

## Uniform Procedures For Collision Repair

# ST11–Structural Straightening

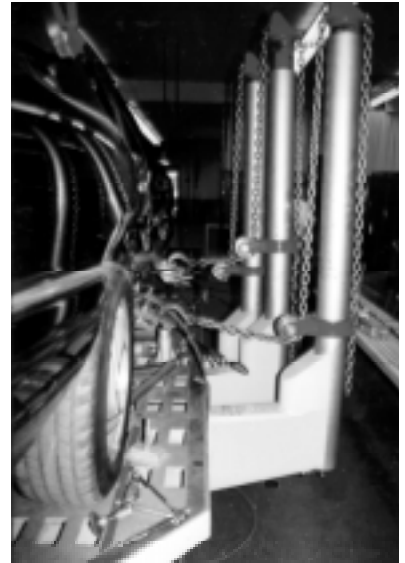
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v.2.3



## 1. Description

This procedure describes repair methods and inspection requirements for straightening **structural parts** using hydraulic pulling equipment.



## 2. Purpose

The purpose of this procedure is to provide industry-accepted requirements for performing high-quality structural straightening. 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
- ME01 Three-Dimensional Measuring
- PS01 Personnel Safety
- RF01S Surface Preparation
- ST01S Stress-Relieving Heat Limitations

#### **3.2 Other Information**

- Equipment-specific information and procedures
- Vehicle-specific dimension specifications
- Vehicle-specific repair information



## 4. Equipment And Material Requirements

### 4.1 Anchoring Equipment

Anchoring equipment must be capable of the following:

- working with a **three-dimensional measuring system**
- holding the vehicle solidly in place
- holding the vehicle at a minimum of four locations
- distributing the forces of **multiple pulls**

### 4.2 Pulling Equipment

Pulling equipment must be capable of the following:

- making multiple pulls
- working with a three-dimensional measuring system
- monitoring the pulling pressure
- making pulls in any direction, at any angle
- applying the forces necessary to return the damaged area to proper dimensions



### 4.3 Measuring Equipment

Use three-dimensional measuring equipment as described in **ME01**.



## 5. Damage Analysis

Damage analysis information is in **ME01**.



## 6. Personnel Safety

### 6.1 General Safety

General safety information is in **PS01**.

### 6.2 Pulling Safety

To prevent injury during pulling:

- Cover or tape any glass that could shatter under pressure.
- Do not use worn or defective pulling clamps, chains, or other equipment.
- Make sure the clamp jaws are clean.
- Remove dirt, grease, and undercoating from the vehicle's attachment points.
- Follow the equipment maker's instructions.
- Use caution when operating hydraulic pulling equipment. This equipment uses very high pressure.
- Do not stand directly in front of, or behind, the pulling equipment or in line with chains.
- Warn others in the area to stay clear of the pulling operation.
- Use safety cables or chains to protect from backlash, should a chain or hook break or a clamp slip.
- Watch and listen for signs of pulls letting loose, such as weld seams splitting, **spot welds** popping, or metal tearing.
- Continuously monitor the pulling pressure.
- Do not exceed the pulling equipment or anchoring system's limits.
- Retighten the anchoring and pulling clamps after the initial pull.
- Use chains rated for the maximum pulling tension to be used.
- Check the anchoring locations throughout the entire pulling process.
- Check pulling angles continually during the pulling process.
- Do not leave an unattended vehicle with the pulling pressure applied.



## 7. Environmental Safety

Does not apply.



## 8. Vehicle Protection

### 8.1 Stress-Relieving

If heat is used for stress-relieving, use temperature-measuring methods as described in **ST01S**.

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

### 8.2 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.

### 8.3 Mechanical System Parts

To protect mechanical system parts:

- Do not use undamaged mechanical parts as attachment points for pulling.
- Insure chains, clamps, and anchoring devices are not crushing, pinching, or applying pressure on undamaged mechanical parts.
- Remove parts or loosen their mounting points, if pulling operations could damage them.
- Follow the vehicle maker's recommendations for disconnection, removal, and installation of mechanical parts.
- Protect any open lines or hoses from contamination.



