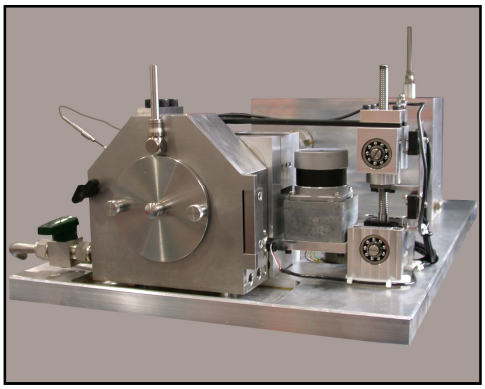
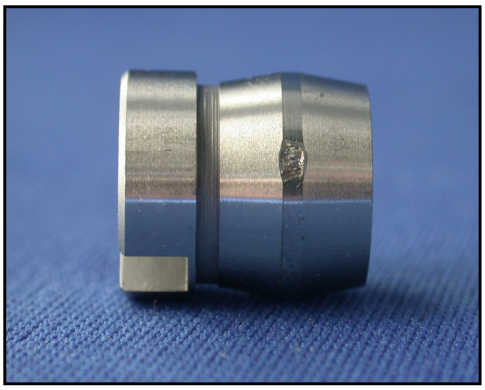
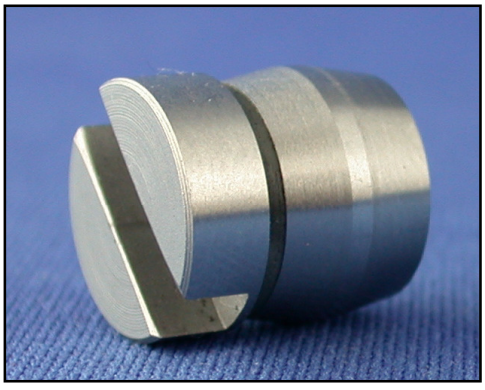
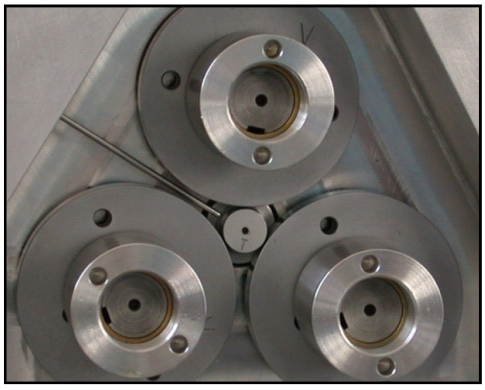
PCS Instruments

MPR Pitting/ Micropitting Rig

A computer controlled three-contact macro and micropitting rig, able to run under realistic contact pressures and film thickness.

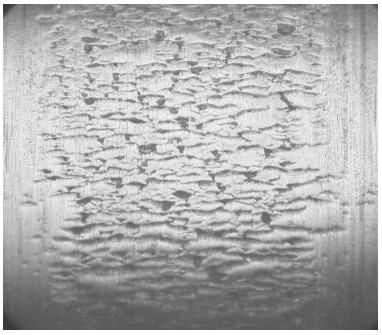
Micro and Macro Pitting

Micropitting and macropitting are rolling contact fatigue failure mechanisms which occur in cyclically loaded machine components such as gears, cams and rolling element bearings.

Micropitting is a fatigue phenomenon resulting in microscopic pits forming on the surfaces in contact. These are produced by asperity scale plastic flow caused by repeated cyclic contact stresses. The pits are typically less than 100 microns wide.

Macropitting is a surface fatigue phenomenon which causes large pits to form on the surfaces in contact. These result from surface or subsurface initiated cracks propagating into large scale pits. Macropitting tends to occur in more heavily loaded contacts than micropitting.

The PCS Micropitting rig (MPR) and test specimens have been designed to reproduce the lubricated contact conditions which can lead to either micro or macropitting.

