

Structural Analysis and Damage 4

Course Information

Developers: Automotive Collision and Repair State Curriculum Committee

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Credit Hours: 3

Description:

Through a variety of classroom and lab/shop learning and assessment activities, students in this course will: apply safety requirements pertaining to structural damage repair; perform advanced welding and cutting techniques for structural repair; perform inspection and measurement of unibody for structural repair; repair unibody direct and indirect damage; perform frame inspection and measurement procedures; repair frame to industry standards; and remove and install fixed glass.

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 1.A Frame Inspection and Repair
- C 1.B Unibody Inspection, Measurement, and Repair
- D 1.C Fixed Glass
- E 1.D Metal Welding and Cutting
- F 4.A Safety Precautions

Competencies

Apply safety requirements pertaining to structural damage repair

Linked External Standards

4.A Safety Precautions

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

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.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 advanced welding and cutting techniques for structural repair

Linked External Standards

1.D Metal Welding and Cutting

ADH01: Adhesive Bonding

FCR01: Fundamentals Of Collision Repair

SPS01: Steel Unibody Front And Rear Rails, Floors, And Front Structure

SPS02: Steel Unibody A-, B-, C-, D-Pillars, And Rocker Panels

SPS03: Steel Full-Frame Sectioning

WCA01: Aluminum GMA (MIG) Welding

WCS01: Steel GMA (MIG) Welding

WCS05: Oxyacetylene/Plasma Arc Cutting

You will demonstrate your competence:

- o in the classroom or classroom shop setting

Your performance will be successful when:

- o 1.D.1 Identify weldable and non-weldable materials used in collision repair. HP-I
- o 1.D.2 Weld and cut high-strength steel and other steels. HP-I
- o 1.D.3 Weld and cut aluminum. HP-G
- o 1.D.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 1.D.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 1.D.6 Store, handle, and install high-pressure gas cylinders. HP-I
- o 1.D.7 Determine work clamp (ground) location and attach. HP-I
- o 1.D.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 1.D.9 Protect adjacent panels, glass, vehicle interior, etc. from welding and cutting operations. HP-I
- o 1.D.10 Protect computers and other electronic control modules during welding procedures. HP-I
- o 1.D.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 1.D.12 Determine the joint type (butt weld with backing, lap, etc.) for weld being made. HP-I
- o 1.D.13 Determine the type of weld (continuous, butt weld with backing, plug, etc.) for each specific welding operation. HP-I
- o 1.D.14 Perform the following welds: continuous, stitch, tack, plug, butt weld with and without backing, and fillet weld. HP-I
- o 1.D.16 Identify the causes of various welding defects; make necessary adjustments. HP-I
- o 1.D.17 Identify cause of contact tip burn-back and failure of wire to feed; make necessary adjustments. HP-I
- o 1.D.18 Identify cutting process for different materials and locations; perform cutting operation. HP-I
- o 1.D.19 Identify different methods of attaching structural components (squeeze type resistance spot welding (STRSW), riveting, structural adhesive, silicon bronze, etc.) HP-G

Perform inspection and measurement of unibody for structural repair

Linked External Standards

1.B Unibody Inspection, Measurement, and Repair

DAM02: Frontal Impact Analysis

DAM03: Mechanical Systems Analysis

DAM05: Aluminum Panels And Structures Damage Analysis

DAM06: Steering And Suspension Damage Analysis

DRT01: Drivetrains And Engine Mounts

FCR01: Fundamentals Of Collision Repair

MEA01: Measuring

SPA01: Structural Aluminum Design And Repair Processes

SPA02: Structural Aluminum Repair Processes

SPS01: Steel Unibody Front And Rear Rails, Floors, And Front Structure

SSA01: Structural Straightening Aluminum

STE01: Tires And Wheels

STE02: Suspension Systems

STE03: Rack And Pinion And Parallelogram Steering Systems

SSS01: Structural Straightening Steel

You will demonstrate your competence:

- o in the classroom or classroom shop setting

Your performance will be successful when:

