



AUTOMOTIVE COLLISION REPAIR

47.0600.30

TECHNICAL STANDARDS

An Industry Technical Standards Validation Committee developed and validated these standards on March 10, 2017. The Arizona Career and Technical Education Quality Commission, the validating authority for the Arizona Skills Standards Assessment System, endorsed these standards on May 24, 2017.

Note: Arizona's Professional Skills are taught as an integral part of the Automotive Collision Repair program.

The Technical Skills Assessment for Automotive Collision Repair is available SY2017-2018.

Note: In this document i.e. explains or clarifies the content and e.g. provides examples of the content that must be taught.

STANDARD 1.0 PERFORM NON-STRUCTURAL ANALYSIS AND DAMAGE REPAIR

- 1.1 Select and use proper personal safety equipment; take necessary precautions with hazardous operations and materials in accordance with federal, state, and local regulations
- 1.2 Locate procedures and precautions that may apply to the vehicle being repaired
- 1.3 Identify vehicle system hazard types [supplemental restraint system (SRS), hybrid/electric/alternative fuel vehicles], locations, and recommended procedure before inspecting or replacing components
- 1.4 Select and use a NIOSH approved air purifying respirator. Inspect condition and ensure fit and operation. Perform proper maintenance in accordance with OSHA regulation 1910.134 and applicable state and local regulation
- 1.5 Review damage report and analyze damage to determine appropriate methods for overall repair; develop, and document a repair plan
- 1.6 Inspect, remove, label, store, and reinstall exterior trim and moldings
- 1.7 Inspect, remove, label, store, and reinstall interior trim and components
- 1.8 Inspect, remove, label, store, and reinstall body panels and components that may interfere with or be damaged during repair
- 1.9 Inspect, remove, protect label, store, and reinstall vehicle mechanical and electrical components that may interfere with or be damaged during repair
- 1.10 Protect panels, glass, interior parts, and other vehicles adjacent to the repair area
- 1.11 Wash entire vehicle with soap and water; complete pre-repair inspection checklist
- 1.12 Prepare damaged area using water-based and solvent-based cleaners
- 1.13 Remove corrosion protection, undercoatings, sealers, and other protective coatings as necessary to perform repairs
- 1.14 Inspect, remove, and reinstall repairable plastics and other components for off-vehicle repair

STANDARD 2.0 PERFORM OUTER BODY PANEL REPAIRS, REPLACEMENTS, AND ADJUSTMENTS

- 2.1 Inspect/locate direct, indirect, or hidden damage and direction of impact
- 2.2 Inspect, remove, and replace mechanically fastened welded steel panel or panel assemblies
- 2.3 Determine the extent of damage to aluminum body panels; repair, or replace
- 2.4 Inspect, remove, replace, and align hood, hood hinges, and hood latch
- 2.5 Inspect, remove, replace, and align deck lid, lid hinges, and lid latch
- 2.6 Inspect, remove, replace, and align doors, latches, hinges, and related hardware
- 2.7 Inspect, remove, replace and align tailgates, hatches, liftgates, and sliding doors
- 2.8 Inspect, remove, replace, and align bumpers, covers, reinforcement, guards, impact absorbers, and mounting hardware
- 2.9 Inspect, remove, replace and align fenders, and related panels
- 2.10 Restore corrosion protection during and after the repair
- 2.11 Replace door skins

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- 2.12 Restore sound deadeners and foam materials
- 2.13 Perform panel bonding and weld bonding
- 2.14 Diagnose and repair water leaks, dust leaks, and wind noise
- 2.15 Identify one-time use fasteners
- 2.16 Weld damaged or torn steel body panels; repair broken welds

