

# Viscosity & Flash Point Standards

## For Reference, Validation, and Calibration

Since 1938 CANNON Instrument Company has been a leader in viscosity measurement. We provide a broad range of viscosity standards and flash point reference materials to customers across various industries. Our standards calibrate and verify the performance of glass capillary viscometers, automated kinematic viscometers, rotational viscometers, falling ball viscometers, cup viscometers and flash point testers.


### Viscosity Reference Standards


- General Purpose
- High Viscosity
- High Temperature (HTHS)
- Low Temperature (TESC, CCS, CMRV)
- SimpleVIS®
- Silicone
- Tapered Bearing Simulator
- Thomas®-Stormer®
- Flow Cup


### Certified Viscosity Check Oils

### Flash Point Reference Materials



 <b>CANNON</b> INSTRUMENT COMPANY®	
<b>CERTIFIED VISCOSITY REFERENCE STANDARD</b>	
All data are traceable to the National Institute for Standards and Technology	
Mfg. Date 04/03/18	Viscosity Std N100
Use Before 04/30/20	Net Contents 1 Liter
Lot Number 18201	

 <b>CANNON</b> INSTRUMENT COMPANY®	
<b>CERTIFIED VISCOSITY REFERENCE STANDARD</b>	
All data are traceable to the National Institute for Standards and Technology	
Mfg. Date 04/03/18	Viscosity Std N100
Use Before 04/30/20	Net Contents 500 mL
Lot Number	

 <b>CANNON</b> INSTRUMENT COMPANY®	
<b>AZLA Accredited</b>	
ISO 17025 Certificate #1282.01 For Technical Competence in Calibration	
<b>CERTIFIED VISCOSITY REFERENCE STANDARD</b>	
Mfg. Date 04/03/18	Viscosity Std N100
Use Before 04/30/20	Lot Number 18201
Temperature °C	Kin. Visc. mm <sup>2</sup> /s
20.00	89.00
25.00	72.93
30.00	60.86
35.00	52.78
40.00	46.88
45.00	42.15
50.00	38.58
55.00	35.15
60.00	32.85
65.00	30.65
70.00	28.55
75.00	26.55
80.00	24.65
85.00	22.85
90.00	21.15
95.00	19.65
100.00	18.35
105.00	17.20
110.00	16.15
115.00	15.20
120.00	14.35
125.00	13.60
130.00	12.95
135.00	12.40
140.00	11.90
145.00	11.45
150.00	11.05
155.00	10.70
160.00	10.40
165.00	10.15
170.00	9.95
175.00	9.80
180.00	9.70
185.00	9.65
190.00	9.60
195.00	9.55
200.00	9.50
205.00	9.45
210.00	9.40
215.00	9.35
220.00	9.30
225.00	9.25
230.00	9.20
235.00	9.15
240.00	9.10
245.00	9.05
250.00	9.00
255.00	8.95
260.00	8.90
265.00	8.85
270.00	8.80
275.00	8.75
280.00	8.70
285.00	8.65
290.00	8.60
295.00	8.55
300.00	8.50
305.00	8.45
310.00	8.40
315.00	8.35
320.00	8.30
325.00	8.25
330.00	8.20
335.00	8.15
340.00	8.10
345.00	8.05
350.00	8.00
355.00	7.95
360.00	7.90
365.00	7.85
370.00	7.80
375.00	7.75
380.00	7.70
385.00	7.65
390.00	7.60
395.00	7.55
400.00	7.50
405.00	7.45
410.00	7.40
415.00	7.35
420.00	7.30
425.00	7.25
430.00	7.20
435.00	7.15
440.00	7.10
445.00	7.05
450.00	7.00
455.00	6.95
460.00	6.90
465.00	6.85
470.00	6.80
475.00	6.75
480.00	6.70
485.00	6.65
490.00	6.60
495.00	6.55
500.00	6.50
505.00	6.45
510.00	6.40
515.00	6.35
520.00	6.30
525.00	6.25
530.00	6.20
535.00	6.15
540.00	6.10
545.00	6.05
550.00	6.00
555.00	5.95
560.00	5.90
565.00	5.85
570.00	5.80
575.00	5.75
580.00	5.70
585.00	5.65
590.00	5.60
595.00	5.55
600.00	5.50
605.00	5.45
610.00	5.40
615.00	5.35
620.00	5.30
625.00	5.25
630.00	5.20
635.00	5.15
640.00	5.10
645.00	5.05
650.00	5.00
655.00	4.95
660.00	4.90
665.00	4.85
670.00	4.80
675.00	4.75
680.00	4.70
685.00	4.65
690.00	4.60
695.00	4.55
700.00	4.50
705.00	4.45
710.00	4.40
715.00	4.35
720.00	4.30
725.00	4.25
730.00	4.20
735.00	4.15
740.00	4.10
745.00	4.05
750.00	4.00
755.00	3.95
760.00	3.90
765.00	3.85
770.00	3.80
775.00	3.75
780.00	3.70
785.00	3.65
790.00	3.60
795.00	3.55
800.00	3.50
805.00	3.45
810.00	3.40
815.00	3.35
820.00	3.30
825.00	3.25
830.00	3.20
835.00	3.15
840.00	3.10
845.00	3.05
850.00	3.00
855.00	2.95
860.00	2.90
865.00	2.85
870.00	2.80
875.00	2.75
880.00	2.70
885.00	2.65
890.00	2.60
895.00	2.55
900.00	2.50
905.00	2.45
910.00	2.40
915.00	2.35
920.00	2.30
925.00	2.25
930.00	2.20
935.00	2.15
940.00	2.10
945.00	2.05
950.00	2.00
955.00	1.95
960.00	1.90
965.00	1.85
970.00	1.80
975.00	1.75
980.00	1.70
985.00	1.65
990.00	1.60
995.00	1.55
1000.00	1.50

# CANNON Viscosity & Flash Point Standards

### Quality/Traceability

Use of high quality standards and reference materials ensures test reliability and accuracy. This is why the National Institute of Standards and Technology (NIST) delegated responsibility to CANNON for U.S. national standards for certified liquid viscosity reference standards in 2003.

All CANNON viscosity standards are traceable to a NIST calibration and prepared in our ISO 9001-registered, A2LA-accredited laboratory. CANNON Instrument Company holds ISO/IEC 17025 and Guide 34 accreditation (certificates 1262.01 and 1262.02) from A2LA for competency in manufacture and certification of reference materials. ISO/IEC 17025 accreditation further demonstrates our technical competence in calibration including the determination of kinematic and dynamic viscosity of standards as well as viscosity certification of customer samples. CANNON performs calibrations using the master viscometer procedures detailed in ASTM D2162.

