

## Non-Structural Analysis and Damage 4

### Course Information

**Developers:** Automotive Collision and Repair State Curriculum Committee

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**KBOR Facilitators:** Shirley Antes/ April Henry

**Credit Hours:** 5

### Description:

Through a variety of classroom and shop/lab learning and assessment activities, students in this course will: remove trim and hardware; install trim and hardware; repair movable glass; protect adjacent body panels; repair outer body panel; replace outer body panels; adjust outer body panels; replace mechanical and electrical components; demonstrate safety protocol appropriate for the auto repair setting, perform welding skills on non-structural damage repairs; and perform plastic and adhesive repairs.

### Exit Learning Outcomes

#### External Standards

- A By meeting any institution-required NATEF Tasks from the criteria outlined below. NATEF Guidelines of: 95% of HP-I items must be taught in the curriculum; 90% of HP-G items must be taught in the curriculum
- B 2.A Preparation
- C 2.B Outer Body Panel Repairs, Replacements, and Adjustments
- D 2.C Metal Finishing and Body Filling
- E 2.D Moveable Glass and Hardware
- F 2.E Metal Welding and Cutting
- G 2.F Plastics and Adhesives
- H 4.A Safety Precautions

## Competencies

### Remove trim and hardware

#### Properties

Domain: Psychomotor Level:

#### Linked External Standards

2.A Preparation

DAM01: Vehicle Identification, Estimating Systems, And Terminology

DAM02: Frontal Impact Analysis

DAM03: Mechanical Systems Analysis

DAM04: Restraints, Interior, Glass, Side And Rear Impact Analysis

EXT01: Bolted-On Part Replacement

EXT02: Welded And Adhesively Bonded Panel Replacement

TRM01: Trim And Hardware

#### You will demonstrate your competence:

- o in the classroom or classroom shop setting

#### Your performance will be successful when:

- o 2.A.1 Review damage report and analyze damage to determine appropriate methods for overall repair; develop and document a repair plan. HP-I
- o 2.A.2 Inspect, remove, store, and replace exterior trim and moldings. HP-I
- o 2.A.3 Inspect, remove, store, and replace interior trim and components. HP-I
- o 2.A.4 Inspect, remove, store, and replace non-structural body panels and components that may interfere with or be damaged during repair. HP-I
- o 2.A.5 Inspect, remove, store, and replace all vehicle mechanical and electrical components that may interfere with or be damaged during repair. HP-G
- o 2.A.6 Protect panels, glass, and parts adjacent to the repair area. HP-I

### Install trim and hardware

#### Properties

Domain: Psychomotor Level:

#### Linked External Standards

2.A Preparation

DAM01: Vehicle Identification, Estimating Systems, And Terminology

DAM02: Frontal Impact Analysis

DAM04: Restraints, Interior, Glass, Side And Rear Impact Analysis

EXT01: Bolted-On Part Replacement

DAM03: Mechanical Systems Analysis

DAM06: Steering And Suspension Damage Analysis

TRM01: Trim And Hardware

#### You will demonstrate your competence:

- o in the classroom or classroom shop setting

**Your performance will be successful when:**

- o 2.A.1 Review damage report and analyze damage to determine appropriate methods for overall repair; develop and document a repair plan. HP-I
- o 2.A.2 Inspect, remove, store, and replace exterior trim and moldings. HP-I
- o 2.A.3 Inspect, remove, store, and replace interior trim and components. HP-I
- o 2.A.4 Inspect, remove, store, and replace non-structural body panels and components that may interfere with or be damaged during repair. HP-I
- o 2.A.5 Inspect, remove, store, and replace all vehicle mechanical and electrical components that may interfere with or be damaged during repair. HP-G
- o 2.A.6 Protect panels, glass, and parts adjacent to the repair area. HP-I

**Repair movable glass**

**Properties**

Domain: Psychomotor Level:

**Linked External Standards**

2.A Preparation

2.E Metal Welding and Cutting

2.D Moveable Glass and Hardware

DAM01: Vehicle Identification, Estimating Systems, And Terminology

DAM02: Frontal Impact Analysis

DAM04: Restraints, Interior, Glass, Side And Rear Impact Analysis

EDSO1: Non-Structural Supplement Diagnose electrical concerns Complete headlamp and fog/driving lamp assemblies and repairs Demonstrate self-grounding procedures for handling electronic components Determine diagnosis, inspection and service needs for brake system hydraulic components Examine components of heating and air conditioning systems Determine the inspection, service and repair needs for collision damaged cooling system components Distinguish between the under car components and systems Determine the diagnosis, inspection and service requirements of active and passive restraint systems