STANDARD 3.0 PERFORM METAL FINISHING AND BODY FILLING

- 3.1 Prepare a panel for body filler by abrading or removing the coatings; featheredge and refine scratches before the application of body filler
- 3.2 Locate and repair surface irregularities on a damaged body panel using power tools, hand tools, and weld-on pulling attachments
- 3.3 Demonstrate hammer and dolly techniques
- 3.4 Heat shrink stretched panel areas to proper contour
- 3.5 Cold shrink stretched panel areas to proper contour
- 3.6 Identify body filler defects; correct the cause and conditions (e.g., pinholing, ghosting, staining, and over catalyzing)
- 3.7 Identify different types of body fillers
- 3.8 Shape body filler to contour; finish sand
- 3.9 Perform proper metal finishing techniques for aluminum
- 3.10 Perform proper application of body filler to aluminum
- 3.11 Straighten contours of damaged panels to a suitable condition for body fillings or metal finishing using power tools, hand tools, and weld-on pulling attachments

STANDARD 4.0 DETERMINE MOVEABLE GLASS AND HARDWARE REQUIREMENTS

- 4.1 Inspect, adjust, repair or replace window regulators, run channels, glass, power mechanisms, and related controls
- 4.2 Inspect, adjust, repair, remove, reinstall or replace weather-stripping
- 4.3 Inspect, repair or replace, and adjust removable power-operated roof panel and hinges, latches, guides, handles, retainer, and controls of sunroofs
- 4.4 Inspect, remove, reinstall, and align convertible top and related mechanisms
- 4.5 Initialize electrical components as needed

STANDARD 5.0 PERFORM METAL WELDING AND CUTTING

- 5.1 Identify the considerations for cutting, removing, and welding various types of steel, aluminum, and other metals
- 5.2 Determine the correct GMAW (MIG) welder type, electrode/wire type, diameter, and gas to be used in a specific welding situation
- 5.3 Set up, attach work clamp (ground), and adjust the GMAW (MIG) welder to "tune" for proper electrode stick out, voltage, polarity, flow rate, and wire-feed speed required for the substrate being welded
- 5.4 Store, handle, and install high-pressure gas cylinders; test for leaks
- 5.5 Determine the proper angle of the gun to the joint and direction of gun travel for the type of weld being made
- 5.6 Protect adjacent panels, glass, vehicle interior, etc. from welding and cutting operations
- 5.7 Identify hazards; foam coatings and flammable materials prior to welding/butting procedures
- 5.8 Protect computers and other electronic control modules during welding procedures
- 5.9 Clean and prepare the metal to be welded, assure good metal fit-up, apply weld-through primer if necessary, clamp or tack as required
- 5.10 Determine the joint type (i.e., butt weld with backing, lap, etc.) for weld being made
- 5.11 Determine the type of weld (i.e., continuous, stitch weld, plug, etc.) for each specific welding operation
- 5.12 Perform the following welds: continuous, plug, butt weld with and without backing, fillet, etc., in the flat, horizontal, vertical, and overhead positions
- 5.13 Perform visual evaluation and destructive tests on each weld type
- 5.14 Identify the causes of various welding defects; make necessary adjustments
- 5.15 Identify cause of contact tip burn-back and failure of wire to feed; make necessary adjustments

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- 5.16 Identify cutting process for different substrates and locations; perform cutting operation
- 5.17 Identify different methods of attaching non-structural components [i.e., squeeze type resistant spot welding (STRSW), riveting, structural adhesive, MIG bronze, etc.]

STANDARD 6.0 PERFORM PLASTICS AND ADHESIVES REPARABILITY

- 6.1 Identify the types of plastics; determine reparability
- 6.2 Clean and prepare the surface of plastic parts; identify the types of plastic repair procedures
- 6.3 Repair rigid, semi-rigid, and flexible plastic panels
- 6.4 Remove or repair damaged areas from rigid exterior composite panels
- 6.5 Replace bonded rigid exterior composite body panels; straighten or align panel supports

STANDARD 7.0 APPLY SAFETY PRECAUTIONS WHEN PAINTING AND REFINISHING

- 7.1 Select and use proper personal safety equipment; take necessary precautions with hazardous operations and materials according to federal, state, and local regulations
- 7.2 Identify safety and personal health hazards according to OSHA guidelines and the Right to Know Law
- 7.3 Inspect spray environment and equipment to ensure compliance with federal, state and local regulations, and for safety and cleanliness hazards
- 7.4 Select and use a NIOSH approved air purifying respirator. Inspect condition and ensure fit and operation. Perform proper maintenance in accordance with OSHA Regulation 1910.134 and applicable state and local regulation
- 7.5 Select and use a NIOSH approved supplied air (Fresh Air Make-up) respirator system. Perform proper maintenance in accordance with OSHA Regulation 1910.134 and applicable state and local regulation
- 7.6 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 (i.e., gloves, suits, hoods, eye and ear protection, etc.)

