Developing Best-In-Class Repairability Guidelines and Procedures

Jason B. Bartanen

I-CAR (Inter-Industry Conference on Auto Collision Repair)
Every person in the collision repair industry has the information, knowledge, and skills to perform complete, safe and quality repairs for the ultimate benefit of the consumer.
2017 Recap

• Material Identification
• Repairability Guidelines
• Standardization and Continued Expansion of Repair Information Types
• Improved Alignment/Standardization of Attachment Methods Used for Collision Repairs
# Repair Information

Body Repair Manual Needs

- Material Identification
- Repairability Guidelines
- Foams, Sealers and Adhesive Locations and Product Requirements
- Partial Service Part/Assembly Replacement Procedures at Factory Seams
- Structural Sectioning Procedures
- Outer Body Panel Sectioning Procedures
Body Repair Manual Needs (cont’d)

• Collision Repair Attachment Methods, Description and Equipment Requirements
• Weld-Through Primer Requirements
• Corrosion Protection Methods and Materials
• Stationary Glass Adhesives and Flange Prep Requirements
• Adhesive Bonding Options
• Layout and Search Functionality
Material Identification

• Key to Repairability
• Important During Damage Assessment & Repair
  – Collision Repairers
  – Insurers
• Easily Accessible
• Need Tensile Strength Identified (Mild, HSS, UHSS)
Honda Accord
Material Identification (cont’d)

Honda
<table>
<thead>
<tr>
<th>No.</th>
<th>Part Name</th>
<th>Tensile Strength (MPa)</th>
<th>Zinc-Plating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hood</td>
<td>Skin [0.7 (0.028)]</td>
<td>340</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Frame [0.55 (0.0217)]</td>
<td>270</td>
</tr>
<tr>
<td>2</td>
<td>Front Fender [0.7 (0.028)]</td>
<td></td>
<td>270</td>
</tr>
<tr>
<td>3</td>
<td>Front Bulkhead Complete</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a:</td>
<td>Bulkhead Center Frame, Upper [0.8 (0.031)]/Lower [1.0 (0.039)]</td>
<td>270</td>
<td></td>
</tr>
<tr>
<td>b:</td>
<td>Bulkhead Side Frame, Inner and Outer [0.8 (0.031)]</td>
<td>270</td>
<td></td>
</tr>
<tr>
<td>c:</td>
<td>Bulkhead Side Stay Plate [0.8 (0.031)]</td>
<td>270</td>
<td></td>
</tr>
<tr>
<td>d:</td>
<td>Bulkhead Side Stay [1.0 (0.039)]</td>
<td>270</td>
<td></td>
</tr>
<tr>
<td>e:</td>
<td>Bumper Beam Bracket [2.3 (0.091)]</td>
<td>590</td>
<td></td>
</tr>
</tbody>
</table>

Honda
Material Identification (cont’d)

Kia Optima
## Repairability Guidelines

### General Motors

**Recommended GM Steel Repairability Matrix**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mild Steel Laminate steel</td>
<td>GM6499M (all), GM6282M (all)</td>
<td>MIG, RSW</td>
<td>Yes*</td>
<td>Yes*</td>
<td>Up to 1200°F (650°C)</td>
<td>90 sec x 2</td>
</tr>
<tr>
<td></td>
<td>Bake Hardened</td>
<td>GM6933M (all), GM69332M (all)</td>
<td>MIG, RSW</td>
<td>Yes*</td>
<td>Yes</td>
<td>Up to 1200°F (650°C)</td>
<td>90 sec x 2</td>
</tr>
<tr>
<td></td>
<td>Solid Solution-Strengthened</td>
<td>GM6208M (all), GM6218M (all), GM62082M (HR CR grades)</td>
<td>MIG, RSW</td>
<td>Yes*</td>
<td>Yes</td>
<td>Up to 1200°F (650°C)</td>
<td>90 sec x 2</td>
</tr>
<tr>
<td></td>
<td>High-Strength, Low Alloy</td>
<td>GM6208M (all), GM6218M (all), GM62082M (HR CR grades)</td>
<td>MIG, RSW</td>
<td>Yes*</td>
<td>Yes</td>
<td>Up to 1200°F (650°C)</td>
<td>90 sec x 2</td>
</tr>
<tr>
<td></td>
<td>Dual Phase ≤700MPa min. UTS</td>
<td>GM63932M (HR DF and CR DP grades)</td>
<td>MIG, RSW</td>
<td>Yes*</td>
<td>Yes</td>
<td>Up to 1200°F (650°C)</td>
<td>90 sec x 2</td>
</tr>
<tr>
<td></td>
<td>Dual Phase ≥800MPa min. UTS</td>
<td>GM63939M (all M5 grades), GM64000</td>
<td>MIG, RSW</td>
<td>Yes*</td>
<td>Yes</td>
<td>Up to 1200°F (650°C)</td>
<td>90 sec x 2</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>UHSS Materials, Boron (P/MHS-Hot-Stamped)</td>
<td>GM6312M (all), GM63123M (all M5 grades)</td>
<td>MIG, RSW</td>
<td>Yes*</td>
<td>Yes</td>
<td>Up to 1200°F (650°C)</td>
</tr>
</tbody>
</table>

