

2 Viscometers
2.1 Viscometers and their range of use

Table with 8 columns: Measurement substance property, and 7 Viscometer types (Ubbelohde, Micro-Ubbelohde, TC Ubbelohde, Ostwald, Micro-Ostwald, Cannon-Fenske-Routine, Cannon-Fenske-reverse flow). Rows include Transparent liquids manual/automatic measurement, Opaque liquids manual/automatic measurement, Foaming liquids, Liquid mixture with highly volatile components, Minimum measurement substance and/or rinsing agent quantities, and High-temperature or low-temperature measurements.

Selection of glass capillary viscometers

Legend for suitability:
- use preferably
- highly suitable
- less suitable
- unsuitable

1) up to 30,000 mm²/s
2) above 30,000 mm²/s

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2.2 Ubbelohde viscometers
normal form (DIN)

Viscometers with suspended level for determination of absolute and relative kinematic viscosity of liquids with Newtonian flow behavior. The calibrated viscometers are delivered with manufacturer's certificate in accordance with DIN 55 350, Part 18. All viscometers are provided with ring marks. This ensures that viscometers for automatic mea-

surements can also be checked by means of manual measurements. The recommended minimum flowthrough time is 200s for absolute measurements of kinematic viscosity. For relative measurements (polymer analytics), the minimum flow time of 50s is allowed by ISO 1628-1 (depending on the capillary size).



Table with 8 columns: calibrated, with constant, for manual measurements; calibrated, with constant for manual measurements; automatic measurement with stand AVS®/SK-HV; v=K · t; K=v/t; t=v/K; Ubbelohde-Viskosimeter (DIN); Type No.; Order No.; Capillary No. acc. DIN; Capillary Ø i ± 0,01 [mm]; Constant K (approx.); Measuring range [mm²/s] (approx.). Rows list various models and their specifications.

2.3 Ubbelohde viscometers normal form (ASTM)



Viscometers with suspended level for determination of absolute and relative kinematic viscosity of liquids with Newtonian flow behavior. The calibrated viscometers are delivered with manufacturer's certificate in accordance with DIN 55 350, Part 18. All viscometers are provided with ring marks. This ensures that viscometers for automatic mea-

surements can also be checked by means of manual measurements. The recommended minimum flowthrough time is 200s for absolute measurements of kinematic viscosity. For relative measurements (polymer analytics), the minimum flow time of 50s is allowed by ISO 1628-1 (depending on the capillary size).

calibrated, with constant and calibration certificate for manual measurements		not calibrated, without calibration certificate for determination of relative Viscosity		calibrated, with constant and calibration certificate for automatic measurements		Ubbelohde Viscometer (ASTM)			
Type No.	Order No.	Type No.	Order No.	Type No.	Order No.	Capillary No.	Capillary Ø i ± 0,01 [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)
525 00	285400501	526 00	285400707	527 00	285401255	0	0.24	0.001	0.35 to 1
525 03	285400518	526 03	285400715	527 03	285401271	0C	0.36	0.003	0.6 to 3
525 01	285400526	526 01	285400723	527 01	285401263	0B	0.46	0.005	1 to 5
525 10	285400534	526 10	285400731	527 10	285401152	1	0.58	0.01	2 to 10
525 13	285400542	526 13	285400748	527 13	285401169	1C	0.78	0.03	6 to 30
525 11	285400550	526 11	285400750	527 11	285401170	1B	0.88	0,05	10 to 50
525 20	285400559	526 20	285400756	527 20	285401177	2	1.03	0.1	20 to 100
525 23	285400567	526 23	285400764	527 23	285401185	2C	1.36	0.3	60 to 300
525 30	285400575	526 30	285400772	527 30	285401193	3	1.83	1	200 to 1,000
525 33	285400583	526 33	285400789	527 33	285401288	3C	2.43	3	600 to 3,000
525 40	285400591	526 40	285400797	527 40	285401296	4	3.27	10	2,000 to 10,000
525 43	285400604	526 43	285400801	527 43	285401309	4C	4.32	30	6,000 to 30,000

