TIRES, HEAT, AND INFLATION PRESSURE

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Product Technical Manager
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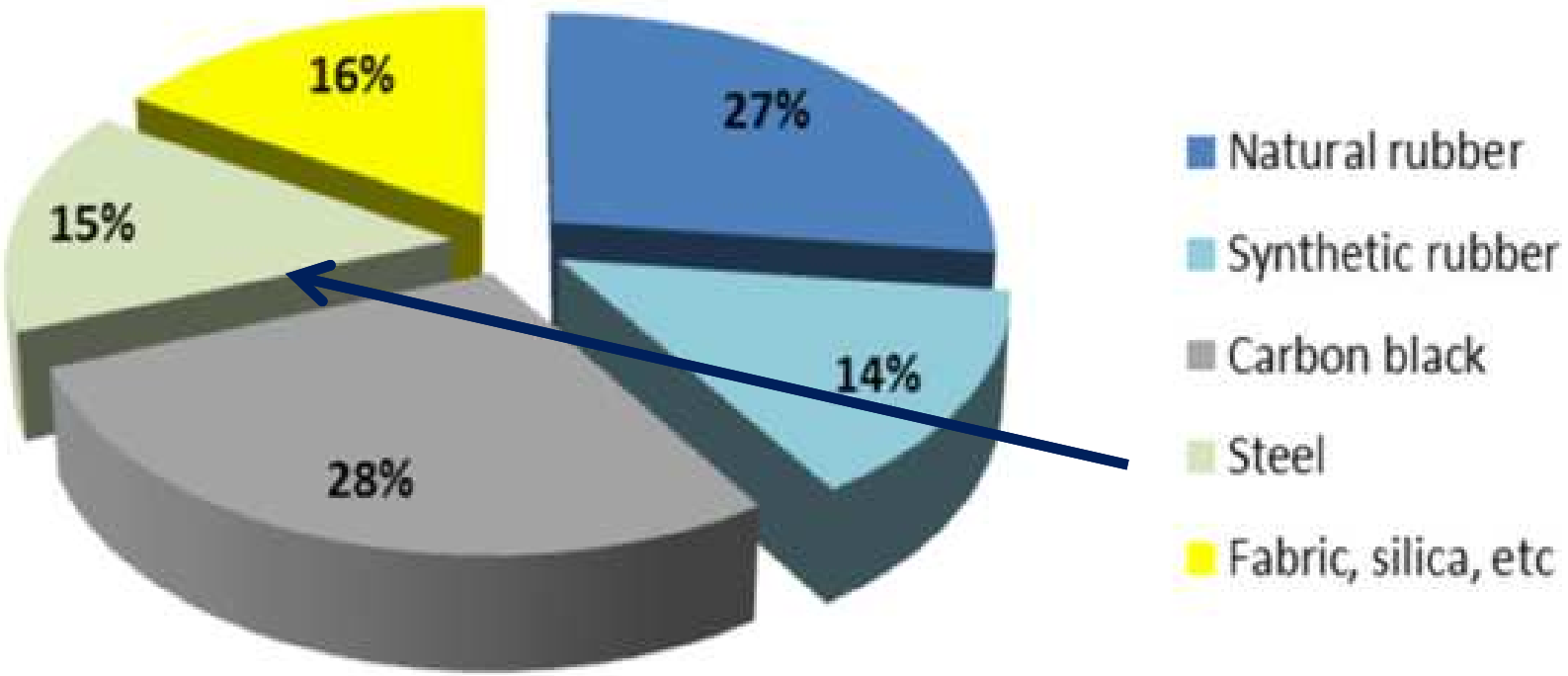
AGENDA

