

Certificate of Calibration



Viscometer No. 0B L155

UBBELOHDE TYPE

(Standard Test ASTM D 445 and ISO 3104)



Viscometer Constant 0.005154 mm²/s², (cSt/s)

1262.01

The viscometer constant is the same at all temperatures.

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

To obtain kinematic viscosity in mm²/s (cSt) multiply the efflux time in seconds by the viscometer constant. To obtain viscosity in mPa-s, multiply the kinematic viscosity by the density in g/ml.

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 D2162, 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 mm²/s as listed in ISO 3666. The gravitational constant, g, is 980.1 cm/sec² 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 is traceable to NIST (Test No. 260470).

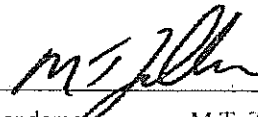
CALIBRATION DATA AT 40°C

Viscosity Standard	Kinematic Viscosity mm ² /s, (cSt)	Efflux Time Seconds	Constant mm ² /s ² , (cSt/s)
I1	1.368	265.42	0.005154
I2	2.417	468.97	0.005154

Average = 0.005154

Calibrated by RMB on 10/7/2009

under supervision of



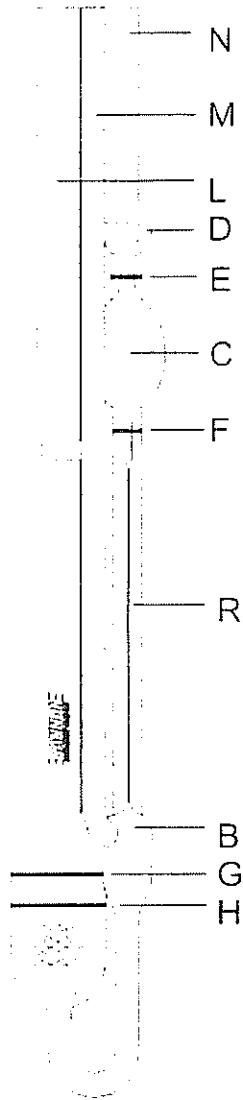
Please note: This calibration remains valid for 10 years unless (1) the viscometer has been damaged or (2) materials which chemically attack borosilicate glass (e.g. hydrofluoric acid or highly alkaline solutions) have been used. Nonetheless, it is recommended that the calibration be verified with kinematic 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 10⁴ 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 Ubbelohde 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 fritted glass filter or fine mesh screen.
3. Charge the viscometer by introducing sample through tube L into the lower reservoir; introduce enough sample to bring the level between lines G and H.
4. Place the viscometer into the holder, and insert it into the constant temperature bath. Vertically align the viscometer in the bath if a self-aligning holder has not been used.
5. Allow approximately 20 minutes for the sample to come to the bath temperature.
6. Place a finger over tube M and apply suction to tube N until the liquid reaches the center of bulb D. Remove suction from tube N. Remove finger from tube M, and immediately place it over tube N until the excess sample drops away from the lower end of the capillary into bulb B. Then remove finger and measure the efflux time.
7. To measure the efflux time, allow the liquid sample to flow freely down past mark E, measuring the time for the meniscus to pass from mark E to mark F.
8. Calculate the kinematic viscosity of the sample by multiplying the efflux time by the viscometer constant.
9. Without recharging the viscometer, make check determinations by repeating steps 6 to 8.

Ubbelohde Type For Transparent Liquids

RECOMMENDED VISCOSITY RANGES FOR THE UBBELOHDE VISCOMETER

Size	Kinematic Viscosity Range	
	mm ² /s ² , (cSt/s)	mm ² /s. (cSt)
0	0.001	0.3 to 1
0C	0.003	0.6 to 3
0B	0.005	1 to 5
1	0.01	2 to 10
1C	0.03	6 to 30
1B	0.05	10 to 50
2	0.1	20 to 100
2C	0.3	60 to 300
2B	0.5	100 to 500
3	1.0	200 to 1000
3C	3.0	600 to 3000
3B	5.0	1000 to 5000
4	10	2000 to 10000
4C	30	6000 to 30000
4B	50	10000 to 50000
5	100	20000 to 100000

The expanded uncertainty¹ with 95% confidence of the calibration measurements relative to the primary standard is as follows:

Range of Viscosity mm ² /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.

¹ An expanded uncertainty U is determined by multiplying the combined standard uncertainty u_c by a coverage factor k: U = ku_c, 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.