



White Paper
Commercial Vehicle Tires

Emissions · Climate Action · Efficiency

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Tires? They're just round, wide and black.

Once upon a time that may have been the case, but those three adjectives no longer paint an adequate picture of the complex product that is a tire. Today, it's the selection of the components and rubber compounds that go into a tire and the quality of the production process that shape its performance and determine its lifespan.

Tires come in all sorts of sizes, from the dimensions of a wheelbarrow tire to the biggest drivable tires in the world (59/80 R63 XDR) that stand as high as a house, measure over four meters in diameter and tip the scales at more than five metric tons.

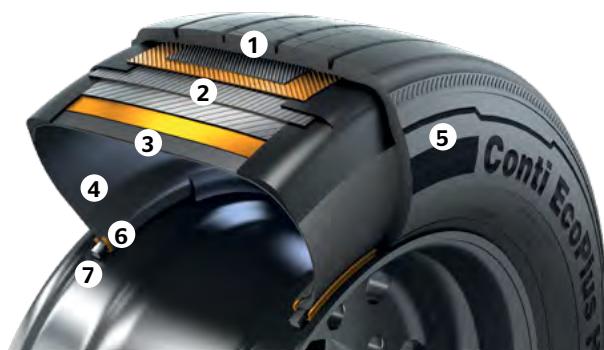
10 Questions to Get Started

1. WHAT'S A TIRE MADE OF?

A truck tire is made up of seven kinds of material. The rubber compound contains natural rubber (around 30 percent), synthetic rubber (around 5 percent), halogenated butyl rubber (around 4 percent) and chemicals (around 37 percent). Then there are the reinforcing materials, including steel cord (accounting for around 15 percent of the material in a tire), bead wire (around 6 percent), and nylon tire cord fabric (around 1 percent).

2. AND WHAT ARE THE ACTUAL COMPONENTS OF A TIRE?

A tire comprises bead, casing, belt, tread and sidewall. The inner liner (an inner layer of rubber) keeps the tire airtight. The seven components of a tire are: the tread strip (1), multi-ply steel belt (2), steel casing (3), inner liner (4), sidewall (5), bead reinforcement (6) and bead core (7).



3. WHAT'S THE JOB OF A TIRE?

On a 12-wheeler semitrailer rig, the total tire surface area in contact with the road measures barely one square meter. Which goes to show how important the tires really are. Their job is to make sure that people and goods are transported to their destination safely and fast. The tires put down traction, deliver grip and ensure optimum braking distances.

4. HOW LONG DOES A TIRE LAST?

The mechanical stress of driving causes abrasion of the tire surface. Along with this tire wear, there are other factors that have a significant impact: On the

one hand, the service life of a tire will depend on its quality, that is to say whether it is a premium, budget or low-budget tire (mostly imported from Asian countries). The life expectancy of a tire will also be influenced by whether or not it is suitable for its intended use. For example, the requirements facing the tires of a line-service bus are by no means the same as those of a truck carrying goods the length and breadth of Europe. And the tires of a construction site vehicle are exposed to a whole different set of challenges. Other factors that come into play here include tire pressure, how the brakes are adjusted, axle and wheel alignment, and how the vehicle is driven.

5. WHAT CAUSES TIRES TO FAIL?

The most common causes of punctures and the associated dangers are incorrect tire pressure, impact breaks and tire wear. Even minor errors in wheel alignment will lead to higher wear and fuel consumption, as well as damage to the casing. Continental's Visual Alignment Indicator VAI™ comprises a system of sipes on the shoulder of the tire. It enables incorrect wheel alignment to be detected without the need for electronic measurement. After a few thousand kilometers it is clear whether the wear on the inner and outer shoulders of the tire is identical. Unequal changes in the VAI™ are easy to spot with the naked eye and tell the driver that the wheel alignment - on both sides of the vehicle - needs correcting.

6. WHAT'S ALL THIS ABOUT ROLLING RESISTANCE?

Before a vehicle can start to move it first has to overcome a number of physical forces. One of these forces is the rolling resistance of the tires, or in other words the physical resistance of the tire to the motion of the rolling wheel. One factor with a major impact on the resistance value is the vertical wheel load (Fz). The rolling resistance indicates the amount of energy lost due to deformation of the tire while driving, so it also affects energy consumption. The EU tire label, introduced in 2012, assigns the rolling resistance of each tire to one of six classes.



7. DOES AN ELECTRIC TRUCK NEED DIFFERENT TIRES?

Compared to conventional drive systems, electric drivetrains require different performance characteristics from the tires. As well as helping to achieve maximum range, they are expected to reduce energy consumption by lowering rolling resistance as far as possible. Which of course helps to minimize the already low CO₂ emissions of an electric truck. New vehicle concepts also bring changes in the center of gravity, wheel loads and torque levels. As a result, the electric trucks of the future ask a great deal of their tires in terms of their load-bearing capacity and abrasion resistance, and their ability to transfer higher levels of torque to the road.

8. SO WHAT IS THE EU TIRE LABEL FOR?

The EU tire label is designed to boost the safety and the commercial and ecological efficiency of road transportation by promoting the use of fuel-efficient and safe tires that generate low tire/road noise. The underlying regulation enables consumers to make a more informed choice when purchasing tires by highlighting aspects they might not have been aware of.

9. WHAT DOES IT SAY ON THE SIDEWALL?

Among the lettering and numbers on the sidewall of a tire are the Load Index (LI) and the Speed Symbol.

10.

HOW MANY LIVES DOES A TIRE HAVE?

Definitely more than one! Professional retreading breathes new life into used tires - in some cases several times over. In the process, approximately 70 percent of the original material is retained, including the casing and some of the rubber. Compared to production of a new tire, a retread calls for roughly 50 percent less energy, consumes around 80 percent less water and requires up to 70 percent less crude oil. Added to which, the raw material uptake in a retread is reduced by an average of 50 kilograms. And at the end of the day, production of retreaded tires generates around 30 percent less CO₂ than that of new tires.



Tires, CO₂ and Climate Action

In the course of a year, almost four billion metric tons of goods are transported across Germany (2018). Some 85 percent of this total are carried by trucks based in Germany. Together with the vehicles in transit across the country, they emit around 40 million metric tons of the greenhouse gas carbon dioxide (CO₂). To help achieve the goals set out in the Paris Agreement on climate action, the German government is targeting a 55 percent reduction in CO₂ emissions for 2030 compared to the 2010 figure. Through their impact on fuel consumption, their positive effect on raw material conservation and their durability, tires play a central role in increasing fleet efficiency. And that means they have enormous potential in terms of climate action and environmental protection.

Tires form a decisive part of the system

Almost three million replacement truck tires are sold each year in Germany, 26 million across Europe and some 165 million worldwide (source: Statista, 2019). And those figures are rising. According to estimates by the European Commission, the volume of goods transported is set to rise by 60 percent by 2050. The German Ministry of Transport forecasts an 18 percent increase in goods traffic by 2030, with metric ton/kilometer figures rising by as much as 38 percent.

All of which makes commercial vehicles and their levels of quality more important than ever. Premium tires ensure safety for both drivers and goods, clear the way for on-time delivery and, through their impact on fuel consumption and their durability, make a decisive contribution to the economic efficiency of a company.

Tire manufacturers and their portfolios

There are many manufacturers in the global tire marketplace. The five largest in terms of sales are Bridgestone, Michelin, Goodyear, Continental and Sumitomo. The range of different tires available is vast, making it possible to select exactly the right tires for each application and axle position. One key consideration is whether the tires are intended for the steer, drive or trailer axle. There are ranges of tires specially designed for freight transportation. Others are ideal for transporting passengers - on urban buses or touring coaches. Still others are robust enough to carry building materials over all kinds of surfaces and are fitted to construction vehicles such as excavators, wheel loaders and tractors.

Tires are divided into categories in line with their quality. There are premium, budget and low-budget or import tires. The subsidiary brands of the major western tire manufacturers produce budget tires.



The Backdrop

More and more people are ordering goods online. Retailers too are driving demand for deliveries. Instead of placing orders and receiving deliveries at regular intervals, today people are often more flexible and order smaller quantities (source: Roland Berger). At the same time, the distances involved are getting longer. For Germany, experts expect the average distance travelled by road freight to increase to 167 kilometers by 2030 (19 percent up on 2010). The volume of freight transported in the EU in 2016 totaled more than 19 billion metric tons. Even so, most EU countries invest less than one percent of their gross domestic product in the transportation infrastructure.

Around three quarters of all freight within the EU is transported by road. And while this share is set to decrease slightly in the coming decades, the drop will be more than offset by growing volumes. Austria, Spain and Poland show the greatest growth potential here (source: Prognos).

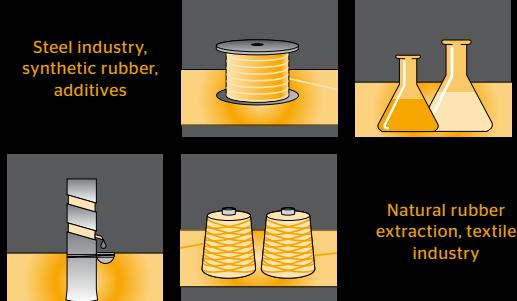
80 percent of cross-trade in the EU (transportation between two countries by a vehicle registered in a third country) is carried out by trucking companies from countries that have joined the EU since 2004.

Commercial vehicles now account for around 19 percent of toxic nitrogen oxide emissions in German cities (source: Roland Berger). By 2030, the EU is aiming to reduce greenhouse gas emissions by at least 40 percent compared to 1990 levels, increase the proportion of energy generated from renewables to at least 32 percent, and improve energy efficiency by at least 32.5 percent.