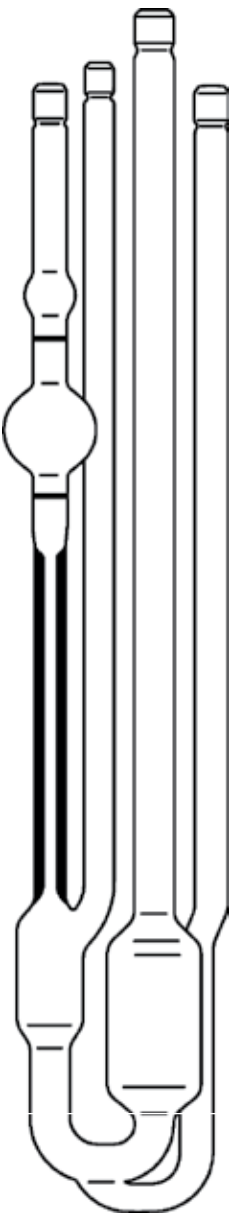
2.4 Ubbelohde viscometers, with additional tube and threads

Viscometers with suspended level for determination of absolute or relative kinematic viscosity. These viscometers are preferably used for automatic measurements. The additional filling and cleaning tube and the glass thread ensure safe operational use. The cali-

brated viscometers are delivered with manufacturer's certificate in accordance with DIN 55 350, Part 18. The ring marks present serve as auxiliary marks in case the viscometers must be checked by manual measurements.

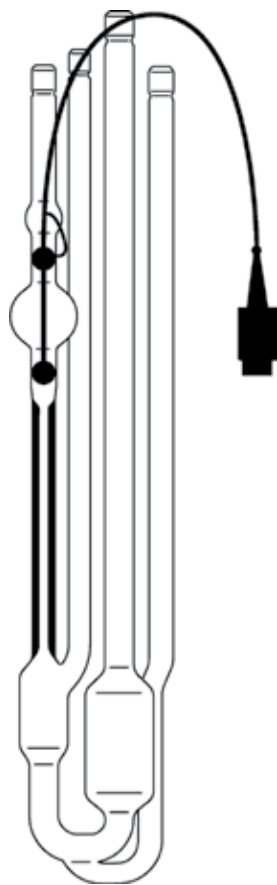
calibrated, with constant and calibration certificate for automatic measurements		Ubbelohde viscometer (DIN)			
		- in accordance with ISO 3105, DIN 53 000 Part 1 - filling quantity: 18 to 22 ml - overall length: approx. 290 mm			
Type No.	Order No.	Capillary No.	Capillary Ø i [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)
541 03	285401925	0c	0.47	0.003	0.5 to 3
541 01	285401917	0a	0.53	0.005	0.8 to 5
541 10	285401933	I	0.63	0.01	1.2 to 10
541 13	285401941	Ic	0.84	0.03	3 to 30
541 11	285401950	Ia	0.95	0.05	5 to 50
541 20	285401958	II	1.13	0.1	10 to 100
541 23	285401966	IIc	1.50	0.3	30 to 300
541 21	285408719	IIa	1,69	0,5	50 to 500
541 30	285401974	III	2.01	1	100 to 1,000
541 33	285401982	IIIc	2.65	3	300 to 3,000
541 40	285401999	IV	3.60	10	1,000 to 10,000
541 43	285402000	IVc	4,70	30	3.000 to 30,000