* Must use 8mm x 16mm slotted holes
* Cold repairs can be performed if damage excludes kinks.
* MIG Plug Only, NO STITCH WELDING. These steels may NOT be used as a backer for stitch welding. NOTE: Deviation from this chart is ONLY allowed if there has been a crash analysis completed by the Design Engineer and a Service procedure has been written. NOTE: number values are tensile strength
* SD Symbol for repair.

### Ford

**Ford-Recommended Steel Repairability Matrix**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Trade Descriptions</th>
<th>Welding Method</th>
<th>Cold Repair</th>
<th>Use of Heat for Repair</th>
<th>Temp. Range</th>
<th>Maximum Heat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild Steel</td>
<td>Mid</td>
<td>Yes</td>
<td>Yes</td>
<td>N/A</td>
<td>Yes</td>
<td>Up to 1200°F (650°C)</td>
</tr>
<tr>
<td>Laminate Steel</td>
<td>Quiet Steel</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes**</td>
<td>No</td>
</tr>
<tr>
<td>Bake Hardened</td>
<td>BH 180C, BH 210C, BH 230C, BH 260</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes**</td>
<td>No</td>
</tr>
<tr>
<td>Solid Solution-Strengthened</td>
<td>HSLA 250, HSLA 350, HSLA 550</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes**</td>
<td>No</td>
</tr>
<tr>
<td>High-Strength, Low Alloy</td>
<td>Dual Phase ≤600 MPa min. UTS</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes**</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>Dual Phase ≥800MPa min. UTS</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes**</td>
<td>No</td>
</tr>
<tr>
<td>M</td>
<td>UHSS Materials, Boron (Particular to 70000 MPa Strength)</td>
<td>Base Boron</td>
<td>Yes*</td>
<td>Yes</td>
<td>Yes**</td>
<td>No</td>
</tr>
<tr>
<td>B</td>
<td>UHSS Materials, Boron (Particular to 50000 MPa Strength)</td>
<td>Base Boron</td>
<td>Yes*</td>
<td>Yes</td>
<td>Yes**</td>
<td>No</td>
</tr>
<tr>
<td>TRIP</td>
<td>TRIP 550, TRIP 780, TRIP 960</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

NOTES:
- MIG Brazed allowed for non-structural applications only.
- MIG Plug Only, NO STITCH WELDING.
- Cold repairs can be performed if damage excludes kinks; may section only if Workshop Manual procedure allows.
- Dual-phase steels: DP 700, DP 960 and DP 980 must be replaced at factory joints; may section only if Workshop Manual procedure allows.
- Boron components must be replaced at factory joints; no sectioning allowed.

* MIG Plug Only, NO STITCH WELDING.
** Cold repairs can be performed if damage excludes kinks, may section only if Workshop Manual procedure allows.
*** Dual-phase steels: DP 700, DP 960 and DP 980 must be replaced at factory joints; may section only if Workshop Manual procedure allows.
**** Boron components must be replaced at factory joints; no sectioning allowed.
Repairability Guidelines (cont’d)

Welding Precautions and Information

REPAIRING 1,500 MPa STEEL PARTS
Observe these precautions when repairing 1,500 MPa steel parts:
- NEVER attempt to straighten damaged 1,500 MPa steel parts because they may crack.
- 1,500 MPa steel parts MUST be replaced at factory seams using squeeze-type resistance spot welding (STRSW).
- MIG brazed joints should be used ONLY in locations not accessible by a spot welder.
- To assure adequate weld tensile strength, always set the spot welder to the specifications provided in the body repair manual.