Tire Production

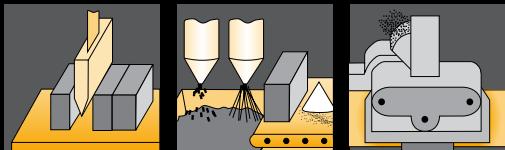
1. Sourcing materials

Various branches of industry supply tire manufacturers with raw materials. The **steel industry** supplies high-strength steel for the steel belts, the casing and the bead cores. The **chemical industry** contributes synthetic rubber as well as substances that add grip and extend the life of a tire. **Natural rubber** (latex) is tapped from rubber trees grown on large plantations in the tropics. The **textile industry** supplies the materials for the production of textile cord.



2. Producing compounds

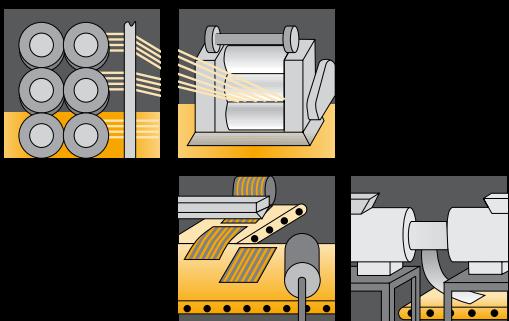
Natural and synthetic rubber are mixed with various additives. Tires are made of the best rubber compound for their intended application



Rubber portioning; weighing the raw materials and additives; production of master batches and production compounds

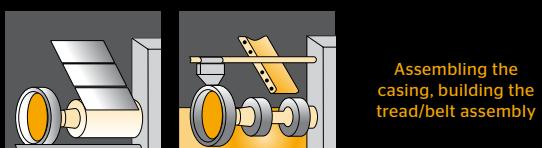
3. Manufacturing components

Steel cord: Pre-treated steel cord is embedded in one or more layers of rubber and cut to the required length.
Tread strip: A screw-type extruder shapes the rubber into an endless strip which is then cooled and cut to length.
Bead core: The core of the bead is made up of several ring-shaped steel wires, each with its own rubber coating.
Sidewall/Inner liner: An extruder forms sidewall sections of various shapes and sizes. A calender produces a wide, thin layer of inner liner.



4. Building the tire

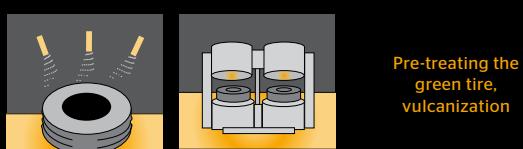
The various components come together on the tire building machine and are assembled into what is known as a "green tire".



Assembling the casing, building the tread/belt assembly

5. Vulcanization

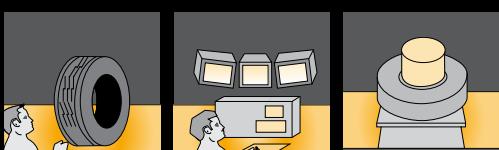
The green tire is sprayed with a fluid and given its final shape when vulcanized in a curing press at a certain pressure and temperature. The raw rubber undergoes a physical change. Molds create the tread pattern and sidewall markings.



Pre-treating the green tire, vulcanization

6. Quality control*

Then the tires are subjected to visual checks and X-ray inspection and checked for uniformity.



*Every stage of production, from raw material inspection to delivery of the tires, is subject to ongoing quality control.

From the Rubber Tree to the Road

A tire is a complex combination of components made from numerous ingredients. The story begins on a rubber tree plantation and ends with a truck out on the road. Here, we look at the key steps along the way:

1. Sourcing materials
2. Producing compounds
3. Manufacturing components
4. Building the tire
5. Vulcanization
6. Quality control

1. The tire manufacturers source the raw materials used to create the necessary compounds and components from various branches of industry. The steel industry supplies high-strength steel. This serves as the starting material for the manufacture of steel belts (steel cord) and of bead cores (steel wire). The chemical industry is a major supplier of tire ingredients – not least synthetic rubber – that help to reduce wear, increase grip, and extend the life of a tire. Then there is the natural rubber. This is obtained from rubber trees grown on large plantations. The milky fluid (latex) extracted from these trees coagulates when acid is added. Then it is washed in water and pressed into solid bales for easier transportation and storage. The bales of natural and synthetic rubber are sectioned, cut to size, weighed, and then mixed with other ingredients. The textile industry supplies the base materials (rayon, nylon, polyester, and aramid fibers) for the production of the cords that reinforce the tires.

Pre-treated steel cord supplied on wire spools is fed into a calender, where it is embedded in one or more layers of rubber. The result is a continuous sheet of cord and rubber. This is cut at a defined angle to the correct length for the size of tire and then rolled up for further processing.

2. Kneadable rubber material that has been blended in a mixer is now ready to be made into the tread. A screw-type extruder shapes the rubber into an endless tread strip. After extrusion, the tread is cooled by immersion and then cut to length in line with the tire size.

3. A multitude of textile threads are fed into the calender by a large roller device and embedded in a thin layer of rubber. This endless sheet is then cut to the desired width at 90 degrees to the direction of travel and rewound for further processing.

The core of the bead is made up of many ring-shaped steel wires, each with its own rubber coating. This loop is then fitted with a rubber apex. An extruder forms sidewall sections cut to size for the particular tire and a calender produces a wide, thin layer of airtight inner liner.

4. Now the process of building the tire can begin. The various components come together on the tire building machine and are assembled into a green tire. This is done in two stages: first the casing, then the tread/belt assembly. The green tire is then sprayed with a special fluid to prepare it for vulcanization.

5. Next comes the vulcanization process in the curing press. This is when the tire receives its final shape after being vulcanized at a certain pressure and temperature. During this process, raw rubber becomes flexible, elastic rubber. Curing press molds give the tire its tread pattern and sidewall markings.

6. Each individual stage of production – from inspection of the raw materials to delivery of the finished tires – is subjected to ongoing quality control. A multi-step process ensures that Continental tires are thoroughly checked for quality. Finished Continental tires are subjected to visual checks and X-ray inspection and checked for uniformity. Once the tires have passed all checks and inspections, they are sent to the distribution warehouse for shipment.

TIRE KNOWLEDGE I

Construction and Applications

Small in surface, big in importance

Commercial vehicle tires are distinguished by an average load carrying capacity of around five metric tons and are larger and wider than passenger car tires. They have a higher aspect ratio, which means a broader contact patch. As the physical link between a vehicle and the ground, the tires take on the full wheel load; when moving off and braking they deliver the requisite grip; and when cornering they provide lateral guidance. Tires are developed for use on a wide range of surfaces, at different temperatures and with all kinds of loads. Which is why there is a specialist tire for every application and every type of conditions. Compared with passenger car tires, truck tires bear greater loads and cover much higher mileages; a premium commercial vehicle tire can expect to cover well over 100,000 kilometers in normal use.

Tires for every purpose

Commercial vehicle tires differ widely according to their intended application. First and foremost, there is the question of the axle on which the tire will be fitted – the steer axle, drive axle, trailer axle or lift axle. In freight transportation, there are differences between tires for tractors and trailers in long-distance, regional and on-/off-road use. And when it comes to taking people from A to B, special bus tires are available for the touring, intercity and urban sectors. In addition, suitable winter tires are available for every type of vehicle. Special tires have

been developed for construction machines such as excavators, wheel loaders and tractors. In sum, there are tires for local and long-distance use for the truck, bus and construction vehicle categories, with truck and bus tires also available as summer, winter and all-season models.

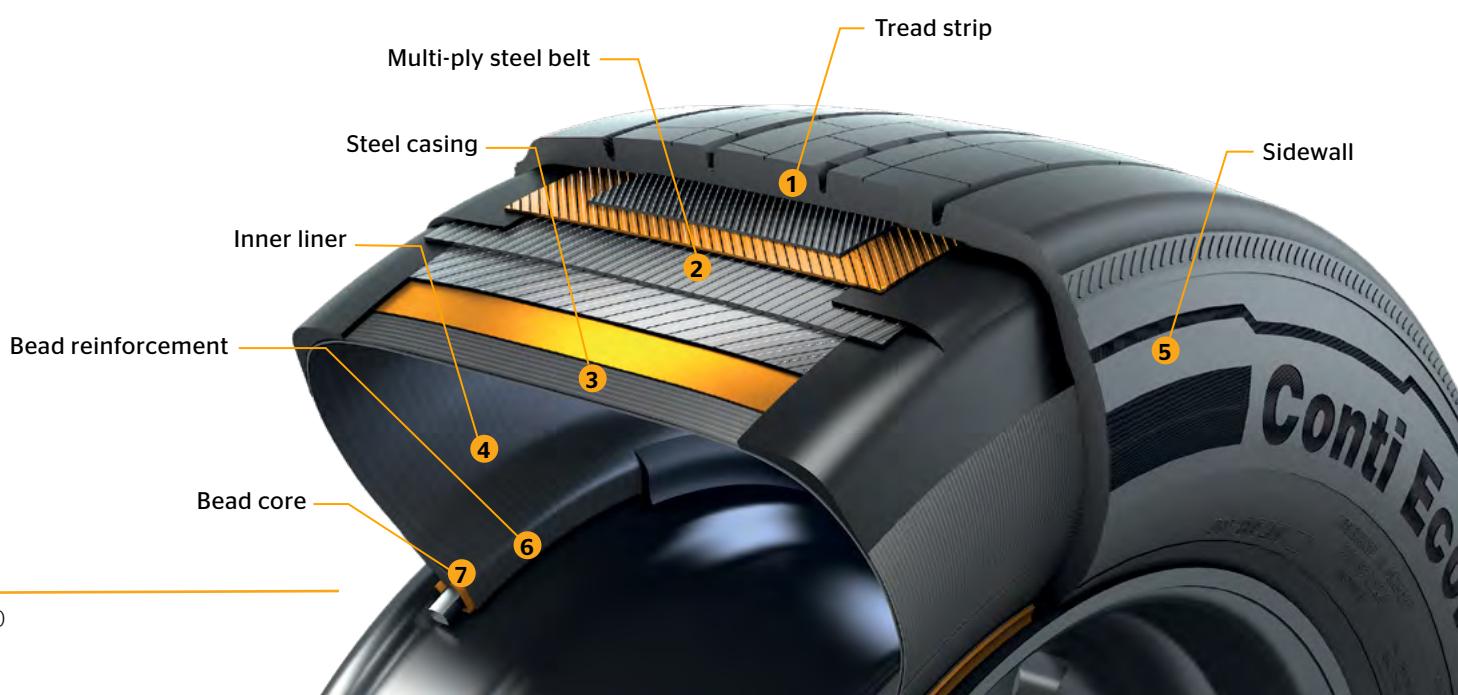
Inside the tire

There is a fundamental difference here between cross-ply and radial tires. Cross-ply tires are an older design and only sold today in modified form. Radial tires, meanwhile, were first introduced in 1948 in response to the need for a more flexible and durable tire which could absorb bumps and ruts more effectively than the cross-ply tires of the day. Even the very first radial tires provided more than twice the service life of cross-ply models. Radial tires are superior in terms of wear resistance and do a more effective job of transferring engine power and braking force to the road.

