

# PCA National Tech Tactics East -2016

# Tire Technology

# The Right Tire Changes Everything

- Road Atlanta Video



Porsche National Tech Tactics East 2016 – Tire Technology



# The Right Tire Changes Everything

## Class Specifications

### Prototype (P)

The Prototype (P) class features the fastest and most technologically advanced cars in North America. They are specifically designed and engineered for the race track and look drastically different than a typical street car.

**TOP SPEED:** 190 mph

**HORSEPOWER:** 450-600

**WHEELBASE:** Length varies; based on production vehicle design

**WEIGHT:** 1,990 to 2,285 pounds

**HEIGHT:** Height varies; based on production vehicle design

**WIDTH:** 74 inches

**CARS:** Corvette DP, DeltaWing DWC 13, HPD

ARX-03b, Onroak, ORECA, Mazda, Riley DP

**ENGINES:** Chevrolet V8, Dinan, Ford EcoBoost Turbo,

Honda V8 Turbo, Mazda SKYACTIV Clean Diesel

**FUEL:** VP Racing Fuel E-10 and Diesel

**GEARBOX:** 6-speed paddle shift

**TIRES:** Continental

**CHASSIS:** Steel tubing with integral roll cage or carbon fiber monocoque

**SUSPENSION:** Front and rear - independent coil springs, upper and lower A arms

**TRACTION CONTROL:** Permitted



### GT Le Mans (GTLM)

The GT Le Mans (GTLM) cars are the most elite and fastest GT cars on the track. They are based on production models and are engineered to extract the maximum performance possible. The class serves as a true proving ground for leading manufacturers such as BMW, Corvette, Ferrari, Porsche, and SRT.

**TOP SPEED:** 180

**HORSEPOWER:** 500

**WHEELBASE:** Length varies; based on production vehicle design

**WEIGHT:** 2,745 minimum

**HEIGHT:** Height varies; based on production vehicle design

**WIDTH:** 79 inches

**CARS:** Aston Martin Vantage V8, BMW Z4 GTE, Corvette C7.R, Ferrari F458 Italia, Porsche 911 RSR

**ENGINES:** Aston Martin V8, BMW 4-valve; 6-liter Chevrolet pushrod 2-valve; Ferrari V8; 5.0 liter Ford 4-valve; Porsche flat 6

**FUEL:** VP Racing Fuel E-85C

**GEARBOX:** 5-speed or 6-speed

**TIRES:** Open (Michelin and Falken currently participating)

**CHASSIS:** Steel tubing and integral roll cage or production tube with cage, based on production model available to the public

