INSIDE BRAKING SYSTEMS

In the first of our new Technician Talk features, we look at how braking systems have undergone considerable development in recent years, and assess what that means for technicians. Brian Tinham talks to Peter Jones, technical training manager at MAN

Brakes aren't what they used to be... Or are they? Yes, modern electrically-controlled pneumatic braking systems are functionally quite different from their forebears. And, yes, they offer faster reaction times than the old direct-applied pneumatics, as well as longer pad service life – not least because many are designed to monitor pad wear patterns and compensate for any disparity by adjusting braking air pressures side to side, or wheel to wheel. But beyond the fancy stuff, you'll recognise callipers, discs and pads that have changed little in years.

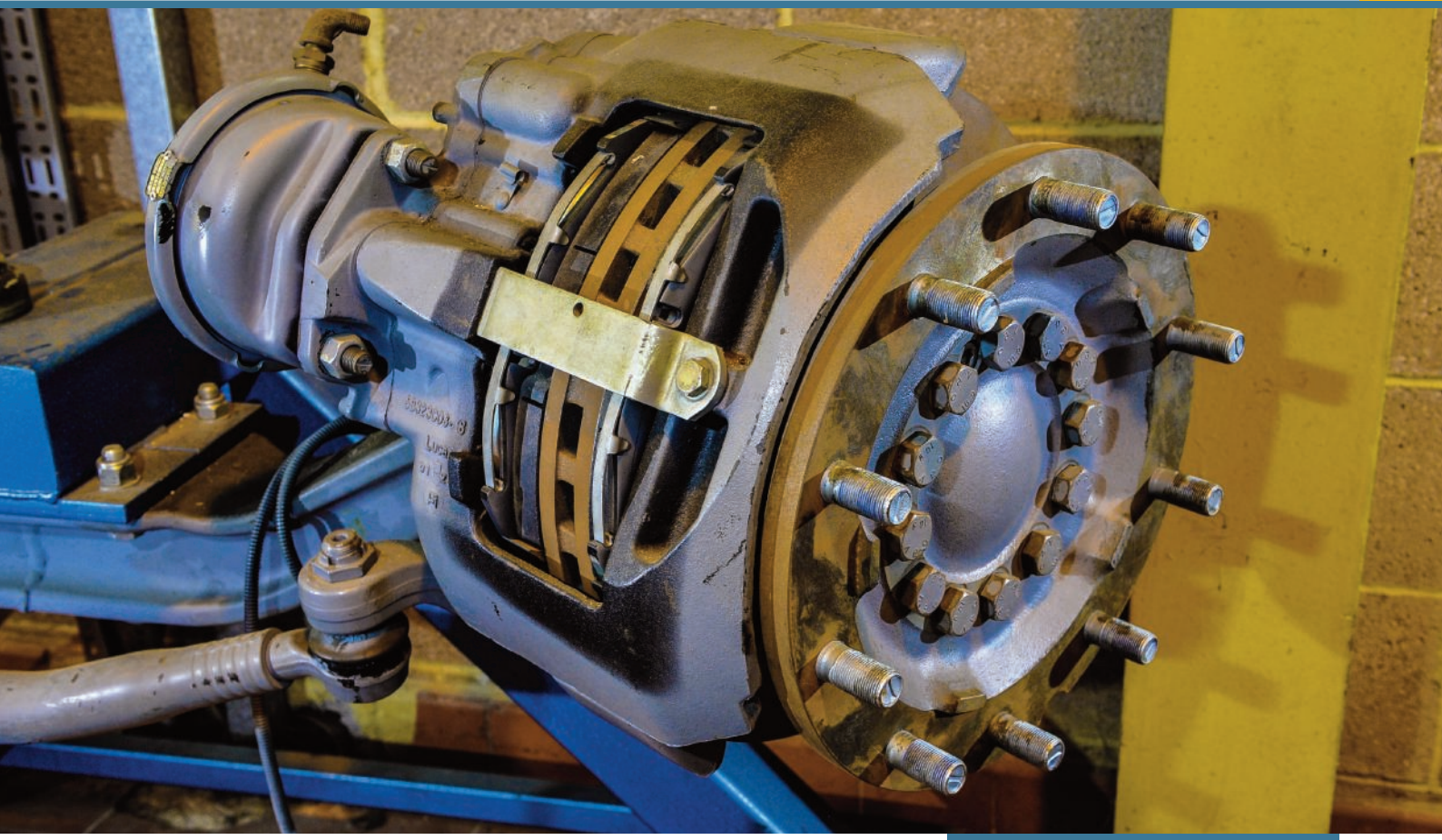
Let's remind ourselves of the basics. All the OEMs use main brake manufacturers, such as Haldex, Knorr-Bremse and Wabco, whose systems work in similar ways. Electrical impulses – generated by the ECU in response to pressure applied to the brake pedal – are sent via CANbus to each wheel module. These are converted to electrical power and drive a solenoid, which controls the admission of pressurised air to each brake chamber. The air, in turn, acts on each calliper piston to press the pads on to the disc. Air is then exhausted. Meanwhile, conventional pneumatics run in the background, providing automatic backup in the event of the electrics failing.

