

# **Intro To Tools, Equipment, And Attachment Methods - Part 1**

**Textbook**



Version: 14.2

© 2012 - 2013 Inter-Industry Conference On Auto Collision Repair

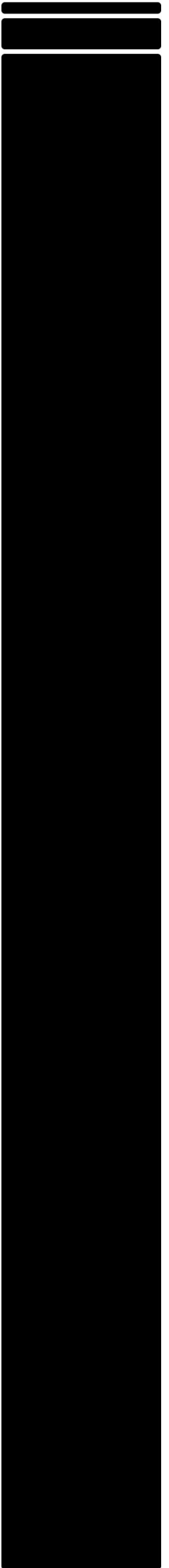
This page is intentionally left blank.

# Contents

Introduction.....	7
Obligations To The Customer And Liability.....	7
Intro To Tools, Equipment, And Attachment Methods - Part 1.....	11
Basic Tools - Part 1.....	11
Basic Tools - Part 2.....	14
Mechanical Fastening.....	19
Glass And Trim.....	22
Estimating Tools And Processes.....	24

This page is intentionally left blank.

# *Introduction*



This page is intentionally left blank.

## Obligations To The Customer And Liability



The Collision Repair Industry has an obligation to correctly repair the customer's vehicle. Collision repairs must be performed using:

- recommended or tested procedures from vehicle makers, I-CAR, and other research and testing organizations.
- quality replacement parts and materials.
- repair processes and parts as written and agreed upon in the repair order.
- If items on the repair agreement are not consistent with the repair order, it can be considered fraud.

Performing proper collision repairs requires using parts and procedures that keep remaining warranties intact. Collision repairs must restore:

- safety.
- structural integrity.
- durability.
- performance.
- fit.

- finish.

Throughout the damage analysis and repair process the repairer and insurer must: communicate with each other.

- maintain constant communication with the customer.
- be in agreement with each other and the customer on how repairs will be performed.
- inform the customer of any changes in the repair plan from the original repair agreement, and explain the changes and why they have to be made.



To reduce liability:

- make sure that all repairs are performed thoroughly, correctly and as listed in damage report.
- follow proper procedures.
- use quality replacement parts and materials.
- have documentation of required repairs with detailed record keeping available for customers.

Technicians are considered the experts and are expected to be knowledgeable on how to perform a quality repair.

Keeping thorough records includes more than recording the date, mileage, and pre-existing damage. Record keeping also includes: making sure all notes are legible.

- verifying the repairs that were made or not made.
- having the customer sign a waiver for repairs that they do not want performed. Repairers must determine their liability on not repairing safety systems such as restraint and anti-lock brake systems.
- keeping computer printouts or worksheets on file showing wheel alignment readings or vehicle dimensions before and after repairs.
- keeping scan tool printouts and records of computer codes for airbag, anti-lock brake, emission, and powertrain control module (PCM) systems. attaching the OEM or other tested procedure printout to the vehicle repair order.
- keeping receipts for all sublet work performed.

Liability insurance that covers the repair facility may not always cover all damages. For example:

- the policy may not cover faulty repairs, leaving liability responsibility completely on the facility.
- a shop owner may find that repair facility liability coverage may not cover the full amount awarded in a lawsuit. The shop owner would have to pay the difference.



***Intro To Tools,  
Equipment, And  
Attachment Methods  
- Part 1***

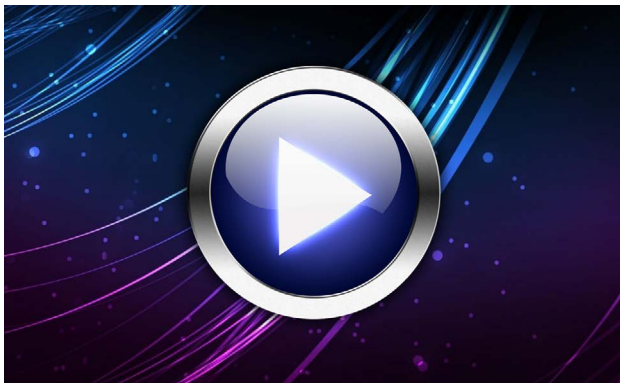
This page is intentionally left blank.