STANDARD 8.0 PERFORM SURFACE PREPARATION FOR PAINTING AND REFINISHING

- 8.1 Inspect, remove, store, protect, and replace exterior trim and components necessary for proper surface preparation
- 8.2 Wash entire vehicle with soap and water; use appropriate cleaner to remove contaminants
- 8.3 Inspect and identify type of finish, surface condition, and film thickness; develop and document a plan for refinishing using a total product system
- 8.4 Remove paint finish as needed
- 8.5 Dry or wet sand areas to be refinished
- 8.6 Featheredge areas to be refinished
- 8.7 Apply suitable metal treatment or primer in accordance with total product systems
- 8.8 Mask and protect other areas that will not be refinished
- 8.9 Demonstrate different masking techniques (i.e., recess/back masking, foam door type, etc.)
- 8.10 Mix primer, primer surfacer, and primer sealer
- 8.11 Identify a complimentary color or shade of undercoat to improve coverage
- 8.12 Apply primer onto surface of repaired area
- 8.13 Apply two-component finishing filler to minor surface imperfections
- 8.14 Block sand area to which primer surfacer has been applied
- 8.15 Dry sand area to which finishing filler has been applied
- 8.16 Remove dust from area to be refinished, including cracks or moldings of adjacent areas
- 8.17 Clean area to be refinished using a final cleaning solution
- 8.18 Remove, with a tack rag, any dust or lint particles from the area to be refinished
- 8.19 Apply suitable primer sealer to the area being refinished
- 8.20 Scuff sand to remove nibs or imperfections from a sealer
- 8.21 Apply stone chip resistant coating
- 8.22 Restore caulking and seam sealers to repaired areas
- 8.23 Prepare adjacent panels for blending

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- 8.24 Identify the types of rigid, semi-rigid or flexible plastic parts to be refinished; determine the materials needed, preparation, and refinishing procedures
- 8.25 Identify metal parts to be refinished; determine the materials needed, preparation, and refinishing procedures

STANDARD 9.0 PERFORM SPRAY GUN AND RELATED EQUIPMENT OPERATION

- 9.1 Inspect, clean, and determine condition of spray guns and related equipment (e.g., air hoses, regulators, air lines, air source, and spray environment)
- 9.2 Select spray gun setup (e.g., fluid needle, nozzle, and cap) for product being applied
- 9.3 Test and adjust spray gun using fluid, air and pattern control valves
- 9.4 Demonstrate an understanding of the operation of pressure spray equipment

STANDARD 10.0 PERFORM PAINT MIXING, MATCHING, AND APPLYING PROCEDURES

- 10.1 Identify color code by manufacturer's vehicle information label
- 10.2 Shake, stir, reduce, catalyze/activate, and strain refinish materials
- 10.3 Apply finish using appropriate spray techniques (e.g., gun arc, angle, distance, travel speed, and spray pattern overlap) for the finish being applied
- 10.4 Apply selected product on test or let-down panel; check for color match
- 10.5 Apply single stage topcoat
- 10.6 Apply basecoat/clearcoat for panel blending and panel refinishing
- 10.7 Apply basecoat/clearcoat for overall refinishing
- 10.8 Remove nibs or imperfections from basecoat
- 10.9 Identify product expiration dates as applicable
- 10.10 Refinish plastic parts
- 10.11 Apply multi-stage coats for panel blending and overall refinishing
- 10.12 Identify and mix paint using a formula
- 10.13 Identify poor hiding colors; determine necessary action
- 10.14 Tint color using formula to achieve a blendable match
- 10.15 Identify alternative color formula to achieve a blendable match
- 10.16 Identify the materials equipment and preparation differences between solvent and waterborne technologies

