



# Certificate of Calibration

## Viscometer No. 200 P223



CANNON-FENSKE ROUTINE TYPE FOR TRANSPARENT LIQUIDS  
 (Standard Test ASTM D 445, IP 71 and ISO 3104)

Constant at 40°C                      0.1089 mm<sup>2</sup>/s<sup>2</sup>, (cSt/s)  
 Constant at 100°C                    0.1084 mm<sup>2</sup>/s<sup>2</sup>, (cSt/s)

1262.01  
 The inclusion of the A2LA logo does not imply certification/approval of the products calibrated or tested.

The viscometer constant at other temperatures can be obtained by interpolation or extrapolation. To obtain kinematic viscosity in mm<sup>2</sup>/s(cSt) multiply the efflux time in seconds by the viscometer constant. To obtain viscosity in mPa·s (cP), multiply the kinematic viscosity in mm<sup>2</sup>/s (cSt) by the density in grams per milliliter.

The above constants assume a value for the coefficient of thermal expansion typical to that for mineral oil, and that the viscometer was filled with test sample at room temperature. If the filling temperature T<sub>F</sub> is substantially different than room temperature, the viscometer constant at test temperature T<sub>T</sub> is C<sub>0</sub> (1 - B [T<sub>T</sub> - T<sub>F</sub>]). The values of C<sub>0</sub> and B shown below are based on a coefficient of thermal expansion typical to that for a mineral oil.

Kinematic viscosities of the standards used in calibrating were established in Master Viscometers as described in Ind. Eng. Chem. Anal. Ed. 16,708(1944), ASTM D 2162, and the Journal of Research of the National Bureau of Standards, Vol. 52, No. 3, March 1954, Research Paper 2479.

Kinematic viscosities are based on the primary viscosity standard, water, at 20°C (ITS-90). The internationally accepted value for the viscosity of water at 20°C (ITS-90) is 1.0016 mPa·s or kinematic viscosity is 1.0034 mm<sup>2</sup>/s as listed in ISO 3666. The gravitational constant, g, is 980.1 cm/sec<sup>2</sup> at the Cannon Instrument Company. The gravitational constant varies up to 0.1% in the United States. To make this small correction in the viscometer constant, multiply the above viscometer constant by the factor [g (at your laboratory) / 980.1]. The calibration data below are traceable to the National Institute for Standards and Technology. Temperature measurement traceable to NIST (Test No. 260470).

### CALIBRATION DATA AT 40°C

Viscosity Standard	Kinematic Viscosity mm <sup>2</sup> /s. (cSt)	Efflux Time Seconds	Constant mm <sup>2</sup> /s <sup>2</sup> . (cSt/s)
I20	25.28	232.14	0.1089
I30	38.94	357.57	0.1089
Room Temp. (approx.)	22 °C.		Average = 0.1089
Charge (approx.)	6.2 ml.		C <sub>0</sub> = 0.1090
Driving fluid head (approx.)	8.7 cm.		B = 75 x 10 <sup>-6</sup> /°C
Working diameter of lower reservoir	3.0 cm.		
Constant at 100° C. is	0.45 % lower than the constant at 40° C.		

Calibrated by **DLH on 5/8/2009**

under supervision of

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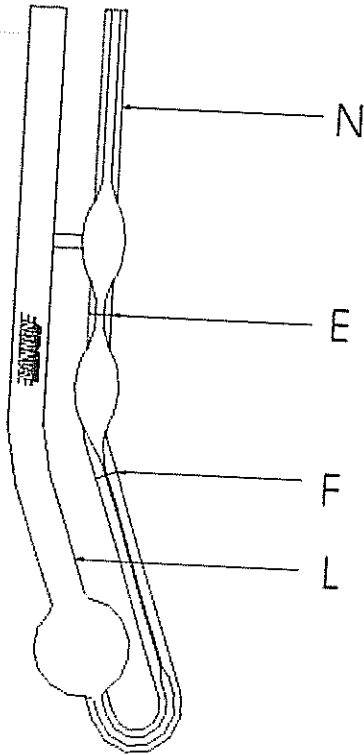
Please note: This calibration remains valid for 10 years unless (1) the viscometer has been damaged or (2) materials which chemically attack borosilicate glass (e.g., hydrofluoric acid or highly alkaline solutions) have been used. Nonetheless, it is recommended that the calibration be verified with kinematic viscosity standards periodically; if a change in calibration is indicated, carefully examine all sources of error, including especially temperature measurement since most apparent changes in calibration of the viscometer are due to errors in temperature measurement.

