

**Designing and manufacturing  
equipment for the testing of  
fuels and lubricants.**



company overview

**PCS Instruments**  
supports a wide range of industries



**Lubricants**



**Powertrain**



**Fuels**



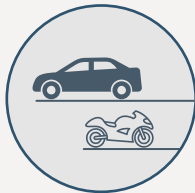
**Transport**



**Lifestyle**



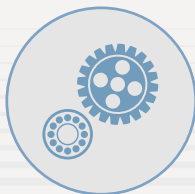
**Food & Beverage**



**Automotive**



**BioMedical**



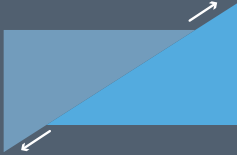
**Industrial**



**Green Tribology**

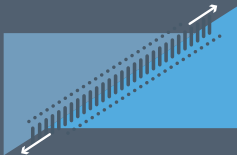


## Tribology Key Elements



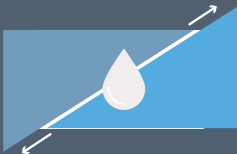
### Friction

The resistance that one object encounters when sliding over another.



### Wear

The damaging, gradual removal of material at contacting solid surfaces in relative motion.



### Lubrication

The process of introducing a substance to reduce friction and wear between surfaces in contact.

## About Us

PCS Instruments are global leaders in the tribology test equipment industry. Established in 1987, we design and manufacture cutting edge instruments for analysing the properties of lubricants and fuels.

Our instruments give researchers the tools to benchmark their products against market leading brands, and play a pivotal role in the development of world class lubricants, materials and formulations.

We have a worldwide client base, spanning over 90 countries, of users performing to ISO and ASTM test methods as well as specialised tribology research in a wide range of industries.

We support our products either directly from the UK or through our extensive network of trained distributors, which ensures all our customers receive fast, reliable service and support.

- = **Compact, benchtop and highly automated, our instruments require minimal lab space and user intervention.**
- = **Simple test setup and calibration procedures help users to produce fast, repeatable results and reduce training time.**
- = **Intuitive software applications make defining and running different test profiles a straightforward task.**
- = **Test data can be easily imported into other applications for further analysis.**

“PCS is very innovative and is strongly tied to the tribology industry. Their instruments are on the cutting edge of testing technology and the constant stream of new methodologies and equipment they produce continuously allows us to solve the problems arising in industry.”

**Jason Galary, R&D Director, NYE Lubricants**

# Innovative Tribology Tools

**Increases efficiency**



**Minimises development costs**

## MTM



A ball-on-disc instrument for measuring the frictional properties of lubricated and unlubricated contacts under a wide range of rolling and sliding conditions.

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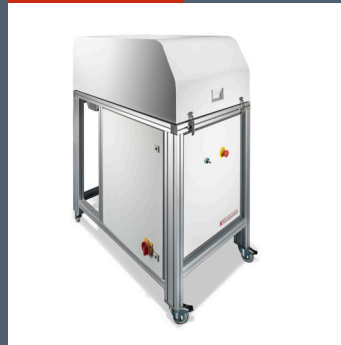
## ETM



A development of the MTM instrument focused on measuring the frictional properties of lubricated and unlubricated contacts under extreme pressures.

PAGE 5

## MPR



A compact, three disc machine for researching rolling contact fatigue (RCF) failure mechanisms in the form of micro and macro pitting.

PAGE 6

## USV



A high shear viscometer measuring viscosity over a shear rate range from  $10^6 \text{ s}^{-1}$  to  $10^7 \text{ s}^{-1}$ .

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**Boosts sustainability**



**Reduces product time to market**



Certification Number 15659  
ISO 9001

## Our Instruments

### EHD



Ultra thin film measurement device for measuring lubricant film thickness down to 1nm in the elastohydrodynamic (EHD) lubricating regime.

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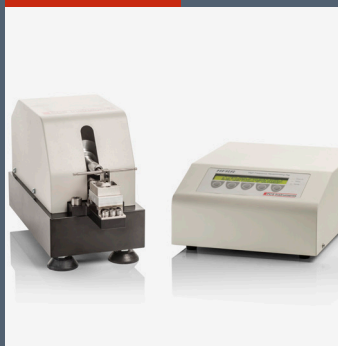
### EHD-HS



A high speed (up to 20 m/s, fully automated benchtop instrument, measuring lubricant film thickness down to 1 nm in the elastohydrodynamic (EHD) lubricating regime.