**SUSPENSION:** Front and rear - independent coil springs, upper and lower A arms

**TRACTION CONTROL:** Not permitted



# Topics

1. New Tire Technology
2. N-Spec Tires
3. Tire 'Care and Feeding'
4. Tires 101
5. New Michelin Products 2015+
6. Q&A



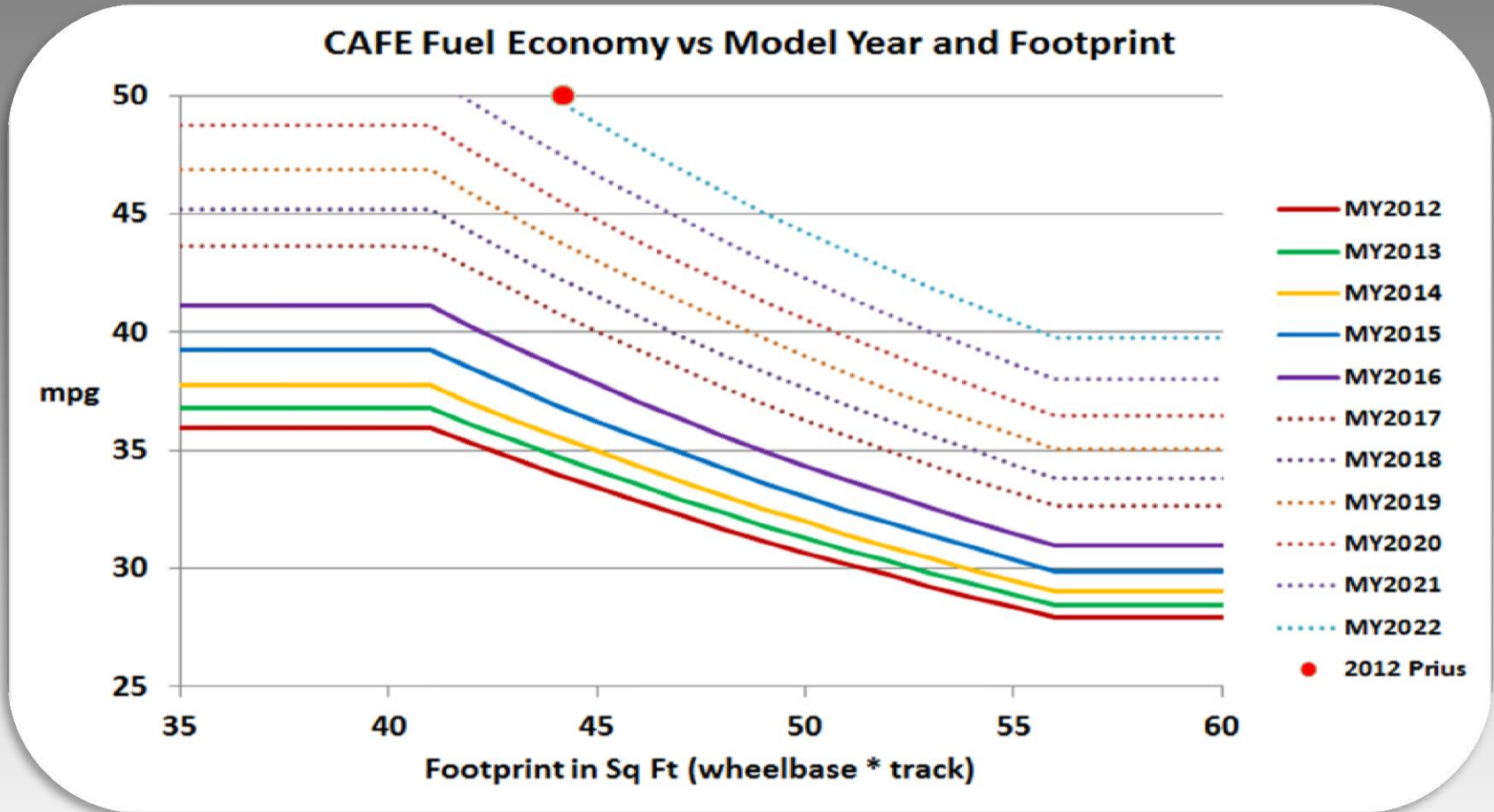
# New Tire Technology



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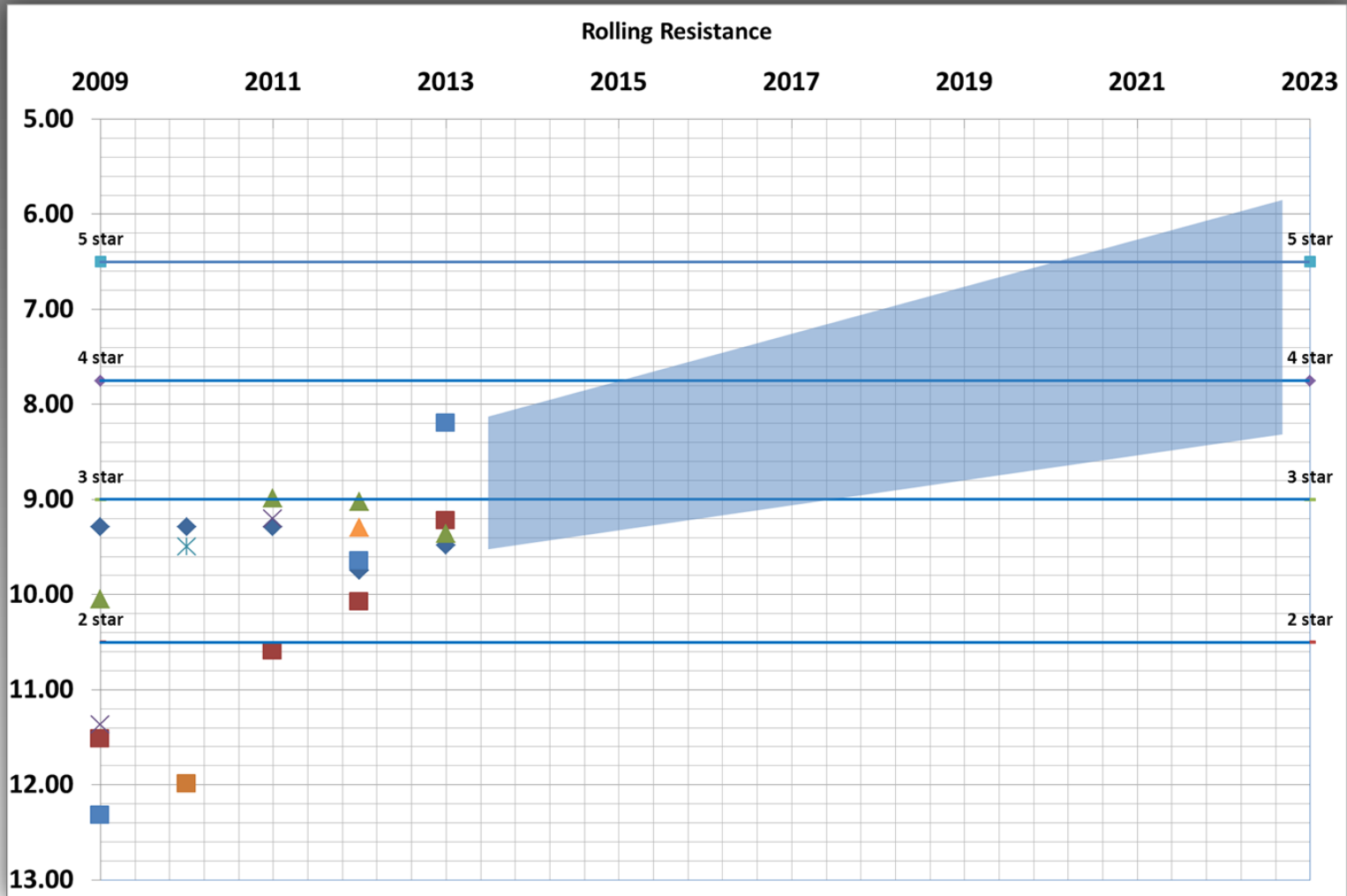
# New Tire Technology – Fuel Economy



★ 20% of the fuel consumed while driving is used to overcome **Rolling Resistance**



# New Tire Technology – Fuel Economy



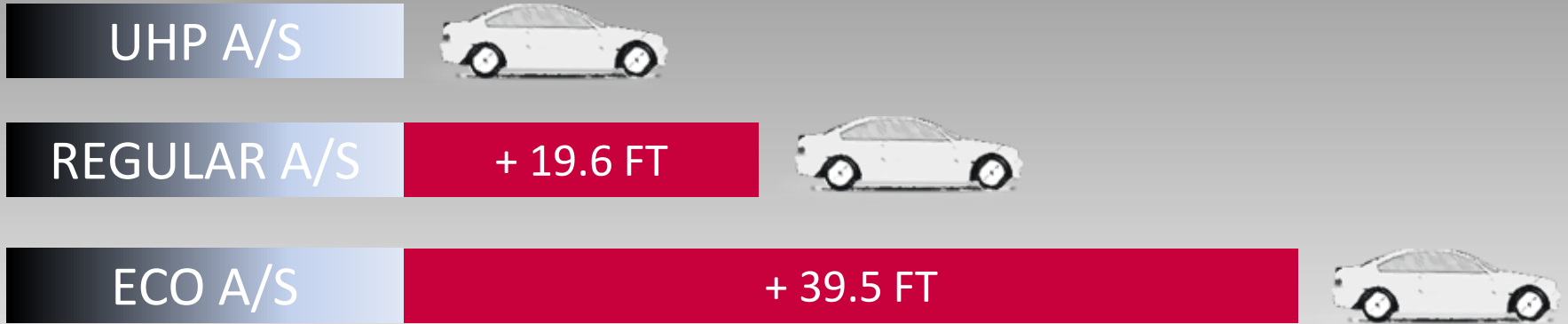






# New Tire Technology – Fuel Economy

Wet Braking from 50 – 0 MPH



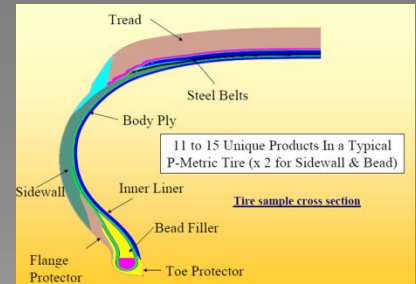
# New Tire Technology – Fuel Economy

Tire Wear Life



# New Tire Technology – Fuel Economy

1. Most of the RR comes from the tread – and there are 2 major levers to reduce the RR of the tread:



2. Lower the tread depth! (which also helps Dry Braking and Handling)

- using a compound that retains the wear promise of the tire
- utilizing new technologies to prevent hydroplaning and low tread depth traction issues (such as expanding rain grooves and emerging features)



# New Tire Technology – Fuel Economy

**TABLE 6.8 Fuel-efficiency rating for small passenger vehicles (ISO norm 28580)**

| Rolling resistance coefficient (RR),<br>in kg/t (kilograms of resistance<br>per tonne) | Labelling category   |                      |
|--|----------------------|----------------------|
| RR ≤ 6,5   | A                    |                      |
| 6,6 ≤ RR ≤ 7,7   | B                    |                      |
| 7,8 ≤ RR ≤ 9   | C                    |                      |
| Not used   | D                    |                      |
| 9,1 ≤ RR ≤ 10,5  | E                    |                      |
| 10,6 ≤ RR ≤ 12   | F                    |                      |
| RR ≥ 12,1  | G                    |                      |
|  | Phase 1 (as of 2012) | Phase 2 (as of 2016) |
| Tire category  | Limit value (kg/t)   | Limit value (kg/t)*  |
| C1 (tires according to ECE R 30 –<br>small passenger vehicles)                         | 12                   | 10.5                 |
| C2 (tires according to ECE R 54 –<br>light trucks)                                     | 10.5                 | 9.0                  |
| C3 (tires according to ECE R 54 –<br>heavy goods vehicles)                             | 8.0                  | 6.5                  |

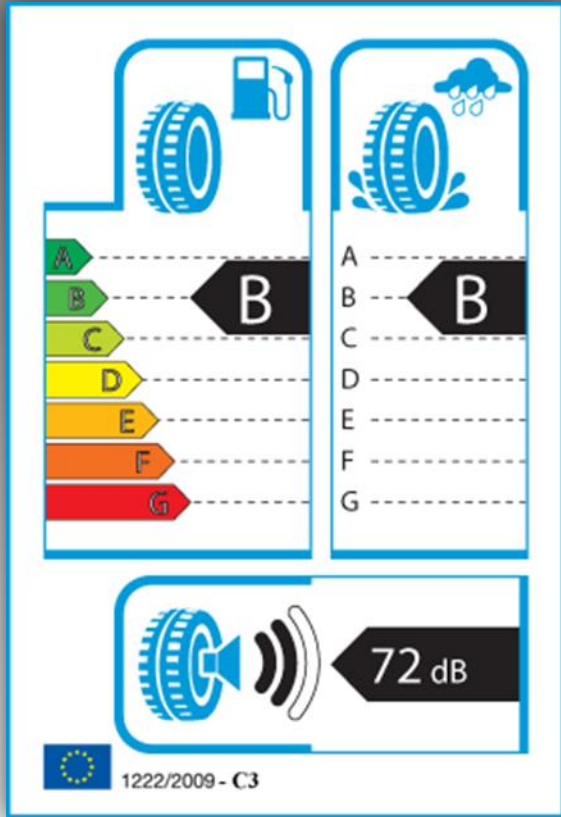
Note: \* for mud and snow tires the second phase limits shall be increased by 1kg/tonne for all three categories

Source: EC Regulation 661 / 2009, <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:200:0001:0024:EN:PDF>

In 2016 European regulations will prohibit tires with **Rolling Resistance** levels > 10.5 kg/ton to be sold in Europe.