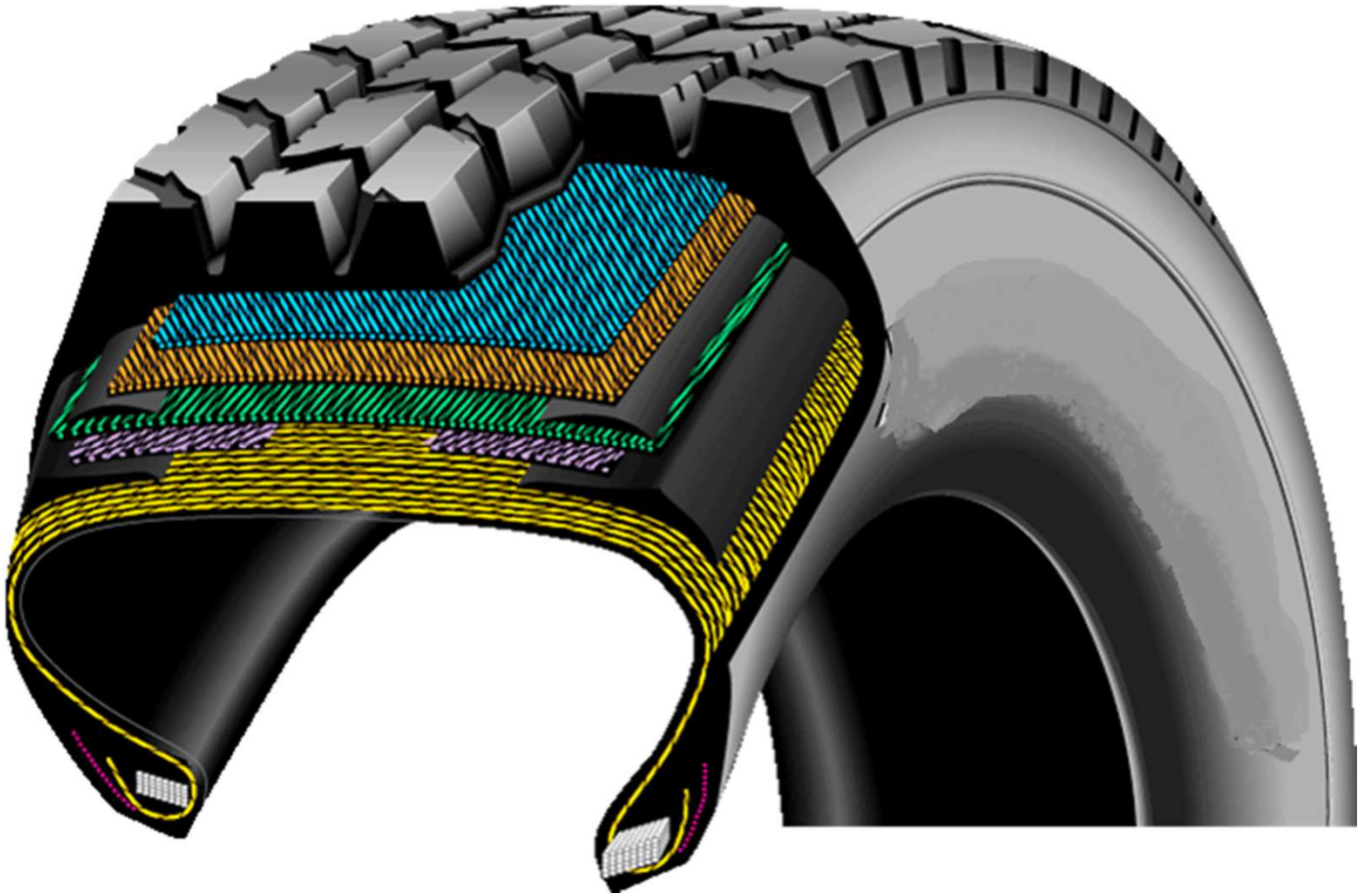
- Review of Tire Construction
- Deflection versus Compression
- Thermal Equilibrium
- Sidewall Fatigue

WHAT'S IN A BUS TIRE?