calibrated, with constant and calibration certificate for automatic measurements		Ubbelohde viscometer (ASTM)			
		- the technical measurement characteristics are in accordance with ISO 3105, ASTM D 446 - filling quantity: 15 to 22 ml - overall length: approx. 290 mm			
Type No.	Order No.	Capillary No. acc. ASTM	Capillary Ø i [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)
545 00	285402005	0	0.24	0.001	0.35 to 1
545 03	285402021	0C	0.36	0.003	0.6 to 3
545 01	285402013	0B	0.46	0.005	1 to 5
545 10	285402038	1	0.58	0.01	2 to 10
545 13	285402046	1C	0.78	0.03	6 to 30
545 11	285402042	1B	0.88	0.05	10 to 600
545 20	285402054	2	1.03	0.1	20 to 100
545 23	285402062	2C	1.36	0.3	60 to 300
545 30	285402079	3	1.83	1	200 to 1,000
545 33	285402087	3C	2.43	3	600 to 3,000
545 40	285402095	4	3.27	10	2,000 to 10,000
545 43	285402108	4C	4.32	30	6,000 to 30,000



Viscometers

2.5 Ubbelohde viscometers with TC sensors



Viscometers with suspended level for determination of absolute and relative kinematic viscosity of liquids with Newtonian flow behavior. The measuring levels are marked by TC sensors. The meniscus passage is detected due to the different conductivity of the liquid phase and the gas phase. A measurement stand of the type series AVS®/S is not required. TC viscometers can be used to determine the kinematic viscosity of all liquids with Newtonian flow behavior.

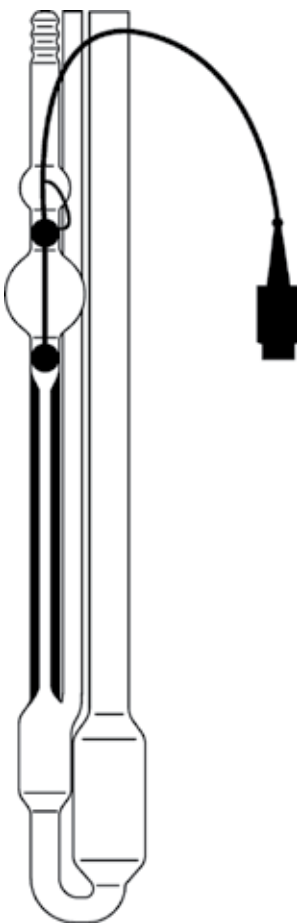
They are especially suitable for liquids that cannot be detected with other systems: opaque and/or black samples.

Due to the electrical properties of TC sensors, it is important to ensure that a suitable type is selected for the required application temperature.

TC viscometers with additional filling and cleaning tube and with glass thread

- the technical measurement characteristics are in accordance with DIN 53 000, part 1, ISO 3105
- for use in combination with an automatic viscosity measuring instrument
- filling quantity: 18 to 22 ml
- overall length: approx. 355 mm
- suitable bracket Type No. 05393, Order No. 285405035

calibrated, with constant and calibration certificate for automatic measurements						Capillary No.	Capillary Ø i [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)
Type No.	Order No.	Type No.	Order No.	Type No.	Order No.				
+ 10 to + 80 °C		- 40 to + 30 °C		+ 70 to + 150 °C					
562 03	285423120	-	-	-	-	0c	0,47	0,003	0,5 to 3
562 10	285423130	563 10	285423240	564 10	285423330	I	0,63	0,01	1,2 to 10
562 13	285423140	563 13	285423250	564 13	285423340	Ic	0,84	0,03	3 to 30
562 20	285423150	563 20	285423260	564 20	285423350	II	1,13	0,1	10 to 100
562 23	285423170	563 23	285423270	564 23	285423360	IIc	1,51	0,3	30 to 300
562 21	285423160	-	-	-	-	IIa	1,69	0,5	50 to 500
562 30	285423180	563 30	285423280	564 30	285423370	III	2,05	1	100 to 1.000
562 33	285423200	563 33	285423290	564 33	285423380	IIIc	2,7	3	300 to 3.000
562 31	285423190	-	-	-	-	IIIa	3,0	5	500 to 5.000
562 40	285423210	563 40	285423300	564 40	285423390	IV	3,7	10	1.000 to 10.000
562 43	285423230	563 43	285423320	564 43	285423400	IVc	4,9	30	3.000 to 20.000
562 41	285423220	563 41	285423310	-	-	IVa	5,3	50	5.000 to 30.000