## Basic Tools - Part 1

Learning objectives for this module include:

- identifying the uses for a hammer and dolly.
- explaining the purpose of paintless dent repair tools.
- explaining the different types of dent pulling equipment and what files are used for.
- explaining the differences between a grinding wheel and a cut-off wheel.
- describing the two common saws used in a collision repair facility.

### Video: Hammer And Dollies



#### Hammer And Dollies

Hammers and dollies used in collision repair are available in different shapes and sizes. Various ones may be suitable for different types of repairs.

A hammer and dolly can be used to straighten dents or flanges, such as this.

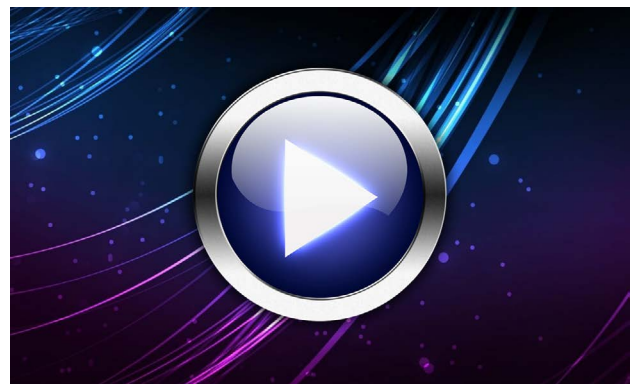


*Some picks are used to move metal to an initial position.*

Picks are typically used after initial straightening of a part has been completed.

Picks, though they may resemble a paintless dent repair tool, are not used for the same function. A paintless dent repair tool is used to move metal in a way that does not disturb the topcoat. A pick is used to move metal that may be refinished.

### Video: Drills And Drill Bits



#### Drills And Drill Bits

Drills used in a collision repair facility may be electric, pneumatic, or battery-operated. These tools are used to make holes as well as remove spot welds.

There are different types of drill bits that are used depending on the material being drilled. Gold drill bits are typically used for hardened steel, while these (spot weld) drill bits are designed to remove spot welds.



Wire brushes may have carbon or stainless steel bristles.

Wire brushes are typically used for removing rust or heavy coatings from steel or cast iron parts. These brushes may also be used for cleaning steel or aluminum before welding.

### Video: Air Chisel



#### Air Chisel

This is a pneumatic chisel, also referred to as an air chisel. Depending on the bit being used, it can be used to break apart

spot welds, as well as cut apart sheet metal.

### Video: Paintless Dent Repair Tools



#### Paintless Dent Repair Tools

Paintless dent repair tools, or PDR tools, are designed to reach into concealed locations and remove dents from the backside of a panel. These tools can remove some cosmetic damage without requiring refinishing.

### Video: Dent-Pulling Equipment



#### Dent-Pulling Equipment

Two general types of dent removal tools include systems that use glue-on or weld-on attachments.

The glue-on attachments are typically used for paintless dent repair, such as hail damage. Once the attachment is glued on

to the center of the dent, a slide hammer is used to remove the dent with slight pressure, slowly removing the dent.

The weld-on attachments need bare metal and are used for larger dents.



Files may be flat or rounded.

Files are generally used for initial shaping or removal of large amounts of body filler.



Cutoff wheels may have a maximum RPM rating.

Cutoff wheels are used to cut metal. Cutoff wheels may look similar to a grinding wheel, however, cutoff wheels are generally smaller and thinner.



Electric grinders work well for grinding welds (left). Some grinders will have many different attachments (right).

Grinders may be electric or pneumatic. Typically, the pneumatic grinders are called 90° angle grinders and are used for removing coatings or dressing welds.

Electric grinders are commonly used for cutting or heavy grinding on vehicle frames or welds.

