

**Uniform
Procedures
For Collision
Repair**

SP21A—Crossmember, Welded

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v.3.3



1. Description

This procedure describes the repair and complete replacement of an aluminum welded crossmember on a unibody vehicle. Inspection and evaluation requirements are also included.



2. Purpose

The purpose of this procedure is to provide industry-accepted requirements for performing high-quality repair of aluminum welded crossmembers on unibody vehicles. This procedure is intended for use by professionals who are qualified through training and experience.



3. Referenced Documents

The following documents are considered part of this procedure by reference.

3.1 Procedures

- CP01A Corrosion Protection
- ME01 Three-Dimensional Measuring
- PS01 Personnel Safety
- RF41 Finish Application
- ST01A Stress-Relieving Heat Limitations
- ST11 Structural Straightening
- ST21A Metal Repair
- WA01 Wheel Alignment, Front
- WA11 Wheel Alignment, Rear
- WE01A GMA (MIG) Plug Weld
- WE11A GMA (MIG) Fillet Weld

3.2 Other Information

- Equipment-specific information
- Product-specific information
- Vehicle-specific dimension specifications
- Vehicle-specific repair information



4. Equipment And Material Requirements

4.1 Welding Equipment

Use GMA (MIG) welding equipment as described in **WE01A** or **WE11A**.

4.2 Welding Filler Wire

Welding filler wire must be compatible with the base metal alloy being joined. See **WE01A** or **WE11A**.

4.3 Straightening And Measuring Equipment

Use straightening equipment as described in **ST11**.

Use measuring equipment as described in **ME01**.

4.4 Special Equipment

Use tools and materials, such as abrasives, that are designated for use only on aluminum, to avoid surface contamination.

A stainless steel wire brush, dedicated for use on aluminum, is recommended for cleaning aluminum before making a weld.



5. Damage Analysis

5.1 General Damage

Inspect an aluminum crossmember for these types of damage:

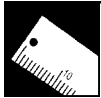
- visible damage
- corrosion**
- dimensional misalignment
- improper previous repairs

5.2 Mounting Locations

Inspect an aluminum crossmember for damage at mounting locations such as these:

- radiator core support
- engine
- transmission
- suspension

(cont'd)



5. Damage Analysis (cont'd)

Determine whether the crossmember should be repaired or replaced. Verify the availability of replacement parts. Do not section an aluminum crossmember.

Note: Some vehicle makers recommend against welding tears in aluminum alloys.

Note: A wheel alignment may be required after repair or replacement of a crossmember



6. Personnel Safety

6.1 General Safety

General safety information is in **PS01**.

6.2 Pulling Safety

Pulling safety information is in **ST11**.

6.3 Welding Safety

Welding safety information is in **WE01A** or **WE11A**.

6.4 Safety With Power Tools And Electrical Equipment

Power tool and electrical equipment safety information is in **ST21A**.



7. Environmental Safety

Does not apply.



8. Vehicle Protection

8.1 Electronic Parts

To protect computers and other sensitive parts from damage:

- Follow the vehicle maker's recommendations for recording and resetting **electronic memories**.
- Ensure that the ignition switch is in the LOCK position, and the key is removed.
- Disconnect and isolate the negative battery cable, and disarm the **passive restraint system**. Follow the vehicle maker's recommendations.
- Carefully remove computer modules when welding or heating within 300 mm (12"), or a greater distance when recommended by the vehicle maker.
- Protect modules, connectors, and wiring from contamination such as dirt, heat, static electricity, and moisture.
- Loosen or remove any wiring harnesses or electrical parts that could be damaged during the repair process.
- Remove any electronic modules that may be subject to impact during the repair procedure.

Remove the battery if it is in an area to be welded or heated.

8.2 Adjacent Areas

Protect glass, upholstery, and other **cosmetic surfaces** from welding and cutting sparks. Remove interior trim and adjacent parts that cannot be protected.

Remove or relocate any wiring or other parts that may be attached to, or routed through, the upper rail.

