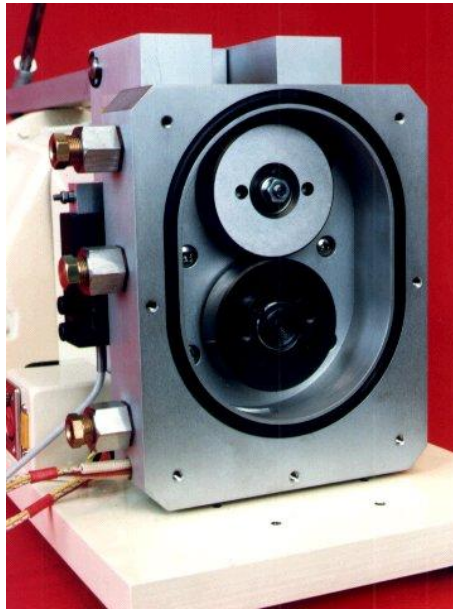
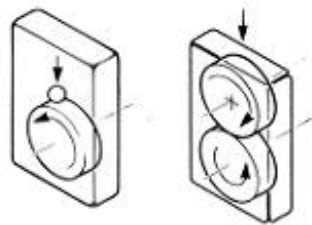


TE 55SLIM LUBRICITY TEST MACHINE



Background:

In recent years a great deal of attention has been made to the development of meaningful tests for the lubricity of fuels. The main reasons are that additive levels are being reduced, new non-sulphur fuels are required by legislation, and failures are being experienced in fuel system pumps and injectors.

There are two possible directions to take. The first is to use a pump, pump parts or injector parts to run a test. This depends on obtaining uniform test samples (pumps are not designed as test specimens) and are expensive to run.

The second is to use bench test machines. These offer simple, well defined test specimens, are cheap to run and give easy access to the surfaces for examination. However, some consideration must be made to the choice of test specimen material and test conditions (load, speed, temperature, time) to achieve good correlation with pump experience.

There are two main standard test rigs for fuels - the ASTM D5001 BOCLE (Ball on Cylinder Lubricity Evaluator), and HFFR (High Frequency Friction Rig). A third, the TAFLE (Thornton Aviation Fuel Lubricity Evaluator) has been used successfully by Shell Research. Work is being carried out at the CEC and SWRI to evaluate these methods and evolve new standard procedures.

The TE 55SLIM Lubricity Test Machine is a multi-function unit with adapters for ball on cylinder (BOCLE) and cylinder on cylinder (TAFLE) and crossed cylinder contact configurations. The control unit includes a SLIM 2000 Serial Link Interface Module and [COMPEND 2000](#) Windows based control and data acquisition software. The main unit is based on the TE 53 Multi-Purpose Friction and Wear Tester. The machine may be used for evaluating both fuels and lubricants. The TE 70 Micro Friction Machine and the TE 77 High Frequency Friction Machine may be used for the HFFR test.

Description:

A bearing housing carries two parallel shafts. The lower shaft carries a flat profile ring or roller and is connected to an ac geared motor with frequency inverter variable speed drive.

In ball on cylinder configuration the upper shaft carries a holder for the fixed specimen and is restrained from rotating. In two roller configuration the upper shaft carries a roller and is driven from the lower shaft through a pair of gears. Seven fixed amounts of percentage slip are provided. The upper roller is mounted on a self-aligning bearing to achieve full width line contact between the specimens.

The TE 55 features a sealed chamber surrounding the test specimens and this allows for the continuous supply of conditioned test fluid into the contact zone, a vital part of controlling the conditions of the test or running with the contact fully immersed with test fluid. The enclosure incorporates a heater element to maintain the test fluid temperature.

The upper shaft is carried in a spherical bearing at one end that permits rotation about the gear contact line and has a floating bearing at the other end. This allow the shaft to pivot freely in the vertical and horizontal axes. Load is applied by dead weights through a 5:1 lever and acts on the front end of the shaft by pressing on the outer race of the floating bearing.

Horizontal movement in the direction perpendicular to the upper shaft axis and is resisted by a strain gauge transducer. This gives measurements of the tangential forces in the contact which are displayed as friction force on the control unit.

Control and Data Acquisition:

The TE 55SLIM has PC based sequence programmable control and data acquisition. This is provided by an integrated Serial Link Interface Module and [COMPEND 2000](#) software running on a host PC, operating under Windows. Data is stored to hard disc in standard spread sheet compatible file formats (.csv or .tsv).

Tests are defined by a sequence of steps, each step containing set-point, data recording rates and alarm level information. Set-points may be adjusted by step change or ramp. The test sequence is followed unless interrupted by the operator or an alarm. Set-points may also be adjusted manually using on screen toggles.

Technical Specifications:

Contact Geometry:	Ball on Cylinder Cylinder on Cylinder Crossed Cylinder
Speed Range:	30 to 850 rpm
Equivalent Velocity:	up to 4 m/s
Slip Rate Gears:	1.79%, 5.13%, 8.70%, 10.53%, 13.33%, 18.18%, 22.22%
Friction Range:	130 N
Load Range:	50 to 750 N
Bath Temperature:	ambient to 150°C
Heater Power:	250 W
Temperature Sensor:	k-type thermocouple
Cylinder Size:	60 mm diameter
Sliding Specimen:	12.7 mm ball, roller or block
Interface:	SLIM 2000 Serial Link Interface Module
Software:	COMPEND 2000
Motor:	0.25 kW ac geared motor

Controlled Parameters

- Rotational Speed
- Reservoir Temperature
- Test Duration

Recorded Parameters

- Rotational Speed
- Friction Force
- Temperature
- Number of Revolutions
- Test Duration
- Sliding Speed
- Friction Coefficient
- Sliding Distance

Services:

Electricity:	220/240V, single phase, 50 Hz, 1.2 kW 110/120 V, single phase, 60 Hz, 1.2 kW
PC and Printer:	Minimum Specification

Installation:

Bench-mounting machine: 1,000 mm x 200 mm x 250 mm high, 50 kg

Bench-mounting cabinet: 530 mm x 520 mm x 400 mm high , 25 kg

Packing Specification: 0.48 m3, GW 165 kg, NW 105 kg

Order As:

TE 55SLIM Lubricity Test Machine

Consumables:

TE 55/UF Two Upper Flat Test Rollers

TE 55/LF Two Lower Flat Test Rollers

TE 55/S Set of Sliding Test Specimens, comprising:

20 annealed gauge plate blocks (12.7 mm)

50 bearing balls (12.7 mm) and 50 bearing rollers (12.7 mm)