### Video: Saws

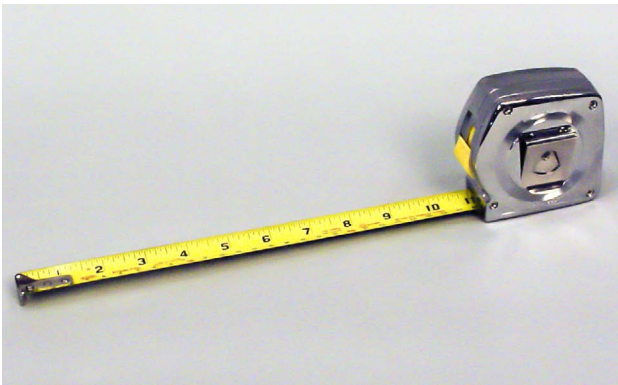


### Saws

There are two types of saws typically used in a collision repair facility, electric and pneumatic.

Electric saws are mostly used when cutting heavyweight parts like frames and thick metal.

Pneumatic saws are used for cutting light gauge metal or when precision cuts are necessary.



*Any type of tape measure can be used as long as it measures in metric.*

Tape measures are often used in a collision repair facility to measure vehicle dimensions. While they may be standard measurements, most are metric since body measurements are generally provided in metric.

Topics discussed in this module included:

- the uses for a hammer and dolly.
- the purpose of paintless dent repair tools. different types of dent pulling equipment and what files are used for.
- the differences between a grinding wheel and a cutoff wheel.
- the two common saws used in a collision repair facility.

## Basic Tools - Part 2

Learning objectives for this module include:

- identifying the uses of a mixing board and spreader.
- explaining the different uses for sanding tools and scrapers.
- describing the different types of pliers and their uses.
- describing the use of different types of wrenches.
- explaining the various types of sockets and screwdrivers.

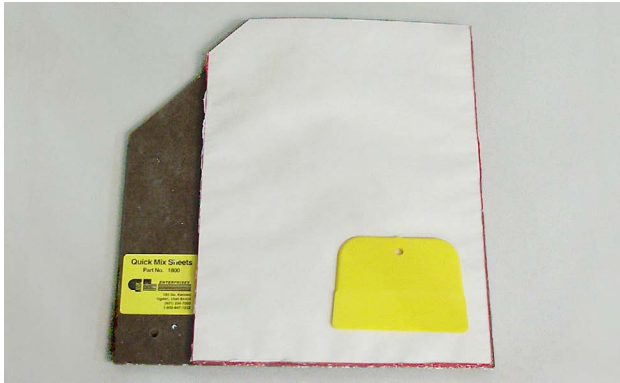


*Heat guns may look different, but they serve the same purpose.*

Heat guns resemble a personal hair dryer.

A heat gun:

- has settings to change the heat output.
- is used to remove emblems or soften adhesive for part removal.



*Wax-covered sheets of paper are used for mixing body filler.*

Mixing boards are used to mix body filler or other two-part materials on coated paper. After the body filler has been mixed and applied, the remaining material left on the coated paper can be torn off and discarded.

Material spreaders are plastic and are used for applying body-filler material.

### **Video: Sanding Tools**



### **Sanding Tools**

Some common sanding tools used in a collision repair facility include a dual-action sander, more commonly referred to as a DA, a straight line air sander, and various sanding blocks.

We've placed tape on the bottom pad of this dual-action sander to show you the different circular and orbital motions it has. As you can see, the pad spins in a circular motion, but when I put my hand on it you can see that it also rotates in an orbital motion. This gives us the dual-action phase of the sander.

Straight line air sanders are used on large areas of body filler that require the surface to remain flat. Depending on the sanding operation, various shaped blocks may be used. They are also available in various lengths. Some blocks may be flexible, while others are rigid.



*Blow guns may have different types of tip adapters.*

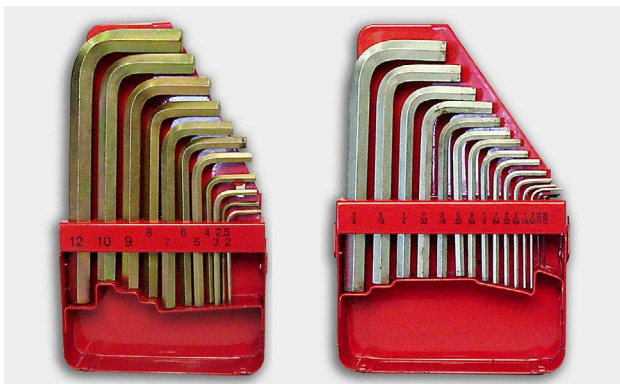
Blow guns are used to force compressed air at a controlled pressure to a surface to remove debris. Using compressed air helps to reduce the chance of scratching the surface or embedding contaminants into a finish.