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The S.I. unit of kinematic viscosity is 1 meter squared per second, and is equal to 10<sup>4</sup> stokes. The S.I. unit of viscosity is 1 pascal second, and is equal to 10 poises. One centistokes is equal to one millimeter squared per second.

# Instructions for the use of The Cannon-Fenske Routine Viscometer

See also ASTM D 445, D 446 and ISO 3105



1. Clean the viscometer using suitable solvents, and by passing clean, dry, filtered air through the instrument to remove the final traces of solvents. Periodically, traces of organic deposits should be removed with chromic acid or non-chromium cleaning solution.
2. If there is a possibility of lint, dust, or other solid material in the liquid sample, filter the sample through a sintered glass filter or fine mesh screen.
3. To charge the sample into the viscometer, invert the instrument and apply suction to tube L, immersing tube N in the liquid sample, and draw liquid to mark F. Wipe clean arm N, and turn the instrument to its normal vertical position.
4. Place the viscometer into the holder, and insert it into the constant temperature bath. A viscometer holder which fits the Cannon-Fenske Opaque viscometer and the Cannon-Manning Semi-Micro viscometer will also fit the Cannon-Fenske Routine viscometer. Align the viscometer vertically in the bath by means of a small plumb bob in tube L, if a self-aligning holder is not used.
5. Allow approximately 10 minutes for the sample to come to the bath temperature at 40°C and 15 minutes at 100°C.
6. Apply suction to tube N (or pressure to tube L) and draw the liquid slightly above mark E.
7. To measure the efflux time, allow the liquid sample to flow freely down past mark F, measuring the time for the meniscus to pass from mark E to mark F.
8. A check run may be made by repeating steps 6 and 7.
9. Calculate the kinematic viscosity in mm<sup>2</sup>/s(cSt) of the sample by multiplying the efflux time in seconds by the viscometer constant.

## Cannon-Fenske Routine Viscometer For Transparent Liquids

### RECOMMENDED VISCOSITY RANGES FOR THE CANNON-FENSKE ROUTINE VISCOMETERS

Size	Kinematic Viscosity Range		
	mm <sup>2</sup> /s <sup>2</sup> , (cSt/s)	mm <sup>2</sup> /s, (cSt)	
25	0.002	0.5 to	2
50	0.004	0.8 to	4
75	0.008	1.6 to	8
100	0.015	3 to	15
150	0.035	7 to	35
200	0.1	20 to	100
300	0.25	50 to	250
350	0.5	100 to	500
400	1.2	240 to	1200
450	2.5	500 to	2500
500	8	1600 to	8000
600	20	4000 to	20000
650	45	9000 to	45000
700	100	20000 to	100000

The expanded uncertainty<sup>1</sup> with 95% confidence of the calibration measurements relative to the primary standard is as follows:

Range of Viscosity mm <sup>2</sup> /s	Combined Expanded Uncertainty
< 10	0.16%
10 - 100	0.22%
100 - 1000	0.29%
1000 - 10000	0.38%
10000 - 100000	0.44%

The assigned uncertainty of the primary viscosity standard at 20°C is ± 0.17%. See ISO 3666.

<sup>1</sup> An expanded uncertainty U is determined by multiplying the combined standard uncertainty u<sub>c</sub> by a coverage factor k: U = ku<sub>c</sub>, where k = 2. See NIST Technical Note 1297, 1994 edition, *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*.

THIS PRODUCT WAS CALIBRATED WITHIN A QUALITY SYSTEM WHICH IS REGISTERED TO ISO 9001:2000.

CANNON INSTRUMENT COMPANY

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