

FOCUS ON | SPECIFYING TRAILER BRAKES

Unlike on the continent, where standardised trailers are built by a few high-volume manufacturers, UK operators expect to buy a trailer tailored precisely for their haulage requirements.

That means the design process is detailed and extensive. Choices include: brake type; size of axle beam; type and configuration of suspension; suspension height; and size of air bags. In addition to the specification and the build, by law trailer designs must also undergo type approval, which requires braking and stability calculations.

For UK and Irish customers, suspension manufacturer BPW produces 43,000 truck and trailer axles per year, backed up by factories in Germany and Hungary. It supplies to more than 50 trailer-builders, large and small. Competitors are SAF and Mercedes-Benz.

Braking occupies a central position in trailer specification, as it is bound by regulatory limits on one side, and affects, and is affected by, design factors and operational/maintenance concerns as well.

DISC OR DRUM?

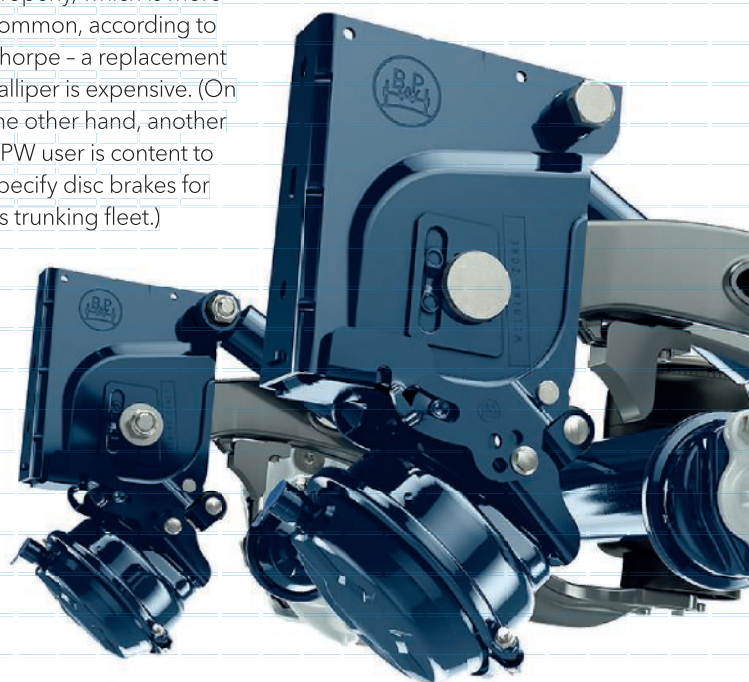
One of the first choices in designing a new trailer is of brake: disc or drum. BPW, for example, provides both (disc brake on Eco Air Compact suspension shown, right; drum on Airlight 2 suspension shown top right). They include BPW-made components: for example, the brake actuation chamber, drum brake housing and disc

brake callipers. They can be equipped with Haldex, Knorr-Bremse and Haldex brand brake systems as required. Such interoperability is made possible by suppliers' reliance on common interfaces.

Still, BPW favours the drum variety for 95% of sales. Engineering manager Roger Thorpe argues that drum brakes suit the climate of the UK (wet and possibly salty conditions near the coasts) and common maintenance regimes here. Drum components are contained (and protected) within the drum housing, and are replaceable, whereas disc brake components are exposed to the elements. They have become unpopular with hire fleets, for example, because of discs rusting during weeks-long storage periods; that rust gets picked up by the brake pads and can damage the disc. And if a disc brake fails - or isn't maintained properly, which is more common, according to Thorpe - a replacement calliper is expensive. (On the other hand, another BPW user is content to specify disc brakes for its trunking fleet.)

Drum brakes are actuated, via a camshaft, by a mechanical double-diaphragm brake chamber. When the parking brake is applied, a powerful spring provides braking force. To release the parking brake, the chamber on the other side of a rubber diaphragm is pressurised; this compresses the spring. The front part of the chamber, as installed on the trailer, houses the service brake diaphragm, which works in a similar way.

