

FOCUS ON TYRES PASSENGER CAR TYRES



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SIGNS OF WEAR AND DAMAGE



WEAR ON BOTH TREAD SHOULDERS



SITUATION

The wear on the shoulders is greater than in the centre of the tread (round wear). Low-section tyres are more prone to this wear pattern.

POSSIBLE CAUSE

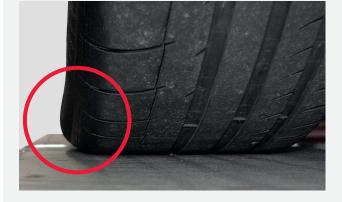
- 1. Driving with underinflated tyres due to:
 - a. negligence
 - b. punctured tyre
 - c. leaking valve
 - d. leaking rim
- 2. Driving with overload
- 3. Hard cornering

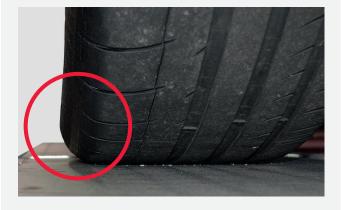
ADVICE

- 1. Find the cause and:
 - a. inform the driver
 - b. depending on the leak: repair or replace the tyre
 - c. replace the valve
 - d. adjust the tyre pressure to the level recommended by the vehicle manufacturer.
- 2. Prevent overload
- 3. Adjust driving style









WEAR IN THE CENTRE OF THE TREAD



The wear in the centre of the tread is greater than on the shoulders (hollow wear). 1. Driving with improper inflation pressure 1. Adjust the tyre pressure to the level recommended by the vehicle manufacturer 2. If you drive at high speed for a longer period of time 3. Rim too narrow 2. Adjust driving style Image: Comparison of the level period of time 3. Rim too narrow Image: Comparison of the level period of time Image: Comparison of the level period of time Image: Comparison of the level period of time Image: Comparison of the level period of time Image: Comparison of the level period of time Image: Comparison of the level period of time Image: Comparison of the level period of time Image: Comparison of the level period of time Image: Comparison of the level period of time Image: Comparison of the level period of time Image: Comparison of the level period of time Image: Comparison of the level period of time Image: Comparison of the level period of time Image: Comparison of the level period of time Image: Comparison of the level period of time Image: Comparison of the level period of time Image: Comparison of the level period of time Image: Comparison of the level period of time Image: Comparison of the level period of time Image: Comparison of the level period of time Image: Comparison of the level period of time Image: Comparison of the level period of time	SITUATION	POSSIBLE CAUSE	ADVICE
period of time		1. Driving with improper inflation pressure	1. Adjust the tyre pressure to the level recommended by the vehicle manufacturer.
			2. Adjust driving style
		3. Rim too narrow	

FOREIGN OBJECT PUNCTURE IN TREAD



SITUATION

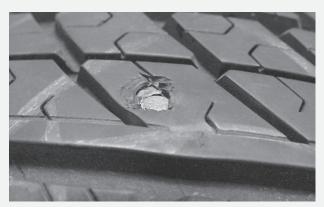
The tread is punctured by nails, shards or iron parts. This has damaged the carcass and the tread can come loose from the carcass (separation). A foreign object puncture will cause the tyre to deflate slowly.

POSSIBLE CAUSE

The tyre has hit sharp objects.

ADVICE

- The tyre must always be checked on the inside for cord ply damage or breakage. If the foreign object puncture is too big, the tyre is beyond repair.
- Any repairs must be carried out according to the manufacturer's instructions. Note: A repair with a plug or lace is only an emergency repair.
- For tyres with a specific technology such as run-flat, sealant or silent there are different repair methods and techniques.