Important Information

Parts made of Ultra High Strength Steel (UHSS/1,500MPa/USIBOR, Hot Stamp) must be installed as a complete part. No sectioning allowed. Ultra High Strength Steel requires special welding equipment, procedures, and settings. See the welding section of the appropriate body repair manual. Failure to use the proper equipment or follow the proper procedures can result in an unsafe repair.
Foams, Sealers and Adhesives

Dodge Durango
Foams, Sealers and Adhesives (cont’d)
Foams, Sealers and Adhesives (cont’d)

Kia Optima
Partial Part Replacement Seams

Chevrolet Impala
Partial Part Replacement (cont’d)

Kia Optima
Service Information

2018 Chevrolet Cruze (Gen II - VIN B) | Cruze Gen II - VIN B Service Manual | Israel-US/Canada 10992987 | Body Repair | Collision Repair | Repair Instructions

Document ID: 4325310

Front Compartment Side Rail Sectioning

Removal Procedure

Warning: Approved Equipment for Collision Repair Warning.

Warning: Collision Sectioning Warning.

Warning: Glass and Sheet Metal Handling Warning.

1. Disable the SIR system. SIR Disabling and Enabling.
2. Battery Negative Cable-Disconnect, Battery Negative Cable Disconnection and Connection
3. Remove all related panels and components.
4. Visually inspect the damage. Repair as much of the damage as possible.
5. Remove the sealers and anti-corrosion materials from the repair area as necessary.

Chevrolet Cruze
7. Cut the front compartment front outer side rail.

8. Create a cut line on the front compartment front side rail (1).
   - \( a = 15 \text{ mm} \)
   
   **Note:** Do NOT damage any inner panels or reinforcements.

9. Cut the front compartment front side rail.
4. **NOTE:** The replacement front frame components are production parts designed with a taper to insert into the front rail section to assist in alignment and welding operations.

Front frame short section overview.

Ford F-150
Outer Body Panel Sectioning Procedures

Sectioning

Adhesives

Foam

Sealer

Weld Locations

Honda
### Outer Body Panel Sectioning Procedures (cont’d)

**CUT AND JOIN REPLACEMENT SECTIONS (SMALL AREAS)**

**Work Procedure**

1. Cut the wheel arch portion.
2. Heat the quarter panel adhesive area and remove the quarter panel.
   - **HINT:** Using an industrial heater gun or gas burner, heat the quarter panel to 110°F.
3. Clean off any adhesive that remains on the vehicle.
   - **HINT:**
     - **Using an industrial heater gun or gas burner:** Heat the adhesive to 110°F to 149°F.
     - Using a scraper, scrape away the adhesive.
     - If adhesive remains, the strength of any subsequently applied adhesive will be reduced.
4. Using a disc grinder or belt sander, scuff and sand any adhesive that remains on the vehicle.
   - **HINT:**
     - Scuff at a width of approximately 10 mm (0.39 in.) over the previous adhesive.
5. Apply adhesive to the exposed metal areas on the vehicle. Using a spatula, spread the adhesive to the vehicle.
6. Apply adhesive to the vehicle again.
7. Using #60-120 grit sandpaper, scuff the adhesive application area on the new quarter panel.
8. Apply adhesive to the new quarter panel. Using a spatula, spread the adhesive evenly over the area.
9. Using a vise grip or the palms of your hands, press the quarter panel so that the thickness is even.
10. Complete installation of the new quarter panel.
11. Dry the adhesive areas of the new quarter panel.
Outer Body Panel Sectioning Procedures (cont’d)

Center Pillar Sectioning - Outer

9. Cut access window (1) in the center pillar outer.

10. Perform additional sectioning procedures as needed depending on damage to vehicle. Quarter Outer Panel Sectioning

11. Locate and remove all factory welds (1). Note the number and location of welds for installation of the service part.
Attachment Methods

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factory rivet</td>
<td>Factory rivet</td>
<td></td>
</tr>
<tr>
<td>Spot weld - one layer</td>
<td>Spot weld - one layer</td>
<td>NOTE: This symbol is used for spot welds that are removed by drilling through one layer.</td>
</tr>
<tr>
<td>Spot weld - two layers</td>
<td>Spot weld - two layers</td>
<td>NOTE: This symbol is used for spot welds that are removed by drilling through two layers.</td>
</tr>
<tr>
<td>Factory self-piercing rivet (SPR)</td>
<td>Factory self-piercing rivet (SPR)</td>
<td></td>
</tr>
<tr>
<td>Factory BLM (blind, oversized mechanically locked fastener)</td>
<td>Factory BLM (blind, oversized mechanically locked fastener)</td>
<td></td>
</tr>
<tr>
<td>Factory pin and collar</td>
<td>Factory pin and collar</td>
<td></td>
</tr>
<tr>
<td>Laser weld</td>
<td>Laser weld</td>
<td></td>
</tr>
<tr>
<td>Plug weld</td>
<td>Plug weld</td>
<td></td>
</tr>
<tr>
<td>Rivet</td>
<td>Rivet</td>
<td></td>
</tr>
<tr>
<td>Sheet metal screw</td>
<td>Sheet metal screw</td>
<td></td>
</tr>
<tr>
<td>Nut</td>
<td>Nut</td>
<td></td>
</tr>
<tr>
<td>Stud</td>
<td>Stud</td>
<td></td>
</tr>
</tbody>
</table>