All brakes – including those on the lift axles, whether lifted or not – are applied every time the brake pedal is depressed. On tractors, the rear two axles on a 6x2 are powered and controlled as one, left and right. Also, for ESC (electronic stability control) and AEBS (automatic emergency braking systems), four wheel-speed sensors are deployed – two on the steer axle and two on the drive axle, whether pusher or tag. More on this later.

BRAKE CLEARANCES

One other point: most automatic systems are designed to sense if one side is wearing more than the other. They then adjust the air pressure during braking to trend towards rebalancing pad wear. That said, the automated system requires no particular attention: it's a matter of being aware and making sure it's working. If it's not, that may mean a calliper problem.

So, for technicians, not a lot has changed. Health and safety first – and as a minimum you should ensure that equipment available includes a crane to lift



the discs, callipers and drums, if fitted.

Then start by checking the foundation brake pad clearances, whether as part of the PMI (preventive maintenance inspection), or if a driver has complained of pulling or another brake-related defect. Use a feeler gauge, nominally set at 0.7mm – although a gap of 1.2mm may be acceptable, depending on piston movement. As always, don't check the clearance between pad and disc: if they're wearing unevenly, you're not going to get a reliable reading. Instead, check, between the pad and the piston.

PAD WEAR

What about pad wear? Most systems are equipped with pad wear monitoring, so you can check the dashboard display, if fitted. Simply call up the dash diagnostic menu and ramp through the axles, looking at left and right wear values. Not all trucks have this system and it's simple enough to check wear at the wheels by looking at the pads' central groove wear indicators, assuming the vehicle owner bought OE replacements.

As for when to change the pads, there are different schools of thought, but most suggest that it depends on several factors. If your task is a scheduled service or inspection, then the question to ask yourself is: 'Will this vehicle stop effectively before the next intervention?'. If you know you'll see it again for the next PMI in six weeks, that's one thing. If you don't know you'll ever see it again, that's another.

Similarly, if it's a tractor unit trunking up and down the motorways, brake demand is likely to be low, so you can take a long view. But if this is a tipper, subject to a lot of off-road working, with all that means in terms of grit forming a grinding paste for the pads, you might want to be more cautious. Unless, of course, your tipper works locally and you'll see it again for the next PMI. It's a judgement call but remember, brakes are safety-critical. As a rule of thumb, 25% pad thickness remaining should be a warning level.

PAD CHANGING

Either way, anyone changing brake pads should check that the calliper is sliding freely by hand, without sticking, when they open it up. You should also look out for wear on the calliper slider bushes and check that there are no splits in the rubber boots. Also, check the discs for cracking, crazing and corrosion.

Refer to the workshop manual for cracking depth tolerance and don't be

Before you do anything

Delphi warns that before you do anything, consider other equipment on the vehicle that may, if faulty, mimic faulty brake systems.

