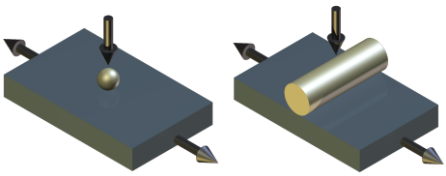
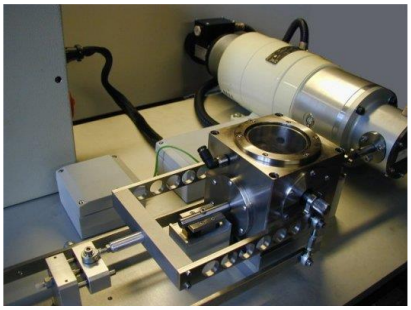
TRIBOLOGY UPDATE: ISSUE 43 – January 2024

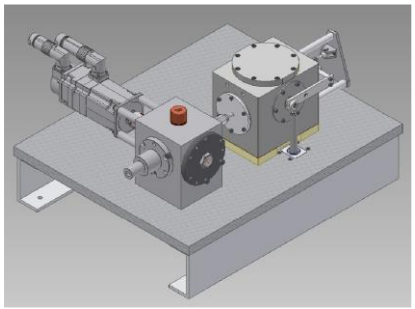
This is the latest issue of our Tribology Update newsletter. Since the last Update, in February 2023, we have successfully implemented our management succession plan; David Harris retired in May, with Cyrille Favede and James Morley being appointed directors, as a result, the average age of the directors has dropped from 66 to 50.

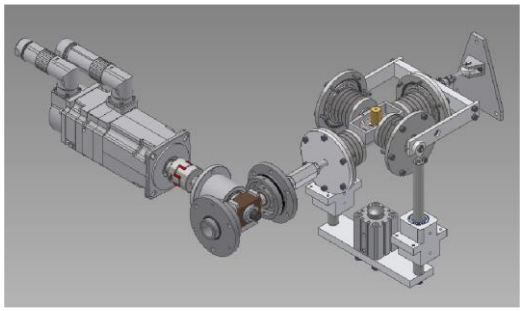
WORK IN PROGRESS – DEVELOPMENT

TE 57 Pressurised Lubricity Tester (2023)





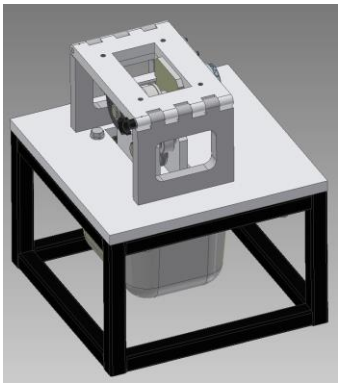


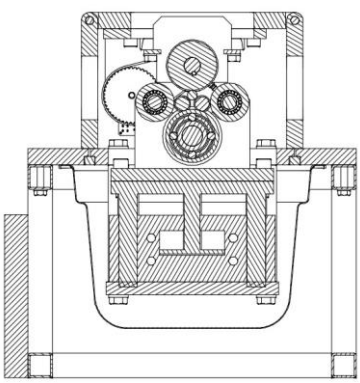


The saturation vapour pressure is that at which the gaseous phase of a substance can co-exist with the liquid. For a refrigerant such as R410A, at a temperature of 25°C, we would need a pressure greater than 15 Bar, to have the refrigerant present in its liquid phase. If we want to ensure that the refrigerant is present in its liquid phase, at much reduced pressure, the simplest solution is to reduce the bulk temperature, cooling the refrigerant to, say, -20°C, thus reducing the required pressure to substantially less than 5 bar. This has been the approach adopted by the University of Bournemouth during their extensive testing of refrigerant lubricants, using an earlier version of TE 57.

We have re-designed the unit to allow pressurized tests, using non-combustible gases, to be run at temperatures from -50°C to 150°C, at a maximum pressure of 10 bar. The load range is 10 to 100 N, the specimen geometry: point or line contact, the frequency range: 2.5 to 25 Hz and stroke: 1 to 5 mm, mechanically set.