# New Tire Technology – Fuel Economy

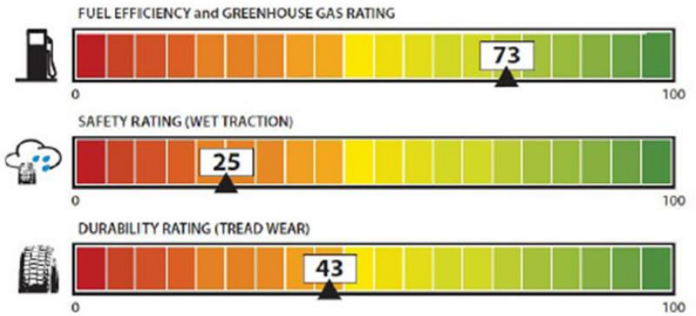


★ European labeling and proposed US labeling will highlight *Rolling Resistance*

## ACME TIRE COMPANY

WILEY RR-S

SIZE: P225/60R16



### Tire Icons – Detailed Version

#### GOVERNMENT TIRE RATING

## ACME TIRE COMPANY

WILEY RR-S

SIZE: P225/60R16



Ratings are based on tires that are properly inflated. Compare this tire with others before you buy. Source: National Highway Traffic Safety Administration (NHTSA). For more information visit [www.SaferCar.gov](http://www.SaferCar.gov)



# New Tire Technology – Noise

## ContiSilent™ tire



A ContiSilent™ tire contains a polyether-based polyurethane foam. It is firmly attached to an adhesive layer on the inner surface of the tire tread area.

## Interior noise

Standard tire    ContiSilent™



Even while driving at high speeds, the ContiSilent™ tire reduces road noises inside the vehicle by up to 9 dB(A). The level of reduction of interior noise depends on the type of vehicle, its speed and the road surface.





# New Tire Technology – Noise



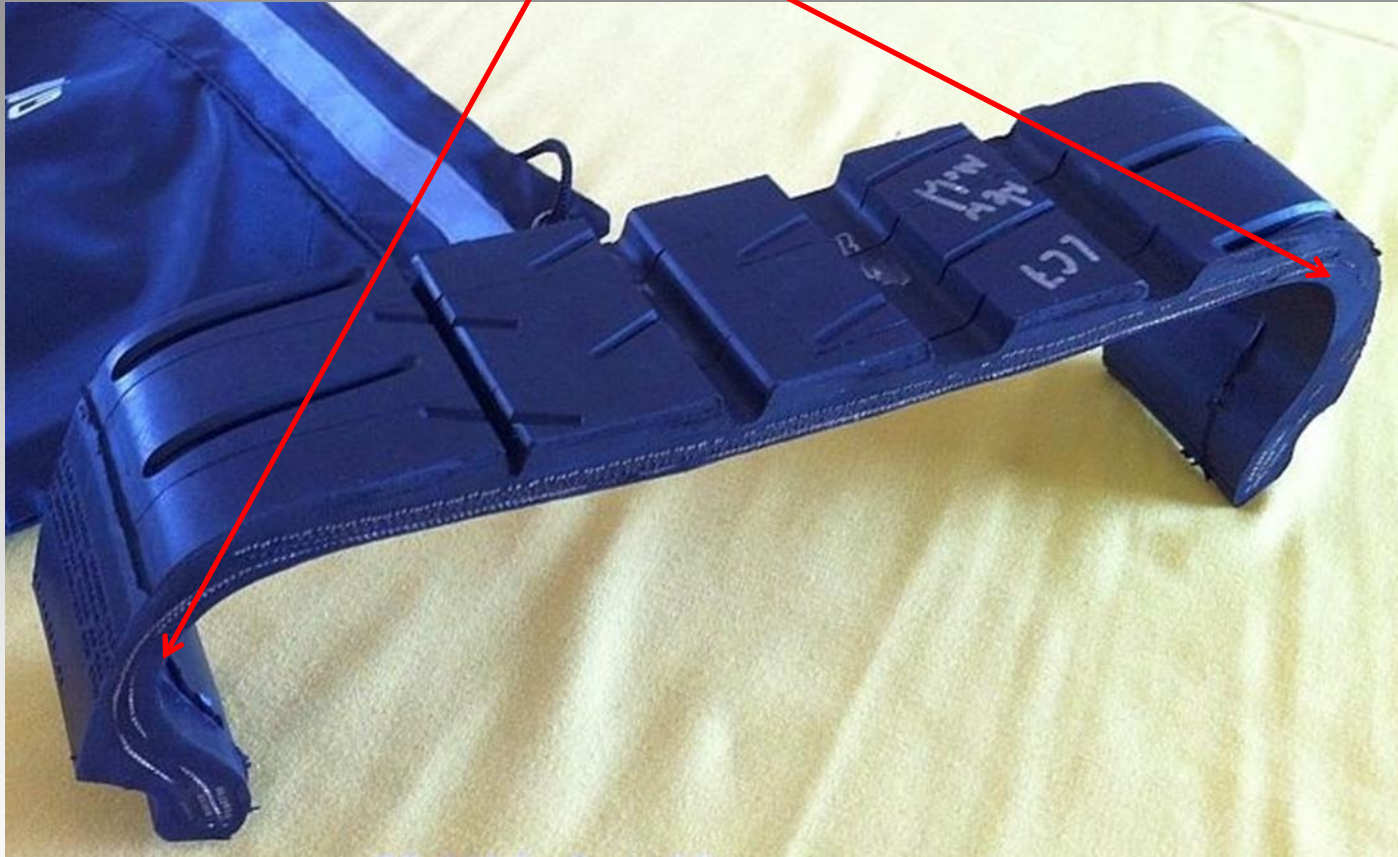
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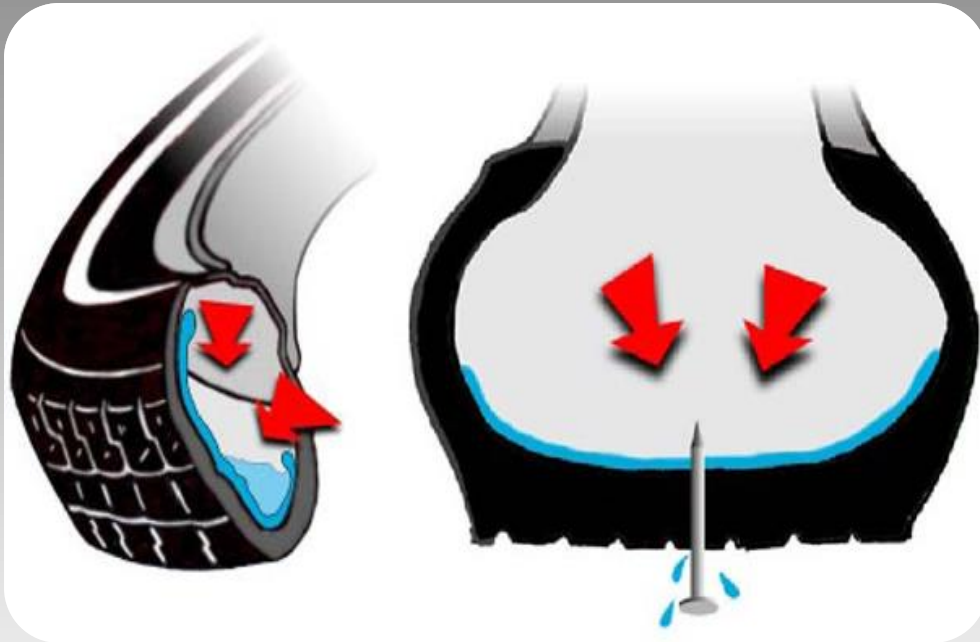
# New Tire Technology – Extended Mobility

