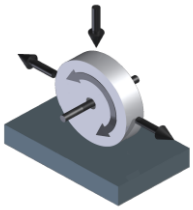
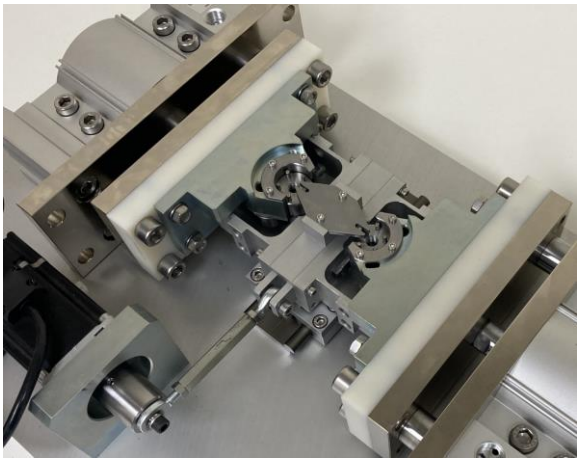
TRIBOLOGY UPDATE: ISSUE 42 – February 2023

This is the latest issue of our Tribology Update newsletter. We have been exceptionally busy since the last Update, as we react to changing market demands, many driven by the transition to a zero carbon economy.

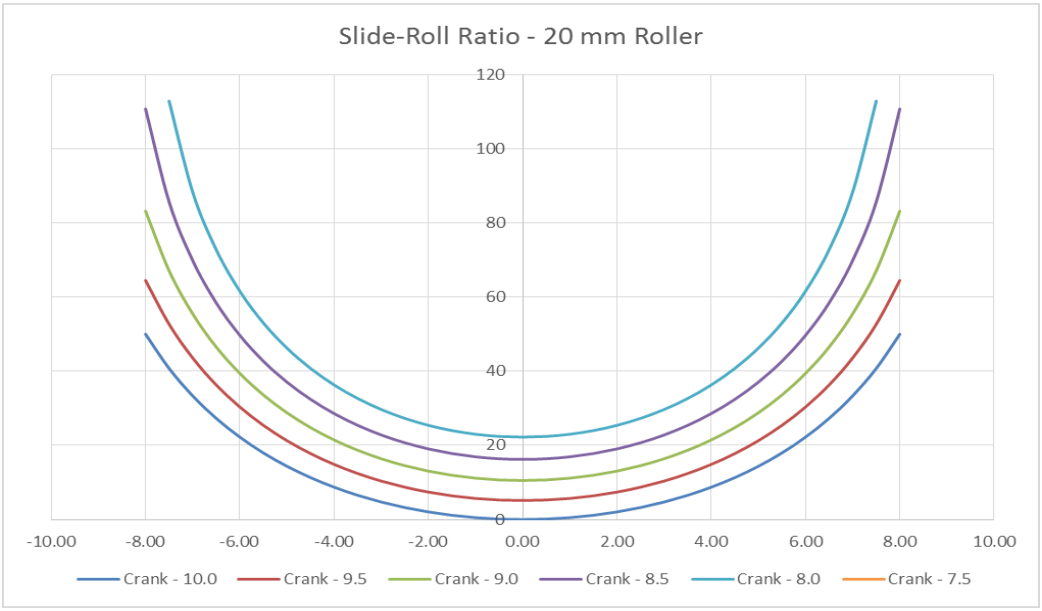
WORK IN PROGRESS – DEVELOPMENT

TE 55 Micro-pitting/Bearing Fretting/Adhesion Delamination



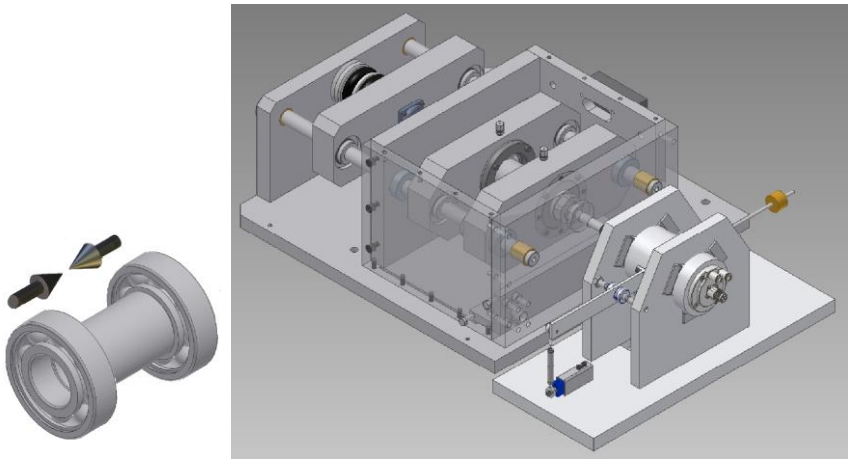


We are currently evaluating the performance of a novel micro-pitting and bearing fretting test rig. Conventional micro-pitting rigs typically have a rod sample loaded between three support rollers, which are driven at different speeds, generating constant slip. These rigs are relatively costly and require one test roller and three driving rollers per test. By comparison, micro-pitting tooling on a reciprocating tribometer can use simpler, less expensive samples. One advantage of using reciprocating motion is that it can be designed to generate slide-roll ratios that vary continuously with stroke position, modelling more closely the varying slide-roll ratio in actual gear contacts.