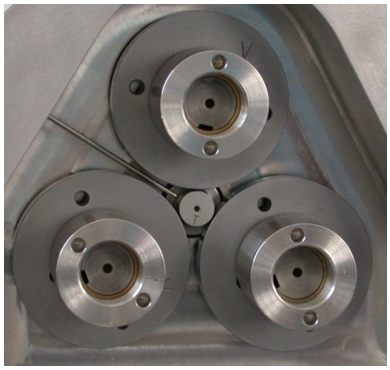


MICROPITTING (TOP) AND MACROPITTING (BOTTOM)

MPR

The MPR is a computer controlled three-contact disc machine in which there are three 'counterface' rings of equal diameter positioned apart with a smaller diameter roller located in the middle and in contact with all the rings. This arrangement allows the test roller to be subjected to a large number of rolling contact cycles in a short period of time and hence significantly reduces testing time. At a typical entrainment speed of 3.5m/s, the central test roller will experience approximately one million contact cycles per hour.

The rig has an on-board processor, which allows the speed, slide-roll ratio, temperature, and load to be automatically controlled. Two servo-controlled motors are used to control the speeds of the rings and the roller separately, therefore allowing any combination of slide-roll ratio and entrainment speed to be set. Since the rig is computer controlled, it is possible to perform both simple and complicated test steps under precisely controlled conditions, allowing the effect of lubricant compositions on micropitting, macropitting or failure load testing to be studied.



MPR SPECIMENS IN SITU - 3 COUNTERFACE RINGS AND A CENTRAL ROLLER

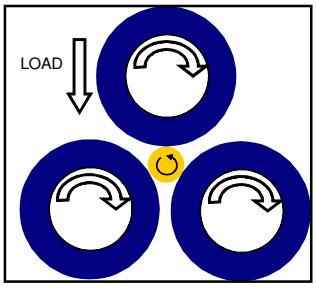
Lubrication

A dip lubrication system is used to supply lubricant into the contacts. The test requires a relatively small volume (150 ml) of oil into which the two lower rings are dipped. An electric cartridge heater is used to adjust the temperature of the test chamber, which in turn heats up the test lubricant. A temperature probe is inserted into the test chamber with the tip of the probe close to the contact region.

MPR RIG WITH LUBRICANT PRIOR TO TESTING

Loading

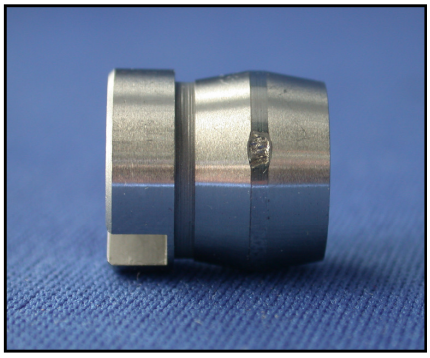
The load is applied by means of a motorised ball-screw, acting through a loading arm. Strain gauges are attached on the loading arm to measure the applied load. The rig is equipped with a piezoelectric accelerometer which is used to measure the vibration in the contact. Once a macropit propagates on the test roller, the increased measured vibration level is detected by the control system and the test is stopped automatically. The number of cycles to failure ("Life") is recorded.



