BICYCLE ASSOCIATION

BA GUIDE:

E-bike conversion kits

bicycleassociation.org.uk

The Bicycle Association of Great Britain

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Welcome

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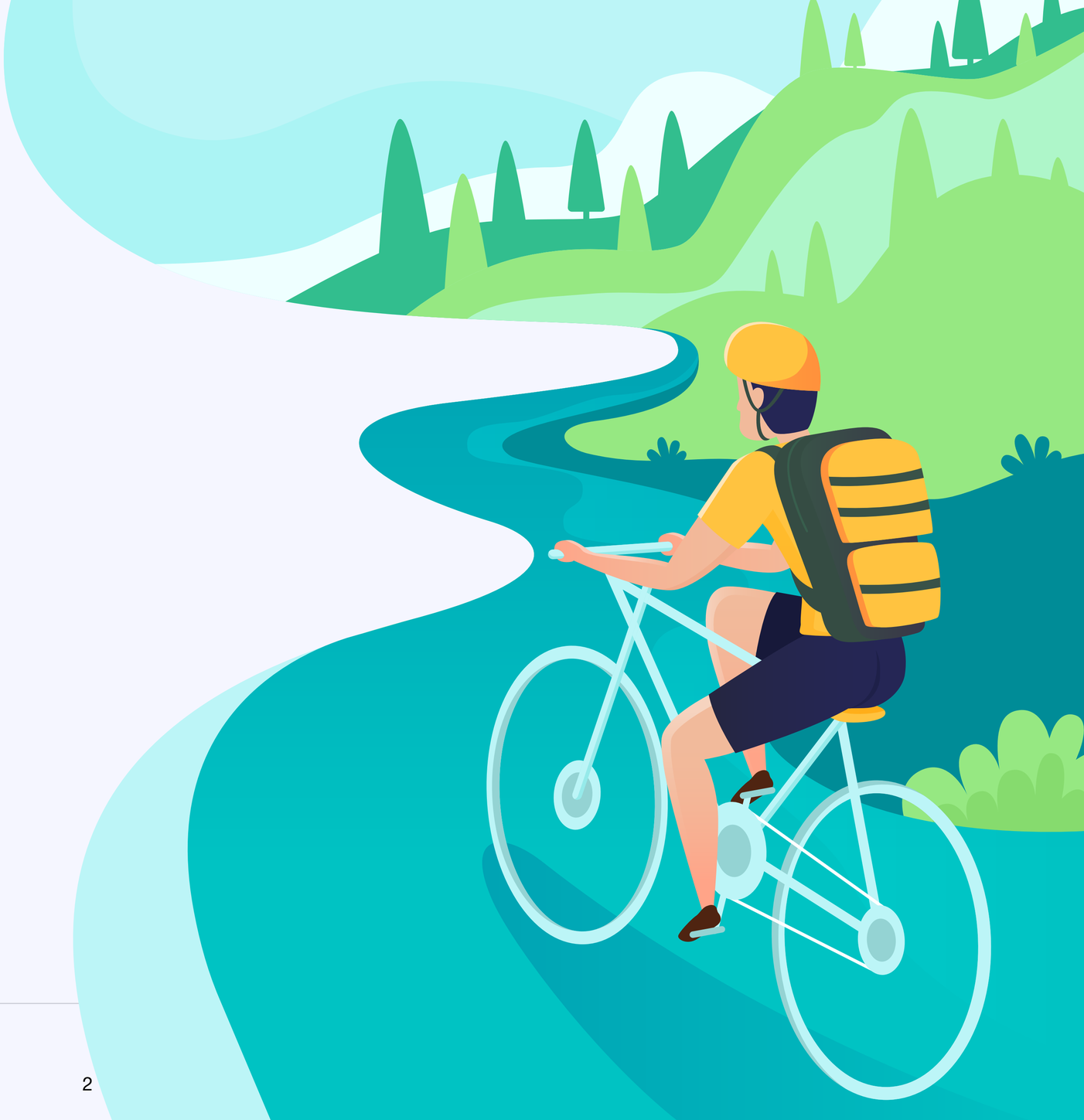

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Introduction

Riding an e-bike is not just a huge pleasure, it can also be transformational in enabling people to gain independent, clean and healthy mobility. Riding an e-bike should be an accessible and safe experience for as many people as possible.