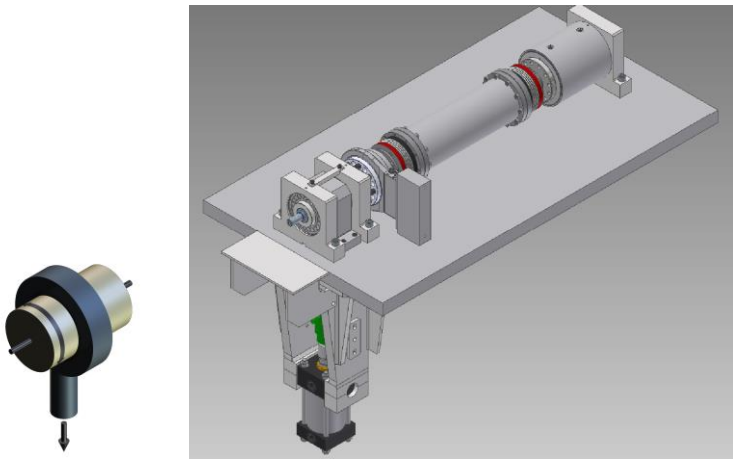
Ratios in the range 10% to 20% may be appropriate for micro-pitting tests, whereas increasing the sliding in the contact, while reducing the reciprocating stroke to a few mm, results in a contact with micro-slip, producing a potential model for a simple bearing fretting test.

High-speed Motoring Dynamometer for Bearing Friction Testing



We have completed a design study for a high-speed, rolling bearing friction rig, comprising a 40,000 rpm spindle motor, torque reaction (dynamometer) mounted in air bearings. Test assemblies provide back-to-back loading of pairs of bearings.

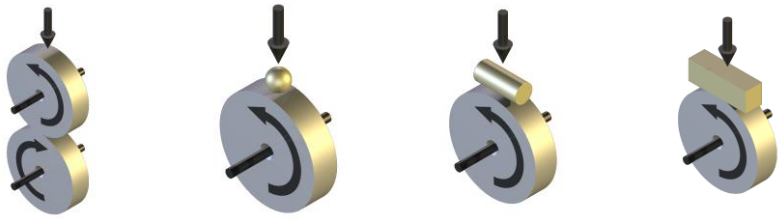
DN 22 High Load Plain Bearing Friction and Wear Rig

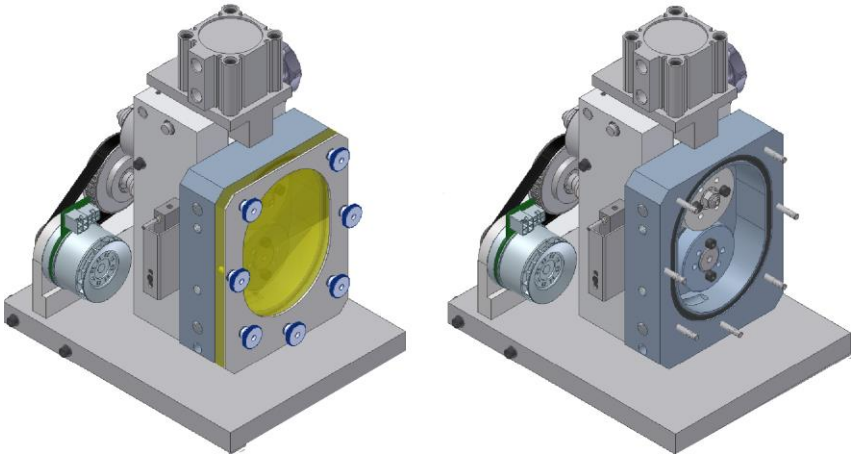


DN 222 Journal Bearing Friction and Wear Test Rig is a multi-station, crank driven, high-load, friction and wear tester, originally designed for testing rod-end bearings. We have now designed a new, single station rig, based on DN 222, with the motion generated by a semi-rotary servo-hydraulic actuator.