### Formulation

Most CANNON viscosity standards are hydrocarbon oils produced from mineral oil base stocks, polyalphaolefins, or polybutenes but silicone standards are also available for the calibration of rotational viscometers. Because most CANNON viscosity standards are Newtonian liquids, their viscosity is independent of shear stress or shear rate. However, "viscous heating" may cause high viscosity standards to appear non-Newtonian by effectively lowering their viscosity when measured at high shear rates.

CANNON flash point standards in the lower flash point range are made from high purity alkane

materials. Those in the higher flash point range are made from narrow distributions of decane oligomers.

### Custom Blends and Added Temperatures

To meet customer-specific needs, CANNON offers testing at additional temperatures for many of our standards. Contact us for additional information and pricing. We can also blend custom standards to your temperature and viscosity specifications. CANNON custom standards are subject to the same stringent quality control as stock standards listed in our catalog. When ordering custom standards please state the acceptable kinematic or dynamic viscosity range and temperature(s) required. Also specify whether density data is required. Custom standards are quoted based on customer-specific formulation and testing requirements. Standards will be blended within  $\pm 5\%$  of the customer specified target.



## A Note Regarding Values Provided in This Document

The tables on the following pages provide nominal viscosity and flash point values for standards and reference materials supplied by CANNON Instrument Company. Actual values, provided with each standard, may vary slightly from lot to lot. Formulations are also subject to change. If your application requires close conformity with published nominal values, please contact CANNON to obtain the actual viscosity values associated with the current formulation.

# CANNON Viscosity & Flash Point Standards

## Container Sizes

The default container size for CANNON viscosity standards is a 500 mL (pint) bottle but other container sizes are also available. The table below indicates a suffix that is appended to the base catalog number to designate a particular container size when ordering. EXAMPLE: The catalog number/suffix combination for an N35 General Purpose Viscosity Standard (catalog #9727-C37) in a 1 liter container (suffix # .032) is 9727-C37.032.

### Catalog # Suffix for Container Sizes

U.S. Customary Units	Approximate Metric Unit Equivalent*	Catalog # Suffix
4 oz. Size	120 mL	.004
Pint Size	500 mL	.016
Quart Size	1 L	.032
Gallon Size	4 L	.128
5-Gallon Size	20 L	.500

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

Default container sizes for Certified Viscosity Check Oils are 1 L (quart) and 3.8 L (gallon). Default container sizes for Flash Point Reference Materials and Silicone Viscosity Standards are 200 mL and 500 mL respectively.

## CANNON Bath Oils

In addition to viscosity standards, CANNON also supplies a wide selection of silicone bath oils. Silicone bath oils are clear, colorless liquids that can be used as heat transfer media in CANNON automated viscometers and some high-temperature CANNON baths where IBF fluid is not effective. Three viscosity grades of silicone bath fluid are available for different temperature/viscosity ranges. 10 cSt oil is recommended for use from 25 °C to 100 °C. 20 cSt oil is recommended for use from 80 °C to 135 °C. 50 cSt oil is recommended for use from 135 °C to 150 °C. IBF is an ideal bath oil for CANNON heated baths with applications at ambient temperature and above. IBF Bath Oil contains an oxidation inhibitor which reduces tendency to darken at higher temperatures. Viscosity value is 36 cSt at 40 °C and 5.6 cSt at 100 °C. This bath oil is recommended only for applications below 135 °C (275 °F).



# CANNON General Purpose Viscosity Standards

ASTM D445/D446

Tables 1-3 provide nominal values for kinematic viscosity in mm<sup>2</sup>/s (cSt), dynamic viscosity in mPa·s (cP) and density in g/mL for CANNON General Purpose Viscosity Standards. All CANNON General Purpose Viscosity Standards meet the precision specifications of ASTM D445/D446 and ISO 3104/3105. Lot specific data is provided with each standard.

Table 1 • Nominal Kinematic Viscosity Values of General Purpose Viscosity Standards in mm<sup>2</sup>/s (cSt)

Catalog Number	Viscosity Standard	-40 °C/ -40 °F	-20 °C/ -4 °F	20 °C/ 68 °F	25 °C/ 77 °F	37.78 °C/ 100 °F	40 °C/ 104 °F	50 °C/ 122 °F	60 °C/ 140 °F	80 °C/ 176 °F	98.89 °C/ 210 °F	100 °C/ 212 °F	SUS 100 °F	SUS 210 °F	SFS 122 °F
9727-C10	N.4†	—	—	0.47	0.45	0.41	0.40	—	—	—	—	—	—	—	—
9727-C15	N.8†	—	—	0.74	0.70	0.61	0.60	—	—	—	—	—	—	—	—
9727-C20	N1.0†	—	2.5	1.3	1.2	1.0	0.97	0.91	—	—	—	—	—	—	—
9727-C22	N2	—	—	2.9	2.6	2.1	2.0	1.7	—	1.1	0.95	0.93	—	—	—
9727-C25	S3	80	—	4.6	4.0	3.0	2.9	2.4	—	1.5	1.2	1.2	—	—	—
9727-C27	N4	—	—	6.7	5.8	4.2	4.0	3.2	—	1.9	1.5	1.5	—	—	—
9727-C30	S6	—	—	11	8.9	6.0	5.7	4.4	—	2.4	1.8	1.8	—	—	—
9727-C31	N7.5	—	—	14	12	8.0	7.5	5.8	—	3.1	2.3	2.3	—	—	—
9727-C32	N10	—	—	21	17	11	10	7.3	—	3.5	2.5	2.4	—	—	—
9727-C34	N14	1,700	—	30	25	15	14	10	—	5.0	3.5	3.4	—	—	—
9727-C35	S20	—	—	44	34	20	18	13	—	5.6	3.9	3.8	100	—	—
9727-C36	N26	—	—	57	46	27	25	18	—	7.9	5.3	5.2	130	—	—
9727-C37	N35	—	—	87	66	35	32	21	—	8.5	5.4	5.3	170	—	—
9727-C38	N44	—	—	110	86	48	44	30	—	12	7.7	7.5	220	—	—
9727-C40	S60	—	—	160	120	60	54	35	—	12	7.7	7.5	280	—	—
9727-C41	N75	—	—	200	150	82	75	50	—	19	12	12	380	—	—
9727-C42	N100	—	—	330	230	110	97	60	—	19	11	11	500	—	—
9727-C43	N140	—	—	400	300	160	140	90	—	31	19	18	720	—	—
9727-C45	S200	—	—	550	410	200	180	120	—	40	24	23	950	112	—
9727-C46	N250	—	—	770	570	280	250	160	—	51	30	29	1,300	140	—
9727-C47	N350	—	—	970	710	350	310	190	—	60	34	32	1,620	160	—
9727-C48	N415	—	—	1,400	990	470	420	250	—	77	43	41	2,180	200	—
9727-C50	S600	—	—	1,740	1,200	600	520	300	—	92	50	49	—	240	150
9727-C51	N750	—	—	2,600	1,900	850	750	440	—	130	68	66	—	—	—
9727-C52	N1000	—	—	3,400	2,400	—	940	550	350	150	—	80	—	—	—
9727-C53	N1400	—	—	5,100	3,600	—	1,400	820	510	220	—	120	—	—	—
9727-C55	S2000	—	—	8,300	5,300	1,900	1,600	800	—	160	75	72	—	360	—
9727-C56	N2500	—	—	10,400	7,000	—	2,500	1,300	750	290	—	140	—	—	—
9727-C57	N4000	—	—	20,000	12,000	—	3,400	1,600	850	290	—	120	—	—	—
9727-C58	N5100	—	—	28,000	18,000	—	5,100	2,500	1,300	420	—	170	—	—	—
9727-C60	S8000	—	—	41,000	25,000	8,000	6,700	3,200	—	530	—	215	—	—	—
9727-C61	N10200	—	—	58,000	36,000	—	10,200	4,900	2,500	775	—	300	—	—	—
9727-C62	N15000	—	—	77,000	47,000	—	13,000	6,100	3,000	980	—	360	—	—	—
9727-C63	N18000	—	—	103,000	64,000	—	18,000	8,500	4,300	1,320	—	500	—	—	—
9727-C65	S30000	—	—	—	79,000	27,000	22,000	11,000	—	1,700	—	630	—	—	—

