Stomp and Steer: Anti-Lock Braking Systems (ABS)

Did you know?

- The primary advantage of ABS is to help drivers maintain steering control in an emergency or hard braking situation.
- ABS does not always help vehicles stop more quickly.
- Not knowing how to use ABS properly might actually result in the vehicle running off the road or in to another vehicle.
- Drivers should safely practice using ABS and performing aggressive steering maneuvers to understand what ABS feels like, how it sounds, and how it helps maintain steering control.

History of ABS

Antilock brakes were originally developed for use on aircraft. As landing speeds increased due to the introduction of jet aircraft after WWII, conventional brakes were not effective. By the late 80's, ABS became relatively common on automobiles often being standard equipment. Unfortunately, in the early 2000's, automobile manufacturers began to make ABS optional in their attempts to lower the vehicle's base price. According to one authority, 82.4 percent of 2003 model-year vehicles had ABS as standard equipment, down from 83.5 percent in 2002.

Transportation safety advocates consider ABS to be the second most important safety feature on a vehicle – second only to using seat belts. Why? Because it is an active safety device – it helps drivers avoid crashes instead of mitigating the effects of crashes like seat belts or airbags.

What Does ABS Do?

ABS assists the driver maintain vehicle stability and directional control. Used correctly, an antilock brake system (ABS) adds an important measure of safety to driving, under all conditions. It may reduce stopping distances during hard braking - particularly on wet or icy roads. On very soft surfaces, such as loose gravel or unpacked snow, ABS may actually lengthen stopping distances although it still enables the driver to maintain greater control.

Regardless of whether a vehicle is equipped with ABS, drivers must always keep a safe distance behind the vehicle in front of them, and travel at a speed consistent with the driving environment.

How Does ABS Work?

To understand ABS, drivers first have to understand traction. Vehicle control is dependent on traction between the tires and road surface.

Regardless of how much advanced hardware or technology a vehicle has, the bottom line is that its entire braking, accelerating, and cornering performance depends on the small patches of rubber in contact with the road, i.e., traction. If tires lose contact with the road because they are sliding or skidding, drivers lose the ability to steer and safely stop the vehicle. Loss of traction equals loss of control.

ABS uses computers and sensors located at each wheel. It automatically limits brake force to any wheel that decelerates too rapidly. This allows maximum stopping force without brake

lockup (skidding). ABS applies and releases braking force up to 10 times per second.

In a non-ABS equipped vehicle, when the brakes are applied too hard such as in an emergency situation, the wheels "lock up" and the tires skid, resulting in loss of directional control. When directional control (steering) is lost, the vehicle skids in a straight line toward wherever it was heading when traction was lost and regardless of which way the steering wheel is turned.

Very simply, ABS allows wheels to continue to rotate, maintaining tire contact with the road surface (traction), and allowing steering control.

With ABS equipped vehicles, the phrase *"STOMP AND STEER,"* describes how to use ABS. Stomp on the brakes, hold the pedal to the floor, and *steer where you want the vehicle to go.*

Don't pump or stab the brakes in a vehicle with functioning ABS!

Vehicles Without ABS

In an emergency situation, drivers of non-ABS equipped vehicles must know how to pump or stab the brakes by pressing rapidly and with force on the brake pedal. Skilled drivers can literally "feel" when the brakes are about to lock up and just before that occurs, release brake pressure to keep the wheels turning. Essentially, the driver is attempting to behave like ABS. However, no matter how skilled, no driver can pump the brakes as fast or effectively as an ABS system.

The Difference Between Four Wheel ABS and Rear Wheel ABS Equipped Vehicles

Four-wheel ABS maintains vehicle stability and improves control in emergency maneuvers. Because the braking system in a four-wheel ABS equipped vehicle directs brake pressure to each wheel depending upon how that wheel is rotating and preventing wheel lock on all four wheels, the driver has improved control over steering.

Rear-wheel anti-lock brakes, found exclusively on some light trucks, vans and sports utility vehicles, prevent wheel lock of the rear wheels only. Preventing lock-up of the rear wheels prevents the rear end of the vehicle from skidding sideways. The front wheels can still lock up on rear-wheel ABS systems just like conventional brakes. If that happens, the driver should ease up on the brake pedal with just enough pressure to allow the front wheels to start rolling again, so the driver can steer.

