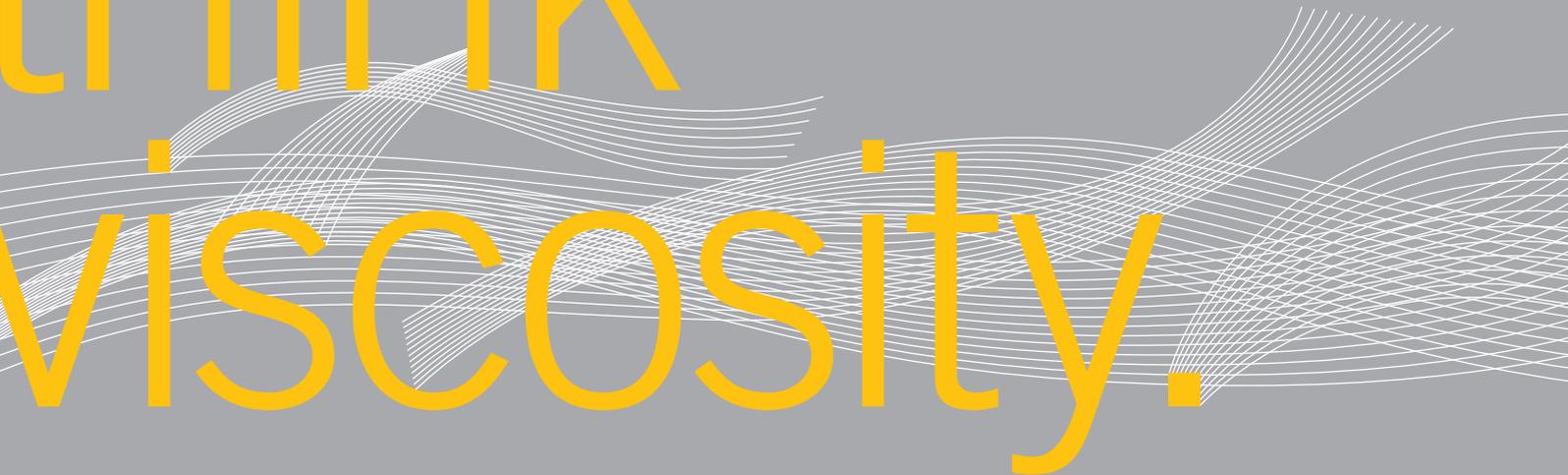


think viscosity.



THINK BROOKFIELD.

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 **PROCESS CONTROL VISCOMETERS**

 **BROOKFIELD**

Why measure viscosity in-line?

Why Measure Viscosity In-Line?

Practical application of viscosity measurement data often leads to the need for in-process control of viscosity. The installation of viscosity control equipment on a process can provide a level of control achievable by no other means. Variations in viscosity are detected and corrected instantly before they can negatively affect product quality. Real-time viscosity control can reduce downtime and material waste by ensuring that the process is operating within its specified viscosity parameters. In many cases, the savings from increased efficiency can pay back the cost of the viscometer in only a few months.

Why Choose Brookfield?

Brookfield builds its Process Control Viscometers to the same high standards of performance and value as its Laboratory Viscometers. Particular attention has been devoted to making these instruments rugged and easy to maintain for long service in demanding industrial environments. The process measurement technologies and variations available from Brookfield allow any fluid to be properly monitored to meet the customers need.



AST-100

Advanced sensor technology for direct in-line viscosity measurement (p4)



TT-100

For in-line system applications requiring pipeline mounting & higher rheology (p8)



TT-200

For in-line system applications requiring flange mounting (p10)



TT-220 Probe

For both solvent and water based products (p11)



PV-100

In-tank, Probe Viscometer for pressurized systems (p12)



Viscosel

For systems open to the atmosphere (p14)



KV-100

Capillary Viscometer for open atmospheres (p16)

Questions to Consider

1. What is the viscosity range of your material?
2. Is your material Newtonian, Dilatant, Non-Newtonian, Thixotropic or Plastic?
3. What is the minimum, maximum and average pressure requirement of your application?
4. What is the minimum, maximum and average temperature of your application?
5. What is the minimum, maximum and average flow rate of your application?
6. Where in production would you like the viscometer: in-line, on the top of the tank or on the side of the tank?
7. What electrical code requirements do you have:
 - NEMA 12 (general purpose—indoor)
 - NEMA 4 (watertight/dust tight for indoor/outdoor use)
 - NEMA 7 (explosion proof—Class 1, Div. 1&2, Group D)
 - ATEX (explosion proof—Code: EE x d 11B T6)

The above parameters may eliminate some of the instrument models because, for example, the viscosity is higher than the range of the instrument or outside of the pressure rating of the instrument. In many cases, more than one instrument may be applicable.

Please allow us to assist you in choosing the best viscosity control system for your application.

In-Line Viscometers Provide Automatic Control of Process Fluid Viscosity

There are many ways that viscosity can be measured, such as capillary, vibration and rotational. These methods have different benefits and may work well for process monitoring or control but will likely not give the same numbers as laboratory or analytical methods. In general, laboratories require a more scientifically accurate measurement, while process control requires a stable, repeatable control signal. Process measurements are made both in-line and off-line. A bench-top viscometer has often been used for off-line measurements wherein a sample of the process fluid is drawn and tested under controlled conditions (temperature, shear history, shear rate, etc.). In-line viscometers are in direct contact with the process stream. They measure and control continuously under process conditions helping to maintain a consistent quality product. The demands of these two environments are different, and it is unlikely the same equipment can be used for both or that the exact same results will be generated. However, if done properly, the results will follow the same trend and can be correlated to the bench top, making in-line measurement useful for ensuring consistent production quality.

WHAT ARE THE BENEFITS TO BRINGING YOUR MEASUREMENT IN-LINE?

In-line measurements give real-time, continuous readings of the fluid's viscosity during processing and consequently provide a means to automate the modification and viscosity control of the process fluid. While it is difficult to control all the factors present in the process that affect the fluids' viscosity (such as temperature, air bubbles, shear history, turbulence, pressure variations, etc.), if these factors are kept relatively constant, then good control can be achieved. Furthermore, the fluid is monitored continuously, providing better total control.

WHAT EFFICIENCIES ARE GAINED BY MEASURING IN-LINE?

Automatic control of the process fluid viscosity insures consistent product all the time and reduces or eliminates human errors and expensive sample testing. Also, it provides for a complete record of how the process varied over a span of time, instead of at just one point in time.

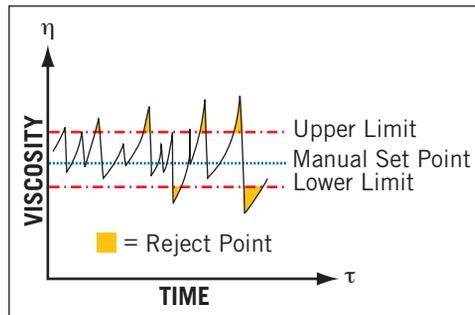
WHAT ARE THE TOP THREE FACTORS TO CONSIDER WITH CHANGING YOUR MEASUREMENT PROCESS?

For process measurements, the critical factors are stability, repeatability, and sensitivity to changes in viscosity. In the laboratory or for analysis environment controls (e.g. temperature, flow, sedimentation, air, etc.) and scientific measurements (controlled shear, geometry measurements and sample preparation) must also be included.

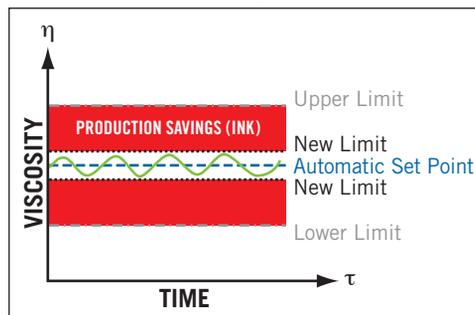
HOW DOES MONITORING THE VISCOSITY AFFECT PRODUCT QUALITY?

