



ST21A

Metal Repair

**Uniform
Procedures For
Collision Repair
UPCR**

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v.4.0



1. Description

This procedure describes repair methods and inspection requirements for straightening damaged aluminum.



2. Purpose

The purpose of this procedure is to provide industry-accepted requirements for performing high-quality straightening of aluminum alloys. 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
- PS01 Personnel Safety
- ST01A Stress-Relieving Heat Limitations
- ST31 Body Fillers

3.2 Other Information

- Equipment-specific information
- Vehicle-specific repair information



4. Equipment And Material Requirements

4.1 Equipment

The use of an orbital or dual-action sander is included in this procedure.

Sanding discs and other abrasives must be kept separate from those used for steel repairs.



5. Damage Analysis

Does not apply.



6. Personnel Safety

6.1 General Safety

General safety information is in **PS01**.

6.2 Safety With Power Tools And Electrical Equipment

To prevent injury when working with power tools and electrical equipment:

- Use the correct tools and equipment for the job. Make sure the tools and equipment are in good working order before and after use. Do not use damaged tools or equipment.
- Respect electricity and power equipment. Turn off equipment when it is not in use.
- Do not use any tool if you have not been trained to use it.
- Make sure guards are in place when operating machinery.
- Lock out all machinery or disconnect the power source of any powered tools before cleaning, clearing, oiling, or adjusting.
- Do not exceed the tool maker's speed restrictions.
- Do not use power tools with torn or broken sanding discs.

6.3 Safety With Heat

To prevent injury when using heat during straightening:

- Wear protective gloves and clothing.
- Wear safety glasses.
- Remove all undercoatings from the underside of areas to be heated.
- Wear proper respiratory protection.
- Properly ventilate the work area
- Do not handle metal parts until they have cooled.



7. Environmental Safety

Does not apply.



8. Vehicle Protection

8.1 Aluminum Surfaces

To prevent damaging the aluminum surface when sanding or straightening:

- Ensure that all tools are cleaned before, or are dedicated for, use on aluminum.
- Use an orbital or dual-action sander.
- Use 80-grit or less open-coat sanding discs.
- Use foam backing pads instead of stiff backing pads.
- Apply less pressure than when sanding steel.
- Do not operate a sander continuously in the same area.
- Keep sanding discs and other abrasives separate from those used for steel repairs.
- Do not use a hand-held grinder.
- Make sure the faces and edges of metal hammers and dollies are smooth and polished and have rounded edges.
- Make sure the points of picks do not have sharp points. 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.

8.2 Galvanic Corrosion

To prevent galvanic corrosion when manually straightening aluminum parts:

- 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.

8.3 Use Of Heat

The application of heat on nonheat-treatable aluminum alloys can greatly reduce their strength. To avoid weakening nonheat-treatable alloys, 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 heating time to no more than 15 minutes. If heat is used for stress-relieving, use temperature-measuring methods as described in **ST01A**.

Note: Some vehicle makers recommend against the use of heat for stress-relieving.

(cont'd)



8. Vehicle Protection (cont'd)

8.4 Adjacent Parts

Protect adjacent, undamaged parts that will not be removed for access, to avoid additional damage.

8.5 Cosmetic Surfaces

Protect glass, upholstery, and other cosmetic surfaces from heat or sparks. Remove interior trim that cannot be protected.

8.6 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 heating within 300 mm (12"), or a greater distance when recommended by the vehicle maker.
- Protect modules, connectors, and wiring from dirt, heat, static electricity, and moisture.
- Loosen or remove any wiring harnesses or electrical parts that could be damaged during the repair process.

Remove the battery if it is near an area to be heated.



9. Repair Procedure

9.1 Preparation

To prepare damaged sheet aluminum:

- 1. Wash the vehicle with a pH-neutral soap and water. Rinse and dry thoroughly.
- 2. Remove any parts required for access to the damaged areas.
- 3. Remove undercoating and sound-deadener from the back of the damaged areas.
- 4. Clean the damaged area to be repaired with the proper surface cleaner, as recommended by the vehicle maker.
- 5. Identify high and low areas.

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9. Repair Procedure (cont'd)

- ❑ 6. Determine the repair method that will be used. If damage is minor and there is enough access to the back side of the panel, use body hammers, dollies, and spoons. See 9.2. If damage is minor and there is limited access to the back of the panel, use body picks or pry bars. See 9.3. If the damage is severe enough to use hydraulic rams, see 9.4. For metal shrinking procedures, see 9.5.

