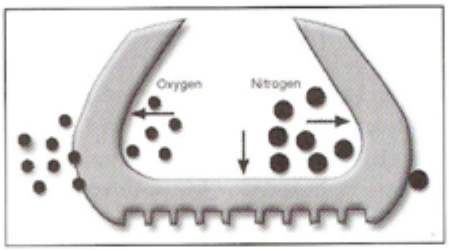
Performing well under pressure

Why inflation of tires with nitrogen makes sense—and saves money

By far, the single most critical factor for maximizing tire life and minimizing the chance of tire failure is maintaining proper inflation pressure. One way to help maintain proper tire inflation is to fill tires with nitrogen instead of compressed air. Nitrogen allows a tire to retain more of its original properties.

Among the benefits of nitrogen inflation: less inflation pressure loss for a more stable, consistent tire pressure; cooler running tires; longer tread life; less oxidation of tire components; and less rim and wheel corrosion. The result is increased tire life, improved fuel economy, reduced tire aging, and a more durable casing.



Oxygen diffuses through a tire much faster than nitrogen.

While the trend toward nitrogen inflation is relatively new to the truck and bus tire market, it has been long used in tires on Formula One, Indy, Le Mans, and NASCAR racecars; commercial and military aircraft; military vehicles; heavy off-road construction equipment, and the space shuttle.

A reason for the slow growth of nitrogen tire inflation in on-highway transportation has been the availability of nitrogen. However, more and more nitrogen filling facilities are appearing nationwide as on-site nitrogen generators have become more affordable and as more manufacturers of nitrogen generators have entered the marketplace.

Over time, the pressurized air inside a tire slowly migrates and permeates its way into and through the tire. Air contains moisture. So, in addition to reducing the tire's inflation pressure, the oxygen and moisture in the air reacts with the rubber compounds in the tire, causing them to break down and lose their strength and durability.

An underinflated tire is much more prone to premature failures. That's because when an underinflated tire rolls, it flexes more than it was designed to. This flexing bends the tire's rubber and steel (used within the rubber to provide additional operating characteristics) and generates heat. Heat, a tire's worst enemy, speeds tire wear dramatically.

Since air, which contains oxygen, is not an inert gas, it is affected by changes in temperature, which affects the rate of air loss from a tire. The air inside a tire expands when heated and contracts when cooled. More air is lost in hot weather. The consensus is that for every 10° F change in temperature, there will be a one psi (pound per square inch) change in the pressure of a tire.

Being an inert gas—not readily changed by chemical reaction—nitrogen provides constant pressure and is less susceptible to accelerated diffusion caused by changing temperatures.

Nitrogen inflation minimizes moisture and oxygen in a tire so there is less rubber degradation and none of the corrosive properties found in compressed air. A reduction in rubber oxidation slows a tire's aging, improving the casing's durability, lengthening its useful life, and yielding a higher proportion of retreadable casings that can survive more retread cycles.

Because nitrogen molecules are slightly larger and less permeable than oxygen and other gases in air, it migrates slower through a tire. It might take a truck or bus tire inflated with nitrogen about three months to lose two psi, whereas even a well-maintained tire inflated with compressed air will lose about two psi per month.

Nitrogen can provide stronger casings for more retreadability, and retreaded tires help conserve finite natural resources and reduce solid waste disposal problems. Every retread produced means one less new tire, which minimizes the number of new tires that need to be produced.

Production of new truck and bus tires consumes large amounts of energy and materials that impact the environment. Truck and bus tires are basically petrochemical products. It takes 22 gallons of oil to manufacture one new tire. Most of that oil is used in the tire casing, which is reused in retreading, where only about 7 gallons of oil is required to retread that same tire. So each time a tire is retreaded, some 15 gallons of oil are saved.

There is some confusion about what happens when nitrogen and air are mixed inside a tire.

Normal air is about 78% nitrogen; so adding compressed air will simply drop the nitrogen purity. There shouldn't be any adverse affects on the tire or vehicle handling, provided the pressure is kept at the proper level.

Manufacturers of nitrogen inflation system advise that any tire containing both nitrogen and air be purged and then reinflated with the proper amount of nitrogen as soon as possible. The same procedure holds true in case a tire would need to be replaced and nitrogen is not available.

When a nitrogen-inflated steer tire has been repaired and refilled with air, some nitrogen inflation system manufacturers recommend that the nitrogen be let out of the other steer tire and refilled with air.

The reason, they say, is that an air-filled tire will heat up and expand, whereas the tire with nitrogen will not, possibly causing a slight pull to the side with the nitrogen-inflated tire. With air in both steer tires, the air pressure will expand relatively equally.

Here again, as soon as possible, the air should be purged from both steer tires and properly reinflated with nitrogen. Some in the field, however, believe topping off a nitrogen filled tire with air has too little an effect on handling terms to be required.

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