EXT01: Bolted-On Part Replacement

EXT02: Welded And Adhesively Bonded Panel Replacement

FCR01: Fundamentals Of Collision Repair

STS01: Cosmetic Straightening Steel

TRM01: Trim And Hardware

WCS01: Steel GMA (MIG) Welding

**You will demonstrate your competence:**

- o in the classroom or classroom shop setting

**Your performance will be successful when:**

- o 2.A.1 Review damage report and analyze damage to determine appropriate methods for overall repair; develop and document a repair plan. HP-I
- o 2.A.4 Inspect, remove, store, and replace non-structural body panels and components that may interfere with or be damaged during repair. HP-I
- o 2.A.6 Protect panels, glass, and parts adjacent to the repair area. HP-I

- o 2.E.9 Protect adjacent panels, glass, vehicle interior, etc. from welding and cutting operations. HP-I
- o 2.D.1 Inspect, adjust, repair or replace window regulators, run channels, glass, power mechanisms, and related controls. HP-I
- o 2.D.2 Diagnose and repair water leaks, dust leaks, and wind noises; inspect, repair, and replace weather-stripping. HP-G
- o 2.D.3 Inspect, repair or replace, and adjust removable, manually or power operated roof panel and hinges, latches, guides, handles, retainer, and controls of sunroofs. HP-G
- o 2.D.4 Inspect, remove, reinstall, and align convertible top and related mechanisms. HP-G

### **Protect adjacent body panels**

#### **Properties**

Domain: Cognitive Level: Application

#### **Linked External Standards**

2.A Preparation

2.B Outer Body Panel Repairs, Replacements, and Adjustments

2.E Metal Welding and Cutting

ADH01: Adhesive Bonding

CPS01: Corrosion Protection

DAM02: Frontal Impact Analysis

DAM05: Aluminum Panels And Structures Damage Analysis

EDSO1: Non-Structural Supplement Diagnose electrical concerns Complete headlamp and fog/driving lamp assemblies and repairs Demonstrate self-grounding procedures for handling electronic components Determine diagnosis, inspection and service needs for brake system hydraulic components Examine components of heating and air conditioning systems Determine the inspection, service and repair needs for collision damaged cooling system components Distinguish between the under car components and systems Determine the diagnosis, inspection and service requirements of active and passive restraint systems

FCR01: Fundamentals Of Collision Repair

FOM01: Automotive Foams

PRA01: Replacing Aluminum Exterior Panels

STA01: Cosmetic Straightening Aluminum

STS01: Cosmetic Straightening Steel

WNW01: Wind Noise And Water Leaks

#### **You will demonstrate your competence:**

- o in the classroom or classroom shop setting

#### **Your performance will be successful when:**

- o 2.A.1 Review damage report and analyze damage to determine appropriate methods for overall repair; develop and document a repair plan. HP-I
- o 2.A.2 Inspect, remove, store, and replace exterior trim and moldings. HP-I
- o 2.A.3 Inspect, remove, store, and replace interior trim and components. HP-I
- o 2.A.4 Inspect, remove, store, and replace non-structural body panels and components that

may interfere with or be damaged during repair. HP-I

- o 2.B.1 Determine the extent of direct and indirect damage and direction of impact; develop and document a repair plan. HP-I

- o 2.E.9 Protect adjacent panels, glass, vehicle interior, etc. from welding and cutting operations. HP-I

## **Repair outer body panel**

### **Properties**

Domain: Psychomotor

### **Linked External Standards**

2.B Outer Body Panel Repairs, Replacements, and Adjustments

2.C Metal Finishing and Body Filling

ADH01: Adhesive Bonding

CPS01: Corrosion Protection

DAM02: Frontal Impact Analysis

DAM04: Restraints, Interior, Glass, Side And Rear Impact Analysis

DAM05: Aluminum Panels And Structures Damage Analysis

EDSO1: Non-Structural Supplement Diagnose electrical concerns Complete headlamp and fog/driving lamp assemblies and repairs Demonstrate self-grounding procedures for handling electronic components Determine diagnosis, inspection and service needs for brake system hydraulic components Examine components of heating and air conditioning systems Determine the inspection, service and repair needs for collision damaged cooling system components Distinguish between the under car components and systems Determine the diagnosis, inspection and service requirements of active and passive restraint systems