RCF 8 Two Ball on Rod Rolling Contact Fatigue Rig

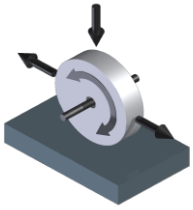


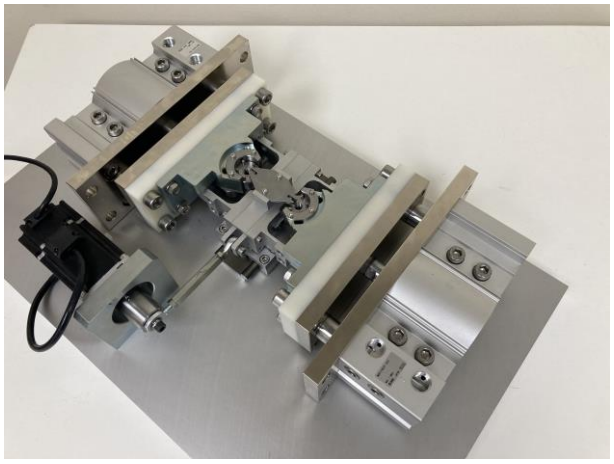


This device appears as Device Number 211 in the ASLE Friction and Wear devices book and was originally developed by NTN in the 1960s. A rod specimen is loaded against an upper driving roller, by two balls supported on a single flat roller and guided by two profiled rollers. Load is applied by a pneumatic cylinder, which carries the supporting rollers.

The test roller is 12 mm diameter the driving roller diameter is 60 mm, giving a test roller speed of 30,000 rpm, for a drive roller speed of 6,000 rpm. The current design uses 20 mm diameter balls and a 12 mm diameter test roller. With steel balls and rod specimens, peak contact pressures of 6 GPa can be achieved.

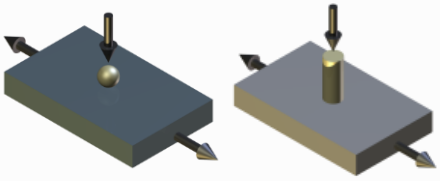
TE 55 Micro-pitting/Bearing Fretting/Adhesion Delamination

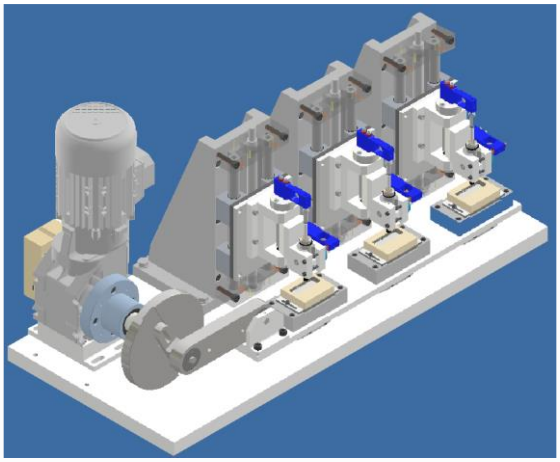




We have been testing the prototype machine and have started to generate some interesting results. A product video has been added to the web site.

TE 88 THREE STATION RECIPROCATING PIN ON PLATE

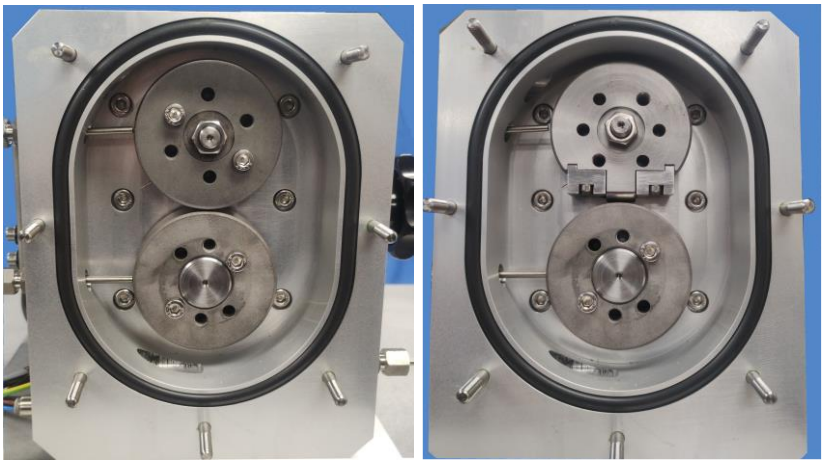




We are in the process of rationalising and re-designing the TE 88 machine, limiting the functionality to multi-station reciprocating pin on plate. We see a role for this type of machine in quality control testing of polymers and coatings, hence in production environments. The loading, friction and wear assembly has been fully developed and has previously been used for upgrades to both UMT machines and pin on disc and pin on plate machines from other manufacturers.