Inside

Outside

SIDEWALL WEAR OR DAMAGE



SITUATION	POSSIBLE CAUSE	ADVICE
 The side wall shows wear of burned rubber. Image: State of the side wall shows wear of burned rubber. Image: State of the side wall shows wear of burned rubber. Image: State of the side wall shows wear of burned rubber. 	1a. If a tyre is underinflated or overloaded for an extended period of time, the sidewall will deform and the tyre will overheat. After some time, the adhesion between the rubber and the cord plies is lost.	1a. Tyre must be replaced
Thiste	1b. The car has been driven with a flat tyre.	1b. Tyre must be replaced
2. The side wall shows signs of wear or damage.	 The tyres has hit or rubbed against curbs or other obstacles (such as roundabouts and drains). 	 If the cord plies are visible, the tyre must be changed. The sidewall of a passenger car tyre cannot be repaired.

TOTALLY BROKEN TYRE



SITUATION	POSSIBLE CAUSE	ADVICE
1. The belt and cord plies are broken.	1. The tyre has been subjected to underinflation or overload for a prolonged period of time. The tyre overheats, the adhesion between the rubber and the cord plies, comes loose and eventually the belt and the cord plies break.	Tyre must be replaced.
2. The tread has separated in whole or in part.	2. A foreign object puncture may cause the belt to rust and hence the tread to become detached from the carcass.	

The tread had separated

BULGE OR DEFORMATION IN SIDEWALL



SITUATION	POSSIBLE CAUSE	ADVICE
There is a carcass fracture in the sidewall of the tyre.	The tyre has hit an obstacle such as a kerb at a sharp angle. Some carcass cords have been broken and a bulge has appeared on the side wall.	Tyre must be replaced.
Outside	Impact damage	

Inside

SAW-TOOTH WEAR (CUPPING)



SITUATION

There is rolling noise (which resembles the noise of a defective wheel bearing) and vibration due to saw-tooth wear on the tyres of the non-driven wheels. The wider the tyre and the more robust the tread blocks, the more visible the saw-tooth effect is.

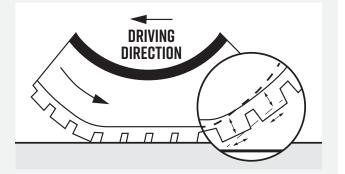




POSSIBLE CAUSE

The cause of this wear is often difficult to determine. The type of car, the type of tyre and the axle load have a great impact on wear. Potential causes are:

1. Excessive load due to vehicle overloading, causing the cams (of the tread) to wear off obliquely in a longitudinal direction.



- 2. Incorrect tyre pressure.
- 3. Wrong toe angle on rear axle.
- 4. The tyre is loaded on the non-driven axle on one side only (the inside).

- 2. Adjust the tyre pressure to the correct level (depending on the correct load; see page 25) and check the tyre pressure regularly.
- 3. The toe angle must be checked and the vehicle aligned.
- 4. Have the toe and camber angles checked. See pages 12 and 13 for more information.

ADVICE

Find the cause:

1. Check the load capacity of the tyres in relation to the load (see page 25).

UNEVEN WEAR



SITUATION	POSSIBLE CAUSE	ADVICE
The tyre shows uneven wear in waves, facets or fields across the entire circumference of the tyre.	The cause of this wear is often difficult to determine. Potential causes are:	Find the cause:
	1. The shock absorber, suspension rubbers or wheel bearings are worn.	 The chassis must be checked. If necessary, replace the shock absorber, suspension rubbers or wheel bearings.
	2. There is a great imbalance in the tyre-wheel combination.	2. The tyre-wheel combination must be checked, balanced or replaced.
	3. The vehicle is not properly aligned.	3. The vehicle must be aligned.

TOE WEAR



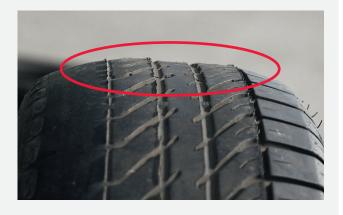
SITUATION

The tyre shows rapid tread wear with burrs. The tread is worn obliquely from the outer side to the inner side or vice versa and the tread edges are sharp. If you rub your hand across the width of the tread, the tyre feels smooth in one direction and rough in the other.

