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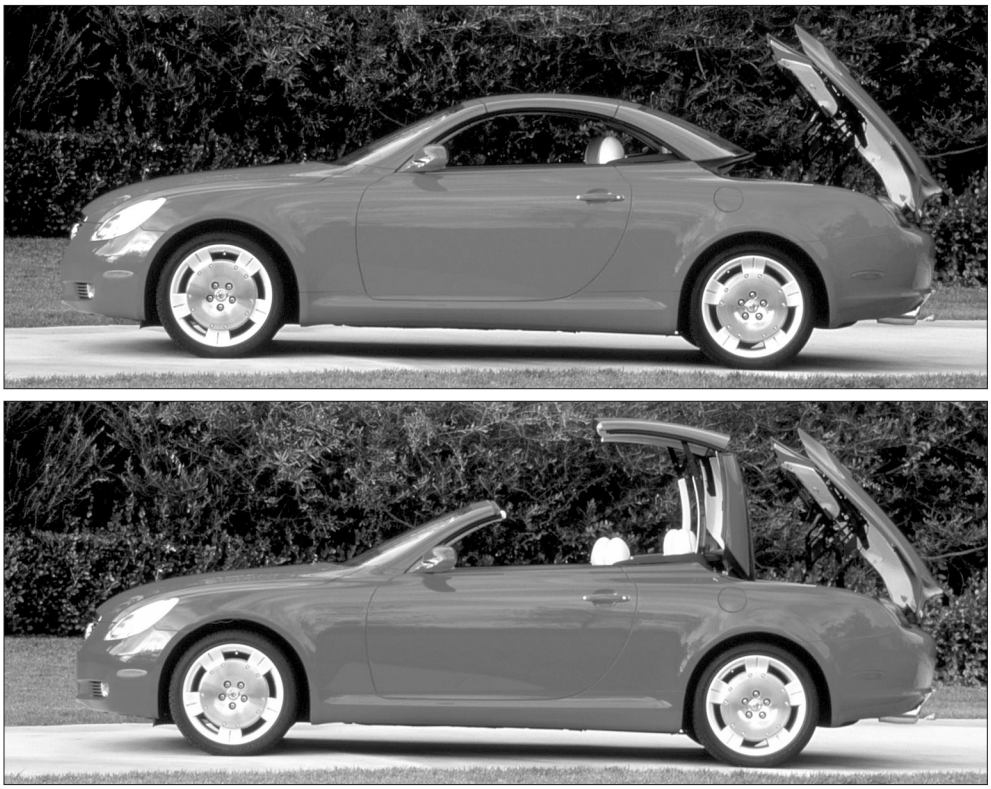
ADVANTAGE

November–December 2001

Technical Information For The Collision Industry

Inside Advantage

Lexus SC 430 Retractable Roof
–A System Of Links Guided By Electronics



The retractable roof on the Lexus SC430 opens and stores in the luggage compartment with the touch of a button.

When Plymouth introduced the first power convertible top in 1939, it was considered a breakthrough for convertibles. The fabric-covered link frame retracted into a back compartment using pneumatic cylinders, removing a major inconvenience of convertibles. It took until model year 2002 to see a similar "one-button" retractable system for hardtops.

Folding convertible tops, or "ragtops," boomed in popularity in North America in the 1950s and 1960s, then went out of production with the 1976 Cadillac *Eldorado*, only to come roaring back with the 1982 Chrysler *LeBaron*. In the meantime, came sun and moon roofs, which offered more convenient open-air motoring and the ability to be retrofitted to existing vehicles. These small, rectangular roof windows are now making way for full open roofs, either fabric, vinyl, or glass or metal hardtops.

But in all of these modern designs, the soft or hardtop needs to be removed and stowed away manually. With a push of a button in the air conditioning control panel, the 2002 Lexus SC430 hardtop opens and stores in the luggage compartment on its own *(see above Figure)*. Another push of a button reverses the

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process, closing the hardtop. Each process takes about 25 seconds. There's a slow start and slow stop built into the system to make the opening and closing as smooth and quiet as possible.

Just how does this electromechanical system work, and what might a technician have to do to troubleshoot this system? That is the focus of this article.

OVERVIEW

The retractable hardtop opens and closes through a series of synchronous movements involving three systems of links *(see Figure 1)*. The **roof link** system opens and closes the roof panel. The **luggage link** opens

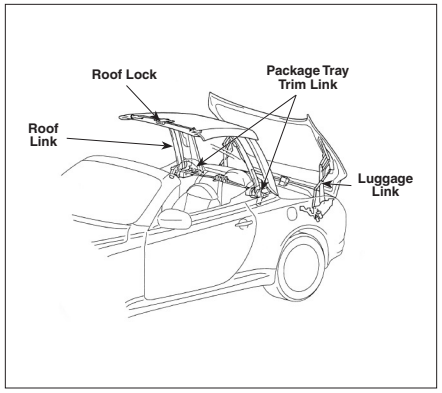

Figure 1–Three link systems must work in harmony for the roof to open and retract.

and closes the luggage or deck lid from the front. And the **package tray** link system slides and tilts the package tray out of the way and into position. There are actually two luggage link systems (4 Link and 6 Link), so that the luggage lid can open from the back like a standard lid when the roof isn't folded inside *(see Figure 2)*. There are also two luggage lid locks, the standard for the rear and an additional lock for the front that automatically locks after the roof is fully retracted.

