



Getting to grips with

tyres

by Theo Egberts

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Lift truck tyres are usually black, round and all look alike. But that's not the case. There are proven differences in rolling resistance, productivity, stability and comfort. All these aspects influence choice, and lead to the question: **does the ideal tyre exist, or is it always a compromise?**

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To come straight to the point, a tyre - even an industrial tyre - is and will always be a compromise. So is that the end of this article? No, of course not. Because for each user, the features of one tyre are not as important as the features of another industrial tyre. There are clear differences in functionality, price, comfort, life, and stability. Unfortunately these factors cannot be combined in one and the same tyre, although the various manufacturers naturally attempt to make their product as universal as possible. It's also clear that a tyre is one of the most important safety components on the lift truck. So it's extremely important to consider the question seriously.

Differences in different parts of the world

This article deals mainly with the solid rubber tyre, which is often known as the pneumatic shaped cushion tyre, Super Elastic (SE) or resilient tyre. The second type is the solid tyre, sometimes known as the steel cylindrical band or - in America - as the press-on band (POB); and the third category is the pneumatic tyre.

The press-on tyre consists of one layer of rubber compound, while the super elastic tyre is built up from three layers: a foot section, a centre section (comfort rubber) and a running surface with tread. Each compound has its own characteristics. The pneumatic tyre - as its name suggests - is a tyre containing air or possibly nitrogen.

Around 69% of lift trucks in Europe run on super elastic tyres because of the stability, life and impossibility of puncture. Around 24%, mainly in the eastern and southern European countries, run on pneumatic tyres, and 7% use press-on tyres.

In the United States, the figures are very different. There, 59% of lift trucks run on POBs and 30% on pneumatic tyres because in America, lift trucks often have to cover greater distances on uneven ground. Solid rubber tyres are very much in the minority with 11%.

In Asia, the pneumatic tyre wins, especially diagonal tyres. Solid rubber and press-on then compete for the honours, but the advantage just goes to the press-on band.

Choose or split?

The choice of make and type of tyre is often determined by the lift truck manufacturer or supplier. On the basis of the truck, they choose the tyre which suits it best. These OEMs usually choose tyres from category A (premium), but under pressure of the recession or strong competition in the market, they can also be category B (standard) or C (budget).

So what is the difference between the various super elastic tyres? Category A brands almost



always use the stronger, more wear-resistant and harder natural rubber. Tyres of category B and C are often constructed from synthetic rubber which is cheaper and has poorer mechanical properties. As well as rubber, the tyres contain various additives which affect amongst others the vulcanisation process, the life and homogeneity. Each tyre has a totally unique recipe, hence the differences in properties and character.

From wear to explosion

As well as mechanical wear on a tyre due to friction over the running surface, the level of heat formation in the tyre plays a significant role in affecting the life. Above all when used intensively under heavy loads, the internal temperature of the tyre rises rapidly. Cheaper tyres are not specifically designed for this, leading to the possibility of devulcanisation in the tyre and even the formation of air bubbles in the tyre. These can lead to explosions!

In pneumatic tyres too, the rubber and carcass of cheaper tyres can sometimes be of poorer quality. In both cases, this can entail a safety risk. The tyre loses its load-bearing capacity and the truck can even tip over. In addition, tyres not matched to the lift truck can have a higher rolling resistance and hence lead to higher energy consumption. Vibrations can also be amplified by the combination of lift truck, tyre and ground, and constitute an additional physical strain on the lift truck driver.

Wolf in sheep's clothing

The physical load is not just a question of corporal vibrations and shocks. It is above all the unpredictability of working with the lift truck which is stressful. During lift truck tests, we came up against tyres which are known to sell on their low cost price. They look like lift truck tyres, and comply closely with the wheel →

Main image. Continental CSEasy (Image courtesy of Continental) www.continental-industrial-tires.com
1. Precision measurement equipment was used to collect large quantities of data in order to learn more about the performance of industrial tyres.
2. On average, the Forkboss tyre with perforation holes in the centre segment causes slightly less corporal vibration than a normal super elastic tyre.
3. A trend in the development of new industrial tyres is simplification of fitting, as in this latest model from Continental, the SC20. (Image courtesy of Continental) www.continental-industrial-tires.com



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4. After entering and computing lots of measurements, the difference in energy consumption is maximum 12.8%.

5. When driven indoors on a smooth ground, there is actually no need for a tread on the tyres.

→ dimensions for the truck concerned. They drive and steer well when unloaded, but as soon as you put any weight on the forks to drive, it's not easy. The truck is no longer stable to drive and drifts about on the ground. As a driver, you feel unsafe and so work more slowly. On braking and cornering, the tyre deflects greatly and you get the sensation of losing control of the truck.

