



Products for Asphalt Testing

For over 50 years, CANNON Instrument Company has provided asphalt testing labs with critical testing equipment and reagents including viscometers, flash point testers, constant temperature baths, standards and the CANNON bending beam rheometer [BBR]. We have helped generations of customers achieve improved measurement accuracy and earned a reputation for reliable, accurate and easy to use instruments that meet or exceed ASTM, AASHTO and other industry-recognized standards.

At CANNON, we engineer our products to take on even the most challenging applications with ease, making life in the asphalt laboratory simpler, faster and safer.

Kinematic Viscosity

Automated Kinematic Viscometers

Manual Glass [Capillary] Viscometers

Vacuum Viscosity Equipment

Constant Temperature Baths

Bath Oils

Kinematic Viscosity Standards

Rotational Viscosity/Rheology

Rotational Paddle Viscometers

Bending Beam Rheometers

DSR/Rotational Viscometer

Rotational Viscosity Standards

Flash Point

Flash Point Testers

Flash Point Standards

Softening Point

Temperature

www.cannoninstrument.com



Asphalt Testing Products Cross Reference

The table below provides a cross-reference between the ASTM and AASHTO standards for specific material types and the products in this brochure. Numbers indicate the page containing product information.

Material	Property Measured	Applicable Method		Bending Beam Rheometers	DSR Temperature Probe & Rotational Viscosity Standards	Rotational Paddle Viscometer	Automated Kinematic Viscometers	Manual Glass Viscometers	Constant Temperature Baths	Vacuum Viscosity Equipment	Viscosity Standards	Bath oils	Thermometers	Flash Pt Testers (Tag Closed Cup)	Flash Pt Testers (Cleveland Open Cup)	Flash Point Reference Materials	Softening Point Testers	
		AASHTO	ASTM	The number below indicates page where info can be found														
Asphalt binders	Asphalt binder ("asphalt") is a dark brown/black bitumen pitch used in paving as an adhesive to bind aggregate particles.																	
	Softening point (Ring-and-ball)	T53	D36															12
	Flash/Fire Point (Cleveland open cup)	T48	D92												11	11		
	Rheological Properties	T315	D7175		10						10							
	Multiple Stress Creep Recovery (MSCR)	T350	D7405		10						10							
	Flexural Creep Stiffness	T313	D6648	9														
	Viscosity (Rotational)	T316	D4402		10						10							
	Viscosity (Kinematic)	T201	D2170				3	4	6		7	7	12					
Viscosity (Vacuum)	T202	D2171					4	6	5	7	7	12						
Asphalt cement	Asphalt cement is asphalt that has been refined to meet roofing and other building product requirements.																	
	Softening point (Ring-and-ball)	T53	D36															12
	Flash/Fire Point (Cleveland open cup)	T48	D92												11	11		
	Viscosity (Kinematic)	T201	D2170				3	4	6		7	7	12					
Emulsified asphalts	Emulsified asphalts are a combination of asphalt binder and water with a small amount of emulsifying agent. They are often used as pavement surface treatments and tack coats.																	
	Viscosity (Rotational paddle)	TP 121*	D7226			8					10							
Asphalt pavement (mixture)	Asphalt pavement (or asphalt mixture) is a multi-layer compacted composite material consisting of asphalt and mineral aggregate. It is used to surface roads, parking lots and airports.																	
	Softening point (Ring-and-ball)	T53	D36															12
	Flash/Fire Point (Cleveland open cup)	T48	D92												11	11		
	Flexural Creep Stiffness for Mixtures	TP 125*	-	9														
	Viscosity (Kinematic)	T201	D2170				3	4	6		7	7	12					
	Viscosity (Vacuum)	T202	D2171					4	6	5	7	7	12					
Cutback asphalt	Cutback asphalt is a combination of asphalt binder and a petroleum solvent. Like emulsified asphalts, they are used as surface treatments and tack coats. Also used as a roof sealant or for damp-proofing concrete and masonry.																	
	Flash/Fire Point (Cleveland open cup)	T48	D92												11	11		
	Flash Point (Tag closed cup)	T79	D3143											11		11		
	Viscosity (Kinematic)	T201	D2170				3	4	6		7	7	12					
	Viscosity (Vacuum)	T202	D2171					4	6	5	7	7	12					
Road tar	Road tar is a durable substance that protects roads from damage due to water, UV rays, sunlight, and cold weather.																	
	Softening point (Ring-and-ball)	T53	D36															12