The newly designated DN 22 has a maximum load of 120 kN, a maximum frequency of 1 Hz with a maximum torque of 1,600 Nm static and 1,000 Nm dynamic, and amplitudes of +/-90 degrees. More importantly, load, speed and stroke are controlled and continuously variable, allowing the test shaft to be moved to a position and paused, with either subsequent movement in the same or reverse direction. Plain bearings with a bore from 16 mm I/D to 80 mm I/D can be accommodated.

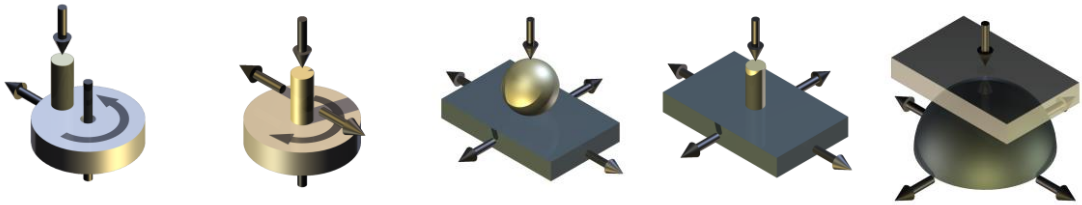
TE 53 Multi-Purpose Friction & Wear Tester

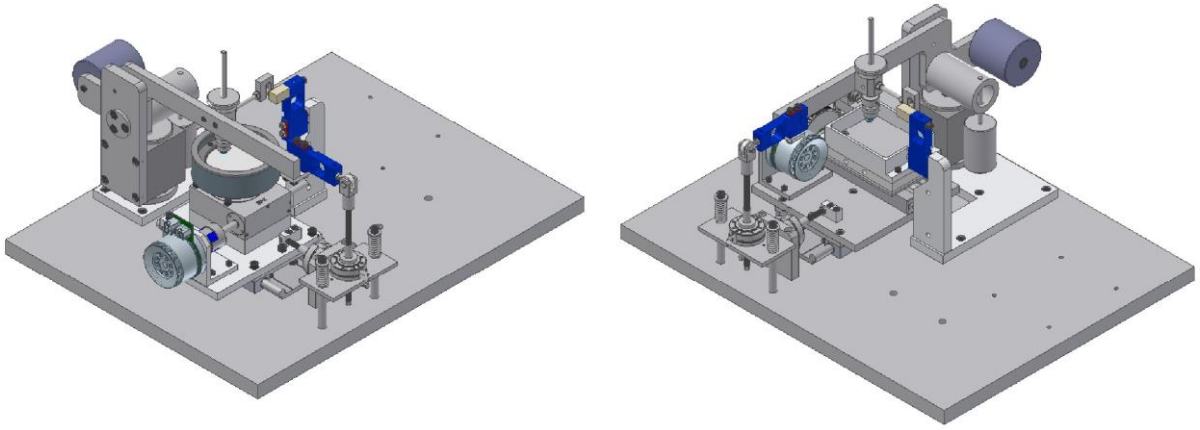




We have updated the design of TE 53, replacing dead-weight loading with pneumatic loading and making other changes to reduce the cost of manufacture. As a result, as well as increased functionality, the price of the new unit is 20% less than the previous design.