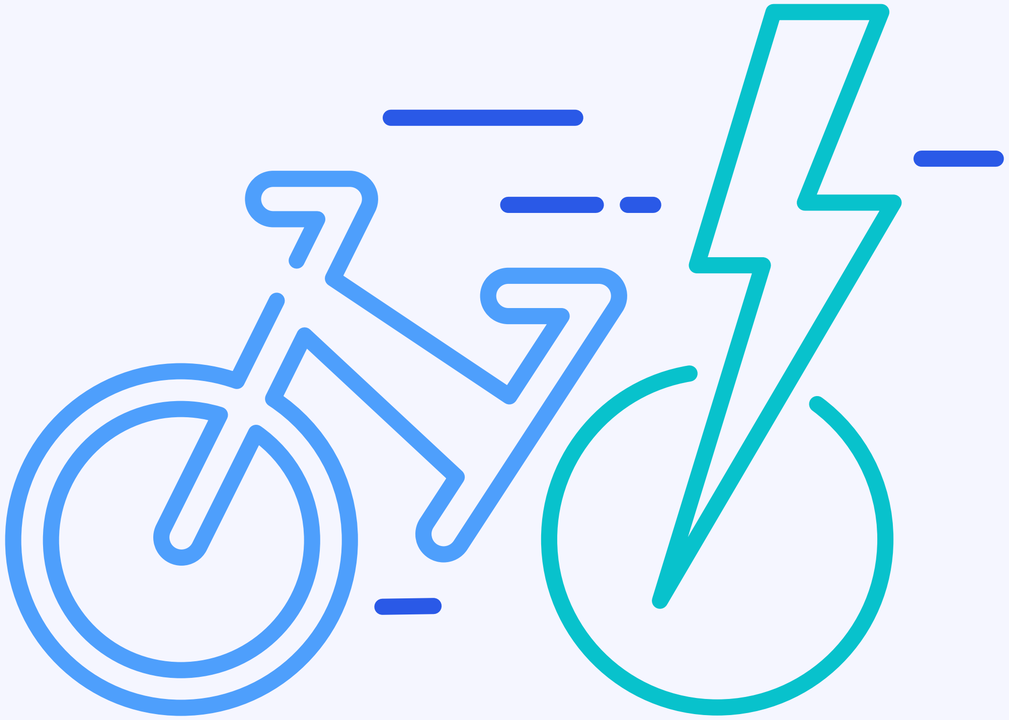
In most cases, the first choice for safety, consistent product quality and peace of mind will be a purpose designed complete e-bike.

E-bike conversion kits can also be an attractive option for some people who may already have a cycle, and they do potentially offer a good way for people to enjoy the pleasure and utility of an e-bike at lower financial and possibly environmental cost than is involved with a complete e-bike purchase.

And it is legal for sellers of e-bike kits to place such items on the market, assuming all relevant laws and regulations are met (which may not be easy, as we will explain).

But as the cycle industry trade association, we believe it is essential that users should be fully informed of some of the potential hazards of this approach.

This document aims to explain some of the possible safety and legal issues around e-bike conversion kits, for end users and for retailers, and outlines our understanding of best practice for e-bike kit sellers.



Safety risks

2.1.1 Fork and frame safety

Complete e-bikes are tested to a different product safety standard **(BS EN 15194)** compared to conventional bicycles **(BS EN ISO 4210).**

A key difference is that e-bike frames and forks undergo more severe fatigue testing than for most conventional bikes (for all type of e-bike, the requirements are more similar to the loading on conventional mountain bikes). This reflects the higher average speeds which e-bikes experience, on average, and thus the greater impacts stressing the frame.

So if a new "normal" bike is used as an e-bike, it will have less safety margin designed into its frame and forks.

And if a used bike (with frame and forks in an unknown state) is converted to an e-bike, again the safety margin may be further reduced by an unknown amount.

