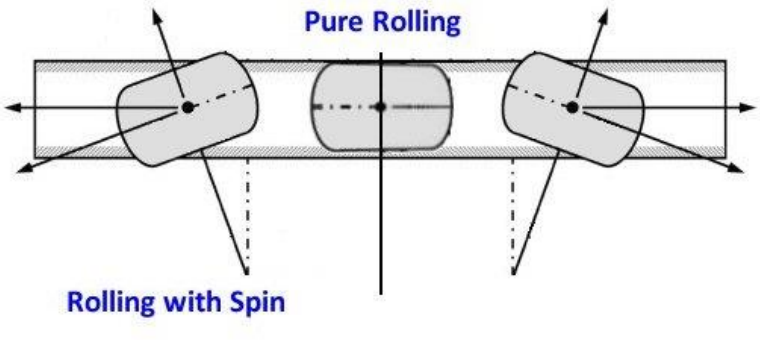
TRIBOLOGY UPDATE: *ISSUE 40 – June 2021*

This is the latest issue of our **Tribology Update** newsletter.

WORK IN PROGRESS – DEVELOPMENT

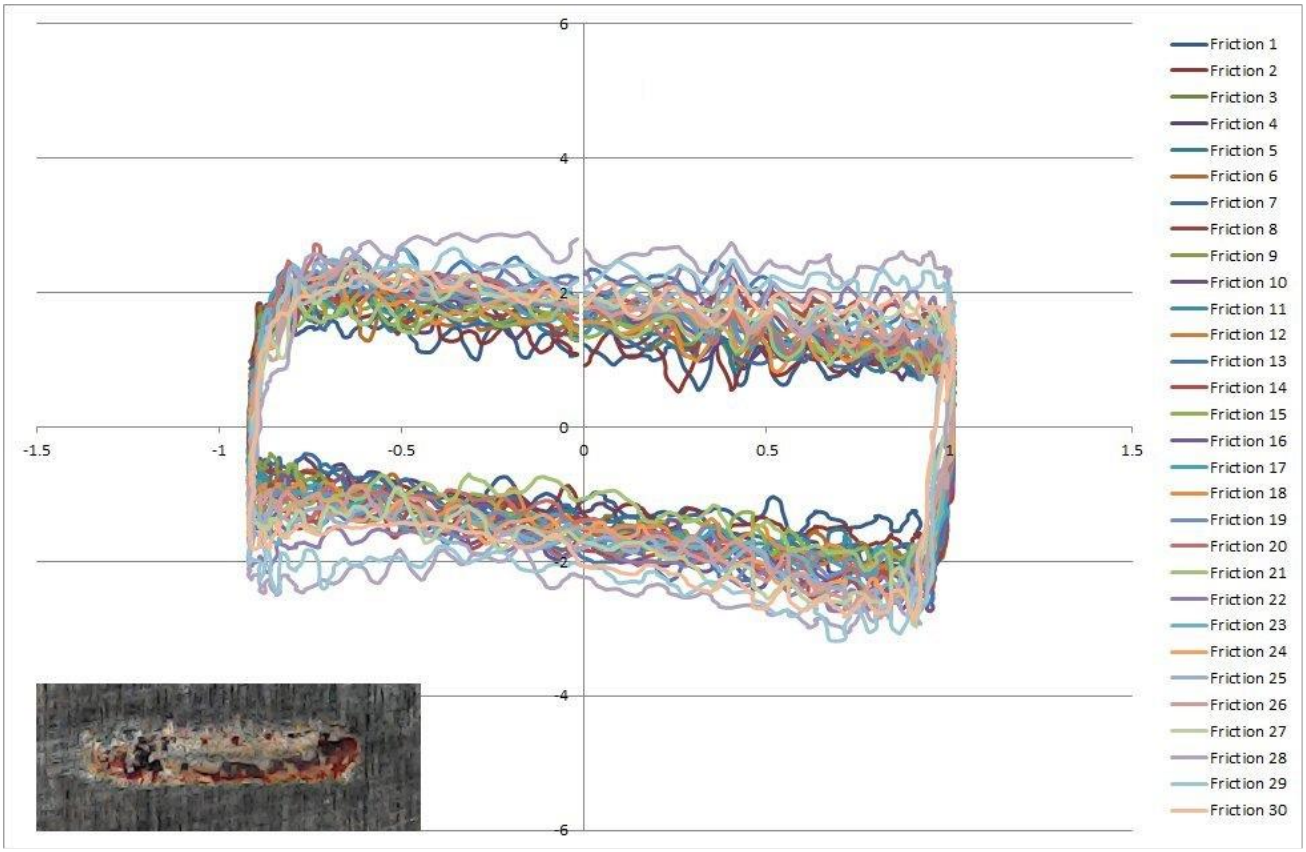
TE 77 Rolling Contact with Contact Spin Adapter



The original purpose of the adapter was to model the sliding-rolling contact in a Tripod CV joint. A short video on this experiment can be viewed on our LinkedIn page. Click on the link to see Tripod CV Joint Friction Test.