1. Improved ZP designs (asymmetric sidewall inserts in the new Pilot Super Sport ZP improve comfort.)



# New Tire Technology – Extended Mobility

## 2. Sealant Tires.



# New Tire Technology – Extended Mobility

## 3. TWEEL.



Porsche National Tech Tactics East 2016 – Tire Technology

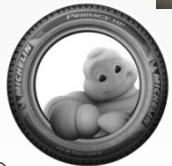




# New Tire Technology – ‘Connected Tire’

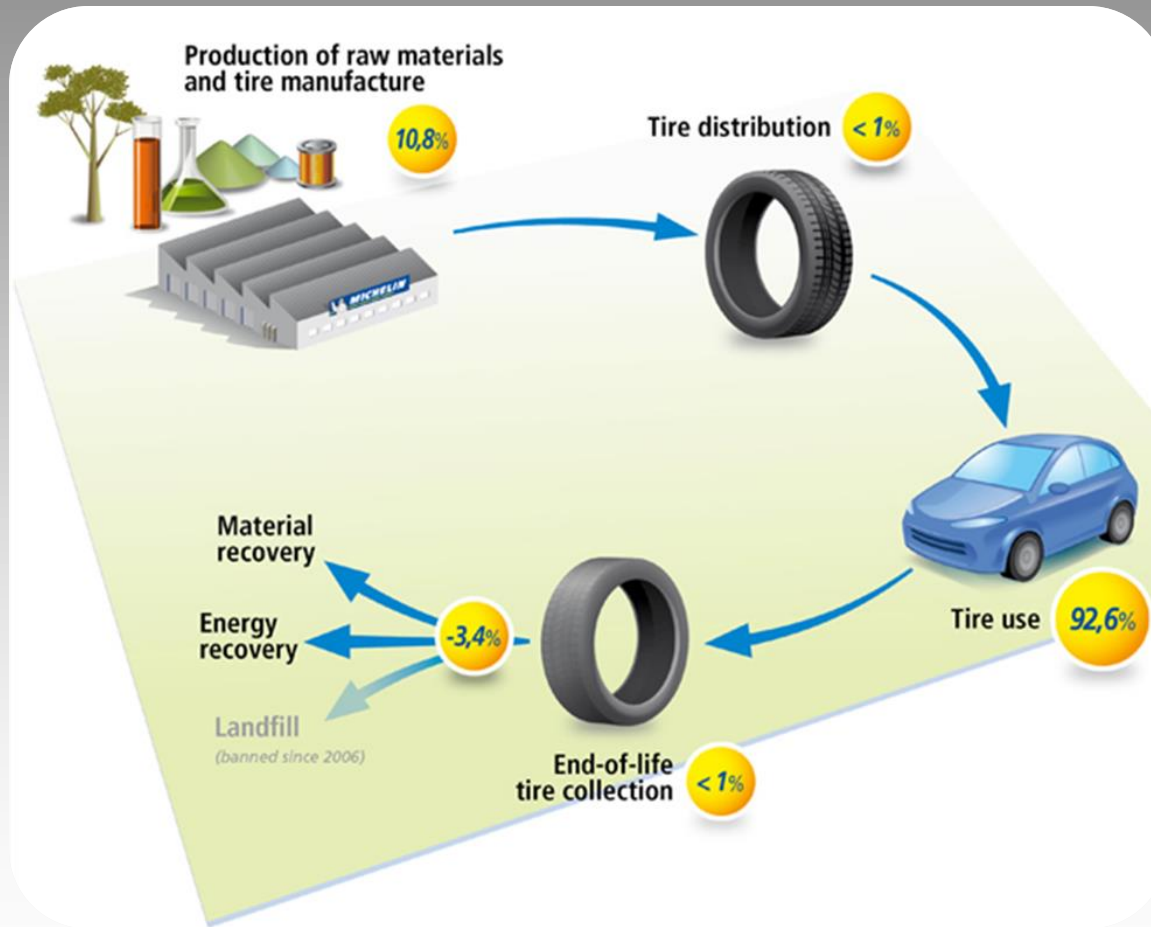


# New Tire Technology – Aesthetics



# New Tire Technology – Eco ‘Green’

- natural rubber, organic oils, natural replacement for nylon, alternatives to steel



# N-Spec Tires



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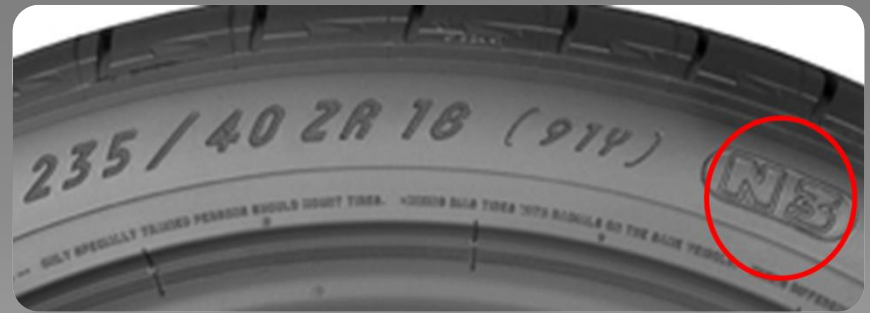
# N-Spec Tires – OE Markings

- N = Porsche
- AO = Audi
- MO = Mercedes
- \* = BMW
- C = Chrysler (Viper)
- TPC = GM
- K = Ferrari



# N-Spec Tires

## Significance of “N” rated tires



- Abbreviation of German word “Norm”
- N marked tires are officially homologated by Porsche and are developed specifically for Porsche range
  - Take into account the unique weight distribution
  - Enhanced performance levels
  - High speed requirements
  - Provide the “Porsche” feel to the driving experience
  - Are specifically tuned to the suspension of that particular vehicle, to give the right feel.
- N0, N1 refer to the evolution of the tire- independently or with the vehicle
  - N spec tires should not be mixed with non-N spec tires
  - N spec iterations should not be mixed on a vehicle
  - If a mis-match of N-spec is required always place the higher N-Spec on the rear
  - Brands of N-spec should not be mixed on a vehicle



# N-Spec Tires



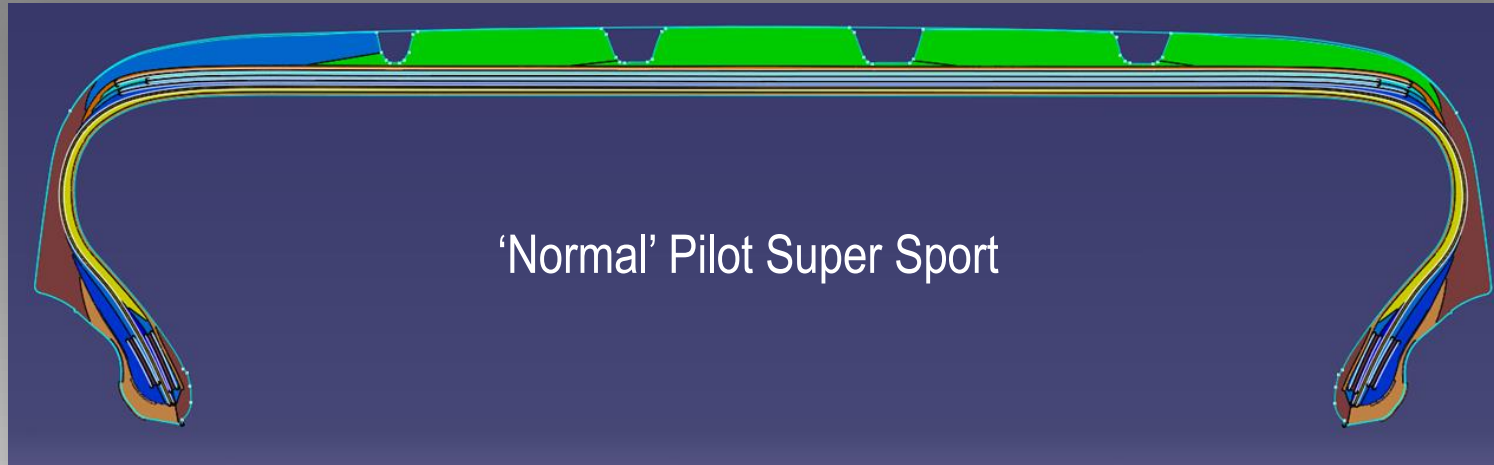
'Normal' Pilot Sport A/S Plus  
Tread Pattern



Pilot Sport A/S  
Plus for Porsche  
Panamera



# N-Spec Tires – OE Tuning Examples



# N-Spec Tires

| TIRENAME        | MSI   | TIRESIZE            | TIRE_WEIGHT_ | OE_MARKIN | OE_TEXT |
|-----------------|-------|---------------------|--------------|-----------|---------|
| Pilot Sport PS2 | 14875 | 255/35ZR19/XL 96Y   | 24.05        |           | AU      |
| Pilot Sport PS2 | 16592 | 255/35ZR19/XL (96Y) | 25.53        | *         | BM      |
| Pilot Sport PS2 | 19229 | 255/35ZR19/XL 96Y   | 25.26        | MO1       | MB      |
| Pilot Sport PS2 | 72772 | 255/35ZR19/XL (96Y) | 25.13        | G1        | MB      |
| Pilot Sport PS2 | 74098 | 255/35ZR19/XL (96Y) | 25.07        |           | DC      |
| Pilot Sport PS2 | 97327 | 255/35ZR19/XL (96Y) | 25.62        | MO        | MB      |