Tesla Model S
### Attachment Methods (cont’d)

**Kia Optima**

<table>
<thead>
<tr>
<th>Attachment Method</th>
<th>Panel Location</th>
<th>Image</th>
</tr>
</thead>
<tbody>
<tr>
<td>25 : Weld points</td>
<td>Outside</td>
<td><img src="attachment-methods.png" alt="Image" /></td>
</tr>
<tr>
<td>25 : Cut side (Remove weld point and panel position)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>25 : Weld points</td>
<td>Inside</td>
<td><img src="attachment-methods.png" alt="Image" /></td>
</tr>
<tr>
<td>25 : Epoxy adhesive</td>
<td>Cut</td>
<td><img src="attachment-methods.png" alt="Image" /></td>
</tr>
<tr>
<td>25 : Spot weld (Installation weld point and panel position)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>: Cut (Removal)</td>
<td></td>
<td><img src="attachment-methods.png" alt="Image" /></td>
</tr>
<tr>
<td>: Butt weld (Installation)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**CAUTION**

Check new panel before removing the existing panel as parts supply unit can be changed without prior notice according to engineering change.
Attachment Methods (cont’d)

Kia Optima

CAUTION
Check new panel before removing the existing panel as parts supply unit can be changed without prior notice according to engineering change.
## Attachment Methods (cont’d)

<table>
<thead>
<tr>
<th>Fastener Symbol</th>
<th>Fastener Type</th>
<th>Fastener Image</th>
<th>Part Number</th>
<th>Fasteners Per Bag</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Rivet, 4.8 mm, 1.6–6.9 mm</td>
<td></td>
<td>1028719-00-A</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Structural Rivet, 6.5 mm, 2.0–9.5 mm (short)</td>
<td></td>
<td>1028408-00-A</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Structural Rivet, 6.5 mm, 3.0–13.5 mm (medium)</td>
<td></td>
<td>1062559-00-A</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Structural Rivet, 6.5 mm, 2.0–15.9 mm (long)</td>
<td></td>
<td>1028409-00-A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Countersunk Rivet, 4.8 mm (short)</td>
<td></td>
<td>1069308-00-A</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Countersunk Rivet, 4.8 mm (long)</td>
<td></td>
<td>1069326-00-A</td>
<td></td>
</tr>
</tbody>
</table>

- **Countsunk Rivet, 6.5 mm**
  - Part Number: 1069627-00-A
  - Fasteners Per Bag: 10

- **Structural Bulb Rivet, 6.5 mm**
  - Part Number: 1069643-00-A
  - Fasteners Per Bag: 10

- **Structural Flange Rivet, 6.5 mm**
  - Part Number: 1069658-00-A
  - Fasteners Per Bag: 10

- **SPR, 5x4**
  - Part Number: 1028936-00-A
  - Fasteners Per Bag: 10

- **SPR, 5x4.5**
  - Part Number: 1028903-00-A
  - Fasteners Per Bag: 10

- **SPR, 5x5**
  - Part Number: 1028939-00-A
  - Fasteners Per Bag: 10
Equipment

Honda

MI200T Spot Welder
Model: CASCELO20000
Supplier Name: CHIEF AUTOMOTIVE TECHNOLOGIES

Description
Chief’s MI200T Spot Welder is the ideal solution for all high strength steel body repairs. The MI200T offers worry-free welding through the TrueAutoMode™ automatic welding system. TrueAutoMode™ detects the metal type and thickness, as well as the presence of adhesives and insulations, and then automatically adjusts and sets the welding parameters accordingly. It provides instant feedback to the technician about the weld result, while simultaneously logging the results into memory.