Piston-type actuators (used also for disc brakes) comprise a machined piston with seal instead of a rubber diaphragm. This is said to provide more even force distribution, and lasts longer, but costs more. "Only just recently have people started to see value for paying more for good brake actuators," comments Thorpe. All brake system components, from the actuators down to the



foundation brake, are subject to design scrutiny under EU regulations. The complete braking system, including EBS (electronic braking system) control, has to comply with UNECE Regulation 13 (<https://is.gd/atekuw>).

OPTIMISATION

Since trailers are custom-made, the form of their suspensions can follow function. Taking a common duty of a trunking trailer, the running gear can be optimised for low maintenance, for example. In such a case, its suspension would be configured to achieve a specified ride height (for BPW, 180-550mm), married to a particular tyre size. The largest possible tyre diameter would be chosen to minimise the number of revolutions, and hence wear, of the tyre, and to also minimise the required brake torque to stop it. Furthermore, the biggest diameter brake possible would be fitted (BPW's range goes from 300-420mm diameter) to reduce frictional wear.

Where fitment of small wheels and small brakes is unavoidable – such as in

double-deck trailers – brake pressures can be tweaked. Modern brake systems enable changes to the shape of the brake performance curve as pressure increases, allowing performance where braking is needed (90% of all braking occurs at less than 2 bar, according to Thorpe) while still meeting the MOT requirement of 6.5 bar.

A trailer's duty cycle also affects its maintenance requirements. Friction material used in brake pads changes with use: on a heavily utilised trailer, the coefficient of friction will stay quite high – and even sometimes increases, Thorpe points out – whereas on a more lightly loaded trailer, friction levels will drop off. "We can choose the braking pressures to keep the braking efficiency optimum,"

Thorpe says, adding:

"Our experience comes more into that than mathematical calculation."

Brake calculations required for type approval that are performed by BPW cover not only the braking system, but also take in other factors in the design chosen. For example, the taller the hanger brackets at the front of the suspension, the higher the forces acting in the structure as a trailer turns a corner. For that reason, BPW prefers to supply a compact suspension.

Should the proposed drum-based braking system prove insufficient to meet statutory requirements, there are (at least) three options. The existing brake chamber could be swapped with a larger unit to provide greater power. Or a different hole position on the slack adjuster on the drum brake camshaft could be chosen, to alter the amount of torque the brake shoes receive. Finally, signals from the EBS modulator can also be adjusted to bring brake performance into line.

EBS systems, which are almost ubiquitous now, should in theory result in equal braking at each wheel. But in practice this ideal remains unlikely, particularly on combinations, Thorpe states. The UK's tractor and trailer parcs vary so greatly in age and condition that mixing and matching them remains difficult. For example,

one tractor OEM method of ensuring tractor-trailer compatibility, called 'coupling force control', does not always work correctly in the specific case of heavily laden spirit trailers, BPW has found.

If customers experience braking problems, BPW's field engineers could carry out a so-called 'hot run' of a standard load in normal operating circumstances. At the end of that process, a technician measures every brake's temperature, including those on the tractor unit. Much hotter readings on trailer than the tractor brakes, say 300°C versus 95°C, mean that the combination is causing excess wear on the trailer's brakes. Then the imbalance would be resolved by working in cooperation with the trailer manufacturer.

Another modern tool in the fleet engineer's toolbox is EBPMs (electronic brake performance monitoring system). This technology compares real braking performance in terms of brake pressure, and deceleration monitored by GPS (included as part of a telematics system) with a computer model of how the truck should behave. Such a system can be used for evidence of acceptable braking performance for a safety inspection report. A competitor product is from Axscend. BPW has been carrying out testing in the UK with plans to submit it to DVSA for launch into the UK market. **TE**

-Will Dalrymple