*Provisional standard

Visit specific pages as indicated on the chart above to learn more about individual products for asphalt testing.

Automated Kinematic Viscometers

CANNON automated kinematic viscometers provide consistent, reliable viscosity determinations of asphalt binders, cements, mixtures and cutbacks.

miniAV® Viscometer

The miniAV® single-bath viscometer is a compact benchtop unit that meets ASTM D445 and exceeds ASTM D2170 precision requirements. miniAV® automates the sampling, testing and reporting processes to provide a complete, turn-key solution for labs seeking to move from labor-intensive manual viscosity testing to a modern, automated testing platform.

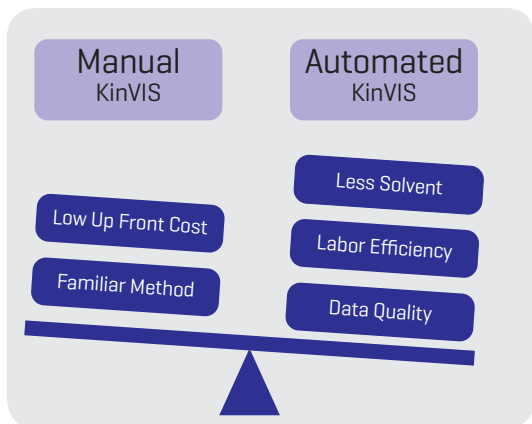
Benefits of automated viscosity measurement:

- Reduced operator-to-operator variability
- Elimination of mathematical errors
- Improved traceability and reporting
- Reduced solvent consumption
- More efficient use of operator time and skill sets

miniAV Specifications

Viscosity range - mm ² /s [cSt]	0.5 to 10,000 ^Y
Temperature range [°C]	15* to 100
Sample handling capacity	1
Preheated sample tray option	Yes
Heated drain line option	Yes
Application	Single sample/ small batch

*with optional bath cooler
^Ydepending on temperature



Manual Glass (Capillary) Viscometers

Use of high quality instruments ensures test reliability and accuracy. All CANNON glass capillary viscometers are traceable to a NIST calibration and manufactured in our ISO 9001-registered, A2LA-accredited laboratory.

Cannon-Fenske Opaque

- 12 mL minimum sample volume
- 9.0 in (23.0 cm) minimum bath depth
- Neoprene (rubber) and self-aligning plastic and metal holders may be ordered separately. Rubber stoppers are also available
- Available calibrated and uncalibrated

Zeitfuchs Cross-Arm

- 1 - 3 mL minimum sample volume
- 9.0 in (23.0 cm) minimum bath depth
- Available with and without permanently attached round or rectangular metal holders
- Neoprene (rubber) and self-aligning metal holders may be ordered separately.

BS/IP/RF U-Tube

- 7 mL minimum sample volume
- 11.0 in (28.0 cm) minimum bath depth
- Neoprene (rubber) holders may be ordered separately

Koppers Modified Vacuum

- 2 mL minimum sample volume
- 7.0 in (17.8 cm) minimum bath depth
- Neoprene (rubber) holders may be ordered separately

Asphalt Institute Vacuum

- 3 mL minimum sample volume
- 7.1 in (18.0 cm) min bath depth
- Available with and without permanently attached round metal holders
- Neoprene (rubber) holders may be ordered separately

Cannon-Manning Vacuum

- 6 mL minimum sample volume
- 7.1 in (18.0 cm) minimum bath depth
- Available with and without permanently attached round metal holders
- Neoprene (rubber) holders may be ordered separately

Reverse Flow Viscometers

Reverse-Flow viscometers measure the viscosity of transparent and opaque liquids. They permit measurement of dark liquids for which the meniscus cannot be readily observed. Reverse-Flow viscometers, including Cannon-Fenske Opaque, Zeitfuchs Cross-Arm and BS/IP/RF U-tube viscometers, meet the requirements of ASTM D2170, "Kinematic Viscosity of Asphalts (Bitumens)".