† Incurs additional shipping charges due to low flash point

## CANNON General Purpose Viscosity Standards

ASTM D445/D446

Tables 1-3 provide nominal values for kinematic viscosity in mm<sup>2</sup>/s (cSt), dynamic viscosity in mPa·s (cP) and density in g/mL for CANNON General Purpose Viscosity Standards. All CANNON General Purpose Viscosity Standards meet the precision specifications of ASTM D445/D446 and ISO 3104/3105. Lot specific data is provided with each standard.

Table 2 • Nominal Dynamic Viscosity Values of General Purpose Viscosity Standards in mPa·s (cP)

Catalog Number	Viscosity Standard	-40 °C/ -40 °F	-20 °C/ -4 °F	20 °C/ 68 °F	25 °C/ 77 °F	37.78 °C/ 100 °F	40 °C/ 104 °F	50 °C/ 122 °F	60 °C/ 140 °F	80 °C/ 176 °F	98.89 °C/ 210 °F	100 °C/ 212 °F
9727-C10	N.4†	—	—	0.32	0.30	0.28	0.27	—	—	—	—	—
9727-C15	N.8†	—	—	0.64	0.60	0.52	0.51	—	—	—	—	—
9727-C20	N1.0†	—	2	0.93	0.86	0.72	0.70	0.62	—	—	—	—
9727-C22	N2	—	—	2.2	2.0	1.6	1.5	1.3	—	0.85	0.66	0.65
9727-C25	S3	—	—	3.9	3.3	2.5	2.4	1.9	—	1.2	0.90	0.90
9727-C27	N4	—	—	5.2	4.5	3.3	3.1	2.5	—	1.4	1.1	1.1
9727-C30	S6	—	—	10	8.0	5.3	5.0	3.8	—	2.0	1.5	1.5
9727-C31	N7.5	—	—	11	9.5	6.3	5.9	4.5	—	2.4	1.7	1.7
9727-C32	N10	—	—	21	16	9.5	8.8	6.3	—	2.9	2.1	2.0
9727-C34	N14	1,400	—	24	20	12	11	8.2	—	3.8	2.7	2.6
9727-C35	S20	—	—	37	29	17	15	11	—	4.6	3.0	3.0
9727-C36	N26	—	—	47	37	22	20	14	—	6.2	4.1	4.0
9727-C37	N35	—	—	75	56	30	27	18	—	7.1	4.5	4.4
9727-C38	N44	—	—	92	71	39	36	24	—	9.5	6.0	5.9
9727-C40	S60	—	—	141	104	52	47	30	—	10	6.4	6.2
9727-C41	N75	—	—	170	125	68	61	41	—	16	9.5	9.2
9727-C42	N100	—	—	283	202	95	84	52	—	16	9.5	9.2
9727-C43	N140	—	—	340	250	130	120	74	—	25	15	14
9727-C45	S200	—	—	460	340	170	150	98	—	31	18	18
9727-C46	N250	—	—	650	480	230	210	130	—	41	23	23
9727-C47	N350	—	—	820	600	300	260	150	—	49	25	25
9727-C48	N415	—	—	1,200	830	390	350	210	—	62	34	33
9727-C50	S600	—	—	1,500	1,100	490	450	260	—	75	40	39
9727-C51	N750	—	—	2,200	1,600	710	620	370	—	100	55	53
9727-C52	N1000	—	—	2,900	2,000	—	800	460	280	120	—	65
9727-C53	N1400	—	—	4,300	3,000	—	1,200	680	420	180	—	92
9727-C55	S2000	—	—	7,300	4,700	1,700	1,400	700	—	140	62	59
9727-C56	N2500	—	—	9,000	6,000	—	2,100	1,100	630	240	—	110
9727-C57	N4000	—	—	17,000	11,000	—	2,900	1,400	730	250	—	100
9727-C58	N5100	—	—	25,000	16,000	—	4,500	2,100	1,100	360	—	140
9727-C60	S8000	—	—	33,000	20,000	7,000	5,900	2,800	—	450	—	200
9727-C61	N10200	—	—	52,000	32,000	—	9,000	4,200	2,100	660	—	250
9727-C62	N15000	—	—	68,000	41,000	—	11,000	5,400	2,600	840	—	320
9727-C63	N18000	—	—	92,000	57,000	—	16,000	7,500	3,800	1,140	—	420
9727-C65	S30000	—	—	—	71,000	23,000	20,000	9,300	—	1,400	—	540

† Incurs additional shipping charges due to low flash point.

# CANNON General Purpose Viscosity Standards

ASTM D445/446

Tables 1-3 provide nominal values for kinematic viscosity in mm<sup>2</sup>/s (cSt), dynamic viscosity in mPa·s (cP) and density in g/mL for CANNON General Purpose Viscosity Standards. All CANNON General Purpose Viscosity standards meet the precision specifications of ASTM D445/D446 and ISO 3104/3105. Lot specific data is provided with each standard.