Features
- Designed for all vehicle body repairs with high strength steels
- Simple to follow LCD user interface
- High performance lightweight transformer pliers - 40% less power than standard cable plier welder
- C clamps with multiple size arms available
- Detects and adjusts welding parameters
- Logs data for each repair
- Provides feedback on the quality of every weld
- 20 ft. of welding cable for increased reach
- High duty cycle: no waiting for cool
- Includes two day training voucher for Chief University ($655 value - valid for 12 months after install). Classes are offered across the country on various collision related fields and students receive 1 Car credit.

Includes
- CASCELO1720 Overhead Balancer and 360° Gyro C Arm
- CASCELO11412 Insulated C1 Arm
- CASCELO34108 Arm Mounting Bracket
- CASCELO06815 Starter Box of Caps
### Assured Performance Network (APN)

#### Equipment (cont’d)

**Technical Capability**

<table>
<thead>
<tr>
<th>Y</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I-CAR Gold Class</td>
</tr>
<tr>
<td>2.</td>
<td>A frame rack or bench, and vehicle anchoring/pulling equipment capable of producing body and structural pulls</td>
</tr>
<tr>
<td>3.</td>
<td>A three-dimensional measuring system, dedicated holding and fixturing system, or universal holding and fixturing system</td>
</tr>
<tr>
<td>4.</td>
<td>Current data subscription for measuring system or proof of required fixtures</td>
</tr>
<tr>
<td>5.</td>
<td>Proper proof of technical training to operate the measuring equipment being utilized</td>
</tr>
<tr>
<td>6.</td>
<td>A 220 Volt, 3-Phase Inverter-Type (or functionally equivalent Hybrid) - Squeeze-type Resistance Spot Welder (STRSW) capable of producing a minimum of 600 lbf (270 daN) of clamping force and 10,000 amps of current at the electrodes</td>
</tr>
<tr>
<td>7.</td>
<td>A 220-volt MIG/MAG welder for steel fusion</td>
</tr>
</tbody>
</table>

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**Ensire Today - www.certifymyshop.com - 949.221.0010**
Weld-Through Primer Requirements

1. A test weld should always be carried out on a test sample.
2. The correct protective clothing should always be worn.
3. Always work in a well-ventilated area to avoid accumulation of noxious and oxygen displacing gases.
4. Place protective covers around components and wiring harnesses to protect from welding splatter.
5. Use grinding discs and wire brushes dedicated to the type of material being welded.
6. Follow equipment manufacturer’s prescribed procedures and equipment settings for the type of weld being used. ER70S-3 or ER70S-6 are typically used for MIG welding on steel.
7. Disconnect and isolate battery ground cable.
8. Components made of Boron, Martensite, HSS (high-strength steel) and UHS (ultra high-strength steel) should not be heated to straighten or repair. Severely bent or kinked components should be replaced with new ones.
9. Factory welds may be substituted with either STRW (squeeze-type resistance welding) spot welds or MIG plug welds.
10. MIG plug welds must equal factory welds in both location and quantity.
11. MIG plug weld holes should equal 8 mm (0.31 in) diameter.
12. Resistance spot welds must equal factory welds in quantity and be placed adjacent to original weld location.
13. Electrodes are consumable and react with the workpiece, filler metal, and electrical currents when welding.
14. Use of a weld-through primer is recommended where applicable.
15. When welding, always place the ground clamp as close as possible to the weld area.
16. Never connect the welder ground clamp to the vehicle subframe.
17. Never weld a vehicle subframe, steering or suspension component. Service is through replacement only.
Weld-Through Primer Requirements (cont’d)

Panel Removal

**WARNING:**
Always Wear Safety Goggles, Work Gloves, Hearing Protection and a Dust Mask when removing welded panels this way. Failure to follow these instructions can result in serious or fatal injury.

When removing panels and components for replacement, care must be taken not to damage the underlying component. On welded and “Weld Bonded” panels spot welds are used to weld cutting type tool, or equivalent. On panels that are adhesive bonded or weld bonded it is acceptable to use heat up to 204°C (400°F), from a Non-Open Flame heat source. This will loosen the bond, so less damage is inflicted to the mating surface. After panel is removed, any remaining weld nugget should be ground smooth. Cut-off wheels and/or potential to remove material from the base material which would weaken the final repair. Place an air hammer with a flat bladed chisel bit (or equivalent) in between panels that should be taken as to not damage mating flanges and the surrounding components.

