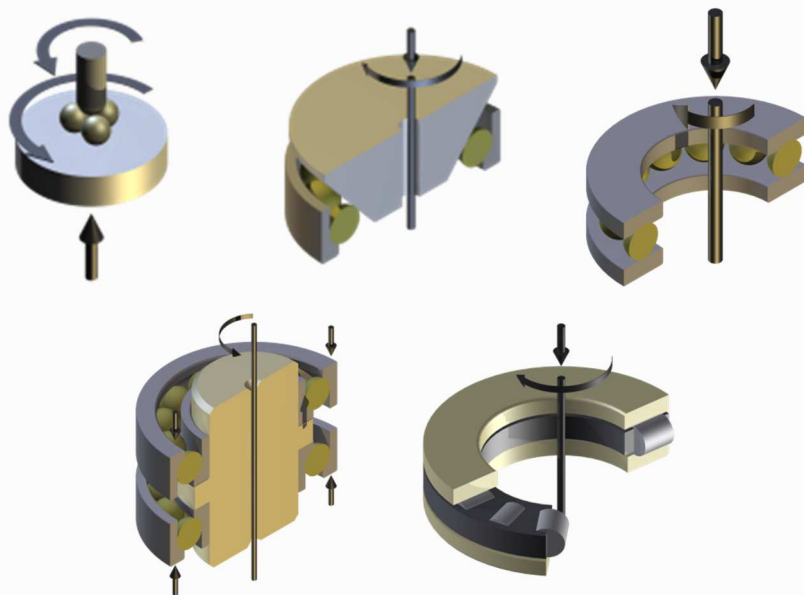


RCF 2 ROLLING CONTACT FATIGUE MACHINE



Description

The RCF 2 Rolling Contact Fatigue Machine is a cut-down version of the TE 92HS Microprocessor Controlled Rotary Tribometer, the key change being the removal of the friction torque measuring arrangement and the clutch assembly used for low speed sliding four ball tests. The RCF 2 machine is used only in the high speed configuration with rolling contact test adapters.

Various well established test adapters are available, including the standard rolling four ball test adapter, typically used for generating surface propagated micro-pitting failures, a cone on angular contact bearing adapter and a thrust ball bearing on disc adapter, which produces rolling with contact spin. All these rely on the high speed test spindle bearings to react the applied axial load. In addition to these, modifications have been made to the spindle and housing to allow back-to-back testing of angular contact bearings. This arrangement results in no axial load on the test spindle, allowing loads up to 40 kN to be applied to the test samples.

The RCF 2 has servo controlled low inertia pneumatic loading with force transducer feedback and vector speed controlled motor speed with encoder feedback. The machine is floor-standing.

Motor and Test Spindle

The test spindle projects downwards and runs in a housing with precision greased for life bearings. The drive motor is connected directly to the drive spindle via a smooth drive belt and pulley. The motor is mounted on a sliding plate with a jacking screw to tension the drive belt. The drive ratio is 6.67:1. This means that for a motor speed of 1,500 rpm the test spindle is rotating at 10,000 rpm. Vector control of the motor with encoder feedback provides a variable speed turn-down ratio of 100:1.

Location for holders for the rotating specimens is provided by a tapered hole in the end of the test spindle and the accurately machined outer diameter and end face of the spindle. The test adapters are mounted directly onto the machine loading beam, which runs on linear bearings.

Thermocouples are located in the adapters to measure the temperature of the test sample (either material or lubricant) and this measurement is used as the feedback for control. The temperature is maintained by software PID controllers.

Rolling contact fatigue tests require the machine to be shut down by detecting the onset of pitting. A piezo-electric sensor is mounted on the machine frame to detect vibration levels. The sensitivity of the detection circuit is adjustable by the operator. A sudden rise in the level of vibration, caused by the pitting damage in the test adapter, will trip the circuit and stop the motor rotating.

Control and Data Acquisition

Control and data acquisition are implemented via host PC running COMPEND 2020 Windows compatible software, in conjunction with a Phoenix Tribology USB micro-controller interface.

Automatic control is implemented via user programmable test sequences. Manual control is implemented using on screen toggles. Data is stored to hard disc in either .csv or .tsv file formats.