The link systems are driven by small motors, similar to power door glass motors. Other motors are positioned to lock and unlock the roof and open and close the door and quarter glass. The door and quarter glass must be at least one-third down before the retractable operation can begin.

There are also several limit switches in the circuit. A limit switch allows a delay to be programmed into an electrical operation, to make sure parts don't start moving prematurely. For example, one limit switch is used to detect when the luggage door is fully open, so the roof link system doesn't start folding into the luggage compartment too early. Another limit switch detects if the package tray has finished tilting out of the way. Other limit switches are used to make sure the luggage compartment is locked, the quarter and door glass are in the proper position, and the roof top is locked.

Naturally, this system of links and limit switches are directed in a workable harmony by a dedicated computer, the Sliding Roof Control ECU, which is located under the rear seat area.

THE SEQUENCE

The opening and closing operation is an engineering accomplishment.

First, for anything to happen, the ignition switch must be ON and the vehicle traveling less than 5 km/h (3 mph). Also, the luggage compartment door must be closed. Also, if opening the roof, the Tonneau Cover switch must be ON. To start the operation of opening the roof, the vehicle owner pushes the instrument panel rocker switch down, into the OPEN position. The Sliding Roof Control ECU takes control of the sequence from there:

1. The luggage door is unlocked from the front, and the door and quarter glass roll down on both sides.
2. The luggage door opens. When the quarter windows are fully open and the door glass is at least one-third open, the roof lock is released. This is accomplished by the roof motor pulling out a guide pin that holds the roof in the closed position.
3. A limit switch signals when the luggage door is fully open, and the roof starts to open. A limit switch signals when the roof is in position to start folding back into the luggage compartment.
4. The package tray is tilted up and begins folding under the roof, which is now in the fully open position.
5. The roof folds back into the luggage compartment.

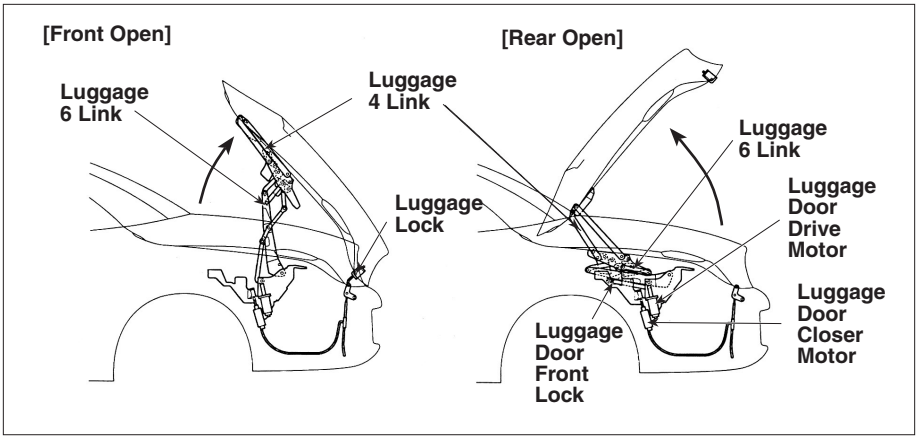

Figure 2–Two luggage links and luggage locks allow the luggage compartment lid to open from the front, to store the roof, and the back, for normal use.

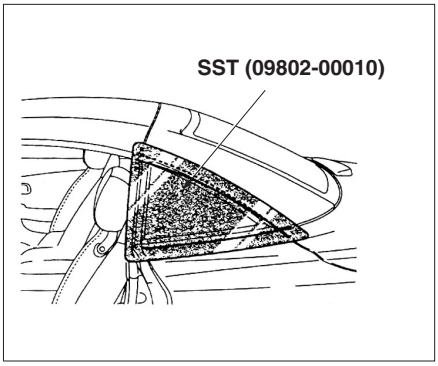

Figure 3–A template (SST 09802-0010) aids in aligning the roof line.

6. When a limit switch signals that the roof is fully retracted into the luggage compartment, the left and right wings of the package tray trim swing out into proper position to allow the package tray trim to tilt down. In the meantime, the roof is locked into position. When another limit switch indicates the roof is fully locked, the luggage lid lock is shifted to a neutral position.
7. The front of the luggage lid closes. When a limit switch signals that the lid is completely closed, the luggage lid is locked in the front. Another limit switch signals that the locking operation is complete.

About 25 seconds has elapsed since the OPEN switch was pressed.

MECHANICAL SERVICE

There are some manual adjustments and checks that can be made to the roof and link systems, either as a precautionary check or if everything is not meshing properly. These adjustments are detailed in the *SC430* service manual. A brief overview is mentioned here.

Roof Panel Alignment

There are adjustment screws in strategic locations to align the protrusion of the roof panel. A panel template is available that aligns the roof line with a printed dotted line on the template *(see Figure 3)*. If the roof line is not aligned, some adjustment may be needed or shims can be added between the roof link and the body for vertical adjustment *(see Figure 4)*.