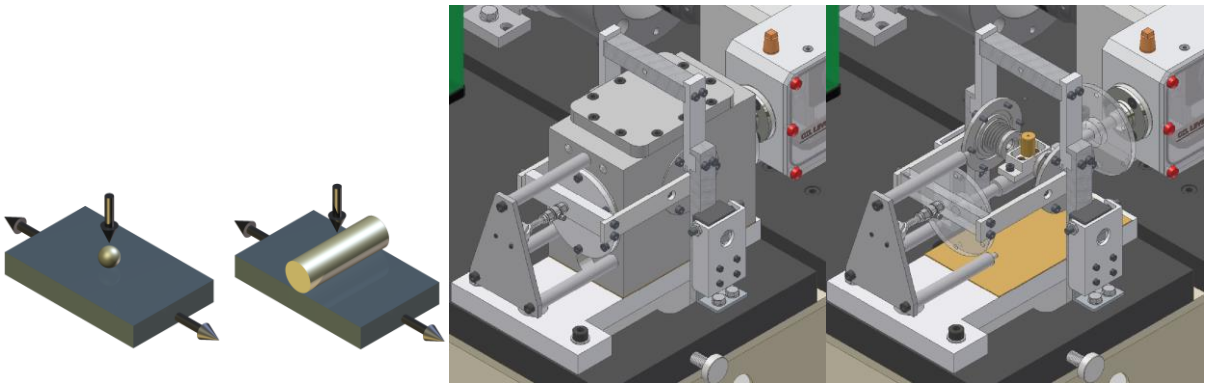
TE 79 Multi-Axis Tribology Machine





We have taken a similar approach to the TE 79, this time replacing dead-weight loading with linear actuator driven automatic loading and adding other functional improvements.

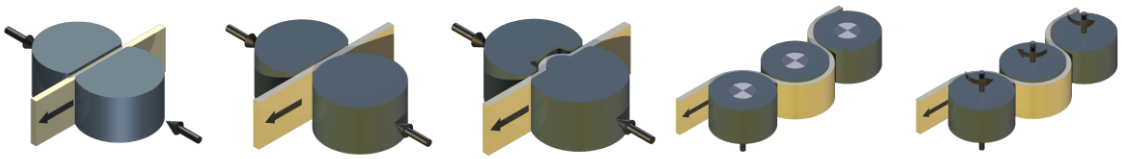
TE 77 Pressurised Chamber for Refrigerants



We have designed a hermetically sealed, pressurised test chamber for TE 77. The chamber fits the standard machine in place of the standard heater pad and bath assembly. The stroke is limited to a maximum of 5 mm and the load to 100 N. A maximum pressure of 10 bar is permitted, using non-combustible gases.

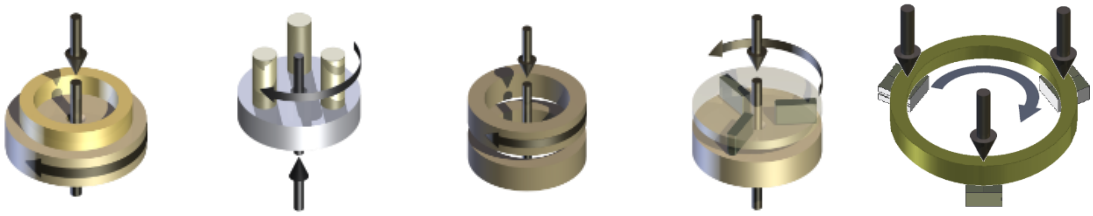
COMPLETED PROJECTS – DEVELOPMENT

DN 33 Modified Draw Strip Machine



We have completed a design and performance upgrade to allow DN 33 to accommodate VDA specification flat on flat tooling (length: 145 mm x width: 70 mm) with correspondingly wider strip specimens, loads and drawing forces. The maximum clamping force is now 68 kN and the maximum continuous drawing force 20 kN, with a peak drawing force on 50 kN. Provision has been made for pre-heating the draw strip and the tools.

TE 92 Rotary Tribometer - Area Contact Specimens

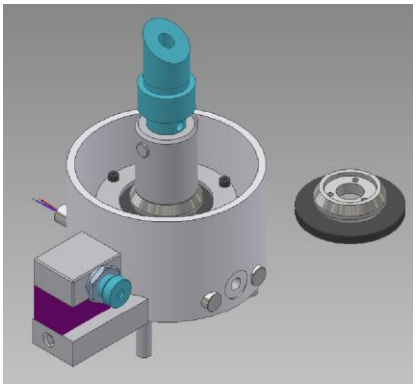


In addition to TE 92/AREA-L: heated test bath for lubricated tests and TE 92/AREA-D: specimen mount with capacitance wear sensor for dry tests, we have now added TE 92/AREA-H: heated specimen mount and shaft hub, for dry tests at temperatures up to 600°C.

We have also added TE 92/AREA/7 Pump Slipper Shoe Specimen Tooling to the range.