Accessories

RCF 2/10 Standard Load Actuator Assembly



The operating envelope of the machine is based on the L10 and L30 lives of the spindle bearings. The standard load actuator assembly provides a loading range of 200 to 10,000 N. The permissible loads and speeds for tests where the machine spindle reacts the axial load, are as follows:

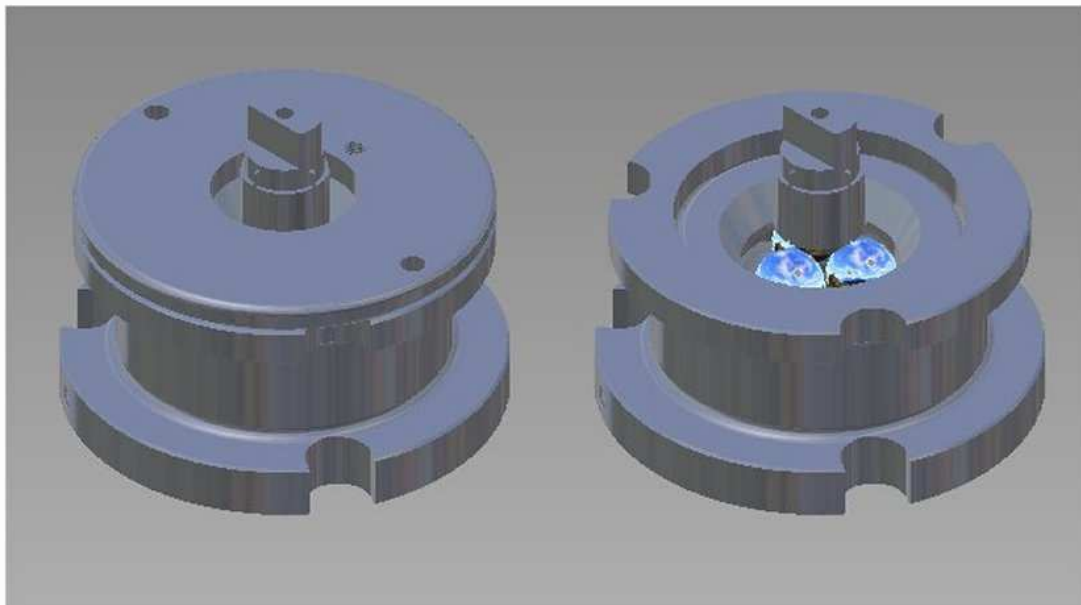
10 kN	1,840 rpm
5 kN	3,000 rpm
3 kN	10,000 rpm

RCF 2/40 High Load Actuator Assembly



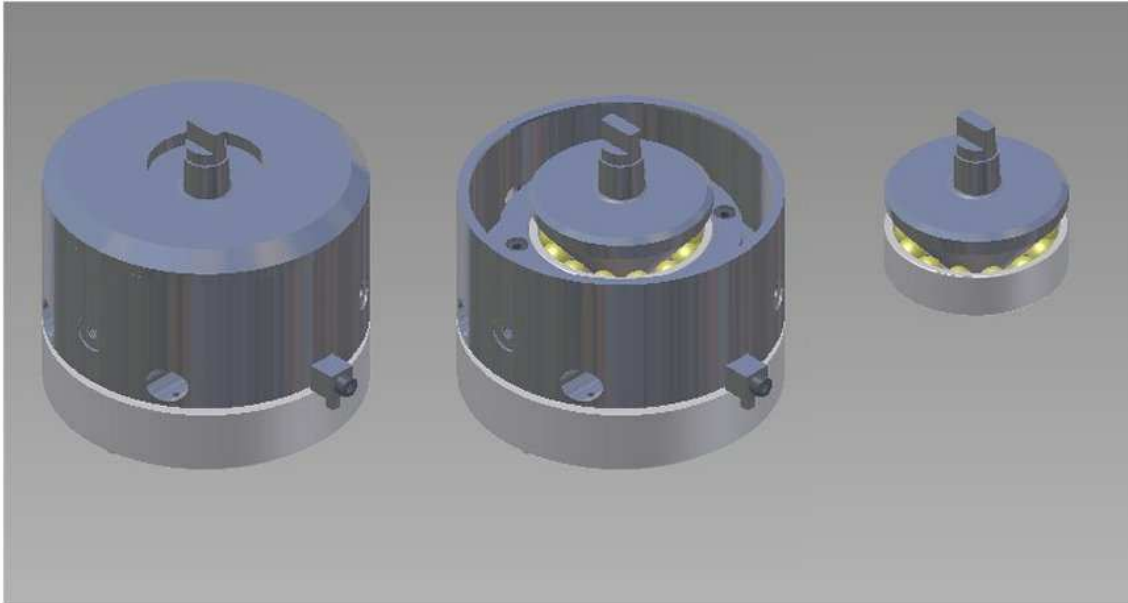
The high load actuator assembly is used in conjunction with the back-to-back bearing assembly and allows loads of up to 40 kN to be applied to the test bearings and a maximum rotational speed of 10,000 rpm to be achieved.