If fitting the kit requires modifying the frame or forks, this can also potentially dramatically affect safety, for example by removing dropout safety features for wheel retention, or by introducing grinding or filing marks which act as stress concentrators where cracks may initiate. Even e.g. clamps with sharp edges could accelerate a failure.

Safety risks

2.1.1 Fork and frame safety

We strongly advise against fitting kits which require any mechanical modifications of the bicycle frame or its forks. Frame and fork failures can be particularly dangerous for the rider, so it is for good reason that the industry has developed e-bike specific designs and testing to ensure an adequate safety margin is in place.

A ‘normal bike’ frame is not likely to fail in use when converted to be used as an e-bike, especially if use is moderate, because most are designed with a good safety margin anyway. But its safety margin is reduced in typical e-bike use. And for harsh e-bike use (e.g. delivery riding), it will be reduced even more.

If an e-bike conversion kit is to be fitted, we recommend using a mountain bike in good condition as the bike for conversion, for the best possible safety (but a purpose made and tested e-bike will still be better).

It is very important that end users be fully informed of all relevant risks (and indeed, arguably it is legally required under The General Product Safety Regulations 2005) and information about reduced safety margins when using ‘normal bike’ frames and forks as e-bikes should, we believe, be available to customers before sale.

Customers should also (as with any cycle) be advised to regularly check (or have their bike checked by a qualified cycle mechanic) for any cracks or deformation which might indicate an imminent failure.

Safety risks

2.1.2 Weight

Adding an e-bike conversion kit to a conventional bike will certainly increase its weight. Care should be taken that the total weight of bike, rider and luggage, plus that of the e-bike conversion kit and battery, does not exceed the maximum permitted by the bicycle manufacturer. This maximum will be stated in the user manual.

This is important both for the structural integrity of the frame and forks (although this may still be stressed by the higher average speeds of e-bike use, as above) and to ensure that braking performance remains adequate.

Safety risks

2.1.3 Integration and reliability

Purpose made e-bikes are designed from the start to integrate all necessary components and wiring, and are tested as complete bikes as part of EN15194 standard compliance.

This is not the case for e-bike kits, which may be designed to fit a wide range of bikes (although reputable kits will comply with those aspects of EN15194 which are relevant to the motor system, controls and battery).

Possible issues include:

- **Wires unprotected or too long for a particular bike – prone to snagging**
- **Battery mounting insecure**
- **Tyre/brake/rim incompatibility. If the kit involves a new front wheel being provided, care (or better, the advice of qualified cycle mechanic) should be taken that the rim or hub is compatible with the existing brakes (which may also need adjusting for the new rim) and with the existing tyre, if that is to be re-used.**

Another key issue is the skill and knowledge of the person fitting the kit.

- **Most conversion kits are sold to members of the public, who will have a wide range of mechanical skills and experience of cycle mechanics. Only some will have appropriate tools. So the quality and safety of the installation may be very variable.**

- **In contrast, complete e-bikes are generally assembled and quality-controlled by the manufacturer, and checked again by qualified mechanics at the retailer, who can also carry out regular servicing and safety checks.**

Safety risks

2.1.4 Handling

Many e-bike kits place the motor on the front wheel, because exchanging this wheel is often the simplest way to add an e-assist motor.

In contrast relatively few complete e-bikes now use a motor in the front wheel, because most riders find that having the power assistance delivered through the rear wheel gives more predictable handling under power, and better traction on poor surfaces.

However, depending on the design of the e-bike overall, front wheel e-assist motors can also be perfectly acceptable.

Whether this is the case for any particular bike to which a front wheel conversion kit is fitted will only become clear in use. In contrast, manufacturers of complete e-bikes will generally have tested the handling of any front wheel motor e-bikes exhaustively before sale.

Finally, some kits add weight to the steering (e.g. with batteries mounted to handlebars). This can also affect the handling.

Legal & liability risks

3.1.1 Manufacturer risks

It is a legal requirement that the GB manufacturer or importer of a complete e-bike declares its safety by UKCA marking the bike (this was CE marking, before Brexit, and CE marking still applies in Northern Ireland and remains valid for GB until end Dec 2022). They must also by law maintain a technical file detailing evidence of compliance with all relevant product safety laws.