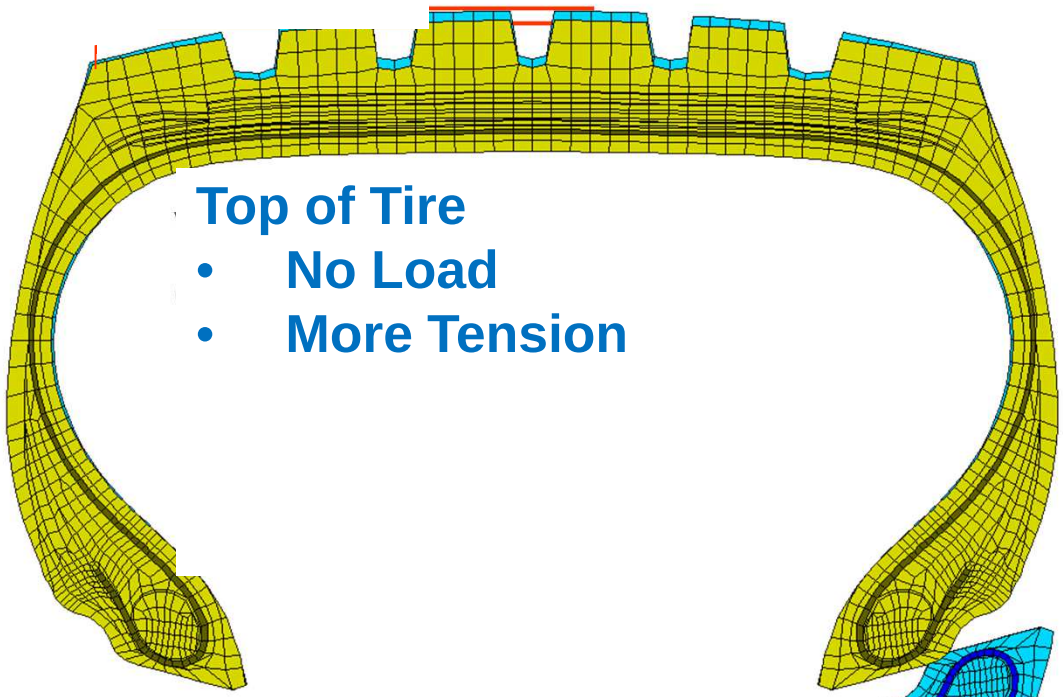


MICHELIN
A BETTER WAY FORWARD

STEEL FOUND WITHIN A TIRE



COMPRESSION VS TENSION



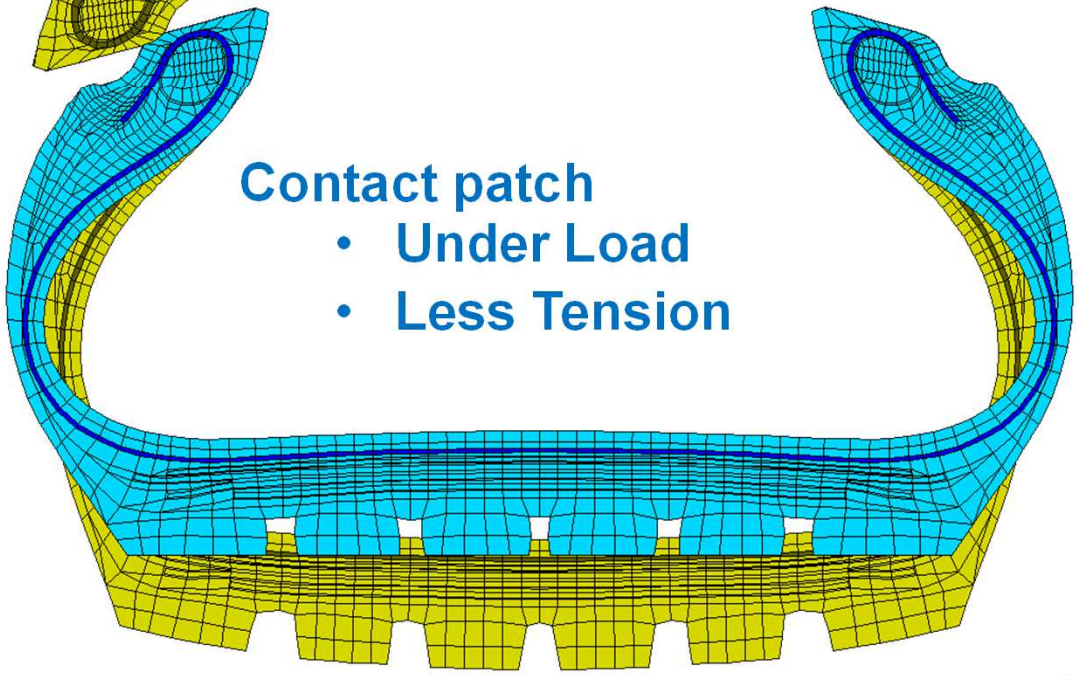
Top of Tire

- **No Load**
- **More Tension**

Yellow: Tire+ Pressure

Blue: Tire + Pressure + Load

deflection



Contact patch

- **Under Load**
- **Less Tension**

HOW MANY TIMES DOES A CASING PLY FLEX IN 10,000 MILES?

500 Revolutions in a Mile

500

x 10,000

5,000,000 Times!

THERMAL EQUILIBRIUM WITHIN A TIRE

- Natural build up of internal operating temperature
- The heat generated within the tire is equal to the heat being dissipated.
- Normally considered to be “ambient + 60 degrees F”, about 10 – 15 % higher than cold pressure.
- Maximum is **194 degrees F**
- Operation above **230 degrees F** impacts rubber properties.