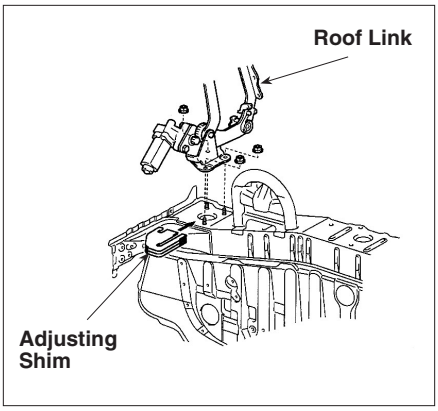

Figure 4–Shims can be added or subtracted to help raise or lower the roof line.

Luggage Link And Package Tray Alignment

There are also shims that can be added or subtracted for the up and down position of the luggage link and the package tray. There's also a guide bar (SST 09803-00010) to pinpoint the exact front and rear position of the luggage link *(see Figure 5)*.

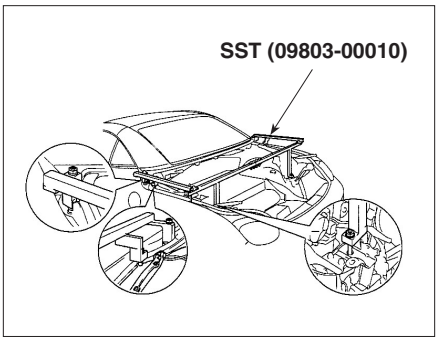

Figure 5–A special guide helps locate the exact position of the luggage link.

Manual Operation

To make some of the required adjustments, it's necessary to be able to manually open and close the roof. For manually opening, there's a release wire to unlock the front of the luggage lid. The cable holding the package tray also must be disconnected. When raising or lowering the luggage lid from the front or moving any part of the automated system by hand, there are cautions to do it carefully and symmetrically to not deform any of the linkage.

There are special tools that come with the vehicle that help in the manual operation of the roof opening and closing. One of the tools is needed to manually remove the luggage lid front catch and release the roof lock.

BODY MATERIALS

The retractable roof needs to be light, and Lexus accomplishes this through the use of aluminum. The roof and back glass frame are aluminum sheet. The hood is also aluminum sheet. Thin, high-strength sheet steel is used for the doors. High-strength steel accounts for over 40% of the body frame weight.

CONCLUSION

The retractable hardtop on the 2002 Lexus SC430 is another example of a sophisticated electromechanical system being introduced on new model vehicles. Repairs to any of these electronic systems requires advanced electronics training. Before repairs can be attempted to some systems, specific training is required. And that is definitely the case with the retractable roof. A one-day training program is available from Toyota Motor Sales, U.S.A., Inc. for this system.

All figures and photos Courtesy of Toyota Motor Sales, U.S.A., Inc.

Inspecting Child Safety Seats – Replacement Is The Standard Requirement

Child safety seats are not part of the vehicle as normally viewed by the collision repair industry. They are, however, a major factor when ensuring occupant safety systems are functioning correctly after a collision.

Vehicle makers have specific inspection and replacement guidelines for occupant restraint systems and airbags. These systems are to be inspected, and the guidelines followed when collision damage is analyzed and repaired. There are also inspection and replacement guidelines for child safety seats that must be followed if the seat was in use during a collision. These guidelines generally come from the manufacturer of the safety seat.

It can be challenging informing the customer of these guidelines, because the child safety seat may not be in the vehicle at the time of damage analysis or when repairs are made to the vehicle. Even if the safety seat is in the vehicle, remembering to consider the guidelines and application of them can be a challenge.

CHILD SAFETY SEAT GUIDELINES

The first thing to do is check the tag on the child safety seat and see if it provides any guidelines. If it does not specifically say what to do following a collision, use the information to contact the manufacturer of the seat *(see Figure 1)*. Most safety seat manufacturers recommend that the seat be replaced following any collision where the seat was "in use." The term "in-use" generally means that the seat was occupied at the time.

One specific manufacturer of a child safety seat says that the unit should be replaced only if the collision is severe. This manufacturer defines "severe" as a collision that causes distortion to the body of the vehicle. All manufacturers suggest that if there's any type of physical damage or distortion to the seat, belt webbing, or latch mechanisms, the seat should be replaced. There are some child safety seat manufacturers that recommend that the seat be replaced following a collision regardless of whether it was occupied or not. If there's any doubt as to what the guidelines are, it's usually best to replace the seat.

At least one state has legislation that mandates that the insurance coverage provider cover the cost of replacing the child safety seat if it was in use during a collision. The subcommittee that helped write the legislation states no parameters for the severity of the collision, because research found no data to back up any kind of minimal threshold.

Many of the child safety seat manufacturers have inspection procedures for child safety seats that have been in use for periods of time or for considering the use of a used seat. These procedures include checking the belt webbing for fraying or physical damage, buckles for sticking and hard operation, and the seat itself for any distortion or cracking. They are all quick to point out that these inspection procedures are NOT to be used following a collision.

It's important for those that work directly with the vehicle owners to understand these recommendations so that they can be explained even if the seat is not present at the time of the inspection or repairs.