Table 3 • Nominal Density Values of General Purpose Viscosity Standards in g/mL

Catalog Number	Viscosity Standard	20 °C/ 68 °F	25 °C/ 77 °F	37.78 °C/ 100 °F	40 °C/ 104 °F	50 °C/ 122 °F	60 °C/ 140 °F	80 °C/ 176 °F	98.89 °C/ 210 °F	100 °C/ 212 °F
9727-C10	N.4†	0.669	0.664	0.652	0.65	—	—	—	—	—
9727-C15	N.8†	0.867	0.862	0.851	0.849	—	—	—	—	—
9727-C20	N1.0†	0.73	0.726	0.717	0.715	0.707	—	—	—	—
9727-C22	N2	0.762	0.758	0.749	0.748	0.741	—	0.719	0.706	0.705
9727-C25	S3	0.868	0.864	0.855	0.854	0.847	—	0.826	0.812	0.811
9727-C27	N4	0.787	0.783	0.775	0.773	0.767	—	0.746	0.734	0.733
9727-C30	S6	0.878	0.874	0.866	0.864	0.858	—	0.837	0.824	0.823
9727-C31	N7.5	0.801	0.798	0.789	0.788	0.781	—	0.761	0.749	0.748
9727-C32	N10	0.884	0.881	0.872	0.871	0.864	—	0.844	0.832	0.831
9727-C34	N14	0.812	0.809	0.801	0.8	0.793	—	0.774	0.762	0.761
9727-C35	S20	0.863	0.86	0.852	0.85	0.844	—	0.824	0.812	0.811
9727-C36	N26	0.82	0.817	0.809	0.808	0.801	—	0.783	0.771	0.77
9727-C37	N35	0.868	0.864	0.856	0.854	0.849	—	0.83	0.818	0.817
9727-C38	N44	0.828	0.825	0.817	0.816	0.809	—	0.791	0.779	0.778
9727-C40	S60	0.876	0.873	0.865	0.863	0.857	—	0.838	0.826	0.825
9727-C41	N75	0.833	0.83	0.822	0.82	0.814	—	0.796	0.785	0.784
9727-C42	N100	0.882	0.879	0.871	0.87	0.863	—	0.845	0.833	0.832
9727-C43	N140	0.838	0.835	0.827	0.826	0.819	—	0.801	0.79	0.789
9727-C45	S200	0.84	0.837	0.829	0.827	0.821	—	0.803	0.792	0.791
9727-C46	N250	0.842	0.839	0.831	0.83	0.824	—	0.806	0.795	0.794
9727-C47	N350	0.843	0.84	0.833	0.831	0.825	—	0.808	0.797	0.796
9727-C48	N415	0.846	0.843	0.835	0.834	0.828	—	0.81	0.799	0.798
9727-C50	S600	0.847	0.844	0.836	0.835	0.829	—	0.811	0.8	0.799
9727-C51	N750	0.849	0.846	0.838	0.837	0.831	—	0.813	0.802	0.801
9727-C52	N1000	0.85	0.847	—	0.838	0.832	0.826	0.814	—	0.802
9727-C53	N1400	0.851	0.848	—	0.839	0.833	0.827	0.815	—	0.804
9727-C55	S2000	0.877	0.874	0.867	0.865	0.86	-	0.842	0.832	0.831
9727-C56	N2500	0.866	0.863	—	0.854	0.849	0.843	0.832	—	0.820
9727-C57	N4000	0.883	0.88	—	0.872	0.866	0.86	0.85	—	0.838
9727-C58	N5100	0.886	0.883	—	0.875	0.87	0.864	0.853	—	0.842
9727-C60	S8000	0.89	0.888	0.881	0.879	0.874	—	0.858	—	0.847
9727-C61	N10200	0.891	0.888	—	0.88	0.874	0.869	0.858	—	0.847
9727-C62	N15000	0.894	0.891	—	0.823	0.877	0.872	0.861	—	0.85
9727-C63	N18000	0.895	0.892	—	0.884	0.879	0.873	0.863	—	0.852
9727-C65	S30000	—	0.894	0.887	0.886	0.881	—	0.865	—	0.854

† Incurs additional shipping charges due to low flash point.

# CANNON High Viscosity Standards

ASTM D2170, ASTM D2171

## High Viscosity Standards

CANNON High Viscosity Standards cover viscosity ranges of particular interest for asphalt and polymer applications. Specifically ASTM D2170, Kinematic Viscosity of Asphalts (Bitumens) and ASTM D2171, Viscosity of Asphalts by Vacuum Capillary Viscometer. Lot specific kinematic viscosity data in mm<sup>2</sup>/s (cSt) and dynamic viscosity data in mPa·s (cP) is provided with each standard as appropriate. Nominal values are shown in Table 4.

Table 4 • Nominal Viscosity Values of High Viscosity Standards

Catalog Number	Viscosity Standard	Dynamic Viscosity in mPa·s (cP)					Kinematic Viscosity mm <sup>2</sup> /s (cSt)		
		20 °C/ 68 °F	25 °C/ 77 °F	40 °C/ 104 °F	60 °C/ 140 °F	135 °C/ 275 °F	60 °C/ 140 °F	100 °C/ 212 °F	135 °C/ 275 °F
9727-E10	N600†	—	1,100	—	160	15	200	—	22
9727-C52	N1000*†	2900	2,000	800	280	—	350	80	—
9727-E15	N2000†	—	4,900	—	380	21	440	—	26
9727-C57	N4000*†	17,000	11,000	2,900	730	—	850	120	—
9727-E20	N8000†	—	20,000	—	1,400	—	1,600	—	—
9727-C62	N15000*†	68,000	41,000	11,000	2,600	—	3,000	360	—
9727-E25	N30000†	120,000	70,000	—	4,700	—	5,400	—	—
9727-E27	N62000	—	200,000	—	13,000	—	—	1,600	—
9727-E29	N150000	—	420,000	—	24,000	—	—	3,000	—
9727-E30	N190000	840,000	520,000	140,000	33,000	—	—	4,000	—
9727-E35	N450000	—	1,600,000	—	100,000	2,350	—	—	—
9727-E40	N2700000	—	5,300,000	—	340,000	—	—	—	—
9727-E42	N2700000SP	Dynamic Shear Rheometer (DSR) standard at 52 °C, 58 °C, 64 °C, 70 °C and 76 °C. Available in a 55 mL bottle only.							

\* Viscosity data for additional temperatures provided with these standards are listed in Tables 1 and 2.

† Density values provided at all test temperatures.



## CANNON High Temperature High Shear Viscosity Standards

ASTM D4683, ASTM D4741, ASTM D5481, ASTM D6616

### High Temperature (HTHS) Viscosity Standards

CANNON High Temperature Viscosity Standards are produced in accordance with ASTM D5481, Apparent Viscosity at High-Temperature and High-Shear Rate by Multicell Capillary Viscometer and ASTM D4741, Viscosity at High Temperature and High Shear Rate by Tapered Plug Viscometer. Lot specific viscosity data in mPa·s (cP) is provided with each standard. Nominal values are shown in Table 5.

