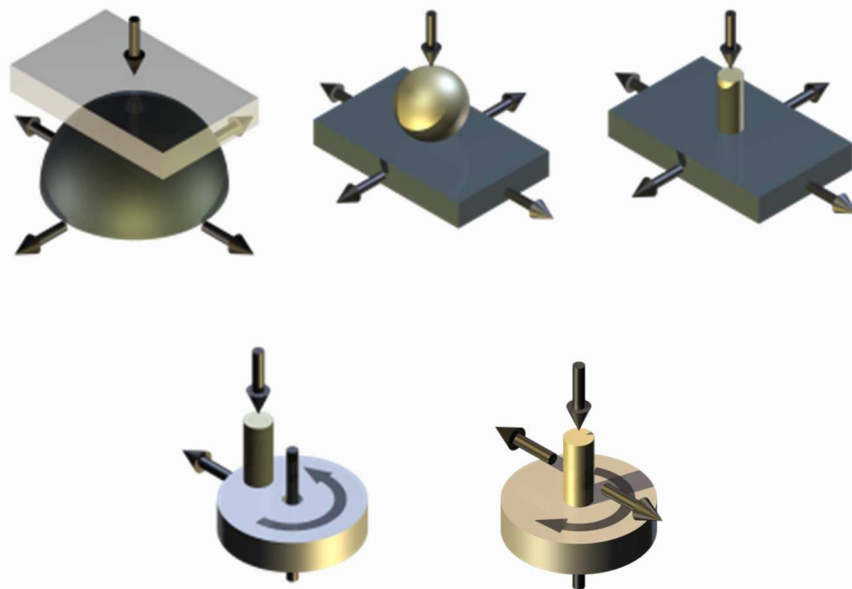


# TE 79 MULTI-AXIS TRIBOMETER

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## Description

The TE 79 Multi-Axis Tribometer is for friction and wear testing of materials under low loads in pin or ball on disc or reciprocating plate configurations. In pin on disc mode the machine can perform tests according to ASTM G 99 and DIN 50 324 and provides a Class 1 contact

configuration (pin or ball loaded vertically downwards onto a horizontally rotating disc). In both pin on disc and pin on plate modes, the indexing capability allows tests to be performed in accordance ASTM G132 Standard Test Method for Pin Abrasion Testing, which requires indexation of the pin so that it is always presented with a fresh abrasive surface. The Tribometer is modular, with two possible configurations, each used in conjunction with the TE 79 Base Unit.

## TE 79 Base Unit

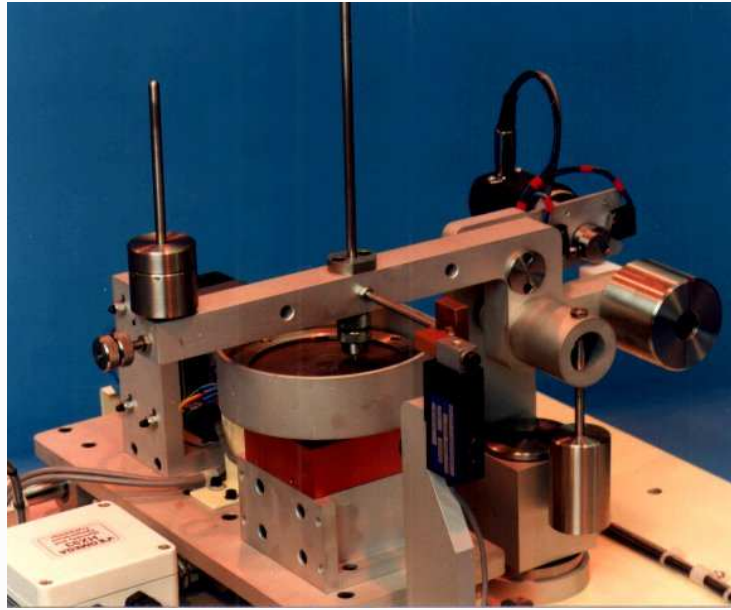
This comprises the loading and friction force measurement system mounted on a base plate, control hardware, USB interface unit and control software. The machine is bench-top mounted and includes a transparent enclosure and ambient humidity and temperature sensor. The enclosure is also used as a safety cover for the machine and incorporates a magnetic proximity switch. The machine will not run if the enclosure is removed.