Vacuum Viscometers

Vacuum viscometers, a type of reverse flow viscometer, measure viscosity of highly viscous samples (both transparent and opaque) that do not readily flow under gravity according to ASTM D2171, "Viscosity of Asphalts by Vacuum Capillary Viscometer". As their name suggests, vacuum viscometers require an accurately controlled vacuum source to pull the sample through the viscometer. CANNON offers three different types of vacuum viscometers.



Vacuum Viscosity Equipment [for use with vacuum viscometers per ASTM D2171]

When measuring the viscosity of highly viscous samples according to ASTM D2171, an accurately controlled vacuum source is essential to obtaining accurate viscosity measurements.

Digital Vacuum Regulators (DVR)

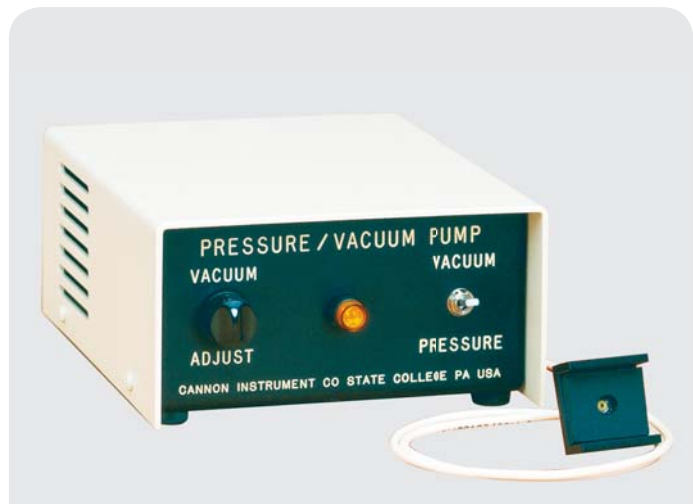
CANNON DVR-1000 & DVR-1500 digital vacuum regulators provide precise vacuum measurement and control.

- DVR-1000 requires a vacuum source
- DVR-1500 has a built-in vacuum pump
- The solid-state DVR-1000 and DVR-1500 use no mercury.



Vacuum Manifolds (3 or 4 port models)

For use with DVR-1000/1500 series digital vacuum regulators, the CANNON vacuum manifold mounts on CANNON CT-1000/2000 baths and permits manual control of vacuum and/or pressure for glass capillary viscometers



Vacuum Pump

CANNON's pressure/vacuum pump provides a cost-effective, compact source of low level pressure/vacuum for filling glass capillary viscometry of high-viscosity liquids

Constant Temperature Baths

Precise temperature control is critical for accurate viscosity measurement of asphalts. CANNON constant temperature baths range from thermo-electrically cooled, low-temperature models to safe high-temperature units. CANNON baths satisfy ASTM D445, D2170 and D2171 requirements



CANNON Bath Cooler

- One-tenth the size of many conventional chillers
- Accurately controls bath temperatures down to as much as 15 °C below ambient



Bath Storage

- A 2 drawer storage unit fits beneath all CANNON constant temperature baths
- Provides elevated bath viewing and storage for viscometers and accessories