Having completed the original task, we then decided to see what would happen if we reduced the reciprocating stroke length to a few millimetres. The result is that we have a rolling contact, with small amplitude rotational displacement, in the contact. This appears to be a very effective means of generating fretting damage, in a test that typically lasts thirty minutes.

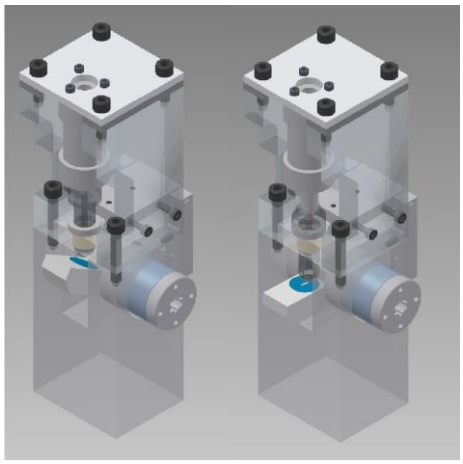
Our initial tests were run with the ball specimen running in a curved groove. We then decided to see what would happen if we ran the ball against a flat surface, which is, of course, much easier to make than a grooved specimen.

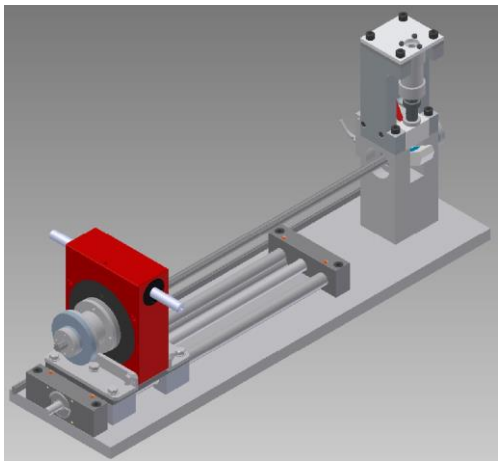


For this ball on flat test, the stroke was 2 mm and the load was 150 N.

Although, the initial results look promising, we have struggled to get consistent results. The variability can be attributed to the familiar problem of consistent specimen manufacture, with results particularly sensitive to variations in specimen hardness and roughness. If we can overcome the problems, we may end up with a viable bearing fretting test.

TE 43 Impact Sliding Tester



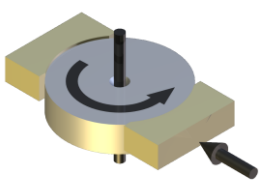


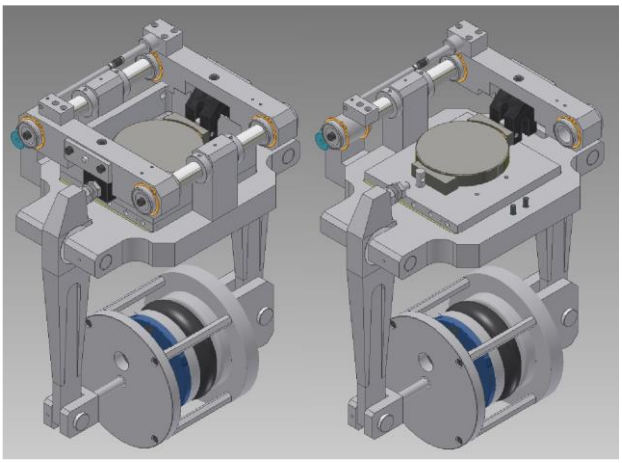
Auto/Steel Partnership 2011 report Impact Sliding Wear Tests on Duplex-Treated Die Materials describes an impact sliding rig developed by the University of Windsor, Ontario, in which a pneumatic actuator is used to drive a ball against an inclined sample plate, mounted at an angle on pivot arm and pre-loaded against a stop, by a heavy die spring. The ball impacts the plate, which deflects through a pre-set angle, causing a wear track to be formed. We have completed a design study for a new rig that follows the basic concept.

In this new rig, the impact motion is generated by a small hydraulic cylinder of the type used in punching applications. Instead of using a die spring for the resisting force, the pivot arm is mounted at one end of a torsion bar. The other end of the torsion bar is connected via a torque transducer to the output of a worm gear-box. The pre-load is set by winding torque into the torsion bar.

The spring rate of the torsion bar can be varied by adjusting the effective length of the bar.