POSSIBLE CAUSE

Too much toe-in or toe-out.

Toe - out







ADVICE

The toe angle, suspension and alignment must be checked for wear and irregularities.

CAMBER WEAR



SITUATION	POSSIBLE CAUSE	ADVICE
The tyre shows one-sided shoulder wear in the longitudinal direction of the tyre (camber).	Irregular camber.	The camber and suspension must be checked for wear. The alignment also needs to be checked.
	Positive camber	
Left: smallest loaded radius. Right: biggest loaded radius.		

BRAKE MARK



SITUATION

The entire width of the tread shows flat wear (brake mark), causing the car to shake.

POSSIBLE CAUSE

- 1. Braking with locked wheels (an emergency stop).
- 2. The ABS system is not working properly.
- 3. The parking brake has been used incorrectly.

ADVICE

- 1. The tyres must be replaced.
- 2. The tyres must be replaced and the ABS system repaired.
- 3. The tyres must be replaced.





AGE-RELATED CRACKS



POSSIBLE CAUSE SITUATION **ADVICE** The tread and sidewall have small or large cracks. 1. Age-related cracks in the sidewall rubber and Only if the carcass cords are **not** visible: Inflate the tread due to exposure to ozone, sunlight or other tyre to the correct pressure. Are the carcass wires becoming visible? If so, replace the tyre. radiation. 2. Age-related cracks of the side wall rubber and tread due to exposure to chemicals at the car wash. 3. Driving with underinflated tyres or overload.

STEERING COMPLAINT: THE CAR OR STEERING WHEEL SHAKES



SITUATION

The steering wheel shakes. In this situation there is no wear or damage, but a chassis-related complaint.

POSSIBLE CAUSE

1. Imbalance (static or dynamic).

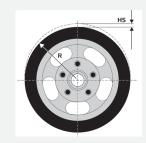


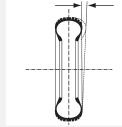
Static imbalance

Dynamic imbalance

- 2. Wrong off-set (ET) value of the wheel.
- 3. Tyre incorrectly centred on the rim.
- 4. Wheel incorrectly centred on the hub.
- 5. Radial or lateral run-out of the tyre or the wheel.







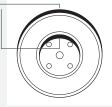
- 6. Radial force variations (non-uniformity) in the tyre.
- 7. Play in the suspension or in the steering house.



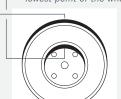




highest point of the tyre lowest point of the wheel



after matching

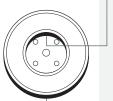




ADVICE

- 1. The tyre-wheel combination must be checked for balance and rebalanced if necessary.
- 2. Check that the off-set (ET) value of the wheels are equal to the value specified by the car manufacturer. If necessary, fit wheels with the correct off-set (ET) value.
- 3. Check the centring of the tyre on the wheel. Refit the tyre if necessary.
- 4. Check the centring of the wheel on the hub. If necessary, re-centre the wheel on the hub.
- 5. Check the radial and lateral run-out of the tyre and the wheel. If necessary, match the highest point of the tyre with the lowest point of the wheel or replace the tyre or wheel if necessary.
- 6. Radial force variations can only be measured on special balancing equipment that measures the tyre-wheel combination under load. Rebalance if necessary.
- 7. Check the play in the suspension and steering rack and repair the fault if necessary.

highest point of the tyre _ lowest point of the wheel



STEERING COMPLAINT: CAR PULLS TO ONE SIDE



SITUATION	POSSIBLE CAUSE	ADVICE
Car pulls to one side. In this situation there is no wear or damage, but a chassis-related complaint.	 A difference between left and right in tyre pressure, tyre size, tyre type, tyre profile, wheel size, conicity in the tyre (cone effect). Wrong vehicle alignment. One brake calliper is stuck. Power steering sensor is set incorrectly. Irregularity in the tyre. 	Find the cause and fix it. If tyre conicity is the cause, the wheels should be changed from front to rear or from left to right. Primarily follow the instruction manual of the car. If the tyre has an irregularity, it must be replaced.
	like a cone. A conical tyre does not roll straight on, but veers constantly.	