Some scrapers are used to remove heavyweight coatings.

Scrapers are generally used to remove thick coatings like undercoating or tar. Scrapers are also used with chemical strippers for removing coatings from a part.

Another use for some types of scrapers is to remove vehicle moldings and trim. Sometimes this can be done without damaging the painted surface or the trim.



Allen wrenches may be bent at a 90°.

An Allen wrench is a hexagonal (six-sided) tool used to turn screws with hexagonal heads.



Some wrenches may have an open end.

Wrenches are hand tools used for installing or removing bolts and nuts. There are different shapes, lengths, and types of wrenches, but their purpose is the same.

### Video: Impact Wrenches



#### Impact Wrenches

Impact wrenches are used to quickly remove and install fasteners, such as lug nuts, or any other fastener on the vehicle.

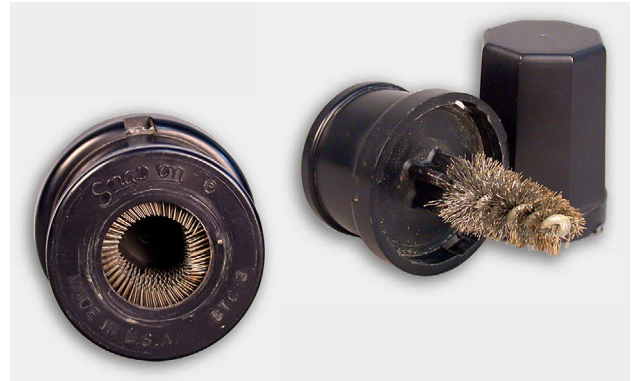


**Video: Pliers****Pliers**

There are a variety of pliers used in a collision repair facility. These include side cutters, which can be used for cutting wire. Vise-grips, such as these, can be used to clamp a part tightly. Needle-nose pliers, such as these, are good for getting into tight spaces.

Another type of vise-grip is a duckbill, which is also used to firmly hold parts. Flat-nose pliers are used to grip parts manually.

This pair of pliers is used for removing insulation from wires. After the insulation is removed, the tool is also used to crimp on wire connectors, such as this.



*Metal bristles are used for cleaning corrosion from the battery lead.*

Battery cleaning tools consist of a:

- dedicated brush for cleaning acid and corrosion from the surface of the battery.
- sharp edge for stripping a small layer of lead from the battery posts and connectors to help ensure a sound connection.



*Some pick-up tools may be flexible or extendable.*

Magnetic pick-up tools are used for retrieving a variety of steel items that can fall in hard-to-reach places.



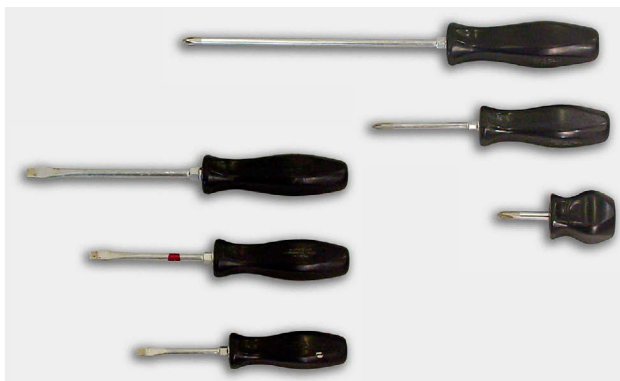
Awls with different style ends can access hard-to-reach areas.

Awls are used for scratching or scribing cut lines on metal parts.



This tire pressure gauge is also used to inflate a tire.

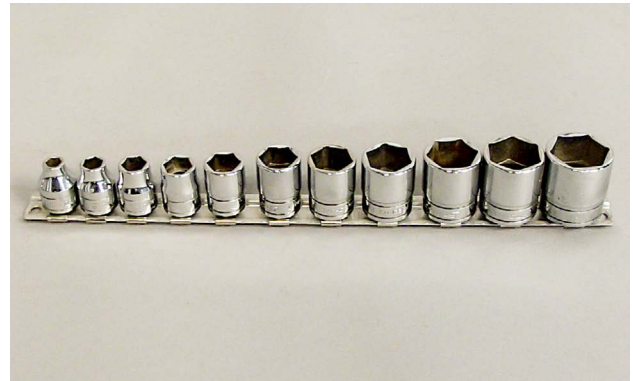
Tire pressure gauges are used to determine the amount of air pressure that is in a tire. Tire pressure gauges may also have a digital display.



