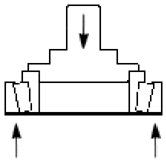
TRIBOLOGY UPDATE: *ISSUE 26 - February 2012*

This is the latest issue of **Tribology Update** newsletter. The last six months have been exceptionally busy for us, so we have a lot to report. For further information, we can be contacted by e-mail at ***info@phoenix-tribology.com*** or by telephone on 44 1635 276064.

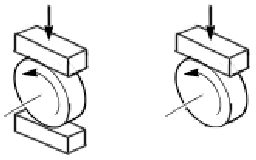
UNDER CONSIDERATION:

Riffel Test



The "Riffel" test was developed at the University of Aachen and involves subjecting a bearing, without rotation, to dynamic loading. The test is used for evaluating lubricants and coatings for wind turbine applications. To date, tests have been run on a 100 kN servo hydraulic dynamic test machine. The key to achieving wider acceptance of the test concept is to devise a dynamic loading system that is smaller and much cheaper than a standard servo hydraulic machine. We are working with Elgeti Engineering in Rothe Erde on the design concept for a compact "half-wave" hydraulic actuator, which would not require a separate power pack, manifold or expensive servo valve and dynamic control system.

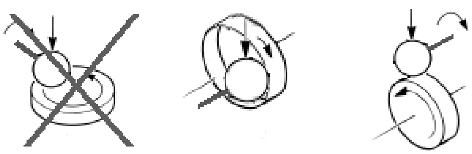
TE 92 Timken Block on Ring Tooling



The TE 92 Pin on Vee Block adapter currently works with a twin opposed block specimen arrangement, giving no net radial force on the machine test spindle. We are currently working on a design that will allow a single block configuration, using the standard Timken Block on Ring samples, to be run on standard TE 92 machines.

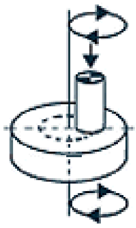
WORK IN PROGRESS – PRODUCT DESIGN:

Optical Elastohydrodynamic Rig



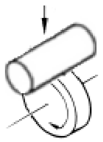
Design work continues with the State Key Laboratory of Tribology, Tsinghua University, on the joint venture design of a new optical elastohydrodynamic test rig. After detailed discussions, we have decided that we should move away from the conventional ball on disc geometry and adopt a ball on ring arrangement, thus avoiding any issues with spin, skew or lubricant starvation in the contact. The arrangement would also allow experiments to be run with line as well as point contacts. Finally, at the suggestion of the University, the arrangement will also be designed so that it can be used as a conventional two roller machine.

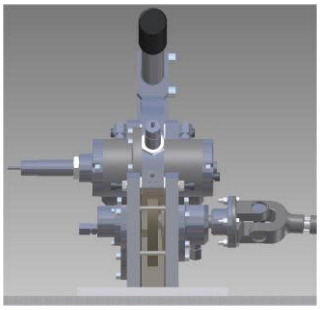
RandomPOD



The licence agreement with Dr Vesa Saikko of Aalto University, Espoo, Finland, for the sixteen test station "RandomPOD" design is now in place. Further to this, Dr Saikko's paper on the device has now been published in the Journal of Biomechanics: [RandomPOD—A new method and device for advanced wear simulation of orthopaedic biomaterials].

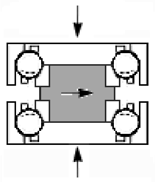
Rolling Contact Fatigue 1





We have run the TE 74S Two Roller Machine in pure rolling with one motor disconnected and the upper roller replaced by a cylindrical specimen. With a lower roller of 65 mm diameter and 15 mm diameter rod as the upper specimen, we have achieved speeds of 11,000 rpm for the latter. We are now designing a pure rolling contact fatigue rig based on the TE 74 design, but with a 20 mm diameter rod upper specimen and a much larger diameter lower roller, potentially up to 100 mm diameter. Our aim is to achieve speeds of up to 30,000 rpm on the rod specimen, with loads up to 14 kN.