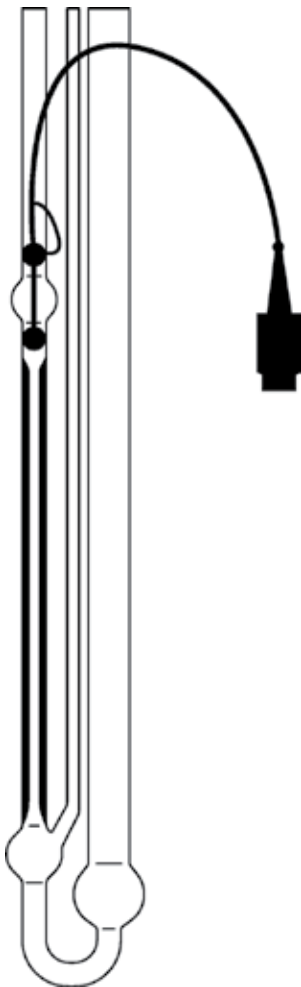


TC viscometers

- the technical measurement characteristics are in accordance with DIN 53 000, part 1, ISO 3105
- for use in combination with an automatic viscosity measuring instrument
- filling quantity: 15 to 20 ml
- overall length: ca. 355 mm
- suitable bracket Type No. 05393, Order No. 285405035

calibrated, with constant for automatic measurements						Capillary No.	Capillary Ø i [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)
Type No.	Order No.	Type No.	Order No.	Type No.	Order No.				
+ 10 to + 80 °C		- 40 to + 30 °C		+ 70 to + 150 °C					
567 03	285423420	-	-	-	-	0c	0,47	0.003	0,5 to 3
567 10	285423430	568 10	285423540	569 10	285423630	I	0,63	0,01	1,2 to 10
567 13	285423440	568 13	285423550	569 13	285423640	Ic	0,84	0,03	3 to 30
567 20	285423450	568 20	285423560	569 20	285423650	II	1,13	0,1	10 to 100
567 23	285423470	568 23	285423570	569 23	285423660	IIc	1,51	0,3	30 to 300
567 21	285423460	-	-	-	-	IIa	1,69	0,5	50 to 500
567 30	285423480	568 30	285423580	569 30	285423670	III	2,05	1	100 to 1.000
567 33	285423500	568 33	285423590	569 33	285423680	IIIc	2,7	3	300 to 3.000
567 31	285423490	-	-	-	-	IIIa	3,0	5	500 to 5.000
567 40	285423510	568 40	285423600	569 40	285423690	IV	3,7	10	1.000 to 10.000
567 43	285423530	568 43	285423620	569 43	285423700	IVc	4,9	30	3.000 to 20.000
567 41	285423520	568 41	285423610	-	-	IVa	5,3	50	5.000 to 30.000

2.6 Micro-Ubbelohde viscometers with TC sensors



Viscometers with suspended level for determination of absolute and relative kinematic viscosity of liquids with Newtonian flow behaviour. The measuring levels are marked by TC sensors. The meniscus passage is detected due to the different conductivity of the liquid phase and the gas phase. A measurement stand of the type series AVS®/S is not required. TC viscometers can be used to determine the kinematic viscosity of all liquids with Newtonian flow behaviour.

They are especially suitable for liquids that cannot be detected with other systems: opaque and/or black and/or electrically conductive measuring samples.

Due to the electrical properties of TC sensors, it is important to ensure that a suitable type is selected for the required application temperature.