The name “radial tire” is derived from the structure of the layers in the casing. These run radially, that is to say at 90° to the tire circumference, from bead core to bead core. The layers of ply are known as the casing and consist of thin wires and fabric, arranged in a series of simple arches. In radial tires, the layers in the casing are made from steel. In contrast to cross-ply tires, the steel cord plies in radial tires lie perpendicular to the direction of travel. This gives radial tires their very smooth sidewalls. In line with ECE regulations, this type of tire is identified by an R before the figure for the wheel rim diameter.



Identify the right tire for every application with the user-friendly Continental TireFinder:
www.continental-truck.com/truck



The Different Types of Tire

The outer shell of a **tubular tire** consists of two to three layers of rubberized cotton or nylon fabric – the casing – on which the protector (a rubber coating) gives the tread its grip. Tubular tires require wheels with a concave rim well and no rim flanges. Tubular tire rims can feature an extremely light and stable construction. Their main advantages lie in their lower mass and their lower rolling resistance by virtue of higher inflation pressure. The absence of the rim flanges required by wire bead tires saves weight.

Summer tires are designed for the warmer months of the year. They have a significantly firmer tread than winter tires and offer far higher mileage and optimal rolling resistance. This is down to the tire compound, which consists mainly of synthetic rubber. As the tire's tread depth decreases, so its ability to take up and displace water also declines.

Winter tires are the tires of choice in low temperatures and wintry road conditions. The silica tread compound becomes more elastic in colder conditions and provides optimal grip on snow-covered surfaces. The tread has extra sipes, which improve the tire's ability to interlock with wintry surfaces. Decreasing tread depth causes a significant drop in grip levels.

All-season tires are hybrid tires with all the benefits of a winter tire. As its tread wears, this type of tire turns into a classical summer tire – with all of the associated advantages – thanks to a second tread layer below the winter tread. All-season tires eliminate the need to change tires twice a year or invest in summer tires.

Studded tires employ an effective technique to enable safe driving on ice and packed snow. This involves "shooting" steel or hard metal studs into the tread of suitable tires. Studded tires are permitted on snow- and ice-covered roads in northern Europe, in particular – although only during a limited period. In many parts of Europe studded tires are banned.

On-road/off-road tires are developed as specialist products for mixed on-/off-road use. These are tires with a rough tread optimized to a greater or lesser extent for use on everything from surfaced to unmade roads and rough off-road terrain. Selection criteria include the anticipated proportion of on-road and off-road driving and the tread design.

Trailer tires marked as **Free Rolling Tires** (FRT) are tires specifically designed for fitment on trailers (non-driven/trailing axle). With dual or twin tires, two tires are fitted to two separate rims or one single wheel rim on each side of the vehicle. This particular configuration is designed to distribute the axle load more effectively. Twin tires are commonly found on trucks and buses. The construction of the rims prevents contact between the two tires while under load.

Super Single tires are specialist products for fitment on the rear axles of semitrailer tractors and trailers. Here, the usual twin tires are replaced by a wide single tire. The benefits of this tire type are its lower overall weight and lower rolling resistance. Super Single tires can be equipped with special runflat elements, which enable vehicles to cover short distances – even when fully loaded – when a tire is damaged.

Solid tires have been used on various vehicle types since 1871. They stand out with their absolute resistance to punctures and ability to carry extremely high loads. The other side of the coin is a low level of damping and inferior traction. Today, almost all industrial trucks, forklift trucks and pallet trucks are fitted with solid tires, which offer three times the service life of pneumatic tires. Modern tire compounds deliver greater durability, minimize heat build-up inside the tire, and reduce rolling resistance and therefore energy consumption.

Electric vehicles require a higher level of performance from their tires than is provided by conventional tires. As well as helping to achieve maximum range, the tires are expected to support low energy consumption by offering the best possible rolling resistance. Which of course helps to minimize the already low CO₂ emissions of the electric vehicle. New vehicle concepts also bring changes in the center of gravity, wheel loads and torque levels. As a result, electric vehicles ask a great deal of their tires in terms of their load-bearing capacity and abrasion resistance, and their ability to transfer higher levels of torque to the road.

iTires like those produced by Continental are fitted with intelligent sensors which constantly record tire pressures and internal temperatures. Out on the road, the driver can view this data on a display. Each sensor is battery powered and bonded firmly with the tire's inner liner, where it is secure and protected from external influences. When a tire is replaced, the sensor can be removed from its mount and glued into place in a new mount in the fresh tire. The service life of the battery is designed to match the normal lifespan of a tire. Given the ever-increasing pace of development with measuring sensors, going forward it will also be possible to record data for additional parameters. As well as the tire pressure and temperature, the load on the tire can also be determined as well as the type of surface it is moving over. Added to which, changes to the condition of the tire – including tread depth and any damage to the casing – can be detected in good time. Finally, grip levels can also be determined, enabling hydroplaning to be avoided.

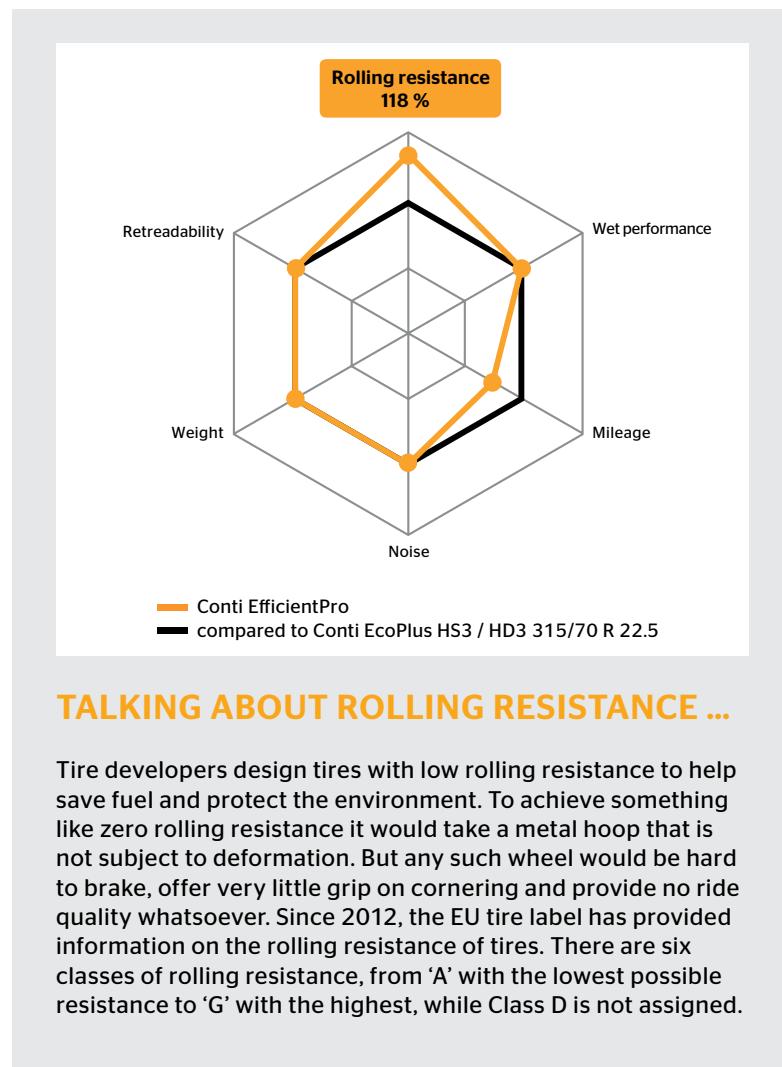
TIRE KNOWLEDGE I

Developing the Perfect Tire

Tire development is all about resolving the conflicting interests of wet grip, durability and rolling resistance. Sometimes, one of these parameters is given precedence over another. The technically highly sophisticated rubber compounds in modern premium tires today contain silica, enabling equal priority to be assigned to both durability and wet grip.

Basically, tire development is about reaching a compromise between durability and grip. To this day, no single compound has been developed with properties that are ideally suited to both cold and hot temperatures. Summer tires are used on both dry and wet roads. On dry surfaces, grip is primarily down to the right rubber compound, with the design of the tread pattern a secondary consideration in this respect. In the wet, the situation is reversed, with the right tread pattern being the crucial aspect. With winter tires, the design of the tread is more important when driving on snow, while on ice it's the ingredients of the compound that determine the performance of the tires.

When it comes to ride quality, tire/road noise and grip, the situation is similar. If the tread strip is soft and the substructure sufficiently stiff, the desired level of grip will be achieved, at the expense of ride quality. At the same time, this configuration will generate lower noise emissions. Alternatively, reinforcing the tires leads to better grip and resistance to strain and damage, at the expense of higher noise levels. The spider chart on the right (comparing the Conti EfficientPro with the Conti EcoPlus) clearly shows which tire characteristics support and oppose one another. Reducing the rolling resistance, for example, will have a negative impact on mileage. The fine art of tire development lies in harmonizing the desired improvements in one characteristic with those opposed to it.