How Do You Know if Your Vehicle is Equipped with ABS?

Read the vehicle's operating manual! Most newer vehicles offer ABS as either standard or optional equipment. Check the instrument panel for an ABS indicator light after turning on the ignition. The light comes on when starting the vehicle and, if the ABS system is functioning properly, it goes out. If the light stays on or flashes, or comes on while driving, it indicates a fault in the ABS system. A professional technician must inspect the vehicle's ABS system immediately to determine the source of the problem. If the light stays on, the ABS is malfunctioning. However, the vehicle still has normal brakes.

As of March 1, 1997, all new truck tractors are required to have ABS. And, ABS has been mandatory on new air-braked trailers and single-unit trucks and buses since March 1, 1998. New single-unit trucks and buses over 10,001 pounds with hydraulic brakes must have antilock brakes after March 1, 1999.

As yet, there are no requirements that motorcycles have ABS, although several manufacturers have made them available.

The Feel and Sound of ABS

When ABS activates, drivers will experience a vibration or a rapid pulsation of the brake pedal or valve – almost as if the brakes are pushing back against their foot. The valves in the ABS unit may make a grinding, scraping or buzzing noise. This simply means that the ABS system is working. Continue to apply firm pressure and steer. Do not release brake pressure until the emergency is over.

Unfortunately, many post-crash police reports indicate that drivers are unfamiliar with how an ABS system sounds and feels. During an emergency situation, those drivers are startled and release the brakes thinking something is wrong. And, a crash occurs.

Practice Using ABS

After reading the operating manual, drivers should test the ABS system. In a safe paved area, away from traffic or obstructions and with seat belt(s) fastened, drive just above the speed that the antilock brake system activates (usually above 10 mph) and apply the brakes hard. ABS is speed-sensitive and will not activate at very slow speeds. Also, it's easier to activate ABS on a wet and slippery surface. The antilock system should prevent the wheels from skidding.

Next, practice a "real" panic braking situation! Again, in a safe place and speed with seat belt(s) fastened, stomp on the brakes and aggressively steer the vehicle as if attempting to avoid an obstacle such as a child or another vehicle. Drivers may be shocked to see that they can steer the vehicle as well as stop it!

And, that's why it is critical that drivers of ABS equipped vehicles practice violent steering maneuvers.

In an ABS equipped vehicle, hard application of the brakes accompanied by aggressive steering maneuvers will cause the vehicle to go where the driver is steering it. Unlike non-ABS equipped vehicles that simply plow straight ahead with the wheels locked, ABS vehicles will go where they are steered. Often, that is off the road into a tree or across the center line head-on into an oncoming vehicle.

Do Anti-Lock Brakes Reduce the Number of Crashes?

The jury is still out. Federal government and private studies indicate ABS is both effective and not so effective in reducing the frequency of fatal *automobile* crashes. Here are some of the principal findings and conclusions from a National Highway Traffic Safety Administration study of automobile crash data:

- ABS significantly reduced the involvements of passenger cars in multi-vehicle crashes on wet roads. ABS reduced police-reported crash involvements by an estimated 14 percent, and fatal involvements by 24 percent. The finding is consistent with the outstanding performance of ABS in stopping tests on wet roads.
- Certain types of collisions on wet roads, such as striking another vehicle in the rear, or striking a stopped vehicle, were reduced by 40 percent or more. This benefit, however, was partially offset by an increased likelihood of being struck in the rear by another vehicle. The better a lead vehicle's braking capabilities, the more likely that a following vehicle with average braking capabilities will hit it.
- The risk of fatal collisions with pedestrians and bicyclists was reduced by a statistically significant 27 percent in passenger cars with ABS.
- All types of run-off-road crashes - rollovers, side impacts with fixed objects and frontal impacts with fixed objects - increased significantly with ABS. Nonfatal run-off-road crashes increased by an estimated 19 percent, and fatal crashes by 28 percent.
- Rollovers and side impacts with fixed objects - crashes that typically follow a complete loss of directional control - had the highest increases with ABS. Nonfatal crashes increased by 28 percent, and fatal crashes by 40 percent.