Micro TC viscometers

- the technical measurement characteristics are in accordance with DIN 53 000, Part 1
- for use in combination with an automatic viscosity measuring instrument
- filling quantity: 3 to 4 ml
- overall length: approx. 350 mm
- suitable bracket Type No. 05393, Order No. 285405035

calibrated, with constant and calibration certificate for automatic measurements						Capillary No.	Capillary Ø i [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)
Type No.	Order No.	Type No.	Order No.	Type No.	Order No.				
+10 ... +80 °C		-40 ... +30 °C		+70 ... +150 °C					
572 10	285423710	573 10	285423780	574 10	285423850	M I	0,40	0,01	0,4 to 6
572 13	285423720	573 13	285423790	574 13	285423860	M Ic	0,52	0,03	1,2 to 18
572 20	285423730	573 20	285423800	574 20	285423870	M II	0,70	0,1	4 to 60
572 23	285423740	573 23	285423810	574 23	285423880	M Ilc	0,95	0,3	12 to 180
572 30	285423750	573 30	285423820	574 30	285423890	M III	1,26	1	40 to 800

2.7 Micro-Ubbelohde viscometers (DIN)



Viscometers with suspended level for determination of absolute and relative kinematic viscosity of liquids with Newtonian flow behavior. Due to their design, these viscometers are especially suitable for measurement of small liquid quantities and for particularly short running times.

ties and for particularly short running times.

All viscometers are provided with ring marks. This ensures that viscometers for automatic measurements can also be checked by means of manual measurements.

Micro-Ubbelohde viscometers (DIN)

The calibrated viscometers are delivered with manufacturer's certificate in accordance with DIN 55 350, Part 18.

- in accordance with DIN 53 000, Part 1
- filling quantity: 3 to 4 ml
- overall length: approx. 290 mm

calibrated, with constant and calibration certificate for manual measurement		calibrated, with constant and calibration certificate for automatic measurement		not calibrated, without calibration certificate; for determination of relative viscosity		Capillary No.	Capillary Ø i [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)
Type No.	Order No.	Type No.	Order No.	Type No.	Order No.				
536 10	285401009	537 10	285401103	538 10	285401206	M I	0,40	0,01	0,4 to 6
536 13	285401017	537 13	285401111	538 13	285401214	M Ic	0,52	0,03	1,2 to 18
536 11	285401050	537 11	285401150	538 11	285401220	M Ia	0,60	0,05	2 to 30
536 20	285401025	537 20	285401128	538 20	285401222	M II	0,70	0,1	4 to 60
536 23	285401033	537 23	285401136	538 23	285401239	M Ilc	0,95	0,3	12 to 180
536 21	285401030	537 21	285401130	538 21	285401230	M IIa	1,07	0,5	20 to 300
536 30	285401041	537 30	285401144	538 30	285401247	M III	1,26	1	40 to 800

Viscometers for dilution viscometry

Viscometers with suspended level designed according to the principle of the Ubbelohde viscometers for determination of the limit viscosity number of polymers. The limit viscosity number can be determined automatically in

combination with one of our piston burettes TITRONIC® 300 or TITRONIC® 500.

- filling quantity: 15 to 75 ml
- overall length: approx. 290 mm

not calibrated without calibration certificate Model with glass filter and discharge tube on request		Capillary No.	Capillary Ø i [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)
Type No.	Order No.				
531 00	285401403	0	0,36	0,001	0,35 to 0,6
531 03	285401428	0c	0,47	0,003	0,5 to 2
531 01	285401411	0a	0,53	0,005	0,8 to 3
531 10	285401436	I	0,64	0,01	1,2 to 6
531 13	285401444	Ic	0,84	0,03	3 to 20
531 20	285401452	II	1,15	0,1	10 to 60

2.8 Cannon-Fenske viscometers



- Cannon-Fenske routine viscometers
- comply with standards ISO 3105, BS 188 and ASTM D446 with respect to technical measuring specifications.
 - are suitable for all Newtonian liquids with a viscosity of 0.35 to 20,000 mm²/s
 - the present design has a deepening in the lower bend. Accordingly, these viscometers mit Abfallsystem can also be used for automatic measurements.
 - filling quantity: approx. 7 to 10 ml
 - overall length: approx. 245 mm