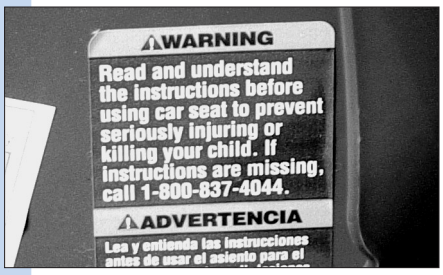

Figure 1–The label attached to a child safety seat may include guidelines for replacement or inspection.

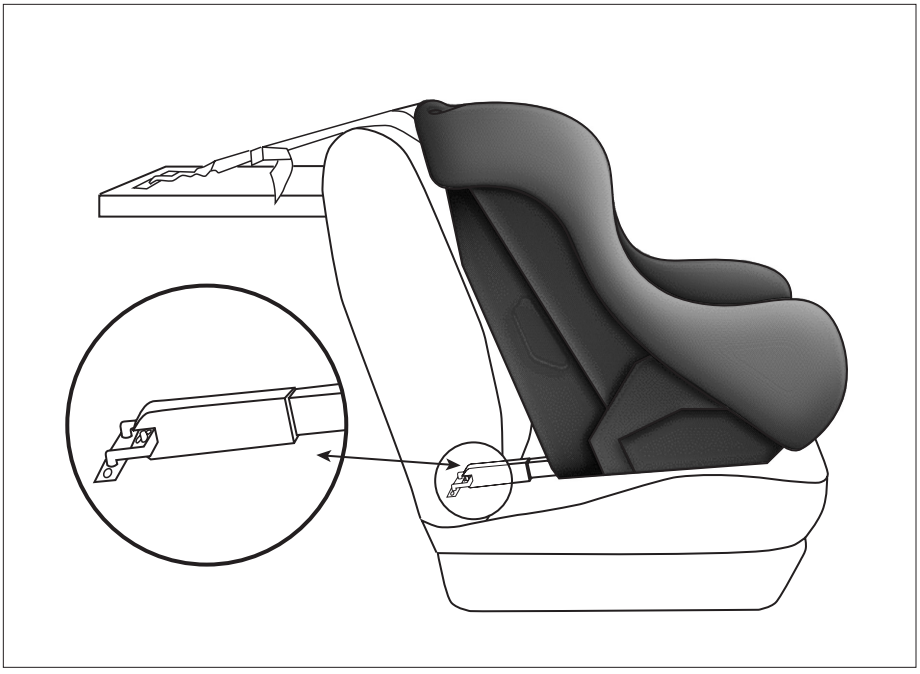

Figure 2–This is a graphic illustration of the anchoring requirements for child safety seats mandated in MVSS 225.

SYSTEM DESIGN CHANGES

With a new National Highway Traffic Safety Administration (NHTSA) rule for child safety seats (MVSS 225), vehicle makers have to change how the vehicle is designed to receive the safety seats. Starting with the 2000 model year, there has been a three year phase-in period of child safety seat attachment points taking place. This phase-in is allowing a uniform installation method for child safety seats. The seats have also been redesigned (in 1999), to work with these attachment points.

Figure 5–By pushing down on the lower half of this rear seat, the lower anchor for the child safety seat can be seen.

Top Tethers And Lower Anchors

In the 2000 model year, 80% of vehicles were required to have a top tether attachment point on the vehicle body or other secure location. By 2003, vehicles are to have low anchor points that are designed for universal use with the child safety seats. The new system is referred to as Lower Anchors and Tethers for Children, or LATCH *(see Figure 2)*.

Top tethers allow a strap to be attached to the back of child safety seats that's attached to an anchor point on the rear package tray or similar area *(see Figure 3)*. The lower anchors are located in the crack between the upper seat back cushion and the lower seat cushion *(see Figures 4 and 5)*. The lower anchors allow straps from the child safety seat to be attached so that the vehicle's lap and shoulder harness aren't the primary attachment system for the child safety seat. The anchorage points are to be located in areas that are not likely to be damaged during a collision. If these parts are damaged or removed during repairs, they need to be reinstalled following the vehicle maker's guidelines.

Figure 3–The top tether anchor allows a child safety seat strap to be attached.

Figure 4–The icon in the circle on the lower rear seat indicates that there are lower anchors for a child safety seat located below the crack of the seat.

CONCLUSION

Child safety seat issues following a collision are not new. What is new is a heightened awareness of the condition of child safety seats due to the federal guidelines. Individual state guidelines may give specific guidance to responsibilities for replacement of the child safety seats following a collision. It's important that these systems be understood and that communications to the vehicle owner be clear and documented when child safety seats have been in vehicles and "in-use" during a collision.

Solvent Recycling
–Not Just A Good Idea, But The Law

Many repair facilities continue to operate under the assumption that solvent recycling isn't a major concern. Part of the reason for this is the mountain of regulations on hazardous materials, air quality, soil contamination, and disposal of these materials. However, the regulations concerning solvent recycling and disposal have been in place long enough to allow all collision repair facilities to be in compliance. Today there are many companies that can assist repair facilities in not only becoming compliant with the regulations, but also improving the operation of the refinish department. Solvent recycling is actually needed to control costs, minimize liability exposure, and become environmentally prudent.