9.2 Procedure For Using Body Hammers, Dollies, And Spoons

To repair minor damage using body hammers, dollies, and spoons:

- ❑ 1. Make sure body hammers, dollies, and spoons are clean and free of steel particles and surface imperfections.
- ❑ 2. Identify high and low areas.
- ❑ 3. If heat is used, stay within the temperatures recommended for repair. Use a minimum of 200° C (400° F) and a maximum of 300° C (570° F), unless otherwise directed by the vehicle maker.
- ❑ 4. Use a dolly block to strike the back of the panel and raise large, low areas. Use a pick for raising small, low areas. Do not raise the surface above its original contour.
- ❑ 5. Use hammer-on- and hammer-off-dolly techniques to return the metal to its original contour. Do not over stretch the metal.
- ❑ 6. Use spoons or pry bars for hard-to-reach areas. See 9.3.
- ❑ 7. Remove ridges or creases by spring-hammering with a flat spoon and a bumping hammer.
- ❑ 8. Check for high and low areas.
- ❑ 9. Use a finishing hammer to lower high spots and a pick to raise low spots. Use light hammer blows and avoid the use of sharp picks. Metal shrinking may be necessary to return stretched metal to its original contour. See 9.6.

If the panel cannot be returned to its original contour, application of body filler will be necessary. The panel must be within 3 mm ($\frac{1}{8}$ ") of its original contour for most body filler applications. Follow the filler maker's recommendations. Ensure that the body filler used is compatible with aluminum. Some vehicle and product makers recommend the application of a two-part epoxy primer before applying body fillers to aluminum.

9.3 Procedure For Using Body Picks Or Pry Bars

To repair minor damage with body picks or pry bars:

- ❑ 1. If heat is used, stay within the temperatures recommended for repair. If vehicle maker recommendations are not available, keep the repair temperature between 200° C (400° F) and 300° C (570° F), while limiting the heating time to no more than 15 minutes.
- ❑ 2. Insert a pick or pry bar through an access hole.

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9. Repair Procedure (cont'd)

- 3. Apply pressure to locate the pick or pry bar. Do not damage access holes when using them for leverage.
- 4. When the pick or pry bar is in the desired location, apply more pressure. Use a body hammer on the front surface to release the tension.
- 5. Work slowly around the damaged area.
- 6. Complete the repair using the procedures in **9.2**.

9.4 Procedure For Mechanical Pulling

To repair damage using mechanical pulling equipment:

- 1. Determine how much force is required. Select the proper type of equipment, along with extensions and attachments.
- 2. Make proper anchors. Reinforce the anchored area with a block, if necessary, to spread the force over a larger area.
- 3. If vehicle maker recommendations are not available, keep the repair temperature between 200° C (400° F) and 300° C (570° F), while limiting the heating time to no more than 15 minutes.
- 4. Use a body hammer to release the tension.
- 5. Complete the repair using the procedures in **9.2**.

9.5 Procedure For Metal Shrinking

To prepare the area for shrinking:

- 1. Remove all paint, sound-deadener, and undercoating in the repair area.
- 2. Apply pressure in several locations to locate the most severely stretched area.

To cold shrink a panel area:

- 1. Select a dolly of the proper contour and hold it tightly against the back side of the panel.
- 2. Strike blows with a hammer on the front surface of the panel, directly above the dolly. Do not use a shrinking hammer with a serrated face.
- 3. Check the panel contour several times.
- 4. Repeat this procedure several times until the area regains its shape and strength.

To heat shrink a panel area:

- 1. Apply heat to the center of the most stretched area. Use temperature indicators to keep the heat within the recommended limits.
- 2. Use the hammer-off-dolly method to shape the area.
- 3. Cool the area with compressed air.
- 4. Repeat the procedure on the next highest spot.
- 5. Repeat until the stretched area is back to its original contour and the strength is restored.



10. Use Of Recycled (Salvage) Parts

Does not apply.



11. Inspection And Testing

11.1 Inspection Of Repaired Areas

Before filling and refinishing, inspect repaired areas for these conditions:

- scratches or file marks
- damage to access holes
- any holes or tears not welded closed
- damage to the back sides of panels
- lack of corrosion protection
- cracks in the repair area

Ensure the following conditions are achieved:

- proper shape and contour
- smooth body lines without waviness