- o 1.B.1 Analyze and identify misaligned or damaged steering, suspension, and powertrain components that can cause vibration, steering, and chassis alignment problems. HP-I
- o 1.B.3 Diagnose and measure unibody damage using tram and self-centering gauges. HP-I
- o 1.B.4 Determine and inspect the locations of all suspension, steering, and powertrain component attaching points on the vehicle. HP-G
- o 1.B.5 Diagnose and measure unibody vehicles using a dedicated (fixture) measuring system. HP-G
- o 1.B.6 Diagnose and measure unibody vehicles using a universal measuring system (mechanical, electronic, laser). HP-G
- o 1.B.7 Determine the extent of the direct and indirect damage and the direction of impact; plan and document the methods and sequence of repair. HP-I
- o 1.B.15 Identify heat limitations in unibody vehicles. HP-I
- o 1.B.16 Identify proper cold stress relief methods. HP-I
- o 1.B.20 Determine the extent of damage to aluminum structural components; repair, weld, or replace. HP-G
- o 1.B.21 Analyze and identify crush/collapse zones. HP-I

Repair unibody direct and indirect damage.

Linked External Standards

1.B Unibody Inspection, Measurement, and Repair

CPS01: Corrosion Protection

DAM05: Aluminum Panels And Structures Damage Analysis

DRT01: Drivetrains And Engine Mounts

EXT02: Welded And Adhesively Bonded Panel Replacement

FCR01: Fundamentals Of Collision Repair

MEA01: Measuring

SPA01: Structural Aluminum Design And Repair Processes

SPA02: Structural Aluminum Repair Processes

SPS01: Steel Unibody Front And Rear Rails, Floors, And Front Structure

SPS02: Steel Unibody A-, B-, C-, D-Pillars, And Rocker Panels

STE02: Suspension Systems

STE03: Rack And Pinion And Parallelogram Steering Systems

SSS01: Structural Straightening Steel

You will demonstrate your competence:

o in the classroom or classroom shop setting

Your performance will be successful when:

- o 1.B.2 Realign or replace misaligned or damaged steering, suspension, and powertrain components that can cause vibration, steering and chassis alignment problems. HP-G
- o 1.B.8 Attach anchoring devices to vehicle; remove or reposition components as necessary. HP-I
- o 1.B.9 Straighten and align cowl assembly. HP-G
- o 1.B.10 Straighten and align roof rails/headers and roof panels. HP-G
- o 1.B.11 Straighten and align hinge and lock pillars. HP-G
- o 1.B.12 Straighten and align vehicle openings, floor pans, and rocker panels. HP-G
- o 1.B.13 Straighten and align quarter panels, wheelhouse assemblies, and rear body sections (including rails and suspension/powertrain mounting points). HP-G
- o 1.B.14 Straighten and align front-end sections (aprons, strut towers, upper and lower rails, steering, and suspension/power train mounting points, etc.). HP-G
- o 1.B.17 Repair damage using power tools and hand tools to restore proper contours and dimensions. HP-I
- o 1.B.18 Remove and replace damaged sections of structural steel body panels. HP-G
- o 1.B.19 Restore corrosion protection to repaired or replaced unibody structural areas. HP-I
- o 1.B.20 Determine the extent of damage to aluminum structural components; repair, weld, or replace. HP-G

Perform frame inspection and measurement procedures

Linked External Standards

1.A Frame Inspection and Repair

DAM02: Frontal Impact Analysis

DAM03: Mechanical Systems Analysis

DAM05: Aluminum Panels And Structures Damage Analysis

DAM06: Steering And Suspension Damage Analysis

FCR01: Fundamentals Of Collision Repair

MEA01: Measuring

SPS03: Steel Full-Frame Sectioning

SPS08: Steel Full-Frame Technologies and Repair

SSS01: Structural Straightening Steel

You will demonstrate your competence:

o in the classroom or classroom shop setting

Your performance will be successful when:

- o 1.A.1 Diagnose and measure structural damage using tram and self-centering gauges. HP-I
- o 1.A.3 Analyze, straighten and align mash (collapse) damage. HP-G

- o 1.A.4 Analyze, straighten and align sag damage. HP-G
- o 1.A.5 Analyze, straighten and align sidesway damage. HP-G
- o 1.A.6 Analyze, straighten and align twist damage. HP-G
- o 1.A.7 Analyze, straighten and align diamond frame damage. HP-G
- o 1.A.10 Analyze and identify misaligned or damaged steering, suspension, and powertrain components that can cause vibration, steering, and wheel alignment problems. HP-I
- o 1.A.14 Diagnose and measure structural damage using a universal measuring system (mechanical, electrical, laser). HP-G
- o 1.A.15 Diagnose and measure structural damage to vehicles using a dedicated (fixture) measuring system. HP-G
- o 1.A.16 Determine the extent of the direct and indirect damage and the direction of impact; document the methods and sequence of repair. HP-I
- o 1.A.17 Analyze and identify crush/collapse zones. HP-I