Most products are formulated to flow or spread in a controlled manner. Monitoring viscosity at critical shear points ensures that the product will act the same way every time the customer uses it. This is the most tangible indicator of quality.

Manual Viscosity Control



In-Line Viscosity Control



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AST-100™ Viscosity Controller

the compact AST-100 is the world's most innovative means of viscosity control

No moving parts to wear, bind or contact process materials and no narrow gaps to trap product

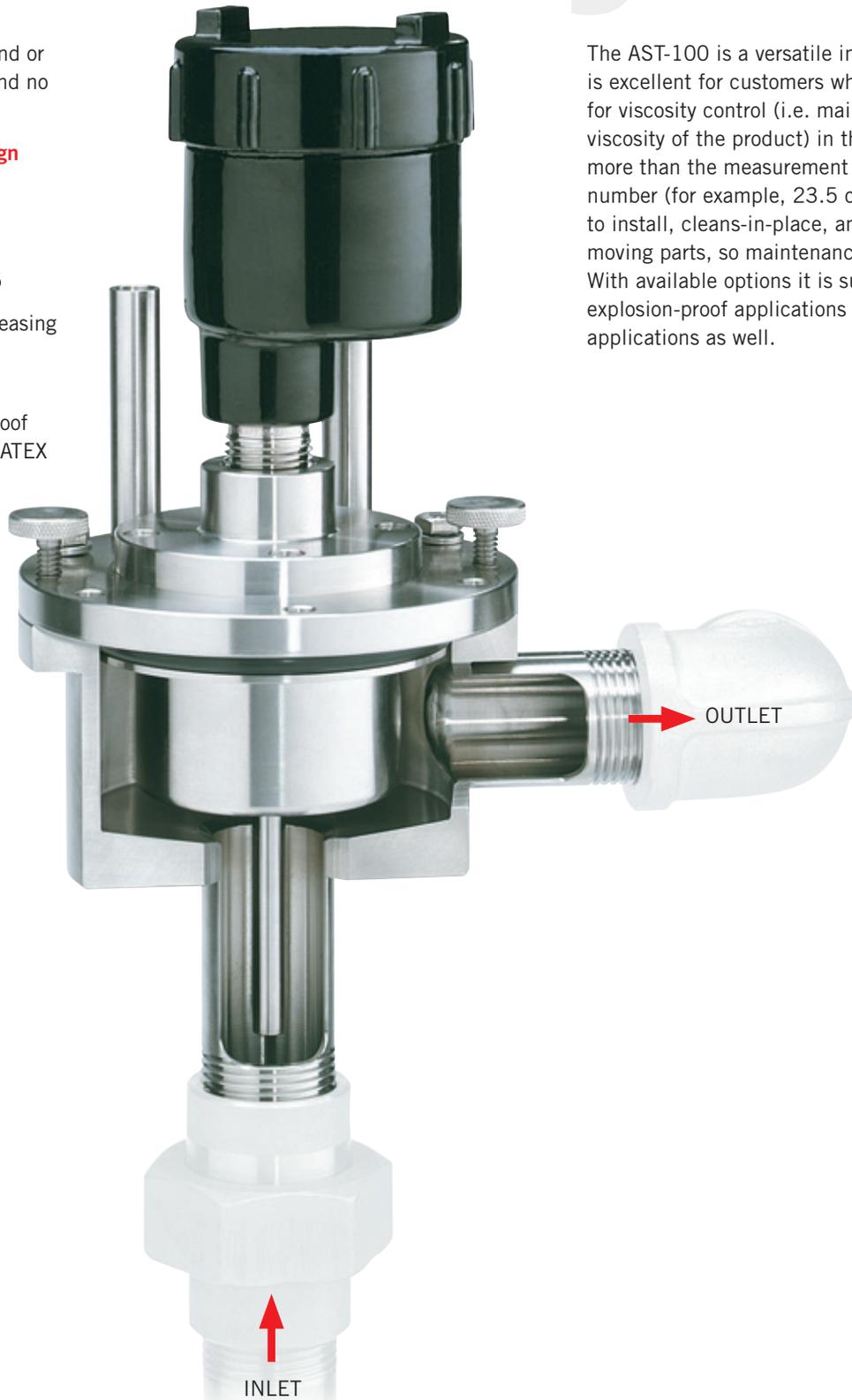
Simple, clean-in-place design
rugged 316 stainless steel construction

Continuous, reliable output
4-20 mA, RS232 or RS485

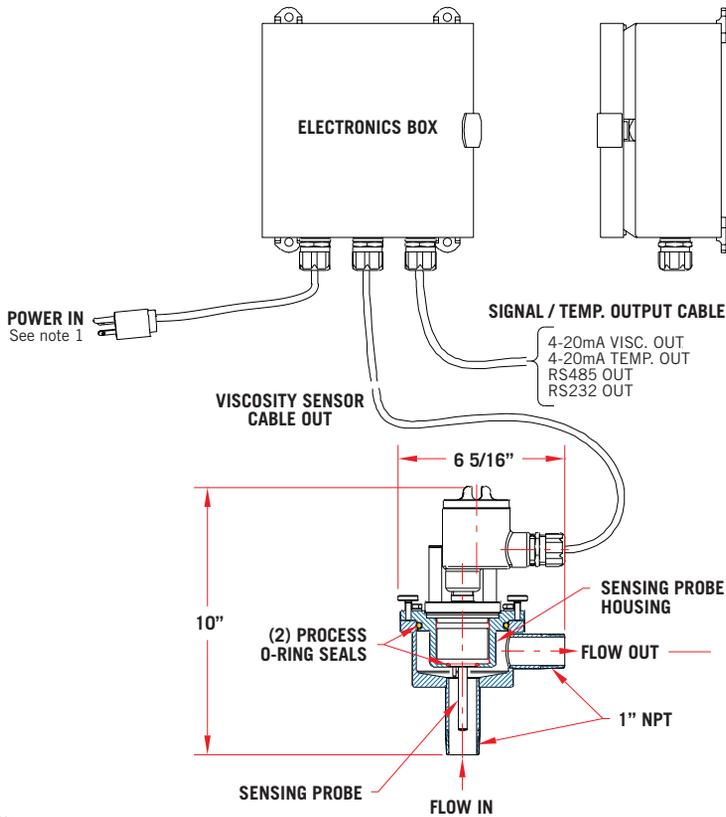
Saves you money while increasing your production

Optional configurations
food grade and explosion-proof designs (Nema 4, Nema 7, ATEX or Sanitary Configurations)

The AST-100 is a versatile instrument that is excellent for customers who are looking for viscosity control (i.e. maintaining the viscosity of the product) in their process more than the measurement of an exact number (for example, 23.5 cP). It is easy to install, cleans-in-place, and has no moving parts, so maintenance is minimal. With available options it is suitable for explosion-proof applications or 3A food-grade applications as well.



