Lower Extension To Dash |
| N. Windshield Frame Side Inner | e. Aperture Retainer, Drip Rail |
| O. Center Upper Windshield Frame | f. Rear Roof Brace |
| P. Side Aperture | |

Body/Unibody Upper Structure

For information on appropriate welding and joining, please refer to Chapter 14.

Procedure

Step 1: Inspect the unibody upper structure for proper alignment.

Reject the vehicle if:

- Pillars are misaligned with fixed glazing or pillars are inappropriately joined.
- Unibody structural control points exceed the manufacturer's dimensions by more than 1/8 inch (3 mm).
- The doors, hood or hatchback/trunk lid are misaligned or slotting has been added to the mounting holes.

Step 2: Visually inspect the welding on the body/unibody upper structure to ensure that it is secure and that proper welding techniques were used.

Reject the vehicle if:

- There is any evidence of cracking or poor quality welds at the upper or lower ends of the pillars.

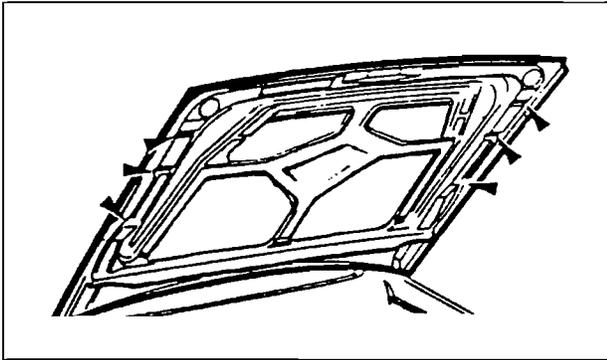
- High strength or high strength low alloy steels are oxy-acetylene or stick electrode welded.
- Continuous welding has been used where spot welding is required.
- Components that were originally bolted or riveted together are now welded.

Step 3: Inspect the upper body structural components to ensure that appropriate repairs have been made. **Note:** On unibody structures, upper body components include the radiator support, upper side rails, inner fender wells and strut towers.

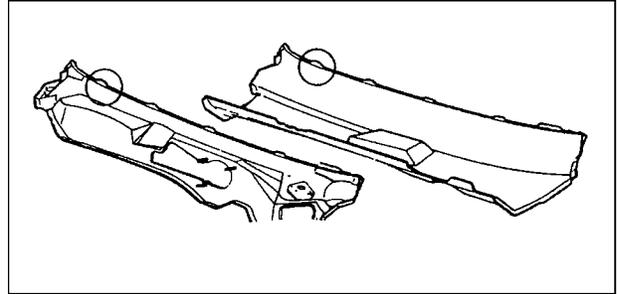
Reject the vehicle if:

- The structural components have been sectioned at places other than the factory seams unless proof that the technician who performed the work was trained in industry recognized standards for sectioning is provided.
- Structural components have been sectioned in or near suspension, engine or drive train mounting locations, at compound shapes or structures, or in collapse or crush zones.