Key Points of a Welding Repair

- Poor fit up will adversely affect weld quality and may result in a weld failure due to excessive metal stretching around the nugget.
- Clamps/Clecos should be used to bring parts together and hold them in position.
- Clamps/Clecos should be insulated when using STRSW to control weld current shorting (This can be accomplished with specialized clamps or by placing a insulating between the clamp jaws and the panels.)
- Number, size and location of welds should closely duplicate the original assembly. Do not place the new spot weld directly on the original spot weld location. Placement of original weld location may lead to metal fatigue or poor weld quality.
- Surfacing of the steel parts should be clean and free of scale, rust, paint, cured adhesives/sealers and any other contaminants that could adversely affect the quality of the removal of any E-coat applied to the service part within 25 mm. (1 in.) of any welds.
- Proper corrosion protection must be installed when repair is complete. (Refer to 31 - Collision Information/Standard Procedure/Corrosion Protection/)

**NOTE:**
FCA US LLC recommends the same quantity of welds as the original panel, but placement of the new weld should NOT be put directly on the original spot weld location. Placement of a new weld over an original weld location may lead to metal fatigue or poor weld quality.

Weld-Through Primer Guidelines: Fiat Chrysler Automobiles - UPDATE

Weld-through primers are generally a zinc-based product that is applied to the mating surfaces prior to welding. When the weld is performed, the zinc liquefies and flows into the weld-pool, protecting the weld from corrosion. Many OEMs have a position on when and how to use weld-through primer or when it shouldn’t be utilized. Let’s see what Fiat Chrysler Automobiles (FCA) recommends and where this information can be found.

FCA has recently updated their weld-through primer recommendations. Previously written manuals by Fiat recommended the use of weld-through primer, while Chrysler wrote manuals advising against the use of weld-through primer. The newly updated editions of the FCA manuals forbid the use of weld-through primer. However, you may find that currently on the free site that some manuals have not yet been updated and still recommend using weld-through primer. Per our contact at FCA, the free site is still in the process of being updated and weld-through primer should not be used.

Use the vehicle-specific body repair manuals to determine which type of welding is required for the repair process. Failing to follow OEM procedures will sacrifice the safety and quality of the repair.

For additional FCA information, check out the following pages:
- Chrysler OEM Information
- Dodge OEM Information
- Fiat OEM Information
- Jeep OEM Information
- RAM OEM Information

FCA
Corrosion Protection Methods and Materials

Anti-Corrosion Treatment and Repair

Undercoating and Closed Cavity Coatings

Warning: When applying sound deadeners, or anti-corrosion materials due care and preventative measures must be exercised to prevent any material from being sprayed into door and quarter panel mechanisms such as door locks, window run channels, window regulators and seal belt retractors, as well as any moving or rotating mechanical or suspension parts on the underbody, particularly the parking brake cable. After material application, be sure that all body drain holes are open. Improper application may increase chance of corrosion damage or limit the operation of moving parts, resulting in personal injury.

Any procedure that disturbs these special treatments, such as panel replacement or collision damage repair operations, may leave the metal unprotected and result in corrosion. Proper recoating of these surfaces with service-type anti-corrosion material is essential.

After repair and/or replacement parts are installed, all accessible bare metal surfaces must be treated with metal conditioner and reprimed. Refer to the GM Approved Refinish Materials book which identifies the paint systems you may use.

The latest revision of the GM Approved Refinish Materials booklet is located on the GM Genuine Parts website at www.gmgeparts.com.

After a collision, some vehicle structure areas such as frame rails, cross-members and rocker panel sections may need to be repaired. In most cases, the anti-corrosion materials need to be removed to perform these repairs. These materials are classified into two types: Closed Cavity coatings and Undercoat coatings. The primary difference is the way the products set up or "dry". Both are intended to protect the surface they are applied to from corrosion caused by water, salt water or Magnesium Chloride blended de-icing compounds used to thaw icy winter roads. They also can provide a measure of sound deadening.

The Closed Cavity coatings remain sticky to the touch and will seep into seams initially and over extended periods of time. Closed Cavity coatings provide the best corrosion protection inside of rocker panel sections, pillar sections, frame rails, cross-members, doors, rear compartment lids and closed areas of hoods - anywhere that is concealed or closed off to exterior surfaces.

The Undercoat coatings are "dry to the touch" and offer the best corrosion protection and sound deadening for floor pans, wheelhouses inside rear compartment and underhood areas - anywhere the coated surface is exposed.

Below is a listing of Undercoat coatings and Closed Cavity coatings that GM believes to be reliable. While others may exist, we have found these products, or equivalents to them, can be used with satisfactory results. Always use these products according to their manufacturer's recommendations.

The following products are available from Automotive International/Vauxgard. Contact them at 1-800-543-7156, or at www.vauxgard.net.