OTHER FACTORS

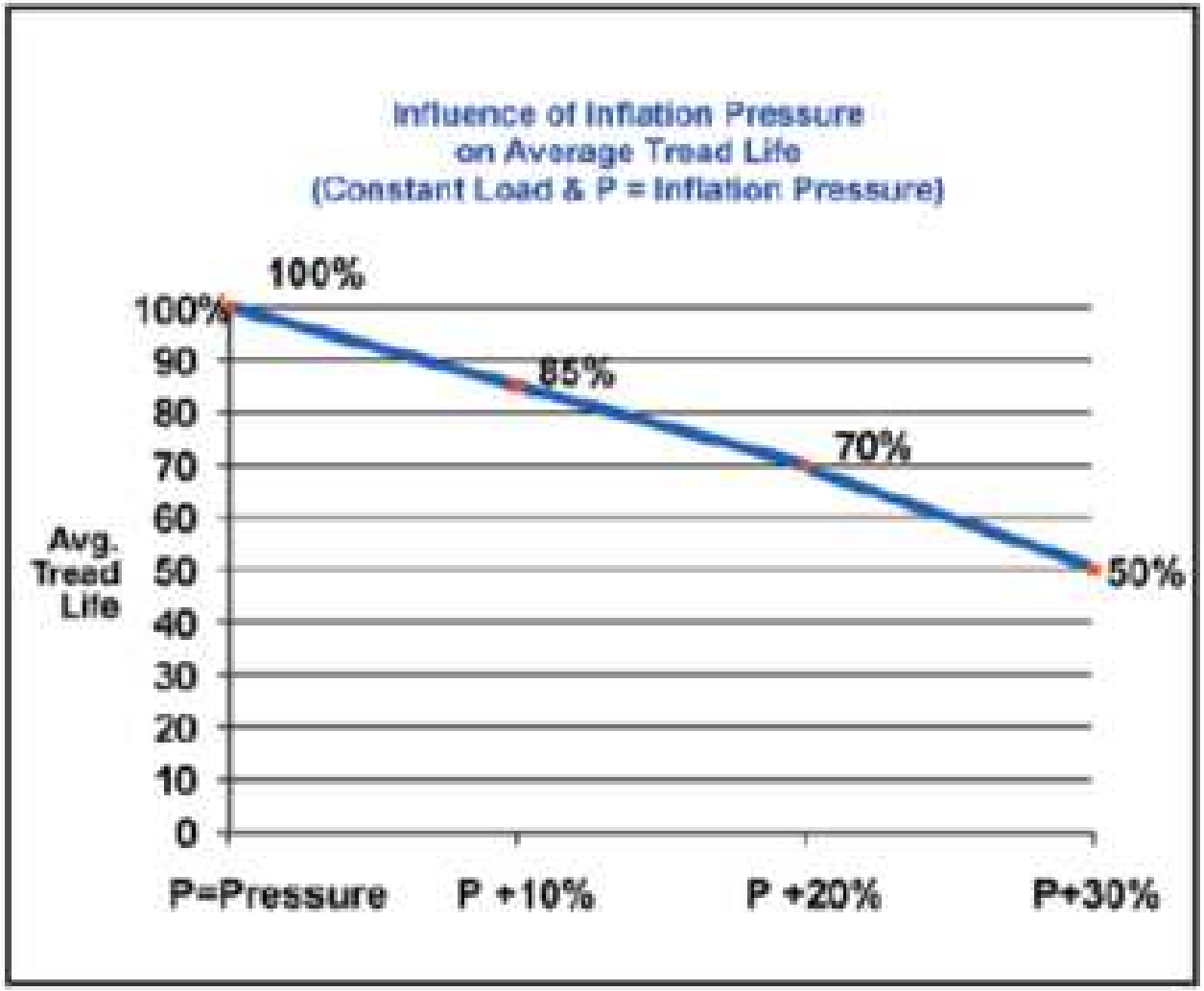


Fig. 1-55: Influence of OverInflation on Average Tread Life

OTHER FACTORS

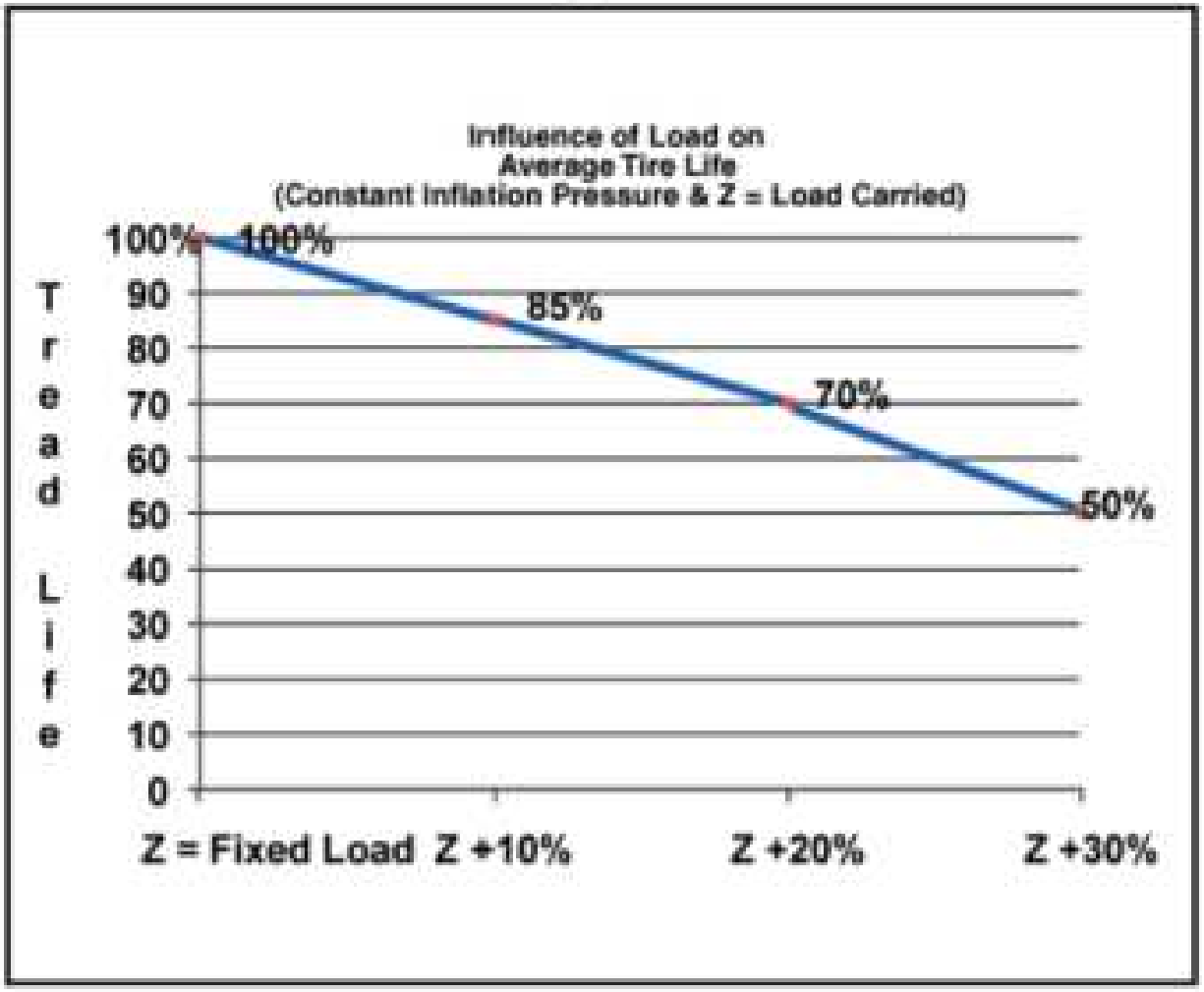


Fig. 1-56: Influence of Load on Average Tread Life

OTHER FACTORS

FACTORS AFFECTING TIRE PERFORMANCE & ENDURANCE

Heat

Heat is a tire's greatest enemy. Excessive heat will cause a breakdown of tire materials and components. Heat is generated by the tire due to the work expended during operation. An equilibrium temperature is developed during continuous operation of a truck tire. The temperature rises very rapidly in the beginning, then gradually levels off to an equilibrium value. At equilibrium temperature, the heat generated within the tire structure is equal to the heat dissipated from the tire surfaces.

Tires are developed to withstand this equilibrium temperature, which for radial heavy-duty truck tires is a maximum of 194EF (96EC). Exceeding this temperature for short periods is not a problem. Exceeding it for long periods under operating road conditions (dynamic) causes loss of strength in the material components and eventually separation of the tire's structure. Any actions to reduce running temperature will extend casing life.

Tire deflection is also a factor in the development of heat in a truck or passenger tire. Overloading and underinflation, which increase deflection, cause increased heat. Radial commercial truck tires are not affected as much as bias tires; however, increased deflection will increase the running temperature.

Matching Duals

Mismatched duals affect the life of tires the same as low inflation or overload. The larger tire of a mismatched dual carries more load and wears faster and unevenly. The smaller tire also wears faster and unevenly because it skips to keep up with the larger tire. Improper matching may also

OTHER FACTORS

⚠ WARNING: Never bleed inflation pressure from a hot tire. When adjusting inflation pressure, the vehicle should be parked for 3-4 hours. If the truck must be moved, be sure it has been driven less than one mile.

Continuous operation above 230°F will damage a tire as rubber begins to revert and loses its strength.