8.3 Aluminum Surfaces

To prevent damaging aluminum surfaces:

- Use an orbital or dual-action sander. Do not use a disc grinder.
- Use 80-grit or finer, open-coat sanding discs.
- Use foam backing pads instead of stiff backing pads.
- Apply less pressure than when sanding steel.
- Do not sand continuously in the same area.
- Keep sanding discs and other abrasives separate from those used for steel repairs.
- Make sure the faces and edges of metal hammers and dollies are smooth and polished and have rounded edges.

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8. Vehicle Protection (cont'd)

- Make sure the points of picks are not sharp. File or grind the tips until they are rounded or flat. An option is to use a tip made of rubber or plastic, or cover the tip with tape.
- Use a dull file.
- Do not use shrinking hammers.

8.4 Galvanic Corrosion

Avoid galvanic corrosion of aluminum parts by following the procedures in **CP01A**.

To prevent galvanic corrosion when straightening aluminum parts:

- Ensure that all tools are cleaned before, or are dedicated for, use on aluminum.
- Thoroughly remove steel particles from power tools before use.
- Keep hand tools separate from those used for steel repairs.
- Keep sanding discs and other abrasives separate from those used for steel repairs.

8.5 Use Of Heat

The improper application of heat on aluminum alloys can greatly affect their strength. To prevent permanent softening, or increasing brittleness, of certain alloys, the temperature and heating time must be strictly controlled. Follow the vehicle maker's recommendations for applying heat to aluminum parts.

If vehicle maker recommendations are not available, keep the repair temperature between 200°C (400°F) and 300°C (570°F), while limiting the total heating time to no more than 15 minutes. Use temperature-measuring methods as described in **ST01A**.

Note: Some vehicle makers recommend against the use of heat on certain parts.



9. Repair Procedure

9.1 Straightening

To straighten an aluminum crossmember:

- 1. Reposition or remove parts required for access or to prevent damage.
- 2. Thoroughly clean the repair area to remove dirt, grease, sealers, anti-corrosion materials, etc.
- 3. Make sure the vehicle is properly anchored to the straightening system.
- 4. Make underbody measurements to determine the location of the crossmember.
- 5. Use **multiple pulls** and heat, if needed, to return the crossmember and the surrounding structure to proper dimensions. Follow the repair and **tolerance** recommendations of the vehicle maker. If no recommendations are given, use a tolerance of ± 3 mm ($1/8$ "). Use a **three-dimensional measuring system** and adjacent panels to verify that the crossmember is properly aligned.
Note: If heat is used, follow the vehicle maker's temperature and time recommendations. Some vehicle makers recommend against the use of heat on certain parts.
- 6. Replace any areas that are **kinked**, have stress cracks, or develop cracks during straightening. Some vehicle makers recommend against welding tears in aluminum alloys. Use a **dye penetrant** to check the damaged area for cracks. If replacement is required, see **9.2** and **9.3**.
- 7. Apply corrosion-resistant **primer** to areas damaged by the collision, repairs, or anchoring.
- 8. Apply **seam sealers**, if required to seal the joints and restore the appearance. Reprime if required by the product maker.
- 9. Apply **anti-corrosion compounds** to enclosed areas, if required.
- 10. Refinish areas damaged by the collision, repairs, or anchoring, if required to restore the appearance.
- 11. Transfer or install replacement mechanical or electrical parts. Include spacers, washers, isolators, etc., required to prevent contact between dissimilar metals.
- 12. Continue vehicle reassembly.

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9. Repair Procedure (cont'd)

9.2 Complete Removal

To remove a complete aluminum crossmember:

- 1. Reposition or remove parts required for access or to prevent damage.
- 2. Thoroughly clean the repair area to remove dirt, grease, sealers, anti-corrosion materials, etc.
- 3. Perform measurements and adjacent panel alignment and straightening. See 9.1.
- 4. Identify areas of overlapped panels to ensure the replacement crossmember will be in the same relative position.
Note: It may be necessary to remove undamaged parts or reinforcements to remove the crossmember.
- 5. Locate and mark all spot weld and rivet locations.
- 6. Drill out the spot welds and rivets. Do not damage any parts which are not to be replaced. Use the proper size and type of **spot weld** cutter.
- 7. Remove the damaged crossmember. Heat may be required to help separate adhesively bonded joints.
- 8. Remove any burrs or spot weld **nuggets** from the mating surfaces, and repair any damage.
- 9. Straighten the mating surfaces, if required to ensure a proper fit-up with the replacement crossmember.