Table 5: Nominal Viscosity Values of High-Temperature HTHS Viscosity Standards

Catalog Number	Viscosity Standard	Type	Dynamic Viscosity in mPa.s (cP)			Applicable ASTM Method(s)
			80 °C	100 °C	150 °C	
9727-U45	HT22 *	Newtonian	—	3.5	1.5	D5481
9727-U50	HT39 *	Newtonian	—	4.7	2.0	D5481
9727-U55	HT75 *	Newtonian	—	7.0	2.7	D5481
9727-U60	HT150 *	Newtonian	—	10.5	3.7	D5481
9727-U65	HT240 *	Newtonian	—	15.4	5.0	D5481
9727-U70	HT390 *	Newtonian	—	23.5	7.0	D5481
9727-U92	HTNN-1 †	Non-Newtonian	—	—	3.6	D5481   D4741   D4683
9727-U94	HTNN-2 †	Non-Newtonian	—	—	3.1	D5481   D4741   D4683
9727-R05.032	HT22 *¥	Newtonian	—	3.5	1.5	D4741
9727-R10.032	RL 102 *¥‡	Newtonian	8.4	4.1	1.8	D4741
9727-R15.032	RL 103 *¥‡	Newtonian	12.8	6.1	2.4	D4741
9727-R20.032	RL 104 *¥‡	Newtonian	18.0	9.8	3.6	D4741
9727-R25.032	RL 105 *¥‡	Newtonian	25.5	12.8	4.4	D4741
9727-R30.032	RL 106 *¥‡	Newtonian	26.9	15.3	5.2	D4741
9727-R35.032	RL 107 * ¥‡	Newtonian	36.8	17.4	5.8	D4741
9727-R62.032	RL 232 †¥	Non-Newtonian	—	6.2	3.2	D5481   D4741   D4683
9727-P10	R-100 *‡	Newtonian	3.5	2.4	1.2	D4683
9727-P15	R-200/R-2200 *‡	Newtonian	5.1	3.4	1.5	D4683   D6616
9727-P20	R-300/R-2300 *‡	Newtonian	8.0	4.8	1.8	D4683   D6616
9727-P25	R-350/R-2350 *‡	Newtonian	12.5	7.2	2.7	D4683   D6616
9727-P30	R-400/R-2400 *‡	Newtonian	18.1	10.0	3.6	D4683   D6616
9727-P35	R-450/R-2450 *‡	Newtonian	24.0	13.5	4.1	D4683   D6616
9727-P40	R-500 *‡	Newtonian	27.0	14.5	5.0	D4683
9727-P45	R-600 *‡	Newtonian	46.0	23.5	7.0	D4683

\* Density values provided at test temperatures

† Data provided at an apparent shear rate of  $1 \times 10^6 \text{ s}^{-1}$

¥ Sold in a 1 liter can only

^ Sold in 0.5 liter, 1 liter and 4 liter sizes

‡ Viscosity data also provided at 40 °C and 120 °C





# CANNON Low Temperature Viscosity Standards

ASTM D2983, SAE J300

## Low Temperature Viscosity Standards (General Purpose, CCS and CMRV)

CANNON Low Temperature Viscosity Standards verify viscometer performance at sub-zero temperatures. These standards are applicable to SAE Specification J300 as well as a variety of ASTM Methods including:

- ASTM D2983, Low-Temperature Viscosity of Lubricants Measured by Brookfield Viscometer
- ASTM D3829, Predicting the Borderline Pumping Temperature of Engine Oil
- ASTM D4684, Determination of Yield Stress and Apparent Viscosity of Engine Oils at Low Temperature
- ASTM D6821, Low Temperature Viscosity of Drive Line Lubricants in a Constant Shear Stress Viscometer
- ASTM D6896, Determination of Yield Stress and Apparent Viscosity of Used Engine Oils at Low Temperature
- ASTM D5293, Apparent Viscosity of Engine Oils and Base Stocks Between -5 °C and -35 °C Using Cold-Cranking Simulator

The General Purpose Low Temperature Viscosity Standards in Table 6 are applicable to a variety of applications, such as testing the viscosity of gear oils (SAE 70W, 75W, 80W and 85W) and automatic transmission fluids (ATF) per ASTM D2983 and SAE J300 with CANNON's Thermoelectric Sample Conditioner System (TESC). Lot specific viscosity data is provided with each standard. Nominal viscosity values are shown in Table 6.

Table 6 • Nominal Viscosity Values of General Purpose Low Temperature Viscosity Standards

Catalog Number	Viscosity Standard	Approximate Viscosity in mm <sup>2</sup> /s (cSt) /mPa·s (cP) except where noted												
		-55 °C/ -67 °F	-40 °C/ -40 °F	-34 °C/ -30 °F	-29 °C/ -20 °F	-26 °C/ -15 °F	-25 °C/ -13 °F	-23 °C/ -10 °F	-20 °C/ -4 °F	-18 °C/ 0 °F	-12 °C/ 10 °F	-10 °C/ 14 °F	-7 °C/ 20 °F	0 °C/ 32 °F
9727-G10	N27B†	—	24,000/ 20,000	12,000/ 10,000	6,100/ 5,200	4,500/ 4,000	—	3,500/ 3,000	—	2,000/ 1,700	—	—	—	—
9727-G12	N27C†	—	45,000/ 40,000	22,000/ 20,000	12,000/ 10,000	8,000/ 7,000	—	6,100/ 5,000	—	3,500/ 3,000	—	—	—	—
9727-G15	N115B†	—	—	—	160,000/ 140,000	110,000/ 95,000	—	75,000/ 65,000	—	37,000/ 30,000	20,000/ 17,000	—	12,000/ 9,500	—
9727-G25	N60B†	150,000 mPa·s (cP)	—	—	—	—	—	—	—	—	—	—	—	—
9727-G30	N120B†	—	150,000 mPa·s (cP)	—	—	—	—	—	—	—	—	—	—	—
9727-G35	N480B†	—	—	—	—	150,000 mPa·s (cP)	—	—	—	—	—	—	—	—
9727-G40	N1400B†	—	—	—	—	—	—	—	—	—	150,000 mPa·s (cP)	—	—	—
9727-G45	N2B	—	—	—	—	—	—	—	8 mm <sup>2</sup> /s (cSt) jet fuel standard	—	—	—	—	—
9727-G50	N74B	—	—	—	—	—	—	—	—	—	—	—	—	3,400 mPa·s (cP)
9727-G55	N38B†	—	—	—	—	—	—	—	—	—	—	4,200 mPa·s (cP)	—	—
9727-G60	N25B†	—	—	—	—	—	8,000 mPa·s (cP)	—	—	—	—	—	—	—
9727-G65	N14B†	—	17,000 mPa·s (cP)	—	—	—	—	—	—	—	—	—	—	—

†Density values provided at all test temperatures.



