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# A Review On Currently Available Different Self-Inflating Tyre Systems In Commercial Vehicles

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***Abstract: Earlier performed studies that show that a drop in tyre pressure by a few PSI may result in the reduction of mileage, tyre life, safety, and vehicle performance. Self-inflating tyre system ensures that tyres are properly inflated at all times. With the increasing prices of oil and growing concern of environmental issues, this system addresses a potential improvement in gas mileage. Thus in this paper, we reviewed the all available self-inflating tyre systems that are used nowadays in commercial vehicles.***

***Keywords: Pressure, Safety, Environmental, Mileage, Self-inflating.***

## 1. INTRODUCTION

The 4 out of 5 cars on the road are driving with one or more tyres underinflated. Tyres can lose one or two PSI each month in winter and even more in the summer season. And, it is Impossible to tell if they are properly inflated or not just by looking at them. Because tyres are flexible they flatten at the bottom when roll. When tyre is under inflated the friction created is greater and friction creates heat. If more heat is generated, the rubber that holds tyre cord together will start melting and tyre will fail to perform its function.

**Table 1.1: Generic fault-finding for most types of tyre wear**

| Sr. No. | Problem | Cause |
|---|---|---|
| 1 | Shoulder Wear: Both Shoulders wearing faster than the center of the tread | Under-inflation |
| 2 | Spot Wear: A part (or a few parts) of the circumference of the tread are wearing faster than other parts. | |
| 3 | Diagonal wear: A part (or a few parts) of the tread are wearing diagonally faster than other parts. | |
| 4 | Centre Wear: The center of the tread is wearing faster than the shoulder. | Over-inflation |

Maintaining correct tire inflation pressure helps optimize tire performance and fuel economy. Correct tire inflation pressure allows drivers to experience tire comfort, durability, and performance designed to match the needs of their vehicles.

 

## 2. CURRENTLY AVAILABLE SELF-INFLATING SYSTEMS FOR COMMERCIAL VEHICLES

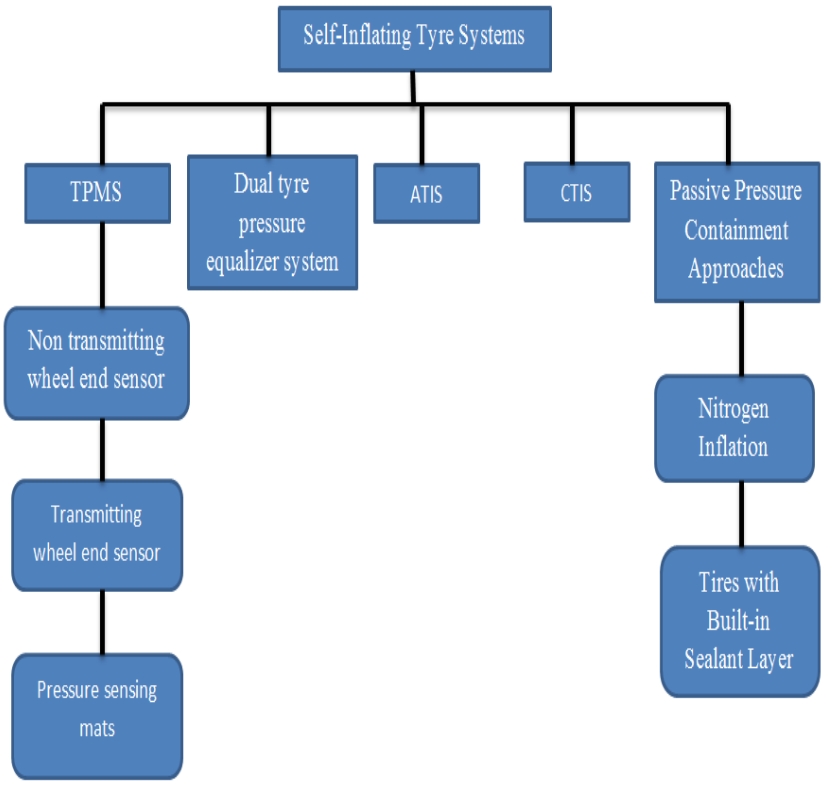


**Figure 2.1 Different self-inflating systems for commercial vehicles**

### 2.1 Tire Pressure Monitoring System (TPMS)

A TPMS monitors pressure and in some cases, temperature, for each individual tire. TPMS can identify underinflated tires by using a device that senses pressure and temperature and in most cases, transmits the data and displays it to the operator. A TPMS monitors each tire based on a pre-set target pressure, and issues alert based on the difference between the target pressure and the actual measured pressure in the tire.

*Types of Tire Pressure Monitoring Systems*

#### 2.1.1 Non-Transmitting Wheel-End Sensors

Non-transmitting wheel-end tire pressure monitors use sensors mounted to the end of the valve stem. This is the most basic type of TPMS because it does not transmit the tire pressure data. The sensor will simply provide a visual indication of the tire pressure, requiring the operator to do a "walk-around" of the tractor and trailer in order to see the tire pressure reading. This type can be used on tractor, trailer, or in combination.

#### 2.1.2 Transmitting Wheel-End Sensors

They obtain a direct measurement of the actual pressure for each individual tire that contains a sensor. The pressure condition for each tire is reported to the operator or to fleet maintenance personnel during both normal operating conditions as well as for pressure alerts. TPMS can link to existing vehicle communications networks to transmit tire pressure data and other tire condition information to Internet and cell phone systems. A fleet may choose to have the initial notification of a tire with low pressure sent to fleet maintenance personnel to determine what action should be taken, rather than to a driver. Data can be collected in central databases and analyzed for tire performance trends, and may also link to a fleet's work order system for tire inspection and maintenance scheduling.

