psl rheotek

UKAS CALIBRATION
0247

precision glass capillary viscometers

ASTM Ubbelohde

Suitable for measuring transparent liquids. High precision & easy to use. Nominal overall length 283 mm; approximate sample volume 18 ml. Complete with ISO 17025 certificate of calibration.

Part No.	Size	Constant	Range (mm²/s)
1643/01	O	0.001	0.3 to 1
1643/02	OC	0.003	0.6 to 3
1643/03	OB	0.005	1 to 5
1643/04	1	0.01	2 to 10
1643/05	1C	0.03	6 to 30
1643/06	1B	0.05	10 to 50
1643/07	2	0.1	20 to 100
1643/08	2C	0.3	60 to 300
1643/09	2B	0.5	100 to 500
1643/10	3	1.0	200 to 1,000
1643/11	3C	3.0	600 to 3,000
1643/12	3B	5.0	1,000 to 5,000
1643/13	4	10	2,000 to 10,000
1643/14	4C	30	6,000 to 30,000
1643/15	4B	50	10,000 to 50,000
1643/16	5	100	20,000 to 100,000

U-Tube Reverse Flow Viscometers

Suitable for measuring opaque liquids. Type BS/IP/RF. Nominal overall length 275 mm; approximate sample volume 12-25 ml. Complete with ISO 17025 certificate of calibration.

Part No.	Size	Constant	Range (mm²/s)
1637/01	1	0.003	0.6 to 3
1637/02	2	0.01	2 to 10
1637/03	3	0.03	6 to 30
1637/04	4	0.1	20 to 100
1637/05	5	0.3	60 to 300
1637/06	6	1.0	200 to 1,000
1637/07	7	3.0	600 to 3,000
1637/08	8	10	2,000 to 10,000
1637/09	9	30	6,000 to 30,000
1637/10	10	100	20,000 to 100,000
1637/11	11	300	60,000 to 300,000

Cannon-Fenske Routine

Suitable for measuring transparent liquids. Calibration data stated at 40 & 100°C. Nominal overall length 250 mm; approximate sample volume 7 ml. Complete with ISO 17025 certificate of calibration.

Part No.	Size	Constant	Range (mm²/s)
1634/01	25	0.002	0.5 to 2
1634/02	50	0.004	0.8 to 4
1634/03	75	0.008	1.6 to 8
1634/04	100	0.015	3 to 15
1634/05	150	0.035	7 to 35
1634/06	200	0.1	20 to 100
1634/07	300	0.25	50 to 250
1634/08	350	0.5	100 to 500
1634/09	400	1.2	240 to 1,200
1634/10	450	2.5	500 to 2,500
1634/11	500	8	1,600 to 8,000
1634/12	600	20	4,000 to 20,000
1634/13	650	50	10,000 to 50,000
1634/14	700	100	20,000 to 100,000

Cannon-Fenske Opaque

Suitable for measuring opaque liquids. Calibration data stated at 40 & 100°C. Nominal overall length 295 mm; approximate sample volume 12 ml. Complete with ISO 17025 certificate of calibration.

Part No.	Size	Constant	Range (mm²/s)
1641/01	25	0.002	0.4 to 2
1641/02	50	0.004	0.8 to 4
1641/03	75	0.008	1.6 to 8
1641/04	100	0.015	3 to 15
1641/05	150	0.035	7 to 35
1641/06	200	0.1	20 to 100
1641/07	300	0.25	50 to 250
1641/08	350	0.5	100 to 500
1641/09	400	1.2	240 to 1,200
1641/10	450	2.5	500 to 2,500
1641/11	500	8	1,600 to 8,000
1641/12	600	20	4,000 to 20,000
1634/13	650	50	10,000 to 50,000
1634/14	700	100	20,000 to 100,000

PSL-RHEOTEK offers a comprehensive range of precision calibrated glass capillary kinematic viscometers. These are hand made by our experienced glass blowers from high grade borosilicate glass tubing. PSL viscometers are used by laboratories throughout the world and enjoy a high reputation for quality workmanship and accuracy of calibration. Calibration is performed on-site by our UKAS accredited ISO 17025 calibration laboratory.