Typical Installation: AST-100TSY (115 or 230V)

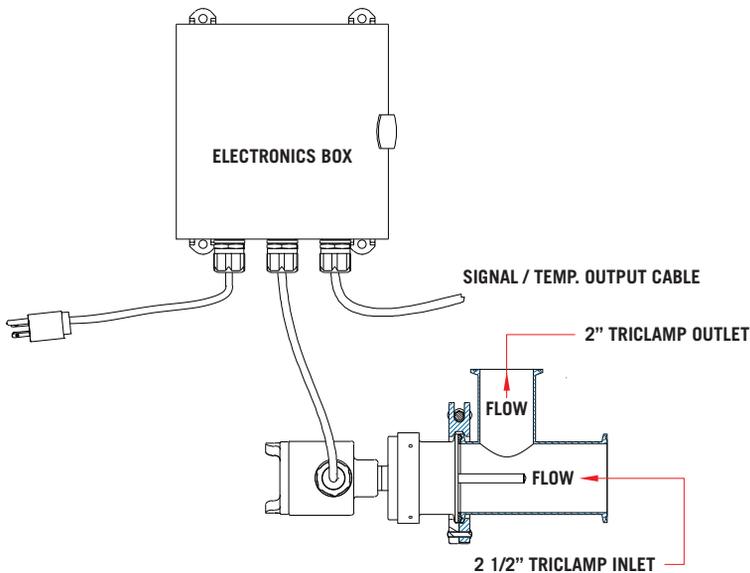


Note:
1. Power in cord may be removed and power may be brought directly into the terminal board located inside of the controller enclosure



AST-101EXP
Explosion-Proof Unit

Typical Installation: AST-100FTSY



AST-100FTSY
Sanitary Unit

AST-100™ Optional Configurations



Flange Mount

Designs are available to allow direct mounting onto a process tank through a sidewall flange.



Immersion Probe

Allows for insertion into the tank from above



Standard Sensor

Option is an economically priced, sensor transmitter design for simple equipment integration

Ranges & Specifications

Measurement Type: Torsionally oscillating probe

Viscosity Range: 1-12500 cST using an NIST traceable, Newtonian fluid measured at 25°C

Temperature (fluid): -20° to +200°C (-4° to 392°F)

Pressure Range: Vacuum to 200 psig maximum,

Repeatability and Stability: ±1% of the Reading

Power Requirements: 115 or 230VAC (auto set), 50 or 60Hz

Connections: - AST-100TSY: 1" male NPT standard (1½" tri-clamp or 3A design, optional)

- AST-100FTSY: 2½" tri-clamp 3A design inlet, 2" tri-clamp outlet

Wetted Surfaces: 316L stainless steel

Sensor O-Ring: Isolast for probe, Viton for chamber housing (EDPM or Kalrez®, optional on AST-100TSY)

Optional Specifications:

- Sanitary 3A design
- Explosion-proof design Class 1, Division 1 Groups C&D FM and ATEX Approved
- pH control
- Probe or flange mounting
- 24V DC power
- >200 psi pressure design

AST-100™ Controllers



AST-310SY Process Viscosity Controller

The AST-310SY is designed for use with the Brookfield AST-100TSY system to control viscosity and temperature, interlock with other process devices, and accurately control fluid viscosity in a variety of industrial applications.

The AST-310SY is a precise, programmable controller with timed dosing intervals. Its intuitive screen layout allows for quick selection of setup and menu items. At a glance, set point and alarm status are displayed as are viscosity in cP, mPa•s, cSt or cup-seconds, current pH value and temperature in °C or °F.

ADDITIONAL FEATURES INCLUDE:

- Touch Screen Convenience
- Viscosity and pH data trending
- pH and pump interlock
- Multi-level password protection
- Viscosity high/low alarms
- Control of viscosity set point
- Ethernet output



AST-400SY Process Viscosity Controller

The AST-400SY is designed for use with the Brookfield AST-100TSY system to monitor viscosity, display temperature, interlock with other process devices, and accurately control fluid viscosity in a variety of industrial applications.

The AST-400SY is a precise, 8-station programmable controller with individual station timed dosing intervals. Its intuitive main screen layout allows for quick individual station selection of setup and menu items. At a glance, set point and alarm status are displayed as are viscosity in cP, mPa•s, cSt or cup-seconds, current pH value, and temperature in °C or °F for all stations.

ADDITIONAL FEATURES INCLUDE:

- Touch Screen Convenience
- Viscosity and pH data trending
- pH and pump interlock
- Multi-level password protection
- Viscosity high/low alarms
- Main screen job run display
- Standby All/Auto toggle button
- Job Recipe/Auto/Load/Save selection button
- Unit-to-unit toggle button to access specific unit detail screen
- Ethernet output

TT-100™ Viscometer

for in-line systems applications

Continuous linear output signal
(4-20 mA)

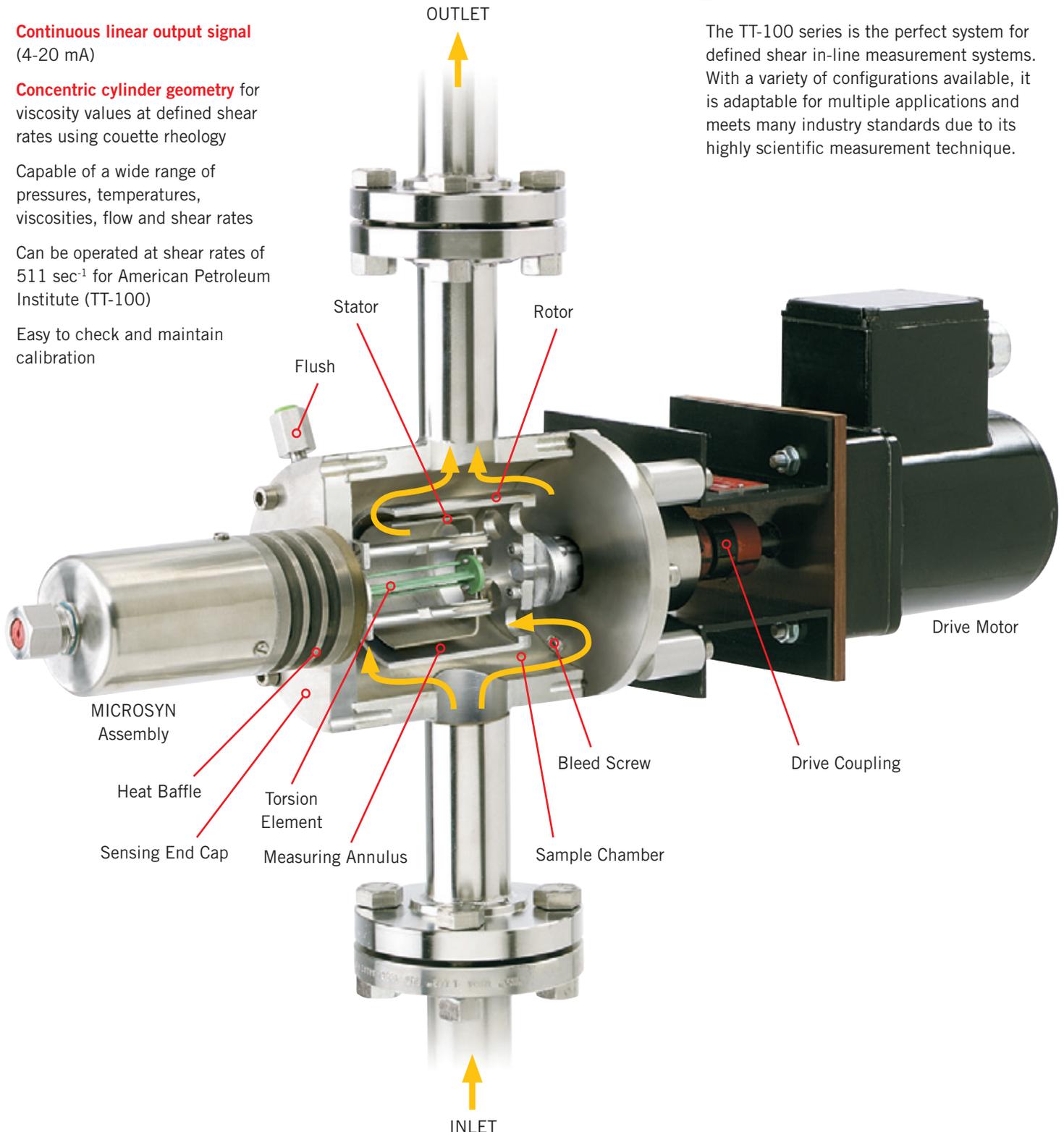
Concentric cylinder geometry for viscosity values at defined shear rates using couette rheology