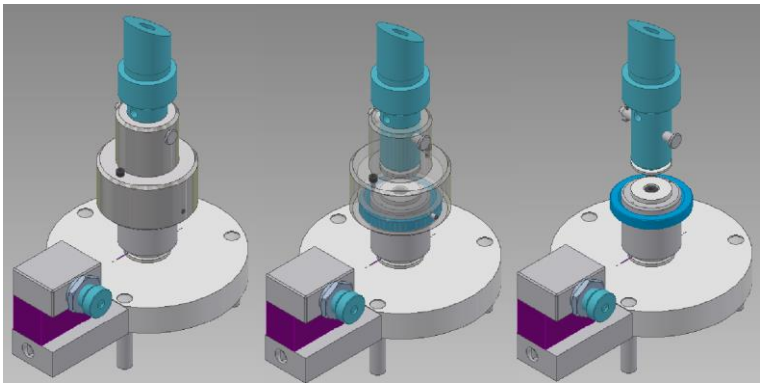
TE 92 Rotary Tribometer – New Special Adapters

TE 92/SA/4 Cone on Elastomer Ring Test Adapter



This test adapter allows measurement of friction between a conical specimen of shaft material and an elastomer ring, under axial load.

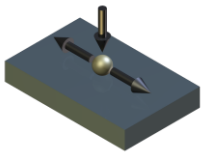
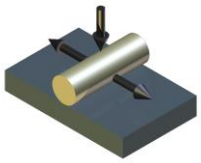
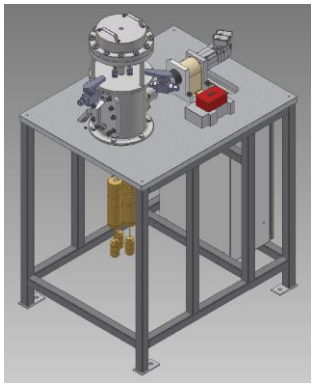
TE 92/SA/6 Lip Seal Friction Test Adapter



The sample lip seal is mounted in a rotating housing that is filled with the test fluid, ensuring that the seal is fully immersed. The shaft sample is non-rotating with any fluid leakage visible on the shaft surface.

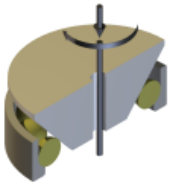
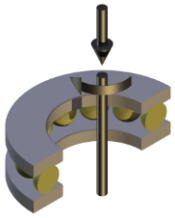
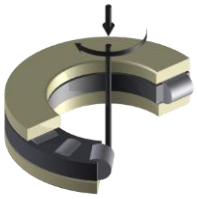
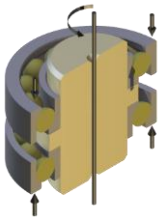
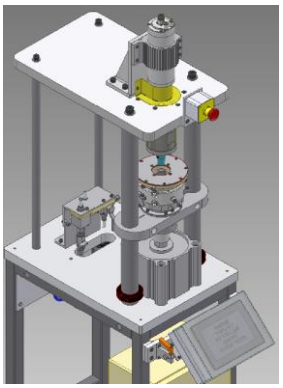
WORK IN PROGRESS – PRODUCTION

TE 60 Pressurized Hydrogen Reciprocating Tribometer

A unit to the latest design is currently under construction.

RCF 7 Multi-station High-speed Rolling Contact Fatigue Machine

The latest addition to our range of modular rolling contact fatigue rigs (RCF 5 & RCF 6) is RCF 7, which provides both high axial load: 10,000 N @ 3,000 rpm, and high speed: 10,000 rpm @ 4,000 N, performance and can accommodate our standard rolling bearing test geometries.

RCF 7 effectively replaces our earlier RCF 2 machine. The current rolling contact fatigue product set now comprises:

RCF 3 Twin Disc on Rod Rolling Contact Fatigue Rig

RCF 4 Rolling Contact Fatigue & Bearing Friction Rig

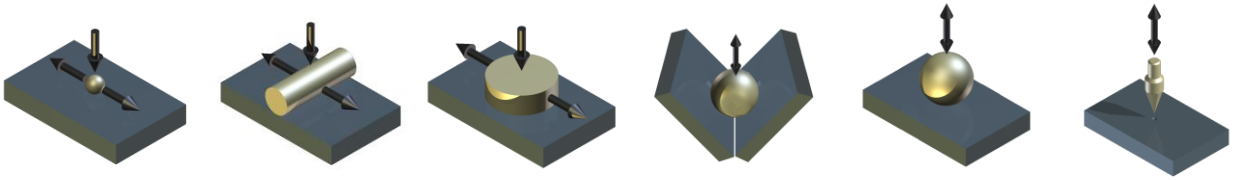
RCF 5 Rolling Contact Fatigue Machine - 3,000 rpm