INFORMATION ABOUT TYRES AND WHEELS



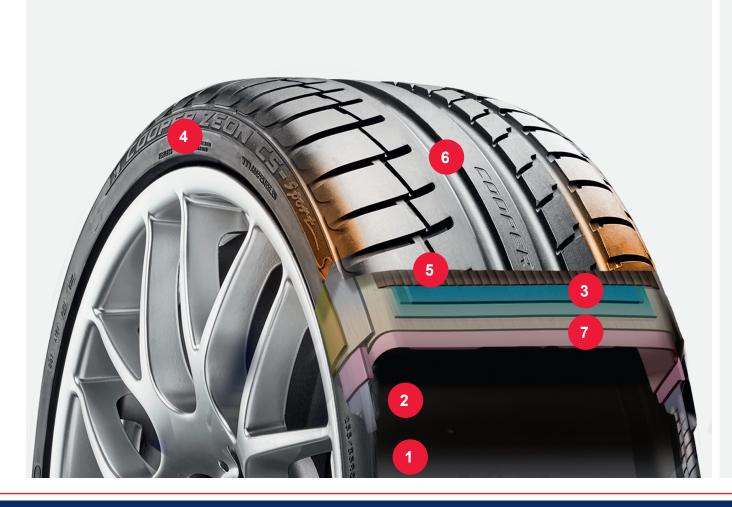


TYRE STRUCTURE



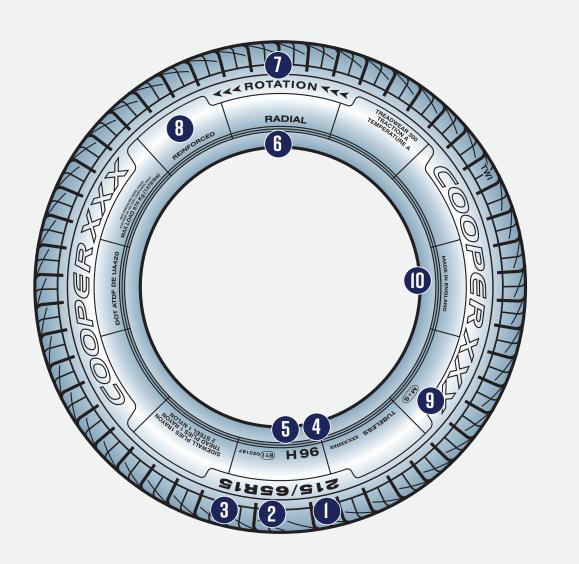
A PASSENGER CAR TYRE IS MADE UP OF The Following Parts.

- 1. The beads
- 2. Bead filler
- 3. Reinforcement belts
- 4. Sidewalls
- 5. Tread compound
- 6. Tread pattern
- 7. The carcass



MARKINGS ON THE SIDEWALL OF THE TYRE

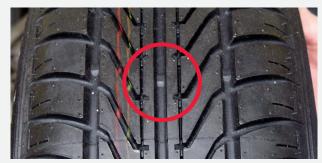






TREAD DEPTH

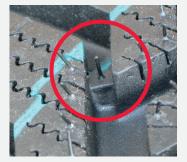




De TWI: good



The TWI (1,6 mm): is equal to the tread



the tyre. The main grooves are located in the centre 3/4 of the tyre's tread width. The profile contains profile depth gauges: the Tread Wear Indicator (TWI). If the TWI is equal to the tread, the minimum tread depth is reached.