TIRE KNOWLEDGE I

The Importance of Tire Pressure

Underinflated tires are liable to fail. They also incur a higher level of wear, which will reduce the mileage of the tire substantially. The accompanying rise in rolling resistance will increase fuel consumption and with it the vehicle's CO₂ emissions. As well as the greater risk of damage to the tire, low tire pressure can lead to a reduction in dynamic stability, higher wear and longer braking distances.

Get it right

User manuals from vehicle manufacturers and technical documentation from tire makers provide information on the correct tire pressures in each case. These values always apply to cold tires because the inside pressure of the tire increases as it warms up out on the road. You should check your tire pressures every two weeks, or every four weeks at the most - and don't forget the spare wheels.

Underinflation

Tire pressure impacts on the safe handling and fuel consumption of the vehicle and the mileage of the tires. Tires invariably lose some air as a result of diffusion through the sidewall. And

although this is initially a tiny proportion, over time it adds up to a noticeable loss of pressure. What does that mean? It means the tires no longer provide sufficient lateral guidance, the vehicle responds sluggishly to steering commands, and both straight-line driving and braking distances deteriorate. When a tire is underinflated, the contact patch becomes larger, while a greater part of the wheel load acts on the outer edges of the tire and less on the center of the tread. Depending on the speed and weight of the vehicle, this divergence in the distribution of forces leads to flexing of the tire and the build-up of heat to over 150°C. The tire overheats in the shoulder area, leading to structural damage and separation of parts of the tread strip and belt. Flexing also means greater rolling resistance with a matching rise in fuel consumption. When tires are underinflated by 0.2 bar, their life expectancy falls by around 15 percent. At 0.6 bar below the recommended pressure, a 45 percent drop in service life can be expected.

Why tires lose pressure

Objects embedded in the tread, damage to the sidewall or a defective valve can all lead a tire to fail when subjected to high loads. Dirt, dust and moisture all impact on the performance of a valve.

Regular checks are the answer

The quality and full capabilities of modern premium tires can only be fully leveraged by regularly checking all the relevant parameters. This includes ongoing monitoring of the tire pressure and regular visual inspection of the inner and outer sidewalls of all the tires on the vehicle.





An Automatic Check

Today, the ongoing monitoring process is made simpler by modern tire pressure monitoring systems (TPMS) created in the context of Logistics 4.0. These smart data-system solutions provide drivers with timely warnings of tire failure. In 2013, Continental's Commercial Vehicle Tire business unit staged the global launch of its ContiPressureCheck tire monitoring system for individual vehicles. This system has now been built into more than 35 telematics systems. 2017 saw the advent of ContiConnect™ - a tire monitoring solution for multiple vehicles, based on a reader station in the fleet yard. The yard reader is the connectivity component of ContiConnect that receives the data from the tire sensors in the vehicles within the yard and transmits it directly to the fleet manager, helping them maintain a clear overview of the state of the tires. The yard reader station is installed at the fleet's most used touchpoints, such as washing bays, fuel stations or other checkpoints within the yard. It reads the data from the tire sensors and sends it via cellular connection to the backend, where it is analyzed and interpreted.

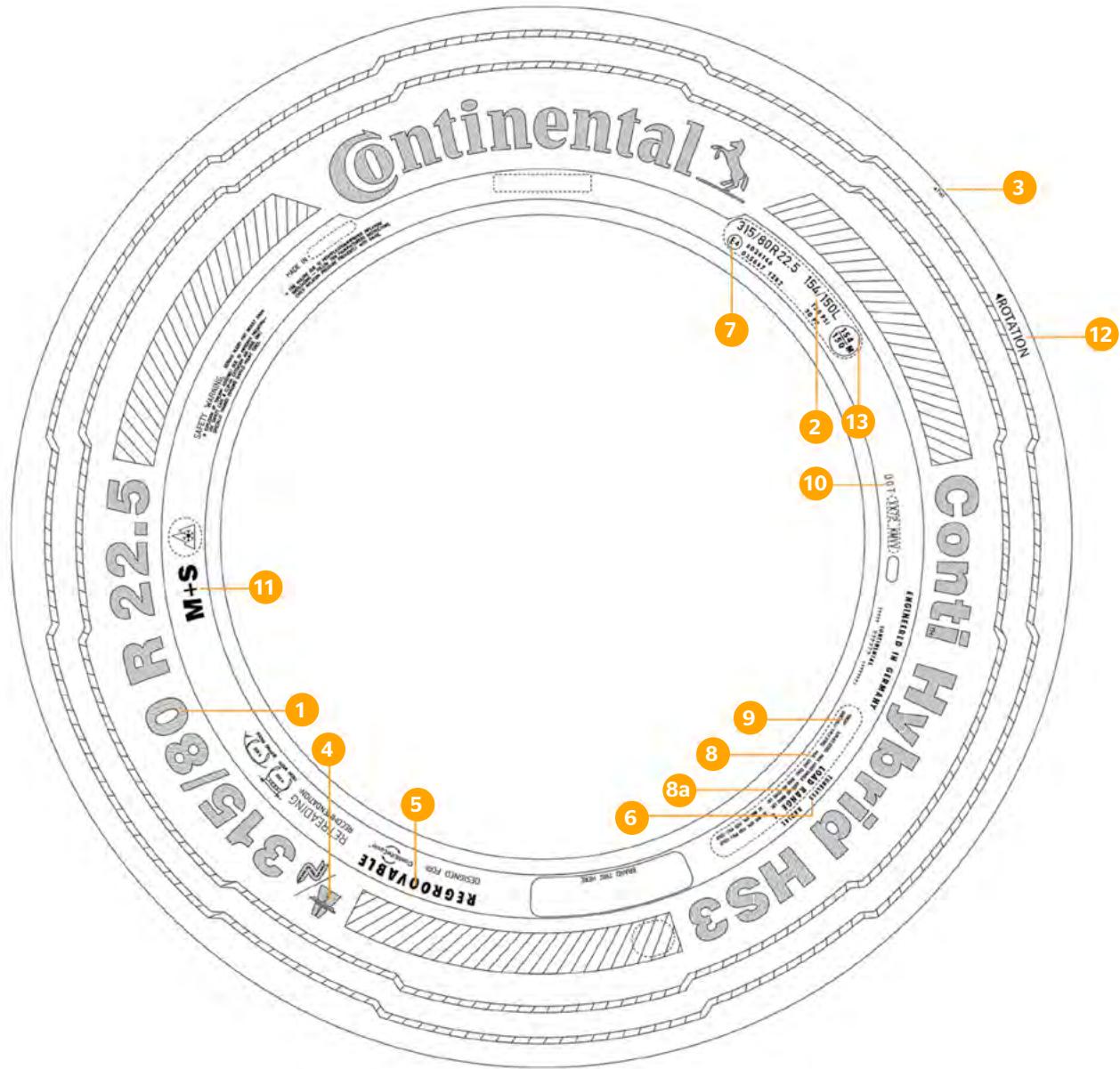
The ContiConnect web portal is the interface where fleet managers can proactively monitor tire condition on all their vehicles. The web portal is a browser-based application and can be accessed from any type of internet-enabled device. ContiConnect™ is based on smart sensors that continuously measure the temperature and pressure inside the tires. Each sensor sends its measured values to the appropriate TPMS system, ContiPressureCheck™ or ContiConnect™. The two systems can also be used in parallel.



For further details, see
www.continental-tires.com/transport/tire-monitoring/conticollect



TIRE KNOWLEDGE I



What It Says on the Sidewall

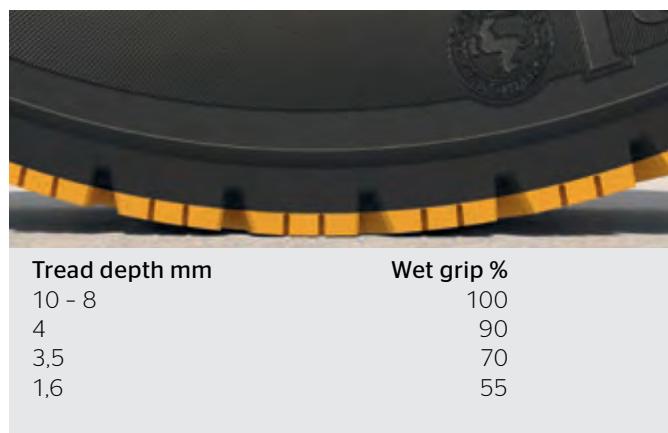
1 Size designation	7 E = Tire complies with UNECE Regulation 54	11 M + S and 3PMSF designation as suitable for winter use. M + S = mud + snow; 3PMSF = 3-peak mountain snowflake
2 Service description	8 US load designation	12 Direction of rotation
3 TWI = tread wear indicator	8a US load range	13 Alternative load and speed (single point)
4 Recommended use (Continental truck tires only)	9 Data as per US safety standard on inner construction	
5 Regroovable	10 DOT = US Department of Transportation (responsible for tire safety standards)	
6 Tubeless		