EXT01: Bolted-On Part Replacement

EXT02: Welded And Adhesively Bonded Panel Replacement

FOM01: Automotive Foams

PRA01: Replacing Aluminum Exterior Panels

STA01: Cosmetic Straightening Aluminum

STS01: Cosmetic Straightening Steel

### **You will demonstrate your competence:**

- o in the classroom or classroom shop setting

### **Your performance will be successful when:**

- o 2.C.1 Remove paint from the damaged area of a body panel. HP-I

- o 2.C.2 Locate and reduce surface irregularities on a damaged body panel. HP-I

- o 2.C.3 Demonstrate hammer and dolly techniques. HP-I

- o 2.C.4 Heat shrink stretched panel areas to proper contour. HP-I

- o 2.C.5 Cold shrink stretched panel areas to proper contour. HP-I

- o 2.C.6 Mix body filler. HP-I

- o 2.C.7 Apply body filler; shape during curing. HP-I

- o 2.C.8 Rough sand cured body filler to contour; finish sand. HP-I

- o 2.C.9 Determine the proper metal finishing techniques for aluminum. HP-G
- o 2.C.10 Determine proper application of body filler to aluminum. HP-G
- o 2.B.1 Determine the extent of direct and indirect damage and direction of impact; develop and document a repair plan. HP-I
- o 2.B.3 Determine the extent of damage to aluminum body panels; repair or replace. HP-G
- o 2.B.9 Straighten and rough-out contours of damaged panels to a suitable condition for body filling or metal finishing using power tools, hand tools, and weld-on pull attachments. HP-I
- o 2.B.10 Weld damaged or torn steel body panels; repair broken welds. HP-I
- o 2.B.11 Restore corrosion protection. HP-I
- o 2.B.12 Replace door skins. HP-G
- o 2.B.13 Restore sound deadeners and foam materials. HP-I
- o 2.B.14 Perform panel bonding. HP-G
- o 2.B.15 Diagnose and repair water leaks, dust leaks, and wind noise. HP-G

### **Replace outer body panels**

#### **Properties**

Domain: Psychomotor Level:

#### **Linked External Standards**

2.B Outer Body Panel Repairs, Replacements, and Adjustments

DAM01: Vehicle Identification, Estimating Systems, And Terminology

DAM03: Mechanical Systems Analysis

DAM04: Restraints, Interior, Glass, Side And Rear Impact Analysis

DAM06: Steering And Suspension Damage Analysis

EXT01: Bolted-On Part Replacement

GLA01: Movable Glass

PWR01: Power Accessories

WNW01: Wind Noise And Water Leaks

#### **You will demonstrate your competence:**

- o in the classroom or classroom shop setting

#### **Your performance will be successful when:**

- o 2.B.2 Inspect, remove and replace bolted, bonded, and welded steel panel or panel assemblies. HP-I
- o 2.B.1 Determine the extent of direct and indirect damage and direction of impact; develop and document a repair plan. HP-I
- o 2.B.4 Inspect, remove, replace, and align hood, hood hinges, and hood latch. HP-I
- o 2.B.5 Inspect, remove, replace, and align deck lid, lid hinges, and lid latch. HP-I
- o 2.B.6 Inspect, remove, replace, and align doors, tailgates, hatches, lift gates, latches, hinges, and related hardware. HP-I
- o 2.B.7 Inspect, remove, replace, and align bumper bars, covers, reinforcement, guards, isolators, and mounting hardware. HP-I

- o 2.B.8 Inspect, remove, replace and align front fenders, headers, and other panels. HP-I
- o 2.B.11 Restore corrosion protection. HP-I
- o 2.B.12 Replace door skins. HP-G
- o 2.B.13 Restore sound deadeners and foam materials. HP-I
- o 2.B.14 Perform panel bonding. HP-G
- o 2.B.15 Diagnose and repair water leaks, dust leaks, and wind noise. HP-G

### **Adjust outer body panels**

#### **Properties**

Domain: Psychomotor Level:

#### **Linked External Standards**

2.B Outer Body Panel Repairs, Replacements, and Adjustments

DAM01: Vehicle Identification, Estimating Systems, And Terminology

DAM03: Mechanical Systems Analysis

DAM04: Restraints, Interior, Glass, Side And Rear Impact Analysis

DAM06: Steering And Suspension Damage Analysis

EXT01: Bolted-On Part Replacement

GLA01: Movable Glass

PWR01: Power Accessories

WNW01: Wind Noise And Water Leaks

#### **You will demonstrate your competence:**

- o in the classroom or classroom shop setting

#### **Your performance will be successful when:**

- o 2.B.2 Inspect, remove and replace bolted, bonded, and welded steel panel or panel assemblies. HP-I
- o 2.B.1 Determine the extent of direct and indirect damage and direction of impact; develop and document a repair plan. HP-I
- o 2.B.4 Inspect, remove, replace, and align hood, hood hinges, and hood latch. HP-I
- o 2.B.5 Inspect, remove, replace, and align deck lid, lid hinges, and lid latch. HP-I
- o 2.B.6 Inspect, remove, replace, and align doors, tailgates, hatches, lift gates, latches, hinges, and related hardware. HP-I
- o 2.B.7 Inspect, remove, replace, and align bumper bars, covers, reinforcement, guards, isolators, and mounting hardware. HP-I
- o 2.B.8 Inspect, remove, replace and align front fenders, headers, and other panels. HP-I
- o 2.B.11 Restore corrosion protection. HP-I
- o 2.B.12 Replace door skins. HP-G
- o 2.B.13 Restore sound deadeners and foam materials. HP-I
- o 2.B.14 Perform panel bonding. HP-G
- o 2.B.15 Diagnose and repair water leaks, dust leaks, and wind noise. HP-G

### **Replace mechanical and electrical components**

#### **Properties**

Domain: Psychomotor

**Linked External Standards**

2.A Preparation

2.D Moveable Glass and Hardware

2.E Metal Welding and Cutting

DAM01: Vehicle Identification, Estimating Systems, And Terminology

DAM03: Mechanical Systems Analysis

DAM04: Restraints, Interior, Glass, Side And Rear Impact Analysis

DAM06: Steering And Suspension Damage Analysis

EXT01: Bolted-On Part Replacement

GLA01: Movable Glass

PWR01: Power Accessories

WNW01: Wind Noise And Water Leaks

**You will demonstrate your competence:**

- o in the classroom or classroom shop setting

**Your performance will be successful when:**

- o 2.A.1 Review damage report and analyze damage to determine appropriate methods for overall repair; develop and document a repair plan. HP-I
- o 2.A.5 Inspect, remove, store, and replace all vehicle mechanical and electrical components that may interfere with or be damaged during repair. HP-G
- o 2.D.1 Inspect, adjust, repair or replace window regulators, run channels, glass, power mechanisms, and related controls. HP-I
- o 2.D.2 Diagnose and repair water leaks, dust leaks, and wind noises; inspect, repair, and replace weather-stripping. HP-G
- o 2.D.3 Inspect, repair or replace, and adjust removable, manually or power operated roof panel and hinges, latches, guides, handles, retainer, and controls of sunroofs. HP-G
- o 2.D.4 Inspect, remove, reinstall, and align convertible top and related mechanisms. HP-G
- o 2.E.10 Protect computers and other electronic control modules during welding procedures. HP-I

**Demonstrate safety protocol appropriate for the auto repair setting**

**Properties**

Domain: Cognitive Level: Application

**Linked External Standards**

4.A Safety Precautions

EDS02: Refinishing Supplement

REF01: Refinishing Equipment And VOC Regulations

REF02: Surface Preparation And Masking

REF03: Color Theory, Application, Tinting, And Blending

WKR01: Hazardous Materials, Personal Safety, And Refinish Safety

**You will demonstrate your competence:**

- o in the classroom or classroom shop setting

**Your performance will be successful when:**

- o 4.A.1 Identify and take necessary precautions with hazardous operations and materials according to federal, state, and local regulations. HP-I
- o 4.A.2 Identify safety and personal health hazards according to OSHA guidelines. HP-I
- o 4.A.3 Inspect spray environment to ensure compliance with federal, state and local regulations, and for safety and cleanliness hazards. HP-I
- o 4.A.4 Select and use the NIOSH approved personal sanding respirator. Inspect condition and ensure fit and operation. Perform proper maintenance in accordance with OSHA Regulation 1910.134 and applicable state and local regulation. HP-I
- o 4.A.5 Select and use the NIOSH approved (Fresh Air Make-up System) personal painting/refinishing respirator system. Perform proper maintenance in accordance with OSHA Regulation 1910.134 and applicable state and local regulation. HP-I
- o 4.A.6 Select and use the proper personal safety equipment for surface preparation, spray gun and related equipment operation, paint mixing, matching and application, paint defects, and detailing (gloves, suits, hoods, eye and ear protection, etc.). HP-I