Accessories

Master Viscometer
Part No. 1690 series

Viscometer Bench Stand
Part No. 20430

SCAN Viscometer
Part No. 21003/Type C
21004/Type T

TLC-1 Chiller
Part No. 20410

Metal Viscometer Holders

Part No.	Specifications
1850/A1	Universal Viscometer Holder
1818/A1	U-Tube Viscometer Holder Size O to F
1818/A2	U-Tube Viscometer Holder Size G & H
1824/A1	Suspended-Level Viscometer Holder Size 1 to 4
1824/A2	Suspended-Level Viscometer Holder Size 4A & 5
1827/A1	Suspended-Level Short Form Viscometer Holder
1833/A1	Cannon-Fenske Routine Viscometer Holder
1836/A1	U-Tube Reverse Flow Viscometer Holder
1840/A1	Cannon-Fenske Opaque Viscometer Holder
1842/A1	Ubbelohde Viscometer Holder Size 0 to 4
1842/A2	Ubbelohde Viscometer Holder Size 4C to 5

Plastic Viscometer Holders

Part No.	Specifications
1933/A1	Plastic holder for Cannon-Fenske Routine
1940/A1	Plastic holder for Cannon-Fenske Opaque
1942/A1	Plastic holder for ASTM Ubbelohde (sizes O to 4)

TCB-7 Viscometer Bath
Part No. 20402

Other Viscometers available:
- **Master Viscometers**
- **Scan Viscometers**
- **Ostwald Viscometers**
- **Suspended-Level dilution Viscometers**
- **Deoxyribonuclease Assay Viscometers**
- **Falling Sphere Viscometers**
- **Bitumen Viscometers**

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Change to read:

⟨911⟩ VISCOSITY■—CAPILLARY VISCOMETER METHODS

The following procedures are used to determine the viscosity of a Newtonian fluid, i.e. a fluid having a viscosity that is independent of the shearing stress rate or rate of shear. Unless otherwise directed in the individual monograph, use *Method I*.

• **METHOD I. UBBELOHDE-TYPE CAPILLARY VISCOMETER**

Apparatus: The determination may be carried out with an Ubbelohde-type capillary viscometer (*Figure 1*) that has the specifications described in *Table 1* or *Table 2*.

Table 1

Size Number	Nominal Constant of Viscometer (mm^2/s^2)	Measurable Kinematic Viscosity Range (mm^2/s)	Internal Diameter of Tube, R (mm) (±2%)	Volume of Bulb, C (mL) (±5%)	Internal Diameter of Tube, N (mm)
1	0.01	3.5–10	0.64	5.6	2.8–3.2
1A	0.03	6–30	0.84	5.6	2.8–3.2
2	0.1	20–100	1.15	5.6	2.8–3.2
2A	0.3	60–300	1.51	5.6	2.8–3.2
3	1.0	200–1,000	2.06	5.6	3.7–4.3
3A	3.0	600–3,000	2.74	5.6	4.6–5.4
4	10	2,000–10,000	3.70	5.6	4.6–5.4
4A	30	6,000–30,000	4.07	5.6	5.6–6.4
5	100	20,000–100,000	6.76	5.6	6.8–7.5