# CANNON Low Temperature Viscosity Standards

ASTM D5293, SAE J300

Low Temperature CCS Viscosity Standards are used for measuring dynamic viscosity (in cP or mPa·s) at temperatures from -5 °C to -40 °C. They are used to calibrate the CANNON Cold-Cranking Simulator (CCS) for oil testing per ASTM D5293, Apparent Viscosity of Engine Oils and Base Stocks Between -5 °C and -35 °C using Cold-Cranking Simulator and SAE Specification J300. Lot specific viscosity data in mPa·s (cP) is provided with each standard. Nominal viscosity values are shown in Table 7.

Table 7 • Nominal Viscosity Values (in mPa·s or cP) of Low Temperature CCS Viscosity Standards

Catalog Number	Viscosity Standard	-40 °C	-35 °C	-30 °C	-25 °C	-20 °C	-18 °C	-15 °C	-10 °C	-5 °C
9727-N02	CL080	1,430	850	—	—	—	—	—	—	—
9727-N04	CL090	1,930	1,150	—	—	—	—	—	—	—
9727-N06	CL100 (CL10)	2,450	1,450	875	—	—	—	—	—	—
9727-N07	CL110	2,880	1,680	1,030	—	—	—	—	—	—
9727-N08	CL120 (CL12)	3,580	2,050	1,230	775	—	—	—	—	—
9727-N09	CL130	4,580	2,600	1,550	975	—	—	—	—	—
9727-N10	CL140 (CL14)	6,380	3,550	2,080	1,300	775	675	—	—	—
9727-N11	CL150	7,830	4,310	2,500	1,530	950	—	—	—	—
9727-N12	CL160	10,300	5,580	3,200	1,900	1,200	1,000	—	—	—
9727-N13	CL170	12,000	6,430	3,650	2,180	1,330	—	850	—	—
9727-N14	CL190 (CL19)	15,900	8,380	4,680	2,750	1,680	1,400	1,080	—	—
9727-N16	CL200	21,100	10,900	6,030	3,500	2,130	—	1,330	875	—
9727-N18	CL220 (CL22)	—	13,600	7,380	4,230	2,550	2,050	1,600	1,030	—
9727-N20	CL240	—	16,900	9,100	5,180	3,050	—	1,900	1,230	—
9727-N22	CL250 (CL25)	—	20,000	10,700	6,000	3,500	2,880	2,180	1,380	—
9727-N24	CL260	—	—	13,100	7,300	4,300	—	2,650	1,680	—
9727-N26	CL280 (CL28)	—	—	16,500	9,080	5,280	4,300	3,200	2,030	—
9727-N28	CL300	—	—	20,700	11,300	6,480	—	3,880	2,430	—
9727-N30	CL320 (CL32)	—	—	26,500	14,300	8,150	6,600	4,850	3,000	—
9727-N31	CL340	—	—	—	17,000	9,580	—	5,650	3,480	—
9727-N32	CL380 (CL38)	—	—	—	20,800	11,600	9,330	6,800	4,180	2,650
9727-N33	CL420	—	—	—	—	14,000	—	8,180	4,950	—
9727-N34	CL480 (CL48)	—	—	—	—	17,400	13,700	10,100	6,000	3,780
9727-N35	CL530	—	—	—	—	22,000	—	12,500	7,500	—
9727-N36	CL600 (CL60)	—	—	—	—	—	20,300	15,700	9,300	5,700
9727-N37	CL680	—	—	—	—	—	—	19,400	11,300	—
9727-N38	CL740 (CL74)	—	—	—	—	—	—	—	12,600	7,650
9727-N43	Set of 20	Set of CCS-2050/2100 Low Temp Standards (includes CL080, CL090, CL100, CL110, CL120, CL130, CL140, CL150, CL160, CL190, CL220, CL250(2), CL280, CL320, CL380, CL480, CL600, CL170 and CL200)								

# CANNON Low Temperature & SimpleVIS® Viscosity Standards

ASTM D3829, ASTM D4684, ASTM D6821, ASTM D6896, SAE J300

The Low Temperature Viscosity Standards in Table 8 are designed for use with the CANNON Mini-Rotary Viscometer (CMRV) for:

- ASTM D3829, Predicting the Borderline Pumping Temperature of Engine Oil
- ASTM D4684, Determination of Yield Stress and Apparent Viscosity of Engine Oils at Low Temperature
- ASTM D6821, Low Temperature Viscosity of Drive Line Lubricants in a Constant Shear Stress Viscometer
- ASTM D6896, Determination of Yield Stress and Apparent Viscosity of Used Engine Oils at Low Temperature
- SAE Specification J300

Lot specific viscosity data is provided with each standard. Nominal viscosity values are shown in Table 8.

Table 8 • Nominal Viscosity Values of Low Temperature CMRV Viscosity Standards

Catalog Number	Viscosity Standard	Approximate Viscosity
9727-T10	N105B†	30,000 mPa·s (cP) at -20 °C CMRV viscosity standard 56,200 mPa·s (cP) at -25 °C CMRV viscosity standard
9727-T20	YS-30	Exhibits yield stress of 70 Pa ±35 Pa at -30 °C
9727-T25	YS-35	Exhibits yield stress of 70 Pa ±35 Pa at -35 °C

†Density values provided at all test temperatures.



## SimpleVIS® Viscosity Standards

CANNON SimpleVIS viscosity standards verify the performance of the CANNON SimpleVIS automated viscometer. Lot specific kinematic viscosity data is provided at 20 °C, 25 °C, 40 °C and 100 °C. Nominal values are shown in Table 9.

Table 9 • Nominal Viscosity Values of SimpleVIS Viscosity Standards

Catalog Number	Viscosity Standard	Approximate Viscosity in mm <sup>2</sup> /s (cSt)			
		20 °C/ 68 °F	25 °C/ 77 °F	40 °C/ 104 °F	100 °C/ 212 °F
03.5942.004	SV3	4.6	4	—	—
03.5946.004	SV20	44	34	—	—
03.5950.004	SV35	—	—	32	—
03.5954.004	SV350	—	—	310	32
03.5958.004	SV1400	—	—	—	120



## CANNON Silicone & Thomas®- Stormer® Viscosity Standards

### Silicone Viscosity Standards for Rotational Viscometers

CANNON Silicone Viscosity Standards are specifically formulated for use with rotational viscometers. Lot specific viscosity data in mPa·s (cP) at 20 °C, 23 °C, 24 °C, 25 °C, 26 °C, 27 °C and 40 °C is provided with each standard. Nominal values at 25 °C are shown in Table 10. Silicone Viscosity Standards are sold in 500 mL bottles. Note: CANNON Silicone Viscosity Standards are intended for use with rotational viscometers only. Silicone Viscosity Standards are not recommended for glass capillary viscometers (including vacuum viscometers), metal cup-type viscometers (such as ISO, Zahn, Ford and Shell cups), or any other viscometers providing kinematic viscosity—CANNON hydrocarbon-based oil standards should be used for these types of viscometers.