Capable of a wide range of pressures, temperatures, viscosities, flow and shear rates

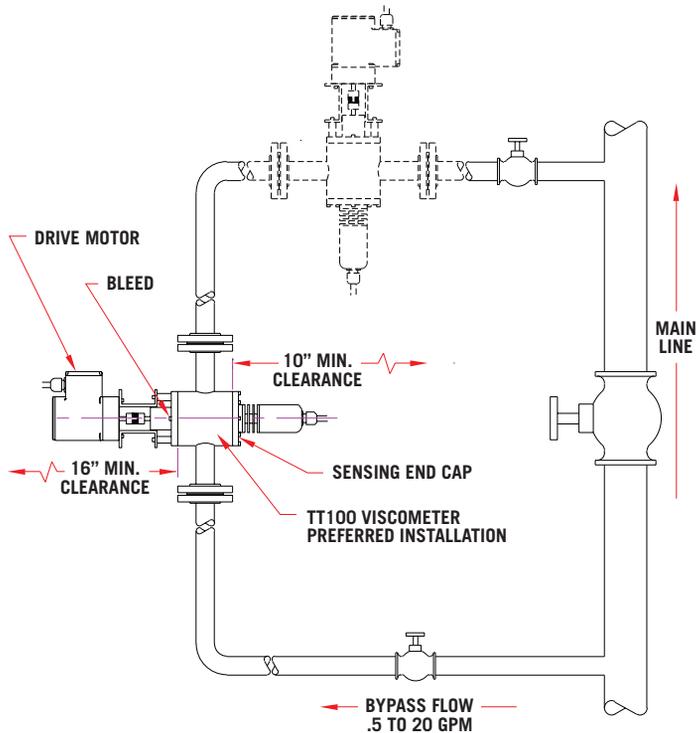
Can be operated at shear rates of 511 sec⁻¹ for American Petroleum Institute (TT-100)

Easy to check and maintain calibration

The TT-100 series is the perfect system for defined shear in-line measurement systems. With a variety of configurations available, it is adaptable for multiple applications and meets many industry standards due to its highly scientific measurement technique.



Typical Installation



Notes:

1. Install viscometer in clean, vibration free, readily accessible area. To avoid air or gas entrapment, preferred installation is vertical bypass line. Allow specified clearance for removal of viscometer endcaps.
2. Provide a minimum of 4-feet of straight pipe to viscometer inlet to minimize turbulent flow caused by elbow.

Optional Configurations

Optional configurations include 500 psi, 500°F construction, ATEX, NEMA 7 explosion-proof (FM approved), 1", 1½", 2" threaded or flanged inlet and outlet fittings, special viscosity ranges or shear rates, 24V DC operations, readout indicator and variable speed motor



TT-100VS™

Optional variable speed instrument for multiple shear rates

Ranges & Specifications

Measurement Type: Concentric Cylinder

Viscosity Range: TT-100: 10 to 500,000 cP
STT-100: 350 to 250,000 cP

Shear Rates: TT-100: 10 to 1,000 sec⁻¹
STT-100: 7.5 to 225 sec⁻¹

Temperature (fluid): TT-100: -40° to +300°F (options to 500°F)

Pressure Range: 200 psig (maximum) (options to 1000 psig)

Repeatability: ±0.5% of span, ±1° Full Scale

Power Requirements: 115/230VAC, 50 or 60Hz, 100W

Maximum Flow Rate: TT-100: 20 gpm (maximum)

Wetted Surfaces: 316L stainless steel

Output Signal: 4-20 mA

Process Connections: STT-100: 3-inch, 4-inch Tri Clamp

Electrical Code: NEMA 4, NEMA 7 or ATEX option



STT-100VS™

Sanitary Viscometer

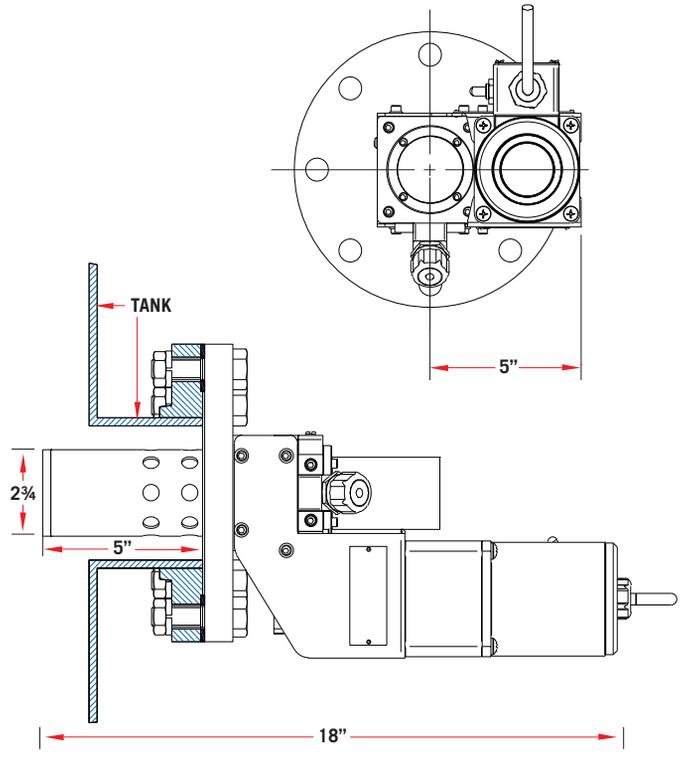
Conforms to 3-A sanitary conditions and has clean-in-place (CIP) technology (STT-100)

3" or 4" tri-clamp connections
Other options available

TT-200™ Viscometer

for use on mixing/blending/storage tanks or in pipelines

Typical Installation



Continuous linear output signal (4-20 mA) eliminates “grab” sampling

Flange mountable directly into tank or in pipeline tee.

Capable of a wide range of pressures, temperatures, viscosities, flow and shear rates

Optional configurations include NEMA 7 explosion-proof (FM approved), 12V or 24V DC operations, readout indicator and variable speed motor

Ranges & Specifications

Measurement Type: Rotational

Viscosity Range: 10 to 100,000 cP

Shear Rates: 10 to 1,000 sec⁻¹

Temperature (fluid): -40° to +300°F (options to 500°F)

Pressure Range: 200 psig (options to >200 psig)

Repeatability: ±0.5% of span, ±1° Full Scale

Power Requirements: 115/230VAC, 50 or 60Hz, 100W
24VDC option

Standard Mounting: 316L stainless steel

Output Signal: 4-20 mA

Electrical Code: NEMA 4 or NEMA 7

TT-220™ Viscometer

for open tank applications requiring constant viscosity monitoring and or control

Continuous linear output signal (4-20 mA) eliminates “grab” sampling

Optimizes product quality through automatic control

Minimum operator involvement helps reduce production and operating costs

Optional configurations include readout indicator/controller and multi-speed motor drive, various probe lengths & special design for increased turnover