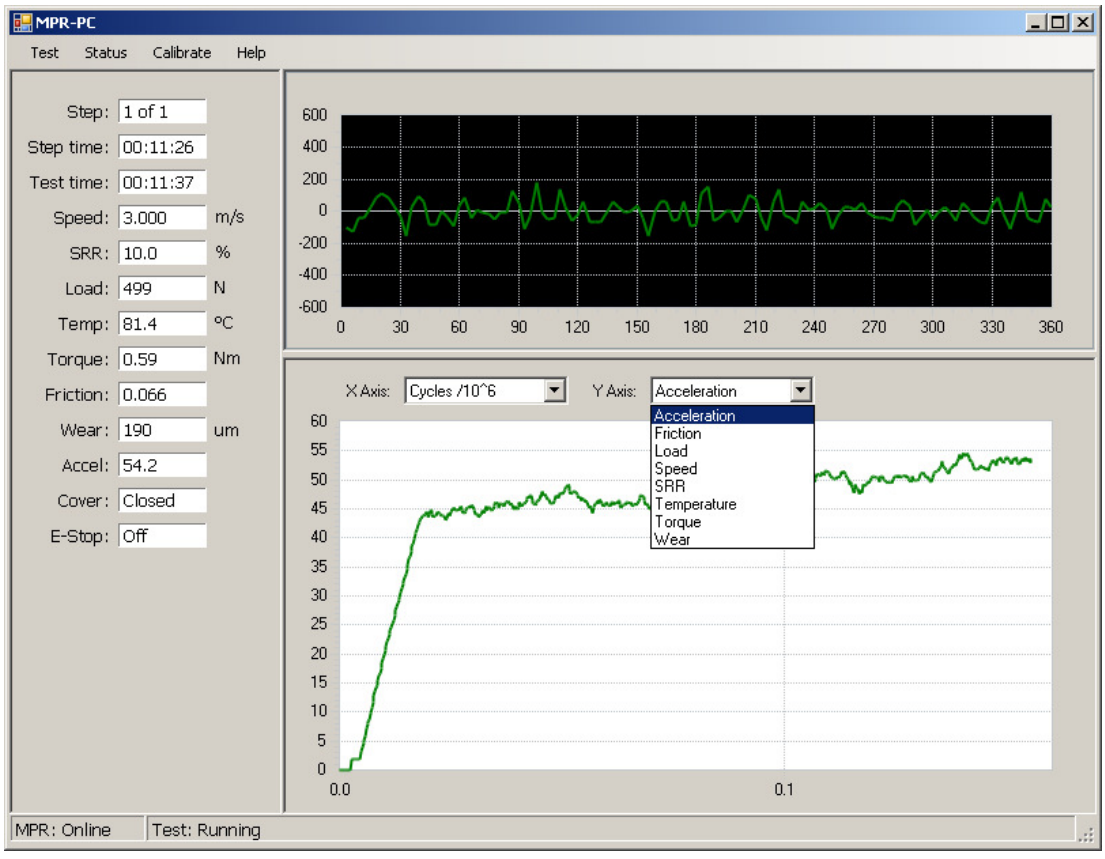
Running a Test

Before a test can be run, a suitable profile is selected. A test profile stores all of the operating conditions for a particular test in a convenient data file format (loads, speeds etc). The profile editor supplied with the MPR is a stand-alone application, which allows the user to create and edit test profiles.

Once a valid profile and filename has been selected, the test will then start automatically. The main display will show the accelerometer trace in the upper graph (the X axis shows the roller rotation angle in degrees, the Y axis shows the centre line average of the accelerometer signal), the current test conditions are shown on the left hand side.



PIT ON SPECIMEN AFTER TEST



SCREEN SHOT FROM SOFTWARE TAKEN DURING A TEST
LEFT HAND SIDE - TEST CONDITIONS
TOP - CURRENT ACCELEROMETER TRACE DURING THE TEST
BOTTOM - ACCELEROMETER TRACE OVER COMPLETE TEST
(THIS GRAPH CAN BE CHANGED BY USING THE DROP DOWN MENUS)

Technical Specification

Operating Conditions

Maximum Load	1250N
Maximum Speed	4 m/s (depending on slide roll ratio)
Slide Roll Ratio	0% (pure rolling) to +/- 200 % (pure sliding)
Maximum Temperature	135°C
Maximum Roller Torque	20 Nm (total of all 3 contacts)

Electrical

Mains Power	200-240 V AC
Frequency	50/60 Hz
Power	3.0 kW maximum (15A)

Weight - 170 kg (Approximate)

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