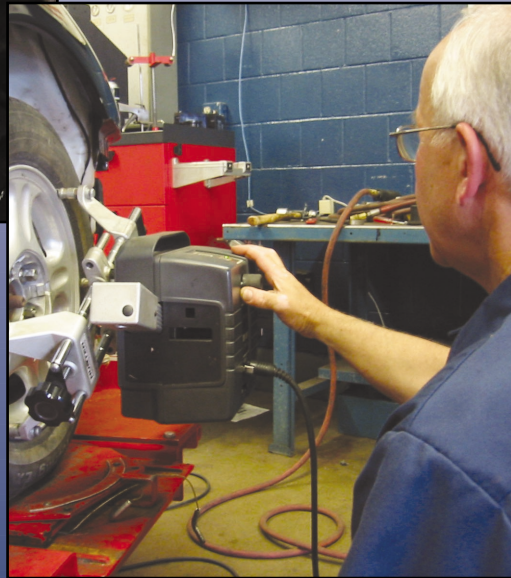
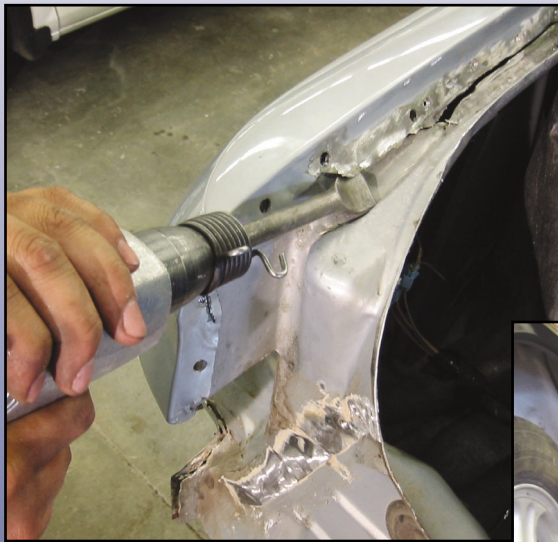




AUTO BODY REPAIR

REPLACING AND ADJUSTING PANELS



TEACHER'S GUIDE

SHOPWARE®

INTRODUCTION

This Teacher's Guide provides information to help you get the most out of *Replacing and Adjusting Panels*. The contents in this guide will enable you to prepare your students before using the program and present follow-up activities to reinforce the program's key learning points.

Replacing and Adjusting Panels describes how to inspect, remove, replace, and then align to manufacturer specs an assortment of non-structural body panels. Related hardware and assemblies are also covered. After viewing the video and completing some of the learning activities included in this guide, students will be better prepared to properly work with damaged vehicle panels, and incorporate industry terminology in order to communicate effectively with coworkers, parts suppliers, and insurance adjusters. Use the *Replacing and Adjusting Panels* video and accompanying activities provided in this guide to prepare students for the most effective way to approach auto body repairs, and to familiarize students with terminology used in the auto repair industry.

LEARNING OBJECTIVES

After viewing the program, students will be able to:

- Demonstrate a basic knowledge of non-structural panel repair operations and safety procedures.
- Identify the correct tools to use given the task to be performed.
- Explain choices or options for correction of structural panel damage.
- List procedures used to inspect, remove, replace, and align bolted steel panels or panel assemblies and related hardware.
- Define rust prevention procedures.

EDUCATIONAL STANDARDS

The primary certifying body for automotive technician training programs is the National Institute for Automotive Service Excellence (ASE). ASE is a non-profit organization established in 1972 by the automotive industry to improve the quality of vehicle repair and service through the voluntary testing and certification of automotive repair technicians. The National Automotive Technicians Education Foundation (NATEF) is a separate non-profit foundation within ASE. The mission of NATEF is to improve the quality of automotive technician training programs nationwide through voluntary certification. The State Departments of Education in all 50 states support ASE/NATEF certification of automotive programs.



National Standards

This program correlates with the Program Certification Standards for Automobile Technician Training Programs from the National Institute for Automotive Service Excellence (ASE) and the National Automotive Technicians Education Foundation (NATEF). The content has been aligned with the following educational standards, which reflect the tasks in the ASE Program Certification Standards for Automobile General Service Technician Programs.