RCF 2/1 Rolling Four Ball Adapter



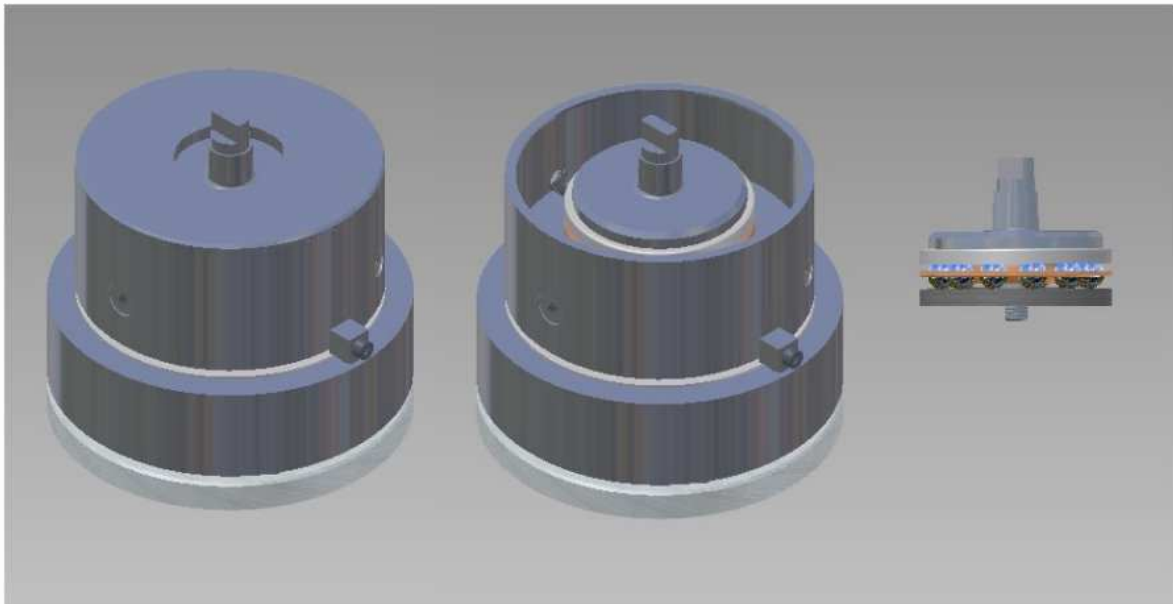
This comprises a test reservoir and precision polished test race. The race is designed to permit the test balls to rotate freely maintaining a defined contact angle with the upper ball fixed in the spindle.

RCF 2/2 Cone on Angular Contact Bearing Adapter



This adapter uses a conical test sample loaded against the lower half of a size 7206 62 mm O/D 30 mm I/D angular contact bearing. The cone angle is designed to give a pure rolling contact. Contact stress can be increased further by removing balls from the bearing cage.