CANNON Constant Temperature Baths

Model	Temp Range [°C]		TE Cooling	Visc/Thermo Ports	Bath Height [in.]	Auto Temp Adjustment	Networking Capability
	Low	High					
Standard Range Baths							
CT-500	20*	100	Option	7/2	12	No	No
CT-518	20*	100	Option	7/2	18	No	No
Extended Range Baths (< ambient; >100 °C)							
CT-600	10	100	Yes	7/2	12	No	No
CT-1000	20*	150	Option	7/0	12	No	No
CT-1000HT	25*	200	Option	7/2	12	No	No
CT-2000	10*	150	Option	7/0	12	Yes	Yes
Sub-Zero Baths							
TE-1500	-30	10	Yes [integrated]	2/1	12	No	No
TE-3000	-30	30	Yes [integrated]	2/1	12	Yes	Yes

*with optional cooling

Bath Oils

CANNON offers bath oils for use as the heat transfer media in CANNON automated viscometers and constant temperature baths.



IBF Bath Oil

- Low cost bath oil for use in CANNON constant temperature baths
- Contains oxidation inhibitor to reduce darkening at high temperatures
- Recommended for applications with test temperatures from ambient to 100 °C [212 °F]

Silicone Bath Oil

- For use in CANNON automated viscometers and constant temperature baths
- Best choice for applications requiring temperatures >100 °C [or 212 °F]
- Clear, colorless liquids available in three viscosity grades. 10 cSt bath oil for temperatures from 25 °C to 100 °C; 20 cSt for 80 °C to 135 °C and 50 cSt for 135 °C to 150 °C



Viscosity Standards

The periodic use of high quality viscosity standards to verify the performance of viscometers ensures proper calibration and reliable measurement. CANNON provides a broad range of viscosity standards applicable to asphalt testing including:

- General purpose viscosity standards (with data provided in both mm²/s and mPa·s)
- High viscosity standards

Container Sizes

U.S. Customary Units	Approximate Metric Unit Equivalent*
4 oz. Size	120 mL
Pint Size	500 mL
Quart Size	1 L
Gallon Size	4 L
5-Gallon Size	20 L

*NOTE: Conversions from U.S. customary units to metric units are approximate

CANNON viscosity standards are traceable to a NIST calibration and prepared in our ISO 9001-registered, A2LA-accredited laboratory. We hold ISO 17025 and Guide 34 accreditation [certificates 1262.01 and 1262.02] from A2LA for competency in the manufacture and certification of reference materials.



Rotational Digital Paddle Viscometers

CANNON's rotational digital paddle viscometers provide an automated alternative to the dated, labor-intensive Saybolt method for measuring the dynamic viscosity of non-homogenous materials such as emulsified asphalts.

DPV and TE-DPV

Both the standard DPV and the thermoelectrically-cooled TE-DPV meet ASTM D977, ASTM D2397, ASTM D7226 and AASHTO TP 121 requirements.

Key advantages over the Saybolt method include:

- **Improved lab efficiency** – enables unattended sample testing
- **Less tedious methodology** – simply load the sample and push a button to initiate testing
- **Easier clean up** – easily removable sample cup and wipe-clean paddle make cleaning between samples quicker and easier
- **Reduced dependence on operator skill level** – fully automated, consistent sample processing and testing
- **Automated calculations** – data may be transferred to an optional printer
- **Improved space utilization** – 1/7 the benchtop footprint and 1/3 the weight of Saybolt viscometer baths
- **Technician safety** – no glass components or accessories and reduced need for hazardous cleaning solvents
- **Convenient portability** – Self-contained, compact instrument requires no ancillary equipment
- **More accurate temperature measurement** – offers direct measurement of sample [not bath] temperature
- **Greater sample homogeneity** – paddle continuously mixes the sample for more representative data



Finally!
CANNON DPV and TE-DPV digital paddle viscometers provide an automated and convenient alternative to the Saybolt method for testing emulsified asphalt viscosity



CANNON's rotational digital paddle viscometers include the standard DPV model and the thermoelectrically-cooled, TE-DPV. Thermoelectric cooling allows the TE-DPV to test asphalt emulsions at 25 °C. The standard DPV permits testing up to 30,000 mPa·s or cP.

