

FORMULA E PIONEERS

The tech frontiers opened up by all-electric racing



Driving Technology Into Pole Position

INTERNATIONAL

RACE TECH

Motorsport Engineering

OCTOBER 2016 No. 191 UK £5.95 USA \$11.99

www.racetechnmag.com

Bernoulli

Last roll of the dice

The developments defining F1's title run-in



WRC 2017: Spirit of Group B haunts the stages

a small valve up the centre of the piston that doesn't have the main seal travelling back across it, so still has the same travel to cut off. The travel to cut-off on a main seal just creeps over this small port that's about 0.75 mm in diameter and then there is still around 5 mm of seal to travel over the port. With the centre valve there's the typical 0.75 mm of travel and there's no seal that can extrude. That works really nicely with the ABS system as it has proven to be a cleaner cut-off and there's been a reduction to about 0.5 mm of travel making the tolerance better.

"Adjacent to that valve, we've put an anti-knockback function in. Traditionally we put anti-knock back springs behind the pistons in the calliper. You can only go so far with those before you induce drag into the brake system. We've had really bad knock-back on some cars if they have flexible uprights or stub axles that flex a lot.

"Putting very strong springs in can mean temperature problems with the induced drag and loss of top speed. What we've done is put a valve system into the piston rather than in the cylinder that sits adjacent to the centre valve. It's a relatively simple

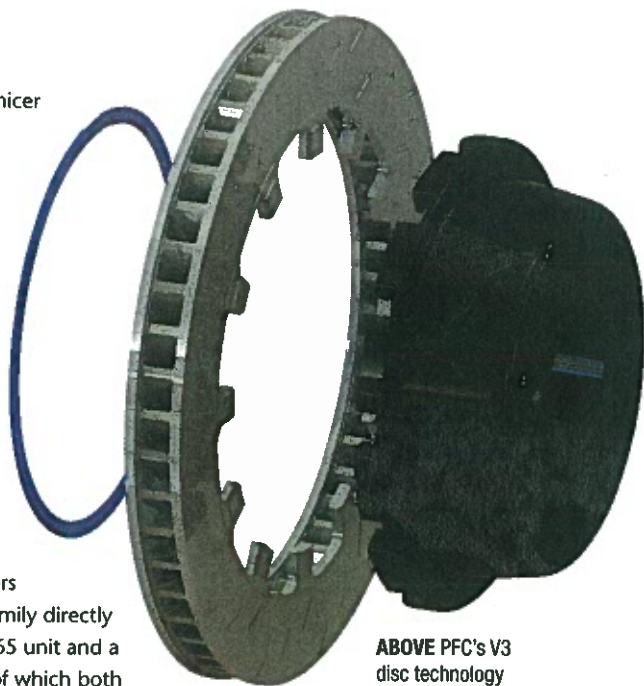
system which makes it a much nicer application and installation.

"For any cars where the rules state ABS is permitted, the new parts would be suitable. It's quite a nice cut-off system that may find use elsewhere. The anti-knockback system can be used absolutely anywhere as it doesn't depend on ABS.

"It's had its first test. Several cars ran it at the last NASCAR race which went really well. It's virtually ready now so we're just building up our stock. There will be two master cylinders available; a pull type CP 6467 family directly interchangeable with the CP 6465 unit and a new push type CP 7198 family of which both are patent pending."

PUSHING BOUNDARIES

While anti-knockback is high on the agenda of many brake manufacturers, it does not mean that development in other areas has ceased. Take Performance Friction



ABOVE PFC's V3 disc technology

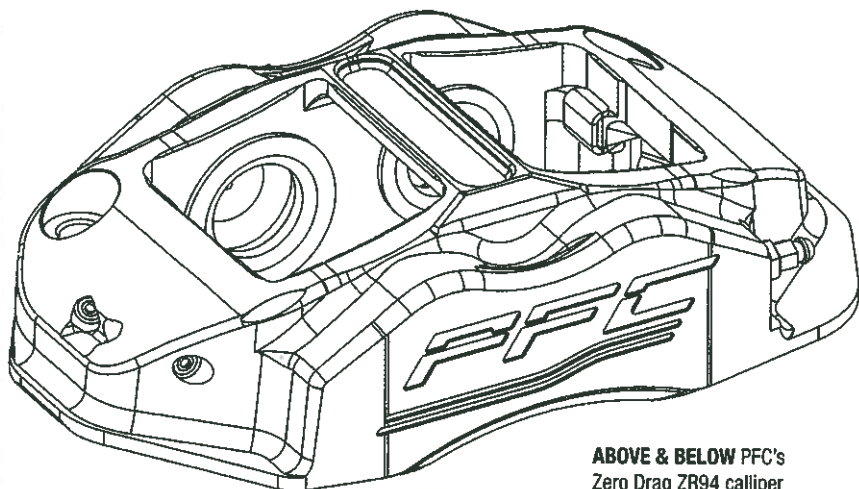
Corporation's (PFC) V3 disc technology. The advanced design features a patented design that uses a two-turn retention ring that is held in a groove in the hat that overlaps the disc flanges, effectively locking it to the hat negating the need for torque wrenches. As well as being convenient and less fiddly, it is also much lighter than previous designs.

