

Structural Analysis and Damage 3

Course Information

Developers: Automotive Collision and Repair State Curriculum Committee

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Credit Hours: 3

Description:

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

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.C Fixed Glass

1.D Metal Welding and Cutting

4.A Safety Precautions

ABR01: Anti-Lock Brakes And Traction Control Systems

ADH01: Adhesive Bonding

AIR01: Air Conditioning

ALT01: Electric And Electric Hybrid Vehicles

ALT02: Hybrid Electric And Alternative Fuel Vehicles

BRA01: Brakes
CPS01: Corrosion Protection
CUS01: Customer Relations And Collision Repair
CYC01: Overview of Cycle Time Improvements for the Collision Repair Process
DAM01: Vehicle Identification, Estimating Systems, And Terminology
DAM02: Frontal Impact Analysis
DAM03: Mechanical Systems Analysis
DAM04: Restraints, Interior, Glass, Side And Rear Impact Analysis
DAM05: Aluminum Panels And Structures Damage Analysis
DAM06: Steering And Suspension Damage Analysis
DCX01: Collision Repair Overview For Chrysler, Dodge, And Jeep Vehicles
DRE01: Driveability Issues, No-Starts, And Emissions
DRT01: Drivetrains And Engine Mounts
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
ELE03: Fault Code Retrieval, Diagnosis, And Testing Electronic Systems
ELE01: Electrical Circuits And DVOM Usage
ELE02: Diagnosis, Testing, And Repair Of Common Electrical Loads
ELE03: Fault Code Retrieval, Diagnosis, And Testing Electronic Systems
EXT01: Bolted-On Part Replacement
EXT02: Welded And Adhesively Bonded Panel Replacement
FCR01: Fundamentals Of Collision Repair
FOM01: Automotive Foams
FRD01: Collision Repair Overview for the 2004 Ford F-150
FUE01: Fuel And Exhaust Systems
GEN01: Collision Repair Overview for the 2006 Corvette Z06
GLA01: Movable Glass
GLA02: Stationary Glass
HEA01: Heating And Cooling Systems
LSC01: Lighting, Starting, And Charging Systems
MEA01: Measuring
PLA01: Plastic Welding Repair
PLA02: Plastic Adhesive Repair
PRA01: Replacing Aluminum Exterior Panels

PWR01: Power Accessories
REF01: Refinishing Equipment And VOC Regulations
REF02: Surface Preparation And Masking
REF03: Color Theory, Application, Tinting, And Blending
REF04: Detailing
REF07: Waterborne Products, Systems, and Application
RES01: Restraints
RES02: Advanced Restraint Systems
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
SPS03: Steel Full-Frame Sectioning
SPS04: Structural Parts Steel Qualification Test Prep
SPS05: Structural Parts Steel Qualification Test
SPS06: Full-Frame Replacement
SPS07: Steel Unitized Structures Technologies and Repair
SPS08: Steel Full-Frame Technologies and Repair
SSA01: Structural Straightening Aluminum
STA01: Cosmetic Straightening Aluminum
STE01: Tires And Wheels
STE02: Suspension Systems
STE03: Rack And Pinion And Parallelogram Steering Systems
STE04: Wheel Alignment And Diagnostic Angles
STE05: Electronically Controlled Steering And Suspension Systems
STS01: Cosmetic Straightening Steel
SSS01: Structural Straightening Steel
TLS01: Compressed Air Systems
TRM01: Trim And Hardware
VLV01: Introduction to Volvo Collision Repair
VLV02: Volvo Non-Structural Repair
VLV03: Volvo Structural Repair
VLV04: Volvo Damage Analysis And Electromechanical Repair
VLV05: Collision Repair Overview for the Volvo XC90
VLV06: Collision Repair Overview for the Volvo S40/V50
WCA01: Aluminum GMA (MIG) Welding
WCA02: Automotive Aluminum GMA (MIG) Welding Qualification Test Prep
WCA03: Automotive Aluminum GMA (MIG) Welding Qualification Test
WCA04: Aluminum GTA (TIG) Welding

WCS01: Steel GMA (MIG) Welding
WCS05: Oxyacetylene/Plasma Arc Cutting
WCS02: Automotive Steel GMA (MIG) Welding Qualification Test Prep
WCS03: Automotive Steel GMA (MIG) Welding Qualification Test
WCS04: Squeeze-Type Resistance Spot Welding
WKR01: Hazardous Materials, Personal Safety, And Refinish Safety
WNW01: Wind Noise And Water Leaks

Competencies

Apply 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.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 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

WCS04: Squeeze-Type Resistance Spot Welding

You will demonstrate your competence:

- o under instructor supervision
- 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.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

Diagnose unibody direct and indirect damage.

Linked External Standards

1.B Unibody Inspection, Measurement, and Repair

DAM02: Frontal Impact Analysis

EXT02: Welded And Adhesively Bonded Panel Replacement

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

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

Apply unibody inspection and measurement procedures

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

EXT02: Welded And Adhesively Bonded Panel Replacement

MEA01: Measuring

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

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

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 under instructor supervision
- 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.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.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.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.15 Identify heat limitations in unibody vehicles. HP-I
- o 1.B.16 Identify proper cold stress relief methods. HP-I
- 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
- o 1.B.21 Analyze and identify crush/collapse zones. HP-I

Apply unibody repair procedures

Linked External Standards

1.B Unibody Inspection, Measurement, and Repair

1.D Metal Welding and Cutting

ADH01: Adhesive Bonding

CPS01: Corrosion Protection

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

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
SPS03: Steel Full-Frame Sectioning
SSA01: Structural Straightening Aluminum
STE01: Tires And Wheels
STE02: Suspension Systems
STE03: Rack And Pinion And Parallelogram Steering Systems
SSS01: Structural Straightening Steel
WCA01: Aluminum GMA (MIG) Welding
WCS01: Steel GMA (MIG) Welding
WCS05: Oxyacetylene/Plasma Arc Cutting
WCS04: Squeeze-Type Resistance Spot Welding

You will demonstrate your competence:

- o under instructor supervision
- 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.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.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.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.15 Identify heat limitations in unibody vehicles. HP-I
- o 1.B.16 Identify proper cold stress relief methods. HP-I
- 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
- 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

Apply frame inspection and measurement procedures

Linked External Standards

1.A Frame Inspection and Repair

DAM02: Frontal Impact Analysis

DAM03: Mechanical Systems Analysis

DAM06: Steering And Suspension Damage Analysis

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.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.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.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

Apply frame repair procedures

Linked External Standards

1.A Frame Inspection and Repair

1.D Metal Welding and Cutting

CPS01: Corrosion Protection

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

SSS01: Structural Straightening Steel

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

WCA01: Aluminum GMA (MIG) Welding

WCA04: Aluminum GTA (TIG) Welding

WCS01: Steel GMA (MIG) Welding

WCS05: Oxyacetylene/Plasma Arc Cutting

You will demonstrate your competence:

- o under instructor supervision
- o in the classroom or classroom shop setting

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.A.17 Analyze and identify crush/collapse zones. HP-I
- 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 fixed glass

Linked External Standards

1.C Fixed Glass

GLA01: Movable Glass

GLA02: Stationary Glass

PWR01: Power Accessories

You will demonstrate your competence:

- o in the classroom or classroom shop setting

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