Screwdrivers are different lengths.

Screwdrivers used in a collision repair facility have different designs. Some screwdriver types include flat blade, Phillips, and Torx.

These types of screwdrivers are used for installing or removing threaded fasteners.



Ratchets and sockets may be a variety of different sizes.

Ratchets are hand operated or pneumatic and use different sized sockets. Special sockets are designed for use with an impact, and some sockets are designed to not be used with an impact.

Topics discussed in this module included:

- the uses of a mixing board and spreader.
- the different uses for sanding tools and scrapers.
- the different types of pliers and their uses. the use of different types of wrenches.
- the various types of sockets and screwdrivers.

## Mechanical Fastening

Learning objectives for this module include:

- identifying some of the bolts, screws, rivets, clips, clinches, and hem flanges used for automotive attachment applications.
- explaining characteristics of some of these mechanical fasteners and installation methods.
- explaining one-time use considerations for some of these mechanical fasteners.

### Video: Bolts And Nuts



#### Bolts And Nuts

Bolts are used in some vehicle attachments. They have a head and a threaded shaft. Bolts are available with different head types, thread types, and strengths.

Bolts have a grade or class number for each type, the higher the number, the stronger the bolt.

Bolts may be used with a nut. The nut and thread types should match that of the bolt. The nut is then threaded onto the bolt to a recommended specification. This is referred to as the torque specification.

Nuts are available in various types and strengths. The same grade or class number should match that of the bolt.

### Video: Screws



#### Screws

Some parts may be attached with a screw. A screw consists of a head and a threaded shaft. There are various styles that come with different head types, and strengths.

Screws are typically installed into a threaded hole without the use of a nut. However, some screws do use a nut.

One type of screw is a sheet metal screw. When installing the sheet metal screw a tapped hole is not required, the hardened threads of the screw cut threads into the surface.

This is a machine screw. They are typically manufactured with a round head, and installed using a nut.

This is a cap screw. They are typically manufactured with a flat head, and installed with or without a nut.

### Video: One-Time Use Considerations



#### One-Time Considerations

Some mechanical fasteners may be considered one-time use. One-time use fasteners are those that the vehicle maker does not recommend reusing once they have been loosened or removed. One type of these fasteners is this suspension bolt.

Additionally, a fastener may be considered one-time use because of a special coating. Some bolts have special coatings to help prevent corrosion, and this coating is typically damaged during removal.

### Video: Additional Considerations



#### Additional Considerations

Some attachments methods involve the use of other hardware, such as washers and pins.

Various materials and types of washers are used. They provide a barrier between the fastener head or nut and the panel surface. Washers are used for protection and prevention. For example, a locking washer prevents the loosening of a fastener.

Various materials and types of pins may be used to link or hold parts together. One example is a cotter pin, which is used for mechanical part attachments.

### Video: Rivets



**Rivets**

There are several different styles of rivets used for automotive attachment methods, made from various materials.

To install some rivets, a hole must be pre-drilled in the panel. The rivet is then installed using a rivet gun. There are several different styles of rivet guns, including manual, pneumatic, and electric.

One type of rivet is the self-piercing rivet or SPR. SPRs pierce through the pieces being joined and expand through the inner panel into the backside without breaking through. No pre-drilled hole is needed for installing an SPR.

These are solid rivets. They have a solid shank, and require a pre-drilled hole for installation.

These are blind rivets. Blind rivets have two sections, the rivet and the mandrel. The rivet section is the part that locks to the panel surface. The mandrel section is the part that is installed into a rivet gun and disposed of after the rivet has been installed. For some, the rivet section may be one material while the mandrel is a second material. Some blind rivets may also be plastic.

Rivets are a one-time use fastener. They are typically damaged during removal.

**Video: Clips****Clips**

Clips are another type of mechanical fastener used for automotive attachments. There are various styles and materials of clips used. Some include plastic push-in clips, and spring clips.

A plastic clip with a push-in pin is another type of clip found on vehicles. These are designed to typically be reused.

Some type of clips may be designed for one-time use, or be destroyed during removal. Removal methods vary according to the type of clip.

One example where clips are used is on bodyside moldings. With these parts, clips can be either attached to the molding or the panel.

Many trim panels use hidden clips that are pressure-fit into holes to provide attachment.

There are various types of clip removal tools available. Using an appropriate

tool may help to remove the clip without breaking it.