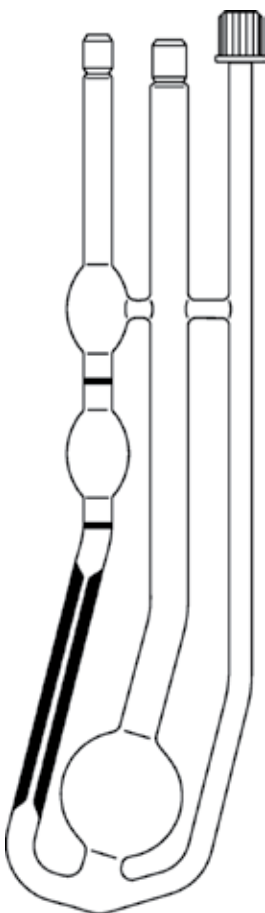
calibrated, with constant and calibration certificate for manual measurements		calibrated, with constant and calibration certificate for automatic measurements		Capillary No.	Capillary Ø i [mm]	Constant K (Richtwert)	Measuring range [mm²/s] (approx.)
Type No.	Order No.	Type No.	Order No.				
513 00	285403507	520 00	285403704	25	0,30	0,002	0,4 to 1,6
513 03	285403515	520 03	285403712	50	0,44	0,004	0,8 to 3,2
513 01	285403523	520 01	285403729	75	0,54	0,008	1,6 to 6,4
513 10	285403531	520 10	285403737	100	0,63	0,015	3 to 15
513 13	285403548	520 13	285403745	150	0,78	0,035	7 to 35
513 20	285403556	520 20	285403753	200	1,01	0,1	20 to 100
513 23	285403564	520 23	285403761	300	1,27	0,25	50 to 200
513 21	285403572	520 21	285403778	350	1,52	0,5	100 to 500
513 30	285403589	520 30	285403786	400	1,92	1,2	240 to 1.200
513 33	285403597	520 33	285403794	450	2,35	2,5	500 to 2.500
513 40	285403601	520 40	285403807	500	3,20	8	1.600 to 8.000
513 43	285403618	520 43	285403815	600	4,20	20	4.000 to 20.000



- Cannon-Fenske reverse flow viscometers
- Comply with standards ISO 3105, ASTM D 446 with respect to technical measuring specifications.
 - filling quantity: approx. 12 ml
 - overall length: approx. 295 mm

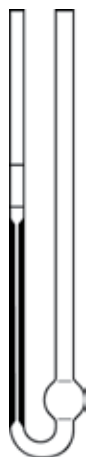
calibrated, with 3 ring marks, with 2 constants and calibration certificate, only for manual measurement		Capillary No.	Capillary Ø i [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)
Type No.	Order No.				
511 00	285403001	25	0,31	0,002	0,4 to 1,6
511 03	285403018	50	0,42	0,004	0,8 to 3,2
511 01	285403026	75	0,54	0,008	1,6 to 6,4
511 10	285403034	100	0,63	0,015	3 to 15
511 13	285403042	150	0,78	0,035	7 to 35
511 20	285403059	200	1,02	0,1	20 to 100
511 23	285403067	300	1,26	0,25	50 to 200
511 21	285403075	350	1,48	0,5	100 to 500
511 30	285403083	400	1,88	1,2	240 to 1200
511 33	285403091	450	2,20	2,5	500 to 2500
511 40	285403104	500	3,10	8	1.600 to 8.000
511 43	285403112	600	4,00	20	4.000 to 20.000