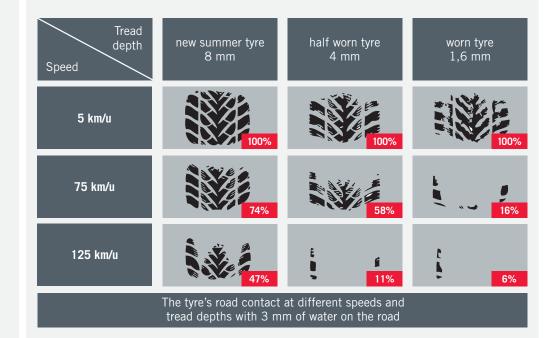
The tread depth is measured in the main grooves of

On winter tyres the Winter Wear Indicator (WWI) indicates whether the tread depth of 4 mm has been reached.

The statutory minimum tread depth varies from country to country. In most European countries the statutory minimum tread depth is 1.6 mm for Summer and Winter tyres. For winter tyres, the 4 mm recommendation applies to ensure optimum safety in wintery conditions.

INFLUENCE OF TREAD DEPTH ON ROAD CONTACT

The adjacent figure shows the tyre's road contact at different speeds and tread depths. There is 3 mm of water on the road. At high speed and a 1.6 mm tread depth, a tyre has hardly any contact with the road surface.



The WWI (Winter Wear Indicator)

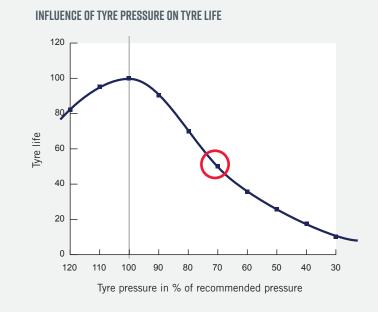
INFLUENCE OF TYRE PRESSURE ON LIFE, ROLLING RESISTANCE



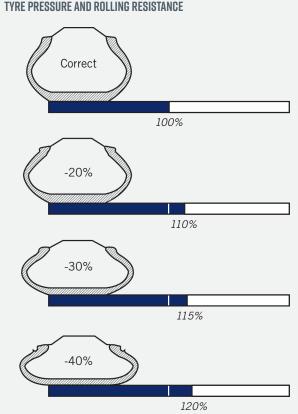
Rubber is porous. As a result, a tyre loses 0.1 bar (1.45 psi) of pressure per month. If you drive with underinflated tyres, the tyres deform and you have less grip, increasing fuel consumption, accelerating tyre wear and causing more harm to the environment. Therefore it is recommended to check the tyre pressure and inflate the tyres every month.

Check the tyres when cold (after no more than 5 km (3 miles) of driving). The measured pressure of hot tyres is higher than that of cold tyres. At a temperature below 7°C, the vehicle manufacturer may recommended pressures to be increased by 0.2 bar (2.9 psi). Check in vehicle booklet.

The correct pressure can be found in the vehicle booklet with the technical data and also on the inside of the fuel lid or the door post. For low-section tyres, it is recommended to select the value indicated for full load and high speeds.



30% under inflation leads to 50% more wear



20% under inflation leads to 10% higher rolling resistance

10% more rolling resistance increases fuel consumption by 2%

MAXIMUM SPEED (SPEED LIMIT SYMBOL)



OVERVIEW OF MAXIMUM SPEED KM/H (MPH):