Modular for Easy Removal or Insertion

Mounts in Open Tank or Container

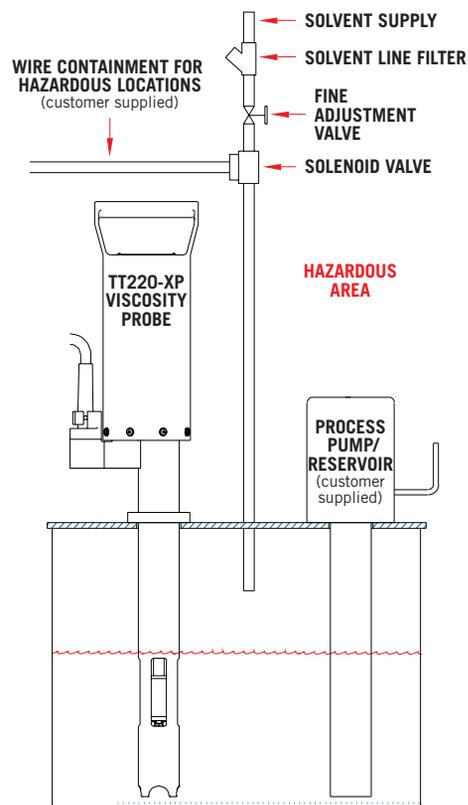
Defined Shear Rate Measurement

Light Enough to Be Hand Held



Adjustable Mounting Flange for Immersion Depth

Typical Installation



Ranges & Specifications

Measurement Type: Rotational

Viscosity Range: 5 to 100,000 cP

Immersion Length: Adjustable from 5” to 15” max
Other lengths available up to 38”

Temperature (fluid): -40° to +100°C

Repeatability: ±0.5% of span, ±1° Full Scale

Power Requirements: 115/230VAC, 50 or 60Hz, 100W

Output Signal: 4-20 mA

Electrical Code: NEMA 4 or NEMA 7, Class 1,
Division 1&2, Groups C&D

PV-100™ Viscometer

a user-friendly in-line process viscosity control system for in-tank measurement

Continuous linear output signal
(4-20 mA) with defined shear measurement

Optimizes product quality through automatic control

Minimum operator involvement helps reduce production and operating costs

Capable of a wide range of pressures, temperatures, viscosities, flow and shear rates

Continuous flow through the measuring gap of the cylinder system.

Immersion version available for use with open containers or closed vessels at high operating pressures.

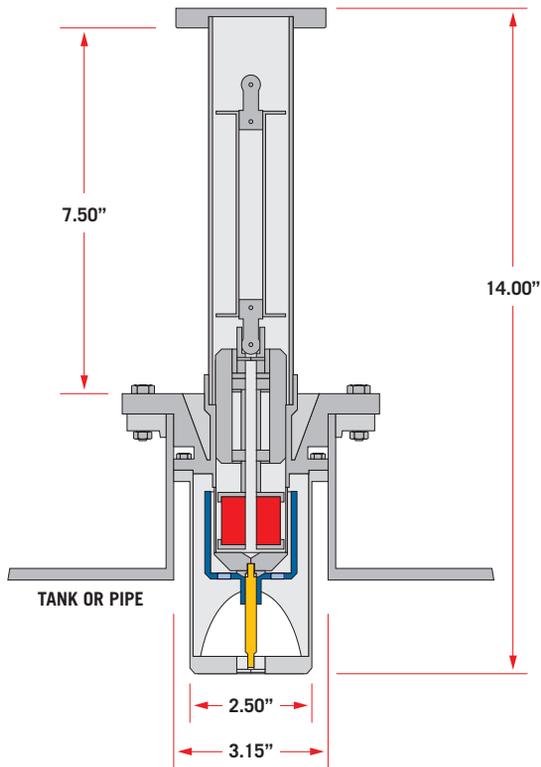
Variety of immersion probes and special lengths available to accommodate a wide sample range.

Optional KS9800 controller displays viscosity, measuring range, temperature, shear rate and shear stress. Calculates and displays temperature correction.

The PV-100 series is excellent for in-tank measurements when highly sensitive control is needed with limited operator involvement. A variety of configurations are available for multiple applications.



Typical Installation



Ranges & Specifications

Measurement Type: Rotational

Viscosity Range: 2 to 10,000,000 cP

Shear Rates: 0.001 to 1,000 sec^{-1}

Shear Stress: 2 to 100 Pa

Temperature (fluid): -25° to +300°C

Pressure Range: up to 930 psi (64 bar)

Repeatability: $\pm 2.5\%$ of Full Scale

Power Requirements: 115/230VAC, 50 or 60Hz, 100W

Output Signal: 4-20 mA

Optional Configurations

Optional configurations include controller, immersion probe and flow probe with magnetic coupling. Resistant to pressure up to 6.4 MPa (930 psi). A variety of immersion probes including special lengths



Flange Mounting Option

VTE-250™ Viscometer

an in-line viscometer for automatic viscosity control of systems open to the atmosphere

Continuous linear output signal
(4-20 mA) easy-to-read indicator

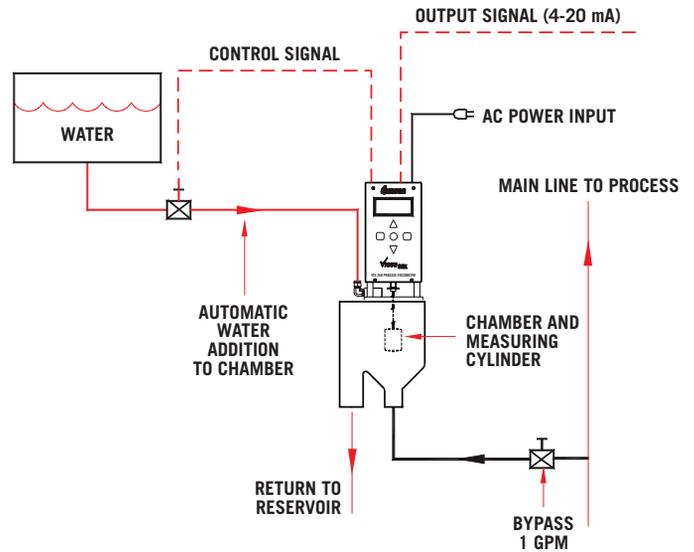
Selectable readout in cP, cup seconds or other units

Simple to change viscosity range
no tools or recalibration required

Options: plastic sample chamber, solenoid control valve, test stand with mounting brackets and additional spindles



Typical Installation



Ranges & Specifications

Measurement Type: Rotational

Viscosity Range: 10 to 4,000 cP, other ranges optional

Display: Digital display of viscosity units

Repeatability: ±0.2% of span, ±1° Full Scale

Power Requirements: 115/230VAC, 50 or 60Hz, 100W

Output Signal: 4-20 mA

Control Signal: Up to 3 amp solenoid relay control

Electrical Code: NEMA 1

Installation: In-tank or flow-through, 1 gpm maximum

VTA™ Viscometer

a completely pneumatic in-line automatic viscosity control instrument for systems open to the atmosphere

No electrical components

safe for solvent environments

Responsive, continuous sensing, easy-to-read indicator

Simple to change viscosity range

no tools or recalibration required

Options: stainless steel sample chamber, solenoid control valve, test stand with mounting brackets, recorder and additional spindles

Built-in Viscosity Indication optional cup-seconds Indicator

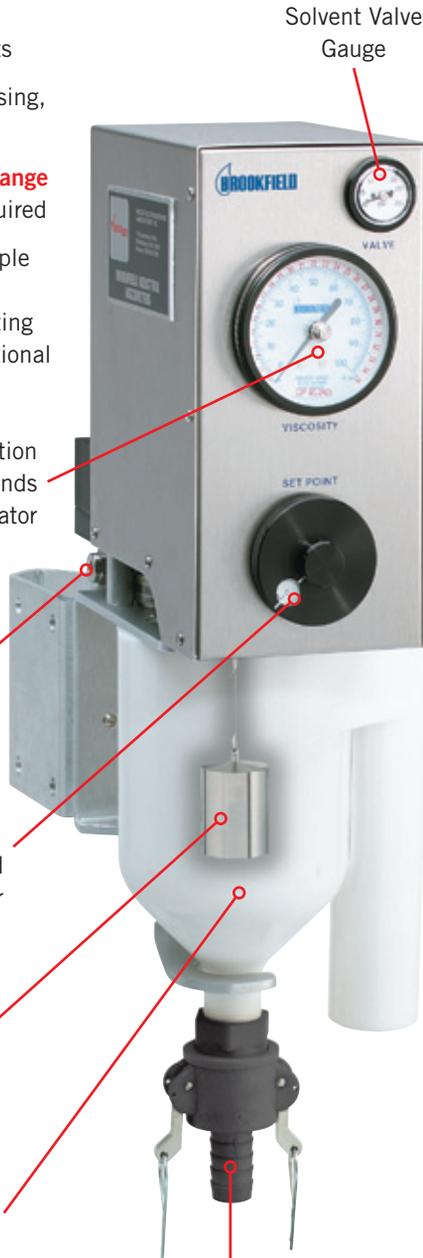
Solvent or Water Addition Made Directly into the Sample Chamber through Built-in Valve

