

Uniform Procedures For Collision Repair

ST01A—Stress-Relieving Heat Limitations

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v.2.4



1. Description

This procedure describes methods and inspection requirements for using heat to relieve stress in aluminum.



2. Purpose

The purpose of this procedure is to provide requirements for performing high-quality **stress-relieving** in aluminum using heat. 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
- ST11 Structural Straightening
- ST21A Metal Repair

3.2 Other Information

- Equipment-specific information
- Vehicle-specific repair information



4. Equipment And Material Requirements

4.1 Heat Sources

The use of these heat sources is included in this procedure:

- oxyacetylene torch
- oxyhydrogen torch
- propane torch
- adjustable heat gun

4.2 Temperature Indicators

The use of these temperature indicators is included in this procedure:

- heat sticks or crayons
- thermal paints
- DVOM with a temperature probe
- non-contact infrared heat probe



5. Damage Analysis

Does not apply.



6. Personnel Safety

6.1 General Safety

General safety information is in **PS01**.

6.2 Heating Safety

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 Heat Control

To help control the use of heat when stress-relieving:

- Use temperature indicators.
- Use **heat-sink** compounds.
- Monitor heat spread across the panel.
- Use a propane torch or heat gun for small, thin areas, or on alloys with lower repair temperature requirements.
- When heating with an oxyfuel torch, use a low-temperature, **neutral flame**.
- Keep times at repair temperatures as short as possible.

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.

(cont'd)



8. Vehicle Protection (cont'd)

8.2 Flammable Parts

To protect flammable parts:

- Remove interior trim, headliners, upholstery, and other parts that may be exposed to heat or flame.
- Avoid applying flame to labels. Do not discard any labels until replacements are obtained.
- Do not apply flame or excessive heat to fuel system parts, fuel, or other flammable liquids.
- To avoid an explosion, do not direct a flame near a battery.
- Keep a fire extinguisher in the work area while applying heat.

8.3 Adjacent Areas

Avoid heating adjacent, undamaged areas.

8.4 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 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 Relieving Stress With Heat

Heat affects various aluminum alloys differently. Follow the vehicle maker's recommendations for the use of heat when stress-relieving aluminum.

To relieve stress in aluminum:

1. Clean the damaged area to bare metal.
2. Use temperature indicators to stay within the vehicle maker's repair temperature recommendations. 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.
3. Follow the instructions with the temperature indicators to obtain proper temperature readings. If using a heat gun, set it to the desired temperature.
4. Apply heat while the pulling force is applied. If the temperature indicator is applied to the front side, direct the heat away from the temperature indicator. Use the proper hammering method while using heat, to assist in relieving stress. Stop heating before the maximum temperature is reached.
5. Allow the metal to cool naturally.
6. Avoid reheating. Follow the vehicle maker's recommendations for repeated heating.
7. Restore corrosion protection to the repair area.



10. Use Of Recycled (Salvage) Parts

Does not apply.



11. Inspection And Testing

11.1 Inspection Of Repaired Area

Inspect the repaired area for any of these defects:

- cracks, in and around the repair area
- signs of **oxidation** or scaling, especially on the back side
- signs that corrosion protection was not restored

Use a **dye penetrant** to detect cracks in the weld or base metal. If defects are detected, adjust the welder and welding technique, and repeat the test welds before welding on the vehicle.

If the vehicle maker recommends the application of a dye penetrant to welds on a vehicle, use the following procedure if a crack or other defect is detected:

- 1. Thoroughly remove the dye penetrant to avoid contaminating the surface.
- 2. Remove the defective area. Do not thin the surrounding metal.
- 3. Reweld the area.
- 4. Repeat the visual inspection.

Correct any defects. If cracks are present, replacement may be required. Follow repair or replacement recommendations described in **ST11**.