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"Tomorrow's Instruments... Today"™

SPECIFICATIONS

Full-Automation **Tapered Bearing Simulator (TBS) Viscometer** **TBS 2100E-F series**

Instrument Basics

Principle:

- High temperature, high shear rate rotational (*absolute*) viscometry.
- Tapered rotor turning at high speeds in very close tolerance to an identically matched tapered stator containing the sample.
- Measures viscosity at multiple shear rates which is particularly useful with multigrade oils and their influence on fuel efficiency.

Key Applications:

- Tests viscosity of organic and water-based fluids, including fresh & 'used' automotive and railroad engine oils, ATF's, hydraulic fluids, inks, and polymeric solutions.
- *Fuel Efficiency Index*, for determining viscosity-related fuel-efficiency contributions of engine oils.
- *Viscosity Loss Trapezoid*, approach of appraising the total viscous influence of VI Improvers, synthetic fluids and their combinations when formulating engine oils.

Dimensions:

- Viscometer: ~32 lbs. (14.5 kg); (7"(W) x 12"(D) x 12") or (18 x 30.5 x 30.5 cm)
- Console Box: ~20 lbs. (9 kg); (17"(W) x 18"(D) x 6") or (43 x 46 x 15 cm)

Voltage:

- Available in either 120 VAC or 220 VAC, 50/60 Hz.

Safety:

- Internal fast-acting Fuses
- Power Failure Protector
- Over-temperature Cut-out Fuse
- CE Mark

Operating Temperatures:

- Constant temperature control from ~80°C to over 200°C ($\pm 0.1^\circ\text{C}$)

Sample Loading/Volume:

- Automation packages include AutoSampler Delivery system and Computer. (See modes below.)
- Fifty (50) mL sample size is recommended for all Modes of Operation.

Motor Capabilities

- Viscosity Range: Powerful DC motor allows measurement of fluids with viscosities up to approximately 30 centiPoise (cP). Rotometer with quick connect ports are included to control viscous heating effects when analyzing higher viscosity fluids, using a house air/nitrogen source.
- Shear Rates: Variable speed (supershear) motor capable of running at 12 different speeds (800-8000 rpm) allowing the operator the ability to change the shear rate by simple adjustment of the motor speed dial located on console box -- as speed is proportional to shear rate.

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Special Features & Benefits:

- Motorized platform for automatic adjustment of rotor height via optional computer.
- 3-Modes of operation available. (See below)
- Sample measurement time as quick as 5 minutes, depending on sample type and viscosity.
- Incorporates chase-flush technique of sample injection.
- Simple adjustment of motor speed for *multiple high shear* rate testing capabilities.
- DC motor is invulnerable to changes in frequency.
- Excellent for measuring viscosities of 'used' oils.
- Reduced operator maintenance requirements.

Test Procedures (Specifications)

- ASTM D4683, D6616
- Equivalent to ASTM D4741, CEC L36-A-90
- SAE J300 Engine Oil Viscosity Grade Classification
- ILSAC GF-2, GF-3, and proposed GF-4 Engine Oil Specifications

Full-Automated Mode of Operation

Specific Features:

- A 56-position AutoSampler Tray, Injector, PC and Windows based software for unattended operation while analyzing up to 56 samples per test cycle.
- Computer controlled rotor height adjustment for *Automated*:
 - Calibrations
 - Viscosity Verifications
 - Position Adjustments
 - Re-calibration (if necessary)
- Samples can be added to AutoSampler Tray during operation.

Calibration Technique:

- Operator finds initial rubbing contact of rotor/stator.
- Computer injects Tannas supplied *Newtonian* and non-*Newtonian* reference oils, logs data, calculates crossover/viscosity calibration information and sets proper operating position.
- Computer controlled rotor height adjustments throughout calibration steps.

Shear Rates:

- After manually setting desired shear rate, computer injects samples for analysis at that shear rate.
- Capable of analyzing oils at shear rates ranging from 100,000 reciprocal seconds (sec^{-1}) to $3 \times 10^6 \text{ sec}^{-1}$ (depending on sample viscosity and test temperature).

Read-out:

- Continuous on-screen viewing of Viscosity, Calibration and Sample data throughout analysis.
- Computer R/S 232 communication & display.
- Torque: In-line Transducer outputs to LED torque meter on console box (0-1 VDC)
- Temperature: Continuous dual-temperature LED reading (actual and set)

Sample Loading:

- Computer controlled sample injection.
- If re-calibration is not necessary, system analyzes 56 samples (after calibration) in less than 5 hours.