Table 2

Size Number	Nominal Constant of Viscometer (mm^2/s^2)	Measurable Kinematic Viscosity Range (mm^2/s)	Internal Diameter of Tube, R (mm) (±2%)	Volume of Bulb, C (mL) (±5%)	Internal Diameter of Tube, N (mm)
0	0.001	0.3–1	0.24	1.0	6.0
0C	0.003	0.6–3	0.36	2.0	6.0
0B	0.005	1–5	0.46	3.0	6.0
1	0.01	2–10	0.58	4.0	6.0
1C	0.03	6–30	0.78	4.0	6.0
1B	0.05	10–50	0.88	4.0	6.0
2	0.1	20–100	1.03	4.0	6.0
2C	0.3	60–300	1.36	4.0	6.0
2B	0.5	100–500	1.55	4.0	6.0
3	1.0	200–1,000	1.83	4.0	6.0
3C	3.0	600–3,000	2.43	4.0	6.0
3B	5.0	1,000–5,000	2.75	4.0	6.5
4	10	2,000–10,000	3.27	4.0	7.0
4C	30	6,000–30,000	4.32	4.0	8.0
4B	50	10,000–50,000	5.20	5.0	8.5
5	100	20,000–100,000	6.25	5.0	10.0

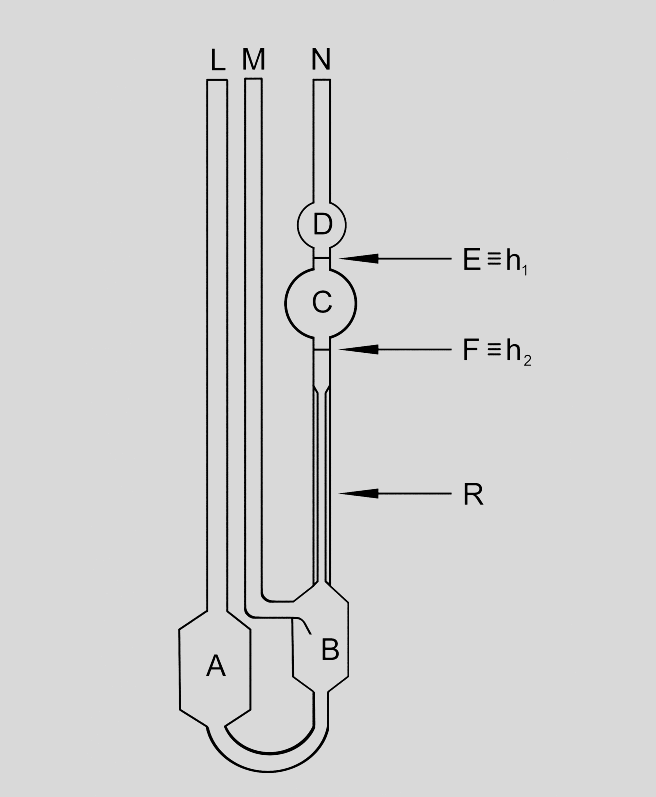

Figure 1. Ubbelohde-Type Capillary Viscometer

Procedure: Fill the viscometer through tube (L) with a sufficient quantity of the sample liquid that is appropriate for the viscometer being used or by following the manufacturer's instructions. Carry out the experiment with the tube in a vertical position. Fill bulb (A) with the liquid, and also ensure that the level of liquid in bulb (B) is below the exit to the ventilation tube (M). Immerse the viscometer in a water or oil bath stabilized at the temperature specified in the individual monograph, and control the temperature to ±0.1°, unless otherwise specified in the individual monograph. Maintain the viscometer in a vertical position for a time period of NLT 30 min to allow the sample temperature to reach equilibrium. Close tube (M), and raise the level of the liquid in tube (N) to a level about 8 mm above mark ($E \equiv h_1$). Keep the liquid at this level by closing tube (N) and opening tube (M). Open tube (N), and measure the time required for the level of the liquid to drop from mark ($E \equiv h_1$) to ($F \equiv h_2$), using an appropriate accurate timing device. [NOTE—In *Table 1*, the minimum flow time should be 350 s for size no. 1, and 200 s for all other sizes. In *Table 2*, the minimum flow time should be 300 s for size no. 0, and 200 s for all other sizes.]

Calibration: Calibrate each viscometer at the test temperature by using fluids of known viscosities of appropriate viscosity standards to determine the viscometer constant, *k*. The viscosity values of the calibration standards should bracket the expected viscosity value of the sample liquid. Determine the viscometer constant at the same temperature as the sample liquid under test.