Outer Body Panel Repairs, Replacements, and Adjustments

- Determine the extent of the direct (Primary) and indirect (Secondary) damage and the direction of impact; plan the methods and order of repair.
- Remove and replace bolted, riveted, bonded, and welded panels or panel assemblies.
- Determine the extent of damage to aluminum body panels; repair, weld, or replace.
- Remove, replace, and align hood, hood hinges, and hood latch/lock.
- Remove, replace, and align deck lid, lid hinges, and lid latch/lock.
- Remove and replace doors, tailgates, hatches, lift gates, latch/lock assemblies, and hinges.
- Remove, replace, and align bumpers, reinforcements, guards, absorbers, isolators, and mounting hardware.
- Check and adjust clearances of front fenders, header, and other panels.
- Check door hinge condition and alignment, adjust or replace as necessary, and adjust door clearances.
- Restore contours of damaged panel to a surface condition suitable for metal finishing or body filling.
- Weld cracked or torn metal body panels.
- Apply protective coatings and sealants to restore corrosion protection.
- Remove damaged sections of metal body panels; weld in replacements.
- Repair door frame, repair or replace door skins; inspect intrusion beams.
- Replace or repair plastic panels.
- Restore sealers, mastic, sound deadeners, and foam fillers.
- Diagnose and repair water leaks, dust leaks, wind noise, squeaks, and rattles.
- Install interior and exterior trim and moldings.

General Operations

- Identify parts using industry terminology.

2004 Automobile Program Standards, *by the National Institute for Automotive Service Excellence (ASE), Copyright 2004 Reprinted with permission.*

Language Arts and Communication Standards

According to ASE/NATEF standards, the automobile technician must be proficient in the following Language Arts and Communications related academic skills that are embedded in the occupation. The activities and information presented in this program and accompanying teacher's guide are aligned to the following standards from the National Automotive Technicians Education Foundation from the National Institute for Automotive Service Excellence.



- Request, collect, comprehend, evaluate, and apply oral and written information gathered from customers, associates, and supervisors regarding problem symptoms and potential solutions to problems.
- Identify the purpose for all written and oral communication and then choose the most effective strategies for listening, reading, speaking, and writing to facilitate the communication process.
- Adapt a reading strategy for all written materials, e.g. customer's notes, service manuals, shop manuals, technical bulletins, etc., relevant to problem identification, diagnosis, solution, and repair.
- Use study habits and techniques, i.e. previewing, scanning, skimming, taking notes, etc., when reviewing publications (shop manuals, references, databases, operator's manuals, and text resources) for problem solving, diagnosis, and repair.
- Write clear, concise, complete, and grammatically accurate sentences and paragraphs.
- Write warranty reports and work orders to include information regarding problem resolution and the results of the work performed for the customer or manufacturer.
- Follow all oral/written directions that relate to the task or system under study.
- Comprehend and apply industry definitions and specifications to diagnose and solve problems in all automotive systems and components of the automobile and light truck.
- Comprehend and use problem-solving techniques and decision trees that are contained in service manuals and databases to determine cause-and-effect relationships.
- Use the service manual to identify the manufacturer's specifications for system parameters, operation, and potential malfunctions.
- Supply clarifying information to customers, associates, parts supplier, and supervisors.

Technology Standards

The activities in this Teacher's Guide were created in compliance with the following *National Education Technology Standards* from the National Education Technology Standards Project. The content has been aligned with the following educational standards and benchmarks.

- Use a variety of media and formats to communicate information and ideas effectively to multiple audiences.
- Use telecommunications to collaborate, publish, and interact with peers, experts, and other audiences.
- Use productivity tools to collaborate in constructing technology-enhanced models, prepare publications, and produce other creative works.
- Use technology tools to enhance learning, increase productivity, and promote creativity.
- Use technology to locate, evaluate, and collect information from a variety of sources.

The *National Education Technology Standards* reprinted with permission from the International Society for Technology Education.



