

HAAKE Viscotester® 550



The Viscometer System

Analyze • Detect • Measure • Control™

Thermo
ELECTRON CORPORATION

Concept

Application

The HAAKE Viscotester 550 is specially designed for Quality Control applications. It is a rotational viscometer that measures precisely, quickly and simply the viscosity and flow behaviour of liquid and semisolid test materials. All results like viscosity, shear stress, shear rate, yield point and operating temperature are displayed in the digital LED display.

The HAAKE Viscotester 550 does not mind if a sample is thin like an oil, a paint or a ceramic slurry or as pasty as cremes, salves or a PVC plastisol. One unit covers the whole application range from very thin to very thick.

Even more demanding tasks will be fulfilled. For example, the automatic characterization of the flow behaviour of non-Newtonian fluids or the determination of the yield point using the CD-principle (= **C**ontrolled **D**eformation) can be done. Any one out of a set of 10 predefined routines will be executed with utmost precision and repeatability. Also all predefined routines and the results obtained with them will be documented using a printer.

Measuring Principle

By its design, the HAAKE Viscotester 550 is a Searle viscometer. A rotational speed is preset and the flow resistance of the sample is measured or in other words the torque required to maintain the set speed is proportional to the viscosity.

From the torque required, the set speed and the geometry factors of the applied sensor all final information on the viscosity, shear stress and the shear rate is calculated. The results are displayed digitally and can be printed simultaneously.

For viscosity measurements a total of 60 different rotational speed steps is available. 50 out of these 60 are factory set, the remaining 10 are user programmable. The 60 steps cover a wide range reaching from 0.5 rpm to 800 rpm. The resulting torque is measured via a non-contact, low displacement sensor which enables the extended measuring range with perfect signal linearity over the whole range. The operating temperature can be measured by Pt100 probes located either in the sensor used or directly in the test material.

Sensors

The modular design of the HAAKE Viscotester 550 system allows the use of nearly any known sensor. So all applications will be covered.

For example:

- Coaxial Cylinder sensors according to DIN 53018 and ISO 3219. Exact temperature control can be provided by use of a circulator.
- Immersion sensors according to DIN 53019 and ISO 3219.
- Cone-and-plate sensors according to ISO 3219 and parallel plate sensors.
- Relative sensors according to ISO 2555.
- Special immersion sensors for highly filled samples or containing large particles, for the determination of the yield point.

All these sensors guarantee that your results will be absolutely comparable either within your company or even worldwide with other laboratories.

Software

The HAAKE Viscotester 550 can be operated using two different software packages:

1. Software OS 550

This EPROM-based operating system controls the unit and allows the user to execute all 10 stored programs for measuring yield points, flow behaviour and time-temperature programs. The results obtained will be displayed on-line and even be printed, if a printer is connected. Permanent modifications to the parameters of the stored routines can be made by use of a computer and the program OS 550.

2. Application Software

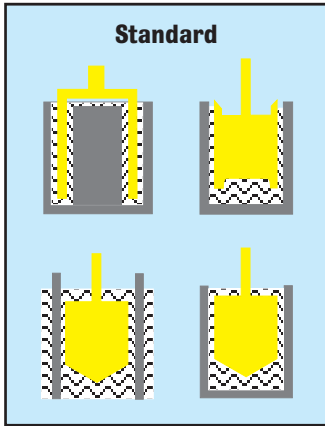
This PC-based software offers highest flexibility for data evaluation. Operated under Windows, it runs on a PC and enables more complex tasks. Special parameter sets can be defined, stored and later easily be invoked as a job. Predefined graphs for documentation of complicated flow characteristics and the rheological models as well as thixotropy and yield point calculations complete the presentation of the results.