The main law which imposes these duties on e-bike manufacturers is the Safety of Machinery Regulations. This states that the "manufacturer" is defined as follows:

“manufacturer” means, in relation to machinery or partly completed machinery—

(a) a person who designs or manufactures that machinery or partly completed machinery—

(I) with a view to its being placed on the market under that person's own name or trademark; or

(ii) for that person's own use in the United Kingdom; or

(b) if there is no such person, the person who places that machinery or partly completed machinery on the market or puts it into service;

While individual cases are always a matter for the courts, it is our view that this means that any person who fits an e-bike kit to a conventional bike becomes the “manufacturer”, in law, of the resulting complete e-bike, even if it is just for their own personal use.

They must therefore make a legal declaration of its safety by UKCA marking it, drawing up and signing a UK Declaration of Conformity, and maintaining a technical file for at least 10 years. They must also place their name and address on the bike to identify themselves as the manufacturer, along with other legally required markings (e.g. the crossed out wheelie bin symbol required by electrical waste legislation)

Legal & liability risks

3.1.1 Manufacturer risks

It is possible for the kit supplier to offer some evidence of the safety of their kit when fitted according to instructions. Formally, the kit as supplied is “partly completed machinery” which should be accompanied by installation instructions, plus a Declaration of Incorporation. To help the person fitting it, the kit supplier could also provide suitable labels for the converted e-bike, and template documents for the technical file, etc…

But it is not reasonably possible for the person fitting the kit to complete a full technical assessment of the safety of the finished e-bike – for example by conducting standards-based testing to EN15194.

If the frame has been used, they cannot even rely on any previous safety declaration or testing which has been carried out by the original supplier before sale, because the current state of the frame is unknown (and that previous testing would have been as a normal bike, not as an e-bike, anyway).

This matters because as “manufacturer”, the person converting the kit takes on liability for product safety. If this safety is challenged, for example after an accident or in an injury insurance claim, clear evidence of product safety is essential to limit what could be potentially large liabilities. And it will be very difficult for the person who fitted the kit to provide good evidence of mechanical safety for a used frame.

It may also be difficult for the person converting the e-bike to obtain insurance to cover these manufacturer liability risks, if they cannot readily prove the safety of the final product.

Legal & liability risks

3.1.1 Manufacturer risks - legal references

The definition quoted on a previous page is from:

Article 2(2) of The Supply of Machinery (Safety) Regulations 2008
legislation.gov.uk/uksi/2008/1597/regulation/2
as amended by The Product Safety and Metrology etc. (Amendment etc.)
(EU Exit) Regulations 2019:
legislation.gov.uk/uksi/2019/696/schedule/12/paragraph/2#schedule-12-paragraph-2-3-h-ii

We have seen it argued that private persons are not subject to the product safety laws as outlined above. However, we have not found any exceptions in the legal texts to justify this, and the wording reproduced above also seems to directly contradict this interpretation.

Legal & liability risks

3.1.2 “Twist & Go” type approval risks

The rules around e-bikes in the UK are clearly set out in Government guidance, for example here:

gov.uk/government/publications/electrically-assisted-pedal-cycles-eapcs

These clearly state the power and speed limits up to which the motor can assist the rider while pedalling. They also note that “twist and go” e-bikes, which can be propelled by the motor at above 4 mph without pedalling, require type approval before they can be used on roads (or more accurately as we understand it, the public highway, which also includes off-road tracks and anywhere the public has unrestricted legal access).

So if a person fits an e-bike kit (which otherwise meets the legal requirements) with a throttle control which can propel the bike (above 4 mph) without pedalling, they must gain type approval for it. This is possible via the Motorcycle Single Vehicle Approval process, in the “250W LPM” category.

If type approval is not obtained, offences may be committed under type approval legislation.