PFC is also famous for its award-winning 'Zero Drag' callipers that are under constant development, the latest iteration being the ZR94 that is both stronger and lighter than its predecessor. It also see the introduction of an anti-rotation fluid inlet that helps increase the calliper's rigidity. It's available for a multitude of racing disciplines providing crucial unsprung mass savings and braking performance.

BACK TO BASICS

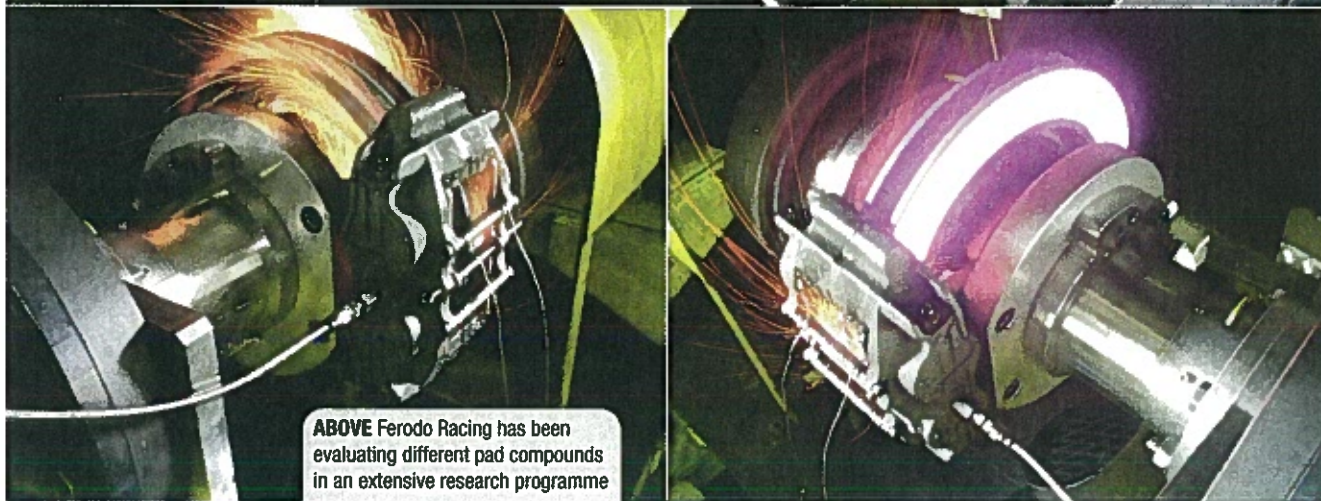
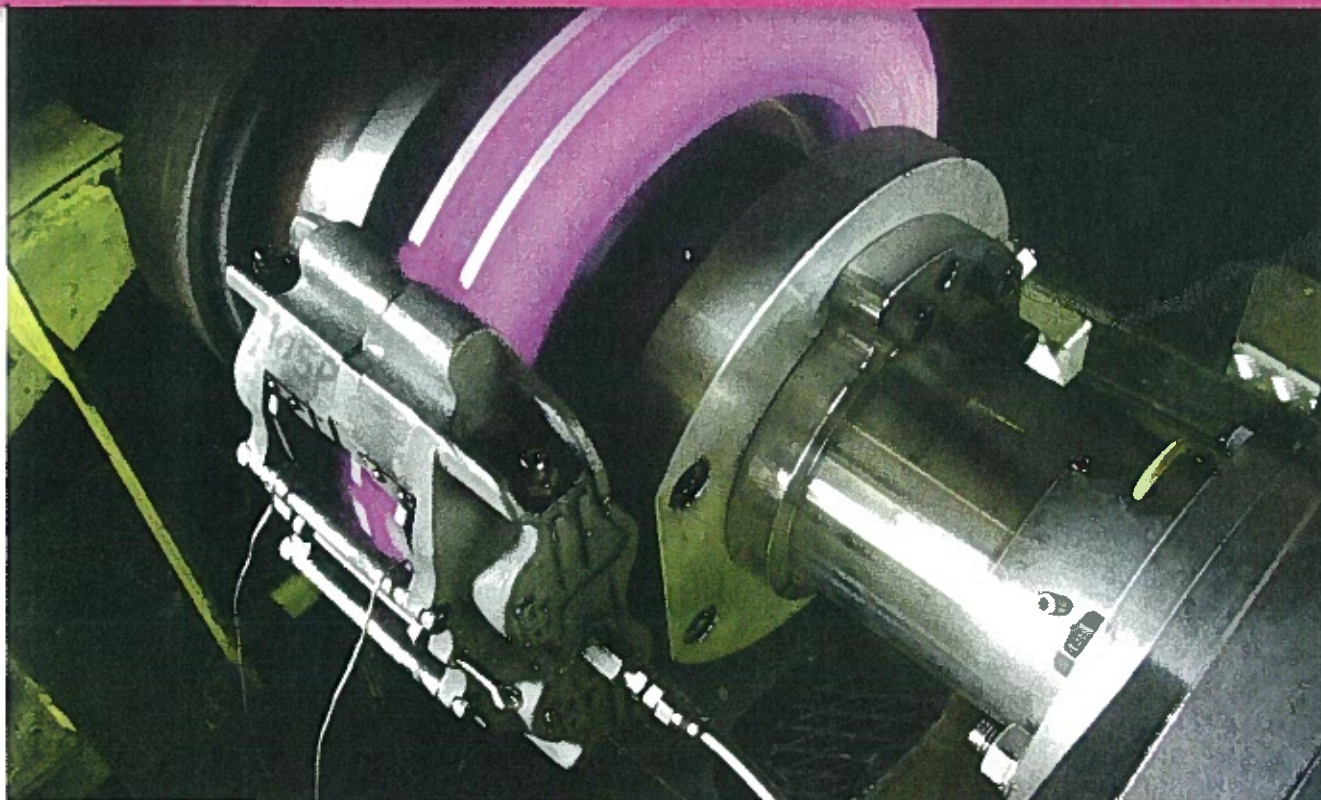
Not to be forgotten in all this is the simple brake pad itself which is the subject of constant development even if it is not that much apparent to the world at large. Long gone are the years when asbestos was thought to provide the best solution to the point where there is an array of compound choices that include semi-metallic, metallic, ceramic and carbon, each having their own attributes, some of which are more suitable for racing than others, depending on the type of event – offroad, endurance, sprint – and type of car – rally, rallycross, single-seater, endurance, GT, Touring Car and so on.