PROGRAM OVERVIEW

How are non-structural panel repair operations performed? What tools are needed? What options does the auto body repair technician have for correction of structural panel damage? These questions and more are answered in the *Replacing and Adjusting Panels* video. This program illustrates how non-structural panel repair operations are performed, and provides a demonstration of the types of tools involved with these repair procedures. Viewers will have the opportunity to explore procedures used to inspect, remove, replace, and align bolted steel panels or panel assemblies and related hardware. After viewing this program, viewers will be better prepared to properly replace and adjust both structural and non-structural panels, and will be able to incorporate industry terminology in order to communicate effectively with coworkers, parts suppliers, and insurance adjusters.

MAIN TOPICS

Topic 1: Assessing and Organizing Repairs

This section of the program describes a general process for assessing and organizing repairs. Students will learn about the types of fasteners that influence the decision process surrounding the assessment of repairs, and learn how to keep parts organized and protected. Students will also learn how to prepare a repair plan.

Topic 2: Replacing and Adjusting Panels

This section of the program describes how to replace and adjust various types of panels. Students will learn the proper procedures for replacing and adjusting hoods, bumpers, grilles, fenders, lids, and quarter panels. Proper removal and replacement of each of these components is also discussed. Students will also learn about some important safety considerations when making panel repairs.

Topic 3: Corrosion Prevention

This section describes the importance of maintaining and restoring corrosion protection during the repair process. Students will learn how to clean and protect various elements of the auto body as work is completed, and explore guidelines for corrosion prevention.

FAST FACTS

- Methods of fastening parts are always changing. Many parts now snap into place rather than being held together by bolts or screws. This is done to save time and money during the manufacturing process, But for you, fastener variations can make repairs more challenging.
- The estimate is an important reference for repairs. If you fail to follow it, the vehicle owner's insurance might not pay for your work.
- Panels that are bonded or welded in place, like quarter panels, take more time to remove and replace than those that are bolted on. You may be able to repair damage to a quarter panel in less time than it would take to remove and replace it.



- The hood is one of the largest and heaviest panels on a vehicle. You'll need someone to help when you remove it.
- Be careful when you lower the hood to check its alignment. If the hood is too far out of alignment, it can damage adjacent fenders.
- Often hood and fender adjustments need to be done at the same time to achieve the best result.
- Today's bumpers will withstand minor impact without damage, but they're designed to crush and absorb the impact of a major collision.
- When removing bumpers, remember bolts can be hidden behind parking lights, inside fender panels, and other places. You might have to refer to that trusty manufacturer's manual for the make and model vehicle you're working on, as procedures can vary from model to model.
- Bumper assemblies can be heavy and clumsy. Always support the bumper properly before removing the last bolts.
- As opposed to other types of panels, quarter panels are structural in nature and are either welded or bonded to the frame, or both. Because of this, quarter panels are the most difficult and time-consuming to remove and replace.
- Manufacturers sometimes use adhesive bonding in place of welds to add strength and corrosion protection.
- On some vehicles, all the seams may be bonded instead of welded.
- Positioning panels correctly is critical not only for cosmetic reasons, but more importantly, for the vehicle's structural strength.
- Some cars today have uni-side construction. That means the quarter panel, rocker panel, and front fender are all one continuous piece. Rather than removing the entire side of the car to replace one of these parts, you can section the part to be repaired.
- Since oxygen and moisture are always present in our environment, corrosion protection is a major feature in every vehicle manufactured today.
- Even touching bare metal with your bare hands can start the corrosion process—that's why it is so important to clean and degrease as you go during the repair. You don't want to "seal in" potentially corrosive elements.

