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September 10, 2009

General Interest #2

~ National Lightning Safety Institute ~

Vehicles and Lightning

What happens when lightning strikes a vehicle? The answer, gleaned from anecdotal observations, is all the way from "Nothing" to "Wow! What a mess . . . my car is a disaster."

Electrically speaking, at lightning's higher frequencies, currents are carried mostly on the outside of conducting objects. A thick copper wire or a hollow-wall metal pipe will carry most of the lightning on outer surfaces. This phenomenon is called "skin effect." The same holds true for lightning when it strikes metal vehicles: the outer surface carries most of the electricity. The persons inside this steel box can be likened to protected by a partial Faraday cage.

But, consistent with lightning's capricious nature, situations alter results. Is the car dry or wet? If the car is made of fiberglass (a poor conductor) or a convertible, skin effect principles may not work. (*Corvette and Saturn owners, please note this fact.*)

Some general recommendations include:

1. **Personal Safety Issues.** Reported incidents and related injuries make it clear that a person inside a fully enclosed metal vehicle must not be touching metallic objects referenced to the outside of the car. Door and window handles, radio dials, CB microphones, gearshifts, steering wheels, and other inside-to-outside metal objects should be left alone during close-in lightning events. We suggest pulling off to the side of the road in a safe manner, turning on the emergency blinkers, turning off the engine, putting one's hands in one's lap, and waiting out the storm.
2. **Heavy Equipment.** Backhoes, bulldozers, loaders, graders, scrapers, mowers, and other heavy equipment that employ an enclosed rollover systems canopy (ROPS) are safe in nearby electrical storms. The operator should shut down the equipment, close the doors, and sit with hands in lap, waiting out the storm. In no circumstances during close-in lightning should the operator attempt to step off the equipment to the ground in an attempt to find another shelter. Very dangerous step voltage and touch voltage situations are created when a "dual pathway to ground" is created. Lightning voltages will attempt to equalize themselves, and they may go through a person in order to do so.
Smaller equipment without a ROPS is not safe. Small riding mowers, golf cars, and utility wagons are examples of unsafe vehicles. Rubber tires provide zero safety from lightning. After all, lightning has traveled for miles through the sky: four or five inches of rubber is no insulation whatsoever. People should safely abandon this machinery and get into a safe shelter.
3. **School Buses.** Metal buses are good Faraday cages. Make sure all windows are closed and the "hands on laps" rule is observed. Pull over and wait out the storm.
4. **Damage.** Reported damage to vehicles includes pitting, arcing, and burning on both exterior and interior places. See the photographs below, courtesy of Mr. Brown, of his Jeep Cherokee that was struck by lightning. Cases have been reported of total destruction of vehicle wiring, and associated electrical and electronic systems. Cases from police departments report bad burns to the hands and mouth where officers were using radio microphones when their vehicles were struck. Cases describe total blow-out of all four tires in passenger cars. A [video in our NLSI library](#) shows a station wagon being struck by lightning in a heavy rain storm, with no damage whatsoever occurring.

Insurance adjusters and claims people note: In many cases you will not find physical damage. Lightning can induce indirect effects to a vehicle's electrical and electronic systems. These low-voltage components may be damaged or destroyed. Auto dealer diagnostics are limited to "it works or it doesn't work" without the ability to disclose the cause or source of malfunction. Sometimes a claims decision may have to be based upon "What else — other than lightning — could have done the damage?"



Strike near hatchback



Close-up of strike



Strike at roof



Roof strike closer to front



Close-up of roof strike



Close-up of strike near axle



Strike on wheel axle

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National Lightning Safety Institute

Providing expert training and consulting for lightning problems