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### HFRR



A ball-on-plate, reciprocating friction and wear test system, assessing the performance of both fuels and lubricants under boundary conditions.

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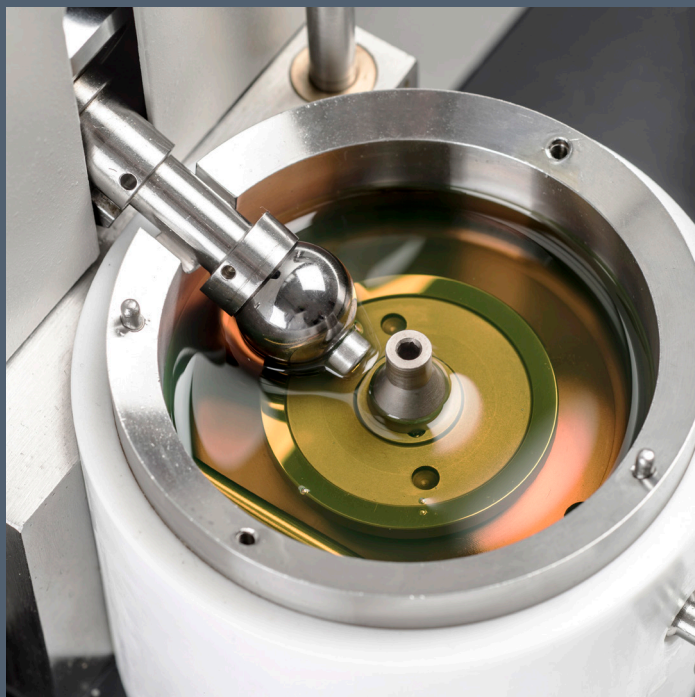
### ABS



A fully automated ball-on-cylinder lubricity test system which provides a fast, repeatable assessment of the performance of aviation fuels.

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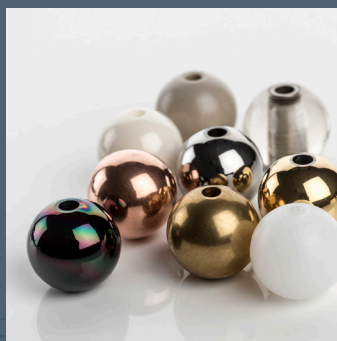
A general purpose, ball-on-disc instrument for measuring the frictional properties of lubricated and unlubricated contacts under a wide range of rolling and sliding conditions.

The MTM is our most versatile instrument with a wide range of applications such as improving fuel economy and engine efficiency, developing new formulations for railway greases, reducing the wear of artificial joints and perfecting the mouth feel of food and the skin feel of cosmetics.

Optimising the friction and wear properties of a system can significantly improve performance and reduce operating costs. Testing lubricants and materials under realistic contact conditions is imperative to understanding where improvements can be made.

The unique ball-on-disc set up enables an unrivalled number of conditions to be simulated. All three regimes (boundary, mixed and EHL) can be duplicated, producing stribeck curves. The test temperature, load and specimen material and geometry can be chosen to further investigate components performance under realistic conditions.

The above features combined with the unique capability of measuring antiwear film build up throughout the test, has propelled the MTM to the position of an industry standard instrument amongst OEM's, lubricant manufacturers and additive suppliers.



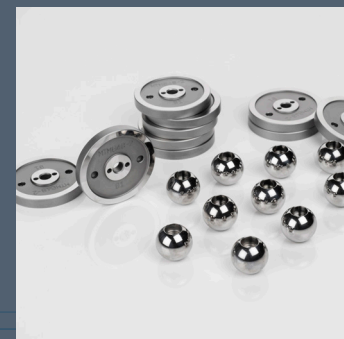
A development of the MTM instrument focused on measuring the frictional properties of lubricated and unlubricated contacts under extreme pressures.