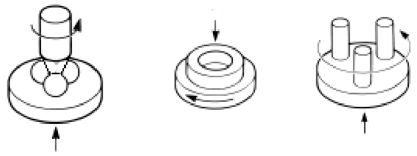
Rolling Contact Fatigue 2



We have various rolling contact fatigue adapters for use with the standard TE 92HS machines. In all cases, these involve single bearings axially loaded against the machine test spindle. Performance is thus dependent on the spindle bearings. We are now designing an adapter that will allow bearings to be run back-to-back, with the axial load reacted by the end of the machine spindle housing, as opposed to the spindle itself. By using a larger load bellows, we are aiming to achieve axial loads of up to 40 kN and speeds of up to 10,000 rpm.

WORK IN PROGRESS – MODIFICATIONS:

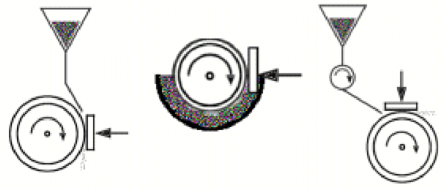
TE 82/TE 92 Loading Systems



We produced more than fifty of our original TE 82 High Speed Four Ball Machines, before it was superseded by the current TE 92 Rotary Tribometer range of machines. The TE 82 was a dead-weight loaded machine and designed as such. The TE 92 was designed from the start as a servo controlled pneumatically loaded machine. As a few people still wanted dead-weight as opposed to pneumatic loading, we then retrofitted a dead-weight loading mechanism to the TE 92. This arrangement worked, but was not necessarily the optimum solution.

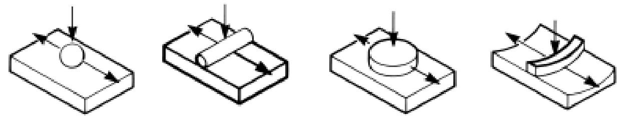
As there still appears to be a market for a dead-weight loaded four ball machine, we have designed a much improved dead-weight loading system, but this has involved some changes to a number of components common to all TE 92 machines. It thus makes sense to give this new dead-weight loaded machine a new product designation. In future, TE 92 machines will be exclusively pneumatically loaded and we will revive the TE 82 designation for the new exclusively dead-weight loaded version of the machine.

TE 65 Loading System



The TE 65 Multiplex Sand/Wheel Abrasion Tester has been offered in various packages, with either dead-weight loading or servo-controlled pneumatic loading, which of course requires some kind of control system to operate. There is of course an alternative to servo controlled pneumatic loading and that is manually controlled pneumatic loading using a precision regulator, force transducer and digital display. It works out that a manual pneumatic loading system is cheaper to make and is certainly more compact than the dead-weight loading system. It therefore makes sense to make all TE 65 machines pneumatically loaded, with closed loop servo control or manual control as the two options; dead-weight loading will disappear as an option.

