

Tribology Update – ISSUE 46 – June 2025

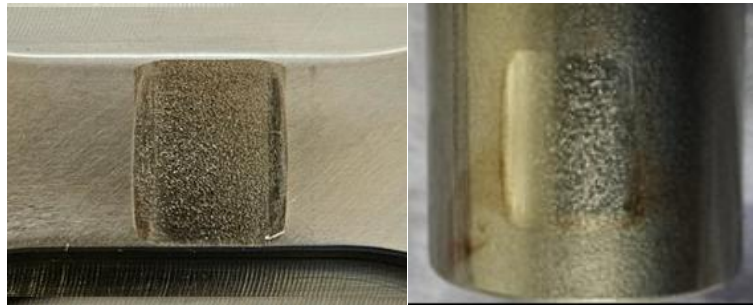
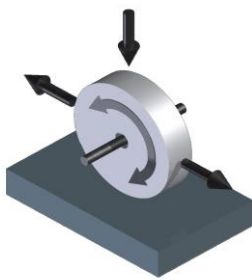
WORK IN PROGRESS – DEVELOPMENT

TE 55 Micro-pitting & Bearing Fretting Rig

As with many screening tests, for a micro-pitting or bearing fretting test, it is essential to choose specimens and test conditions that tend to produce the required failure mechanisms. A lubricant or grease can then be assessed, based on its ability to prevent these forms of damage.

Micro-pitting Test

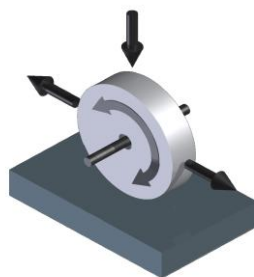
This is a base-line test using PAO4. Post running-in at 0.25 GPa, the test was run at 10 Hz and 1.0 GPa. The stroke amplitude was ± 4 mm with the slide-roll ratio zero at mid-stroke and 8.7% at stroke ends. After 600,000 reciprocating cycles—equal to 1,200,000 fatigue cycles—the specimen surfaces are as shown below:



At stroke ends, where slide-roll ratio is a maximum, sliding velocity falls to zero and micro-pitting gives way to plastic deformation and sliding wear.

Fretting Test

Reducing the stroke amplitude to ± 1 mm, while maintaining the same slide-roll ratio setting, allows bearing fretting tests to be performed. The results for two different greases, at 10 Hz frequency and 1.0 GPa, after 36,000 fatigue cycles (30 minutes), is shown below.

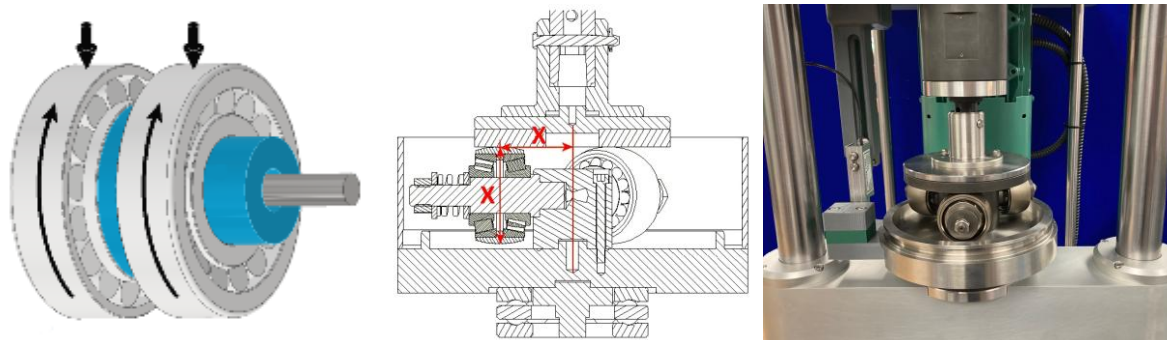


Fretting corrosion can be seen on both specimens, with more severe damage on the right specimen.

ASTM D3527 Grease Bearing Friction Test

There is a programme to replace the existing ASTM D3527 test. We do not think that it is necessary to design a single purpose, free-standing, bearing test machine and that the tests could equally well be run using appropriate adapters, on a standard rotary tribometer or four ball machines. Two new adapters have been designed and developed.

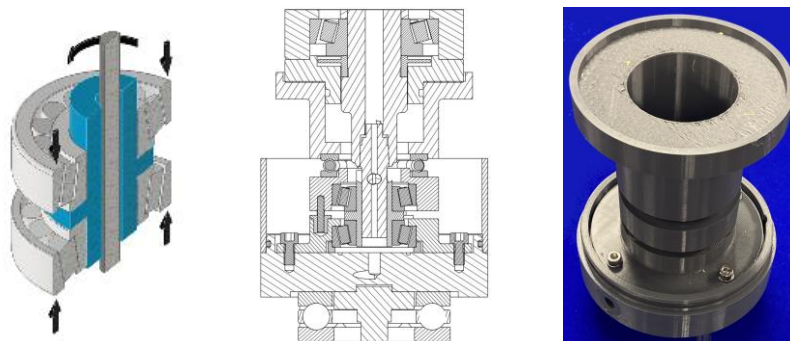
Radial Loaded Bearings - Patent Application: GB2504361.3



The adapter illustrated shows 30204 taper roller bearings. The radially loaded test geometry with the bearing carrier diameter equal to the driving disc track radius means that the test bearings rotate at twice the speed of the driving disc. Increasing the driving disc track diameter increases the bearing speed, allowing bearings to be run at substantially higher speeds than the test machine.