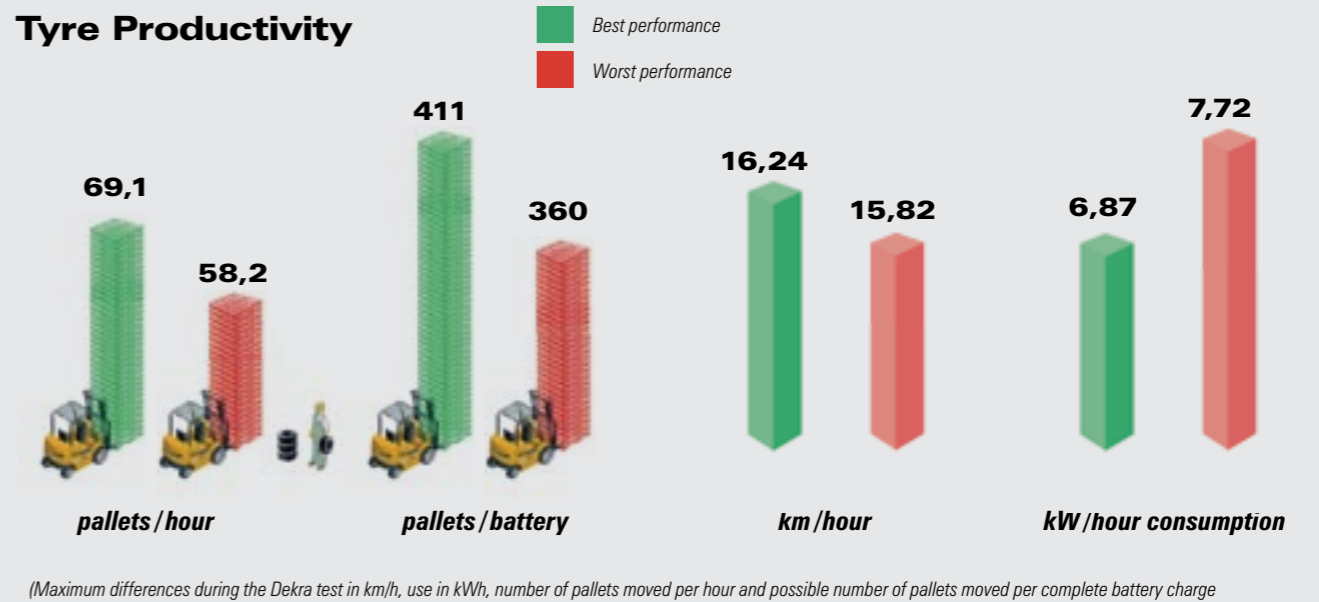
On light use, such a tyre would not be too bad. It is also pleasantly soft and hence comfortable. At least, that's what you feel. During an extensive test into corporal vibrations on lift trucks for the Dutch industry association of lift truck suppliers (BMWT), the influence of the truck tyre was studied. Vibration measurements were made on various trucks (LPG and electric) and various tyres (super elastic and pneumatic). Measurements were also made with super elastic tyres with perforations in the intermediate layer. The courses ran over relatively flat asphalt, a section with cobbles, and "rain gullies". Super

the harder the tyre, the lower the energy consumption, and the higher the productivity too. But now the ground is decisive for the first choice. On uneven ground, you cannot drive with a press-on tyre. Pneumatic or super elastic tyres (SE) are a better choice.

If you want to get maximum performance and maximum safety from your lift truck, you simply cannot stint on the tyres. A certified test from the German research institute Dekra came up with the following figures:

With a 2.5 tonne electric lift truck, the same driver performed the same task with 12 different makes and types of category A tyres. The result: the highest speed measured was 16.24 km/h, the lowest 15.8 km/h. The consumption varied from 6.87 to 7.72 kWh and the number of pallets moved per hour was between 58.2 and 61.9. If we combine these aspects of time and consumption, and look at the number of pallets moved per battery charge (80V/480 Ah), then with the best performing tyre we can move 411 pallets while with the worst performing tyre only 360. A difference of 14.16%! So it's well worth while to pay more attention to the shoes of the lift truck.

Tyre Productivity



Corporal vibrations (in m/s² per truck, tyre type, ground and load)

Lift Truck	Tyre type	Cobbles, no load	Cobbles, with load	Asphalt, no load	Asphalt, with load
Electric 3wl, 1.8 tons	Super elastic rubber	1,14	0,933	0,828	0,733
Electric 3wl, 1.8 tons	Sidewall perforations	1,08	0,821	0,809	0,667
Electric 4wl, 2.5 tons	Super elastic rubber	0,990	1,040	0,600	0,510
Electric 4wl, 2.5 tons	Pneumatic	0,987	0,820	0,985	0,977
LPG, 4wl, 2.5 tons	Super elastic rubber	1,25	0,987	0,790	0,867
LPG, 4wl, 2.5 tons	Pneumatic	1,14	0,945	0,907	0,780

(Source: BMWT Netherlands)



elastic tyres generally gave the best values. On the asphalt, pneumatic and other softer tyres become unpleasantly unbalanced, which increases vibration levels. Only with a load on the forks and when driving over uneven ground such as cobbles do pneumatic tyres have the advantage. On all ground types, the super elastic tyre with perforations gives slightly better vibration figures than the other tyre types, although the differences are marginal.