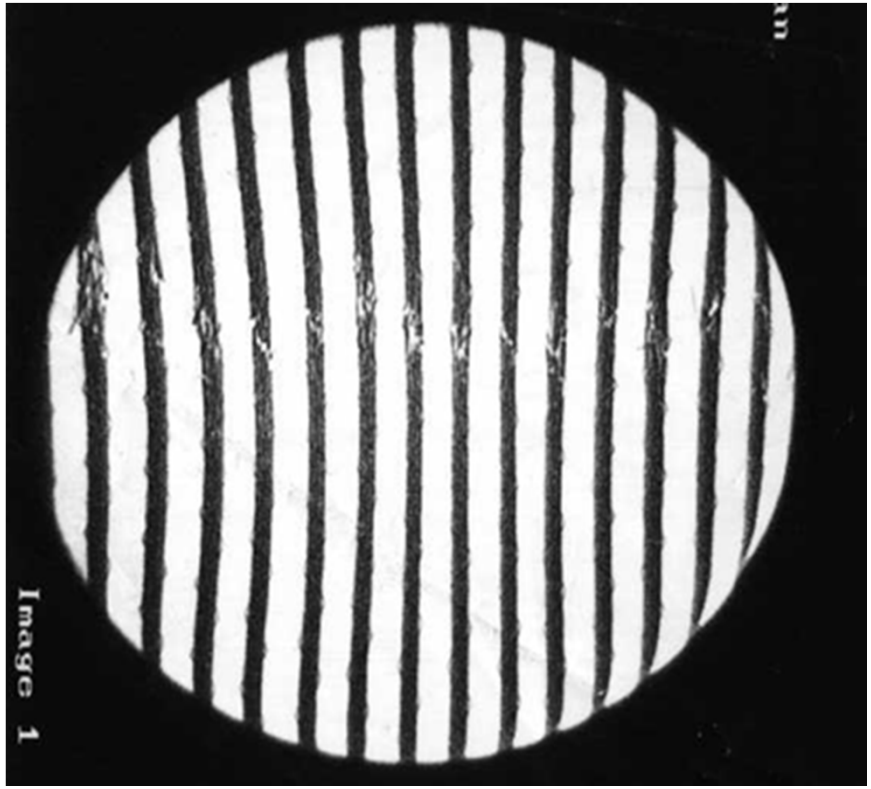
If a vehicle is equipped with a tire pressure monitoring system that provides an over-temperature alert, the driver should stop and investigate the cause.(See Fig. 8.)

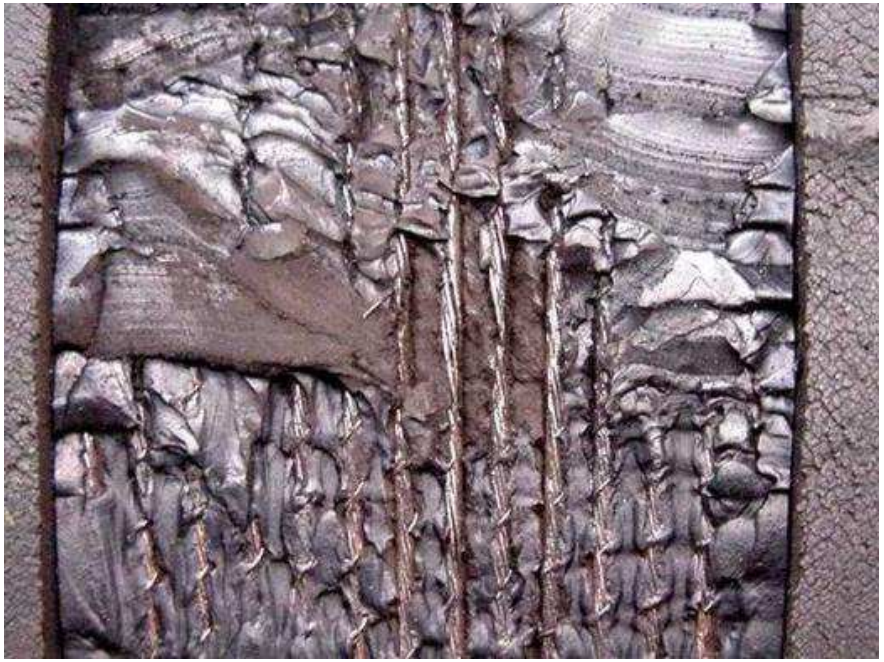
OTHER FACTORS

Tire service life is influenced by differences in the internal air chamber. Air pressure inside a tire rises as heat is generated during normal operation. Heat causes air to expand, and the inflation pressure increases. For example, tests show that air inside a 11R22.5 tire can reach 160°F or more, depending on air pressure, road temperature, ambient air temperature, altitude, and other factors (see Figs. 8 and 9).

Inflation pressure can rise 10-15 percent as a result of normal operation. This is considered hot inflation pressure. In some cases the actual hot inflation pressure could be higher than the maximum inflation pressure marked on the sidewall. This is not a safety issue. Tires are designed to withstand this normal pressure buildup.

SIDEWALL FATIGUE OVER TIME





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