	Test Temperatures [°C]					Viscosity Range [mPa·s or cP]		
	25	40	50	80	100	30	3,000	30,000
TE-DPV								
DPV								

Bending Beam Rheometers [BBR]

CANNON worked in close collaboration with SHRP researchers to develop the first bending beam rheometer on which the original SuperPave test methods were developed. Bending beam rheometers simulate low temperature stresses that build gradually in pavement, predicting low temperature thermal cracking.

A workhorse instrument in asphalt testing labs world-wide, CANNON's newest BBR models feature the same durability that characterized their predecessors. In addition, both the TE-BBR and TE-BBR Pro offer TE-cooling with solid state Peltier elements. Reliability and performance establish CANNON as the industry leader for measuring flexural creep stiffness of asphalt binders and mixtures.



TE-BBR Pro for asphalt research

Optimized for high load testing (up to 4.5 kg), TE-BBR Pro is the only true stress/force controlled BBR. It is ideal for research applications of asphalt and aggregate beam [mixes].

TE-BBR for asphalt QC

A specification grade instrument, TE-BBR meets SHRP, AASHTO and ASTM requirements for AASHTO T313, AASHTO TP 125 & ASTM D6648.

Bending Beam Rheometer [BBR] Accessories

Complete BBR precision calibration kit

A high precision gage block, precision-cut stainless steel thin beam, 1/4" compliance beam, four 100 g weights and NIST-traceable calibration certificates in a convenient carrying case

BBR precision calibration kit [D6648 update]

Provides items required for update to D6648 including a high precision gage block, precision-cut stainless steel thin beam and NIST-traceable calibration certificates in a convenient carrying case

Silicone rubber mold for BBR

Simplifies the procedure for making asphalt beams

Crack seal kit

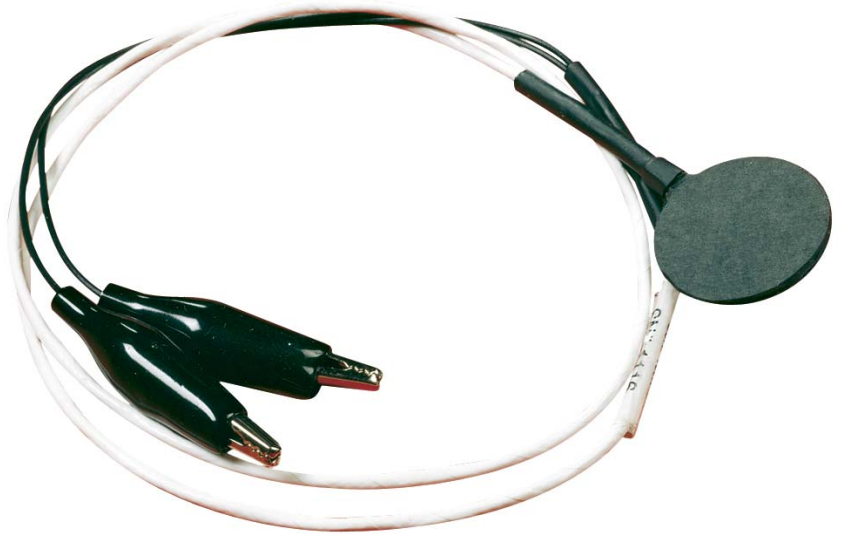
Includes a set of 5 modified beam supports, a thin and thick beam [for calibration], installation hardware and documentation

DSR Temperature Probe & Rotational Viscosity Standards

DSR Temperature Probe

A dynamic shear rheometer determines the viscous and elastic behavior of asphalt binders per AASHTO T315 and AASHTO T350. Data obtained from the DSR indicates the material's workability at medium to high temperatures and ensures it can be handled and pumped at the refinery, terminal or hot mixing facility.