# Tire 'Care and Feeding'



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# Tire Pressure – Road Use

- Use the car manufacturer’s recommended pressures – ie placard pressure – NOT WHAT IS MARKED ON THE TIRE.
  - Can be found on the door jamb, or inside the fuel filler door, or in the owner’s manual

|                    | bar | kPa | psi |     | bar | kPa | psi                   |     |
|--------------------|-----|-----|-----|-----|-----|-----|-----------------------|-----|
| 235/40 ZR 18 (91Y) | 2.0 | 200 | 30  | 2.5 | 250 | 37  | 265/40 ZR 18 (101Y)XL | 2.5 |
| 235/35 ZR 19 (87Y) | 2.2 | 220 | 32  | 2.5 | 250 | 37  | 265/35 ZR 19 (94Y)    | 2.5 |
| 235/40 R18 M+S 91V | 2.0 | 200 | 30  | 2.5 | 250 | 37  | 255/40 R18 M+S 95V    | 2.5 |

Reifenfülldruck kalte Reifen (20°C). Nur von Porsche freigegebene Reifen verwenden. Handhabung Reifendichtmittel gemäß Fahrzeug-Bedienungsanleitung / max. 80 km/h

Cold tyre inflation pressure (20°C). Use only tyres released by Porsche. Use puncture sealing kit as indicated in vehicle Operating Instructions / max. speed: 80 km/h

Pression des pneus froids (20°C). N'utilisez que des pneus autorisés par Porsche. Utiliser le jeu d'étanchéification de pneus selon mode d'emploi du véhicule / vitesse maxi: 80 km/h

Presión de neumáticos fríos (20°C). Utilice únicamente neumáticos homologados por Porsche. Utilización del kit para parchar neumáticos de acuerdo a las instrucciones para el uso del vehículo / máx. 80 km/h

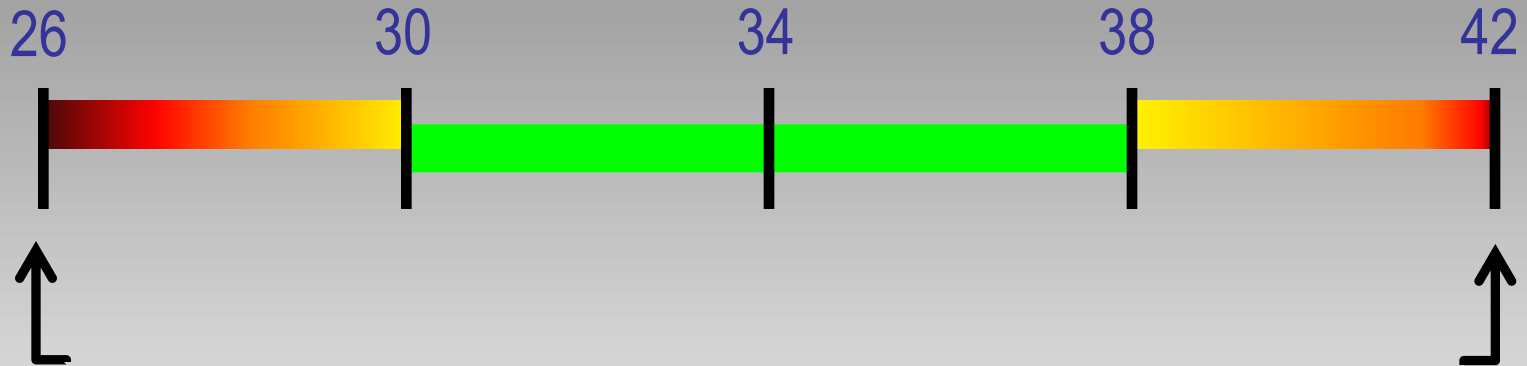
Pressione pneumatici freddi (20°C). Usare soltanto pneumatici omologati dalla Porsche. Uso del kit di ermetizzazione pneumatici in ottemperanza alle istruzioni d'uso del veicolo / velocità massima: 80 km/h





# Tire Pressure - Track Use - Hot Pressure Targets

– Start at your vehicle’s placard pressure and adjust up or down in front or rear to tune balance.



- Casing Endurance Concerns
- Contact Patch Instability/Badly Shaped
- Unequal Loading
- Difficulty to Maintain Tread Temperature
- Wear appearing on upper sidewall
- Contact Patch Too Small
- Overheating of Rubber on Tread
- Reduced Grip Longevity



# RECOMMENDED PRESSURE – SPORT CUP 2

- ROAD USE
  - Adhere to the inflation pressures recommended by the car manufacturer
- TRACK USE
  - CAUTION
    - For a track day, always begin with inflation pressures recommended for ROAD USE, gradually bring the MICHELIN PILOT SPORT CUP 2 tires up to temperature with steady moderate laps.
    - After a run of some steady laps, then only slightly adjust the inflation pressure to reach the best operating inflating pressure
  - HOT TIRES
    - The best operating pressure of MICHELIN PILOT SPORT CUP 2 is between 2.3 bar (33 psi) and 2.7 bar (39 psi) hot, according vehicle model and track where used
    - However, some vehicle models will need a higher inflating pressure than 2.7 bar (39 psi Hot)
  - COLD TIRES
    - Don't ever use inflation pressure below 1.9 bar (28 psi) cold
    - To optimize the track longevity of MICHELIN PILOT SPORT CUP 2, MICHELIN strongly recommends to use a minimum inflation pressure between 2.0 (29 psi) and 2.4 bar (35 psi)



# RECOMMENDED ALIGNMENT – SPORT CUP 2

- Geometrical settings e.g. Camber/Toe
  - On the track, geometry settings (camber primarily) can be modified to improve cornering speeds and grip through maximizing the tires footprint and also to prevent excessive wear/fatigue to the outer shoulder.
  - Camber : for optimal results on a circuit , the negative camber settings should be between  $-1.5^{\circ}$  &  $-3^{\circ}$  dependent upon the circuit layout and the type of vehicle. NEVER exceed  $-4^{\circ}$  of negative camber
  - Camber values for road use must be based upon the recommended « road » settings to ensure the correct handling and vehicle behavior for the vehicle and tire



# Tire Pressure - Track Use - Hot Pressure Targets

- Generally, the more race-like the vehicle (ex Porsche), the more the placard pressures can be trusted. Typically the stiffer suspension on these cars will allow lower pressure.
- For cars not intended to be raced, the pressures will usually need to be higher due to the softer suspension. You will see wear on the upper (sometimes middle) of the sidewall with pressures too low.
- Road cars, especially front wheel drive, are tuned to understeer severely from the factory. Sometimes a rear pressure 10psi higher than the front is necessary to balance the handling.