**Perform welding skills on non-structural damage repairs**

**Properties**

Domain: Psychomotor

**Linked External Standards**

2.E Metal Welding and Cutting

ADH01: Adhesive Bonding

EXT02: Welded And Adhesively Bonded Panel Replacement

FCR01: Fundamentals Of Collision Repair

WCA01: Aluminum GMA (MIG) Welding

WCS01: Steel GMA (MIG) Welding

WCS04: Squeeze-Type Resistance Spot Welding

**You will demonstrate your competence:**

- o in the classroom or classroom shop setting

**Your performance will be successful when:**

- o 2.E.1 Identify weldable and non-weldable materials used in collision repair. HP-I
- o 2.E.10 Protect computers and other electronic control modules during welding procedures. HP-I
- o 2.E.11 Clean and prepare the metal to be welded, assure good metal fit-up, apply weld-through primer if necessary, and clamp as required. HP-I
- o 2.E.12 Determine the joint type (butt weld with backing, lap, etc.) for weld being made. HP-I
- o 2.E.13 Determine the type of weld (continuous, butt weld with backing, plug, etc.) for each specific welding operation. HP-I
- o 2.E.14 Perform the following welds: continuous, stitch, tack, plug, butt weld with and without backing, and fillet. HP-I

- o 2.E.15 Perform visual and destructive tests on each weld type. HP-I
- o 2.E.16 Identify the causes of various welding defects; make necessary adjustments. HP-I
- o 2.E.17 Identify cause of contact tip burn-back and failure of wire to feed; make necessary adjustments. HP-I
- o 2.E.18 Identify cutting process for different materials and locations perform cutting operation. HP-I
- o 2.E.19 Identify different methods of attaching non-structural components (squeeze type resistant spot welds (STRSW), riveting, non-structural adhesive, silicon bronze, etc.) HP-G
- o 2.E.2 Weld and cut high-strength steel and other steels. HP-I
- o 2.E.3 Weld and cut aluminum. HP-G
- o 2.E.4 Determine the correct GMAW (Mig) welder type, electrode, wire type, diameter, and gas to be used in a specific welding situation. HP-I
- o 2.E.5 Set up and adjust the GMAW (MIG) welder to "tune" for proper electrode stickout, voltage, polarity, flow rate, and wire-feed speed required for the material being welded. HP-I
- o 2.E.6 Store, handle, and install high-pressure gas cylinders. HP-I
- o 2.E.7 Determine work clamp (ground) location and attach. HP-I
- o 2.E.8 Use the proper angle of the gun to the joint and direction of gun travel for the type of weld being made in the flat, horizontal, vertical, and overhead positions. HP-I
- o 2.E.9 Protect adjacent panels, glass, vehicle interior, etc. from welding and cutting operations. HP-I

## **Perform plastic and adhesive repairs**

### **Properties**

Domain: Psychomotor

### **Linked External Standards**

2.F Plastics and Adhesives

DAM02: Frontal Impact Analysis

EXT01: Bolted-On Part Replacement

EXT02: Welded And Adhesively Bonded Panel Replacement

PLA01: Plastic Welding Repair

PLA02: Plastic Adhesive Repair

### **You will demonstrate your competence:**

- o in the classroom or classroom shop setting

### **Your performance will be successful when:**

- o 2.F.1 Identify the types of plastics; determine repairability. HP-I
- o 2.F.2 Identify the types of plastic repair procedures; clean and prepare the surface of plastic parts. HP-I
- o 2.F.3 Replace or repair rigid, semi-rigid, and flexible plastic panels. HP-G
- o 2.F.4 Remove or repair damaged areas from rigid exterior composite panels. HP-G
- o 2.F.5 Replace bonded rigid exterior composite body panels; straighten or align panel supports. HP-G