Legal & liability risks

3.1.3 Risks with over-power (>250W) or over-speed (>15.5 mph) kits

As the Government advice quoted earlier makes clear, any bike fitted with a kit which exceeds the power or speed limits to be treated as an e-bike is instead treated as a motor vehicle – an unregistered moped. Anyone using it is liable to be committing numerous traffic offences, and any third party insurance cover which they may have is almost certainly going to be invalid.

We very strongly recommend that customers only consider kits which remain within the UK legal limits, and, to avoid any issues around type approval, which require the rider to pedal for the motor to operate (although a “walk assist” mode of up to 4 mph is acceptable without pedalling).

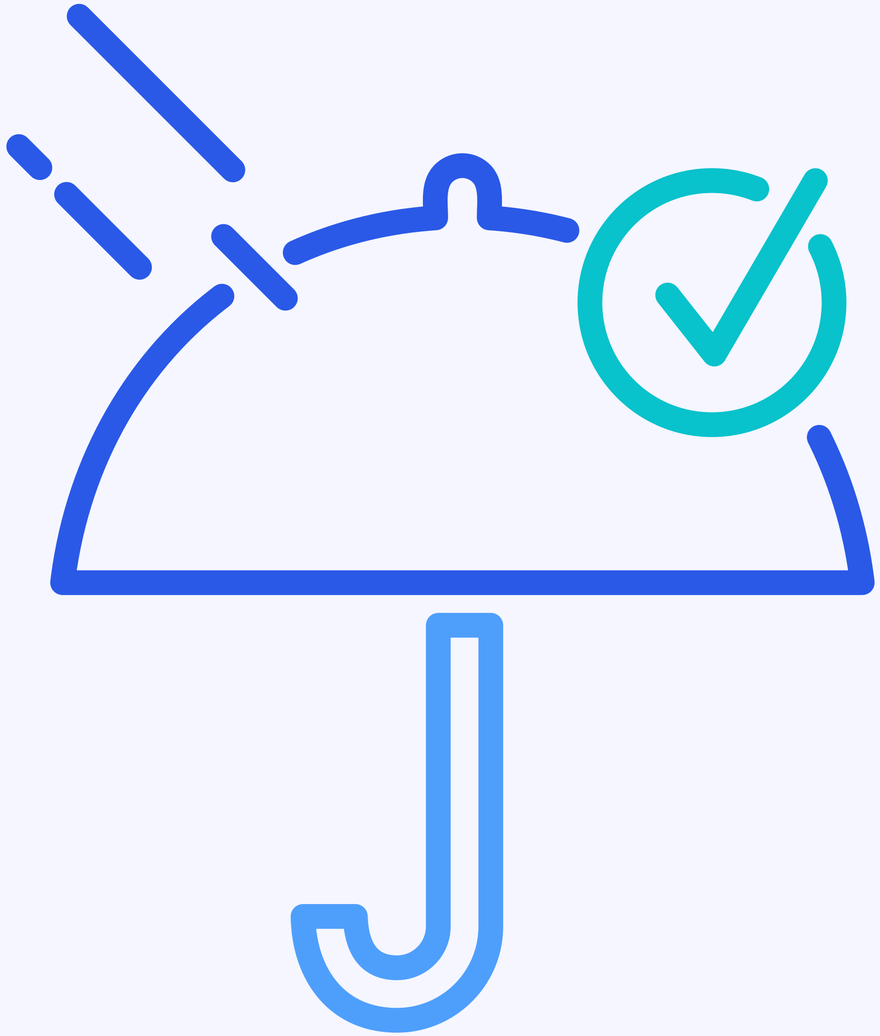
Note that the Government guidance also states:

“We are aware of some electric cycles that have a switch offering a temporary increase in top speed that is often advertised as an “off road” facility. When the switch is pressed the vehicle can be propelled by the motor at a speed greater than 15.5 mph. Vehicles with this feature fitted do not, in our opinion, comply with the GB EAPC regulations”

While this uses the word “switch”, it is our view that this will be broadly interpreted. So it should not be possible at all for the user to alter the motor assistance speed limit, even if that alteration doesn’t involve a switch as such, to avoid the converted bike potentially being considered non-compliant with the e-bike regulations.