STANDARD 11.0 DETERMINE PAINT DEFECTS, CAUSES, AND CURES

- 11.1 Identify blistering (raising of the paint surface, air entrapment); correct the cause(s) and the condition
- 11.2 Identify a dry spray appearance in the paint surface; correct the cause(s) and the condition
- 11.3 Identify the presence of fisheyes (crater-like openings) in the finish; correct the cause(s) and the condition
- 11.4 Identify lifting; correct the cause(s) and correct the condition
- 11.5 Identify clouding (mottling and streaking in metallic finishes); correct the cause(s) and the condition
- 11.6 Identify orange peel; correct the cause(s) and the condition
- 11.7 Identify overspray; correct the cause(s) and the condition
- 11.8 Identify solvent popping in freshly painted surface; correct the cause(s) and the condition
- 11.9 Identify sags and runs in paint surface; correct the cause(s) and the condition
- 11.10 Identify sanding marks or sand scratch swelling; correct the cause(s) and the condition
- 11.11 Identify contour mapping/edge mapping while finish is drying; correct the cause(s) and the condition
- 11.12 Identify color difference (off-shade); correct the cause(s) and the condition
- 11.13 Identify tape tracking; correct the cause(s) and the condition
- 11.14 Identify low gloss condition; correct the cause(s) and the condition
- 11.15 Identify poor adhesion; correct the cause(s) and the condition
- 11.16 Identify paint cracking (i.e., shrinking, splitting, crow's feet or line-checking, micro-checking, etc.); correct the cause(s) and the condition
- 11.17 Identify corrosion; correct the cause(s) and the condition

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- 11.18 Identify dirt or dust in the paint surface; correct the cause(s) and the condition
- 11.19 Identify water spotting; correct the cause(s) and the condition
- 11.20 Identify finish damage caused by bird droppings, tree sap, and other natural causes; correct the cause(s) and the condition
- 11.21 Identify finish damage caused by airborne contaminants (e.g., acids, soot, rail dust, and other industrial-related causes); correct the cause(s) and correct the condition
- 11.22 Identify die-back conditions (dulling of the paint film showing haziness); correct the cause(s) and the condition
- 11.23 Identify chalking (oxidation); correct the cause(s) and the condition
- 11.24 Identify bleed-through (staining); correct the cause(s) and the condition
- 11.25 Identify pin-holing; correct the cause(s) and the condition
- 11.26 Identify buffing-related imperfections (swirl marks, wheel burns); correct the condition
- 11.27 Identify pigment flotation (color change through film build); correct the cause(s) and the condition

STANDARD 12.0 PERFORM FINAL PAINTING AND REFINISHING DETAIL

- 12.1 Apply decals, transfers, tapes, woodgrains, pinstripes (painted and taped), etc.
- 12.2 Sand, buff, and polish fresh or existing finish to remove defects as required
- 12.3 Clean interior, exterior, and glass
- 12.4 Clean body openings (i.e., door jambs and edges, etc.)
- 12.5 Remove overspray
- 12.6 Perform vehicle clean-up; complete quality control using a checklist

STANDARD 13.0 PERFORM DAMAGE ANALYSIS

- 13.1 Position the vehicle for inspection
- 13.2 Prepare vehicle for inspection by providing access to damaged area
- 13.3 Analyze damage to determine appropriate methods for overall repairs
- 13.4 Determine the direction, point(s) of impact, and extent of direct, indirect, and inertia damage
- 13.5 Gather details of the incident/accident necessary to determine the full extent of vehicle damage
- 13.6 Identify and record pre-existing damage
- 13.7 Identify and record prior repairs
- 13.8 Perform visual inspection of structural components and members
- 13.9 Identify structural damage using measuring tools and equipment
- 13.10 Perform visual inspection of non-structural components and members
- 13.11 Determine parts, components, material type(s), and procedures necessary for a proper repair
- 13.12 Identify type and condition of finish; determine if refinishing is required
- 13.13 Identify suspension, electrical, and mechanical component physical damage
- 13.14 Identify safety systems physical damage
- 13.15 Identify interior component damage
- 13.16 Identify damage to add-on accessories and modifications
- 13.17 Identify single (one time) use components