Table 10 • Nominal Viscosity Values of Silicone Viscosity Standards at 25 °C

Catalog Number	Viscosity Standard	Approximate Viscosity in mPa·s (cP) at 25 °C
9727-Z10	RT5†	4.6
9727-Z14	RT10†	9.4
9727-Z18	RT50†	48
9727-Z22	RT100†	96
9727-Z26	RT500†	480
9727-Z30	RT1000†	960
9727-Z34	RT5000†	4,800
9727-Z38	RT12500†	12,000
9727-Z42	RT30000†	29,000
9727-Z46	RT60000†	58,000
9727-Z50	RT100000†	97,000

†Density values provided at all test temperatures.

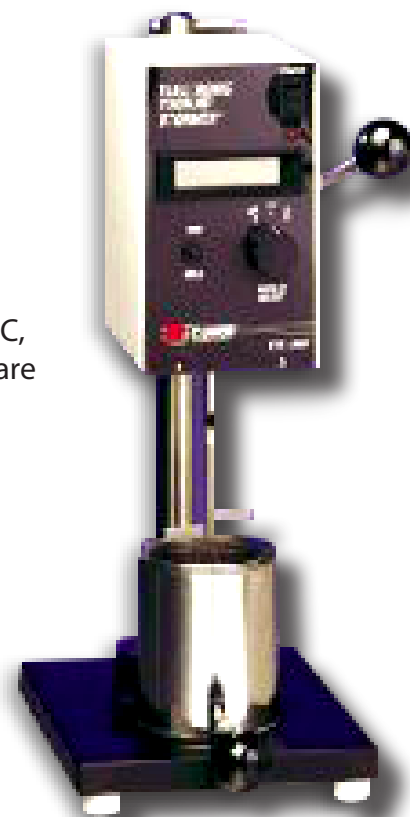
### Thomas®-Stormer® Viscosity Standards

Thomas-Stormer Viscosity Standards calibrate manual and electronic Thomas-Stormer viscometers. The KREBS UNIT (KU) is often used for Thomas-Stormer viscometers. Lot specific viscosity data is provided with each standard at 23 °C, 24 °C, 24.5 °C, 25 °C, 25.5 °C and 26 °C in both mPa·s (cP) and KU. Nominal values at 25 °C are shown in Table 11.

Table 11 • Nominal Viscosity Values of Thomas-Stormer Viscosity Standards at 25 °C

Catalog Number	Viscosity Standard	Approximate Viscosity	
		mPa·s (cP)	Krebs Unit (KU)
9727-Y10	S200(KU)†	350	62
9727-Y15	N350(KU)†	600	73
9727-Y20	K400(KU)†	940	84
9727-Y25	S600(KU)†	1,050	87
9727-Y30	N1000(KU)†	2,000	106

†Density values provided at all test temperatures.



# CANNON® Flow Cup Viscosity Standards

ASTM D4212, ASTM D1200

Table 12 • Nominal Viscosity Values of Flow Cup Viscosity Standards at 25 °C

Catalog Number	Viscosity Standard	Kinematic viscosity mm <sup>2</sup> /s (cSt)	Zahn Cup		Shell Cup		Ford Cup	
			Size	Drain time (sec)	Size	Drain time (sec)	Size	Drain time (sec)
9727-W10	C6*	8.9	—	—	1 2	52 20	—	—
9727-W12	C10*	17	1 —	45 —	2 2½	35 22	1 —	70 —
9727-W15	C20*	34	1 2 —	60 24 —	2 2½ 3	64 40 24	2 — —	42 — —
9727-W20	C35*	66	2 — —	33 — —	2½ 3 3½	74 46 32	2 3 —	64 35 —
9727-W25	C60*	120	2 —	48 —	3½ 4	57 36	3 4	58 36
9727-W30	C100*	230	3 4	27 21	4 5	68 36	4 —	64 —
9727-W35	C200*	420	3 4	43 32	5 6	64 26	5 —	36 —
9727-W40	C350	710	4 5	53 31	6 —	44 —	5 —	60 —
9727-W45	C600	1200	5	54	—	—	—	—

\* Data is also provided for ISO cups

Viscosity Standards for use with Zahn, Shell, & Ford Cups

CANNON flow cup viscosity standards are for use in Zahn, Shell and Ford flow cups. Lot specific kinematic viscosity data in mm<sup>2</sup>/s (cSt) and calculated cup drain times are provided with each standard. Nominal values at 25 °C are shown in Table 12. Data is also provided at 20 °C and 23 °C.

Table 13 • Equations and Ranges of Viscosity Flow Cups at 25 °C

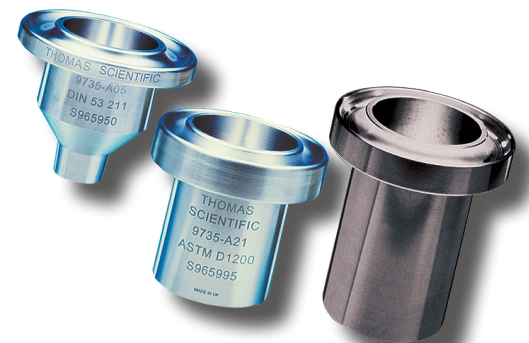
Cup Number	Equations † where t = Flow time in seconds n = Kinematic viscosity in mm <sup>2</sup> /s	Drain time (seconds)		Approximate Kinematic viscosity mm <sup>2</sup> /s (cSt)	
		min	max	min	max
Zahn Cup (Refer to ASTM D4212)					
1	$n = 1.1 (t - 29)$	35	80	5	60
2	$n = 3.5 (t - 14)$	20	80	20	250
3	$n = 11.7 (t - 7.5)$	20	80	100	800
4	$n = 14.8 (t - 5)$	20	80	200	1,200
5	$n = 23t$	20	80	400	1,800
Shell Cup (Refer to ASTM D4212)					
1	$n = 0.226 (t - 13)$	20	80	2	20
2	$n = 0.576 (t - 5)$	20	80	10	50
2½	$n = 0.925 (t - 3)$	20	80	20	80
3	$n = 1.51 (t - 2)$	20	80	30	120
3½	$n = 2.17 (t - 1.5)$	20	80	40	170
4	$n = 3.45 (t - 1)$	20	80	70	270
5	$n = 6.5 (t - 1)$	20	80	125	520
6	$n = 16.2 (t - 0.5)$	20	80	320	1,300
Ford Cup (Refer to ASTM D1200)					
1	$n = 0.49 (t - 35.0)$	55	100	10	35
2	$n = 1.44 (t - 18.0)$	40	100	25	120
3	$n = 2.31 (t - 6.58)$	20	100	49	220
4	$n = 3.85 (t - 4.49)$	20	100	70	370
5	$n = 12.1 (t - 2.00)$	20	100	200	1,200