TE 92/PV Self-aligning Partial Journal Bearing

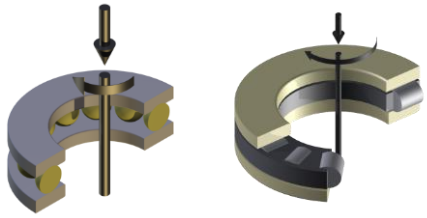


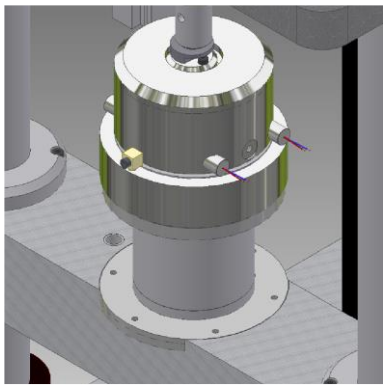


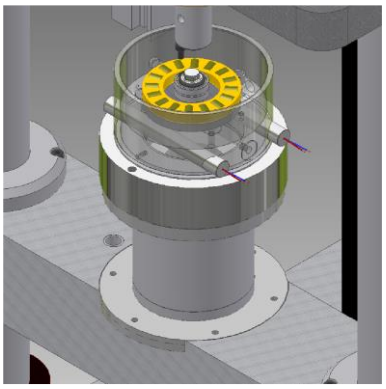
In a journal bearing, the point of peak pressure is not on the centre line. With a half journal bearing contact configuration (which includes conforming block on ring), this results in the inlet closing over, preventing lubricant entering the bearing contact and causing starved lubrication. Designers of partial journal bearings address this problem by designing bearings with the required "pre-load" and "off-set".

We have now designed tilting pad partial journal bearing tooling based on the existing TE 92/PV adapter.

TE 92 Rolling Bearing Friction



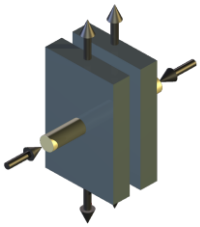


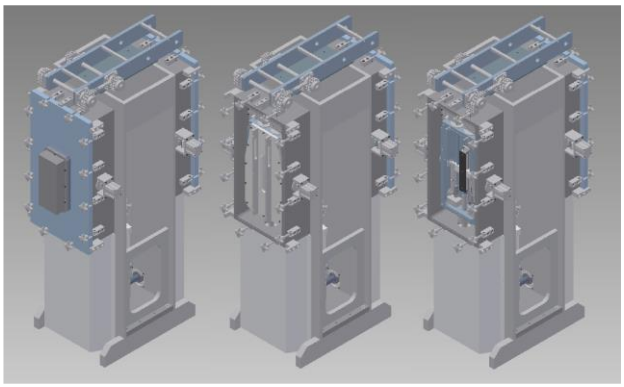


For a number of years, Professor Jorge Seabra and his team at the University of Porto have been publishing the results of tests on a modified TE 92 machine, with a rolling bearing test assembly mounted direct on a torque transducer. The most recent paper appears to be Friction torque in grease lubricated thrust ball bearings - T Cousseau, B Graca, A Campos, J Seabra - Tribology International 44(5):523-531 2021.

This is an interesting and useful thing to do and with this in mind we have now designed a combined axial load and torque transducer for mounting rolling element bearing test adapters. This allows simultaneous measurement of applied load and torque, with a maximum capacity of 5 kN and 50 Nm respectively.

TE 104 Long-stroke Hydrogen Reciprocating Rig – Upgrade

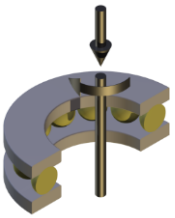
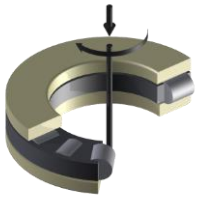
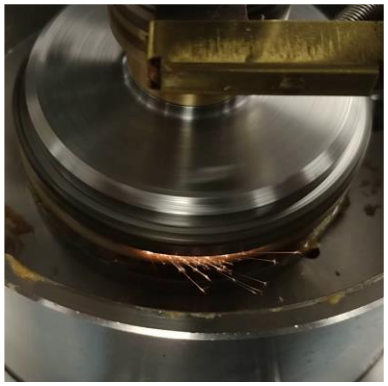
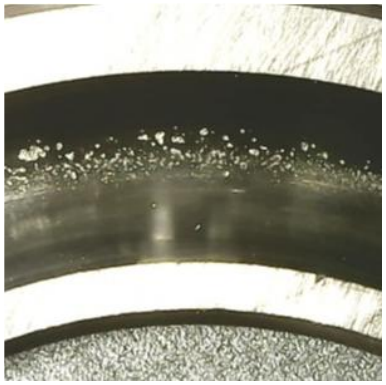




We are completing the re-design of the TE 104 test rig, improving the hydrogen security, increasing the test pressure to 5 bar, the load to 500 N and the stroke amplitude to +/-100 mm. Maximum frequency remains 20 Hz and instrumentation includes on-line measurement of friction, wear displacement and specimen surface temperature on each of the four tests stations.