COMPLETED PROJECTS – DEVELOPMENT

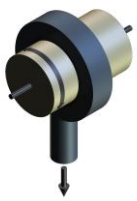
TE 53 Multi-Purpose Friction & Wear Tester (2023)

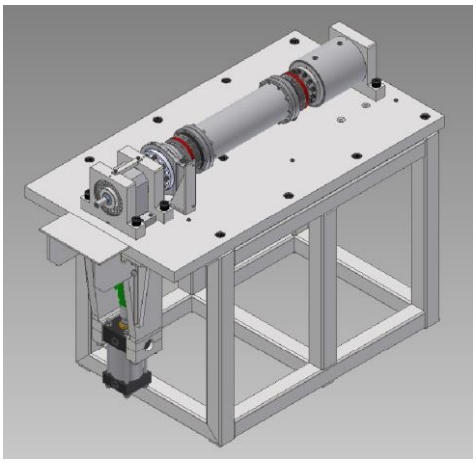


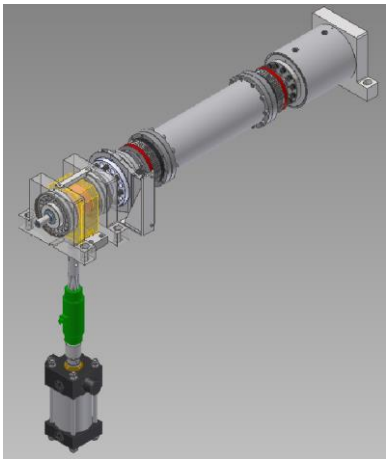
The new design TE 53 has been manufactured and tested.

WORK IN PROGRESS – PRODUCTION

DN 22 High Load Plain Bearing Friction and Wear Rig



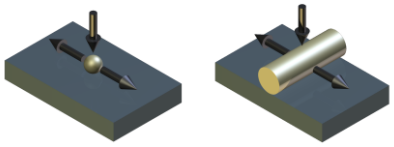


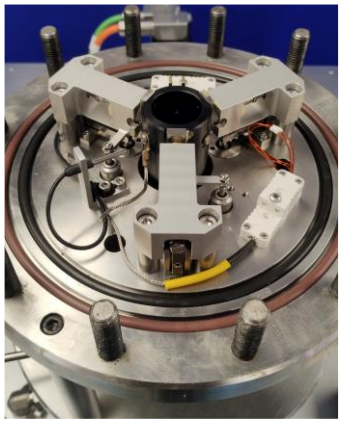


Production of the latest version of servo hydraulic, high load, low speed, journal bearing friction and wear tester is under way.

COMPLETED PROJECTS – PRODUCTION

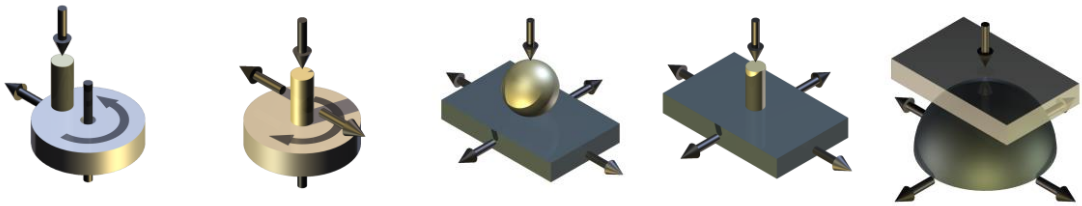
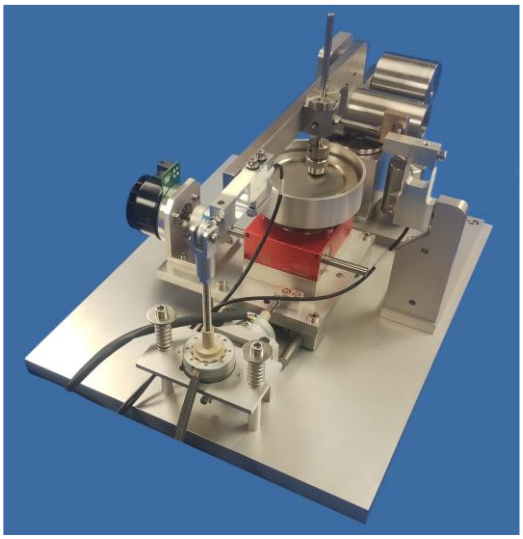
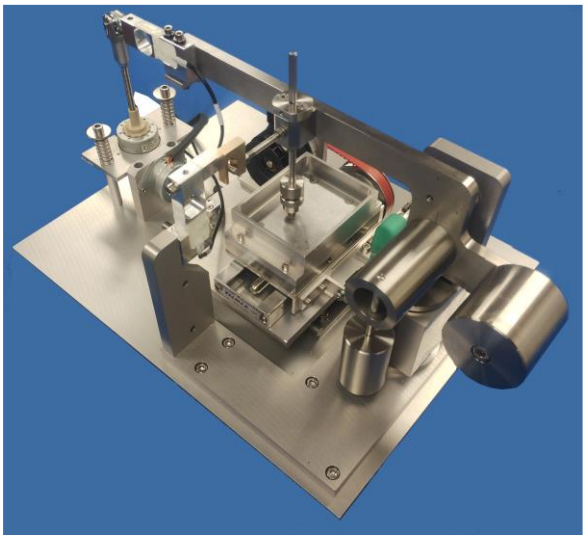
TE 60 Pressurized Hydrogen Reciprocating Tribometer (2023)





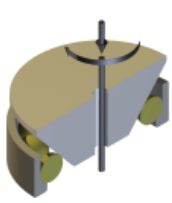
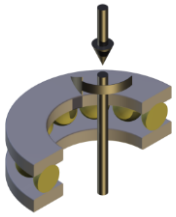
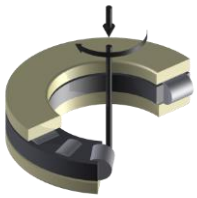
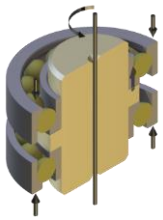
Manufacture and test of the latest version of TE 60 has been completed.

