

RCF 3 ROLLING CONTACT FATIGUE MACHINE



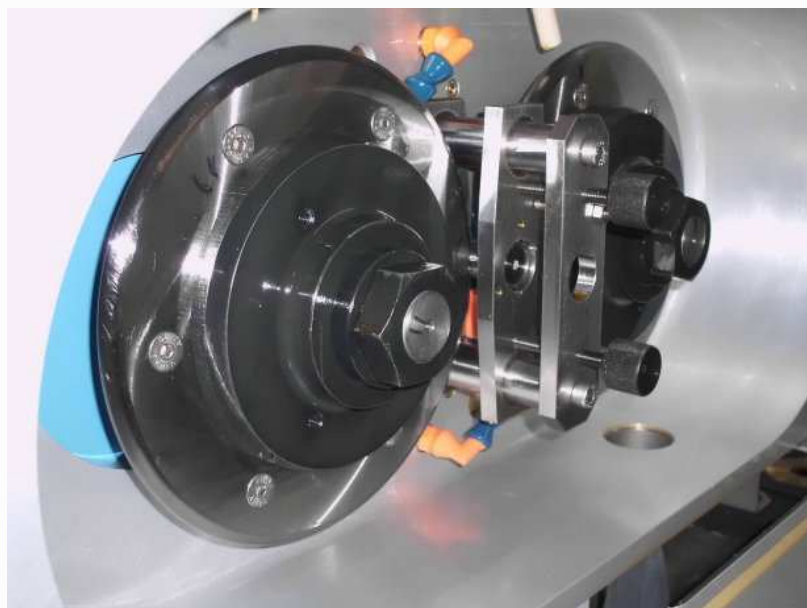
Description

The RCF 3 Rolling Contact Fatigue Machine is a modified version of the TE 73H Two Roller Machine. It provides a three roller test configuration similar to the now obsolete GE Polymet machine. Two large diameter rollers are loaded diametrically opposed against a small diameter rod specimen. In the original Polymet design, the latter was driven. In the current design, the two outer rollers are driven, allowing much higher rotational speeds to be achieved, while at the same time substantially eliminating potential slip in the roller contacts.

The machine is designed for performing rolling contact fatigue tests under conditions of elastohydrodynamic lubrication, with well filtered lubricant feed, thus minimizing the potential for adhesive, abrasive or oxidative wear or surface propagated micro-pitting; the intended failure mechanism is thus by pressure generated, sub-surface propagated, flaking or spalling.



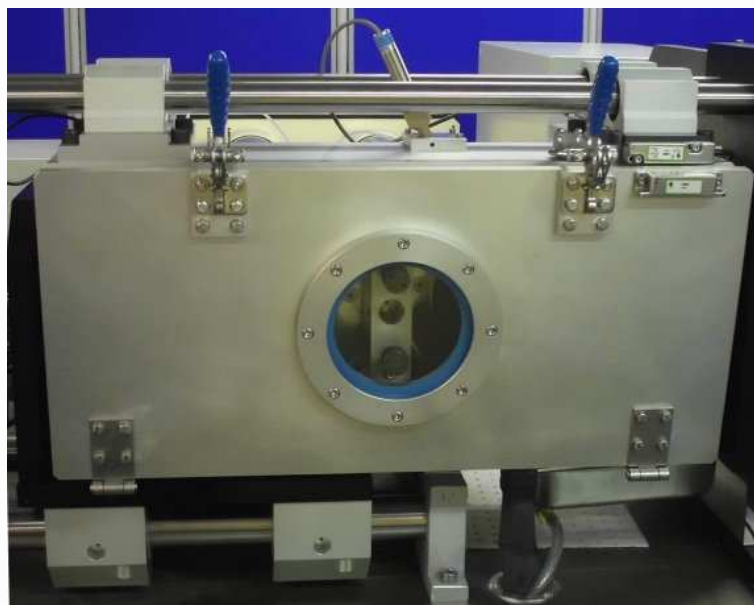
The rod specimen is reduced to a simple cylindrical roller running in rolling contact with the driven rollers. Specimens of diameters ranging from 20 mm to 50 mm can be accommodated.



The rod specimen is carried in two deep groove ball bearings, which are subjected to no radial load. A small axial pre-load is applied with wave washers. The maximum achievable rod specimen speed is a function of the quality of the supporting deep groove ball bearings and the ability to fine tune the lubricant supply to allow operation at speeds in excess of the normal limiting speed for the given bearing. Typical operating conditions, with different sized rod samples, hence support bearings, are as follows:

Drive Roller Diameter	Drive Roller Speed	Test Roller Diameter	Support Bearing	Reference Speed	Limiting Speed	Test Speed	Cycles per Day (million)
mm	rpm	mm		rpm	rpm	rpm	
200	4500	20	61804	45000		45000	129.6
200	2800	20	61804		28000	28000	80.6
200	4800	30	61806	32000		32000	92.2
200	3000	30	61806		20000	20000	57.6
200	5200	40	61808	26000		26000	74.9
200	3200	40	61808		16000	16000	46.1
200	5000	50	61810	20000		20000	57.6
200	2600	50	61810		13000	13000	37.4

For high speed operation, the deep groove ball bearings must be press-fitted to the rod sample, with the tolerances adjusted to ensure the correct bearing operating internal clearance. Other than the press-fit, no other means is provided for locating the rod sample within the bearings, thus removing the requirement for circlip grooves in the rod samples. The bearings are treated as consumable items and used once only.



The "race-way" surface temperature (the running surface of one of the driving rollers) and the rod sample end-face surface temperature are monitored by pyrometers. A vibration sensor with adjustable level trigger circuit is provided for stopping the machine at the on-set of rolling contact fatigue.

Load is applied by means of a servo-controlled pneumatic bellows with force transducer feedback. One of the driving roller assemblies is mounted on a linear slide and is indexed, under load from the bellows, into contact with the rod specimen, also mounted on the linear slide, and hence into contact with the fixed driving roller.

The drive system comprises an a.c. vector motor and drive with encoder feedback. The motor output incorporates belt drives to two lay-shafts, each connected by high speed cardan shafts to the driven roller spindle assemblies. The spindles are electrically insulated and provided with slip rings to allow electrical contact potential measurements to be performed in order to detect the presence or otherwise of thick lubrication films.

Lubricant supply to the test assembly and roller spindles is provided by separate service modules.

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.

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Technical Specifications

Contact Configurations:	Flat Roller on Flat Roller (Line Contact) Flat Roller on Crowned Roller (Elliptical Contact)
Maximum Load:	21 kN
Loading Rate:	50 N/s
Temperature Range:	Ambient to 150°C
Test Roller Diameter:	20 mm to 50 mm
Driving Rollers:	
Diameters:	200 mm to 250 mm
Maximum Speed:	6,000 rpm
Vibration Sensor:	Piezo-electric type with adjustable threshold sensitivity and cut-off time
Interface:	Phoenix Tribology USB micro-controller interface
Software:	COMPEND 2020
Motor:	4 kW a.c. vector motor, 2048 ppr encoder, force vent

Controlled Parameters	Motor speed Applied load Lubricant inlet temperature Test duration
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Recorded Parameters	Motor speed Applied load Lubricant inlet temperature Race-way temperature Rod Sample end-face temperature Vibration sensor output Electrical contact resistance
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Services

Electricity:	220/240 V, single phase, 50/60 Hz, 7.5 kW
Clean, dry air:	4 cfm at 8 bar (120 psi)
Mains water and drain:	10 l/min (typical)