The ETM uses the same theory as the MTM but can run at loads up to 1650 N generating contact pressures up to 3.5 GPa using standard specimens, manufactured from highly polished 52100 bearing steel. The ball and disc are affordable single use specimens ensuring highly accurate, repeatable results are produced every test whilst keeping running costs low. Readily available specimen packs enables multiple samples to be tested and analysed for quick comparisons between formulations. Tungsten carbide alternatives are available for achieving pressures up to 7.1 GPa.

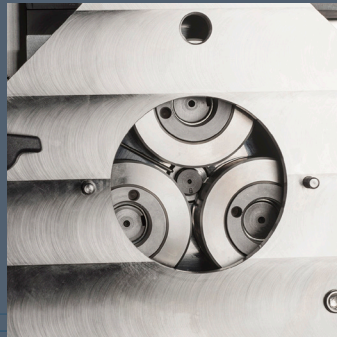
The high pressure capability makes the ETM ideal for researching applications such as rolling bearings and toroidal traction drives. Tests simulating scuffing can be executed under realistic conditions for advanced research into lubricants', additives' and materials' performance.

Launched in 2019, the ETM is designed and assembled using cutting edge engineering components able to withstand extreme conditions in a compact controlled environment. Designed alongside the ETM, the Fluid Extraction System (FES) is a sleek compact accessory which safely and automatically removes lubricant from the pot, thereby significantly reducing turnaround time between tests.

Using the ETM and SLIM in tandem, researchers have the unique capability of observing the behaviour of antiwear additives in extreme conditions whilst simultaneously measuring the size of the film build up.



## MPR



A fully automated, triple disc machine, for researching rolling contact fatigue (RCF) failure mechanisms in the form of micro and macro pitting.

RCF leads to increased downtime, expensive repairs and reduced efficiency of key components such as gears, bearings and cams. Due to their size and geometry, traditional gear tests require weeks to produce failures. As these tests are highly unpredictable, repeat tests are required, leading to months of testing for each potential lubricant formulation. This method is costly, time consuming and utilizes valuable space in the lab.

The MPR runs at realistic contact pressures and film thicknesses found in most industrial applications, aiding development of improved lubricants and materials to eliminate the onset of premature failure mechanisms in a system.

The unique three rings and central roller configuration allows the roller to be subjected to up to 1 million contact cycles per hour, significantly decreasing test time and increasing productivity. Post analysis requires only one specimen per test to be examined, ensuring user intervention time is also kept to a minimum.

The two independently driven motors can produce a wide range of sliding and rolling conditions and the central roller is available in a variety of materials and geometries, producing different contact pressures. This enables the MPR to simulate most research areas in RCF including micro-pitting and pitting, white etching cracks (WEC's) and scuffing resistance.





A fully automated benchtop instrument measuring viscosity over a shear rate range from  $10^6 \text{ s}^{-1}$  to  $10^7 \text{ s}^{-1}$ .

Modern engines are subjected to shear rates of up to  $10^7 \text{ s}^{-1}$ . Testing lubricant properties at these shear rates is vital for accurately analysing its service capabilities.

Traditional viscometers use a tapered steel plug and copper stator design. This set up requires time consuming calibration between tests and limits the measurement range to a maximum shear rate of around  $4 \times 10^6 \text{ s}^{-1}$ .

As the demand for improved efficiency increases, lower viscosity (LV) engine oil is becoming more popular. Testing LV oils at realistic shear rates to investigate the effect of both the temporary and permanent shear thinning is imperative to understanding their performance in the engine. Recent research has shown that this can be studied using the USV, due to the well-defined, controllable high shear conditions it can operate at.

The unique measurement technique of the USV makes it the only commercially available instrument able to run at shear rates up to  $10^7 \text{ s}^{-1}$ . With no re-calibration required and a complete temperature / shear rate map for a lubricant completed in under 1 hour, the USV comes out on top for range and efficiency.



## EHD



A fully automated, benchtop instrument, measuring lubricant film thickness down to 1nm in the elastohydrodynamic (EHD) lubricating regime.

The film thickness of a lubricant plays an essential role in the durability of key components. It needs to be thick enough to protect the moving surfaces but thin enough to minimise energy losses due to shearing.

As a result of enhanced surface finishing and system design, conformal contacts such as gears, rolling element bearings and cams are operating effectively with lubricant films less than 10nm thick.