All About Tread

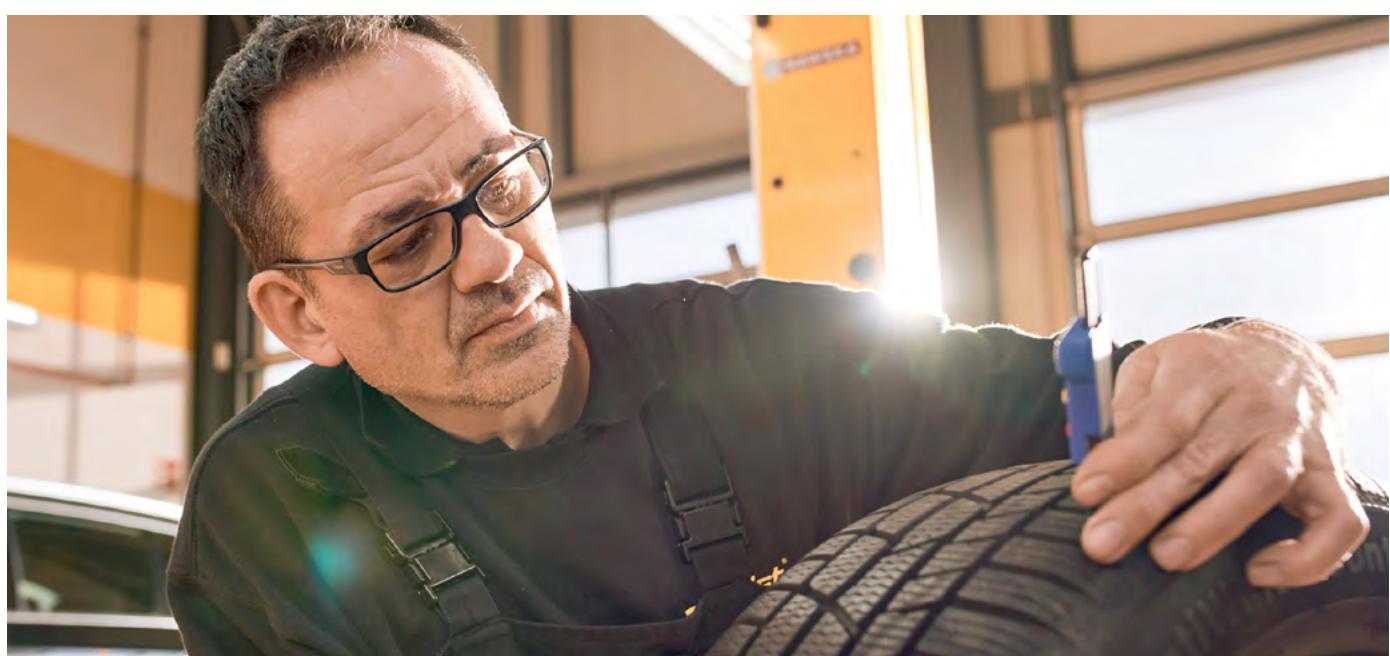
In Europe, the legal minimum tread depth for summer and winter tires is 1.6 millimeters. Experts recommend maintaining a safe tread depth of three millimeters in summer and four millimeters in winter. In the case of winter tires, their fitness for wintry conditions is substantially impaired when the tread depth falls below four millimeters, particularly when driving on snow, because they cannot deliver the necessary grip.

Tread depth is measured with a gauge or with the aid of other indicators. Tread Wear Indicators (TWI) are mandatory for passenger car tires and retreads, as well as for commercial vehicle retreads. They are located in the base of the tread and become visible when the tire reaches the minimum permissible tread depth. For its part, Continental offers the Visual Alignment Indicator VAI™ – a wear indicator integrated into the tread itself. There are two indicators per tire, one on each shoulder. When they both show equal wear, the wheels are correctly aligned. Unequal wear indicates incorrect wheel alignment, which will lead to premature tire wear and higher fuel consumption. Optimum wheel alignment can increase the mileage of a tire by up to 10 percent, with an improvement in fuel economy of up to three percent.

On dry roads, drivers might not even notice that their tires are worn. But that is in stark contrast to driving in the rain or on wet asphalt. The British Rubber Manufacturers Association ran a series of tests to assess the impact of tread depth on wet grip. Their findings are shown here. The data collected and analyzed points to the conclusion that with a tread depth of 3.5 millimeters and below, grip decreases dramatically with every kilometer driven. The ability of a tire to deliver traction falls away rapidly



as the tread depth decreases. One simple means of checking your tread depth is to use a 1-euro coin. The golden outer ring measures exactly three millimeters. If the ring disappears into the tread grooves, the tire still has enough tread. But if you can see it, then it's time to take a closer look and replace the tire.





TIRE KNOWLEDGE II

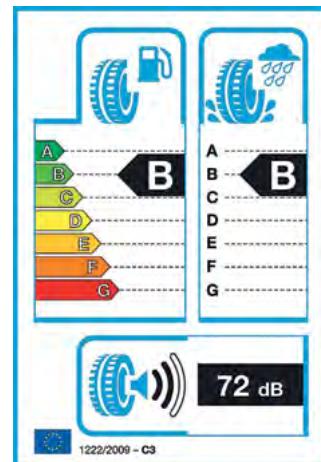
The EU Tire Label

Covering three aspects – efficiency, safety and environmental protection – the label indicates a tire's performance in terms of fuel efficiency, wet grip and external rolling noise. The principle is similar to the energy efficiency label on washing machines, refrigerators and other electric household appliances. There are seven categories from A to G, each assigned its own color, with A (green) indicating the best performance and G (red) the worst.

The aim of the label is to increase the safety and the environmental and economic efficiency of road transportation by promoting the use of fuel-efficient, safe

and quiet tires. It allows consumers to compare tires more objectively before they buy and to incorporate these criteria, along with the findings of other tire tests, into their purchasing decision.

The EU label applies to truck, van and car tires, but not to retreads, tires not approved for road use such as racing tires, temporary use spare tires, classic car tires, motorcycle tires, studded tires, tires for earthmoving machines and agricultural tires.



WHAT THE LABEL SHOWS IN DETAIL

Wet grip / braking performance

Wet grip is one of the most important safety properties of a tire. A good value means a short braking distance on a wet road. Improvement by one class corresponds to a reduction of the braking distance by between five and ten meters under emergency braking from 80 km/h. And in an emergency, every meter counts.

Fuel efficiency / rolling resistance

The rolling resistance directly influences a truck's fuel consumption and is therefore an important factor from an economic and ecological point of view. The difference between a dark green A and a light green B classification can represent fuel savings of up to 3.5 liters per 100 kilometers. Low fuel consumption has a positive effect on the carbon footprint of the vehicle.

External rolling noise / noise emission

The rolling noise of a truck tire contributes to traffic noise and thus environmental noise pollution. Along with the measured value in decibels (dB), the label shows the noise level in classes (between one and three sound waves). Tires with three sound waves do not comply with the current noise regulations introduced in 2016. Tires with two sound waves are below the existing limit, while those with one sound wave are below it by more than 3 dB.

New Regulations from 2021

From 2021, new rules will make tire labels more visible and more accurate. This is the aim of the reform of the EU tire label originally introduced in 2012, which takes effect in 2021. Commenting on the agreement reached by the European Parliament, the European Commissioner responsible, Miguel Arias Cañete, said the new label was designed to help consumers switch to energy-efficient tires, enabling them to "reduce their fuel consumption significantly, saving money and helping the environment."



The Lifespan of a Tire

How much mileage can be expected from a tire will depend on the type of ground it has to cover and whether it has to handle local or long-distance work. If the tire pressure is too low, this will have a negative impact on both mileage and fuel consumption.

Normal tread wear results from contact between the tire and the ground. Incorrect wheel alignment can lead to excessive wear on the inner or outer shoulder of the tire. Driving over unmade roads and rough or rocky terrain will accelerate tire wear. Overinflated tires will wear unduly in the center of the tread strip, while underinflated tires will show excessive wear on the outer ribs. Unbalanced wheels also lead to uneven tire wear because they do not track straight and true.

Aging in a tire results from physical and chemical processes, including climate- and weather-related effects such as ultraviolet light, moisture or extremely high or low temperatures. These alter the elasticity and grip of the tire, something that also applies to new or little-used tires. To counteract this process, substances that slow the aging process are added to the tire compound. This way, even a tire that has been stored - correctly - for several years (although no more than five) will meet the specification of a new tire and remain fully fit for purpose. Tires should be replaced after ten years at the latest.

VISUAL ALIGNMENT INDICATOR (VAI)

The most common causes of punctures and the associated dangers are incorrect tire pressure, impact breaks and tire wear. Even minor errors in wheel alignment will lead to higher wear and fuel consumption, as well as damage to the casing. Continental's Visual Alignment Indicator VAI™ comprises a system of sipes on the shoulder of the tire. It enables incorrect wheel alignment to be detected without the need for electronic measurement. After a few thousand kilometers it is clear whether the wear on the inner and outer shoulders of the tire is identical. Unequal changes in the VAI™ are easy to spot with the naked eye and tell the driver that the wheel alignment - on both sides of the vehicle - needs correcting.

How Tires Age

Tire aging is the result of chemical and physical processes which, over time, bring about irreversible changes in the material properties of a tire.

Post-vulcanization aging

Chemical tire aging is the result of various tire components being oxidized due to the impact of oxygen, ozone, UV radiation, temperature, moisture and the passage of time. Oxygen and ozone initiate oxidation of the polymer chains in the tire, causing chain scission and resulting in the formation of new crosslinks. This is known as post-vulcanization. Over time, this degrades component adhesion and elasticity, and thus also tire performance.

High temperatures and humidity accelerate this phenomenon, which is externally manifested as ozone cracking. Static and dynamic antioxidants incorporated into tire compounds counteract chemical aging processes. Static antioxidants form a protective surface film of wax and, among other effects, inhibit surface ozone cracking. Dynamic antioxidants react more quickly with oxygen and ozone than do the polymers in the tire and so have a protective effect. Antioxidants ensure that, if tires are properly used and stored, they will wear out well before they become too old to use.

Correct storage

Correct storage leads to a marked slowdown in the tire aging process, which then only effectively begins when the tires are first used.

Ideal storage conditions will be cool, dry, with a low air exchange rate and no equipment present that generates ozone in the storage area – such as electrical motors. Wherever possible, the storeroom should not be exposed to direct sunlight. All contact with solvents, fuels and lubricants, chemicals, acids or disinfectants should be avoided. Stored tires should not be exposed to stress, pressure, tension or distortion. When stored for long periods, tires should be placed upright in suitable tire racks at least ten centimeters off the floor.