VOCABULARY TERMS

bumper assembly: An assembly that consists of a plastic bumper cover and an inner steel or aluminum bumper and grille, which bolts to the front frame horns in a conventional frame or to the frame rails that extend out near the bottom of the front section of a unibody frame. Some vehicles have a plastic honeycomb or foam structure that is designed to compress and absorb the energy of a front-end collision.

butt weld: A type of weld that is used to join two metal parts aligned in the same plane (butt up against one another) by filling the gap between the two metal parts.

corrosion: Corrosion is the wearing away or breaking down of a substance. Wherever oxygen, moisture, and exposed metal come together, rust and corrosion occur.

cowl assembly: The part of a car's body located directly in front of the windshield, which includes the top cowl panel and side cowl panels that extend down on either side of the body.

deck lid: Similar in construction to the hood, two hinges connect the deck lid to the rear body panel. The edge is secured with a locking latch.



fascia: The part of an automobile body that is in front of the fenders. The fascia is also known as the nose of the car's body.

frame: The structural foundation of a vehicle to which all other parts and assemblies are attached directly or indirectly.

floor pan: The main structural panel, usually comprised of one piece of stamped steel, in the center or midsection of a vehicle that forms the floor of the interior of the vehicle.

front fender: A component that extends from the front bumper to the front doors and covers the front suspension and the inner fender aprons.

grille: Grating that allows air to reach a car's radiator, for the purpose of cooling. This is found on the front of an automobile.

hood: The hinged panel that covers the engine compartment.

hood hinge: Components that attach the hood to the cowl.

hood spring tool: A tool used to remove and reinstall hood springs, which are part of hood hinges.

hood stop adjustment: Controls the height of the front of the hood. It's usually made up of rubber bumpers mounted on threaded studs.

hood striker: The part of the hood that fits into the hood latch, allowing the hood to stay closed until released.

lid shock absorber: Lid shock absorbers hold the lid open and cause it to close more slowly.

lid torsion rod: Lids are sometimes held open with torsion rods. Torsion rods extend across the body to a stationary bracket. They can also be adjusted to carry more of the weight of the lid by moving the location of the rod in the mount.

lock cylinder: The lock cylinder engages the key so you can turn it and unlock the latch.

locknut: A thin nut screwed down on a another nut to keep the main nut from loosening.

lower rear panel: The panel that extends from one quarter panel to the other and forms the bottom side of the trunk.

mounting bolts: A fastener used to attach car parts to a vehicle. A mounting bolt is secured with a nut.

plug weld: A type of weld that is used to weld two or more base metals together by drilling small holes (8 millimeters to >1/4 inch) that get progressively smaller and filling them with short bursts from the outside, working inward to ensure fusion of each layer.

quarter panels: The large side panels in a unibody vehicle extending from the rear doors to the rear bumper, which are attached to the inner wheel houses, rear pillars, trunk floor panel, and rear crossmember.

rear assembly: The stamped metal panel that is often welded to the rear rails, inner wheel houses, and lower rear panel; it includes the trunk floor panel that forms the bottom of the trunk, and often provides a "well" for storing the spare tire.

spot weld: A type of weld that is used to fuse the top metal to the bottom without pre-drilling a hole. A spot weld is made by holding the welding gun at a 90-degree angle from the base metals to be welded. This weld type is not strong or consistent.

spot weld cutter: A drill bit used to cut out spot welds.

uni-side construction: In cars with uni-side construction, the quarter panel, rocker panel, and front fender are all one continuous piece.



PRE-PROGRAM DISCUSSION QUESTIONS

1. Can you name all the panels on your family's vehicle? Which panel do you think is the largest and heaviest on a vehicle?
2. What are the various ways that panels can be fastened to a vehicle? Can you name all four?
3. What tools do you think are used by auto body repair technicians when replacing and adjusting panels?
4. What do you think is the easiest job involved in panel repair and adjustment? What do you think is the most difficult?
5. What safety procedures do you think need to be considered when repairing and adjusting panels?

POST-PROGRAM DISCUSSION QUESTIONS

1. What is the first step in preparing any vehicle for repair? Why is it important to do this step first? How would skipping it be detrimental to the replacement and adjustment of panels?
2. As a group, discuss the process used to protect vehicles from corrosion. Why is it important to work on corrosion protection during the process, instead of waiting until the end? What procedures are used?
3. Now that you've seen the *Replacing and Adjusting Panels* video, describe the tools used for corrosion protection. Do you know of any other tools or procedures used for this task?
4. What is the difference between direct and indirect damage? How do both types of damage affect the replacement and adjustment of panels?
5. In your opinion, what do you think is the most challenging aspect of auto body panel replacement and adjustment?