STANDARD 14.0 PERFORM ESTIMATION

- 14.1 Determine and record customer/vehicle owner information
- 14.2 Identify and record vehicle identification number (VIN) information, including nation of origin, make, model, restraint system, body type, production date, engine type, and assembly plant
- 14.3 Identify and record vehicle mileage and options, including trim level, paint code, transmission, accessories, and modifications
- 14.4 Identify safety systems; determine replacement items
- 14.5 Apply appropriate estimating and parts nomenclature (terminology)
- 14.6 Determine and apply appropriate estimating sequence
- 14.7 Utilize estimating guide procedure pages

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- 14.8 Apply estimating guide footnotes and headnotes as needed
- 14.9 Identify operations requiring labor value judgment
- 14.10 Select appropriate labor value for each operation (e.g., structural, non-structural, mechanical, and refinish)
- 14.11 Select and price OEM parts; verify availability, compatibility, and condition
- 14.12 Select and price alternative/optional OEM parts; verify availability
- 14.13 Select and price aftermarket parts; verify availability, compatibility, and condition
- 14.14 Select and price recyclable/used parts; verify availability, compatibility and condition
- 14.15 Select and price remanufactured, rebuilt, and reconditioned parts; verify availability, compatibility, and condition
- 14.16 Determine price and source of necessary sublet operation
- 14.17 Determine labor value, prices, charges, allowances, or fees for non-included operations and miscellaneous items
- 14.18 Recognize and apply overlap deductions, including operations and additions
- 14.19 Determine additional material and charges
- 14.20 Determine refinishing material and charges
- 14.21 Apply math skills to establish charges and totals
- 14.22 Interpret computer-assisted and manually written estimates; verify the information is current
- 14.23 Identify procedural differences between computer-generated and manually written estimates
- 14.24 Identify procedures to restore corrosion protection; establish labor values, and material charges
- 14.25 Determine the cost-effectiveness of the repair and determine the approximate vehicle retail and repair value
- 14.26 Recognize the differences in estimation procedures when using different information provider systems
- 14.27 Verify accuracy of estimate compared to the actual repair and replacement operations

STANDARD 15.0 DETERMINE VEHICLE CONSTRUCTION AND PARTS IDENTIFICATION

- 15.1 Identify type of vehicle construction (i.e., space frame, unibody, body-over-frame, etc.)
- 15.2 Recognize the different damage characteristics of space frame, unibody, and body-over-frame vehicles
- 15.3 Identify impact energy absorbing components
- 15.4 Identify steel types; determine reparability
- 15.5 Identify aluminum/magnesium components; determine reparability
- 15.6 Identify plastic/composite components; determine reparability
- 15.7 Identify vehicle glass components and repair/replacement procedures
- 15.8 Identify add-on accessories

STANDARD 16.0 PERFORM CUSTOMER RELATIONS AND SELLING SKILLS

- 16.1 Acknowledge and/or greet customer/client
- 16.2 Listen to customer/client; collect information, and identify customers/client's concerns, needs, and expectations
- 16.3 Establish cooperative attitude with customer/client
- 16.4 Identify yourself to customer/client; offer assistance
- 16.5 Deal with angry customer/client
- 16.6 Identify customer/client preferred communication method; follow up to keep customer/client informed about parts and the repair process
- 16.7 Recognize basic claims' handling procedures; explain to customer/client
- 16.8 Project positive attitude and professional appearance
- 16.9 Provide and review warranty information
- 16.10 Provide and review technical and consumer protection information
- 16.11 Estimate and explain duration of out-of-service time
- 16.12 Demonstrate negotiation skills to obtain a mutual agreement
- 16.13 Interpret and explain manual or computer-assisted estimate to customer/client

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