### Video: Clinches And Hem Flanges



#### Clinches And Hem Flanges

Clinches and hem flanges may also be used for attaching panels or pieces of panels.

A clinch is a vehicle-maker joining method that uses a combination of compression and punching. This process uses the panel as its own fastener and the installation process does not require making a hole in the panel. A clinch is formed by compressing two parts between two dies to form an interlocking connection.

A hem flange is formed when the panel is attached to another panel by crimping the flange of one part around the other. For example, most door skins are attached to the door shell using a hem flange in conjunction with welds and adhesives.

Topics discussed in this module included:

- identification of some bolts, screws, rivets, clips, clinches, and hem flanges used for automotive attachment applications.
- characteristics of some of these mechanical fasteners and installation methods.
- one-time use considerations for some of these mechanical fasteners.

### Glass And Trim

Learning objectives for this module include:

- identifying the different types of cutting knives.
- explaining why suction cups are used for installing glass.
- explaining the different types of adhesive applicator guns.



*Some power knives are operated by compressed air.*

Some of the cutting tools used for removing trim or stationary glass may be electric or pneumatic to help make part removal easier.



A cold knife is typically pulled through the adhesive (left). Some wire cutting tools are manually pulled through the adhesive (right).

Two common glass cutout tools include:

- a cold knife, which has an L-shaped blade, a handgrip, and an attached pull handle. This type of knife has different length blades.
- a wire tool, which is a piece of thin-gauge wire attached to two handles. A wire tool may also be used for removing moldings.



Suction cups are used to lift glass.

To help the technician remove and install stationary glass, suction cups are used to pick up and move the glass without touching the edges.



This is one style of a pneumatic adhesive gun.

Windshield urethane adhesive is a very thick material that can be hard to manually dispense. There are different types of applicator guns. These guns may be manual, pneumatic, or electric.



Removal tools may have unique shapes.

Door trim removal tools are made in different shapes to reach under door trim panels to release clips. Some of these tools look like a pliers that pry apart when they are squeezed. Others are generally a plastic or metal pry bar-type tool used for removing trim and clips.

Topics discussed in this module included:





- are written by an auto physical damage appraiser or a collision repair facility estimator.
- may require an inspection of the damaged vehicle.
- may be written anywhere a vehicle is located. Locations may include a collision repair facility, a drive-through claims service, or insurance company location. A damage report may also be written at the vehicle owner's residence or place of employment.

### Video: Estimating Guides



#### Estimating Guides

Estimating guides are used to look up part numbers, prices, and labor units used for replacing and refinishing parts. These estimating guides are available, either electronically or in print format.

The front section of this printed estimating guide contains reference information, such as definitions for common terms, and the procedure pages.

The majority of the estimating guide contains information on most of the available replacement parts for a vehicle. The parts are listed in order from the front of the vehicle to the rear. This makes it easier to locate specific parts in the estimating guide. For example, we know we can page through to the rear section if we need to look up information on a rear bumper cover.

Illustrations are used represent the various replacement parts and are identified by numbers. These numbers can be used to identify the part name, the cost of the part, and the part number.

Part assemblies are identified with a box and a number. This example shows these parts can be purchased separately or as a complete assembly.

You can download sample pages from a printed estimating guide from the link below.

### Video: Computer-Generated Damage Reports



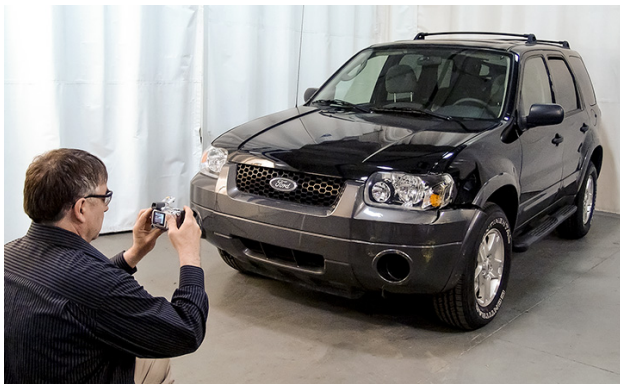
### Computer-Generated Damage Reports

Most damage reports are created using an electronic estimating system, such as this system. Here we can add a damaged part to the damage report by clicking on the part in the illustration, or from a list, such as shown here on the left.

The estimating system automatically enters part prices and does the math necessary for cost estimating, such as including the part price, labor time for replacing the part, and the labor time and the total cost for refinishing the part.