GROUP ACTIVITIES

Panel Presentation

As a group, prepare a poster that identifies each of the panels of a vehicle of your choice. Then, research the replacement and adjustment techniques for each panel on this vehicle. Be prepared to present your poster to the class, and discuss how an auto body repair technician must decide whether to repair or replace a panel, depending on the direct and indirect impact a vehicle experiences in a crash.

Panel Feud

As a group, research the panels and repair techniques for a vehicle that your teacher assigns. Prepare a list of questions about your vehicle's panel repair that are designed to stump your classmates. Turn in your questions to your teacher, who will verify their accuracy, and then get ready to play "Panel Feud."



On “Panel Feud” day, your team will face off against another team in front of the rest of the class. The teacher will ask a question from among those each team has prepared, and the first group to “buzz” in will answer the question. Each member of your team will get a question in order. If you answer the question right, you will earn the points the teacher has designated for that question. If you answer wrong, the other team gets a chance to answer. If the other team answers correctly, they get the points, and you lose that number of points from your total score. If they answer the question wrong, all scores remain the same. The team with the most points at the end of the game wins.

Fasteners

How are panels fastened to vehicles? As a team, collect samples of each type of fastener, label them, and prepare them for presentation. Then, prepare a discussion of how each type of fastener is used to attach panels to vehicles, as well as how different vehicles use different types of fasteners. Be prepared to make your presentation to the class.

During each group’s presentation, write down any information you hear or see that is different from what your group discovered. At the end of all presentations, share the new information you learned as a result of each presentation in a group discussion. Why did some groups have different information? Was it a result of inconsistent source material? Or did some groups find information you did not find? Where did they find it? Can you use their sources when you do research in the future for class, and on the job?

Make a list of the best sources of information, along with the type of information each one contains, and turn your list in to your teacher in order to compile a master list of auto body repair research sources.

INDIVIDUAL STUDENT PROJECTS

Crash Test

Using modeling clay (or a plastic model car kit), create a model of a car that your teacher assigns, complete with the panels found on this model. Then, simulate a crash with the model. Finally, prepare a written estimate detailing both the direct and indirect damage to the car as a result of the crash. Turn in your estimate to your teacher, along with your damaged model.

Panel Estimate Research

Get permission to visit an auto body repair shop. View a car that has been in an automobile accident and watch as a technician prepares the written estimate. Take pictures, if possible, during the procedure. What does the technician do to prepare the estimate? How does he/she determine the repairs needed? Does the technician have to take anything apart on the car to determine the damage?

After the car has been repaired, return to the auto body repair shop and find out the actual repairs that have been performed. Was any additional damage discovered during the repair process? Why wasn’t the damage identified initially? What was done about this damage? How was the customer informed? How much did the additional damage cost to repair?



After conducting this research prepare a written report (including photos of the actual vehicle, if possible), describing the damage and how the estimate was prepared. If additional damage was discovered while actually repairing the car, describe why the damage was not identified initially, as well as the financial impact for the customer. Be prepared to present your findings to the class.

Panel Removal Technique Demonstration

Prepare a demonstration for your class in which you show the class how to remove a panel on a vehicle (your teacher will assign the panel). Be sure to demonstrate the correct use of the tools required to do the job, as well as the safety procedures an auto body repair technician has to follow to get the job done safely. Prepare a one-page handout for the class that illustrates the procedure, the tools needed, and the safety procedures required.

INTERNET ACTIVITIES

Parts Catalog

How much do panels and their accessories cost? Go online to auto body repair web sites, dealer sites, etc., and find the costs for quarter panels, fenders, hoods, and other parts. Where can you find the most reasonably-priced parts? Are these parts of the best quality? Are there better dealers? If you were repairing your own car, which retailer would you use? Compile your findings in a catalog that you create in spreadsheet software, listing parts with item numbers, retailers, address information, shipping information, and pricing information. Print your catalog for distribution to the class.