‘BRAND NEW’ AND ‘GOOD AS NEW’

As defined by the German Tire Retail and Vulcanisation Trade Association (BRV), new tires are ‘brand new’ (fabrikneu) if they are less than three years old. The BRV calls five-year-old tires ‘good as new’ (neuwertig). Why make the distinction between two tires which are both in mint condition? Because some tires spend considerable periods in the warehouse before being sold. “There are several reasons why tires might need to be stored for longer periods in order to safeguard availability,” explains René Siebeneicher, Head of Regional Service/Technical Customer Service, Replacement Tires Germany at Continental. First there is the complexity of the product itself, he says, with enormous ranges of tread patterns and sizes, different load index ratings and speed symbols, and unique OE specifications. “Added to which, there are seasonal shifts in demand and sometimes unpredictable changes in the market significance,” says Siebeneicher. Moreover, capacities at the various tire plants need organizing as efficiently as possible – a factor with a positive impact on the retail price for the customer. “The normal storage period for new tires involves no drawbacks in terms of customer rights,” our expert confirms. “For the consumer, the warranty period begins on the date of sale, not when the tire was manufactured. We don’t think legal regulations on tire age make much sense, because service life and mileage will depend on the sum of storage, operational and service demands made on the tire.” A tire is exposed to all sorts of stress during its lifetime, including load, speed, inflation pressure, longitudinal and lateral forces and damage, among others. As these conditions can vary widely, it is not possible to forecast the life expectancy or define a legal expiry date solely on the basis of when the tire was manufactured.

TIRE KNOWLEDGE II

Second Time Around

Retreading

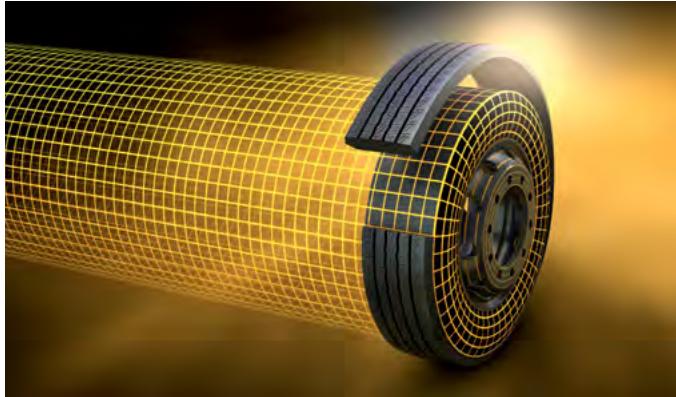
Retreading grants a tire a second lease of life and sometimes even a third or fourth. In the process, some 70 percent of the material in the tire is retained – in the shape of the casing and a proportion of the rubber. The remaining 30 percent of rubber material goes for thermal recycling. Compared to production of a new tire, retreading requires some 50 percent less energy, around 80 percent less water and up to 70 percent less crude oil. A retread also requires 50 kilograms less raw material on average, which equates to savings of approximately 70 percent compared to production of a new tire. Overall, production of retreads generates around 30 percent less CO₂ than that of new tires. Two methods are employed: hot retreading (mold cure) and cold retreading (precure).

Two options: cold or hot

Cold retreading begins with painstaking visual inspection of the used casing. At this early stage, any casings unfit for retreading are rejected. Then comes a process called shearography. This optical, non-destructive test will identify any defects that a visual inspection cannot spot – damage such as belt or tread separation, air bubbles or moisture. Here again, casings that cannot be repaired are rejected. Then the casing is buffed, which involves a computer-controlled machine stripping rubber off the old tread.

With any damage now carefully assessed, it is time to repair the casing. This involves patching any nail holes and grinding rust off the steel cord. Then in a computer-controlled





process, an unvulcanized bonding gum is applied to the buffed surface, followed immediately by application of a pre-vulcanized tread strip. Packed into a curing envelope, the tire is then cured under pressure in a hermetically sealable pressure vessel called an autoclave, causing the casing, gum and tread strip to bond. Vulcanization occurs at a temperature of approximately 110°C and takes around four hours. Finally, the finished tire is subjected to thorough inspection.

In **hot retreading**, the pattern on the tread is formed during the vulcanization process at a temperature of approximately 150°C. Up to the point at which the casing is repaired, the procedure is the same as for cold retreading. From then, the next step involves bead-to-bead application of an unvulcanized rubber compound by a computer-controlled extruder. With this tread material applied, the casing is placed in a mold with the required tread pattern and vulcanized at around 150°C. Here too, the final step involves thorough inspection of the finished tire.

Using less raw material makes a big difference for the climate

There are many good reasons to opt for retreaded tires: Production of a new bus or truck tire requires between 60 and 80 kilograms of rubber compound. A retread accounts for just 15 kilograms or so - roughly one quarter of the amount. And while producing a new tire calls for 83 liters of crude oil, a retread gets by on 26 liters. That represents a reduction of two thirds. Overall, the amount of raw material consumed by a retreaded tire is around one quarter of that required for a new one.

Scientists have registered a new record high for the level of the greenhouse gas carbon dioxide in the atmosphere: For the first time since measurements began, the global monthly average

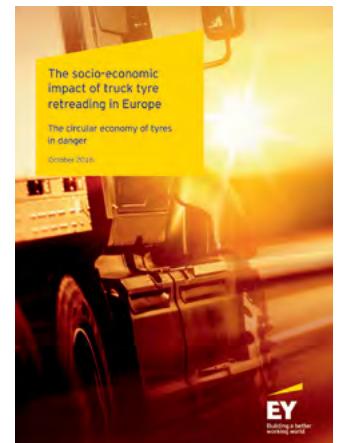
carbon dioxide (CO₂) concentration exceeded 400 ppm. By opting to use retreaded tires, trucking companies, vehicle manufacturers and consumers are actively helping to ensure that this development goes no further than necessary. Because production of a retread generates one third of the greenhouse gases emitted during manufacture of a new tire. At 100 kilograms of CO₂ per tire, that equates to annual savings of up to 500,000 metric tons of CO₂.

European study on retreading

As the German Tire Retail and Vulcanisation Trade Association (BRV) points out, retreading truck tires in Europe aligns well with the principles of the circular economy, benefits the environment and safeguards local jobs. To provide public and private stakeholders with a quantified understanding of the socio-economic and environmental issues at stake for Europe with regard to the industry's recent developments, management consultants EY (Ernst & Young et Associés) joined with representatives of the retreading industry to draw up a study. According to the findings,

retreading today supports over 19,000 direct, indirect and induced jobs in the EU.

Further information on the topic can be found (in German) on the BRV website. The study itself, titled "The socio-economic impact of truck tire retreading in Europe - The circular economy of tires in danger", can be downloaded here https://www.etrma.org/wp-content/uploads/2019/09/201611-ey_retreading_lr.pdf



TIRE KNOWLEDGE II

VECTO: Reducing CO₂ Emissions by 2030

Commercial vehicles are responsible for generating approximately one quarter of all CO₂ emissions from road traffic. In efforts to promote a healthy planet, cutting fuel consumption – and thereby reducing emissions of carbon dioxide – is crucial. Using less fuel also means lower fleet operating costs, making trucking companies more competitive.

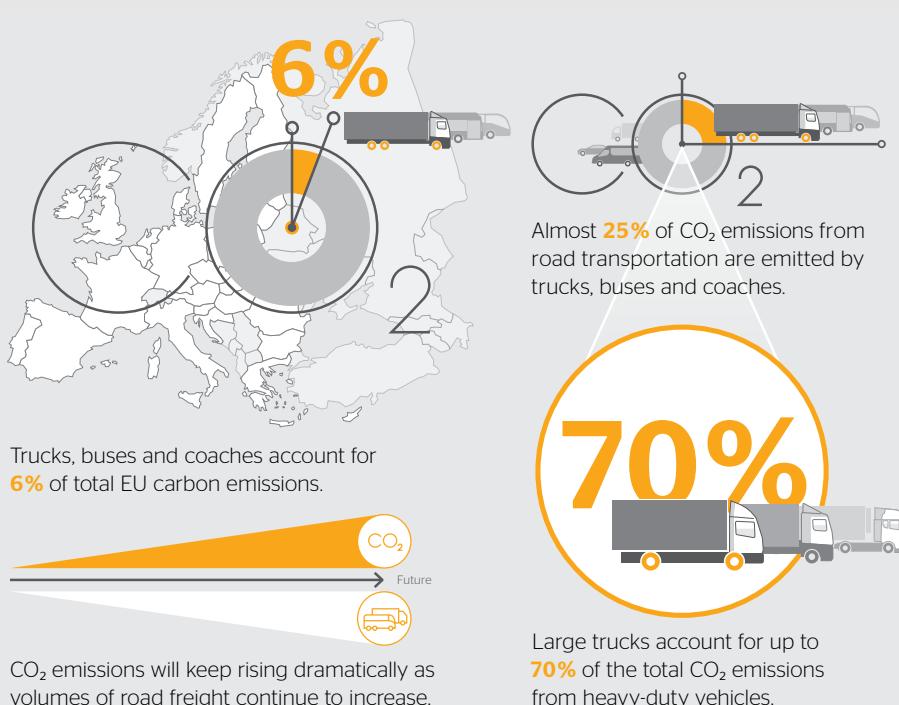
30 percent less by 2030

Protecting the environment concerns all of us – as individuals and as organizations. In the interests of a sustainable society we need to achieve a global reduction in greenhouse gas emissions – primarily CO₂. The transport sector as a whole can make a major contribution to climate action by reducing its fuel consumption and the associated carbon

emissions. Lower emissions of carbon dioxide hold the key to a green future for planet earth.