Spray gun cleaning is the main culprit, generating the greatest volume of waste solvents *(see Figure 1)*. Spray gun cleaning has taken some major strides in becoming more efficient, consuming less solvent, more user friendly, multi-functional, and profitable. No longer is more solvent required to clean spray equipment than is needed to mix refinishing materials.

EARLY EFFORTS

Traditionally, waste solvents were dumped out back or taken home to pour on weeds or to treat fence posts, just to get rid of it. Regulations started surfacing in the late 1970s that would have a tremendous impact on how repair facilities dispose of this waste. Jobbers and distributors began selling solvent recyclers with good intentions. However, service was lacking and the process ground to a halt. Soon companies were offering a service of picking up a facility's solvent, even providing recycling units and waste containers. Although a good process, many repair facilities refused to have someone else come on the property and do the work.

The regulations continued to vary by state and province. In the U.S., California, Texas, and New York were the strictest. The U.S. federal government then stepped in and began developing a number of regulations under various agencies. This process even more confused the general public. Regulations could now be found under the National Fire Code, Environmental Protection Agency (EPA), Department of Labor, and the Department of Health and Human Services.

Figure 1–The practice of cleaning spray guns uses more solvents than any other process in a collision repair facility.

FACT vs. FICTION

When discussing solvent recycling, there is confusion over what is fact and what is fiction.

Fiction: All of the solvent recycling regulations are governed by the EPA.

Fact: The U.S. regulations covering solvent recycling for collision repair facilities are still present in each of the federal departments just listed. The National Fire Code governs hazards from fire and explosion of the solvent recycling machine, the EPA governs the disposal of the waste (section 40 CFR part 261), and the Departments of Labor and Health and Human Services regulate the protection required when working with the products and the process of solvent recycling.

Fiction: Repair facilities outside of major metropolitan areas do not have to comply.

Fact: Repair facilities outside of major metropolitan areas may not have the same regulations of those in the city, but there are still the federal regulations. States may also have additional rules, but they can't be less than the federal requirement and most often are stricter. Cities and counties may also have their own enforcement departments.

In Canada, there are no federal regulations that govern all provinces. Each province has its own regulations. City regulations can also be stricter than the provincial regulations.

Fiction: Still bottoms, being hard, are considered solid waste.

Fact: Still bottoms are not considered solid waste. Even though the solvent content is very low, the material is flammable and toxic. All still bottoms are considered hazardous waste until proven otherwise. The testing process for still bottoms requires a Toxic Characteristic Leaching Procedure (TLCP) test. The TCLP test identifies heavy metal content, dryness percent of solvent content, and the material's flammability. This test must be performed following a specific written process from the EPA. The cost of this process often exceeds that of disposal using a certified hauler.

WASTE GENERATION STATUS

A hazardous waste generator is any person, by site, whose act or process produces hazardous waste or whose act first causes a hazardous waste to become subject to regulation. This means a person, business, owner or operator of a business, etc., who generates a waste stream as a result of any process in that business and that waste stream is deemed to be hazardous as defined in federal regulations or by the state or province in which the business is located. Many states or provinces have different regulations and it's important to check with the individual state. To find contacts for the regulations in individual states, go to: www.epa.gov/epaoswer/hotline/states.txt.

The U.S. federal regulations set standards for three categories of generators of hazardous waste *(see Figure 2)*. Each category is determined by the total quantity of hazardous waste generated by the repair facility in a calendar month and by the total amount of hazardous waste the facility accumulates on-site at any one time.

A **Conditionally Exempt Small Quantity Generator** generates less than 100 kg (220 lb) in any calendar month. This is about half of a 200 liter (55 gal) drum.

A **Small Quantity Generator** generates more than 100 kg (220 lb), but less than the volume of a Large Quantity Generator. This is about one-half to five, 200 liter (55 gal) drums, or 95–945 liters (25–250 gal).

A **Large Quantity Generator** generates more than 1,000 kg (2,200 lb) of hazardous waste in any calendar month.

Again, state regulations again may differ and must be checked. In Canada, similar waste generator categories are set by some provincial governments. There is no national set of regulations in Canada.

Identification Number

All handlers or generators of hazardous waste must obtain an EPA identification number. This number is assigned by the Administrator of the EPA through the regional/state offices. Each handler must complete the Notification of Regulated Waste Activity form (EPA Form 8700-12) and submit the form to the appropriate regional/state office. Once a number is assigned, the handler or generator is notified and the number must then be used in conjunction with all hazardous waste management activities.

On-Site Storage

Large Quantity Generators can accumulate hazardous waste for up to 90 days. Small Quantity Generators can accumulate hazardous waste for up to 180 days (or up to 270 days if the disposal facility is located further than 320 km (200 mi) from the generation site), provided that no more than 5,900 kg (13,000 lb) is accumulated. For Conditionally Exempt Small Quantity Generators, there's no maximum accumulation time, but no more than 1,000 kg (2,200 lb) can be accumulated without being subject to the Small Quantity Generator regulations.

All stored waste must be kept in containers that are in good condition, and marked with the words "Hazardous Waste". The containers also must be marked with accumulation start dates. Fire extinguishers and spill containment equipment must be located near the storage site.