# Temperature Targets for Track Use

160 - grip starts to come in

180 - optimal temp for max grip

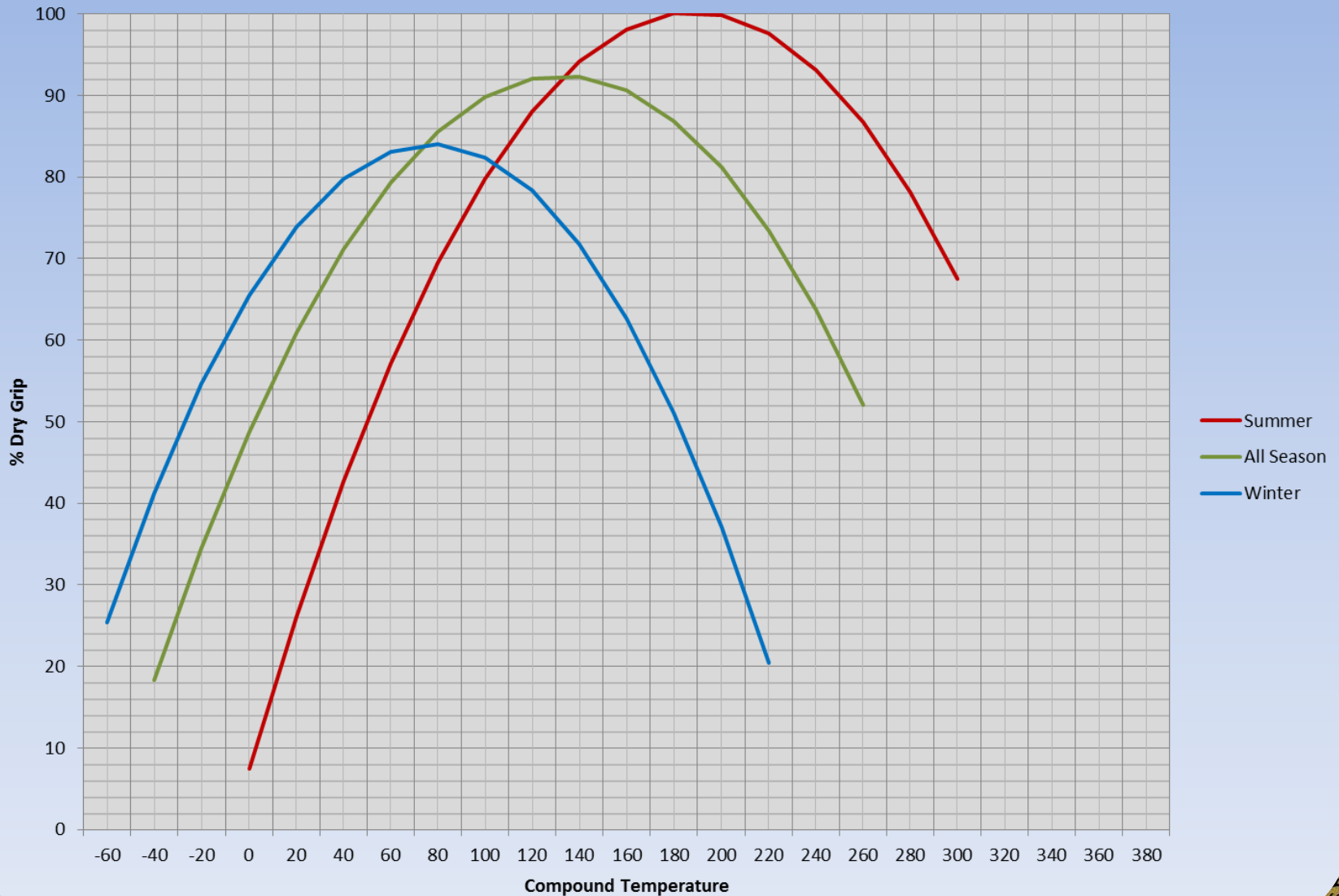
200 - grip begins to fall off

use a probe thermocouple – non-contact will read inaccurately



# Temperature Targets for Track Use

## Dry Grip vs Temperature



## MICHELIN® Ultra-High Performance Sport Summer Tire Cold Weather Precautions

Michelin Ultra-High Performance (UHP) Sport Summer tires use tread compounds that are optimized for maximum dry and damp grip in temperate conditions. As the temperature of the compound nears freezing, the grip level of the tire begins to degrade. Michelin does not recommend using UHP Sport Summer tires when tire temperatures drop below 40°F (5°C) or on snow and ice.

At tire temperatures below 20°F (-7°C) Michelin UHP Sport Summer tires may develop surface cracks in the upper sidewall and tread area if flexed. **Do not use, roll, or drop MICHELIN UHP Sport Summer tires with temperatures below 20°F (-7°C).** If the tires have been cooled to 20°F (-7°C) or less, let them warm up in a heated space to at least 40°F (5°C) before being installed or moving a vehicle on which they are installed. Do not apply heat or blow heated air directly on the tires. Always inspect tires before use.

Never use a tire with freeze cracks, breaks, or damage to the sidewall or tread. If in any doubt please consult your local Michelin contact or call Michelin Consumer Care at 1-866-866-6605.





## Tire Storage

If you have multiple sets of tires, proper tire storage is a must. (Just setting them off in the corner of your garage isn't enough.) Proper storage ensures that your tires' appearance and performance are maintained. Before you store your tires, be sure to inspect each one for damage or uneven wear.



### How to Store Your Tires

- Store your tires indoors in a clean, cool and dark location away from direct sunlight, sources of heat and ozone such as hot pipes or electric generators.
- Be sure the surfaces on which tires are stored are clean and free from grease, gasoline or other substances that could deteriorate the rubber.
- If storing outdoors raise tires off the ground and use water proof covering with holes to prevent moisture build-up.
- If tires are on vehicle, store on blocks to remove load from the tires. Maintain placard inflation pressure.
- If your tires have whitewall or raised white lettering, store them with the whitewall or raised white lettering facing each other. Otherwise, black rubber could stain them. (The results are not pretty.)



# Tire Storage

## TIRES WITH RIMS



Do not store upright



Hang



Stack

(Rotate the stack order regularly and do not place under heavy objects)

## TIRES WITHOUT RIMS



Do not stack



Do not hang



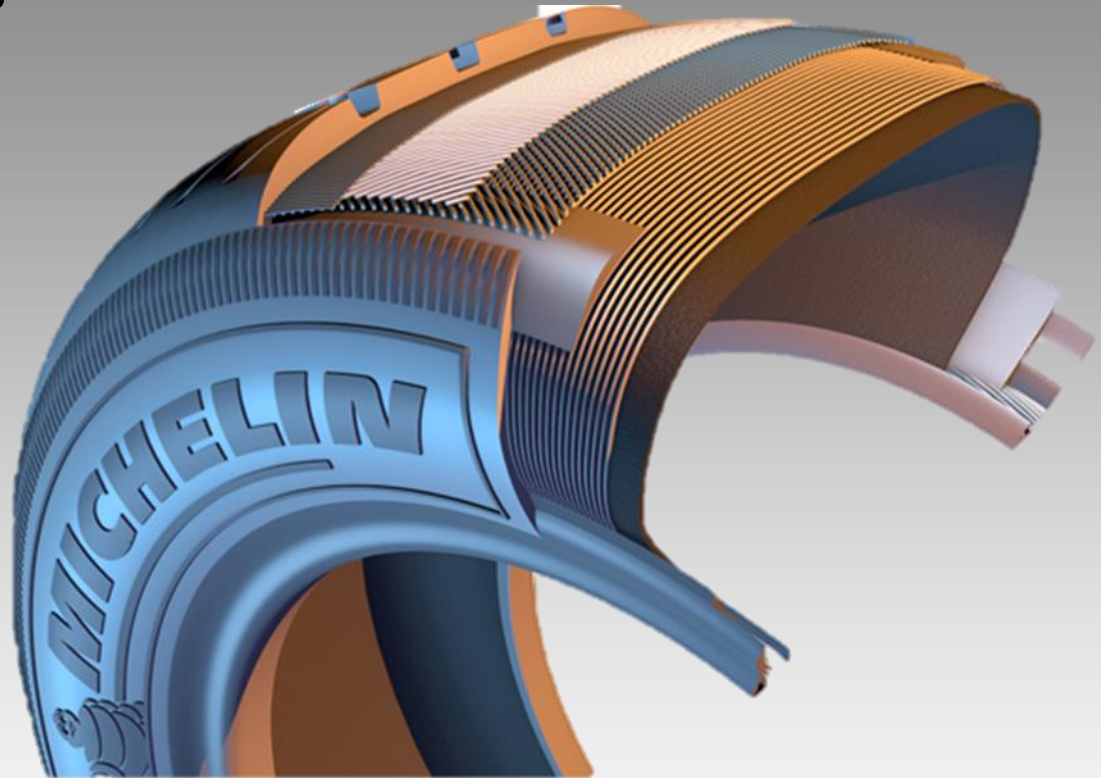
Store upright

(rotate slightly once a month)