TE 79 Multi-Axis Tribology Machine (2023)

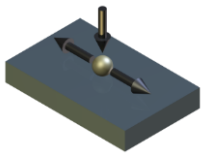
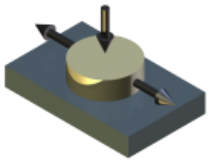
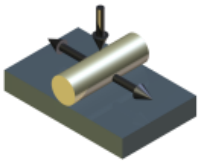
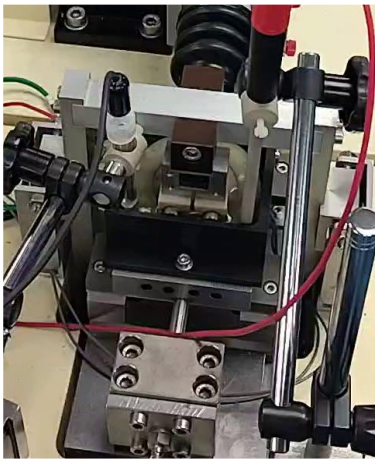
The new design TE 79 has been manufactured and tested.

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

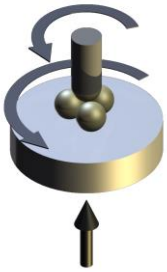
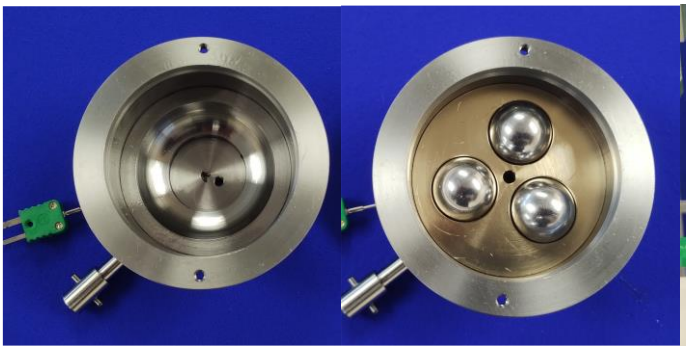
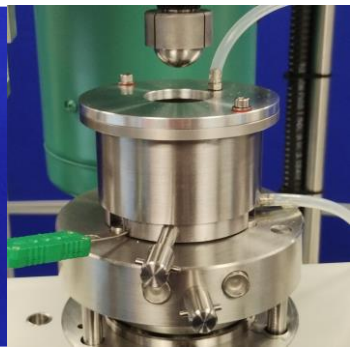

The first production unit of this latest addition to our range of rolling contact fatigue machines has been completed.

TE 77 Electro-chemical Test Cell

We have designed and manufactured of a new electro-chemical test bath for the TE 77. It is supplied complete with silver/silver chloride reference electrode, platinum mesh counter electrode and potentiostat/galvanostat/ZRA. A Faraday cage is provided.

TE 92 Rotary Tribometer 1 inch Rolling Four Ball Adapter

With balls larger than the standard 1/2-inch balls, it is necessary to separate the three lower supporting balls with a cage, to prevent excess friction between the balls. Large diameter rolling four and five ball adapters have been designed with contact angles in the range 40 to 50 degrees. With this design, a contact angle of 45 degrees has been chosen; this simplifies the arithmetic, when calculating the contact load.

For a "standard" bearing, race curvature is typically approximately 50% higher than ball radius. For rolling four ball test geometries, a figure of 25% has commonly been used, as in this design. This is sufficient to reduce the contact pressure between ball and supporting race to less than 1 GPa, when the contact pressure between supporting ball and test ball is of the order of 4 GPa. Less than 1 GPa between supporting ball and race, is low enough to provide an adequate bearing race life.

OTHER NEWS

On-line Tutorials and Product Videos

We continue to add video content to our web site.

Conferences and Exhibitions

We will be exhibiting at the 24th International Colloquium Tribology: TAE, 23rd to 25th January 2024.

The next major exhibition after that will be STLE Annual Meeting and Exhibition, 19th to 23rd May 2024 in Minneapolis.

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George Plint, Cyrille Favede and James Morley

Phoenix Tribology Ltd