Repair frame to industry standards

Linked External Standards

1.A Frame Inspection and Repair

1.D Metal Welding and Cutting

ADH01: Adhesive Bonding

CPS01: Corrosion Protection

DRT01: Drivetrains And Engine Mounts

FOM01: Automotive Foams

MEA01: Measuring

SPS01: Steel Unibody Front And Rear Rails, Floors, And Front Structure

SPS02: Steel Unibody A-, B-, C-, D-Pillars, And Rocker Panels

SPS03: Steel Full-Frame Sectioning

SSA01: Structural Straightening Aluminum

STE02: Suspension Systems

STE03: Rack And Pinion And Parallelogram Steering Systems

WCA01: Aluminum GMA (MIG) Welding

WCS01: Steel GMA (MIG) Welding

WCS05: Oxyacetylene/Plasma Arc Cutting

WCS04: Squeeze-Type Resistance Spot Welding

Your performance will be successful when:

- o 1.A.2 Attach vehicle to anchoring devices. HP-I
- o 1.A.3 Analyze, straighten and align mash (collapse) damage. HP-G
- o 1.A.4 Analyze, straighten and align sag damage. HP-G
- o 1.A.5 Analyze, straighten and align sidesway damage. HP-G
- o 1.A.6 Analyze, straighten and align twist damage. HP-G
- o 1.A.7 Analyze, straighten and align diamond frame damage. HP-G
- o 1.A.8 Remove and replace damaged structural components. HP-G

- o 1.A.9 Restore corrosion protection to repaired or replaced frame areas. HP-I
- o 1.A.11 Align or replace misaligned or damaged steering, suspension, and powertrain components that can cause vibration, steering, and wheel alignment problems. HP-G
- o 1.A.12 Identify heat limitations in structural components. HP-I
- o 1.A.13 Restore structural foam. HP-G
- o 1.D.1 Identify weldable and non-weldable materials used in collision repair. HP-I
- o 1.D.2 Weld and cut high-strength steel and other steels. HP-I
- o 1.D.3 Weld and cut aluminum. HP-G
- o 1.D.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 1.D.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 1.D.6 Store, handle, and install high-pressure gas cylinders. HP-I
- o 1.D.7 Determine work clamp (ground) location and attach. HP-I
- o 1.D.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 1.D.9 Protect adjacent panels, glass, vehicle interior, etc. from welding and cutting operations. HP-I
- o 1.D.10 Protect computers and other electronic control modules during welding procedures. HP-I
- o 1.D.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 1.D.12 Determine the joint type (butt weld with backing, lap, etc.) for weld being made. HP-I
- o 1.D.13 Determine the type of weld (continuous, butt weld with backing, plug, etc.) for each specific welding operation. HP-I
- o 1.D.14 Perform the following welds: continuous, stitch, tack, plug, butt weld with and without backing, and fillet weld. HP-I
- o 1.D.15 Perform visual and destructive tests on each weld type. HP-I
- o 1.D.16 Identify the causes of various welding defects; make necessary adjustments. HP-I
- o 1.D.17 Identify cause of contact tip burn-back and failure of wire to feed; make necessary adjustments. HP-I
- o 1.D.18 Identify cutting process for different materials and locations; perform cutting operation. HP-I
- o 1.D.19 Identify different methods of attaching structural components (squeeze type resistance spot welding (STRSW), riveting, structural adhesive, silicon bronze, etc.) HP-G

Remove and install fixed glass

Linked External Standards

1.C Fixed Glass

GLA02: Stationary Glass

PWR01: Power Accessories

You will demonstrate your competence:

- o in the classroom or classroom shop setting
- o 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

Your performance will be successful when:

- o 1.C.1 Remove and reinstall or replace fixed glass (heated and non-heated) using recommended materials. HP-G
- o 1.C.2 Remove and reinstall or replace modular glass using recommended materials. HP-G