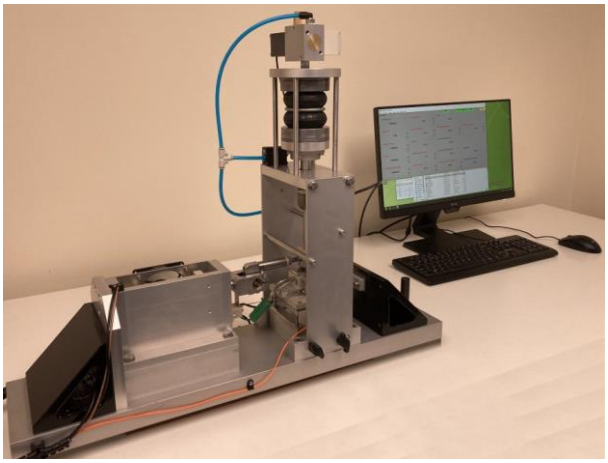
RCF 6 Three Ball on Rod Machine - 15,000 rpm

RCF 7 Rolling Contact Fatigue Machine - 10,000 rpm

COMPLETED PROJECTS – PRODUCTION

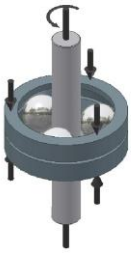
TE 44 Piezo Fretting Test Rig





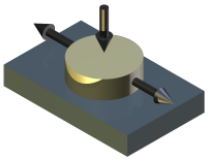
We have completed are in the process of manufacturing the first production version of a new fretting rig, which uses the piezo actuator currently used on the TE 77/PIEZO fretting adapter and incorporates other test configurations, from previous instruments and applications. The unit can perform sliding-fretting tests with ball on flat, line contact and flat on flat geometries, impact fretting with ball on twin flats at 45 degree impact angle, hertzian fretting with ball on flat, plus depth sensing micro-hardness.

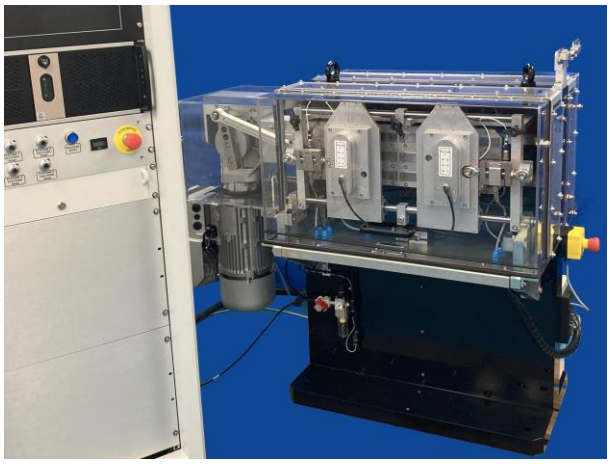
RCF 6 Multi-station High-speed Three Ball on Rod Machine



We have recently completed the first batch of three RCF 6 machines, which run the standard three ball-on-rod rolling contact fatigue test at speeds up to 15,000 rpm.

Multi-station Production Line Friction and Wear Rig for Polymers





We have designed and manufactured a twelve-station, long-stroke, reciprocating friction and wear tester for production-line testing of polymer specimens. The maximum stroke is 200 mm, with a maximum reciprocating frequency at 200 mm stroke of 3.5 Hz. The maximum frequency is 5 Hz at 50 mm stroke. Loading is via pneumatic pin cylinders, which generate 130 N force, at 8 bar applied pressure. Sensors are provided for measuring friction, wear displacement and counter-face surface temperature.

OTHER NEWS

On-line Tutorials and Product Videos

We continue to add video content to our web site.

Conferences and Exhibitions

We will be attending **Wear of Materials 2023** and Exhibiting at **STLE Annual Meeting and Exhibition 2023**.

Follow us on LinkedIn

George Plint and David Harris

Phoenix Tribology Ltd