On March 14, 2019, the EU Regulation setting out CO₂ emissions standards for new heavy-duty vehicles (HDV) came into force. The aim of these new EU rules for commercial vehicle manufacturers is to arrive at a marked reduction in carbon

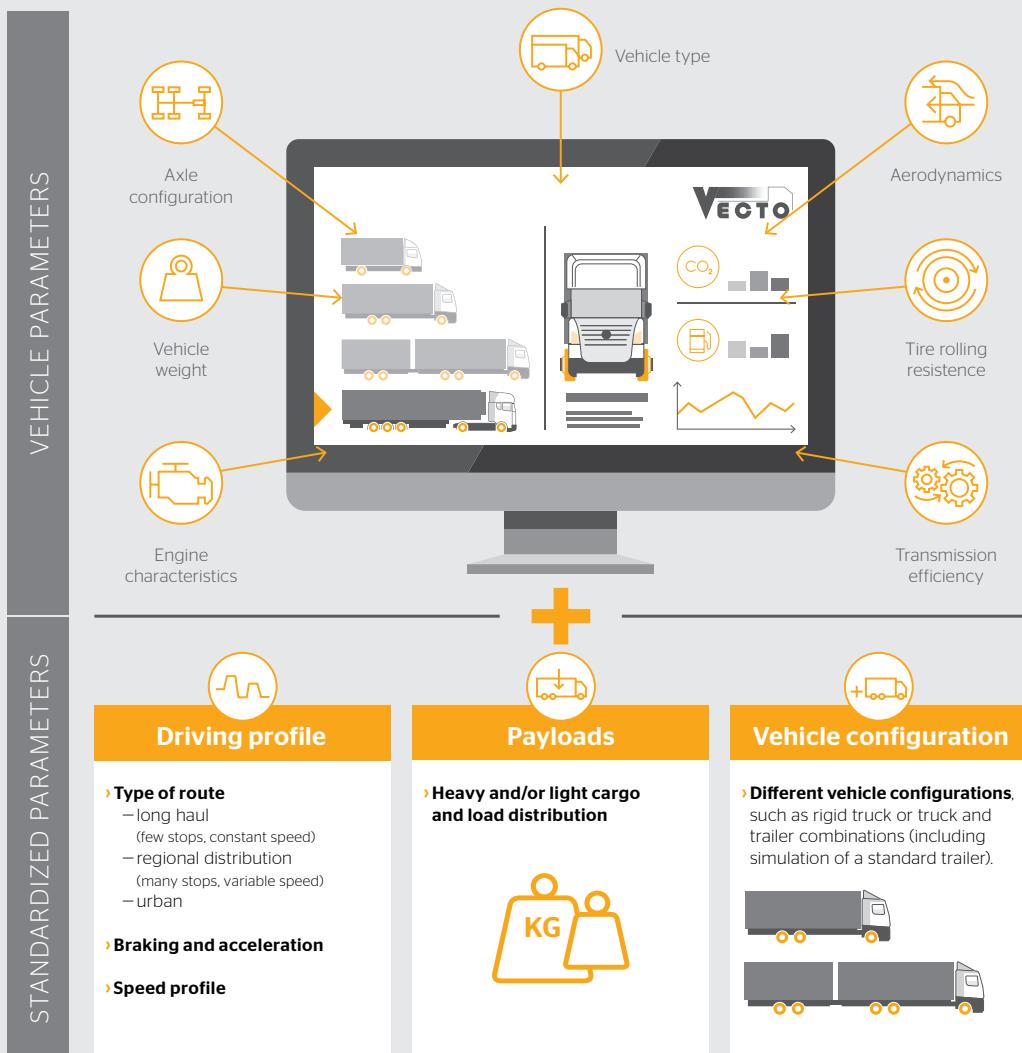
dioxide emissions by 2030. They will mean cutting average CO₂ emissions from new HDVs by 15 percent by 2025 and 30 percent by 2030 (baseline 2019-2020). If manufacturers fail to comply with the new regulations, they will incur penalty payments for each vehicle. And while the current rules apply to truck manufacturers, future regulations are expected to cover fleet operators as well.



Rolling resistance a key factor

When it comes to tires, rolling resistance is one of the main factors impacting on fuel costs, which can account for up to 30 percent of fleet operating costs. The main source of power losses in a truck is the engine, at around 55 percent. But in second place comes rolling resistance, accounting for just over 15 percent.

The level of CO₂ emissions is directly related to the fuel consumption of the fleet and the rolling resistance of the tires. Premium tire manufacturers today offer the right tire for every application. And particularly with a view to sustainability and fuel consumption, a wide selection of products is available.



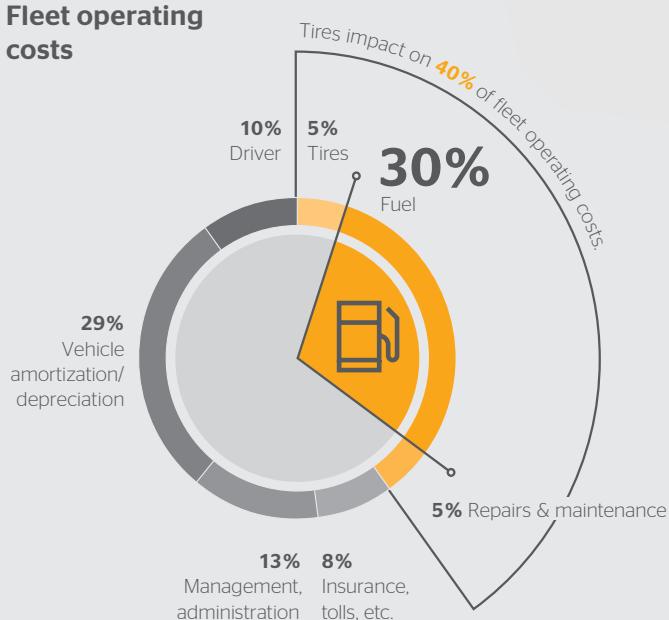
For further details, see:
www.continental-tires.com/transport/fleetsolutions/co2-regulations-veco

VECTO simulation tool

To assist the transportation industry and OEMs, the European Commission has launched the VECTO simulation tool. VECTO stands for Vehicle Energy Consumption Calculation Tool and it helps to calculate a vehicle's CO₂ emissions.

With the aid of VECTO, manufacturers can simulate the CO₂ emissions and fuel consumption of any truck configuration. The tool draws upon a number of standardized parameters, including simulated driving behavior, engine output, aerodynamic drag, and the rolling resistance of the tires. This makes for greater transparency regarding the carbon dioxide emissions and fuel consumption of each individual truck configuration, with a positive impact on fuel efficiency across the fleet.

Fleet operating costs





TIRE KNOWLEDGE II

Tires for Alternative Drive Systems

Powertrains that look beyond the internal combustion engine, such as electric and fuel cell drive systems, call for different properties from their tires. We are witnessing changes in wheel loads and shifts in axle weight distribution. For the development departments of tire manufacturers, the challenge of the next few years will be to come up with new tires that are ideally geared to alternative drive systems and at the same time offer the customary top level of safety, efficiency and environmental protection.

Tires for electric trucks

Electric mobility is driving a shift in emphasis when it comes to tire properties. Despite reduced powertrain complexity, wheel loads may still rise on account of the weight of the traction batteries. This can mean that the load-bearing capacity of the tires needs to rise. At the same time, it is important to make efficient use of the battery capacity to deliver the greatest possible range, which means employing tires with the lowest possible rolling resistance. This will also drive a drop in vehicle emissions.

New vehicle concepts also spell changes in vehicle dynamics – not least owing to shifts in weight distribution and levels of torque. These are accompanied by revised requirements for the tires in terms of wear resistance, wet grip and handling, leading to a series of robust tires specially designed for electric mobility.

TIRE KNOWLEDGE II

From Field to Road: Dandelion Rubber

Environmental protection, sustainability, energy efficiency and resource conservation – tire production too is focused on these goals. That's why Continental uses rapeseed oil in place of the fossil-based crude oil and opts for cellulose fibers and viscose instead of polyester. The company is aiming to achieve a dramatic reduction in its consumption of crude oil and identify a replacement for the scarce resource that is natural rubber – while also, of course, ensuring that this presents equally good or better handling characteristics out on the road.

Since late 2018, Continental's search for a replacement material has been centered on Taraxagum Lab Anklam, a research and test facility in the town of Anklam in north-eastern Germany. Here, on a site covering 30,000 square meters, Continental is studying the cultivation and processing of the Russian dandelion as an alternative to rubber trees on tropical plantations. Continental duly became the world's first tire manufacturer to fund significant investments in the industrialization of dandelion rubber.

Large-scale cultivation of the Russian dandelion on fallow land in Europe would enable the rising global demand for natural rubber to be met in an environmentally compatible and reliable way. At the same time, this would avoid the need for costly long-distance transportation – with all its environmental drawbacks.

The aim is for this plant to meet a growing proportion of the demand for natural rubber in series production within the next ten years. In the process, the advantage of natural rubber over many kinds of synthetic rubber – its greater flexibility at low temperatures – will be retained. A high proportion of this expensive rubber gives winter tires their dependable grip on snow and ice. So a low-cost raw material obtained from dandelion roots could provide an affordable means of further improving the performance of these tires.

The development team charged with driving forward the research in Anklam is made up of around 20 agricultural scientists, chemists and production and process engineers. The arrival of the Continental facility is also opening up new opportunities for local farmers looking to repurpose their fields.



The company's research into the use of renewable raw materials was launched in 2011 in collaboration with a number of partners. These include the Fraunhofer Institute IME in Münster, the Julius Kühn Institute in Quedlinburg, and expert plant breeder ESKUSA in Parkstetten (all in Germany). Their research work is subsidized by the German Federal Ministries of Education and Research, and Food and Agriculture.

The first sample of a premium winter tire with a tread strip made entirely of dandelion rubber took to the roads in 2014. Two years later, at the 2016 International Commercial Vehicle Show (IAA) in Hanover, this was followed by the first truck tire with a tread strip made of Taraxagum rubber.

What the Experts Say

An interview with Continental truck tire development engineer Dr. Frank Walloch



Dr. Frank Walloch

What were the key aspects of truck tire development in the past? What are you focusing on now and what does the future hold?

