Tyre Wear

Normal wear

Tyres wear down over the course of their usage. The level of wear depends heavily on the driving style of the driver. Other influencing factors are the road surface and types of road (straight/winding), the mean ambient temperature and the drive concept of the vehicle.

Tyres fitted to high performance vehicles that are often driven at high speeds primarily wear down in the centre of the tyre tread. This wear comes about through the slight increase in the diameter of the tyre at the centre of the contact area, which is caused by the strong centrifugal forces.

In particular, this pattern of wear can be seen on the tyres on the drive axle, since the tyres are subject to slip due to the drive. This slip amounts to approx. 1%, at 100 km/h (62 mph), but as much as 3% at 180 km/h (112 mph). When the degree of slip increases threefold as above, the degree of wear actually increases by a factor of nine!

The tyres fitted on the front axle of a vehicle show above all things wear at the outer edge of the contact area. Front tyres are subjected to particularly strong lateral forces when cornering. This stems on the one hand from the steering geometry, on the other hand from the fact that (in the majority of vehicles) the weight of the engine exerts a load on the front axle.

Whereas with rear-wheel drive both wear patterns can be observed separately, with front-wheel drive (engine at front, drive axle at front) both types of wear affect the front tyres. Therefore, they wear considerably quicker than the rear tyres.

On the front tyres of rear-wheel-driven vehicles one can sometimes observe a saw-toothed pattern of wear. The individual lugs wear due to the slip that arises when they lift off the road surface, which is caused by the discharge of internal stresses. A saw-toothed wear pattern can lead to increased tyre noise.

We see, then, that different patterns of wear arise on the front and rear axles. In the interest of safety and optimum running-gear operating conditions, it is not recommended that the wheels be swapped over from axle to axle.

Nevertheless, if a vehicle owner wants to achieve even wear of the tyres, the swapping-over of the front and rear wheels must be carried out at short intervals of approx. 5,000 km (3,000 miles). When this is done, the direction of rotation of the tyres must never be changed, even with tyres which are not designed for a specific direction of rotation. The wheels must therefore be swapped over front to rear and vice versa on the same side of the vehicle, possibly integrating the spare wheel into the procedure. Even when this procedure is followed, it is possible for the braking behaviour and road grip of the vehicle to be adversely affected; vehicle handling changes and tyre noise may also become louder.

Legally stipulated minimum tread depth and wear indicators

The tyre wears down when used. Material is worn off the lug surface through abrasion and the tread depth is reduced.

The legally stipulated minimum tread depth has been standardised throughout the member countries of the EU since January 1, 1992 at **1.6 mm** . BMW recommends 3 mm.

Today's tyres have ridge-like humps in a number of the grooves on the carcass. These are the 1.6-mm-high tread wear indicators which are sometimes indicated by the letters TWI on the tyre shoulder. It is in these grooves that the tread depth is measured, but not on the tread wear indicators themselves.

If these indicators are flush with the lug surface at any point around the circumference of the tyre, the tyre may no longer be used. However, it is advisable to replace the tyres sooner. With a tread depth of 2 to 3 mm, the volume of the grooves has been reduced to such an extent that they are no longer capable of collecting and expelling an adequate amount of water.

Snow tyres have only a limited suitability for winter use as of a tread depth of 4 mm and should be replaced in the interest of safety.

Furthermore, the legislator prohibits the use of tyres suffering damage to the contact surface or sidewall, which could adversely affect operating safety, and tyres with cord breaks or torn steel inlays.

The legislator does not prohibit the use of a tyre whose outer shoulder is worn.

Tyres should be checked at regular intervals to determine how much tread is still available. The tread depth must be measured in the "groove that covers the entire circumference".

It is illegal to regroove the tread, since this could result in the carcass becoming damaged.

Age of the tyre

The rubber in the tyre is subject to a natural ageing process. It develops cracks and the tyre can no longer perform the tasks demanded of it to the full extent. A tyre can achieve of maximum life of ten years, if it is not worn out beforehand, after which it should be replaced.

For safety reasons, however, tyres should no longer be used after they are six years old. The age of a tyre is indicated by the DOT number.

Caution must be practised when using a spare tyre. The tyre may well still have the full depth of tread, that is appear to be as good as new, but due to its age is already unsuitable for use.

If a spare tyre is to be used and worn in a manner that makes sense from an economical and safety-related point of view, the following procedure is advisable. On a new car, once the first pair of tyres is found to have wear (2 - 3 mm!), the spare tyre is fitted together with an identical new tyre. One of the worn tyres is then used as the spare tyre, it only being brought into action for brief periods to bridge gaps that may occur if another of the tyres is damaged.