Optimising the lubricant thickness over the operating conditions of an application will improve performance, longevity and help reduce emissions and running costs. Unlike other techniques which have a minimum film thickness limit of 50 nm, the EHD uses optical interferometry enabling it to accurately measure down to 1 nm.

The contact pressures and shear rates in the contact are similar to those found in many industrial applications. The ability to measure the film thickness in mixed sliding rolling contacts expands the EHD's research capabilities even further, making it the go to choice for experts studying the effect of additives, metalworking fluids, emulsions, turbine oils and greases.

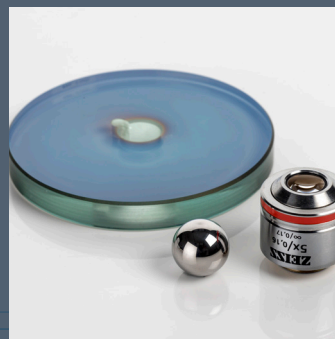


**A high speed (up to 20 m/s), fully automated, benchtop instrument measuring lubricant film thickness down to 1 nm in the elastohydrodynamic (EHD) lubricating regime.**

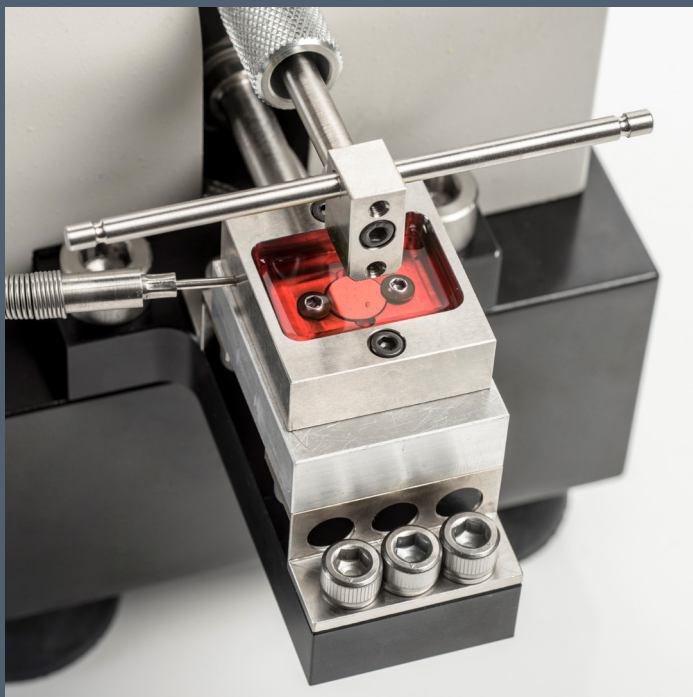
Modern system designs have super finished contacting surfaces allowing them to operate with lubricant film thicknesses below 10 nm. The unique interferometry method used by the EHD-HS enables accurate measurements down to 1 nm, far below the values possible with other measurement techniques.

Upgraded software and mechanical systems make improvements to the instrument's already outstanding reliability and usability. The ability of the EHD-HS to run at speeds up to 20 m/s makes it an ideal choice for researchers studying high speed applications such as electric vehicle drivetrains, and for those studying the effect of additives in automotive lubricants, metalworking fluids, emulsions, turbine oils and greases.

In addition to film thickness measurements, traction coefficients can be measured at any slide/roll ratio from pure rolling up to pure sliding.



## HFRR



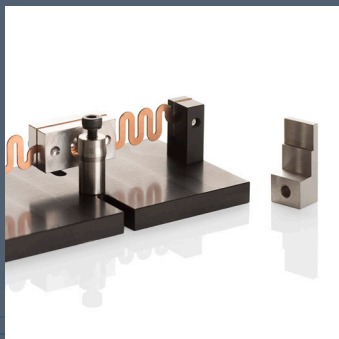
A ball-on-plate, reciprocating friction and wear test system, assessing the performance of both fuels and lubricants under boundary conditions.

Optimising the lubricity properties of diesel fuel within the engine is imperative for adhering to standard regulations and ensuring your vehicle runs at maximum efficiency. The PCS HFRR is the only specified instrument on the following international standard test methods: D6079, ISO12156, EN 590 and IP450.