Ρ

Q

R

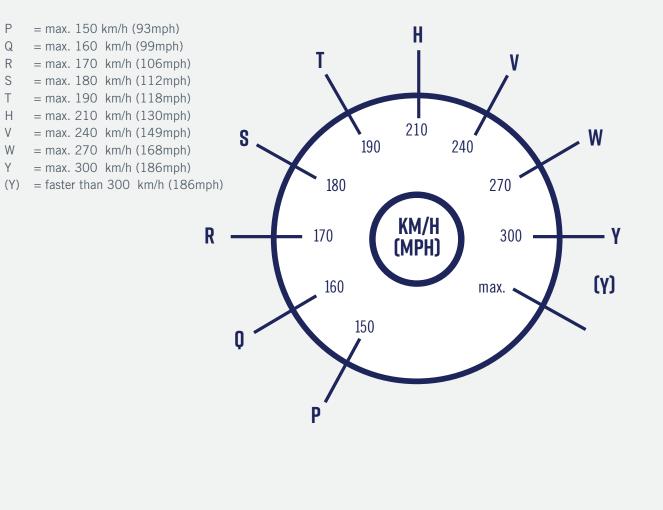
S Т

Н

V

W

Υ



SPEED STICKER FOR WINTER TYRES

Some countries may require that if the speed category of Winter tyres is lower than the maximum speed of the vehicle, but at least Q = 160 km/h (99mph), a sticker should be placed in a prominent place in the vehicle, within the driver's range of vision. This sticker shows the maximum speed for the Winter tyres fitted to the vehicle.

MAXIMUM LOAD CAPACITY (LOAD INDEX OR LOAD CAPACITY CODE)



The adjacent table with load index only applies to passenger cars. Other types of tyres (such as van or reinforced tyres) are subject to a different load index.

Load index	kg	Load index
75	387	101
76	400	102
77	412	103
78	425	104
79	437	105
80	450	106
81	462	107
82	475	108
83	487	109
84	500	110
85	515	111
86	530	112
87	545	113
88	560	114
89	580	115
90	600	116
91	615	117
92	630	118
93	650	119
94	670	120
95	690	
96	710	
97	730	
98	750	
99	775	
100	800	

An example for a car with tyre size 205/55 R 16 91 H.

kg

The load index of this tyre is 91. The table shows that 91 corresponds to a maximum load of 615 kg per tyre.

For two axles with two tyres each, the maximum load is therefore $2 \times 2 \times 615 \text{ kg} = 2,460 \text{ kg}.$



MAIN LEGAL REQUIREMENTS:

It is important that the tyre size, load index, speed category and use category of the tyre meets the manufacturers specifications for all wheel positions. Consult the countries local law for requirements. For example. All tyres fitted onto one axle must be of the same make & type, (summer, winter, all-terrain).

M+S AND SNOWFLAKE SYMBOL.

The snowflake symbol was officially recognised by the European Union in 2010. Legally speaking, most European countries do not distinguish between M+S and the snowflake symbol (Three Peak Mountain Snowflake symbol). In most European countries, a tyre with an M+S marking is legally considered a winter tyre. The German legislation makes a distinction based on production date (DOT – Code) of the tyre. A tyre produced from January 1st 2018 is legally a winter tyre if it bears the snowflake symbol. Tyres produced before 2018 that only have the M+S mark (and no snow flake symbol) are perceived as a winter tyre until September 30th 2024.

Given that M+S tyres are made for use in mud and loose snow and not for low temperatures and compacted snow, there is technically a significant difference with tyres bearing the snowflake symbol. Tyres with the snowflake symbol comply with European practical tests for grip on compacted snow and, accordingly, have much more traction on snowy and slippery roads than tyres without this symbol. Even at temperatures below 7°C, tyres bearing the snowflake symbol have a better grip thanks to a different composition of the rubber.



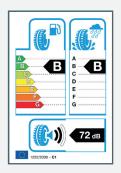


Snowflake symbol

M+S-symbol

TYRES AND LEGAL REQUIREMENTS (TYRE LABEL)





On the road towards greater traffic safety, greater environmental awareness and more economical car use, the European Parliament has made the tyre label compulsory. By classifying tyres, they can be compared for a conscious purchasing decision.

WHICH TYRES ARE SUBJECT TO THE REGULATIONS?

European regulations apply to passenger car tyres (C1), van tyres (C2) and commercial vehicle tyres (C3). There are a number of exceptions. For example, the tyre label does not (yet) apply to re-treaded tyres Temporary use spare tyres & marked Temporary use only, tyres having a rim diameter of ≤ 10 " (254 mm) or ≥ 25 " (635mm), tyres designed for competitions, tyres fitted with ice studs, speed rating less than 80kmh (50 mph), Professional Off Road tyres (POR) & tyres designed to be fitted to vehicles registered for the first time before 1st October 1990.