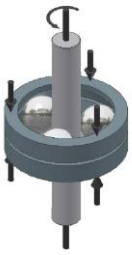
COMPLETED PROJECTS – PRODUCTION

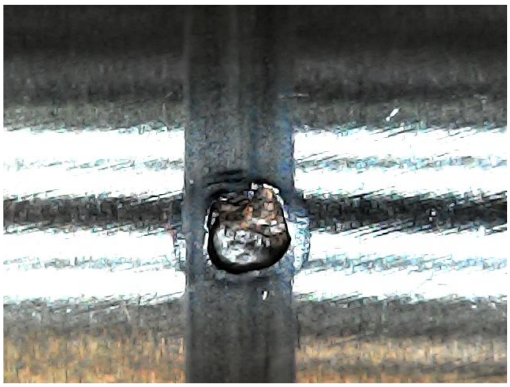
TE 92 & RCF 2 Rolling Bearing Electrical Discharge Machining

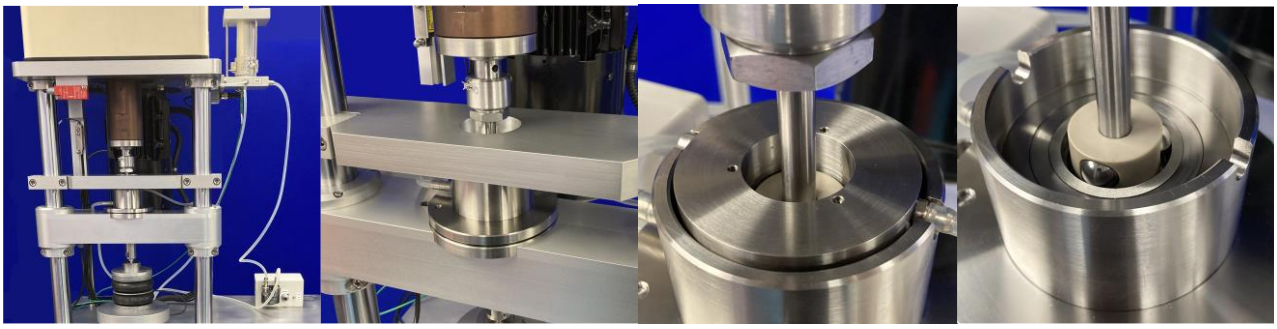





We have posted short videos of our latest electrical discharge machining tests on our LinkedIn page. Click on the links to see EDM First Post and EDM Second Post.

TE 92HS Three Ball on Rod Rolling Contact Fatigue Adapter

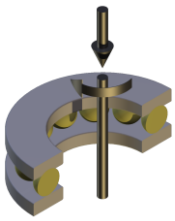






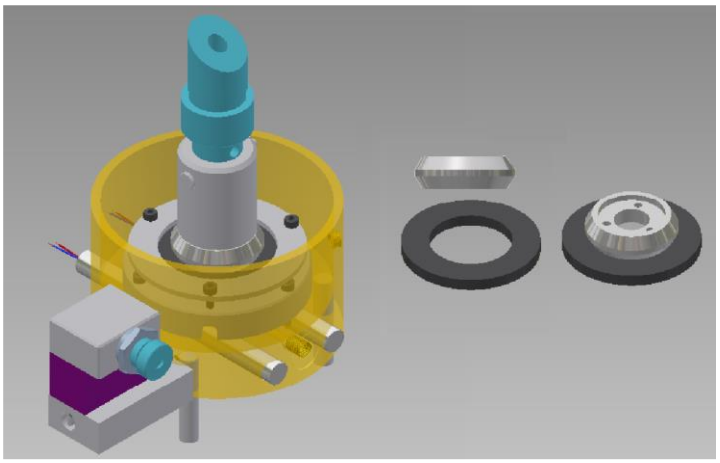
We have now successfully run a standard ball on rod rolling contact fatigue test geometry, on a TE 92HS, for extended periods, at 10,000 rpm.

RCF 5 Multi-station Thrust Ball Bearing on Disc Machine



The first modular RCF 5 machine has now been shipped.

TE 92 Cone on Elastomer Ring Tooling



We have completed the design and manufacture of cone on elastomer ring tooling for dry and lubricated friction tests of metal-polymer contacts.

OTHER NEWS

On-line Tutorials and Training Videos

We have added more training videos and two new on-line tutorials:

Abrasion and Erosion Testing

Machining, Forming and Forging Tests

Friction Force Measurement in Reciprocating Tribometers

Follow us on LinkedIn

George Plint and David Harris

Phoenix Tribology Ltd