Built-in, Easy-to-Read Setpoint Indicator/Controller

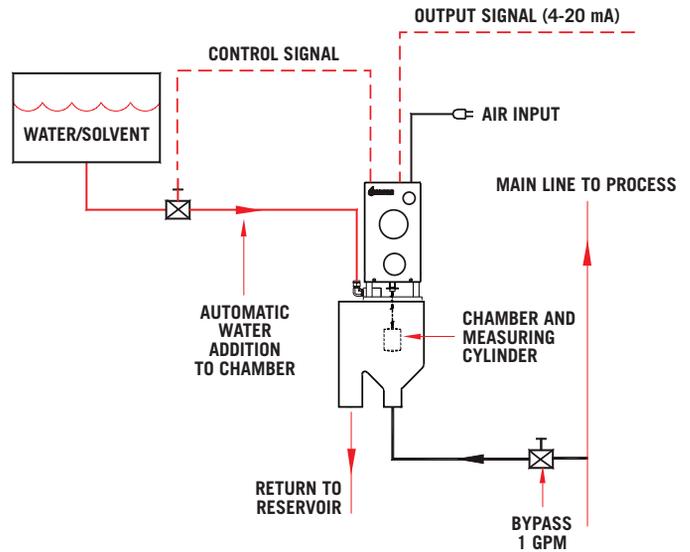
Measuring Cylinders Snap In or Out for Quick Cleaning and Change of Range

Durable and Easy-to-Clean Optional Sample Chamber

Optional Quick Connect Fittings for Easy Change of Sample Chamber



Typical Installation



Ranges & Specifications

Measurement Type: Rotational

Viscosity Range: 1 to 4,000 cP, other ranges optional

Display: Pneumatic display of viscosity

Repeatability: $\pm 0.2\%$ of span, $\pm 1^\circ$ Full Scale

Power Requirements: 115/230VAC, 50 or 60Hz, 100W

Output Signal: 0-15 psig (1 bar) to solvent valve
3-15 psig (.20 to 1 bar) linear signal proportional to viscosity to gauge, optional recorder, or 4-20 mA with converter

Air Requirement: 20-22 psig (1.4 to 1.5 bar) regulated input
3 CFM maximum consumption

Installation: In-tank or flow-through, 1 gpm maximum

KV-100™ Viscometer

an in-line capillary viscometer for automatic viscosity control

Continuous measurement eliminates need for “grab” sampling and allows for prediction of final product flow properties

Instrument resists pressure and temperature fluctuations through the use of gear pump and magnet coupling

4-20 mA output signal provides a variety of display and control capabilities

Accurate, repeatable measurements under variable conditions

Displays measurement data and calculation options capable with optional accessories

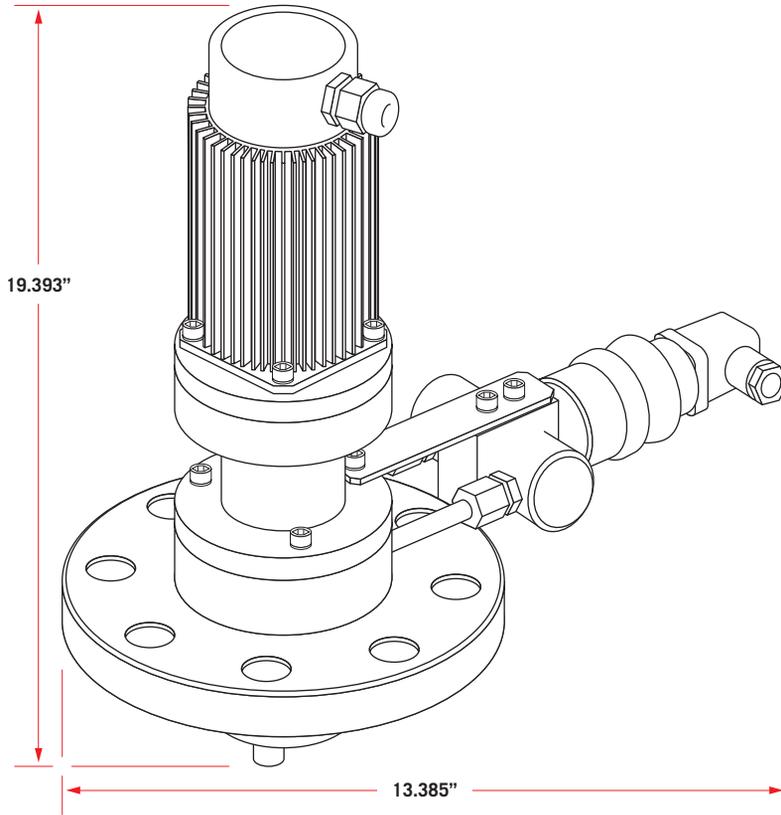
Custom viscosity ranges up to 500 mPas (cP) available



Model KV100 is a user-friendly capillary viscometer that excels in rough process environments, on downgraded set-ups at pilot plants, and under semi-laboratory conditions.

The KV100 Capillary Viscometer easily measures low and medium viscosity materials. Measurements are based on the principle that pressure decrease between the two ends of the measuring capillary is proportional to viscosity.

Typical Installation



Optional Configurations

Pipeline adapters including flow-through, flanged Tee's and continuous flow cells for flexible tubes or small pipe diameters.

Ranges & Specifications

Measurement Type: Capillary

Viscosity Range: 0 to 500 / 0 to 2,000 mPa•s

Pressure Range: 2 to 0.25 MPa 0-2.5 MPa

Temperature (fluid): -25° to +150°C

Ambient Temperature: -25° to +50°C

Pressure Range: up to 930 psi (64 bar)

Repeatability: ±2.5% of Full Scale

Power Requirements: 230VAC, 50 or 60Hz, 100W

Output Signal: 0 to 10 V

Enclosure Code: IP 54

PVS™ Viscometer

allows quick and easy viscosity measurements under pressure where sample boil-off is a problem