# Tires 101 (It's more complicated than you might think!)

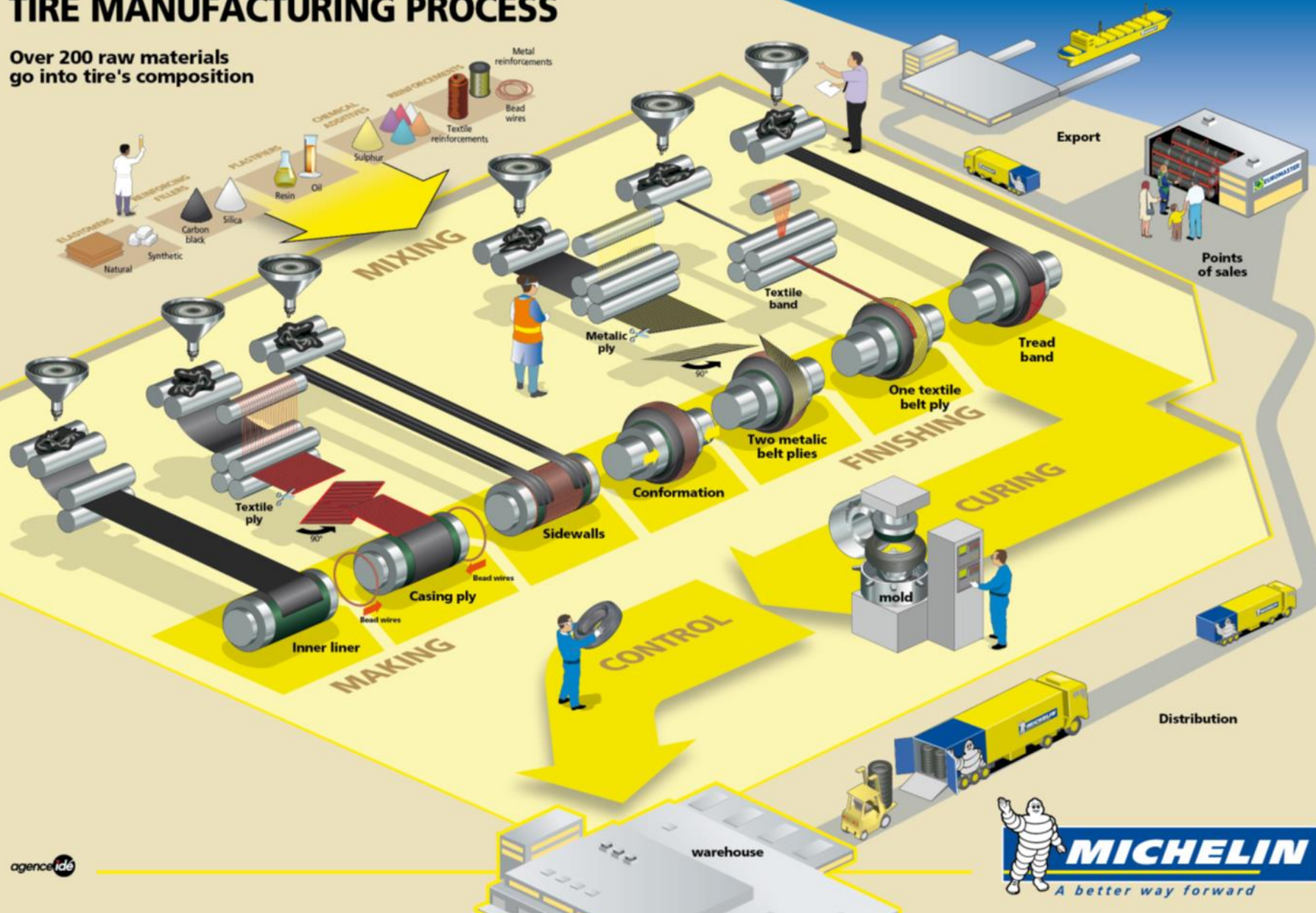
1. Manufacturing Process
2. Sizing
3. Other Markings





# TIRE MANUFACTURING PROCESS

Over 200 raw materials go into tire's composition



agence id6



# Tires 101 – Manufacturing Video

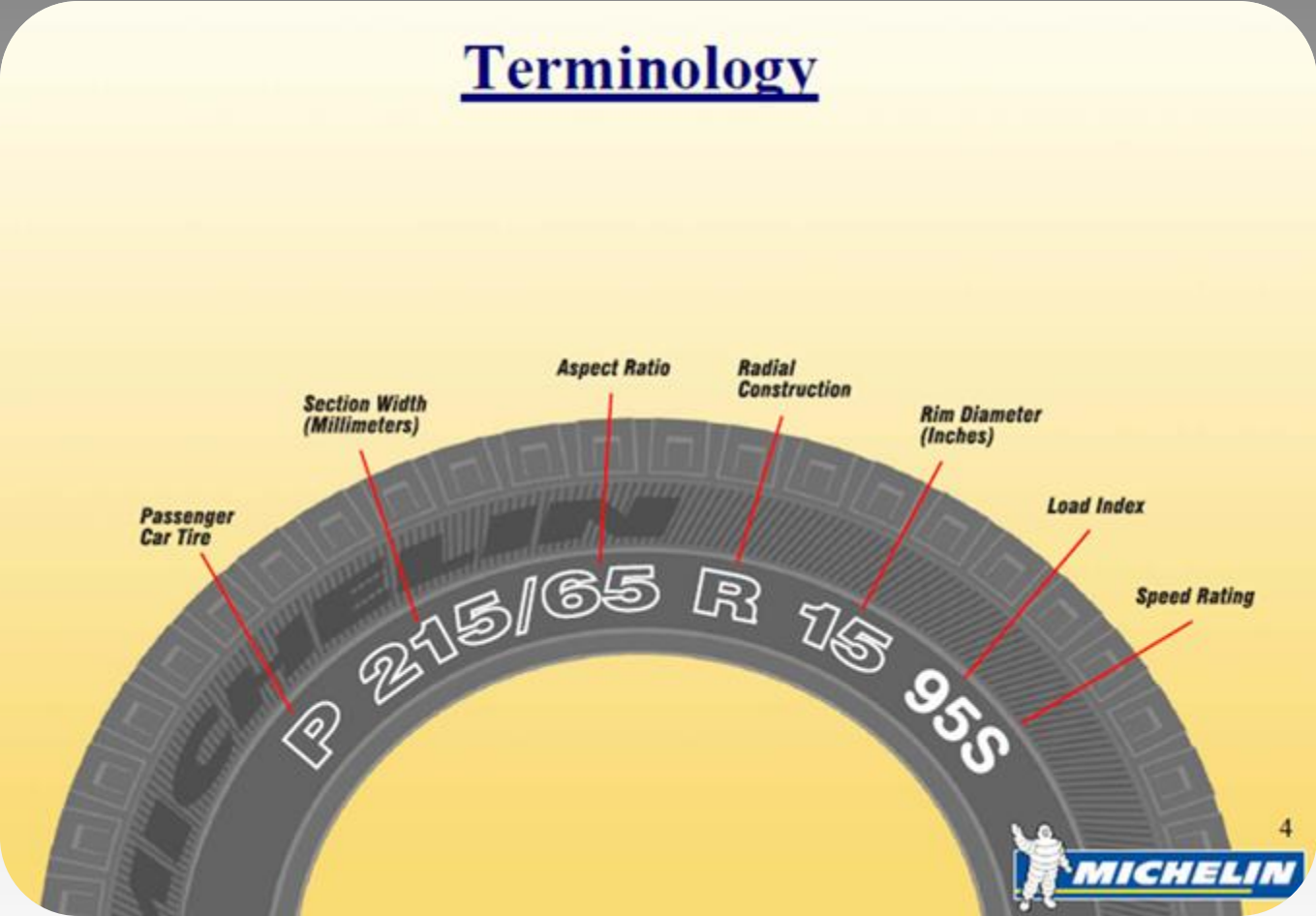


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# Tires 101 - Sizing

## Terminology



# Tires 101 - Markings



## Department of Transportation Safety Code

This assures that your tire complies with all Department of Transportation (DOT) safety standards. After the DOT insignia is your tire's identification number, which begins with the tire's manufacturer and plant code where the tire was manufactured (two numbers or letters). The ninth and tenth characters tell the week the tire was manufactured. The final number(s) signifies the year the tire was manufactured.





# Tires 101 - Markings

The Uniform Tire Quality Grading (UTQG) was established by the National Highway Traffic Safety Administration (NHTSA) to test tires following government prescribed test methods and then grade each tire on three main components:

**Treadwear:** This is the wear rate of the tire, comparable only to other tires within a tire manufacturer's line. 100 is the baseline grade. Therefore a tire with 200 would theoretically last twice as long on the government's course compared to a tire with 100.