Car tyres



PERFORMANCE CRITERIA

There are dozens of performance criteria to assess the quality of a tyre. For the tyre label, attention is focused on three key performance criteria: wet grip of tyre, fuel efficiency and external rolling noise. Examples of criteria that are not mentioned on the tyre label are: wear resistance (mileage), braking on dry roads, noise produced in the vehicle, handling and aquaplaning.



LABEL REQUIREMENTS

For C1 and C2 tyres, the supplier must ensure that a label is affixed to the tread of those tyres, showing fuel efficiency class, external rolling noise value measured and wet grip class. In the case of a batch of identical tyres, the label may also be supplied in printed form.

WET GRIP

The braking distance of a Class A tyre may be up to 12 metres shorter than that of a Class E tyre when applying the brake maximally at a speed of 80 km/h (50 mph) and the entire vehicle is fitted with the same tyres.

FUEL EFFICIENCY

The rolling resistance of a tyre may vary depending on vehicle type or weather conditions. The engine of the vehicle needs to generate power to overcome rolling resistance, which costs fuel. The fuel consumption associated with a Class A passenger car tyre is several percent lower than with a Class E tyre if the entire vehicle is fitted with the same tyres.

EXTERNAL ROLLING NOISE

The tyre label indicates the external rolling noise of the tyre. Three black waves means the tyre complies with current regulations. Two means it meets the new type approval. Each wave extra or less accounts for a difference of 3 dB(A). The volume halves when the volume drops by three decibels. So from three waves to one the noise is even 75% less.

27

RUN-FLAT TYRES



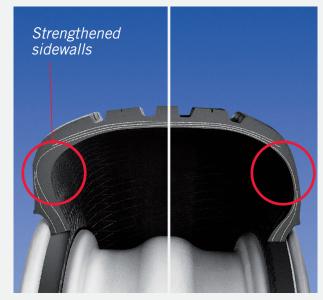
Nowadays more and more cars are fitted with run-flat tyres, with which you can continue driving even if they are empty, so that a spare tyre is no longer needed. Although run-flat tyres save a lot of space in the boot, they do need to be treated with extra care.

Fitting: run-flat tyres have a more rigid sidewall than normal tyres, which makes them so difficult to fit that a professional with the right equipment needs to be called in.

Until recently, run-flat tyres could only be fitted onto specially developed wheels with elevated humps. Tyres must be fitted onto these wheels strictly in accordance with the tyre manufacturer's instructions. The latest generation of run-flat tyres can also be fitted onto normal wheels

Run-flat tyres may only be repaired if the tyre manufacturer allows this. Repairs must be carried out using special repair tools and in accordance with a special guideline. Run-flat tyres may only be used in conjunction with a tyre pressure monitoring (TPMS) system (see page 29). When this system produces a warning, the motorist must not exceed the maximum speed at which the deflated run-flat tyre can be driven (often 80 km/h (50 mph)) and the maximum distance that can be travelled with these tyres (often 80 km) (50 mph).

Run-flat tyres can be identified by a symbol or sign of the manufacturer. Here are a few examples: RFT, SSR, RSC, ROF or ZP~ (common symbol after 2006).



Run-flat tyre

Normal tyre

TPMS (TYRE PRESSURE MONITORING SYSTEM)



Every new passenger car is fitted with a system to monitor tyre pressure (TPMS). A proper tyre pressure promotes road safety and tyre life and helps reduce fuel consumption and CO_2 emissions.

WHAT DOES A TPMS DO?

A vehicle with a tyre pressure monitoring system has a warning light on the dashboard that warns the motorist if the pressure in one or more tyres is 20% too low or if the tyre pressure has reached the lower limit of 1.5 bar (21.8 psi). Depending on the system, a display shows the pressure in each tyre. If the tyres are inflated to the correct pressure, the warning disappears automatically, otherwise the system must be reset.