## 9. Repair Procedure

### 9.1 Anchoring

To anchor the vehicle:

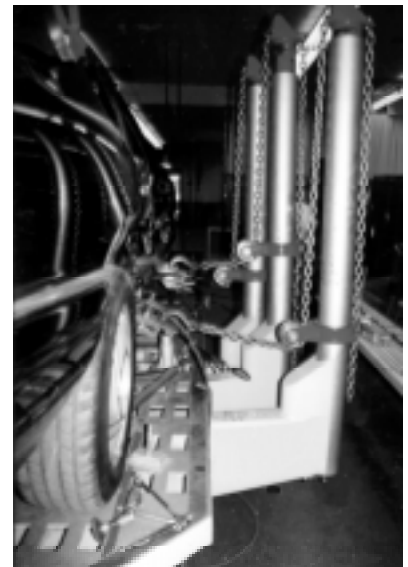
- 1. Determine the anchoring locations and required adapters or methods. Use vehicle repair information or anchoring equipment instructions. The anchoring locations must be able to withstand the pulling forces to be applied.
- 2. Remove parts, if required for access to anchor locations.
- 3. Remove grease and undercoatings from the areas where anchoring clamps will be installed.
- 4. Reposition or remove brake and fuel lines and wiring harnesses to avoid damage and provide clearance for the pulling and measuring systems. Inspect for missing or damaged fasteners, mounting hardware, etc. Plan to replace any damaged parts.
- 5. Support the suspension system. Follow the vehicle and equipment makers' recommendations.
- 6. Tighten the clamp fasteners securely. Follow the equipment maker's instructions. On systems using chains, remove all slack and twists from the chains.
- 7. Retighten the anchoring clamps after the initial pull.
- 8. Add any additional anchoring locations, as necessary, to prevent damage and to aid in the pulling process.
- 9. Restore **corrosion** protection and refinish all anchoring locations after straightening is completed.



### 9.2 Pulling Procedure

To correct structural damage:

- 1. Develop a repair plan by determining the location of all damage and the direction of impact. Use a three-dimensional measuring system to verify the damage. Record and compare the vehicle measurements to the dimension specifications. Determine which parts must be removed for access, the number and direction of pulls, and any pushing or blocking requirements.
- 2. Attach pulling clamps, weld-on tabs, or other devices to areas that will allow the damage to be removed, reversing the direction of damage.
- 3. Set up multiple pulls, if necessary, to remove as much damage as possible at one time, and to prevent tearing or distorting the metal.



(cont'd)



## 9. Repair Procedure (cont'd)

- 4. Apply pressure evenly to all points at one time, or pull small amounts at a time moving from one attachment point to another, depending on the plan.
- 5. Monitor the pulling process visually, including spot weld locations. It may be necessary to reweld damaged spot welds before or after the pulling process. Measure the complete vehicle to ensure all damage is being corrected.
- 6. Correct **secondary damage** and damage farthest from the impact point before removing all **primary damage**. Follow a last-in, first-out order.
- 7. Relieve stress frequently throughout the pulling process. Monitor the pulling pressure to ensure stress is being relieved.
- 8. Continue pulling until the dimensional alignment is restored.
- 9. A calculated overpull may be necessary, to allow the parts to stay in correct dimensional alignment when the pulling pressure is released. If not, the process must be repeated.
- 10. Use a three-dimensional measuring system to verify the repair. Record the measurements.
- 11. Restore the corrosion protection to the repaired areas, and to the areas where anchoring and pulling clamps were installed.
- 12. Refinish as necessary to restore the appearance.



## 10. Use Of Recycled (Salvage) Parts

Does not apply.



## 11. Inspection And Testing

### 11.1 Dimensional Alignment

After pulling, inspect for proper dimensional alignment:

- The **tolerance** for unibody vehicles is  $\pm 3$  mm ( $1/8$ " ), unless the vehicle maker specifies less. This tolerance is for individual measurements, as well as the overall length of the vehicle.
- The tolerance for body-over-frame construction is  $\pm 5$  mm ( $3/16$ " ), unless the vehicle maker specifies otherwise.
- Verify the operation of all **closure panels**, including proper gaps and margins.

### 11.2 Damage After Straightening

Inspect the straightened structure or frame for any of these defects:

- visible damage
- shiny, silvery splinters in the stressed area
- improper corrosion protection

Note: A dye penetrant may aid in locating minor stress cracks in the repair area.

If any of these defects are found, the parts may have to be replaced. If excessive overpulling occurred, the parts will usually have to be replaced. Follow the vehicle maker's guidelines for replacement of structural parts.

### 11.3 Inspection Of Fasteners

Inspect all reinstalled fasteners for replacement of one-time fasteners and proper torque.