1. **Inspect the wheels** Look for damage to the rim that might be causing buckling
2. **Check the tyres** Inflation pressures and wear patterns tell useful stories
3. **Wheel bearings** Check for correct adjustment
4. **Suspension system** Check components for signs of wear or damage
5. **Wheel alignment** Problems may result in an incorrect diagnosis of braking system faults. For example, if the camber or caster is out-of-tolerance, this can cause a vehicle to pull to one side, in much the same way as a brakes problem
6. **Check complete** Once other relevant vehicle systems have been ruled out, it's time to focus on the brake system.

✓Checklist

- ✓ Consider health and safety, and use appropriate equipment
- ✓ Check brake clearances
- ✓ Check pad wear
- ✓ Check calliper function
- ✓ Check for calliper slider bush wear and boot condition
- ✓ Check discs for cracking, crazing and corrosion
- ✓ Check braking air pressure
- ✓ Look and listen for leaks
- ✓ Examine wiring condition from the harness to the brakes
- ✓ Where fitted, ensure AEBS sensor is properly aligned.

guided solely by what you think you see. Incidentally, the same goes for clearances: there will be variations between vehicles, both in terms of gvw and marque. Only when you're satisfied that all the above are satisfactory should you install the new pads, remembering to replace all of them.

AIR PRESSURE

Beyond the brake mechanisms, you may need to consider braking air pressure, particularly if a problem has been reported by the driver. For routine checks, first read the pressures using the dashboard gauges, the truck's onboard diagnostic menu or the workshop diagnostics.

You should also look and listen for air leaks. If they're present, you'll notice long before they're visible on the gauges. Likely causes might include a rubbing air pipe or a corroded connector. Take care to check all systems after depressurisation.

Similarly, examine the wiring condition from the harness to the brake components. Again, check for signs of rubbing or exposed connections.

Note that, while load sensing valves are a thing of the past, many truck manufacturers were still using them until circa 2005, so you may still come across some. However, today load sensing is achieved through the EDC (electronic diesel control) unit. That module derives the vehicle weight from the power, and hence fuel, required to move the load. It requires no technician attention.

Note that while the EDC cannot function properly if a vehicle stops with ignition off over the brow of a hill – since fuel consumption moving off downhill will be low, so the system will assume low load – in fact, the preset start condition is

Checking AEBS and ACC radar sensor set-up with the laser-based tracking gauge

125 tonnes of braking, so full braking power is always available.

ELECTRONIC SYSTEMS

Moving on to AEBS, which uses the same front-mounted radar sensor as used in ACC (adaptive cruise control), there are several points to note. The sensor must be forward facing; its plastic case must be fitted, to avoid chipping of the glass lens; and the case must not be painted. Failures with any of the above will render the system useless.

The remaining task is to ensure proper set-up. First, check the rear axle wheel alignment, using standard equipment, to ensure that the vehicle is running square and the radar is facing forward. Then use a tracking gauge two metres in front of the truck to set the radar angle. Adjust the laser so that it hits the small mirror beside the sensor glass and reflects back to the cross hairs on the instrument. Don't align it to the middle. Your diagnostics will tell you the required settings from the ECU. Then adjust the truck-mounted radar, using the two alignment screws.

Finally, on ESC, although in the event of a fault the controller is a bolt-on bolt-off unit, there are two concerns. The system uses a pair of sensors, one mounted under the steering column, the other nominally in the middle of the chassis.

First, to avoid damage to the former if the steering shaft has to be disconnected, the steering wheel must be maintained in the central position. The sensor itself is a coil, so excessive turning of the steering wheel risks breaking the sensor.

Second, the chassis sensor must not be moved. The device is mounted centrally and facing forwards, because it's designed to detect vehicle roll and yaw. If it is placed elsewhere to overcome some equipment packaging issues, the roll parameters it sees may not match the mapping program. Worse, if its orientation also changes, it will see pitch instead of roll, and malfunction. TE