## Equations for Zahn, Shell, & Ford Cups

The equations in Table 13 convert cup drain times, collected at 25 °C and between the minimum and maximum drain times indicated, into kinematic viscosity values in mm<sup>2</sup>/s (cSt). For more information on cups, contact our Technical Service team.

*Note:*

While the equations in Table 13 are widely used,  $n = at - b/t$  is often more applicable at short flow times and low KV.



## CANNON Flash Point Reference Materials

ASTM D56, ASTM D92, ASTM D93

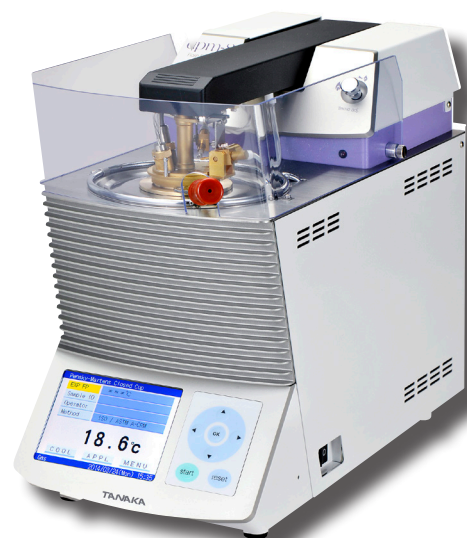
### Flash Point Reference Materials

CANNON Flash Point Reference Materials are produced in accordance with ASTM D56, Tag Closed Cup Flash Point, ASTM D92, Cleveland Open Cup Flash Point and ASTM D93, Pensky Marten Closed Cup Flash Point. Lot specific data including average flash point and observed standard deviation (from a statistical analysis of 40 tests in 20 different laboratories) is provided with each standard. Nominal flash points are shown in Table 14. Flash Point Reference Materials are sold in 200 mL bottles.

Table 14 • Nominal Values of Flash Point Reference Materials

Catalog Number	Product ID	ASTM D56 Nominal Flash Point (°C)	ASTM D92 Nominal Flash Point (°C)	ASTM D93 Nominal Flash Point (°C)
9727-A10	FPRM10*	50	-	55
9727-A15	FPRM11	66	-	72
9727-A20	FPRM14	-	116	113
9727-A25	FPRM16	-	137	132
9727-A30	FPRM2D	-	163	155
9727-A35	FPRM4D	-	224	218
9727-A40	FPRM9D	-	274	-

\*Incurs additional shipping charges due to low flash point



## CANNON Certified Viscosity Check Oils

ASTM D445, ASTM D5293, ASTM D4684

### Certified Viscosity Check Oils

CANNON Certified Viscosity Check Oils verify SAE target viscosities for kinematic viscometers per ASTM D445, cold-cranking simulators per ASTM D5293, and mini-rotary viscometers per ASTM D4684.

Each check oil contains a commercial engine oil with certified values at common blend target values for density in g/cm<sup>3</sup> (g/mL) at 15 °C, kinematic viscosity in mm<sup>2</sup>/s (cSt) at 40 °C and 100 °C as well as cranking and pumping viscosities in mPa·s (cP) at SAE J300 specification temperatures. CANNON Certified Viscosity Check Oils are available in 1 L (quart) and 3.8 L (gallon) sizes. Refer to Table 15 for catalog numbers and specifications.

Table 15 • Nominal Viscosity Values of CANNON Viscosity Check Oils (CVCO)

Catalog Number	ASTM Test Method	Temp. (°C)	Typical Viscosity
CVCO-5W30 9727-S00.032 (1 L) 9727-S00.128 (3.8 L)	D445	40	58 cSt
	D445	100	11 cSt
	D5293	-25	3,000 mPa·s
	D5293	-30	5,800 mPa·s
	D4684	-35	20,000 mPa·s
	D4052	15	0.85 g/mL
CVCO-10W30 9727-S01.032 (1 L) 9727-S01.128 (3.8 L)	D445	40	70 cSt
	D445	100	11 cSt
	D5293	-20	2,800 mPa·s
	D5293	-25	5,700 mPa·s
	D4684	-30	21,000 mPa·s
	D4052	15	0.88 g/mL
CVCO-15W40 9727-S02.032 (1 L) 9727-S02.128 (3.8 L)	D445	40	100 cSt
	D445	100	14 cSt
	D5293	-15	3,500 mPa·s
	D5293	-20	6,500 mPa·s
	D4684	-25	25,000 mPa·s
	D4052	15	0.88 g/mL

# Get to know Cannon Instrument Company

*Where Precision and Accuracy Intersect*

## About Cannon Instrument Company

Cannon Instrument Company delivers value to our customers by providing the highest quality instruments, services, and certified reference materials for the characterization of viscosity, rheology and other physical properties. At Cannon Instrument Company, we strive to be the trusted world leader in viscosity and physical property characterization.

Cannon Instrument Company has earned international acclaim for the quality of its viscosity-related products and services since its founding in 1938 by scientist, inventor, and educator Dr. Michael R. Cannon. The company's longstanding emphasis on production of premier-quality test equipment has kept CANNON at the cutting-edge of research and development.

### Mission

Cannon Instrument Company delivers value to our customers by providing the highest quality instruments, services, and certified reference materials for the characterization of viscosity, rheology and other physical properties.

- Accuracy, precision, and long-term reliability are the defining elements of our products and services.
- Innovative spirit and a desire to exceed customer expectations are the traits that we value most in our employees.
- As an internationally recognized expert in viscosity characterization, we seek to advance technology through our service and leadership in various international standardization and professional trade organizations.



### Vision

At Cannon Instrument Company, we strive to be the trusted world leader in viscosity and physical property characterization. We are passionate about driving our financial growth through:

- Technological excellence and new product innovations
- Consistent manufacturing
- Market diversification
- And an obsessive commitment to customer satisfaction



*Where Precision and Accuracy Intersect*

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