The DSR temperature probe consists of a tiny thermistor mounted within a thin 25 mm disk made of silicone rubber. When the probe is inserted between the plates of a dynamic shear rheometer and the probe wires are connected to a digital ohmmeter, temperatures between -40 °C and 100 °C may be measured to an accuracy of ± 0.05 °C. The DSR temperature probe is supplied with a calibration certificate and instructions for use.



Rotational Viscosity Standards

Use of high quality standards ensures test reliability and accuracy. CANNON provides a broad range of viscosity standards to calibrate and verify the performance of rotational viscometers for asphalt testing including:

- Dynamic Shear Rheometer (DSR) Viscosity Standard
- High Viscosity Standards
- Silicone Viscosity Standards

CANNON viscosity standards are traceable to a NIST calibration and prepared in our ISO 9001-registered, A2LA-accredited laboratory. We also hold ISO 17025 and Guide 34 accreditation [certificates 1262.01 and 1262.02] from A2LA for competency in manufacture and certification of reference materials.

Flash Point Testers

Flash point is the lowest liquid temperature at which a test flame causes sample vapors to ignite. Fire point is the temperature at which the test flame causes the sample to ignite and remain burning for ≥ 5 seconds. CANNON offers several flash point testers applicable to the asphalt testing market.

Tanaka aco-8as Cleveland Open Cup Flash Point Tester

The aco-8as is an automated ASTM D92 Cleveland Open Cup (COC) flash and fire point tester designed specifically with features for testing bituminous materials to improve precision and safety.

Key Features:

- Unique skimmer to automatically remove surface skin that forms on the sample
- Automatic fire containment lid activates to cover the test cup when a sustained fire is detected.
- Password protection and data storage (up to 200 results)
- USB port for use of flash memory or keyboard



Tanaka atg-8 Tag Closed Cup Flash Point Testers

atg-8l Tag closed cup flash point tester

- Automated ASTM D56
- Metal block bath for low temperature testing
- Cooling/heating controlled via liquid cooled Peltier modules (optional chiller required)

atg-8w Tag closed cup flash point tester

- Automated ASTM D56
- Conventional water bath

Flash Point Reference Materials

CANNON flash point reference materials, sold in 200 mL bottles, are produced in accordance with ASTM D56, "Flash Point by Tag Closed Cup Tester" and ASTM D92, "Flash and Fire Points by Cleveland Open Cup Tester".

Nominal flash point values of flash point reference materials

Standard	ASTM D56 Flash Point [°C]	ASTM D92 Flash Point [°C]
FPRM10†	50	—
FPRM11	66	—
FPRM14	—	116
FPRM16	—	137
FPRM2D	—	163
FPRM4D	—	224
FPRM9D	—	274

† Incurs additional shipping charges due to low flash point



Softening Point Testers

Softening point testers are used as a consistency check for modified asphalts. Bitumen samples supporting steel balls are confined in brass rings suspended in a liquid bath which is heated at a prescribed rate. As the sample softens, the balls and bitumen sink to the plate. When bitumen touches the plate, the bath temperature is recorded as the softening point.

Tanaka asp-6 Softening Point Tester

The automated ASTM D36 asp-6 reliably tests the softening point of bitumen and other materials.

Key Features:

- Wide light beam provides reliable, automatic falling ball detection
- Built-in safety shutdown in the event of harmful vapor generation from overheated glycerin
- Password protection and data storage (up to 200 results)
- High visibility display
- Ethernet/RS-232 port for LIMS connectivity
- USB port for use of flash memory or keyboard



Thermometers

Accurate and precise temperature measurement is critical when testing asphalt materials.

Dostmann P795 Digital Thermometer

The handheld Dostmann P795 digital thermometer provides precise temperature measurement and meets the stringent temperature requirements of ASTM D445, D2170 and D2171.

- Accuracy of ± 0.015 °C from -50 °C to +200 °C.
- Dual channel
- Provides simultaneous display of two measured values or a differential temperature measurement
- Smartprobes are sold separately.

To learn more about specific products, contact CANNON or visit our website at:

www.cannoninstrument.com



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