1'x1'x2' footprint
for site to site mobility

Includes RheoVision Software
for sophisticated rheological analysis

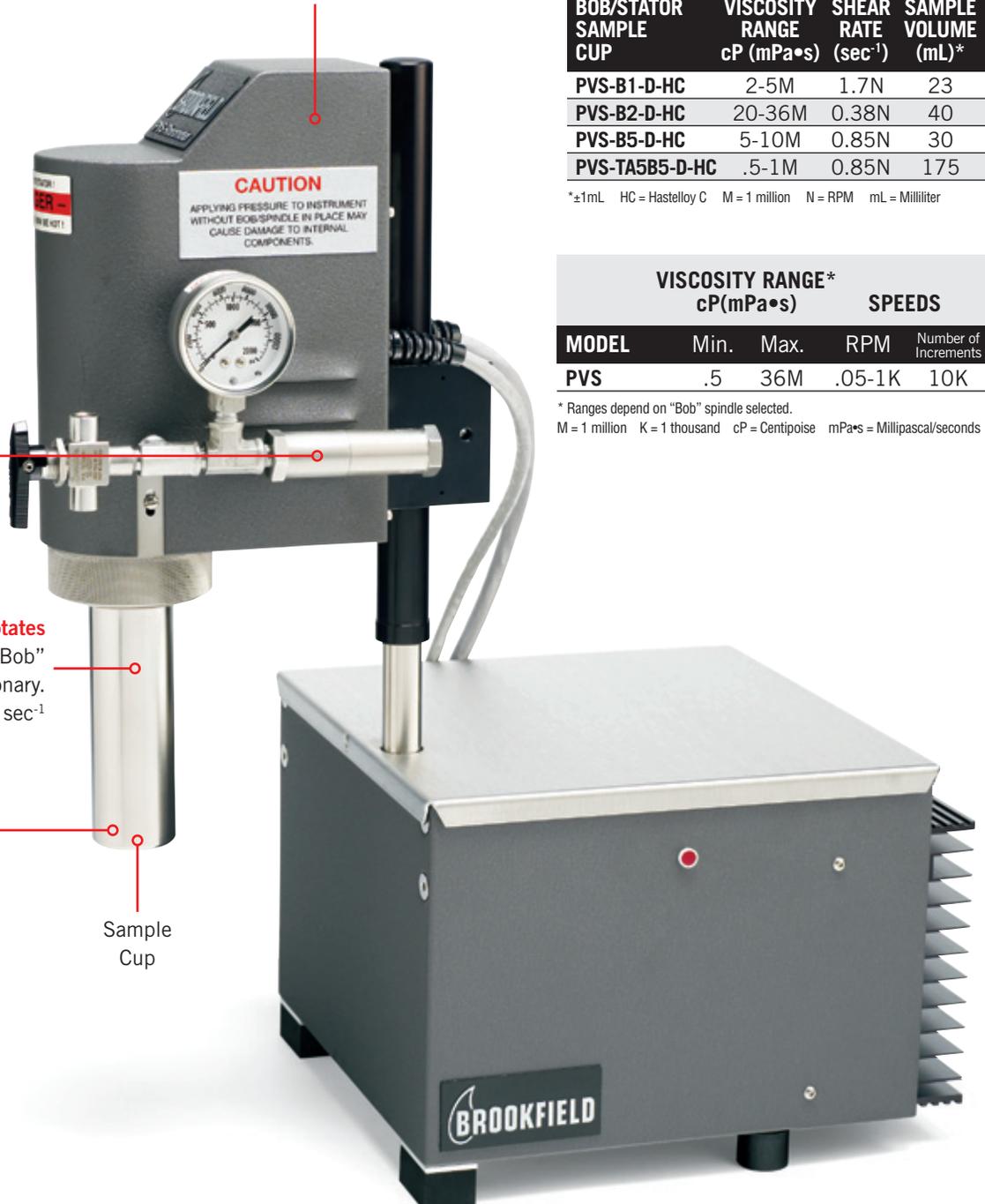
Hastelloy C cup and bobs
for operation in severe field environments

Robust Drive Capable of
Speeds Up to 1000 RPM

PVS Rheometer Ranges

BOB/STATOR SAMPLE CUP	VISCOSITY RANGE cP (mPa•s)	SHEAR RATE (sec ⁻¹)	SAMPLE VOLUME (mL)*
PVS-B1-D-HC	2-5M	1.7N	23
PVS-B2-D-HC	20-36M	0.38N	40
PVS-B5-D-HC	5-10M	0.85N	30
PVS-TA5B5-D-HC	.5-1M	0.85N	175

*±1mL HC = Hastelloy C M = 1 million N = RPM mL = Milliliter



High Pressure
(1000 psi) Safety
Release Valve

Outside Cylinder Rotates
While Inside "Bob"
Remains Stationary.
Shear Rates to 1700 sec⁻¹

RTD on the Inner Cylinder
Ensures Accurate Sample
Temperature Measurement

Sample
Cup

MODEL	VISCOSITY RANGE* cP(mPa•s)		SPEEDS	
	Min.	Max.	RPM	Number of Increments
PVS	.5	36M	.05-1K	10K

* Ranges depend on "Bob" spindle selected.
M = 1 million K = 1 thousand cP = Centipoise mPa•s = Millipascal/seconds

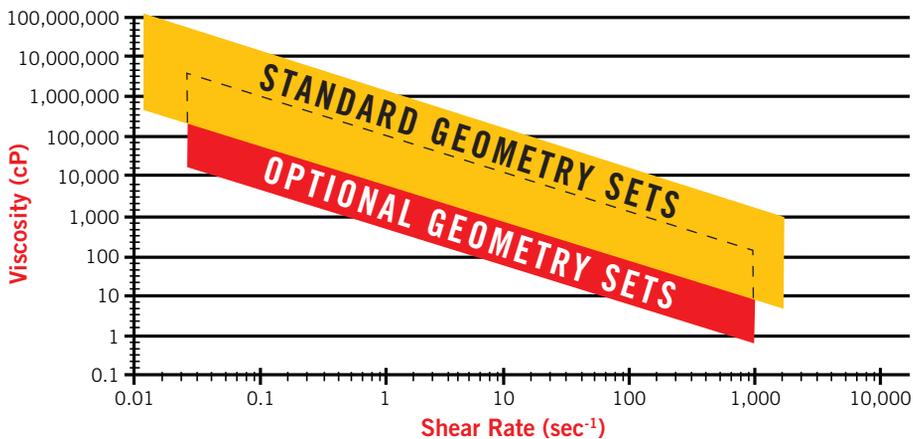
RheoVision Software Included

FOR AUTOMATION AND CONTROL OF ALL TEST PARAMETERS

Specifically designed for sophisticated rheological analysis, RheoVision makes viscosity measurement under pressurized and temperature controlled conditions an easy task. Powerful scripting language provides simple to complex data collection programs including automatic calculation of yield stress using Bingham, Herschel-Bulkley, and Power Law equations.



PVS Operating Range



Optional Configurations

Optional configurations include additional spindles and bobs, computer, temperature control bath, thermo bath, triple annulus geometry for increased sensitivity when measuring low viscosity fluids



Thermo Bath Option

For sample heating with small space requirement. Call for details.



Carrying Case

For in-the-field portability

Typical In-Line Applications



VTE-250

Process Viscometer (p14)



AST-100

Process Viscometer (p4)

Dip coating thickness control: capsules/batter/paint

The thickness or consistency of a fluid is controlled to provide a dependable and uniformly coated substrate when dipped, then removed, from the coating tank. In this application, the thickness or consistency of a fluid is controlled so that when something is dipped in it and pulled out, it is uniformly and consistently coated. Dipping applications are designed in automated systems whereby the substrate is brought over a tank or pan, dipped into the bath, removed and allowed to drip dry before proceeding through the process. The main problem with the open tank is with evaporation of fluids to the environment. Viscosity control is used for addition of water, solvents, or other modifiers as needed to control viscosity to a set point. In capsules, if the fluid is too thin, the capsule will break during filling or dissolve too soon when swallowed. If it is too thick, then there is raw material waste on millions of capsules, and it may not dissolve properly when swallowed. For batter applications, too thin a batter will mean improper coating and product quality. Too thick a batter will mean bad product quality, longer cook/dry times, and raw material waste. The VTE 250 is commonly used for capsule/tray coating control, with the AST-100 used extensively for batter or tank coating controls.

Roll coating thickness control: Book binding, can coating, printing

BOOK BINDING – Animal glue is an adhesive used in the binding industry due to its flexible properties and general ease of handling. Solid glue bars are put into a pot, and heated to form liquid glue which is pumped to a roller pan, where the substrate picks up the adhesive in an automated process. The viscosity is held to a set point, as it is crucial to optimum coverage and quality of the final product. The typical instrument for this is the AST-100

PRINTING – In print applications, constant maintenance of proper ink viscosity ensures the quality of the printing, which reduces rejects and waste, while also keeping ink costs to a minimum. To assure the uniform application of water-based inks on a variety of substrates, it is necessary to control viscosity and pH.