9.3 Complete Installation

To install a complete replacement aluminum crossmember:

- 1. Verify that the proper parts are being installed by checking the part number and performing a trial fit. Ensure that all mating surfaces are properly aligned.
- 2. Clean the mating surfaces with the proper surface cleaner.
- 3. Refer to the vehicle maker's recommendation for the location, number, and size of **plug weld** holes. If no recommendations are available, punch or drill 10 mm ($\frac{3}{8}$ ") holes in the replacement crossmember at the same locations used originally by the vehicle maker.
- 4. Use a stainless steel brush, designated for use on aluminum only, to remove aluminum oxide from the weld locations. Do not touch cleaned areas.
- 5. Test-fit the replacement crossmember, straighten and align the weld surfaces, and clamp the crossmember in place.

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9. Repair Procedure (cont'd)

- 6. Use a three-dimensional measuring system and adjacent panels to verify that the crossmember is properly aligned.
- 7. Mark the location of the crossmember and remove it from the vehicle.
- 8. Apply adhesive when recommended by the vehicle maker. Avoid applying the adhesive in the weld areas.
- 9. Position the crossmember on the vehicle and clamp or securely hold it in place.
- 10. Verify that the crossmember is properly aligned.
- 11. **Tack weld**, or securely hold, the crossmember in position. Ensure that the proper electrode wire is being used for the type of alloy being welded.
- 12. Recheck the alignment.
- 13. Install any rivets, following the vehicle maker's recommendations.
- 14. Make test welds, before welding on the vehicle, using the same type and thickness metal that will be welded on the vehicle. Make the test welds in the same position as the welds on the vehicle. Visually inspect and **destructively test** the welds before welding on the vehicle.
- 15. Make the required welds. Make all welds as long as possible, without causing heat distortion, to avoid start and stop defects. Use a dye penetrant to check the repair area for cracks, only if recommended by the vehicle maker. Correct any defects.
- 16. Use the three-dimensional measuring system and adjacent panels to verify that the crossmember is still properly aligned.
- 17. **Dress the welds**, if required.
- 18. Apply corrosion-resistant primer to all interior and exterior surfaces damaged by the collision, repairs, or anchoring.
- 19. Apply seam sealers, if required to seal the joints and restore the appearance. Reprime if required by the product maker.
- 20. Apply anti-corrosion compounds to enclosed areas, if required.
- 21. Apply undercoating and sound deadeners to underbody areas.
- 22. Refinish areas damaged by the collision, repairs, or anchoring, if required to restore the appearance.
- 23. Transfer or install any replacement parts. Include spacers, washers, isolators, etc. required to prevent contact between dissimilar metals.
- 24. Continue vehicle reassembly.



10. Use Of Recycled (Salvage) Parts

10.1 Inspection Of **Salvage Parts**

Do not install a salvage aluminum crossmember having any of these defects:

- unrepairable damage
- corrosion that has caused pitting
- improper previous repairs
- missing or damaged mounting locations

10.2 Preparation Of Salvage Parts

To prepare a salvage aluminum crossmember for installation:

- Make any required repairs.
- Trim the part to fit.
- Remove all **heat-affected zones**.
- Make sure the part is not deformed along the weld joints.
- Remove any corrosion.



11. Inspection And Testing

11.1 Inspection Of A Repaired Or Replaced Aluminum Crossmember

Inspect a repaired or replaced aluminum unibody crossmember for these conditions:

- dimensional alignment
- weld quality
- proper application of corrosion protection
- proper finish appearance and film thickness
- proper installation of seam sealers
- proper installation of sound-deadening materials
- proper alignment with adjacent parts
- proper installation and operation of all attached mechanical and electrical parts
- proper installation of mechanical fasteners and non-conductive isolators

Correct any defects.

The front or rear wheel alignment should be checked, after repairing or replacing a suspension crossmember, to determine if re-alignment is required.