Calculate the viscometer constant, *k*, in mm^2/s^2, from the equation:

$$k = \eta/(\rho \times t)$$

η = known viscosity of the liquid (mPa · s)
ρ = density of the liquid (g/mL)
t = flow time for the liquid to pass from the upper mark to the lower mark (s)

Calculation of kinematic and Newtonian viscosities of sample fluid: A capillary viscometer is chosen so that the flow time, *t*, ranges between 200 and 1000 s, and the kinematic energy correction is typically less than 1%. If the viscosity constant, *k*, is known, use the following equation to calculate the kinematic viscosity, *v*, in mm^2/s, from the flow time, *t*, in s.

$$v = k \times t$$

If the density of the fluid is known at the temperature of the viscosity measurement, then the Newtonian viscosity, η, in mPa · s, is calculated by the following equation:

$$\eta = v \times \rho$$

ρ = density of the fluid (g/mL)

The flow time of the fluid under examination is the mean of NLT three consecutive determinations. The result is valid if the percentage of the relative standard deviation (%RSD) for the three readings is NMT 2.0%.

• **METHOD II. OSTWALD-TYPE CAPILLARY VISCOMETER**

Apparatus: The determination may be carried out with an Ostwald-type capillary viscometer (*Figure 2*).

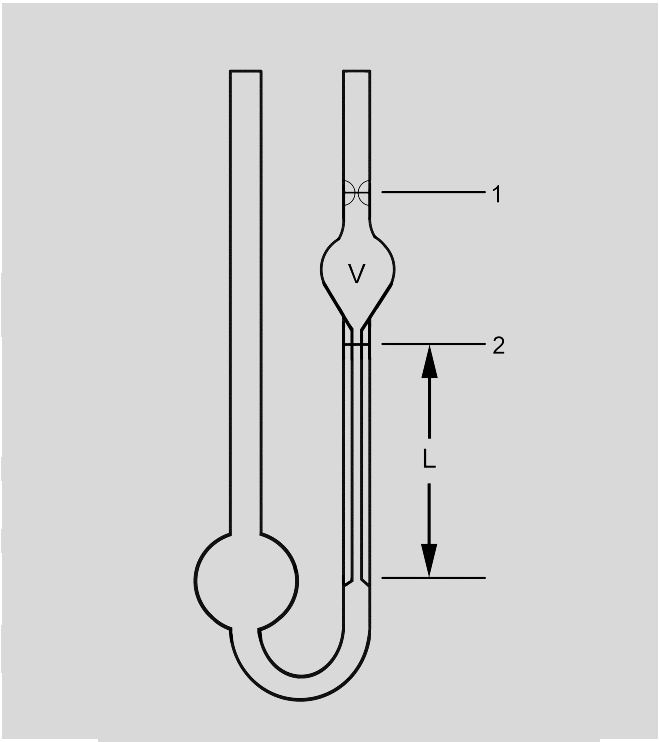

Figure 2. Ostwald-Type Capillary Viscometer

Procedure: Fill the tube with an amount of the sample that is appropriate for the viscometer being used or by following the manufacturer's instructions. The volume of fluid used should be such that the lower bulb is not entirely emptied when the fluid is drawn up through the capillary tube to the uppermost graduation mark. Carry out the experiment with the tube in a vertical position. Immerse the viscometer in a water or oil bath stabilized at the temperature specified in the individual monograph, and control the temperature to ±0.1°, unless otherwise specified in the individual monograph. Maintain the viscometer in a vertical position for a time period of NLT 30 min to allow the sample temperature to reach equilibrium. Using suction, draw the fluid up through the capillary tube until the meniscus is at the level of the uppermost graduation. With both the filling and capillary tubes open to atmospheric pressure, record the time, in s, required for the liquid to flow from the upper mark to the lower mark in the capillary tube. [NOTE—The minimum flow time should be 200 s.]