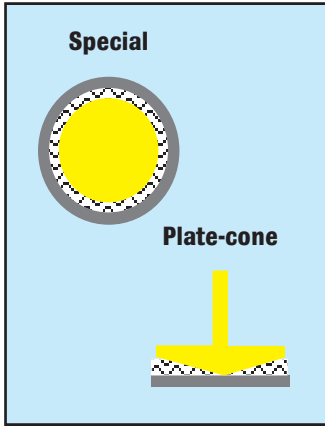
Specifications

Viscosity (mPas) :	1 - 10 ⁹
Shear Stress (Pa):	1 - 10 ⁵
Yield Stress (Pa) :	10 - 10 ⁵
Shear Rate (s ⁻¹):	0.6 - 3 · 10 ⁴
Speed Range (rpm):	0.5 - 800
Uncertainty:	+/- 0.1 %
CD Mode (rpm):	0.0125
Torque Range (Ncm):	
up to 400 rpm:	0.01 - 3
up to 800 rpm:	0.01 - 2
Uncertainty:	+/- 0.5 % fsd
Temp. Display (°C):	-50 - +250
Sensor Type:	Pt100
Interface	RS232C
Autoswitch Power Supply:	230/115 V (50-60 Hz)

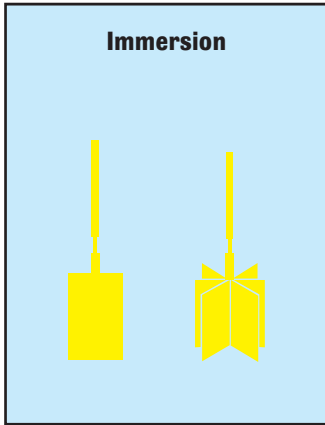
Measuring Sensors



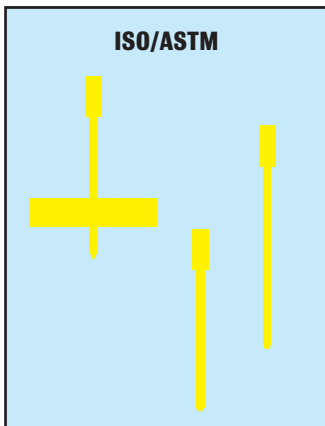
Sensor	NV	MV1	MV2	MV DIN	SV 1	SV 2	SV DIN
Cup	NV	MV	MV	MV/TMV	SV	SV	SV/TSV
Temperature Vessel	+	+	+	±	+	+	±
Application	Low viscosity	Medium viscosity liquids			High viscosity liquids		
Viscosity Range (mPas)	2-2000	3-10 000	8-30 000	8-18 000	50-10 ⁵	100-3 · 10 ⁵	50-10 ⁵
Recom. Viscosity Range (mPas)	5-300	10-7000	20-20000	15-10000	150-60000	300-2 · 10 ⁵	150-60000
Shear Rate (s ⁻¹)	27-27000	11.7-1170	4.5-450	6.5-645	4.5-445	4.5-445	6.5-645
Sample Volume (cm ³)	9	40	55	50	9	6	14
Gap (mm)	0.35	0.96	2.6	1.64	1.45	1.45	0.9
Radius, Length (mm)	20.1/60	20.04/60	18.4/60	19.36/58.08	10.1/61.4	10.1/19.6	10.65/31.95
Repeatability (± %)	1	1	1	1	1	1	1
Reproducibility (± %)	3	2	2	3	3	3	3



Sensor	PK 1,1°	PK 1,0,5°	PK 2,1°	PK 2,0,5°	HV 2 DIN	MV 2P	SV 2P
Cup	–	–	–	–	HV 2	MVP	SVP
Temperature Vessel	PK 100 D or PK 200				+	+	+
Application	Small sample volume, high viscosity samples				High viscosity	Slippage	
Viscosity Range (mPas)	50-10 ⁵	20-50 000	100-3 · 10 ⁵	100-1.5 · 10 ⁵	10 ³ · 2 · 10 ⁶	8-30 000	100-3.5 · 10 ⁵
Recom. Viscosity Range (mPas)	100-70000	50-40000	200-2 · 10 ⁵	150-800000	2 · 10 ³ · 10 ⁶	20-20 000	350-2 · 10 ⁵
Shear Rate (s ⁻¹)	30-3000	60-6000	30-3000	60-6000	6.5-645	4.4-440	4-390
Sample Volume (cm ³)	0.1	0.1	<0.1	<0.1	1	55	6
Gap (mm)	0.0174 rad	0.0087 rad	0.0174 rad	0.0087 rad	0.34	2.6	1.45
Radius, Length (mm)	14/–	14/–	10/–	10/–	4/11.8	18.4/60	10.1/19.6
Repeatability (± %)	2	2	3	3	2	2	2
Reproducibility (± %)	4	4	6	6	4	4	5