**Traction:** Traction grades are AA, A, B and C (with AA being the highest grade). They represent the tire's ability to stop straight on wet pavement as measure on a specified government track. Any tire rated under C is considered unacceptable for road travel.

**Temperature:** The temperature grades, from highest to lowest, are A, B and C. These represent the tire's ability to dissipate heat under controlled indoor test conditions. Any tire rated below C is considered unacceptable.



# Tires 101 - Markings



|                     |          |        |        |        |        |
|---------------------|----------|--------|--------|--------|--------|
| <b>MODEL</b>        | LTX M/S2 |        |        |        |        |
| <b>UTQG</b>         | 720      | 360    | 440    | 640    | 600    |
| <b>WARRANTY</b>     | 70,000   | 60,000 | 50,000 | 60,000 | 60,000 |
| <b>WEAR RESULTS</b> | 79400    | 36200  | 56200  | 41600  | 41900  |

\* Tire size = P235/70R16 104T

\*\*based on internal Michelin wear testing





# New Products 2015+



Porsche National Tech Tactics East 2016 – Tire Technology



# Pilot® Sport A/S 3 +

More dry grip than competitive max performance summer tires. \*

The shortest wet and dry braking of leading competitors in the Ultra High Performance A/S category.\*\*

28% better snow grip than the Pilot Sport A/S 3.



\* Based on internal dry autocross testing versus the Continental ExtremeContact DW and Pirelli Pzero Nero tire size 225/45ZR17.

\*\* Based on internal braking tests from 50 mph versus the Goodyear Eagle F1 Asymmetric A/S, Bridgestone RE970AS Pole Position, Pirelli Pzero Nero A/S, Continental ExtremeContact DWS, Dunlop SP Sport Signature, and Yokohama ADVAN S.4. tire size 225/45ZR17.



# Older Products

www.michelin-passion.com

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# Q&A



Porsche National Tech Tactics East 2016 – Tire Technology



PORSCHE



# Annex



Porsche National Tech Tactics East 2016 – Tire Technology



# Michelin History



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## The Michelin Man, the living tire

First created in 1898 by the imagination of the Michelin brothers and the paintbrush of the talented poster artist O'Galop, alias Marius Rossillon, the Michelin Man was immediately a great success. Depending on the period and current tire innovations, he evolves to remain always in phase with his time.



INSPIRATION



METAMORPHOSES



## HISTORY



1829-1868

### Rubber in Auvergne



1829 1832 1863 1867 1868

Two cousins, **Aristide Barbier et Édouard Daubrée**, open a small manufacturing plant for farm machinery and rubber balls in Clermont-Ferrand. They are quick to foresee the potential industrial applications of rubber and use it to manufacture gaskets, valves and tubing.



## HISTORY



1889-1891

### Michelin & Compagny



1889 1891

With the support of his brother who is already working for the family company, **Édouard Michelin** closes up his painting studio in Paris to take over management of the company, which becomes: "**Michelin & Co**".

The Michelin plant lies on 30 acres close to the Place des Carmes in Clermont-Ferrand and employs 52 people.

It attempts to revitalize its activity with a rubber brake pad called "**The Silent**" thus reflecting the company's early interest in transportation.



1829-1868



1889-1891



1892-1899



1900-1907



1908-1913



1914-1916



1919-1927



1928-1933



## HISTORY



1889-1891

### Michelin & Compagny



1889 1891

A cyclist comes to the plant to buy the materials needed to repair the Dunlop tires on his bicycle. It takes three hours of labor and overnight drying to repair the tire and glue it to the rim. Édouard Michelin dreams about a tire for the future...  
**a tire that is easy to repair.**

Michelin files its first patents for detachable tires that can be repaired in a quarter of an hour.

The **Paris-Brest-Paris** bicycle race, ultimately won by Charles Terront on Michelin detachable tires, provides the occasion to give the public a chance to see them.



1829-1868



1889-1891



1892-1899



1900-1907



1908-1913



1914-1916



1919-1927



1928-1933



## HISTORY



1892-1899

### The first automobile races

1892 1895 1898 1899



Michelin organizes a **cycle race** between Paris and Clermont-Ferrand.

The Michelin brothers scatter nails on the road to prove that, with a **detachable tire**, a flat tire is not such a big deal anymore.



1829-1868



1889-1891



1892-1899



1900-1907



1908-1913



1914-1916



1919-1927



1928-1933



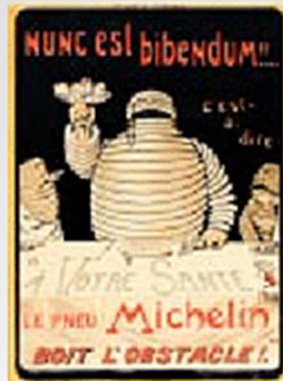


## HISTORY



1892-1899

### The first automobile races



1892 1895 1898 1899

At the Universal and Colonial Exhibition in Lyon in 1894, the entrance to the Michelin stand is decorated with two columns of tires piled high, prompting Édouard Michelin to remark: "Give it some arms and legs and it would look like a man!". Soon afterwards, André Michelin conceives a character based on a sketch by the illustrator O'Galop. His motto is "**Ilunc est bibendum!**", a Latin verse from the poet Horace which means "it's time to drink!". A clever association between this cartoon character and the piles of tires gives rise to the creation of the Michelin Man, and the translation of the slogan becomes "Michelin tires drink obstacles!".



1829-1868



1889-1891



1892-1899



1900-1907



1908-1913



1914-1916



1919-1927

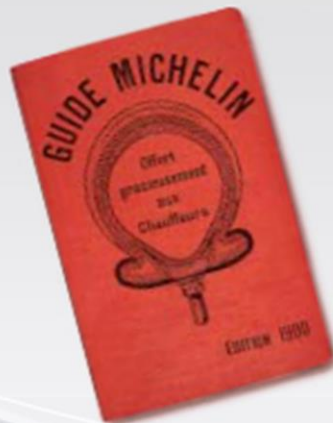


1928-1933



1900 - 1907

Promotion of pneumatic tire and the automobile



1900 1905 1906 1907

The first **Michelin Red Guide** is published; 35,000 copies are printed with the prophetic words of André Michelin: "This guide is born with the century, and will last as long as the century does."

Both instruction guide and a reference book for the traveler, the Red Guide is a source of reliable and practical information.



## HISTORY



1900 - 1907

### Promotion of pneumatic tire and the automobile

1900 1905 1906 1907



Michelin crosses the Atlantic to build a plant in the **United States** in **Milltown**, New Jersey (closed in 1931).

The **Estaing plant** is built in Clermont-Ferrand.



1829-1868



1889-1891



1892-1899



1900-1907



1908-1913



1914-1916



1919-1927



1928-1933



## HISTORY



1908-1913

The tire equips new vehicles



1908 1910 1911 1912 1913

Michelin invents the **detachable steel wheel**, prefiguring the spare wheel.



1829-1868



1889-1891



1892-1899



1900-1907



1908-1913



1914-1916



1919-1927



1928-1933



## HISTORY



### 1928-1933

#### A stage marked by inventions

1928 1929 1930 1931 1932 1933



Michelin files a patent for a **tire with a built-in tube**, ancestor to the tubeless.





## HISTORY



1940-1948

A time of significant disruptions



1940 1945 1946 1948

The research continues, culminating in an **avant-garde** solution: the **radial casing**.

Michelin files the patent for the radial tire on June 4th .



1900-1907



1908-1913



1914-1916



1919-1927



1928-1933



1934-1938



1940-1948



1949-1952





## HISTORY



### 1981-1990

#### Conquering world markets



1981 1982 1984 1986 1988 1989 1990

The Michelin Air X is the **first radial tire for aircraft**.

Michelin becomes the majority shareholder of **Kléber Colombes** (France).

Michelin opens a plant in **Columbia**, South Carolina, USA.

In Brazil, Michelin builds two plants at **Campo Grande** and **Resende**; opens a 22,800 acre rubber plantation in the state of **Mato-Grosso**, and takes over another plantation in the state of **Bahia**.



1928-1933



1934-1938



1940-1948



1949-1952



1955-1967



1968-1979



1981-1990



1991-1997





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