

DIRK ZEDLER

WHEELS: THE SOURCE OF MANY TROUBLES

With e-bikes continuing their sales boom, front and rear wheels are increasingly the focus of attention, since the limited lifespan of wheel components often leads to arguments with customers. What can dealers and manufacturers do about that?



photo@zedler.de

For a few years now, we have seen our wishes come true: More and more people switch over to electric bicycles. Many of them also ride many more miles than they did with their city or trekking bike. Baggage or trailer loads are no longer a deterrent, and neither are hilly terrain and strong headwinds. What's more, on the strength of their e-bike's motor and the longevity of modern batteries, riders who do not exactly boast the physique of a pro cyclist venture more and more into mountainous regions. A frequent outcome: unexplainable punctures, frequent spoke failures or rims breaking in two along their well.

What are the reasons behind these phenomena, which hitherto used to be encountered mostly by dealers with a lot of road cyclists among their clientele, even still in the era of the early system wheels?

It is mainly on the manufacturers to improve the situation. After all, they are the ones who can get so many things right or wrong when building wheels.

But if something does go wrong, it is up to the dealers with their workshops to help the customer out.

Testing is too lax

Modern e-bikes weigh approx. 10 kilograms more than city or trekking bikes made for similar types of use. But it is not just the bikes themselves that have gained weight over the past 10 years. The average man in the D-A-CH region weighed 89 kilograms, the average woman 71 – and that was before Corona hit. Would you have guessed it? Surveys have revealed that people gained an additional two to four kilograms during the pandemic.

The optional test on the roller test bench included in the applicable EN standard places a load of 640 newtons on wheels and tyres. Is that a lot? No, not even close! Assuming a typical wheel load distribution of 70 % of the weight resting on the rear wheel, a 30 kg heavy pedelec with a rider of aver-

age weight (90 kg) results in a wheel load of 824 newtons, which is almost 30 % more than what the test specifies. If the rider weighs 100 kg and carries with them 10 kg of baggage, almost 960 newtons would apply. The 750,000 impacts with 10 mm bumper height are not even worth discussing as they are simply not sufficiently demanding for a typical tyre with 40 to 50 mm width.

This means that testing according to the standard is absolutely inadequate for finding wheels with sufficient engineering strength for typical pedelec use. It is up to manufacturers and their testers to act.

Spoke count too low, spokes too weak

For many years rear wheels used to come with 36 spokes by default. This was pared down to 32 as the spokes got stronger over time. But for heavy pedelecs, subjected to high driving forces in combination with disc brakes, we should actually turn back time. Although, merely returning to the traditional spoke count will not suffice. The significantly higher loads will also require borrowing a few tricks from builders specialising in sport wheels. Double butted spokes are solid at the thread and bend but thinned out along their centre section. This makes for some elasticity in this section, relieving the two weak spots and drastically prolonging the lifespan.

If a customer experiences repeated failure of individual spokes, it can be worthwhile to spoke the complete wheel with such spokes.

Flanges that are too thin

If spokes break at the bend, it may help to have a look at the hub flanges and the clearance between the spoke's head and bend. That clearance can be so big, especially with some speed hubs, that the bends are no longer properly in contact with the flange, leading to harmful movement.

If the spokes frequently break at

the bends, washers underneath each spoke head may help. They are available from the spoke manufacturers.

Spoke tension is too low

With high loads acting on the wheel on any ride, the spokes are strongly unloaded at the centre of the tyre contact with every revolution. A spoke is only able to cope with these periodic changes in tension for a reasonable amount of time if it still remains under tension at the point of maximum load relief. In other words: If the spokes are insufficiently pretensioned, they will fail after only a few hundred kilometres due to the load peaks/impacts at the lowest point of the wheel.

This can be avoided only through a maintenance regime that goes beyond a perfunctory check for the axial runout. It is also necessary to check the spoke tension and increase it as required. Spoke manufacturers will provide information on the correct spoke tension and also supply testing devices.

Internal tyre failure

If customers complain of flat tyres for which there seems to be no explanation, take a closer look at the inner tube. Two holes close to each other are an unmistakable sign that the inner tube was crushed while riding over a curb while the tyre pressure was much too low, a phenomenon known as 'snake bite'. The thing to do here is to advise the customer on the correct tyre pressure and on checking the pressure regularly.

But what if air escapes through a multitude of miniscule holes? This is usually due to high loads acting on the wheel, wide tyres and an unsuitable tyre pressure, leading to increased flexing work. The resulting strong friction between the tyre and the inner tube leads to the tube material being virtually ground away over time and becoming porous.

Talcum works particularly well with rubber-based products and helps reduce friction; it can be introduced into the tyre with a shaker. Carefully distribute this dry lubricant around the complete inner diameter of the tyre before inserting a new inner tube. Experience shows that this will solve the problem.

Building wheels that last longer even in bikes subjected to high loads comes down to a combination of the engineering undertaken by the manufacturer and solid craftsmanship applied in workshops. Manufacturers are well-advised to test their wheels diligently to avoid problems further down the line. Dealers, for their part, still need to check good wheels for proper spoke tension. Only when manufacturers and dealers work together will the customer be satisfied in the long run and ideally decide to buy another e-bike of the same brand in the future. ■ Dirk Zedler



Dirk Zedler (photo©Bernd Lammel)

DIRK ZEDLER

Since 1993, Dirk Zedler has been an analyst and expert witness on bicycle accidents and product failures for courts, bike and insurance companies, and private individuals. He got his start in the industry by working for a large bike shop from 1986 on, and now holds the respected advanced engineering degree known as "Diplom-Ingenieur."

Courts have recognized Zedler as an officially appointed and sworn expert on bicycles since 1994, and on electric bicycles since 2014.

The Zedler – Institute for Bicycle Technology and Safety has used this wealth of knowledge, derived from his and his teams work in thousands of court proceedings and expert's reports not only in Germany but from the US to all over Europe, to enhance research and development in the bicycle industry.

The Institute sets the standards for the bicycle industry. It develops and builds testing equipment that is used by manufacturers to improve the riding performance and safety of their bikes, and by leading European bicycle magazines to test them. The Institute's work provides a basis for European and American manufacturers to communicate with their Asian suppliers. Manufacturers can buy test equipment from the Institute or use its state-of-the-art testing labs.

The Zedler Institute also prepares risk analyses, conformity papers, workshops, recall papers and user manuals for bicycles and pedelecs. These manuals, now available in more than 40 languages, help consumers use their bikes properly — and in many cases have protected manufacturers from liability.

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