Sensor	E 3	E 30	E 100	E 500	E 1000	FL 10	FL 100	FL 1000
Cup	Beaker and sample volume depend on application							
Adapter	Adapter is required (part.-no 808-0579 or 222-1359)							
Application	Fast and simple relative measurements					Relative measur. of disperse samples		
Temperature	-30 – 200 °C					-30 – 200 °C		
Viscosity (mPas)	3 · 10 ²	10 ² · 10 ⁵	10 ³ · 10 ⁶	5 · 10 ³ · 5 · 10 ⁶	10 ⁴ · 10 ⁷	10 ² · 10 ⁵	10 ³ · 10 ⁶	10 ⁴ · 10 ⁷
Radius, Length (mm)	25/116	12/50.5	8/34.5	5/9	3.5/17.7	20/60	11/16	5/8.8
Repeatability (± %)	3	3	3	5	5	3	5	5

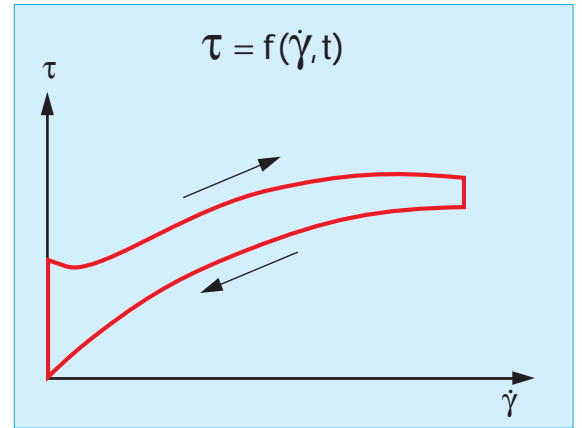
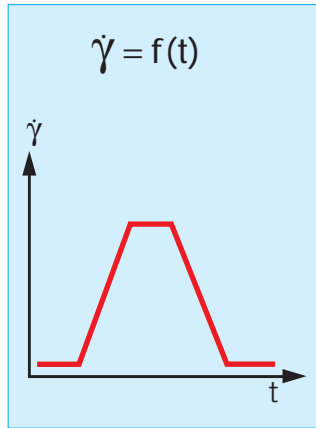


Sensor	B 1	B 2	B 3	B 4	B 5	B 6	B 7
Cup	Beaker and sample volume depend on application						
Adapter	ISO-Adapter is required, part.-no 222-1204						
Application	Viscosity measurement according to ISO 2555, ASTM D 115-72, D789-73, D2196-68						
Temperature	-30 – 200 °C						
Viscosity (mPas)	10 ² · 10 ⁵	500-5 · 10 ⁵	10 ³ · 10 ⁶	2 · 10 ³ · 2 · 10 ⁶	3 · 10 ³ · 5 · 10 ⁶	8 · 10 ³ · 10 ⁷	3 · 10 ⁴ · 5 · 10 ⁷
Radius, Length (mm)	28.13/22.5	23.5/1.65	17.35/1.65	13.65/1.65	10.55/1.65	7.3/1.65	1.6/50.4
Repeatability (± %)	3	4	5	5	5	5	7