Semi-Automated Mode of Operation

Specific Features:

- A 56-position AutoSampler Tray, Injector, PC and Windows based software enabling virtually unattended operation while analyzing up to 56 samples per test cycle.
- Samples can be added to AutoSampler Tray during operation.

Calibration Technique:

- Operator finds initial rubbing contact of rotor/stator.
- Computer injects Tannas supplied *Newtonian* and non-*Newtonian* reference oils, logs data and calculates crossover/viscosity calibration information.
- Operator conducts rotor height adjustments throughout calibration steps.

Shear Rates:

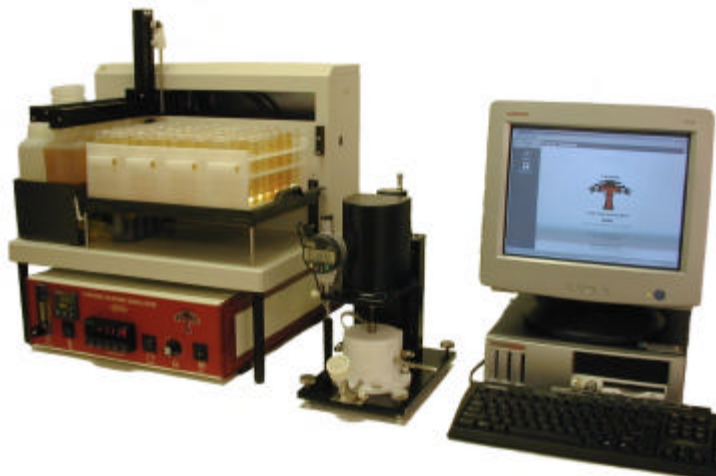
- After manually setting desired shear rate, computer injects samples for analysis at that shear rate.
- Capable of analyzing samples at shear rates ranging from 100,000 reciprocal seconds (sec^{-1}) to $3 \times 10^6 \text{ sec}^{-1}$ (depending on sample viscosity and test temperature).

Read-out:

- Continuous on-screen viewing of Viscosity, Calibration and Sample data throughout analysis.
- Computer R/S 232 communication & display.
- Torque: In-line Transducer outputs to LED torque meter on console box (0-1 VDC)
- Temperature: Continuous dual-temperature LED reading (actual and set)

Sample Loading:

- Computer controlled sample injection.
- If re-calibration is not necessary, system analyzes 56 samples (after calibration) in less than 5 hours.



Configuration for *Fully & Semi* Automated Modes of Operation



Identification of key components of *Fully* Automated unit

Manual Mode of Operation

Specific Features:

- Ability to measure viscosities under a wide range of shear rates determined by the operator on a given fluid. (See Shear Rates below.)

Calibration Technique:

- Operator finds rubbing contact of rotor/stator and injects Tannas supplied *Newtonian* and non-*Newtonian* reference oils, performing manual crossover/viscosity calibrations.

Shear Rates:

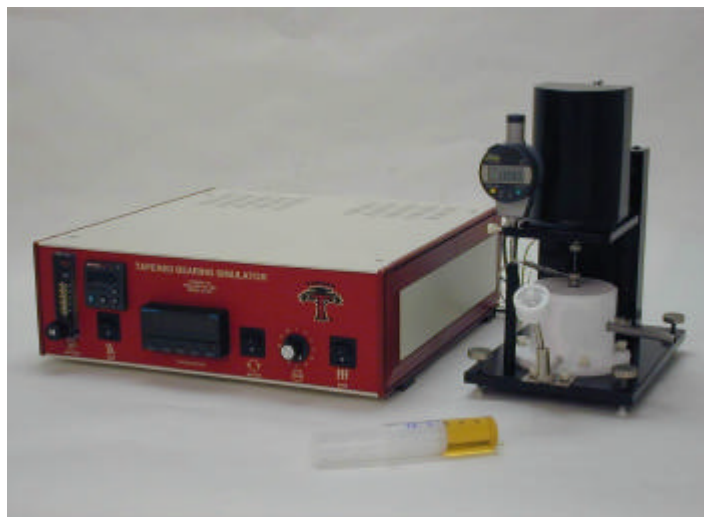
- Capable of analyzing samples at shear rates ranging from 50,000 reciprocal seconds (sec^{-1}) to beyond $7.5 \times 10^6 \text{ sec}^{-1}$ (depending on sample viscosity and test temperature).

Read-out:

- Torque: In-line Transducer outputs to LED torque meter on console box (0-1 VDC)
- Temperature: Continuous dual-temperature LED reading (actual and set)

Sample Loading:

- Sample injection via hand-held syringe.



Configuration for *Manual* Mode of Operation