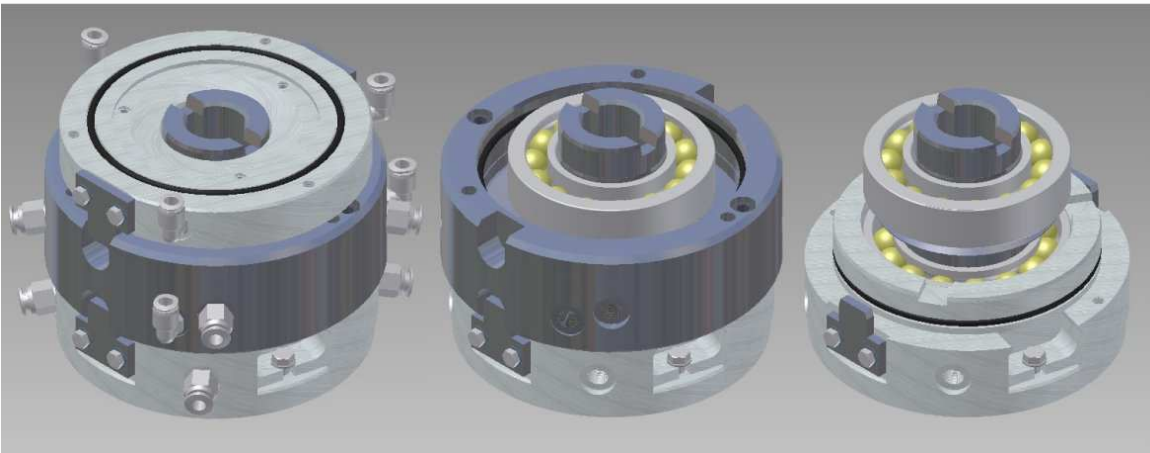
RCF 2/3 Thrust Ball Bearing on Disc Adapter





This adapter uses one half of a standard size 51208 68 mm O/D 40 mm I/D thrust bearing, with the balls running between the normal bearing race and a flat disc. A cage is provided to retain the balls.

RCF 2/4 Back-to-back Bearing Adapter



This adapter uses two size 7209 85 mm O/D 45 mm I/D angular contact bearings, loaded back to back, as the test samples. Separate oil ways are provided to ensure that oil and wear debris from the upper test bearing does not pass through the lower bearing.

RCF 2/5 Roller Thrust Bearing on Disc Adapter

This adapter is essentially similar to RCF 2/3, but uses one half of a standard size 81208 TN roller thrust bearing, loaded against a flat lower disc sample, of chosen material. The standard bearing cage is used to locate the rollers, with the cage centred by a spindle mounted deep groove ball bearing.

RCF 2/LS Lubricant Service Module

A lubricant service module is required for all types of test adapter except the standard rolling four ball adapter. The module has a sump tank with immersion heater, delivery and scavenge pumps and oil to water heat exchanger, for cooling.

RCF 2 ROLLING CONTACT FATIGUE MACHINE

Technical Specifications

Contact Configurations:	Rolling Four Ball Adapter Cone on Angular Contact Bearing Adapter (Bearing 7206) Thrust Ball Bearing on Disc Adapter (Bearing 51208) Roller Thrust Bearing on Disc Adapter (Bearing 81208 TN) Back-to-back Bearing Adapter (Bearing 7209 x 2)
Rotational Speed:	100 to 10,000 rpm
Standard Load Range:	10,000 N
Back-to-back Load Range:	40,000 N
Spindle Bearing Load:	10,000 N @ 3,000 rpm 4,000 N @ 10,000 rpm
Motor:	2.2 kW ac @ 1500 rpm 50% overload available for 30 seconds
Heated Block Power:	550 W
Temperature Sensor:	k-type thermocouple
Vibration Sensor:	piezo-electric type with adjustable threshold sensitivity and cut-off time
Interface:	Phoenix Tribology USB micro-controller interface
Software:	COMPEND 2020

Controlled Parameters	Rotational Speed Temperature Load Test Duration
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Recorded Parameters	Rotational Speed Temperatures Number of Revolutions Test Duration
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Vibration Sensor Output

Services

Electricity: 220/240 V, single phase, 50/60 Hz, 3 kW
Clean, dry air: 4 cfm at 8 bar (120 psi)

Installation

Floor-standing machine: 900 x 600 x 2000 mm high, 250 kg
Bench-mounting cabinet: 530 x 420 x 300 mm high, 20 kg
Packing Specifications: 2.2 m³, GW 600 kg, NW 450 kg