

Structural Analysis and Damage 1

Course Information

Developers: Automotive Collision and Repair State Curriculum Committee

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Credit Hours: 2

Description:

Through a variety of classroom and/or lab/shop learning and assessment activities, students in this course will: identify measuring procedures; analyze the basic structural damage conditions; identify the safety requirements pertaining to structural damage repair; analyze frame repair methods; analyze unibody inspection and measurement and identify procedures of welding for structural repair.

Exit Learning Outcomes

External Standards

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

- 1.A Frame Inspection and Repair
- 1.B Unibody Inspection, Measurement, and Repair
- 1.D Metal Welding and Cutting
- 4.A Safety Precautions

Competencies

Identify measuring procedures

Linked External Standards

- 1.A Frame Inspection and Repair
- 1.B Unibody Inspection, Measurement, and Repair

DAM02: Frontal Impact Analysis

FCR01: Fundamentals Of Collision Repair

MEA01: Measuring

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.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.B.5 Diagnose and measure unibody vehicles using a dedicated (fixture) measuring system. HP-G

o 1.B.3 Diagnose and measure unibody damage using tram and self-centering gauges. HP-I

o 1.B.6 Diagnose and measure unibody vehicles using a universal measuring system (mechanical, electronic, laser). HP-G

o 1.B.15 Identify heat limitations in unibody vehicles. HP-I

o 1.B.21 Analyze and identify crush/collapse zones. HP-I

Analyze the basic structural damage conditions.

Linked External Standards

1.A Frame Inspection and Repair

1.B Unibody Inspection, Measurement, and Repair

DAM02: Frontal Impact Analysis

DAM03: Mechanical Systems Analysis

DAM06: Steering And Suspension Damage Analysis

DRT01: Drivetrains And Engine Mounts

FCR01: Fundamentals Of Collision Repair

MEA01: Measuring

SPS03: Steel Full-Frame Sectioning

SPS08: Steel Full-Frame Technologies and Repair

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.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
- 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.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

Identify the safety requirements pertaining to structural damage repair

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.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

Analyze frame repair methods

Linked External Standards

1.A Frame Inspection and Repair
DAM02: Frontal Impact Analysis
DAM03: Mechanical Systems 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.12 Identify heat limitations in structural components. HP-I
- o 1.A.14 Diagnose and measure structural damage using a universal measuring system (mechanical, electrical, laser). 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

Analyze unibody inspection and measurement

Linked External Standards

1.B Unibody Inspection, Measurement, and Repair
DAM03: Mechanical Systems Analysis
DAM06: Steering And Suspension Damage Analysis
DRT01: Drivetrains And Engine Mounts
FCR01: Fundamentals Of Collision Repair
MEA01: Measuring
SPS01: Steel Unibody Front And Rear Rails, Floors, And Front Structure
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.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.21 Analyze and identify crush/collapse zones. HP-I

Identify procedures of welding for structural repair

Linked External Standards

1.D Metal Welding and Cutting

FCR01: Fundamentals Of Collision Repair

ADH01: Adhesive Bonding

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

WCS01: Steel GMA (MIG) Welding

WCS05: Oxyacetylene/Plasma Arc Cutting

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 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.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