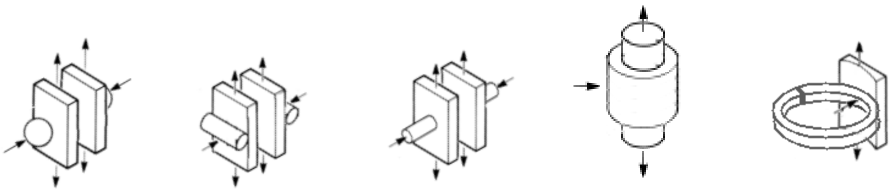
TE 90 Re-packaging

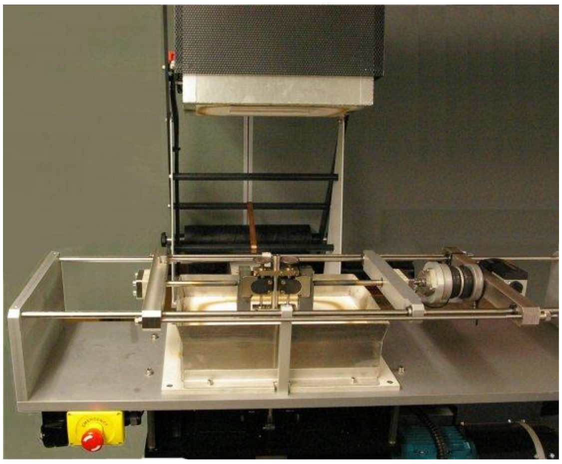


We originally conceived the TE 90 machines as either a four station 1 mm stroke “wear generator” or as a two station 10 mm stroke “instrumented” machine, which included load, friction and electrical contact potential measurement. In an exercise designed to teach us that we cannot predict what people might actually want, we have been asked to produce a four station 10 mm stroke “semi-instrumented” machine, everything except friction force measurement. As the design is modular, this is not difficult to achieve, however, explaining the options in a leaflet or on a price list is more challenging. We will attempt to do this to maximize the choices for configuration of the machine to meet specific requirements.

WORK COMPLETED:

TE 33 Engine Tribometer

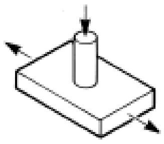


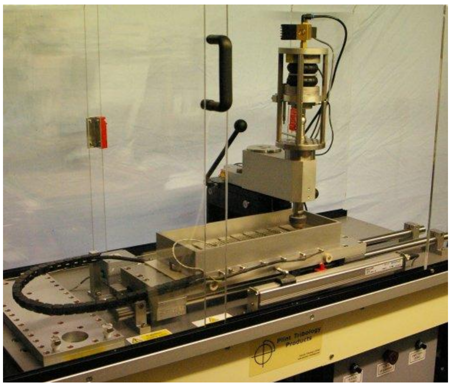


Based on the twin specimen arrangement of the DN 55 High Temperature Dry Sliding & Fretting Test Machine and the standard reciprocating drive of the TE 77 High Frequency Friction Machine, the TE 33 is a long stroke high temperature reciprocating test machine. Samples include standard point, line and area contacts, valve stem and valve guide, and piston ring against cylinder liner. In this latter configuration, a complete piston ring is loaded against a segment of cylinder liner and means are provided for closing the ring gap and for tilting the ring relative to the liner, thus facilitating conformity and alignment.

A high temperature furnace allows dry tests at temperatures up to 1000°C. A hot air enclosure allows tests with drip feed lubrication at temperatures up to 300°C, with either propane gas jet or hot air heating.

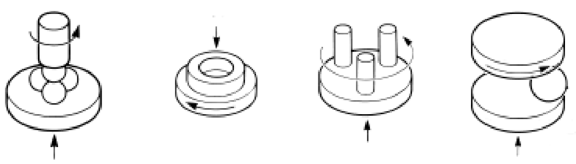
TE 37 Bowden-Leben Machine

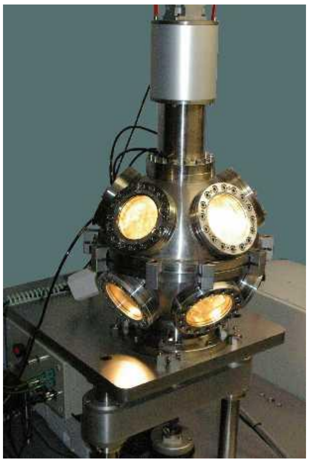




We have now produced a long stroke, low speed, reciprocating rig, for testing standard and large area contact specimens in dry or wet sliding. The loading and friction measuring system is based on the TE 67 test head and the drive mechanism on the TE 69 linear drive.

TE 91 Vacuum Tribometer

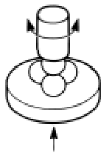




The second TE 91 unit has completed production and includes tooling for spiral orbit tribometer tests in accordance with ASTM F2661.

OTHER NEWS:

Oscillating four ball:



We have always been critical of the un-controlled frictional heating associated with the high frictional energy input in standard four ball tests, preferring the minimum energy pulse experiments typical of reciprocating tribometers. With this in mind, we decided to run a standard four ball wear test, not with continuous rotation, but in oscillating mode. This arrangement allows good control of temperature and generates three separate wear scars on the moving ball and, one each on the fixed balls as in the standard continuous rotation test. Surely someone has done this before?

The Cambridge Tribology Course 2012

The 2012 course will take place from Monday 17th to Wednesday 19th September 2012.

George Plint and David Harris
Phoenix Tribology Ltd