- Cannon-Fenske routine viscometers with additional tube and threads
- comply with standards ISO 3105, BS 188 with respect to technical measuring specifications. These viscometers are preferably used for automatic measurements. The additional filling and cleaning tube and the glass thread ensure safe operational use. The calibrated viscometers are delivered with manufacturer's certificate in accordance with DIN 55 350, Part 18.
- are suitable for all Newtonian liquids with a viscosity of 0.35 to 20,000 mm²/s.
 - filling quantity: approx. 7 to 12 ml
 - overall length: approx. 245 mm



calibrated, with constant and calibration certificate for automatic measurements		Capillary No.	Capillary Ø i [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)
Type No.	Order No.				
546 00	285402116	25	0,30	0,002	0,4 to 1,6
546 03	285402132	50	0,44	0,004	0,8 to 3,2
546 01	285402124	75	0,54	0,008	1,6 to 6,4
546 10	285402149	100	0,63	0,015	3 to 15
546 13	285402157	150	0,78	0,035	7 to 35
546 20	285402165	200	1,01	0,1	20 to 100
546 23	285402181	300	1,27	0,25	50 to 200
546 21	285402173	350	1,52	0,5	100 to 500
546 30	285402198	400	1,92	1,2	240 to 1.200
546 33	285402202	450	2,35	2,5	500 to 2.500
546 40	285402219	500	3,20	8	1.600 to 8.000
546 43	285402227	600	4,20	20	4.000 to 20.000

2.9 Ostwald viscometers



Ostwald viscometers

- filling quantity: 3 ml
- overall length: approx. 220 mm
- only available without calibration

with ring marks, without calibration certificate, for manual measurements		Capillary Ø i [mm]	Transit time for water ~ [s]	Constant K (approx.)	for use from [mm²/s] (approx.)
Type No.	Order No.				
509 03	285404006	0,3	250	0,004	0,3
509 04	285404014	0,4	75	0,01	1
509 05	285404022	0,5	30	0,03	2,5
509 06	285404039	0,6	15	0,07	5,5
509 07	285404047	0,7	10	0,1	10



Micro-Ostwald viscometers

- are suitable for measurements of small liquid quantities even with tendency to excessive foam formation.
- filling quantity: 2 ml
- overall length: approx. 290 mm

calibrated, with ring marks, with constant and calibration certificate for manual measurements		calibrated, with ring marks, with constant and calibration certificate for automatic measurements		not calibrated, without calibration certificate; for determination of relative viscosity		Capillary No.	Capillary Ø i [mm]	Constant K (approx.)	Measuring range [mm²/s] (approx.)
Type No.	Order No.	Type No.	Order No.	Type No.	Order No.				
516 10	285404203	517 10	285404306	518 10	285404409	I	0,43	0,01	0,4 bis 6
516 13	285404211	517 13	285404314	518 13	285404417	Ic	0,60	0,03	1,2 bis 18
516 20	285404228	517 20	285404322	518 20	285404425	II	0,77	0,1	4 bis 60
516 23	285404236	517 23	285404339	518 23	285404433	IIc	1,00	0,3	12 bis 180
516 30	285404244	517 30	285404347	518 30	285404441	III	1,36	1	40 bis 800

3 Accessories
3.1.1 Viscometers - Brackets and stands

Brackets and stands

All brackets and stands are designed to ensure that the viscometers are held vertically. They also protect the viscometers from breakage. The maximum deviation is < 1°.

In conjunction with Xylem Analytics Germany and other commercially available seethrough thermostats the viscometers can only be used with the appropriate stand or bracket.

For DIN Ubbelohde viscometers that are used as reference measuring standard, specifically modified bracket (VZ 5840, see below) must be used.

Brackets made of stainless steel
suitable for use with all Ubbelohde viscometers
for manual and automatic measurements

Type No.	Order No.
053 92	285405043
VZ 5840 (accessory for reference measuring standard)	285417201

suitable for use with Ubbelohde viscometers with TC sensors

Type No.	Order No.
053 93	285405035

suitable for use with Cannon-Fenske reverse flow viscometers
for manual measurements (not illustrated)

Type No.	Order No.
053 96	285405019

suitable for use with Micro-Ostwald viscometers
for manual and automatic measurements

Type No.	Order No.
053 97	285405027



Accessories

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