Ferodo Racing has been part of the motor racing scene for decades and continues to be actively involved in many series. One such is in FIA Formula 4 where it offers a ▶



ABOVE & BELOW PFC's Zero Drag ZR94 calliper





ABOVE Ferodo Racing has been evaluating different pad compounds in an extensive research programme

wide choice of pads. "Often with these racing series there can be finances involved as well, so we offer a range of materials to accommodate everyone. Moreover even professional drivers have varying preferences – one could prefer to stamp on the brake, while others might prefer to feel their way into a brake application," says Edward Little, Ferodo Racing's technical manager. "We therefore offer heavy-duty racing compounds, such as our DS1.11 down to the DS2500 high-performance track day pads that are also suitable for some race applications such as Formula 4."

Ferodo Racing also supplies the Italian GT3 series which requires a different style of brake pad altogether, one of the key differences between the two series being ABS. "The requirements of a car with ABS are very different in the sense that in some ways three quarters of the brake application is managed

by the system," says Little. "The friction needs to develop in the very early part of the stop, but not super-instantly nor too-slowly, to bring the ABS into operation in a way that the driver likes. We thus have to deal with requirements as subtle as that. And understanding how such subtleties are linked with the formulation can be largely trial and error.

"If formulators claim that they can achieve that level of refinement by formulation intentionally, I'd be a bit dubious about it. You roughly know what you want, such as stable friction and high or low level friction that comes in quickly or slowly, but how it brings the ABS in is an empirical exercise."

Little confirms that Ferodo Racing is continuing its process analysis as reported in the March issue of *Race Tech* having benefitted from its focus on motorcycle racing last year. "We're in a phase at the moment where we are concentrating on

what is the 'cleverness' in our business – the formulation. It's in the recipe of the brake pad mix. It went through a phase until about a year ago where we were looking at the production techniques and how we could improve the product by cooking and pressing it in a different way. However, that phase has ended resulting in some progress.

"We thought it was time to step back and evaluate each of the key components that make up a brake pad. We are consequently going back to basics, starting again from scratch and making progress by returning to more traditional methods. We are looking at the formulation again and going back to a more traditional formulation approach with the 'recipe', how it's made up and whether we're using the correct raw materials. At the moment, although there isn't anything commercially ready for the market, we are track testing promising candidates." **RT**