Warranty risks

Fitting an e-bike kit will almost certainly void any warranty remaining on the conventional cycle to which it is fitted, leaving the customer to bear all costs of any future repairs.



Considerations for retailers who fit kits to customers' bikes

If a retailer fits an e-bike kit to an existing bike, then they take on the "manufacturer" role as detailed above and thus the liability for product safety.

They may be somewhat better placed to evidence this safety than an end user, with the kit installation presumably carried out by a qualified cycle mechanic who can also inspect the condition of the recipient bike.

But any inspection can only go so far in determining how well a frame and forks will stand up to e-bike use, and some reports indicate that this approach is unlikely to be acceptable to (for example) Trading Standards, who may expect more formal evidence of safety.

So retailers should consider carefully whether they wish to take on this responsibility, and consult their insurance provider to check whether their cover includes this aspect – which may be called "product liability" or "manufacturing cover" or similar.

Retailers should also note that any original warranty on the bike will almost certainly be voided if an e-bike conversion kit is fitted without the bike manufacturer's authorisation.

Summary and best practice

While recognising their appeal, the Bicycle Association has some concerns about the concept of kits in general, especially:

- **The reduction in safety margin when fitting e-bike kits to frames not designed for use as e-bikes.**
- **The potential legal liability of the person fitting the kit, because as "manufacturer" in law they cannot practically evidence the safety of the complete e-bike.**
- **The risks involved in unqualified persons assembling kits onto bikes.**
- **The lack of consumer awareness of all of the above risks, and that bike warranties will be voided by fitting e-bike conversion kits.**

And as the industry association we must also note:

- **When kits are fitted there is a risk of unjustified reputational damage to the manufacturer of the original bike – which was never designed as an e-bike – if there is a failure as a result of an e-bike conversion kit being installed.**

That said, it is legal for these kits to be sold, and some suppliers are doing their best to sell responsibly.

We should also note that data on actual product failures (or injuries) directly linked to e-bike kit use is lacking, and as far as we are aware the liability issues noted above have not yet been tested in court.

But end users should nonetheless be fully informed of risks, so that they can decide for themselves.

Summary and best practice

6.1 Best practice for e-bike conversion kit sellers

Therefore we consider that as a matter of best practice kit suppliers should:

1. Inform customers pre-sale that fitting an electric conversion kit will almost certainly void any warranty on the host bike.

2. Inform customers pre-sale that while risk of any failure is low, normal bike frames have a lower structural safety margin when used with e-bike kits than frames designed specifically for e-bikes.

3. Stress that consumers should fit kits only to robust bikes in good condition and which are structurally sound – ideally MTBs – and to get bikes inspected by a bike shop if in any doubt.

4. Note that if fitting the kit involves changing a wheel this can affect the bike's braking systems, which are safety-critical. Advise customers to ensure that any brake adjustments or replacements are carried out properly (by a bike shop if in doubt) to maintain safe braking performance.

5. Inform customers pre-sale of the liability risk and product safety responsibilities involved in fitting a kit. Provide a Declaration of Incorporation with the kit (including evidence of testing to the relevant sections of BS EN15194:2017) and labels and template compliance documents for the customer to complete and retain. Consider bundling manufacturer insurance.

6. Inform customers that the extra weight of the kit should be taken into account. Weight of kit, rider and luggage combined must not exceed the maximum permitted for the bike (which will be stated in the owner's manual).

7. Offer only UK-legal kits for sale in the UK (max assist speed 25 km/h, max rated power 250 W, rider must be pedalling for motor to operate). Do not offer, encourage or enable speed or power de-restriction or 'Twist and go' throttle operation.

8. UK e-bike kit suppliers should (as complete e-bike suppliers also should) comply fully with the UK's regulations around packaging, electrical waste and battery reporting obligations, and battery take-back obligations, alongside other legal requirements such as the safe transport/shipping of lithium batteries as hazardous goods.

9. To avoid potential confusion or reputational risk to other companies, e-bike kit suppliers should cover or remove any visible branding of any cycles they use in advertising or promotions unless they have obtained explicit permission from the original cycle manufacturer or brand owner.

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