Essentially oxygen attacks tires from the inside out. The oxygen passes through rubber, intermingling with the rubber molecules and steel belts on the tire. As it passes through the wall of the tire, oxygen alters the rubber and prematurely ages the tire.

In a 2003 study brought about by the Ford/Firestone tire debate, NHTSA reports chemical aging is due to oxygen diffusing through the tire composite and reacting with the internal components. If the rate at which air diffuses through the tire is slowed, the rate of chemical aging will be similarly slowed. Typical results of chemical aging, according to NHTSA, include belt-edge failure (which may lead to tread separation) and bead cracking (which results in more rapid air loss), and less frequently, tread chunking and sidewall failure, better known as a blowout.

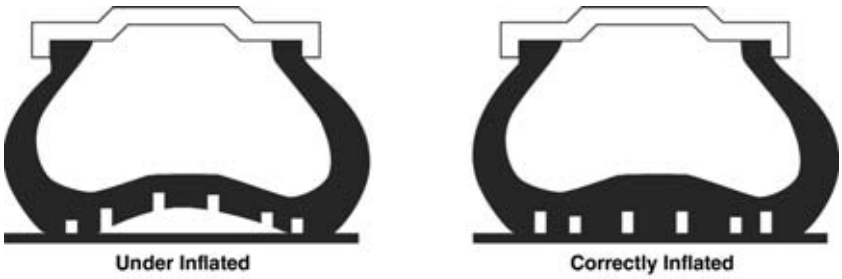
As a result of research into mechanical and chemical aging, NHTSA concludes that:

- High ambient temperatures result in an increase in tire failures;
- High ambient temperatures accelerate the rate of chemical aging;
- Tire failures don't begin to manifest until about two to three years of use; and
- Testing new tires from the factory may not identify defective designs.

Top 'em off

Tires must be kept properly inflated to their recommended pounds per square inch (PSI) measurement in order to live their expected life. A tire 20 percent under inflated will have a 15 percent shorter tire life. An under-inflated tire will also speed the chemical aging process as flexing causes the air in it to heat, speeding chemical aging. The rubber prematurely breaks down and a catastrophic failure due to under inflation and the weakness of the rubber may take place.

A Goodyear bulletin reports the service life of a tire, under inflated by 10 percent, will decrease by 7 percent. Pirelli Tyres Ltd. reports 20 percent under inflation equals 15-percent-shorter tire life. According to a survey from NHTSA, it is reported that 27 percent of passenger cars are driven with one or more substantially under-inflated tires. In addition, the survey found 33 percent of light trucks are driven with one or more substantially under-inflated tires.



Tire life and performance depends on correct inflation. Under inflation cannot always be detected by simply looking at a tire. Under inflation results in an over-loaded tire, which causes mechanical flexing, heat build up and leads to tire failure.

Tire inflation determines a tire's load capacity and an under-inflated tire may overload the tire. Gas mileage, tire wear, sluggish handling and excessive mechanical flexing causing heat build up are all tire-related problems due to improper inflation.

Keeping tires properly inflated is being stressed by the automobile industry to ensure safety and extended tire life. In fact, NHTSA requires vehicle manufacturers to equip light vehicles (those with a gross vehicle weight rating of 10,000 pounds or less) with tire pressure monitoring systems (TPMS). The TPMS alerts the driver when a tire or combination of tires has become substantially under inflated through an illuminated telltale.

The solution

To avoid these problems, oxygen is being taken out of the equation and tires are being filled with nitrogen. Because nitrogen is an inert and dry gas, when inflating car tires, the process of oxidation (rusting and corrosion) is practically eliminated. Nitrogen also permeates out of tires at a much slower rate than air. Bridgestone reports that air-inflated tires lose 2.7 PSI per month while nitrogen-inflated tires lose approximately 0.7 PSI per month.

Loss of tire pressure between scheduled check-ups was one problem Tom Vasko, fleet services director for the City of Wichita, Kansas, was having with its police patrol cars. Changes in the tire's temperature caused the tire pressure to fluctuate and activated the TPMS, requiring an officer to leave the street to check the vehicle's tire pressure.

After learning that nitrogen held a much more constant tire temperature, Vasko contacted Parker Hannifin to participate in a prototype test program that allowed the police department to test running nitrogen in patrol car tires. Vasko quickly noticed the difference. "It was nice because none of the low pressure alarms came on in the vehicles," says Vasko. "I think it's normal to lose 1 to 2 pounds a month (with air), and we weren't even losing that anymore."

Low tire pressure was leading to uneven tire wear for the Raymond (New Hampshire) Police Department, especially with its winter tires. Despite providing excellent traction and performance, the tires tended to prematurely wear in the center of the tread, according to Police Chief David Salois. The department also worked with Parker Hannifin to test the nitrogen system for just under a year. After putting nitrogen in one of its cruisers and testing without problems, the other eight department cruisers were filled as well.

"On the Goodyear winter version of the RSAs, we noticed that there was a center wear problem," Salois reports.