Damaged parts are entered into the system while the vehicle is being inspected, using computers such as this, or done at a later time based off of handwritten notes by the estimator or damage appraiser.

When the damage report is complete, it can be printed or emailed in an electronic version.



*A digital image is being taken of the damage to the front end of this vehicle.*

During the damage report writing process, digital photos of the collision-related

damage are taken. The digital photos are attached to a damage report. This may allow the damage appraiser to verify damage to the vehicle on a computer without having to visit the repair facility. Photos of pre-existing damage may also be taken to upsell additional repairs or for documentation.

Digital photos may also be added to a damage report when additional damage is found during the repair process. Again, this allows the damage appraiser to verify the damage on a computer rather than making a trip to the repair facility.



*The customer is discussing details about the collision with the damage appraiser before the damage report is written.*

A customer consultation is done before or during the inspection process. A customer consultation may provide information about the vehicle and collision. Information about the collision obtained during a customer consultation may include:

- the speed and direction of the impact.
- the road conditions at the time of the collision.

- other vehicles or objects involved with the collision.
- whether or not the vehicle was drivable after the collision.
- which seat belts were in use during the collision. Some vehicle makers recommend replacing seat belts that were in use during a collision.



*The damage appraiser is pointing out a narrow door-to-quarter panel gap on one side and a dent over the rear wheel on the opposite side.*

When assessing damage, an initial vehicle inspection:

- involves identifying all visible damage and looking for indicators of additional damage that is not visible.
- considers the collision energy transfer and absorption.
- determines if there is inertial damage inside the passenger compartment.
- involves identifying pre-existing damage.



*The damage appraiser has this vehicle raised on a lift to inspect the underbody for damage.*

The complete damage inspection may require raising a vehicle for better access to the underbody. A complete damage inspection may include checking for visual damage indicators and may require some disassembly of a vehicle to help locate hidden damage.

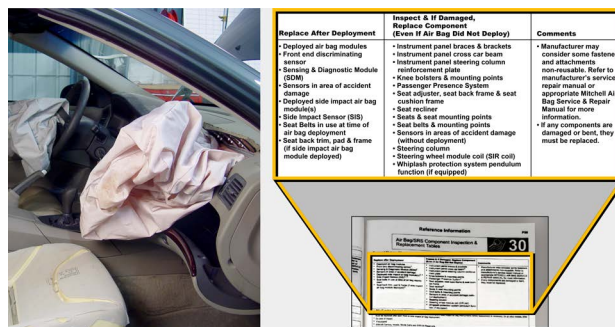


*Before the vehicle starts the repair process in this facility, it is disassembled and undamaged parts are properly stored.*

Hidden damage can be found by doing a partial disassembly as part of the repair blueprint. Repair blueprinting is the process of:

- developing a complete and accurate damage report.

- identifying the full extent of damage before repairs are started on a vehicle.
- an orderly removal of parts (teardown), at least enough to access and identify all of the damage.
- determining the total repair cost. This includes identifying all parts needed down to the clips, moldings, and one-time-use fasteners to ensure all the parts are in-house before work is begun.
- making repair or replace decisions as the damage is revealed.
- taking measurements.

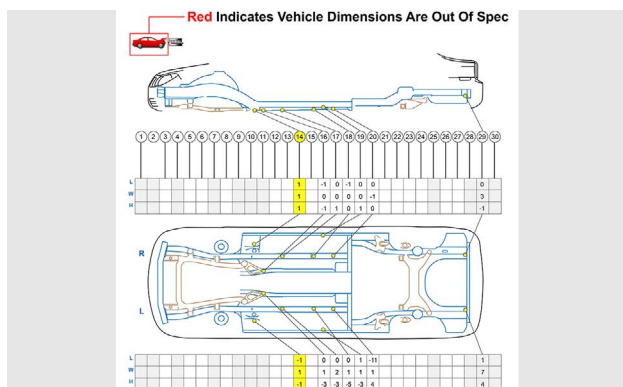


Deployment of the restraints on this vehicle may require additional parts to be replaced. (left) This airbag parts replacement chart is located in the P-pages of the estimating guide from the estimating system being used. (right)

When a vehicle has deployed airbags, replacement and inspection items need to be determined. Airbag replacement charts can be referenced to determine the requirements for a specific vehicle.