<table>
<thead>
<tr>
<th>Stock number</th>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VG-104</td>
<td>WAX/SOLVENT BASED UNDERCOAT</td>
<td>Traditional Wax/Solvent based Undercoating available in aerosol or spray gun canister</td>
</tr>
<tr>
<td>VG-076M</td>
<td>HYBRID (SOLV/WATER) UNDERCOAT</td>
<td>Meets OE specifications for corrosion resistance</td>
</tr>
<tr>
<td>VG-140</td>
<td>WATER BASED UNDERCOAT</td>
<td>Meets OE specifications for corrosion resistance</td>
</tr>
<tr>
<td>VG-101</td>
<td>WAX BASED CLOSED CAVITY COATING</td>
<td>Meets OE specifications for corrosion resistance</td>
</tr>
<tr>
<td>VG-UCG</td>
<td>CANISTER UNDERCOATING GUN</td>
<td>High quality undercoating gun uses canister packaging of undercoating</td>
</tr>
<tr>
<td>VG-CRG</td>
<td>CANISTER CLOSED CAVITY COATING GUN</td>
<td>High quality closed cavity coating gun uses canister packaging of coating and comes with 30in inner panel application tube with nozzle</td>
</tr>
</tbody>
</table>
### Corrosion Protection (cont’d)

#### Ford Focus

<table>
<thead>
<tr>
<th>Special Tool(s) / General Equipment</th>
</tr>
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<tbody>
<tr>
<td>350-6A1274D LBE Gun</td>
</tr>
<tr>
<td>350-6A32926 HRB Rust Gun</td>
</tr>
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</table>

#### Materials

<table>
<thead>
<tr>
<th>Name</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motorcraft™ Metal Surface Prep</td>
<td>ZC-31-A</td>
</tr>
<tr>
<td>UltraGuard™ Premium Undercoating VG101, VG101A</td>
<td></td>
</tr>
<tr>
<td>UltraGuard™ Rust Inhibitor VG104, VG104A</td>
<td></td>
</tr>
</tbody>
</table>

#### Repair

**NOTE:** Undercoating

**NOTE:** The following illustrations are not vehicle specific and are intended for reference only.

1. **WARNING:** Before beginning any service procedure in this section, REFER to Safety Warnings in section 100-00 General Information. Failure to follow this may result in serious personal injury.
   - Refer to: Body Repair Tools and Accessories (100-00 General Information, Description and Operation).
2. Wipe brush the area and make sure the surfaces are free of oil, dirt and other foreign material. Carry out the undercoating process in the following sequence.
3. Thoroughly clean and degrease metal surfaces to remove wax and grease. Material: Motorcraft™ Metal Surface Prep / ZC-31-A
4. For best results, the vehicle should be at room temperature.

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**Ford F-150**

11. **NOTE:** Cross-section view of typical underbody frame rail shown.

   Apply Rust Inhibitor to the inner surfaces of the rail after carrying out welding process. Depress trigger and wait 2-3 seconds and slowly pull the wand to make sure the area is completely fogged.

12. **NOTE:** Full frame vehicle, front rail-to-mid rail section repair shown.

   Apply Premium Undercoating to the exposed surfaces after carrying out the welding process. Make sure to completely cover any bare metal areas.
Adhesive Bonding Options

**Metal Panel Bonding (Steel)**

This information is intended to provide general guidelines for adhesive bonding of steel panels. Panel bonding of steel is only recommended when the panel is originally bonded to the vehicle. In every application adhesive bonding is combined with resistance spot welding, rivet bonding or other types of mechanical fastening. Always refer to service procedure for recommended fastening strategy. The only joints that use adhesive only are joints which have no way to introduce a resistance spot weld or rivet or other mechanical fastener. These will always be outlined in their specified procedure.

The adhesives listed in this document are known to meet the General Motors specifications and requirements for bonding of steel body panels.

Bonding procedures in general are applicable only at factory joints.

The use of adhesive to section steel panels is not recommended by General Motors.

Rivets, or other mechanical fasteners, need to be used in combination with adhesive bonding of steel panels. The specified rivets, or fasteners, should be used with adhesive, when replacing the original panel.

Two types of adhesives are listed here. Impact Resistant Adhesive is used in joints in frame rail assemblies and strut tower assemblies and other body structure joints that have critical strength requirements. The factory applied Impact Resistant Adhesive is purple in color when cured. The Impact Resistant adhesives available for servicing these joints are considerably stronger once cured than panel bonding adhesives. The other bonding adhesives are non-impact resistant, offer a lower strength rating and are only used in door outer panel attachment hem joints.