Records And Documentation

Hazardous waste manifests and any other associated paperwork which are created for the shipment of hazardous waste to a treatment, storage, or disposal facility must be maintained for five years. It's good management practice to keep all records for 5 years.

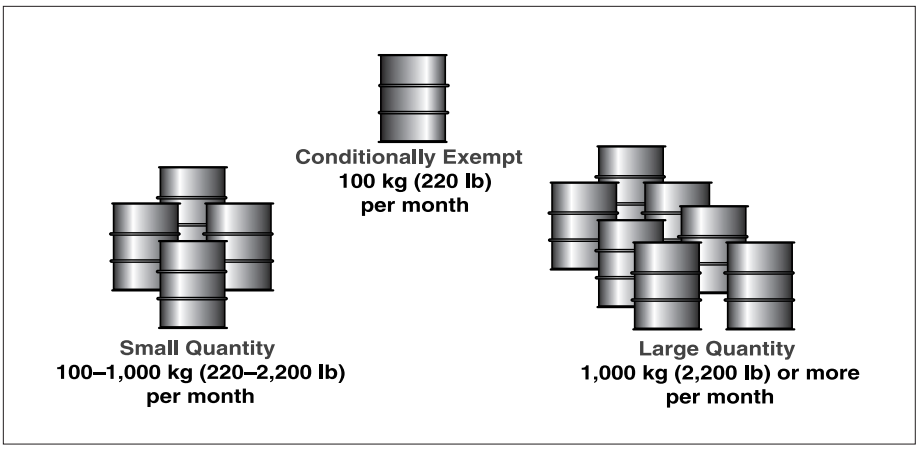

Figure 2–There are three categories of waste generators classified by the EPA.

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Sovlent Recycling–
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SAFETY

Multiple issues of safety surround spray gun cleaning and solvent recycling. The equipment must be placed in the proper location and meet all code requirements for proper ventilation, electrical, and fire suppression *(see Figure 3)*. Spill containment kits must be close by. Operators must be properly trained in the operation of the system, record keeping, and labeling.

Figure 3–The solvent recycling equipment must be located in an area that meets all local code requirements.

Personal safety can't be ignored. Protection against hazards of inhalation, contact, ingestion, and injection must be provided and used. Cartridge respirators, butyl or nitrile rubber gloves, eye and face protection, coveralls, and boots are required during these operations.

CONCLUSION

Cleaning spray equipment is a required process in collision repair resulting in the generation of hazardous materials. Solvent recycling converts that hazardous by-product to a reusable material that reduces the overall cost of the refinish operation. Not only is time saved, the recycled solvent has a cost factor of 30% less than that of new solvent. Reducing a facility's category as a waste generator alone will create financial benefits.

The biggest benefit to recycling is the reduction of liability exposure. Non-compliance to the environmental rules and laws today can bring fines and imprisonment to all involved.

Fuel Cells
–They Are Getting A Serious Look

Zero-emissions vehicles are mandated as part of the transportation mix in California. Hybrid vehicles such as the Honda *Insight* and Toyota *Prius* are already on the street. Looking not too far ahead, many experts think fuel cell technology is ready to become a major part of automotive propulsion technology.

The vehicles listed in the March-April, 1998 *Advantage* have been upgraded and joined by other vehicle maker concept fuel-cell vehicles. DaimlerChrysler has the Necar 5 in testing.

Figure 1–Ford's first working production-prototype, direct-hydrogen-powered fuel cell vehicle, the Focus FCV. (Courtesy of Ford Motor Company)

Ford has a Focus FCV *(see Figure 1 and 2)*. GM has the Hydro-Gen 1 *(see Figure 3)*. Toyota has the *FCHV* series *(see Figure 4)*. In Chicago and Vancouver, six busses are beginning a two-year trial. Honda, Hyundai, Nissan, Volkswagen, BMW and others also have prototype vehicles in testing or development. This technology is quickly moving from the lab to the street. This article will look at the technology and what repair issues the collision industry needs to prepare for.

THE SCIENCE OF FUEL CELLS

In 1839, Sir William Robert Grove first demonstrated the principle of fuel cells. He called it a "gaseous battery" so it wouldn't be confused with his other invention, the electric storage battery. Fuel cells were used in the Gemini space program (1965). They offer excellent energy density. This means they convert much more of the energy contained in a fuel into work than other technologies, such as internal combustion engines. Fuel cells are as much as 70% efficient.