Autobody Online Weekly Newsletter Review

Visit <http://www.autobodyonline.com> and sign up for their weekly newsletter. What kind of information do you receive in the newsletter? Will it be helpful to you as an auto body repair technician? Select an article from the newsletter and write a review about it using word processing software. Include in your review what you think of the article, how useful you find the information, and how you think the article will help someone else considering a career in auto body repair. Then, give a printed copy of both the newsletter and review to your teacher, who will compile a bulletin board of the class' findings.

Auto Body Repair Around the World

Using a search engine, research auto body panel repair techniques in at least three other countries. Do these countries use the same techniques in panel repair that are used in the United States? Are there differences? Look into the costs of auto body repair in these countries. How much would the same repair cost in the United States as compared to the three other countries?

After completing your research, prepare a database using the following fields: Country; Panel Repair Techniques; Costs. Print out a comparison report from your database that shows the differences in each country. Be prepared to share your findings with the class.



ASSESSMENT QUESTIONS

Q: Which of the following is NOT a method used to fasten panels to vehicles?

- (a) Screwed or bolted on
- (b) Snap-on fasteners
- (c) Welded on
- (d) Plug-in fasteners

A: (d)

Feedback: There are several ways parts are fastened onto a vehicle. They can be screwed or bolted on, attached with snap-on fasteners, welded on, or bonded.

Q: If you are in doubt as to how to remove a part, what is likely the most accurate source of step-by-step information?

- (a) Web sites
- (b) The vehicle's service manual
- (c) Other technicians
- (d) None of the above

A: (b)

Feedback: If you're in doubt about how to remove a part, refer to the body repair section of the vehicle's service manual. The manual will give you step-by-step instructions for removing and replacing parts for the specific make and model vehicle, plus other important information.

Q: Which part of a vehicle should be removed first when beginning panel repairs?

- (a) Exterior trim and molding
- (b) Damaged panel
- (c) Tires
- (d) Hood

A: (a)

Feedback: Depending on the area of damage, remove and store external parts first, beginning with exterior trim and moldings.

Q: Why is it sometimes advisable to repair a damaged quarter panel rather than replace it?

A: Quarter panels are bonded or welded into place, and it takes longer to remove and replace them. It may take less time just to repair a quarter panel than it would to remove and replace it.

Feedback: Panels that are bonded or welded in place, like quarter panels, take more time to remove and replace than those that are bolted on. You may be able to repair damage to a quarter panel in less time than it would take to remove and replace it.

Q: The hood is one of the largest and heaviest non-structural panels on a vehicle. (*True or False.*)

A: True

Feedback: The hood is one of the largest and heaviest panels on a vehicle. You'll need someone to help when you remove it.



Q: What type of fastener is typically used to attach fenders to the vehicle?

- (a) Bolts
- (b) Welds
- (c) Bonds
- (d) Snap ons

A: (a)

Feedback: Fenders are typically bolted into place. As with all parts, remove securing bolts and wires before removing the fender. It's often helpful to put the vehicle up on a hoist to gain easier access to hidden and hard-to-reach fasteners.

Q: Today's bumpers are designed to _____ when in a major collision.

A: crush and absorb the impact

Feedback: Today's bumpers will withstand minor impact without damage, but they're designed to crush and absorb the impact of a major collision.

Q: Hinges are often equipped with strong _____ that will pinch your fingers if you do not use the proper tool.

A: coil springs

Feedback: Be aware that hinges are often equipped with strong coil springs. To keep from pinching your fingers, use a hood spring tool to remove and reinstall the springs. Also remember to always wear eye protection.

Q: When removing a vehicle's bumper, what does the technician need to disconnect first?

A: The first thing a technician needs to disconnect when removing a bumper is the wiring going to any lights.

Feedback: To remove a bumper, first disconnect wiring going to any lights. And remember, bolts can be hidden behind parking lights, inside fender panels, and other places. You might have to refer to that trusty manufacturer's manual for the make and model of the vehicle you're working on, as procedures can vary from model to model.

Q: All spot welds should be readily visible to the auto body repair technician. (*True or False.*)

A: False

Feedback: You may need to remove protective coatings, such as paint and sealers, in order to find all the spot welds.