Results

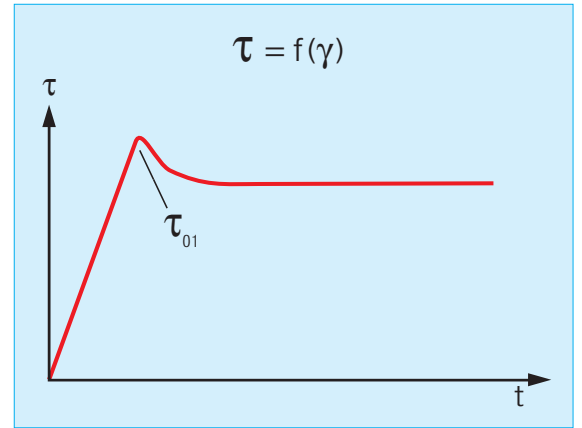
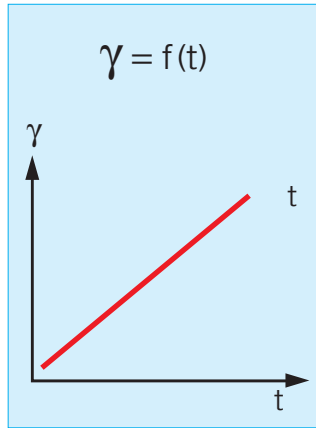
Flow Curve

A flow curve characterizes the flow behaviour of a sample. It also allows estimations of storage stability and processing conditions. Important special characteristics like pseudoplasticity, plasticity and thixotropy are automatically quantified by the HAAKE Viscotester 550 and can easily be taken from the protocol.



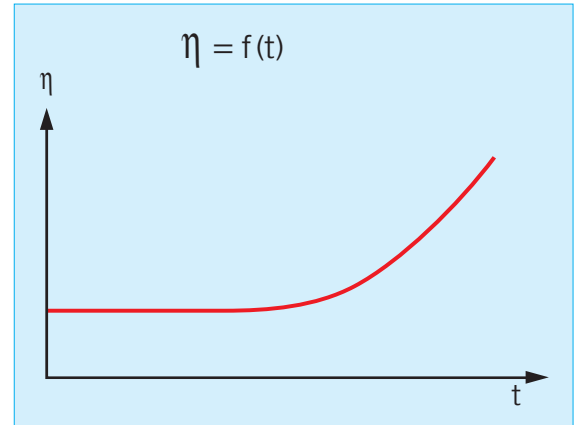
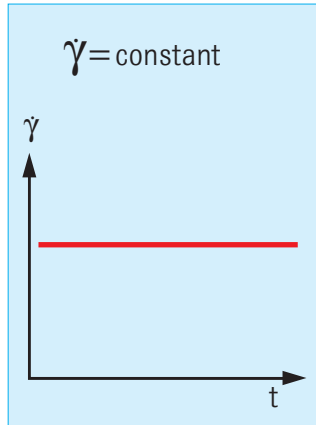
Yield Point

The yield stress is the force required to make a material flow. It controls the thickness of coating layers, ensures storage stability but inhibits free flow. By applying the CD-method (Controlled Deformation) the HAAKE Viscotester 550 characterizes the yield point with very high reproducibility.



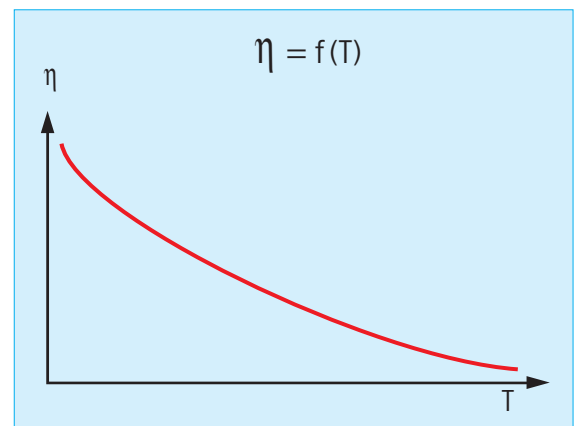
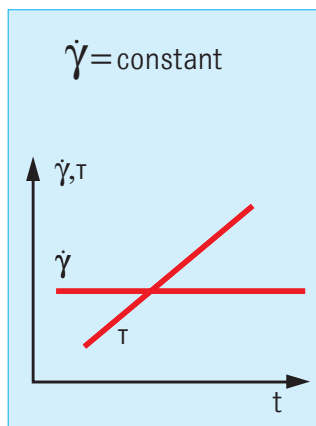
Time Curve

Chemical or physical changes in the sample can be tracked with a time curve. The test consists of applying a constant shear rate and monitoring the viscosity as a function of time. Time-dependant phenomena such as epoxy curing, chemical reactions and thixotropy breakdown can be precisely determined.