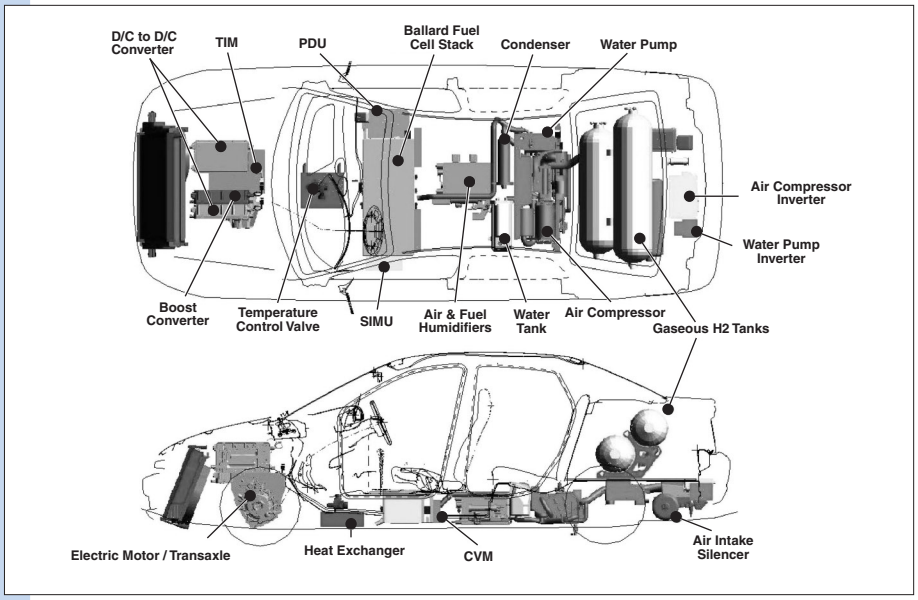

Figure 2–A visible view of the Focus FCV shows the fuel cell stack and other part locations. (Courtesy of Ford Motor Company)

Figure 3–The only materials coming from the exhaust pipe on the GM Hydrogen 1 fuel cell concept vehicle is pure water vapor. (Courtesy of General Motors Corp.)

Figure 4–Toyota's FVHV-4, the latest in a series of Fuel Cell Hybrid Vehicles, stores hydrogen in high-pressure tanks. (Courtesy of Toyota Motor Corporation)

Fuel cells also have no emission problems and make very little noise. The reason they haven't yet been used widely in transportation is expense. The parts used to make a fuel cell are very expensive. And the infrastructure to deliver the needed fuel to consumers is not in place. Recent innovations have made it possible to produce more affordable fuel cell parts. Worldwide $6-8 billion has been spent on fuel cell research and development.

Fuel cells are electrochemical devices, which directly combine hydrogen and oxygen to produce electricity and water *(see Figure 5)*. Hydrogen fuel is pumped into a fuel cell and exposed to a catalyst, usually in the platinum family, at the anode (positive). Oxygen, or air, enters the fuel cell through the cathode (negative) and is also exposed to a catalyst. Resulting reactions cause electrons to flow as current. Heat and water are the major byproducts.

The hydrogen used in fuel cells may be stored in liquid or gaseous form. Liquid hydrogen must be kept at –253°C (–423°F), while gaseous hydrogen is difficult to contain as the molecules are very small and able to migrate through many materials. Also, hydrogen must be stored at very high pressures to achieve sufficient capacity, typically 3,500-5,000 psi.

Another approach to getting hydrogen to the fuel cells is to "reform" a hydrocarbon fuel into hydrogen in the vehicle. Gasoline or methanol is processed onboard and the hydrogen sent to the fuel cell. This process eliminates the need to store hydrogen, but introduces new complexities to the powertrain.

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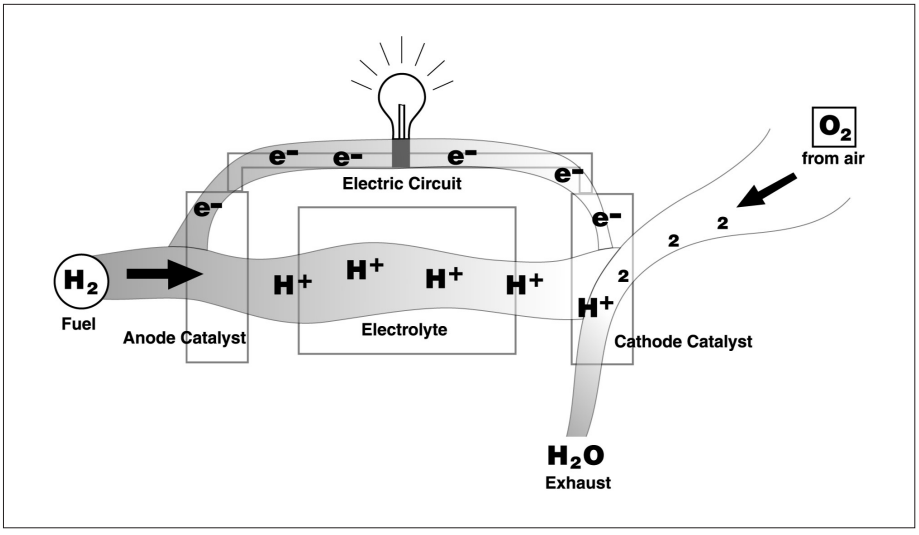

Figure 5–A schematic of a fuel cell shows graphically how hydrogen and oxygen are input and catalyzed to generate electricity and pure water as exhaust. (Courtesy of Fuel Cells 2000)

Hydrogen Power –Alternative To Fuel Cells

Most major vehicle makers are pursuing zero or low emissions vehicles on several fronts. BMW is developing hydrogen power using internal combustion engines. On July 12, 2001, BMW launched a fleet of ten hydrogen powered sedans. BMW is also working on fuel cells, and includes a small fuel cell in this vehicle to supplement the electrical needs. The first North American liquid hydrogen filling station was installed at the Engineering and Emissions Control Test center in Los Angeles, CA. BMW is investigating hydrogen as an automotive fuel because they think the public may accept this more readily than fuel cells.