ADDITIONAL RESOURCES

WEB SITES

Auto Body Curriculum Guide

www.sasked.gov.sk.ca/docs/paa/autobody/index.html

Auto Body Online

www.autobodyonline.com



Auto Body P.I.

www.autopi.com/frame.htm

Auto Body Pro

www.autobodypro.com

Auto Body Tool Mart Repair and Restoration Tutorials

www.autobodytoolmart.com/restorations.html

Automotive Body Repair News

www.abrn.com/abrn

Auto Glossary

www.autoglossary.com

Automotive Learning Online

www.innerauto.com

Autobytel.com: The best place to research, buy and sell your car

www.autobytel.com/index.cfm

Autosite: Your Key to Automotive Research

www.autosite.com/garage/garmenu.asp

Automotive Services Association®

www.asashop.org

AA1Car.com Automotive Technical Library

<http://hostingprod.com/@aa1car.com/library.htm>

Automotive Youth Educational Systems (AYES)

www.eyes.org/index.asp

Collision Repair Industry: Insight

<http://www.collision-insight.com>

Do-It Yourself Network—Automotive Body Work

www.diy.net.com/diy/ab_auto_body_work/0,2020,DIY_13675,00.html

How Stuff Works—Auto Stuff Page

<http://8auto.howstuffworks.com>

I-car

www.i-car.com



National Automotive Service Task Force

www.nastf.org

National Automotive Technicians Education Foundation

www.natef.org

OEM Tech Sites: Auto Body Online: A Portal for the Autobody Professional

www.autobodyonline.com/industry/OEM/index.cfm

Society of Collision Repair Specialists

www.scrs.com

Tektips—Auto Body Pro Website

www.autobodypro.com/tektips.htm

BOOKS

Duffy, James E., *Auto Body Repair Technology, 4th Edition*. Delmar Thomson Learning, 2004. ISBN: 0766862747

Chilton Book Company, *Chilton's Auto Repair Manual, 1998-2002 (Chilton's Reference Manuals)*. Chilton Book Company, 2003. ISBN: 0801993628

Duffy, James E., *I-CAR Professional Automotive Collision Repair*. Delmar Thomson Learning, 2001. ISBN: 0766813991

OTHER PRODUCTS

Auto Body Shop Safety, Software, Cambridge Educational

Safety procedures relevant to the auto body shop are outlined, along with lessons on First Aid, Fire Safety and Prevention, Wire Feed MIG Welding, and Proper Use of Auto Body Tools. 3.5" IBM version, Mac version also available. A Shopware Production.

Order #: 20941, www.cambridgeeducational.com, 1-800-468-4227

Automotive Measurements, VHS/DVD, Meridian Education

Examines how to use the precision measuring tools essential to auto mechanics.

Demonstrates the use of micrometers, dial indicators, feeler gauges, plastigauges, dial bore gauges, straight edges and other tools essential to the trade, while showing actual auto part measurements. A Meridian Production. (33 minutes)

Order #: 24752, www.meridianeducation.com, 1-800-727-5507



Automotive Technicians, VHS/DVD, Meridian Education

Sponsored by the National Automotive Technicians Education Foundation (NATEF), this program explores automobile repair and collision repair. NATEF works closely with Automotive Service Excellent (ASE), the nation's only industry-wide certification program for automotive technicians. Technicians with a sound education have a choice of career avenues. Aside from fixing cars and trucks, they can become service managers, service engineers, automotive writers, or even auto technology teachers. A Meridian Production. (28 minutes)

Order #: 24924, www.meridianeducation.com, 1-800-727-5507

Understanding Cars, VHS/DVD, Films for the Humanities and Sciences

First they revolutionized travel. Then they reshaped American culture. This program, narrated by Jane Curtin, traces the history of automobile technology and design through the 20th century. Stops along the way include visits to the Sandia National Laboratories, the GM Design Center, the Detroit Car Show, and the Petersen and Blackhawk Automotive Museums. The mechanics of four-stroke and two-stroke internal combustion engines, energy-efficient vehicles that run on electricity and fuel cells, automated highways and smart cars, and a number of automotive curiosities are featured. A Discovery Channel Production. (53 minutes)

Order #: 29881, www.films.com, 1-800-257-5126





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