#### 2.1.3 Pressure Sensing Mats

Pressure sensing "mats" or "plates" has been developed by a small number of suppliers as a means to quickly measure and report the tire inflation condition automatically as a vehicle enters a garage or service center. A matrix of sensors is arranged into a metal plate structure that can be installed into an indoor floor or driveway surface. In a typical configuration, each sensor records an incremental load on the sensor area as a tire is driven across the plate at low speed. By reconstructing the history of sensor loading as the tire passes, the system is able to determine the shape and contact area of the tire footprint and the total load being carried by the tire. This information is used to calculate the tire inflation pressure.

 

**2.2 Dual Tire Pressure Equalizer Systems**

Dual tire pressure equalizer systems are designed to maintain the same inflation pressure between the two tires in a dual assembly. Typically, a central sensor unit is attached to the outer wheel, with tire hoses running from the unit to the valve stems of both tires. The unit allows air to flow back and forth between the two tires but does not add or remove air during normal operation. For example, if the temperature of the outer tire rises faster than that of the inner tire, resulting in a higher pressure at the outer tire, the equalizer system will slowly transfer air to the inner tire, until both tires are operating at the same pressure. Conversely, if one tire of the dual assembly is leaking, the system will transfer air from the non-leaking tire in an attempt to balance the pressure between the tires.

**2.3 Automatic Tire Inflation Systems (ATIS)**

The ATIS will operate automatically to restore the tire inflation pressure to its target or specified level, that is, without requiring any manual intervention to initiate re-inflation. The system will function to maintain target pressure across a normal or typical range of ambient operating conditions. The system is pre-set to one single target pressure, or to a single target pressure per control unit, this target value being non-adjustable by the vehicle operator from inside the cab during vehicle use. Actual tire pressure is typically not reported for the tire/wheel assemblies connected to the system.

The distinction between ATIS and CTIS is considered to be the ability of the CTIS to respond to on-demand changes in target pressure which can be achieved with a user interface inside the cab. In contrast, ATIS are generally designed for single target pressure.

**2.4 Central Tire Inflation Systems (CTIS)**

Like ATIS, Central Tire Inflation Systems (CTIS) use air from the vehicle's compressed air system to inflate the tires, normally from the vehicle's air brake tank. The components used in these systems are sensors, manifolds, hoses and valves, harnesses, and the controller/display. In contrast to ATIS, a CTIS set-up includes an ECU in addition to an air regulating the system. The vehicle operator has the ability to change the target pressure of the tires from inside the cab, on demand, in response to changes in road or environmental conditions. The ECU controls the signaling to the pneumatic system to inflate or deflate the tires. Air is also delivered to maintain a constant target pressure. CTIS systems are most often found in off-road applications characterized by uneven terrain and costly vehicle equipment, including mining, logging, construction and military operations.

**2.5 Passive Pressure Containment Approaches**

Additional tire pressure product categories offer ways to maintain air in the tire without any action to measure, report, or adjust inflation pressure once a tire has been aired up. Nitrogen inflation attempts to reduce natural pressure losses due to diffusion through the casing. Use of tire sealants, in several forms, is generally aimed at downtime reduction due to air loss caused by small punctures.

**2.5.1 Nitrogen Inflation**

Use of concentrated nitrogen instead of atmospheric air slows down the natural pressure loss in tires.

Suppliers of nitrogen systems typically use a membrane process to remove oxygen and moisture from the air, taking advantage of faster permeation rates of these components relative to nitrogen. High concentration nitrogen gas is then collected in a pressurized storage tank. Generally, the percentage nitrogen in the tank is about 95% or higher. The same permeation properties that slow the diffusion of nitrogen in commercial nitrogen generator systems help keep air in the tire once it has been inflated.

Laboratory tests comparing tires inflated with atmospheric air versus tires inflated with high concentration nitrogen have shown that nitrogen inflation can reduce natural pressure losses. However, it should be noted that the measured pressure losses are small in both cases. In the absence of other sources of leaks or air seepage, a tire inflated with nitrogen will hold its original pressure longer than one filled with standard air.

**2.5.2 Tires with Built-in Sealant Layer**

In recent years, certain tire lines containing a built-in sealant layer have been developed and commercialized for heavy truck applications. The sealant layer is built into the tire between the inner liner and casing ply as part of the normal manufacturing process. During curing, the sealant takes on a gel-like consistency that enables it to flow in the finished tire. For example, if a nail penetrates the tread and the sealant layer, the sealant immediately sticks to the nail and surrounds the area around it, sealing the leak. If the nail is pulled out, sealant is pulled into the puncture area and seals the hole. Positioning the sealant layer between components of the tire construction maintains an even distribution of sealant around the tire circumference.

In current configurations, sealant is present only in the tread area of the tire, covering the repairable zone of the tire and also the zone in which most punctures occur. Multiple punctures of up to ¼" diameter can be sealed with high reliability, and the product may be effective in repairing damage from larger obstacles. Because sealant has been directly incorporated into the conception of the tire, products with built-in sealant perform with known and controlled properties. They are compatible with normal re-tread processes and are designed to undergo multiple re-treading. Sealant is not removed or added during re-treading. Sealant tires in this category are covered by the same warranty as the equivalent tire model without sealant.

## CONCLUSION

The reliability and durability of the available commercial vehicle self-inflating system are strong. As with many new innovations, early issues were identified and corrected and the current products are generally believed as acceptable and companies capable.

 

Adoption of these solutions is increasing. The systems are moving from retrofit via aftermarket to available from the tractor and trailer manufacturers, increasing the quality of the installation and decreasing cost with scale.

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