FUEL SOURCE

Where will the fuel come from for fuel cell vehicles? Hydrogen can be produced from natural gas, methanol, gasoline, or simply extracted from water. This makes it a very desirable fuel, as it can be obtained from existing resources, such as compressed gas, or from renewable resources. New delivery systems will have to be established. Hydrogen could even be produced in small plants with dispensing stations located on the same property.

If existing service stations are going to sell hydrogen, they will require refitting with tanks and pumps capable of dispensing hydrogen. The reformer technology can't use gasoline as presently formulated, because there's too much sulfur present. Gasoline or methanol supply lines would need to be established, but existing pumping stations could easily be modified. These are all questions to be answered during the current testing phase.

REPAIR ISSUES

The devices to reform gas or methanol will produce heat, requiring radiators to cool them. Because they must be fitted into vehicles along with the fuel cell, space will be used even more efficiently than current vehicles. Some prototypes are putting many of the parts under the floor.

Fuel cells themselves produce heat, which must be rejected. While gas or diesel engines reject some of the heat out the tailpipe and some into the coolant, fuel cells need 80% of the waste heat to be extracted by the coolant. The heat produced is relatively low 80–120°C (175–250°F), making it more difficult to reject into the atmosphere in high ambient temperatures. Radiators for the coolant used with fuel cells will be larger than those found on internal combustion vehicles.

At least as many electronic control modules will be used on fuel cell vehicles as are found currently. The fuel cells themselves will be designed to last the life of the vehicle. Some vehicles may have small fuel cells in place of alternators, while still propelled by conventional engines. Electric drive systems will not change much from what is now found on the electric and hybrid vehicles.

The systems are going to be more complex in many ways, which will lead to very tightly packaged "engine" bays. In collisions, there will be more parts exposed to damage. The risk of explosion is very low, as the strength needed to contain the high pressure will easily sustain collision energy. Lines will need to be examined carefully for any damage, which might lead to failure. As with the Toyota *Prius*, there may be a need to sublet operations to gain access to structures.

CONCLUSION

Fuel cell powered vehicles are not for sale yet, but plenty of prototypes are now being tested. The fact that the hydrogen fuel can be obtained from existing sources or from renewable resources, and the continued quest for more energy-efficient vehicles, means that this is a technology that is definitely coming. It's only a matter of time. For more information on fuel cell testing and updates on the technology, check out the fuel cell website at: www.fuelcells.org.

The Hindenburg Experience
–Is Hydrogen Safe Enough?

Hydrogen has long been associated with the Hindenburg disaster. In 1937, the great airship burned in a spectacular fire that ended zeppelin traffic. In the year before the fire, there were 10 successful crossings between Europe and the U.S. The trip took 2½ days, which was a fraction of the time ships took to make the crossing.

Recent examination of the accident shows that the coating on the zeppelin was the primary cause, not the hydrogen gas. The color of the fire and the fact that the ship kept floating for several seconds after the fire was burning support this conclusion. Hydrogen would have burned blue and been difficult to see. The flames in the films are red and orange. If the hydrogen had burned first, the explosion would have caused the craft to fall immediately.

Hydrogen was used to provide lift to the great airships. The coating used on the zeppelin to contain the hydrogen had to be waterproof and heat-resistant. The hydrogen could not be heated by the sun or it would expand and give the vehicle more lift than was desired. The Germans used a compound of iron oxide and powdered aluminum. In proper proportions, this makes a good rocket fuel.

Hydrogen was not the cause of the disaster, only a contributing factor.

General Motors Issues Updated Seat Belt Replacement Guidelines

A new service information bulletin issued by General Motors clears up any confusion there might have been regarding the replacement of seat belt system parts after a collision. The guidelines apply to all 2002 and prior passenger cars and trucks.

The bulletin states that to help avoid injury and ensure that all parts of a restraint system in need of a replacement are replaced:

- replace any seat belt system that was in use during a collision serious enough to deploy any automatic restraint device such as airbags and seat belt pretensioners. This not only includes seat belt systems in use by adults, but seat belt systems used to secure child restraints, infant carriers, and booster seats.
- replace any seat belt system (including child restraint systems) that has torn, worn, or damaged parts.
- replace any seat belt system if you observe the words "REPLACE" or "CAUTION" or if a yellow tag is visible.
- replace any seat belt system if you are doubtful about its condition.

The bulletin also states to NOT replace single seat belt system parts in vehicles that have been in a collision. Always replace the entire seat belt system with the buckle, guide, and retractor assembly, which includes the latch and webbing material.

After a minor collision where no automatic restraint devices were deployed, seat belt system replacement may not be necessary unless some of the parts are torn, worn, or otherwise damaged.

I-CAR Industry Briefs

2001 Advantage Annual Index

I-CAR Advantage

Volume XIV, Number 6

Editorial Office: I-CAR Tech Centre, N127 South Park Drive, Appleton, WI 54914, 920-749-0444, Fax: 920-749-0336.

The I-CAR Advantage is published six times per year and features technical articles for the Collision Industry. Articles submitted for publication may not be used and will not be returned.

Annual subscription rate: $29 in the U.S. and $34 in Canada. Other international subscriptions are available.

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