- Frontal impacts with fixed objects, where the driver is more likely to have retained at least some directional control prior to impact, increased by about 15-20 percent, both nonfatal and fatal.
- The overall, net effect of ABS on police-reported crashes (including multivehicle, pedestrian and run-off-road crashes) was close to zero.
- The overall, net effect of ABS on fatal crashes was close to zero.

There are several reasons to view this data with caution.

First, by measuring only the frequency of crash occurrence, the data does not consider how many crashes are prevented by proper use of ABS.

Second, the data comprise the initial years of exposure of the first groups of cars equipped with ABS. Results could change as drivers gain more experience with the ABS in these cars, or for later cars with improved ABS systems.

Finally, actual experience in hundreds of emergency reaction crash avoidance maneuvers at the Liberty Mutual Research Institute shows that, with practice, drivers are far more capable of controlling ABS equipped vehicles. These maneuvers are conducted under controlled training conditions in vehicles where ABS can be turned on or off, at the discretion of instructors. In virtually every case, drivers are able to more effectively control the ABS equipped vehicle. And, after the training, participants have a far greater appreciation of how ABS works and its effectiveness as a crash avoidance tool.

They also learn that ABS will not prevent all skids. It does prevent the wheels from locking in typical panic situations. *ABS cannot change the laws of physics.* A combination of excessive speed, sharp turns and hard braking can still throw an ABS-equipped vehicle into a sideways skid.

ABS is not a cure for unsafe driving or risk taking on the highways. It will not compensate for unsafe driving behaviors.

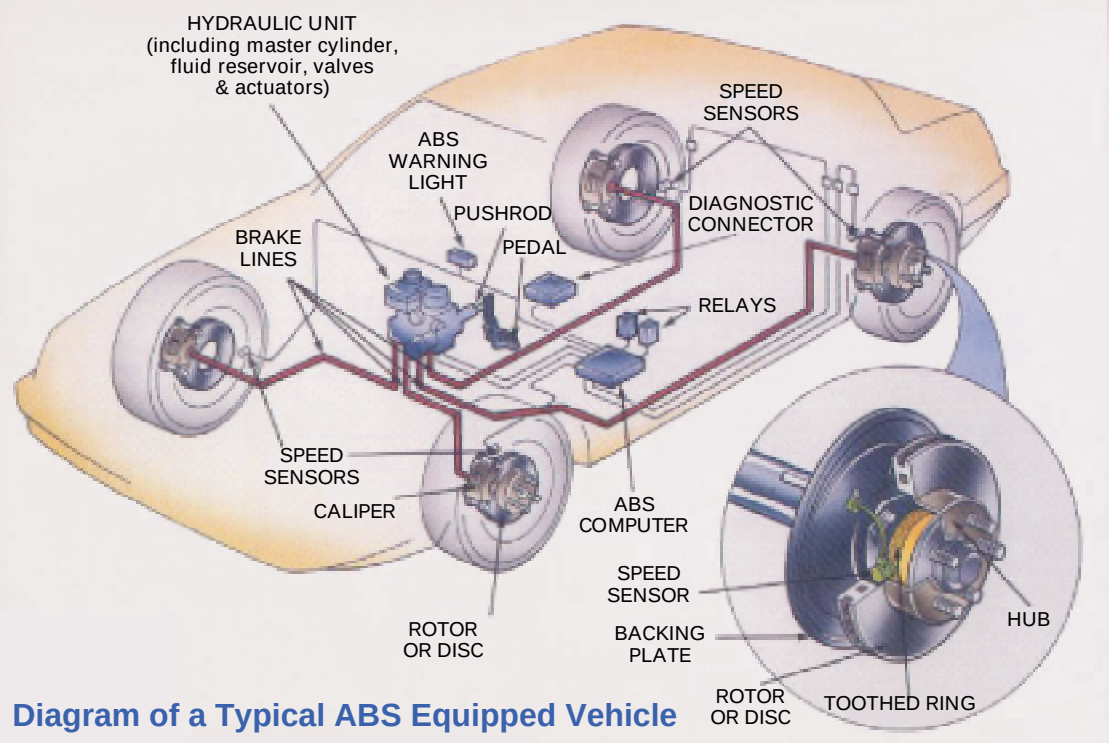

Diagram of a Typical ABS Equipped Vehicle

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