Differences in productivity

We find greater differences in the performance and energy measurements. The rule of thumb:

Show profile

The function of the tread on a lift truck is not always equally important. Tread is actually unnecessary on a lift truck tyre which is used exclusively on a dry, flat ground. For a low rolling resistance and maximum contact surface, a smooth unprofiled tyre is best. But lift trucks for internal use almost always have a tread because users expect this from a tyre. Outside, a profiled tyre has a purpose and a function. The tread gives more grip on loose ground and prevents skidding on (wet) cobbles and stelcon plates. Lift trucks which drive from outside to inside should really be profiled to reduce the chance of skidding.

On the wheels on the steered axle (not the driven wheels), the tread prevents sliding in corners. Various makes offer a length profile for the steered axle. On wheels on the drive axle, the block profile offers most traction.

The tread depth is of more importance for pneumatic tyres than for super elastic tyres (SE). In pneumatic tyres, it gives a clear indication that a tyre is due for replacement. For SE tyres, this is not the case. Even if the tread has completely disappeared, the tyre may still be suitable for use even though there is a greater chance of skidding in the wet. SE tyres have a wear indicator line on the side wall which, depending on make and size, can lie up to five centimetres below the tread surface. As long as this mark has not been reached and the tyre does not show signs of serious damage, it can still be used.

Marks or no marks?

Industrial tyres are not always black, although there is a clear reason why they are often black. The black is due to the soot which is added to the natural rubber mixture. This makes the rubber more resistant to wear because soot absorbs heat. The soot also protects against ageing from UV radiation. The disadvantage is mainly that the soot in the tyres leaves black marks on the floor. This is a problem mainly when the lift truck is used inside. More and more often, factory floors have a light-coloured coating or surface finish, and the black streaks do not look good. It also reduces the luminance of the lighting and can soil the goods in the warehouse.

"Around 40% of customers order the wrong compound or size of industrial tyres."

Partly for these reasons, so-called "non-marking" tyres are popular. These non-marking tyres contain silica or chalk as a wear agent instead of soot. Non-marking tyres without chalk are yellow in colour, the addition of chalk makes the tyres whiter.

Anti-oxidants are also added to the rubber compound to protect against UV radiation. Grey non-marking tyres have also been available for some time.

Unfortunately it is a misconception that non-marking tyres are not as dirty. The tyres themselves wear 25% faster and are on average 25% harder. The main difference is that we cannot see the worn material as clearly and it therefore looks cleaner. In fact the rubber is deposited just the same.

40% of tyre choices wrong

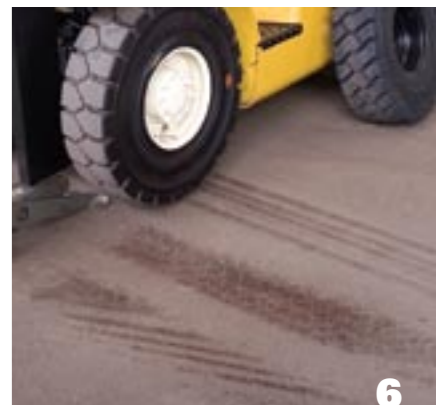
Around 40% of customers order the wrong compound or size of industrial tyres, concluded

Briggs Equipment on the basis of its own analysis. A problem, because the use of the wrong tyre means that accidents are harder to avoid.

Many customers also specify the wrong tyre size, according to Briggs. Often the tyres are worn or damaged so far that the size marking on the side wall is no longer legible. Another problem is that customers believe that they can buy an industrial tyre just as well from a car tyre supplier. But the latter is not as well informed of the differences in use, load and application of the lift truck tyre as a specialist supplier of industrial tyres.

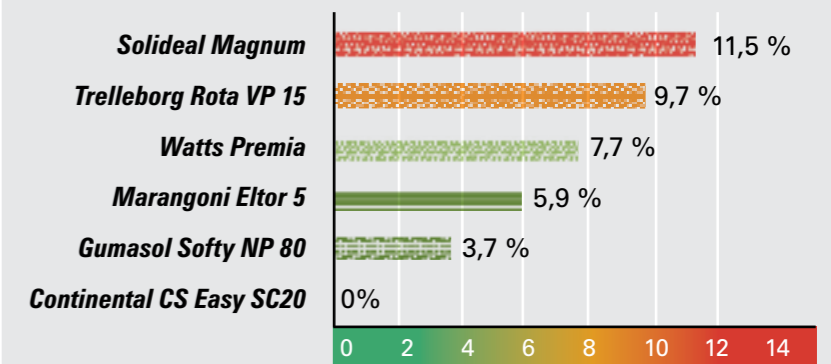
Another common problem is neglect of the state of the tyres and wheel bolts. This should be part of the daily checks performed by the lift truck driver, according to Briggs. Unfortunately this aspect often gets overlooked on busy multishift use. ■

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6. The disadvantages of the black industrial tyres is that the soot in the tyres leaves black marks on the floor. This is a problem mainly when the lift truck is used inside.

Energy consumption



(differences in energy consumption % per band during the Dekra test)