



ST21S

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 manually straightening damaged sheet steel.



2. Purpose

The purpose of this procedure is to provide industry-accepted requirements for performing high-quality metal straightening using hand tools. 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

- CP01S Corrosion Protection
- PS01 Personnel Safety
- RF01S Surface Preparation
- ST31 Body Fillers

3.2 Other Information

- Equipment-specific information
- Vehicle-specific repair information



4. Equipment And Material Requirements

4.1 Power Tools

The use of these types of power tools is included in this procedure:

- pneumatic and electric grinders
- portable hydraulic ram
- stud welder
- washer welder
- orbital sander



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.
- Make sure the grinding discs are properly attached.
- Do not use torn or broken discs.
- Use discs rated for the speed of the grinder.
- Keep grinding discs as flat as possible.
- Make sure parts are properly anchored, and the anchored area is strong enough to withstand the required pressure from hydraulic ram equipment.
- Do not use standard pipe threads for hydraulic ram equipment.

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6. Personnel Safety (cont'd)

- Use proper hydraulic fluid for hydraulic ram equipment. Check the fluid level before each use.
- Stay clear of the ram when under pressure.
- Check hydraulic hoses, fittings, and seals before each use.

6.3 Heat Shrinking Safety

To prevent injury when heat shrinking:

- Wear eye protection and gloves to protect against burns.
- Remove all undercoatings from the underside of areas to be heated.
- Wear proper respiratory protection.



7. Environmental Safety

Does not apply.



8. Vehicle Protection

8.1 Adjacent Parts

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

8.2 Adjacent Areas

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

8.3 Protection Of 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.

(cont'd)



8. Vehicle Protection (cont'd)

- Carefully remove computer modules when welding or heating within 300 mm (12"), or a greater distance when recommended by the vehicle maker.
- Protect computer 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 steel:

- 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 wax and grease remover, as recommended by the vehicle maker.
- 5. Identify high and low areas.
- 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 there is no access to the back of the panel, use a stud or washer welder with pull rods or slide hammers. See **9.4**. If the damage is severe enough to use hydraulic rams, see **9.5**. For metal shrinking procedures, see **9.6**.

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 surface imperfections.
- 2. Identify high and low areas.
- 3. Use a dolly block to strike the back of the panel and raise large, low areas. Use a pick hammer for raising small, low areas. Do not raise the surface above its original contour.
- 4. Use hammer-on- and hammer-off-dolly techniques to return the metal to its original contour. Do not overstretch the metal.
- 5. Use spoons or pry bars for hard-to-reach areas. See **9.3**.

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9. Repair Procedure (cont'd)

- 6. Remove ridges or creases by spring-hammering with a flat spoon and a bumping hammer.
- 7. Check for high and low areas.
- 8. Use a finishing hammer to lower high spots and a sharp pick to raise low spots. 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.

9.3 Procedure For Using Body Picks Or Pry Bars

To repair minor damage with body picks or pry bars:

- 1. Insert a pick or pry bar through an access hole.
- 2. Apply pressure to locate the pick or pry bar. Do not damage access holes when using them for leverage.
- 3. 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.
- 4. Work slowly around the damaged area.
- 5. Complete the repair using the procedures in **9.2**.

9.4 Procedure For Using Stud Welders

To repair damage using a stud welder:

- 1. Prepare the panel and remove the paint from stud or washer attachment points. Avoid removing any zinc coating.
- 2. Weld studs or washers in the low spots along the damaged area.
- 3. Attach a slide hammer to the welded studs, or place a hook on the slide hammer and pull the washer holes.
- 4. Use the force of the slide hammer to raise the low areas. Use a body hammer or spoon to release the tension while pressure is applied.
- 5. When the desired contour is obtained, remove the studs or washers.
- 6. Grind the surface level. Avoid removing any zinc coating or thinning the surrounding metal.
- 7. Restore corrosion protection.
- 8. Complete the repair using the procedures in **9.2**.

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9. Repair Procedure (cont'd)

9.5 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. Use a body hammer to release the tension.
- 4. Complete the repair using the procedures in **9.2**.

9.6 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 shrinking dolly of the proper contour and hold it tightly against the back side of the panel.
- 2. Strike blows with a shrinking hammer on the front surface of the panel, directly above the dolly.
- 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. Heat until the spot glows a cherry red color. Follow the vehicle maker's recommendations for the use of heat on steel.
- 2. After heating the spot, use the hammer-on-dolly technique to lower the area.
- 3. When the redness disappears, use the hammer-off-dolly method to further shape the area.
- 4. Cool the area with water or compressed air.
- 5. Repeat the procedure on the next highest spot.
- 6. 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
- damage to the back sides of panels
- lack of corrosion protection
- cracks in the area where heat was applied

Ensure the following conditions are achieved:

- proper shape and contour
- smooth body lines without waviness