The fixed pin or ball sample is carried on a trunnion and gimble mounted loading beam. This is counterbalanced both to give a neutral balance and to bring the centre of gravity onto the contact plane. Load is applied by dead weights in a range from 0.1 N to 50 N.

The loading beam is restrained by a strain gauge force transducer in a sliding link. This link ensures that only the tangential component of force in the contact (the friction force) is measured even with the large deflections associated with elastomeric test pieces. As the lower specimen surface moves the friction force on the ball or pin sample is measured.

The load beam lift/lower is servo controlled so that the load can be applied at a specific point in the test. The program can also introduce a dwell between load application and movement. This dwell period is an important parameter in determining the start-up friction in elastomeric contacts.

## TE 79/P Indexing Pin on Disc Module



This Module comprises a rotating disc assembly mounted on a cross slide, thus allowing the pin sample to follow a spiral track on the disc, if required. Rotary and translatory motions are driven by stepper motors. The module locates on the base plate of the TE 79 Base Unit and is fixed in place with locating screws.

The disc specimen is mounted in a reservoir to retain lubricating fluid. The reservoir is mounted on a vertical drive shaft assembly. This is mounted on a traversing slide, which permits the radius to be changed during a test. The control software may be set to run with a constant rpm or constant velocity during a traverse.

## TE 79/R Indexing Reciprocating Module



The Module locates on the base plate of the TE 79 Base Unit and is fixed in place with locating screws. It provides X/Y axis movement with linear positional feedback. Tangential (friction) force measurement is in the X direction. The axes are formed by cross-axis linear slides with 1 mm pitch lead screws and are driven by stepper motors.

The fixture for the lower (moving) specimen includes an electrical resistance heater and two thermocouples for temperature measurement and control above ambient conditions.

A programmable motion controller is used to coordinate movement of the two axes. Numerous motions are possible including:

Simple reciprocating along one track in the X direction.

Reciprocating in the X direction with indexing in the Y direction at stroke end, so that the wear track resembles a square wave.

Reciprocating in the X direction with indexing in opposite Y directions at stroke end, so that the wear track is rectangular.

Simultaneous indexing on both the X and Y axes so that the pin follows a circular or elliptical track with an orbiting (rotating friction vector) motion.

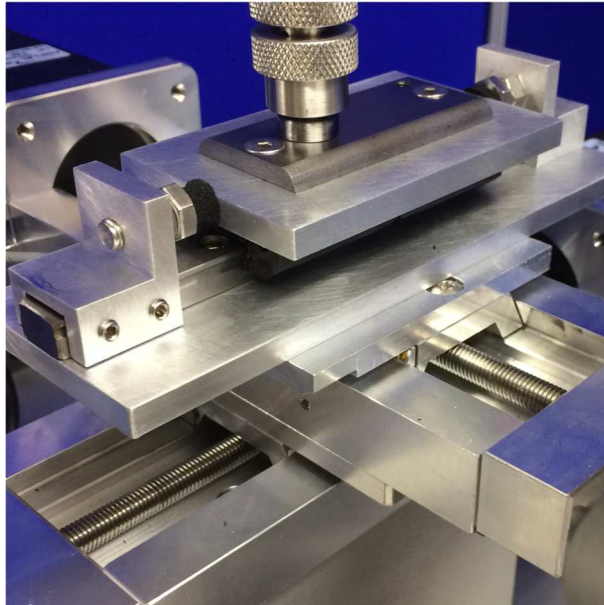
## Test Environment

The TE 79 Base Unit is provided with a plastic safety cover, which also acts as a chamber for the user to run under controlled humidity conditions. An ambient temperature and humidity sensor is mounted on the machine base inside the chamber.