Body Construction Characteristics

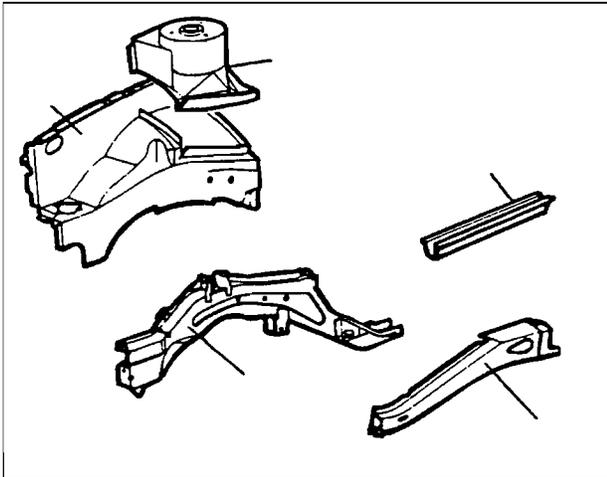


Designed Stress Concentrators

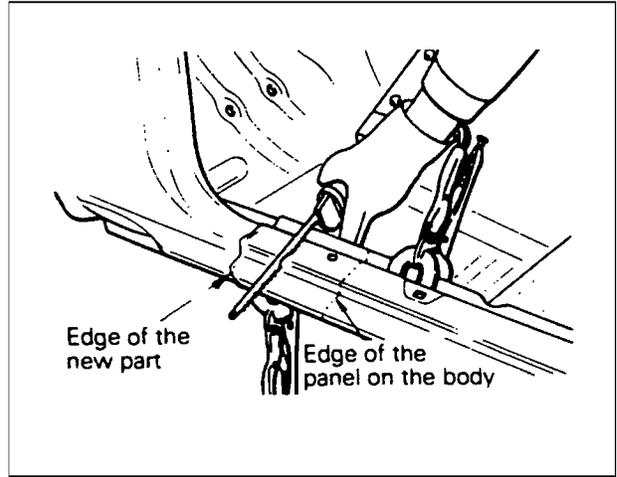


Mating Flange

Structural Panel Repair Techniques



Non-Sectioned Structural Panels



Sectioned Structural Panels

General Information

1. Examples and Characteristics of Various High Strength Steels

A. UHSS—Ultra High Strength Steel

- Strength is destroyed by any heating during repair.
- Metal is so hard that it cannot be readily straightened without compromising its high strength.
- Most components made of this metal must not be repaired. They must be replaced unless recommended otherwise by the manufacturer.
- It is used in door guard beams and in bumper face bars and reinforcements.

B. HSS—High Strength Steel

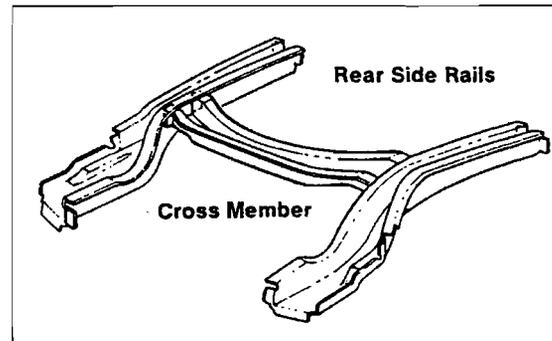
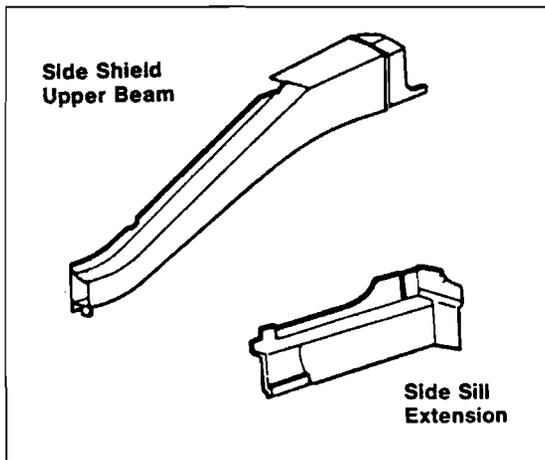
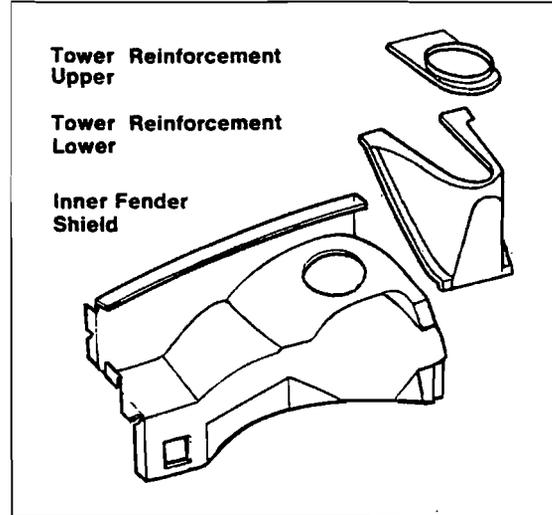
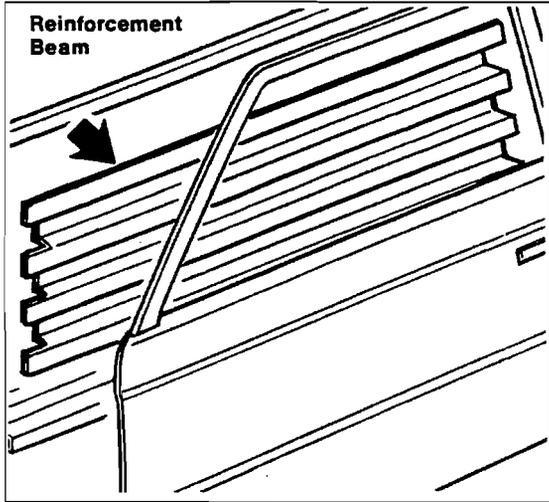
- High strength steel is heat sensitive. 1200 degrees Fahrenheit or 650 degrees Celsius maximum, depending on the manufacturer's recommendations.
- It can be straightened when cold.
- Heat is useful in relieving stress at straightened areas if temperature indicating methods are applied.
- High strength steel is sometimes used in inner fender shields and strut towers on unibody cars.