Continuous monitoring and control of the ink reservoir viscosity using the Brookfield AST-100 can provide simultaneous viscosity and pH measurement and control at multi-stations and save money by using less ink.

- Optimizes printing quality and consistency
- Assures that ink quality is maintained
- Ensures continuity of color value
- Provides cleanliness of image with no haloing
- Maximizes press operating speeds
- Prevents ink curdling due to wrong pH
- Assures product consistency
- Minimizes waste
- Provides a permanent record for QC, when used with data recorder

SENSITIVE CONTROL IS THE KEY

Control of the slightest change in viscosity makes all the difference to successfully applying material - particularly in the low viscosity region of the thin inks currently in use. The Brookfield AST-100 has a simple, rugged design that allows it to maintain accurate control at low viscosities. With an economical price, no moving parts, and no calibration required, other viscosity control systems can't match it.

Spraying through nozzles: Fuel oil/ paint

In this application, the viscosity of a fluid is controlled so that when it is pumped through a spray nozzle, proper atomization of the material occurs.

FUEL OIL

Proper atomization ensures the best combustion efficiency which requires continuous and accurate viscosity measurement and control. To burn fuel oil at the high volume flow rates demanded of modern boiler units, the oil must be atomized (i.e. dispersed into the furnace as a fine mist). This assures high speed vaporization and ignition. Most burners atomize oil by shearing the oil into small droplets. Burner manufacturers recommend that the oil be supplied to the burners at a specific viscosity to maintain consistent atomization. Failure to maintain proper atomization results in:

- Dirty fuel burning due to carbon and soot buildup
- Higher fuel consumption and costs
- Increased stack emissions and possible fines from government agencies
- Increases costly downtime in manufacturing and office operations

The Brookfield AST-100 inline process viscometer monitors and controls viscosity and temperature in pressurized oil delivery systems. Repeatable viscosity measurements are necessary to maximize the efficient atomization and delivery of a variety of paraffin-based oils, asphaltic-based oils, as well as #5 and #6 heating fuels, and waste oils. The AST-100 process viscometer also ensures that no fluctuations in viscosity occur. The AST-100 solution includes the following design considerations:

- Bypass loop for viscometer installation to for fail-safe operation
- Use of viscosity feedback to control the heat rate to the oil feed line heat exchanger
- Output from the viscometer goes to a single loop controller which instantly responds to in-line viscosity changes
- System design can accommodate the large thermal capacitance of the oil heat exchangers and the varying oil flow rates through the heat exchanger

PAINT

It's a matter of maintaining optimum coverage. Paints that are too thin have a lower viscosity and may require multiple coats. Paints that are too thick will provide optimal coverage in less coats but costs more to produce. To the unaided eye, borderline differences may be difficult to see without sophisticated viscosity control.

Brookfield's AST-100 Automatic Viscosity Control maintains paint thickness at correct levels throughout the run. This is an automatic control system that continuously senses viscosity, transmitting a signal when additional solvent is required, thus preventing wasteful material buildup.

Quality control: Shampoo/Yogurt

Production of many products requires that viscosity be constantly measured and controlled in order to ensure consistent product quality. In-line measurement ensures consistent quality control in real-time. It saves on lab testing times, and hold up of product waiting for evaluation.



AST-100
Process Viscometer (p4)



AST-100
Probe Style
Process Viscometer (p6)



AST-100FTSY
Process Viscometer (p5)

viscosity

End Point of Reaction

The viscosity of the product is continuously monitored in-tank and the process is either stopped, or the next steps taken once a specific viscosity limit is reached. This approach is used with chemical reactions, as well as the blending of multiple ingredients in batch process. (ex. synthetic fiber manufacturing)

FIBER MANUFACTURE

Latex, spandex, and other synthetic materials are used to manufacture fibers, which are stretchable, rugged and used in many applications such as clothing. The manufacturing process is held in a reactor, where both temperature compensation and tight viscosity control are required over the steps and additions made in the process. The leading instrument for this service is the TT-100



TT-100
Process Viscometer (p8)

Carrying properties: Drill mud, fracturing fluids

In many oil production applications, viscosity is monitored and controlled to make sure that the fluids have the proper rheological properties to carry solids. For example, in stimulation operations the fracturing fluid has to have the proper viscosity under various shear conditions to carry the proppant downhole, and deposit it at the required location. For drilling fluids, the viscosity must be correct to carry the cuttings away from the drill bit and out of the hole.

Field engineers in oil and gas drilling operations can make a mistake if the viscosity specifications of fluids pumped down-hole are incorrect. This complicates testing procedures, increases the risk of costly errors and wastes time. Consequently, it's necessary to ensure fast, accurate viscosity measurement, data collection and analysis of small fluid samples (tested under pressure and elevated temperatures) before they are pumped down-hole.

The in-line TT-100 and the portable, benchtop PVS Rheometer give field engineers reliable viscosity measurement on-site at the well, simplify complicated test procedures, minimize human error and ensure quality control without delay. The Brookfield PVS bench-top Rheometer:

- Permits easy relocation to the most remote job site due to its small size and light weight
- Allows quick and easy viscosity measurements under pressure and elevated temperature
- Provides complete automation of standard test procedures and conditions
- Utilizes coaxial cylinder geometry identical to existing standards
- Allows easy cleaning and disassembly due to simple, straightforward design
- Isolates torque transducer, bearings and other mechanisms from sample/test environment

The TT100 is a field proven, in-line Couette measurement system that provides continuous measurement capabilities. The TT100 output allows for constant monitoring and reporting of Frac Fluid viscosity or for use in ECD (Equivalent Circulating Density) calculations by Rig Engineers.



PVS Rheometer (p18)

Accessories & Service



Brookfield Dip Viscosity Cup (Zahn Type)

Robust and inexpensive

**Complies with
ASTM methods**
(D816, D1084, D4212)

**Wide viscosity range
with 5 cups:**
1 – 1840 cSt

**Highly compact
and portable**
requiring no electricity

Cup No.	Viscosity Range (cSt)	Application (material)
1	60 max	very thin liquids
2	20 – 230	thin oils, mixed paints, lacquers
3	150 – 850	medium oils, mixed paints, enamels
4	220 – 1100	viscous liquids and materials
5	460 – 1840	extremely viscous liquids and materials

Accessories

VTA 106-212AY Solvent Line Assembly

VTA 106-104AY Air Set Assembly

VTA 107-2 Support Bracket

VTA 107-44S Inlet Quick Connect

SB-2 48" Column

SB-3Y Base

SB-9Y Portable Base

SB-10Y Solvent Bottle

SB-1Y Solvent Bottle Holder

SCV-1HY Solvent Control Valve

VTA 107-33T Sample Chamber

VTA 107-45 Outlet Quick Connect

VTA 106-155Y Solenoid Valve Assembly

VTA 107-36T Sample Chamber

VTA 107-44 Inlet Quick Connect

SB-23Y Pipe Stand Assembly

TT-100-289 4-20mA Loop Powered
Signal Indicator



Service

Brookfield Engineering has **Brookfield Process Instrument Service Centers** located in Middleboro, MA, Guangzhou, China, and Dresden, Germany.

Onsite Service is also available through our main office in Middleboro, MA as well our Dresden and Guangzhou Offices.

We also have a world wide network of Dealers & Representatives factory trained to assist you with your Brookfield Process Viscometer.

For service outside the United States, contact our authorized representatives. Go to our website www.brookfieldengineering.com for a comprehensive list.

Contact our Process Sales & Service for complete details:

T 800.628.8139 or 508.946.6200.

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