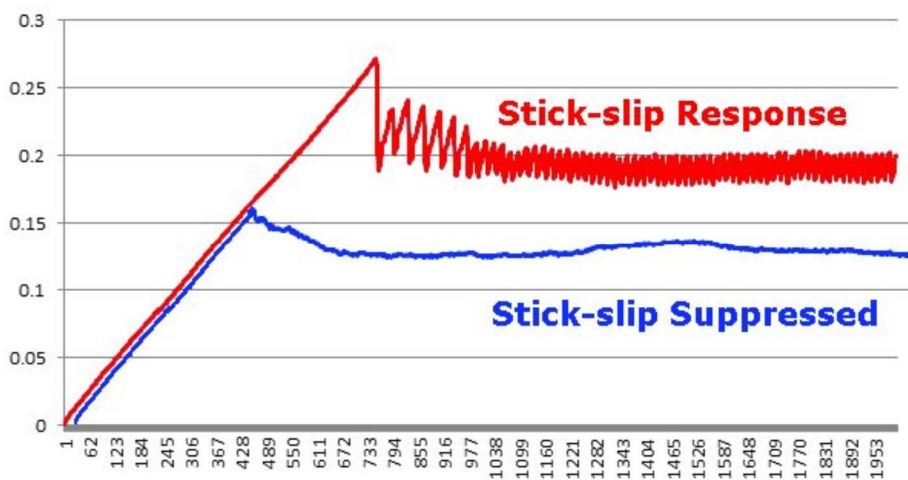
## TE 79/R/C Cooler Pad and Laboratory Chiller

This test assembly replaces the standard fixed specimen heater block in the reciprocating module with a cooler pad. Used in conjunction with a Laboratory Chiller unit with water/glycol mixture as the coolant, temperatures from -25°C to ambient may be achieved. To avoid ice formation, this adapter is best used in conjunction with a simple desiccant dehumidifier system used in conjunction with a controlled air supply.

## TE 79/R/S Stick-slip Adapter



The stick-slip adapter is used in conjunction with TE 79/R Indexing Reciprocating Module. A plate specimen is supported on a linear bearing, with axial movement constrained either by elastomeric stops or adjustable springs. By adjusting the axial stiffness of the system, the stick-slip response can be tuned. For evaluating a slide-way lubricant, the system is first adjusted to give a stick-slip response, either with a base oil or a poor reference fluid, then tested with the candidate sample, to determine its ability to suppress stick-slip.



## 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.

## Technical Specifications

Contact Configurations:

Normal Load:

Friction Force Range:

Humidity Sensor:

Interface:

Software

Ball on Flat

Pin on Flat

Customised Specimens

0.1 to 50 N

0 to 50 N

10 to 90% RH

Phoenix Tribology USB micro-controller interfac

COMPEND 2020

### TE 79/P Indexing Pin on Disc Module

Contact Configurations:

Disc Diameter:

Track Radius:

Y Traverse Speed:

Rotation Speed:

Sliding Speed:

Ball on Disc

Pin on Disc

100 mm

0 to 40 mm

10 mm/min

0 to 250 rpm

up to 1 m/s

### TE 79/R Indexing Reciprocating Module

Contact Configurations:

Maximum X Axis Speed:

Maximum X Stroke:

Maximum Y Axis Speed:

Maximum Y Stroke:

Temperature Range:

Dwell (time delay):

Temperature Sensor:

Heating Power:

Ball on Plate

Plate on Plate

Plate on Hemisphere

10 mm/s

50 mm

10 mm/s

30 mm

ambient to 100°C

User selected in seconds up to 8 hours

J-type thermocouple

150 W

## TE 79/R/C Peltier Cooler

Minimum Temperature:

-15°C (ambient water cooled)

Minimum Temperature:

-30°C (chiller water/glycol cooled)

## RE 79/R/C Laboratory Chiller

Working Fluid:

50:50 Water/Glycol

Fluid Temperature:

-35°C

## Controlled Parameters

X Position (TE 79/R)

RPM (TE 79/P)

X Axis Speed (TE 79/R)

Y Position (TE 79/P and TE 79/R)

Y Axis Speed (TE 79/P and TE 79/R)

Temperature (TE 79/R)

Dwell Period

Test Duration

## Measured Parameters

X Position (TE 79/R)

Y Position (TE 79/P and TE 79/R)

Humidity

Ambient Temperature

Temperature (TE 79/R)

Friction

Friction Coefficient

## Services

Electricity:

220/240 V, single phase, 50 Hz, 720 W

110/120 V, single phase, 60 Hz, 720 W

## Installation

Bench-mounting machine:

570 mm x 600 mm x 600 mm high, 40 kg

Bench-mounting controller:

530 mm x 530 mm x 240 mm high, 20 kg

Packing Specifications:

0.59 m<sup>3</sup>, GW 120 kg, NW 70 kg