C. HSLA—High Strength Low Alloy Steel

- Heat cannot be applied to high strength low alloy steel.
- It can be straightened cold.
- It is stronger than mild steel.
- It is used in the front and rear rails, rocker panels, door pillars and bumper face bars.

D. Galvanized Steels

- High strength steel or high strength low alloy steel can be galvanized (zinc coated).
- **Caution:** Toxic fumes are released when galvanized steel is heated. Be sure to provide proper ventilation and protection.
- The zinc coating must be stripped from galvanized steel before it is welded.
- Corrosion protection must be replaced after it is repaired.



Locations Where Special Metals Are Used in Unibody Construction

2. Welding

A. Recommendations

On unibody vehicles, do not use oxyacetylene gas torch or stick electrode arc welding on high strength steels. These methods do not provide a concentrated heat source that can create a satisfactory weld before adjacent areas are overheated. Metal Inert Gas (MIG) welding, or Squeeze Type Resistance Spot Welding (STRSW) are recommended for unibody and collision repairs. STRSW is recommended only by Asian and European vehicle makers.

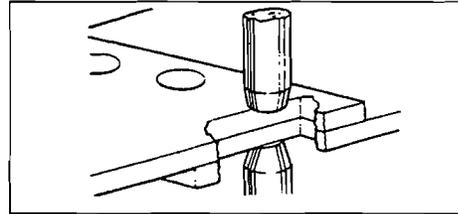
The gas torch welder can be used for attaching cosmetic panels, door skins and other panels. However, gas torch welding cannot be used on structural parts. These include radiator supports, inner fender skirts, the floor pan, rocker panels, engine compartment side rails, upper reinforcements, lower body rails in the rear, inner fender wells, and luggage compartment floors.

B. Types of Welding

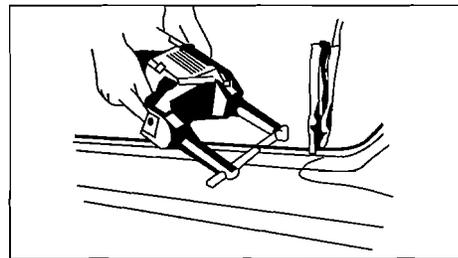
Spot, plug, butt and lap welding are used for the repair and re-attachment of damaged or replacement sections:

1. **Spot Welding or STRSW:** This type of welding is formed by clamping the panels to be welded together between two electrodes and then passing an electrical current between the two electrodes. It is not for multiple panels with a combined thickness over 1/8 inch (3 mm). A spot welded part should include at least as many welds as the original welding from the manufacturer. (See illustration.)
2. **Plug Welding:** Used as a replacement for the spot weld, plug welds are formed by drilling or punching a hole in the outer panel that is being joined, and may appear slightly larger than factory welds. Plug welding may be used to join more than two panels together. A panel replacement should have at least as many plug welds as the number of spot welds used by the original equipment manufacturer (OEM).

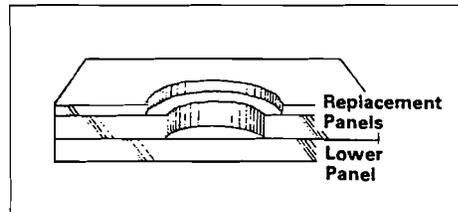
Types of Welding



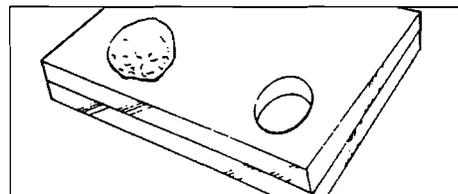
Spot Weld



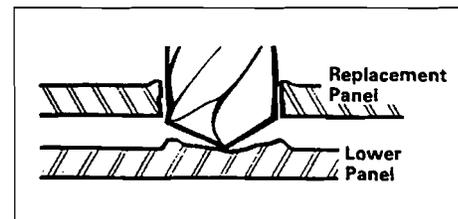
STRSW



Plug Weld



Plug Weld



Plug Weld

3. **Butt Joints:** A butt joint is formed by fitting two adjacent panels together and welding along the mating or butting edges of the panels. The manufacturer's recommendations must be followed before butt welding is attempted. Panels to be butt welded should be the same thickness, especially in stress bearing areas. The butt joint weld should be made continuously. On vertical sections of structural panels, the butt joint weld cannot be made in a straight line on the structural panels.
4. **Lap Joints:** A lap joint is formed by melting two surfaces to be joined at the edge of the top surface of two overlapping surfaces. Lap joints should only be used to replace original factory lap joints or where outer panel and not structural panels are involved. Lap joint welds should not be used to join more than two thicknesses of material together.