The design concept can be scaled up or down to accommodate different types and sizes of bearing.

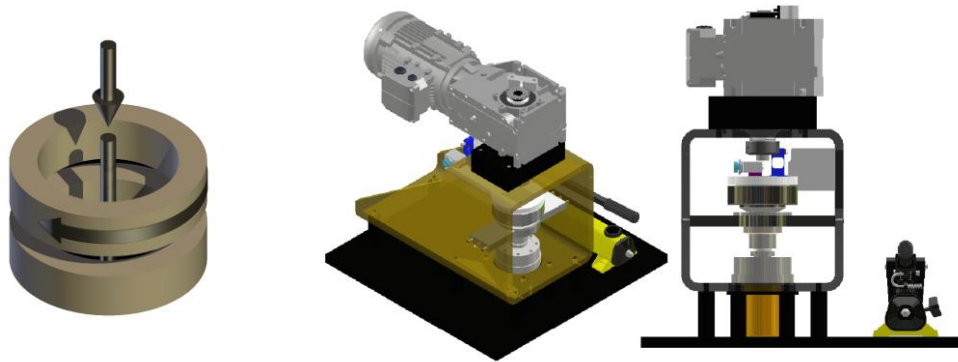
Axial Loaded Bearings - Patent Application: GB2501479.6



The adapter illustrated shows 30204 taper roller bearings. The axially loaded, back-to-back, test geometry, with the addition of a second ball thrust bearing, means that the test bearings can be run at loads exceeding the capacity of the test machine spindle.

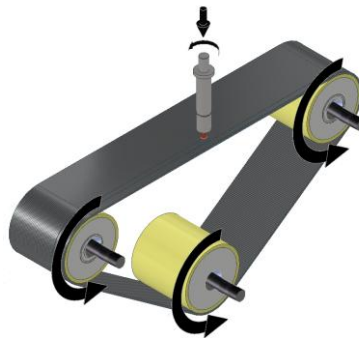
The design concept can be scaled up or down to accommodate different types and sizes of bearing.

ST-TC Standard Test - ASTM G223 Twist Compression Tester



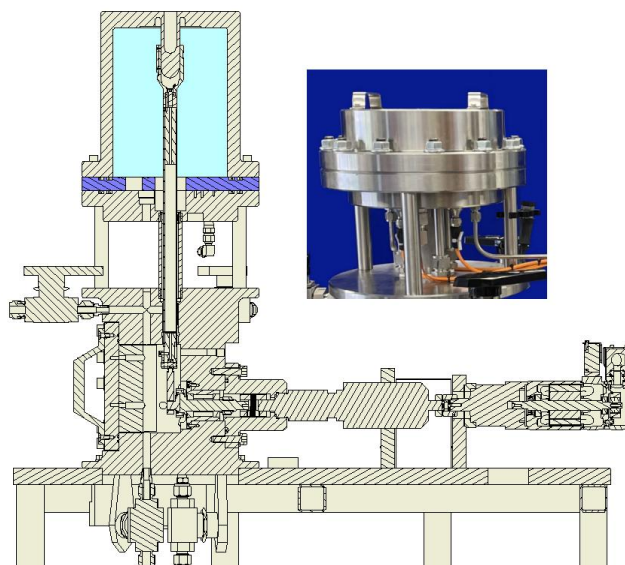
We have finalized the design for a value engineered, bench-mounting, Twist Compression Tester, as per ASTM G223, and are now in the process of producing a prototype.

ST-BA Standard Test - ASTM G132 Belt Abrasion



We are completing a design study for a value-engineered test machine to meet the requirements of the ASTM G132 two body abrasion tests.

