

## BREAKING THROUGH TECHNOLOGICAL BOUNDARIES

Volvo, the clear leader in transport safety innovation, has earned widespread commendation for the design of the disc brake system on its new heavy-duty truck range.

It may have all started with the humble wagon wheel, but the wood on wood brakes of the past in no way compare to the technological masterpieces on today's Volvo trucks. Designed to maximise safety, efficiency and productivity, Volvo's Braking Systems compliment each other to deliver Volvo operators a competitive edge.

Volvo disc brakes are made of a metal alloy (molybdenum-vanadium) that is highly durable in order to withstand very high temperatures and transfer a large amount of brake torque.

"Disc brakes are more stable, more consistent, have shorter stopping distances and are more responsive in an emergency situation," Mr Mal Brown, Volvo Truck Australia's Product Strategy Manager, reported.

Mounted on the hub via a patented spline-like joint with a spring washer, the design of the Volvo disc brake allows the brake disc to expand symmetrically, both axially and radially to increase service life and reduce the risk of cracking.

The design also allows the brake disc to be in full contact with the brake linings, regardless of the temperature of the disc.

Air channels build up in the spline-like joint and act like a heat barrier to reduce the risk of the wheel bearings overheating.

"When drum brakes and disc brakes are perfectly bedded in, and in a cold state, there is little to choose between them," conceded Mr Brown. "But after prolonged application, the superiority of disc brakes becomes increasingly apparent."

Volvo disc brakes are designed to ease the maintenance burden and improve the vehicle's productivity. When it is time to replace the rotor, it's simply a matter of sliding the worn rotor from the hub and sliding the new rotor back on. There is no need to replace the wheel hub or bearing assembly.

The brake discs are 45 mm thick and 430 mm in diameters and the wearing surface is 5 mm and the disc can be reground within the wearing limit.

The Volvo disc brake is of a simple design and has few parts that wear, to further reduce maintenance costs. There is also a Lining Wear Sensor (LWS) for the brake linings on each brake calliper. When approximately 20 percent of the brake lining remains, a signal is sent to the driver information display. This clever device facilitates planning of service and maintenance routines.

"Volvo disc brakes are also aired," Mr Brown explained. "This lowers the working temperature of the tyres and wheels and obviously has a positive effect on the service life of the tyre. It also reduces the risk of separation between the tyre carcass and the thread.

Floating, self-adjusting brake callipers provide even braking. The brake force from the brake cylinder presses out the two pistons in the brake calliper, pressing the inner brake pad against the brake disc. Since the brake calliper is mounted so that it floats, the entire calliper can move laterally, and the outer brake pad is therefore also pressed against the disc.

The brake calliper is equipped with a function for automatic adjustment of the clearance between the brake lining and brake disc and in addition to the electrical lining wear sensor, the calliper is also equipped with a mechanical wear sensor in the form of a graduated measuring stick.

Volvo has not only designed a highly effective and efficient disc brake, but an entire braking system to optimise productivity, safety and efficiency.

"ABS (Anti-lock Braking System) is an important element in our braking system," Mr Brown continued. "Trucks with ABS are able to stop faster and the system also helps the driver to maintain control of the vehicle and steer it during the entire braking period.

"And, as a result of Volvo's EBS (Electronic Brake System), actuation of each wheel brake is instantaneous in direct proportion to pedal pressure," Mr Brown explained. "This greatly enhances stability in all conditions and eliminates much of the unwanted drama and stress associated with emergency stops."

These superior performance characteristics are the result of better heat dissipation and less fade. The disc and pads retain their shape while maintaining the maximum contact area.

The same cannot be said of traditional drum brakes. Under frequent and heavy use, drums and shoes can suffer distortion that will reduce friction contact area; effectiveness is bound to decrease, though a driver may not notice the gradual degradation.

Volvo's EBS is a rapidly reacting brake system, which improves traffic safety and vehicle productivity. The disc brakes are operated pneumatically, but the EBS control unit regulates the actual function of the brakes. It is an intelligent system that is able to apportion precisely the right amount of braking force to each wheel. This results in more even wear on all brakes at each wheel.

When the front axle pads need replacement, the rear ones will need replacing too. That equates to one visit to the workshop rather than two, and better productivity.

Drivers will immediately appreciate the more positive feel of the brake pedal. Better feedback allows accurate judgement of the appropriate pedal pressure needed. Those vibrations that can occur with drum brakes under severe, prolonged pressure are all but eliminated.

EBS provides the best possible control of the brake system; giving instantaneous actuation and release of the brakes. This increases a brake's efficiency and saves fuel because fast and simultaneous release of the brake overcomes 'brake drag'. Brake drag occurs when release on some axles is momentarily delayed (a traditional air system reacts more slowly than electronic actuation). So, with EBS, acceleration after braking requires less fuel.

EBS also provides better interaction of the Anti-lock Braking and Traction Control Systems and is equipped with a pneumatic back-up system with two independent brake circuits.

Volvo's ABS (Anti-lock Braking System) is an anti-lock brake system that forms part of EBS. With ABS, the friction from the road is put to maximum use when braking. With vehicle combinations in which the trailer is also equipped with ABS, there is less risk of jack-knifing when the brakes are applied forcefully.

When ABS engages, the engine's exhaust brake and the gearbox retarder are automatically disengaged.

Another element of Volvo's superior braking system is the Traction Control System (TCS). The Volvo TCS system minimises wheel spin, ensuring the engine's power is converted to forward or rearward motion.

If the wheels spin when the accelerator is pressed, the system senses this and reduces the engine power. On the other hand, if only one wheel spins as a result of the differences in road friction, the TCS applies the brakes to that wheel and the traction is then transferred to the remaining wheels. In short, the TCS basically acts as an automatic differential brake.

Volvo Disc Brakes are now fitted as standard in all Volvo Heavy Duty trucks, but how is this system affected by various pieces of trailing equipment?

Volvo answered that query with its Braking Compatibility System (BCS), which adjusts the brake forces between the truck and trailer so that each part of the vehicle combination brakes its own weight.

The system also contains a function that regulates the brake pressure between the truck's front and rear axles based on the information from the brakes' wear sensors. The total brake pressure is always the same, but the function evens out the wear between the brake linings on the different axles.

Trailers, regardless of whether they are equipped with ABS, EBS or a standard brake system, can be connected to the truck with EBS. The trailer modulator supplies the trailer's brake system with compressed air. On trailers without EBS, it regulates the trailer's brake force.

Apart from the enhanced driving environment, long-term tangible efficiencies and significant safety benefits provided by Volvo's disc brake system, there are sizeable direct operating gains that Volvo operators will notice immediately.

"It's part of what we at Volvo call Uptime," Mr Brown pointed out. "We believe that a Volvo truck should spend most of its life on the road earning money, not in a workshop being serviced, and with our disc brakes, brake service time is reduced by a staggering amount. By design our disc brakes are self-adjusting, there are no expensive add-ons to consider and there are no shafts and bushes to replace.

"If you consider the time involved with adjusting traditional drum brakes regularly," Mr Brown concluded, "and compare it to the time needed to replace the disc or pads in our system, you'll find the turn around time with disc brakes is almost five times faster. That means your labour bill is considerably reduced compared to a drum brake reline."

Volvo consistently breaks through technological boundaries to deliver the highest in efficiency and safety for Volvo truck operators. On learning more about each of the elements that make up a Volvo truck, one has to wonder why Volvo isn't asked to design NASA's space shuttles.

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