Temperature Curve

It is important to know the behavior of viscosity as a function of temperature. This can be realized by applying a constant shear rate to a sample and monitoring the viscosity as a function of temperature. Greases and oils must perform in summer and winter, and likewise food products must retain their shape under various temperatures.

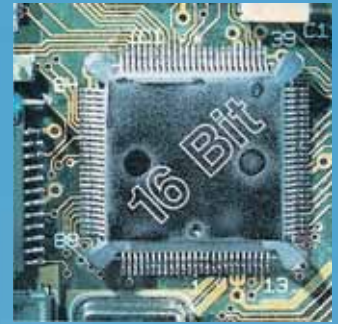


Viscometer



Keypad/Display

The LED-display with its excellent readability shows all the values entered via a dustsealed keypad. There are no double functions on the keypad. Operation is self-explanatory with separate cursor keys for the selection of the parameters.



16 Bit Processor

All control and data evaluation tasks are performed by a powerful 16 bit processor. The real time operating system runs the routines, controls rpm, reads the torque and calculates the final results. If a printer is connected, it also prints a comprehensive protocol.

HAAKE Viscometer VT550

Substance: *Suprastin* Batch No: *F-01* Da

Company: *Haeke* Operator: *Delius*

System # : 3 f1 65.7 M: 2.340

Prog. Seq.	D[1/s]	t[s]	#	ETA[mPas]
10	1	0.00	60	1
10	2	0.00	180	15
10	3	500.29	60	10
10	4	0.00	180	15
10	5	0.00	0	0

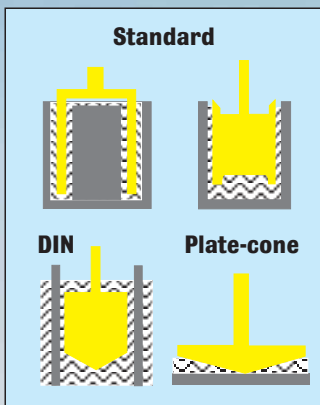
#	Seq.	t[s]	Temp.[C]	D[1/s]	Tau[F]
1	1	60.0	25.7	0.00	-6.570
2	2	72.0	25.6	0.00	0.000
3	2	84.0	25.6	35.37	3.679
4	2	96.0	25.7	71.14	7.227
5	2	108.0	25.6	106.70	1.071
6	2	120.0	25.6	142.51	1.419
7	2	132.1	25.9	178.07	1.780
8	2	144.9	25.7	213.41	2.329
9	2	157.0	25.6	248.38	2.483
12	2	193.0	25.7	355.45	3.515
13	2	205.0	25.6	391.48	3.857
14	2	217.0	25.6	426.82	4.192
15	2	229.0	25.7	462.38	4.520
16	2	241.0	25.6	497.55	4.849
17	3	247.0	25.6	500.29	4.868
18	3	253.0	25.6	500.29	4.895
19	3	259.0	25.6	500.29	4.862
20	3	265.0	25.6	500.29	4.849
21	3	271.0	25.6	500.29	4.849
22	3	277.0	25.6	500.29	4.836
23	3	283.0	25.6	500.29	4.842
24	3	289.0	25.6	500.29	4.836
25	3	295.0	25.6	500.29	4.829
26	3	301.0	25.6	500.29	4.822

Motor

A powerful and dynamic motor guarantees high torque and correct rpm values. In case of overload the test is terminated automatically. That means quality by design!

Sensors

Sensor geometries according to DIN, ISO and ASTM as well as customized geometries let your system grow unlimited. Also, cone-and-plate and parallel plate and coaxial cylinder sensors are available.



Routines

10 factory set program routines with one common protocol are available. They include yield points, flow curves and cure testing. If necessary they can be edited and modified by the user.

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