A spare tyre which is older than 6 years can only be used in case of a breakdown. It must then be replaced immediately for a new tyre and must not be used together with new tyres when the tyres are replaced.

To guarantee good handling characteristics, tyres of the same make and same tread pattern must be used.

Tyre damage (caused by mode of use)

Tyres must be checked at regular intervals for damage and/or foreign objects; at the same time, it is important not to forget to carry out a visual check on the wheels to look for damage to the sidewalls.

The most frequent cause of all damage to tyres is driving with too low an inflation pressure. The inflation pressure can drop over a period of time and remain undetected unless checked regularly at short intervals. Too low a pressure first of all leads to increased wear at the shoulders of the tyres. In addition, the tyre shoulders and sidewalls are flexed to an even greater degree, which leads to them heating up. On long journeys at high speed, the temperature can increase by such an amount that symptoms of disintegration appear and in the worst possible case the tyre is destroyed.

Separate areas of damage to the sidewall tend to be caused by hitting a kerbstone. Cord breaks in the area of the contact area are caused by driving over sharp-edged obstacles. Both are made more likely through the inflation pressure being too low.

Individual sections where the tread depth is greatly decreased can usually be traced back to panic braking with the wheels locked up.

Punctures and cuts have become fewer and far between thanks to today's improved road conditions, but they still do occur. They must be repaired immediately, because as a consequence, the rubber tears further until the fabric ply is reached. Repairs must only be carried out by an expert.
In the case of cuts, the depth of the cut must be determined. It must not reach the carcass of the tyre. With punctures, any foreign bodies in the area of the tread are pulled out and the depth of the puncture is likewise measured. Whereas a hole caused by a nail may still be able to be repaired, a cut weakens the carcass considerably. It is particularly problematical if the cut is not new. In this case, moisture may have penetrated the cut and caused the steel cord to corrode; the corrosion creeps along the steel cord.

If the steel belt has been reached, either through the puncture/cut itself or through later tearing of the rubber, moisture gets in and corrodes the steel threads. This can also lead to the fabric being broken at a point which is far away from the original point of damage (known as wicking).

Punctures/cuts which have cut through the cords of the tyre cannot be repaired. The judgement as to whether a less damaged tyre can be repaired or not must be left to a tyre expert. Generally speaking, high-speed tyres (classes H, V, ZR, W and Y) are not repaired. In the speed classes below these, too, one has become more cautious for safety reasons. The person who carries out the repair accepts full product liability for the tyre.

Repairing a tubeless tyre by fitting an inner tube is absolutely illegal.

A tyre is replaced if there is damage to the carcass, bulges in the sidewalls or chunks torn out of the tread. Constriction in the area of the sidewalls must be no greater than max. 0.5 mm.

The customer should, in the cases mentioned, be informed of the causes. In particular, the role of the tyre inflation pressure and the fact that it must be checked regularly every two weeks must be emphasized.

BMW recommends:
A tyre should only be repaired in an absolute emergency. The repaired tyre should be replaced as quickly as possible.

Tyre damage (caused by defects of the vehicle or fitting of the tyre)

One-sided wear of a tyre (wear on only one shoulder) may indicate a fault in the geometry of the running gear. If necessary, the camber and toe of the wheel should be checked.

If the vehicle has suffered an accident, it is also conceivable that the two axles are not parallel due to inadequate repair. In this case, the geometry of the running gear must be checked on a wheel analyser.

If tyre wear occurs at a number of points distributed evenly around the circumference, this is usually the result of wheel shimmy (wobble). This too may be determined on the basis of irregular running. The causes of this irregular running may be:

- play or damage to the steering geometry
- play or damage to the wheel suspension
- play or damage to the suspension
- defective shock absorbers

Damage to the tyre bead can lead to insecure seating of the tyre on the rim and a slow loss of air with all that that entails.
Damage to the bead has usually been caused by errors made when fitting the tyre. It may come about due to the fitter not applying any fitting paste at all or not enough. In this case, the bead does not slide easily enough over the rim flange and it can become overstretched and damaged.

The bead can also be destroyed by damaged fitting tools. A tyre which has been found to be suffering from bead damage must under no circumstances be used any longer.

The tyres must also be checked for flat spotting. A flat spot can be returned to its original shape by taking the vehicle for a quiet drive, warming up the tyre and then letting it cool down.