C. Structural Panels

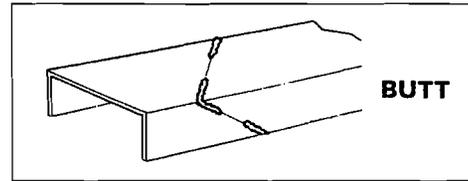
Structural panels should be serviced or replaced at the factory joints or seams where they are usually attached to other panels by the manufacturer. Some manufacturers may not recommend the sectioning of certain structural panels.

While outer panels like hoods, fenders, quarter panels and doors give some support to the total structure, they are not considered key structural panels of a unibody assembly. The individual panels are joined together at flanges of mating surfaces usually formed at the edges of the panels during factory production.

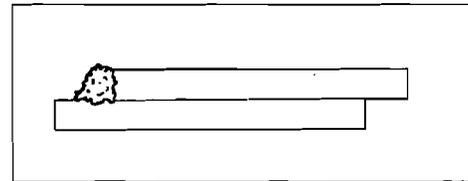
When replacing a structural panel, the same number and location of welds as used by the original manufacturer, should be provided. For inspection purposes, this can usually be determined by comparing the same part on the opposite side of a vehicle.

If reinforcements are added, stress concentrators are created and may change the crash pulse in the event of a second collision. As a

Types of Welding, *continued*



Butt Joint



Lap Joint

result, the reinforced parts may not perform the same way they were originally designed to function. Stress concentrators designed by the manufacturer should not be removed. They are designed into modern vehicles to control and absorb collision forces to minimize structural damage and increase occupant protection.

D. Full Body Sectioning (Clipping)

Full body sectioning repairs, also known as clipping, on unibody structures involves taking a good front half of a titled car and joining it to a good rear half of a different car of the same make and model. A full body section is usually done by sectioning at the two A pillars, two rocker panels and the floor pan. The sectioning should be done at the factory seams or at the industry recognized points. Attachments at factory seams must be made using welds that are similar to the factory welding.

Note: All salvage vehicles with full body sectioning or clipping must have proof that such work was done by qualified auto body technicians. Such proof shall be in the form of a signed statement indicating the technician responsible for the repair, accompanied by a copy of the technician's course certification from I-Car, Tech Cor or any other course recognized by industry that teaches full body sectioning.

About the Publishers

American Association of Motor Vehicle Administrators

Founded in 1933, AAMVA is a nonprofit, educational organization representing state and provincial motor vehicle and law enforcement agencies throughout the United States and Canada.

AAMVA's programs encourage uniformity and reciprocity among the states and provinces, and promote liaison activities with other levels of government and the private sector. AAMVA also stresses highway safety through its involvement in numerous national coalitions, and its program and research activities provide guidelines for more effective public service.

Association members include all United States and Canadian jurisdictions plus American Samoa, Guam, Puerto Rico and the Virgin Islands. AAMVA associate members include organizations, associations and business enterprises with interests compatible with AAMVA and its program objectives.

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Established by the provincial, territorial and federal governments, CCMTA is a nonprofit organization that promotes understanding and cooperation in all matters concerning the administration, regulation and control of motor vehicle transportation and safety in Canada.

CCMTA reports to the Council of Ministers Responsible for Transportation and Highway Safety and is responsible for motor vehicle registration, driver licensing, road safety programs, motor carrier regulatory issues, compliance activities for commercial vehicles and drivers, and other transportation projects and agreements.

Members include senior representatives from all of the provincial and territorial governments, as well as representatives from the federal government. Private industry organizations and other government agencies in Canada and the United States participate as associate members.

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American Association of Motor Vehicle Administrators
4301 Wilson Blvd., Suite 400, Arlington, VA 22203
703-522-4200
www.aamva.org

CCMTA • CCATM

Canadian Council of Motor Transport Administrators
2323 St Laurent Blvd., Ottawa, Ontario K1G 4J8
613-736-1003
www.ccmta.com