TPMS SYSTEMS

There are two types of TPMS: the direct and the indirect system. A direct TPMS works on the basis of sensors that measure the tyre pressure. The measured pressure is then fed back to the vehicle's electronics. Each tyre has its own sensor, which is not visible from the outside. Most sensors are located directly behind the valve. An indirect TPMS works on the basis of the software of the car, so without a sensor. An indirect system generally makes use of the knowledge that a tyre with too low a pressure has a smaller circumference than a tyre with the correct pressure. A tyre with a smaller circumference rotates faster and the car's electronics measure that difference.

DIRECT TPMS: WORK FOR THE TYRE SPECIALIST

In the first few years of a new car, there is usually no need to worry about the TPMS system. The system of cars with direct TPMS and the status of the batteries in the sensors should be read out (checked) in the workshop with special equipment. If the dashboard reports a fault, the tyre specialist must rectify the fault.

A direct TPMS

INDIRECT TPMS: DRIVERS CAN DO MANY THINGS THEMSELVES

If a car is equipped with an indirect TPMS system, the driver must occasionally perform a simple operation via the dashboard, after the tyres have been inflated, for example. It is a matter of pressing a button or operating a screen, in the same way as setting up navigation equipment. How to do this is described in the instruction booklet.

THE USE OF CORRECT TYRE PRESSURE:

- shorter braking distance
- less chance of a blowout
- less wear
- lower fuel costs
- less CO₂ emissions
- more riding comfort
- more stable roadholding



Motorists who opt for Winter tyres in Winter and Summer tyres in Summer drive on the most suitable and safest tyres all year round. All-season tyres combine the properties of Summer and Winter tyres, which means that an All-season tyre is a compromise.

BELOW 7°C: WINTER TYRES

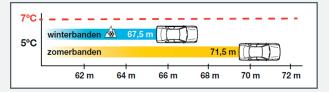
Winter tyres offer extra safety at temperatures below 7°C, which means that winter tyres are also recommended for 'mild' Winters. Even without snow and ice, the temperature (low to the ground) in the morning and evening rush hour is usually below 7°C. It has been statistically proven that cars on Winter tyres are less likely to have an accident in Winter than cars fitted with Summer tyres. **DIFFERENCE IN PROPERTIES BETWEEN SUMMER AND WINTER TYRES** Winter tyres owe their extra grip at lower temperatures to two important features:

- The composition of the winter tyre rubber is different, keeping the tyre flexible at low temperatures, which provides extra grip. The rubber of Summer tyres hardens (at temperatures below 7°C) and loses grip. And if you continue to drive with Winter tyres in the Summer, the softer rubber will cause them to steer less precisely and slip sooner, resulting in a longer braking distance. The advice is therefore: Summer tyres in Summer and Winter tyres in Winter.
- Winter tyres have small, highly effective notches (sipes) in the tread. These sipes provide extra grip by applying more gripping points on the road surface.

SO FOR WHOM COULD THE ALL-SEASON TYRE BE AN ALTERNATIVE?

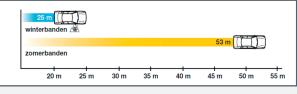
As the name suggests, an All-season tyre has been developed for all seasons. The tyre combines the properties of a summer and a winter tyre and will therefore always be a compromise. They are not a good alternative for intensive car users or for motorists who depend on their car to go abroad (for example for a Winter sports holiday) or have a sporty driving style. All-season tyres are an alternative for cars with a relatively low annual mileage, such as a second car in the family.

BRAKING DISTANCE AT 100 KM/H (62 MPH) ON WET ROADS



At a speed of 100 km/h (62 mph) on wet roads, the braking distance is four metres (4.3 yards) shorter than that of the same car on summer tyres.

BRAKING AT 50 KM/H (31 MPH) ON SNOW



At a speed of 50 km/h (31 mph) on snowy roads, the braking distance is even more than half shorter. Your car stops 28 metres (30.6 yards) earlier.





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