To confirm your fuel sits within the specified limits, analysis of the wear scar on the ball is completed using an optional microscope, digital camera and associated software. The camera functionality is an integral part of the HFRR software which produces automated in-depth test reports, allowing full traceability and test data files to be exchanged between labs.

In addition to diesel fuel testing, current HFRR applications include gasoline testing, measuring grease behaviour under boundary conditions, the evaluation of marine engine lubricants and investigations into fretting, both dry and in the presence of a lubricant. Using additional software, the user has complete flexibility when defining test conditions.

The HFRR is compact, user friendly and inexpensive making it the perfect choice for entry level tribology research.





A fully automated ball-on-cylinder lubricity test system which provides a fast, repeatable assessment of the performance of aviation fuels.

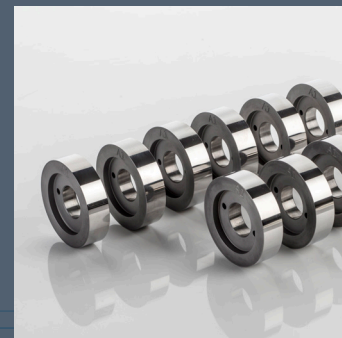
The manufacturing process of aviation fuels varies between refineries, giving way to potential lubricity issues when they are put in service. Whilst the fuels' main role is to provide thrust, it is equally important that the internal components are kept well lubricated throughout, protecting against wear and potential catastrophic failure.

The ABS is the only specified equipment on the ASTM D5001 test method for "Measurement of Lubricity of Aviation Turbine Fuels by the Ball-on-Cylinder Lubricity Evaluator."

A fully automated test sequence and minimal maintenance reduces user intervention. Simple test setup and PCS supplied test specimens eliminate operator errors and ensure tighter quality control, giving you full confidence in the results.

An optional PC and integrated wear scar camera assembly produces automated in-depth test reports allowing full traceability and test data files to be exchanged between labs.

The ABS-SL (Automated BOCLE System- Scuffing Load) is a modified ABS and conforms to ASTM D6078, "Evaluating Lubricity of Diesel Fuels by Scuffing Load Ball-on-Cylinder Lubricity Evaluator".



## Our Services



**A highly qualified workforce in a range of technical disciplines, specialising in tribology and so providing you with access to unparalleled expert analysis on results.**



**Trained engineers offer a range of services including onsite installation and training, preventative maintenance and recalibration of instruments and parts.**



**Fast, helpful customer service and support are available, ensuring all our customers have instant access to required information and services.**

To develop better lubricant additives, Afton strives to better understand how lubricants perform under a wide variety of operating conditions. This deeper understanding of tribology cannot be achieved without the proper instruments. PCS Instruments has supplied Afton with a wide range of innovative instruments to help us answer the difficult tribology questions that lead to innovative lubricants.

**Dr Mark Devlin, Technical Advisor, Afton Chemicals**

## Collaborations

PCS has a long-standing partnership with the Tribology group at Imperial College. Both parties frequently come together for in-depth technical discussions on new research topics and associated testing methods. Imperial College utilise the complete PCS product range producing high calibre research papers and providing valuable feedback and insight for ongoing instrument development.

We are passionate about giving back to education and research, specifically within the STEM divisions. We have sponsored EDT Head Start for over a decade, providing funding for ongoing projects to encourage students to study STEM subjects. Alongside this, we offer year-in-industry students the opportunity to complete work experience at PCS, gaining a valuable insight into work life in an engineering company.



## Our Core Values



### **Innovation**

We are at the forefront of producing cutting edge products and leading the way in the tribology industry



### **Quality**

Ensuring all our products and services achieve the highest quality and exceed expectations



### **Consistency**

Continuously offer the most reliable instruments alongside excellent service provision



### **Integrity**

Conducting business to the highest level of professionalism and honouring our ethics and company ethos



### **Customer Focus**

We are fully committed to developing our customer knowledge and research capabilities



### **Continuous Improvement**

Always striving to constantly improve our products, processes, and services

Tribology is an important regime during oral processing (mouthfeel) and it is therefore important for us to have the ability to measure these properties accurately. PCS Instruments have been a valuable partner for us, not only providing us with reliable and precise instrumentation, but through their continued above and beyond customer service support.

**Stefan Baier, Associate R&D Fellow, PepsiCo**



**PCS Instruments**

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