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USA



SPECIFICATIONS

Full-Automation
Tapered Bearing Simulator (TBS) Viscometer
TBS 2100E-F model
(with Thermal Electrical Cooling)

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 and temperatures 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.
- With use of associated cooling device, HTHS viscosities can be measured at temperatures ranging down to +40°C and viscosities up to 30 cP.
- *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.

Test Procedures (Specifications)

- ASTM D4683, D6616, CEC L-36-A-90
- Equivalent to ASTM D4741
- SAE J300 Engine Oil Viscosity Grade Classification
- API SL, SM, *upcoming* SN; Japan Classification JPI-5S-36-03
- ILSAC GF-2, GF-3, and GF-4, *upcoming* GF-5 Engine Oil Specifications

Operating Temperatures:

- Constant temperature control from 40°C to over 200°C ($\pm 0.1^\circ\text{C}$) with appropriate stator cooling.

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. Smaller sample sizes can be analyzed with modified injection technique.

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)
- Viscosity analysis on wide range of temperatures down to +40°C with associated cooling device.
- 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.

Dimensions:

- Viscometer: ~33 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 or 60 Hz. Power draw: 6 Amps.

Safety:

- Internal fast-acting Fuses
- Power Failure Protector
- Over-temperature Cut-out Fuse
- Optional Secondary Over-temperature Device available
- CE Mark

Full-Automated Mode of Operation

Specific Features:

- A 42-position AutoSampler Tray, Injector, PC and Windows based software for unattended operation while analyzing up to 42 samples per test cycle.
- Computer (Laptop) 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:

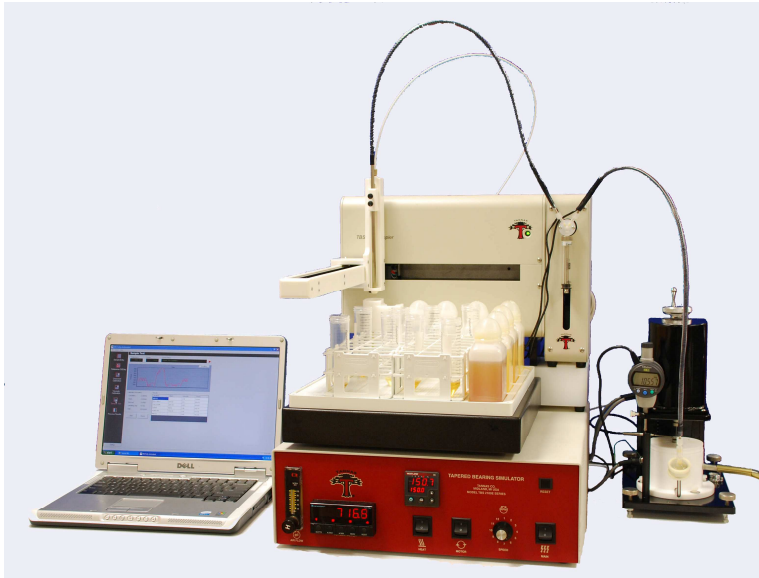
- After manually setting desired shear rate, computer injects samples for analysis at that shear rate.
- Capable of analyzing samples at shear rates ranging from 50,000 reciprocal seconds (sec^{-1}) to beyond $7.5 \times 10^6 \text{ sec}^{-1}$ (depending on sample viscosity and test temperature).

Read-out:

- 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 42 samples (after calibration) in less than 4 hours.



Configuration for *Fully Automated*
Mode of Operation

Full-Automated Mode of Operation – Manual Injection

Specific Features:

- Modification of Full-Auto software eliminating the AutoSampler Delivery System.
- Computer controls rotor height adjustments and sample viscosity printout.
- Computer instructs the operator to manually inject the samples via syringe.

Calibration Technique:

- Operator finds initial rubbing contact of rotor/stator.
- Computer instructs operator to inject Tannas supplied *Newtonian* and non-*Newtonian* reference oils.
- Computer logs data, calculates crossover/viscosity calibration information and sets proper operating position.
- Computer controls 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 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:

- 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:

- Sample injection via hand-held syringe.

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:

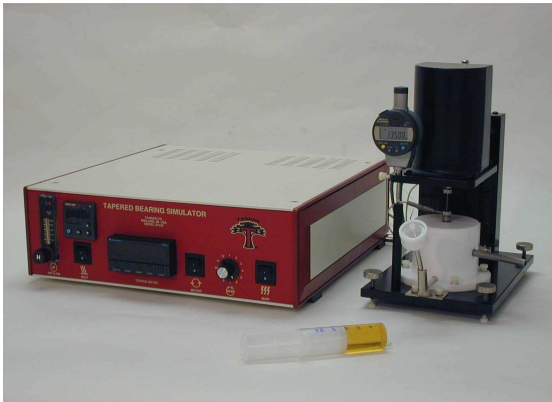
- Capable of analyzing samples at shear rates ranging from 50,000 reciprocal seconds (sec^{-1}) to beyond $7.5 \times 10^6 \text{ sec}^{-1}$ (depending on sample viscosity and test temperature).

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



Manual Mode of Operation with Thermal Electrical Cooler (TEC) for operating at temperatures to +40°C.