Airbag part replacement charts:

- list mandatory part replacement requirements after an airbag deployment.
- give inspection guidelines for which parts must be inspected after an airbag deployment.
- can typically be found in the vehicle maker service information, estimating guides, or computerized estimating system



The red-colored vehicle on the upper left portion of this measurement system printout shows that the vehicle has damage to its structure.

Measurements made during the estimating process:

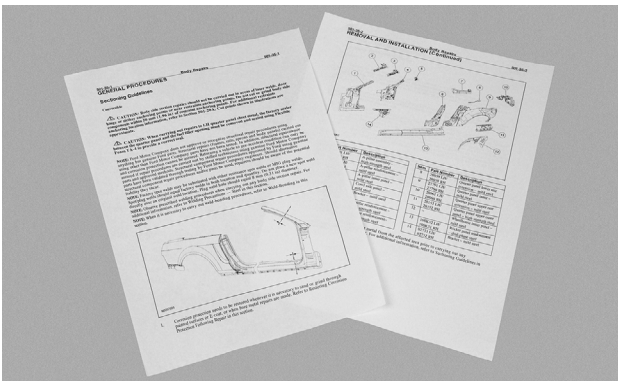
- are quick checks designed to determine if the vehicle structure or suspension parts were moved or damaged.
- may be made using an electronic measuring system that will provide a printed record of the results.



Vehicle service information is being accessed on this laptop computer.

The vehicle service information may provide useful information for damage appraisers when determining the repairability of damaged parts on a vehicle.

The [I-CAR website](#) provides links to vehicle maker service information websites. An additional source for links to vehicle maker websites is the [OEM One Stop TechInfo](#) web page.



Service information may provide information about parts available for a repair.

Service information may include detailed information for:

- special tools, products, and equipment that will be required to complete a repair.
- specific repair procedures. The vehicle service information may provide specific procedures or a variety of options for repairing a damaged part. Replacement part numbers may also be included in the repair procedure.
- material usage charts. Material usage charts or listings may specify the types and strengths of steel used for various parts. Material usage charts may include the repairability of certain parts.
- measurements, such as underbody, underhood, and side aperture dimensions.



I-CAR provides several vehicle-specific training courses.

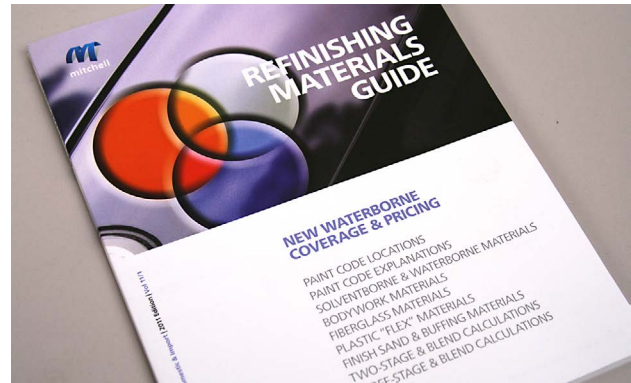
Additional sources of information can be found on the [I-CAR website](#) under the Technical Information pull-down menu. Choices include:

- the Advantage Online. This section includes archives of I-

CAR technical articles dating back to 1989 up to the most recent Advantage Online article.

- the Top Technical Inquiries. This section provides a list of the top vehicle technical inquiries received at the I-CAR Tech Centre.
- the Airbag Parts Replacement Charts. This section provides a list of all parts that must be inspected and/or replaced following an airbag deployment for all makes and models of vehicles dating back to 1993.
- the Partial Replacement Recommendations matrix. This matrix may be referenced to determine if a partial replacement procedure exists for a vehicle, which could save time and expense of purchasing and searching through unnecessary sources. Information in this matrix is specific to individual vehicle make, model, and year. Partial replacement refers to installing a portion of a part at factory seams or at a sectioning location.
- UPCR. These are general repair procedures for all parts of a vehicle.

[I-CAR](#) provides several vehicle-specific training courses that provide information on vehicle-maker guidelines and vehicle-specific repair procedures.



The Mitchell Refinishing Materials Guide can be referenced when determining paint and materials costs.

The Mitchell Refinishing Materials Guide is one source for information regarding paint code locations, paint code explanations, and paint and materials costs.

Paint makers, such as PPG, Spies-Hecker, and BASF, provide information to determine the correct refinish types and materials.

Topics discussed in this module included:

- why damage reports are written.
- when, where, and by whom damage reports are written.
- processes that are done when writing a damage report.
- information sources used when writing a damage report.