TE 60 High Pressure Hydrogen Tribometer - Extended Functionality



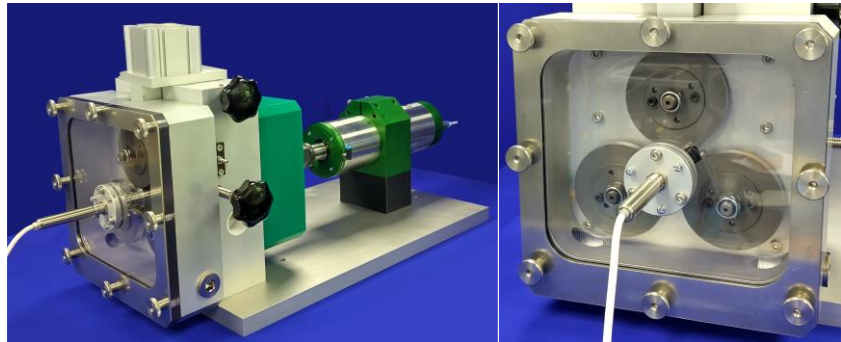
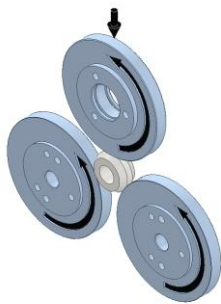
For regulatory reasons, the high-pressure test chamber on the TE 60 must be as small as possible, to achieve a maximum bar-litre value of less than 25. This allows test to be run under hydrogen at pressures up to 100 bar.

It has been suggested to us that if someone wanted to run tests at much lower pressures, then perhaps we could offer alternative, lower pressure, chambers, thus providing more space for test assemblies and instrumentation. We think this is a very good idea, so have modified the design to include a new interface plate as standard, allowing different chambers and test assemblies to be mounted. For the standard, high-pressure, set-up, the fixed specimen test assembly is now mounted on the interface plate, allowing easy removal from the test machine.

New low pressure and high and low temperature test assemblies are to be designed and will be retrofittable to new machines.

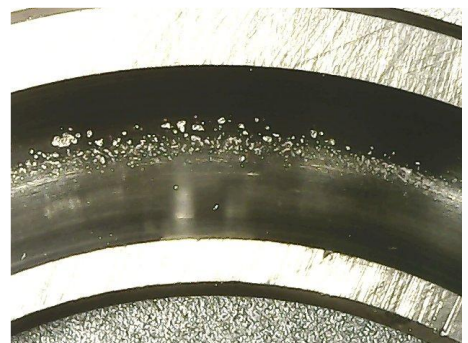
COMPLETED PROJECTS – DEVELOPMENT

ST-PR Standard Test – Pitting Rig



We have now completed the assembly of the ST-PR Pitting Rig and optimised the technical specification to achieve the right balance between functionality and price.

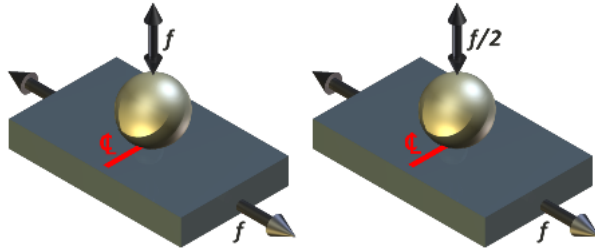
ST-FB – Four-Ball Machine - Rolling Bearing EDM Test System



We have added our Electrical Discharge Machining Test System as an option on ST-FB.

WORK IN PROGRESS – PRODUCTION

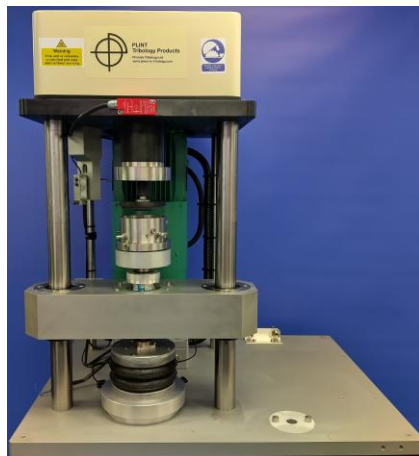
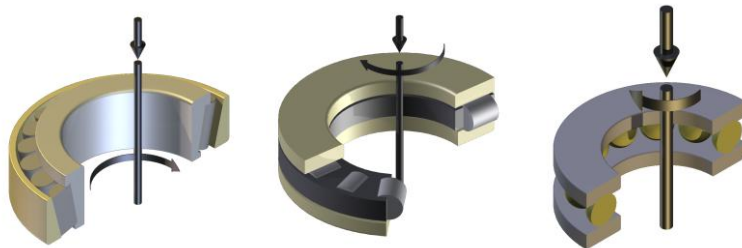
TE 77 Impact Fretting Adapter



This adapter produces normal impact of a ball against a reciprocating plate specimen, with fully synchronised vertical and horizontal motion.

COMPLETED PROJECTS – PRODUCTION

RCF 2 Rolling Bearing Tribometer



This is the first production unit of our recently updated RCF 2 machine. Two interchangeable test assemblies are available, one for smaller bearings and lower loads (maximum 10 kN) and the other for larger bearings (maximum O/D 180 mm) and higher loads (maximum 40 kN). In both cases, bearing friction torque is measured.

OTHER NEWS

Product Videos and On-line Tutorials

We continue to add product videos to the web site and have also added a new tutorial on Rolling Contact Fatigue, which can either be accessed via the website or viewed direct on [YouTube](#).

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George Plint, Cyrille Favade and James Morley

Phoenix Tribology Ltd