

# Magic carpet ride

In a sense, commercial vehicles ride not on tyres but on the fat fingers of roller bearings housed inside wheel hubs. Although the traditional designs are proven to be robust, that does not mean they never go wrong, writes Toby Clark



**F**undamentally, wheel hubs have not changed in design for a hundred years, with some combination of tapered roller bearings (TRBs) taking axial and radial forces, and seals to keep lubricant in and water and dirt out. But there are developments even now, and it is useful to be aware of what these mean for inspection, maintenance and replacement.

"It's such a small area of the repair side of trucks, but with big consequences," says Paul Bodycot, product quality engineer for Volvo Group UK.

Inspection can involve static testing using a dial test indicator (DTI) - in which case even a very small amount of play is unacceptable. But Alistair Baldwin, master technician at TruckEast Scania in Norwich, prefers to spin the wheel and listen to the hub bearings - a straightforward test which needs no specialist equipment. He says: "When we inspect [trucks and trailers] we always jack them up and spin them. You'll hear if it's gone, whether it's a tapered bearing or a cassette.

"Sometimes you can hear it on road test, especially when you go round a roundabout and it's loaded up."

But Paul Bodycot adds that bearing problems are not too common now:

"We have more problems from wheel vibration due to tyres," he says.

Individual TRBs are increasingly being replaced by cassette-type assemblies of matched bearing units. These are sometimes known as HBUs (hub bearing units) or truck hub units.

SKF has laid out the stages of integration of wheel bearings and hubs. They start with the single TRB with separate seals and lubricant, for assembly by the customer (a repair kit is shown below right). The next stage is a 'truck matched unit' (TMU) of paired TRBs.

Next comes the cassette-type truck hub unit 1 (THU1) which includes a pre-assembled pair of bearings, greased and sealed for life. The truck hub unit 2 (THU2) which adds an integrated flange and ABS ring; this is also available as a stepped unit, designed for stepped spindles, or as a full-flange unit

(THU2 FF) with wheel bolts built in (pictured below left).

The most integrated solution is a full hub, which SKF calls an 'assembled truck matched unit' (A-TMU): here the bearings and seals are mounted in a flanged cast iron hub, complete with wheel bolts and ABS ring.

## WATCH FOR PRELOAD

Other aftermarket manufacturers also offer preassembled hub units with the bearing unit, seals, ABS encoder ring and all the fixings and fasteners required; FAG's Complete Hub is one of these.

While cassette-type units have the paired bearings correctly set up at the factory, individual TRBs need to be adjusted - particularly in terms of preload.

SKF defines preload as "the condition of a paired tapered roller bearing



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arrangement which is not allowing any axial movement”. That happens when there is no clearance, it adds. SKF continues: “Generally speaking, a slight preload can be considered to be the best setting, as it will distribute the load evenly on all rollers and therefore improve bearing life”.

Excessive preload increases the forces bearing on the rollers, raising the temperature and harming the lubricant as well as the rollers. On the other hand, excessive clearance allows the rollers to skew or even leave their cage. Either extreme can ultimately lead to bearing failure or even a lost wheel.

Traditionally, the preload is set by torquing the axle nut to a known value, then turning it back to a locking hole. Some units, such as BPW’s ECO Plus axles (such as pictured top left), include a torque-limiting axle nut that indicates, with a click, when the correct value has been achieved; then a locking key is inserted, without turning the nut back.

**THE FULL RUNDOWN**

It is also important to use the correct run-down procedure when setting the preload: this should be detailed in the installation instructions, but usually involves turning the wheel hub five to 20 revolutions while tightening the axle nut to the specified torque – so you must not use an impact wrench. These revolutions allow the rollers to be seated properly, so they do not shift later and introduce a clearance. If the bearing is tightened without the run-down



procedure it can also create indentations in the bearing track, which can later spall (shed particles of metal).

BPW’s current ECO Plus 3 axles use matched pairs of TRBs, which should be inspected and lubricated (and ideally replaced) after the first five years of operation, then every three years. In off-road use the intervals are shorter.

If your hub ends are lubricated with grease, be sure not to overfill them; some space is needed for the grease to flow and to expand when it heats up. Without this space, ‘grease churning’ will increase friction and raise the bearing temperature.

If you are applying the lubricant

with a grease gun, be sure to apply the lubricant slowly. Stop if you come across excessive back-pressure, so that you do not blow out the seals and let dirt in.

The bearings themselves are only part of the equation. Seals are also critical in terms of design, materials and installation. After all, they have to work while resisting axial and radial loads with the minimum of friction. In fact, bearing manufacturer SKF goes so far as to say that “seals are, and will remain, the main HBU performance differentiator”.

Of course, a seal can only take so much force, so pressure-washing or steam cleaning needs to be done with care (cleaners should also avoid the axle breather pipes too). But if they are fitted carefully, hub seals are pretty reliable.

“Although we think this is very rare, if the seal fails on unit bearings, we expect that the bearing is most probably already failed and will need replacing,” says Bodycot. “If the unit bearing fails, then the seal is replaced”. In fact, in the event of a seal failure, “all oil feed bearings would be inspected to see any bearing or race failure prior to changing the seal”.

Alistair Baldwin agrees: “You don’t normally have any problems with the hub seals leaking”. But on the other hand, he agrees, “if the bearing is gone, then the seal is going to leak”. **TE**

**FURTHER INFORMATION**

FAG information portal – [www.is.gd/lisece](http://www.is.gd/lisece)

SKF data – [www.is.gd/kikifo](http://www.is.gd/kikifo)

BPW axle information – [www.is.gd/joxobi](http://www.is.gd/joxobi)

**HUB CAPS**

Hub caps might seem outmoded, but as a defence against bearing and seal damage they have their place. SKF says its hub caps offer “resistance against impact damage, weather, chemicals, UV radiation and ozone”. Rather more dramatically, they claim to give “protection from ricocheting rocks and flooded shipping docks”.

They can be specified with oil level sight windows, and incorporate other features, such as an embedded aluminium ring to evenly distribute load, and a centre-fill vented plug-in design, or a side-fill plug with an O-ring for extra leak protection and a magnet to trap metallic particles.