Dr. Frank Walloch: Until 2010 or so the main focus for truck tires was on mileage – durability. So we engineered tires that would bear heavy loads and could be relied upon to deliver reliability and a long service life. That's still essentially the way things are today; those requirements still stand. But the introduction of the European Tire Label brought other requirements that we had to meet with our third generation of tires. Mileage was joined on center stage by low rolling resistance, wet grip and noise emissions. Around this time, many new requirements were tabled in response to the increasing economic impact of rising fuel prices and tougher competition. In line with state-of-the-art fleet management, which is ultimately geared to generating a high level of economic efficiency, we aimed – and still aim – for our tires and assistance systems to help operators achieve the lowest overall driving costs. But for some time now, the need for efficiency has been joined by demand for lower emissions. Here too, as developers we've put a lot of hard work into responding to this trend: Both in isolation and together with assistance systems, our tires make an effective contribution to reducing CO₂ levels in the commercial vehicle sector. This is also in the interests of the commercial vehicle manufacturers, who now have to provide the buyer with a certificate showing details of fuel consumption and carbon dioxide emissions when their vehicles are delivered.

The European Commission has set the commercial vehicle sector strict targets for the coming years with the aim of reducing emissions of the greenhouse gas carbon dioxide. How does the legislative backdrop affect the tire development process?

Dr. Frank Walloch: The new regulations and targets within the context of VECTO certification are being flowed into the development of our fifth generation of tires. We are going to be

reducing the rolling resistance of our tires even further. And at the same time, we are offering intelligent sensor systems that provide users with a constant flow of information on the condition of their tires. This includes automatic tire pressure and temperature monitoring and will in future also provide data on the condition of the tread.

What can Continental offer its customers when it comes to cutting the CO₂ emissions of their vehicles?

Dr. Frank Walloch: Thanks to an ongoing process of dialogue with the vehicle manufacturers and operators and taking account of the EU regulations, we know which paths we need to follow in order to generate a more than adequate response to the demand for lower emissions on the one hand and the desire for greater economic efficiency on the other. Further optimization of rolling resistance bring savings in terms of carbon dioxide and fuel. And we are already certain that our improvements in this respect will be well into double digits in percentage terms. One typical example here is our new long-distance transportation tire, the Conti EfficientPro, which effectively showcases what our development engineers can achieve.

What can we expect from the fifth generation of truck tires from Continental?

Dr. Frank Walloch: Our next generation of tires is mainly aimed at the original equipment market although we will never neglect the replacement tire business. We are focusing on new technologies, new materials, belt and casing constructions and modified production processes. As well as aiming for lower CO₂ emissions, we want to see our tires turning in top performances when it comes to mileage as well. On the one hand, we need to further reduce the rolling resistance in order to make a substantial contribution to reaching the CO₂ targets across the EU. But on the other hand, our tires need to offer a long service life and deliver impressive traction and wet grip. From a development point of view that is not an easy undertaking, but when successfully implemented it gives us a decisive competitive edge.

As part of the Vision Zero project, we maintain an unwavering focus on the operational safety of our tires.

How can you achieve further reductions in rolling resistance without negatively affecting the other properties of the tire?

Dr. Frank Walloch: We start with the mechanics of the tire; wherever heat occurs in the tire; where the rolling resistance is generated. To get to the bottom of this tire behavior, we work with new simulation tools – our thermal tools. These provide us with a crystal-clear indication of the thermal behavior of the

tire structure. If the build-up of heat is not uniform, we modify the tire structure until ultimately a uniform temperature level is reached.

What are the decisive tire properties when it comes to safety?

Dr. Frank Walloch: As part of the Vision Zero project, we maintain an unwavering focus on the operational safety of our tires. And we ensure this safety through the structure of the tire, its compound and the design of the tread strip. This approach covers the full lifetime of the tire, and benefits its wet braking properties and dynamic stability in particular. In the bus tire segment, with our Conti Coach HA3 M+S tire, we are currently the only manufacturer that scores an A grading on the tire label for wet grip. In the winter tire segment too we offer a wide range of tires geared not only to moderate wintry conditions but also to spells of more severe weather. And with intelligent sensor systems that provide continuous feedback on tire pressure and temperature we can provide an even higher level of tire safety.

What's your view on airless tires? Is that where the future lies? Is Continental developing anything along these lines?

Dr. Frank Walloch: Ideas like this keep cropping up. In the passenger car sector they've taken them a little further. When it comes to trucks, this kind of new concept is far more difficult to realize, not least on account of the very heavy loads that commercial vehicles have to carry. In our view, it will be a very, very long time before these innovative tire designs meet the complex requirements in our field, if indeed they ever do so. Of course, we too give thought to innovations in terms of tire construction, but we believe there are more pressing challenges that first need to be met in the field of tire development.

How do you see tire development responding to the conflicting interests of economics and the environment?

Dr. Frank Walloch: We have concrete strategies in place that respond to both economic necessities and environmental needs. Both fields are of great importance for tire development and tire applications. So for us it's not a question of conflicting interests. Economy and ecology are two sides of the same coin that call for a parallel approach and need considering as an integral whole.

Turning now to the Taraxagum Lab - which alternative raw materials are available today and which do you expect and need going forward?

Dr. Frank Walloch: We are currently testing Taraxagum - dandelion rubber - for its suitability for applications in the truck sector.

We are in the process of manufacturing initial test tires with which to study the performance of these tires. The Taraxagum Lab represents a USP for Continental and the ongoing tests are an important strategic step for us. At the same time, we are also pursuing other means of conserving resources and/or cutting our consumption of materials. These include our multi-award-winning process for recycling tires.

Among other things, this involves returning the crumb rubber produced during retreading to the tire production cycle. That said, our recycling concept goes one step further and envisages the substitution of other materials as well.

How would you describe the potential and importance of retreading?

Dr. Frank Walloch: Retreading has great potential and, in my view, it will take on more and more importance going forward. We will see improvements in the process technology and the tires themselves will become suitable for additional applications. One important consideration here, however, is that new tires must be provided with the potential to be retreaded. In other words, they need to be durable and robust enough for a third or even fourth lifetime. Our acquisition of the market leader Bandvulc - based in the UK - has opened up new opportunities for us to make good progress in this field.

How do you assess Continental's position in view of these many different requirements and parameters?

Dr. Frank Walloch: I'm convinced that these new requirements represent an opportunity for us. As a technology-driven company with decades of experience in developing and manufacturing tires, we reckon that we are in good shape to face the future - and that also applies to the Group as a whole. If anyone can come up with meaningful responses to the new requirements and targets for lower CO₂ emissions, then we can.

Note: In January 2020, Dr. Frank Walloch was succeeded by Hinnerk Kaiser.

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Contacts



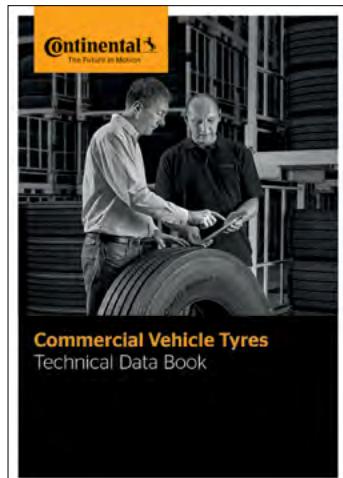
On request, we can put you in touch with our colleagues from the various departments at Continental, who will provide expert information and answers to your questions.

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Information in Brochures



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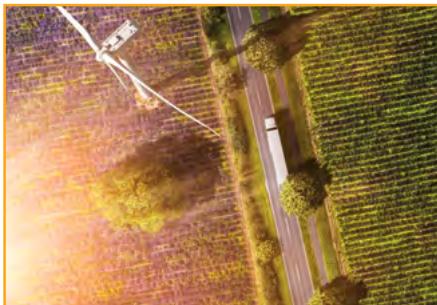
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Information in Photos and Graphics



1_PP_Continental_Conti_Hybrid_HD3



2_PP_Continental_On_the_road_with_Continental



3_PP_Tire_production



4_PP_Continental_Cross-section_of_a_tire



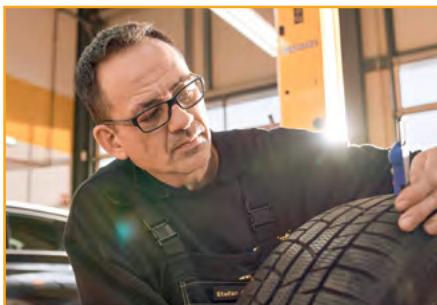
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6_PP_Continental_winter_tire_portfolio



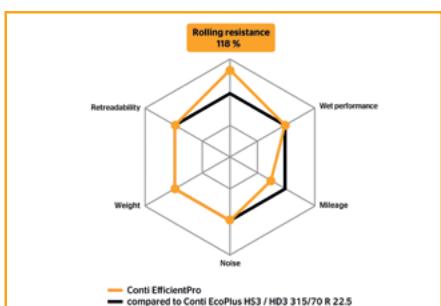
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8_PP_Continental_Tread_depth



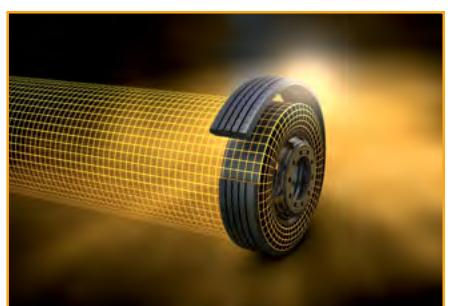
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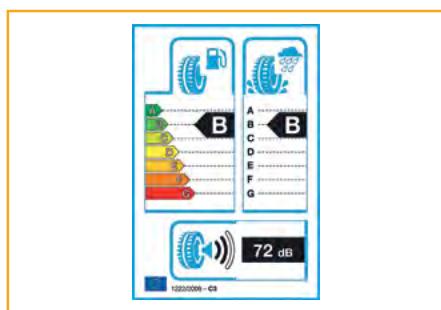
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14_PP_Continental_Dandelion_rubber



15_Continental_Conti_CrossTrac_HD3



16_Continental_EU_tire_label

White Paper Commercial Vehicle Tires

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