**Notes:** Always follow the adhesive manufacturer’s instructions for application, handling, and curing for the specific product. Adhesives currently meeting the performance requirements include the adhesive products listed below meet these guidelines:

<table>
<thead>
<tr>
<th>Manufacturer and Part Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fusor 2098</td>
<td>Fusor 2098 Impact Resistant Adhesive Available from Lord Fusor 800-234-3876 <a href="http://www.fusor.com">www.fusor.com</a></td>
</tr>
<tr>
<td>3M 07333</td>
<td>3M Impact Resistant Structural Adhesive Available from 3M <a href="http://www.3MCollision.com">www.3MCollision.com</a></td>
</tr>
<tr>
<td>SEM 39757 Structural Impact Resistant Adhesive</td>
<td><a href="http://www.semproducts.com">www.semproducts.com</a></td>
</tr>
</tbody>
</table>
Adhesive Bonding Options (cont’d)

Quarter Outer Panel Sectioning (Coupe)

Note: Apply panel bonding adhesive to the entire joint between the outer wheelhouse panel and the quarter outer panel.
5. Position the new service panel and clamp in place (1).
6. Perform the sectioning procedure.
Layout and Search Functionality

- Master DTC Chart
- Specifications
- Metrics
- Torque Wrench Adapter Formulas
- Alphabetical Index
  1: General Information
  2: Chassis
  3: Engine
  4: Electrical
  5: Body and Paint
  6: Frame and Mounting
- 00: Service Information
- 01: Body and Paint
- 02: Frame and Mounting

- 01: Body and Paint
  - 01: Body and Paint
  - 02: Frame and Mounting

- Ford

- 01: Body and Paint
  - 501-00 Body System - General Information
  - 501-02 Front End Body Panels
  - 501-03 Body Closures
  - 501-05 Interior Trim and Ornamentation
  - 501-06 Exterior Trim and Ornamentation
  - 501-09 Rear View Mirrors
  - 501-10A Front Seats
  - 501-10B Rear Seats
  - 501-11 Glass, Frames and Mechanisms
  - 501-12 Instrument Panel and Console
  - 501-14 Handles, Locks, Latches and Entry Systems
  - 501-16 Wipers and Washers
  - 501-17 Roof Opening Panel
  - 501-19 Bumpers
  - 501-20A Seatbelt Systems
  - 501-20B Supplemental Restraint System
  - 501-25 Body Repairs - General Information
  - 501-26 Body Repairs - Vehicle Specific Information and Tolerance Checks
  - 501-27 Front End Sheet Metal Repairs
  - 501-28 Roof Sheet Metal Repairs
  - 501-29 Side Panel Sheet Metal Repairs
  - 501-30 Rear End Sheet Metal Repairs
  - 501-36 Paint - General Information
Layout and Search Functionality (cont’d)

<table>
<thead>
<tr>
<th>Procedure Name</th>
<th>Description</th>
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<tbody>
<tr>
<td>Body Panel Sectioning</td>
<td>General Procedures, 501-28 Body Repairs - Vehicle Specific Information and Tolerance Checks</td>
</tr>
<tr>
<td>Body Repair Health and Safety and General Precautions</td>
<td>(Description and Operation, 100-00 General Information)</td>
</tr>
<tr>
<td>Specifications</td>
<td>(Specifications, 501-26 Body Repairs - General Information)</td>
</tr>
<tr>
<td>Fender Apron Panel Reinforcement</td>
<td>(Removal and Installation, 501-27 Front End Sheet Metal Repairs)</td>
</tr>
<tr>
<td>Front Side Member Section</td>
<td>(Removal and Installation, 501-27 Front End Sheet Metal Repairs)</td>
</tr>
<tr>
<td>A-Piller Outer Panel</td>
<td>(Removal and Installation, 501-29 Side Panel Sheet Metal Repairs)</td>
</tr>
<tr>
<td>A-Piller Outer Panel Section and Reinforcement</td>
<td>(Removal and Installation, 501-29 Side Panel Sheet Metal Repairs)</td>
</tr>
<tr>
<td>Quarter Panel LH</td>
<td>(Removal and Installation, 501-30 Rear End Sheet Metal Repairs)</td>
</tr>
<tr>
<td>Rear Floor Panel Section</td>
<td>(Removal and Installation, 501-30 Rear End Sheet Metal Repairs)</td>
</tr>
</tbody>
</table>

Ford
For More Information

Jason B. Bartanen
I-CAR
847.915.8743
jason.bartanen@i-car.com