



Paul N. Gardner Company

ISO STANDARD CUP VISCOMETERS

Instructions for measuring efflux time,
converting results to viscosity, and
caring for the ISO Standard Viscosity
Cups.



ISO Standard Cup



ISO Standard Viscosity Cups measure the efflux time of liquids flowing through precision 3 mm, 4 mm, 6 mm, or 8 mm orifices. Efflux time can be used directly as a process-control value or converted to kinematic viscosity in centistokes using the applicable conversion formula, conversion table, or the [GARDCO Viscosity Calculator](#).

The ISO cup series uses easily removable stainless-steel Snap-In, Snap-Out orifices. The removable design allows an orifice to be replaced if damaged without replacing the complete cup.

The cup bodies are machined from solid aluminum bar stock. Reduced mass near the orifice helps limit temperature effects during testing. The exterior cup dimensions are compatible with commonly used support stands.

GARDCO ISO Standard Viscosity Cups are designed for use in accordance with ISO 2431 and ASTM D5125. Optional calibration certification is available using viscosity standards traceable to the National Institute of Standards and Technology.

Select the Correct Cup

Orifice	Efflux-Time Range	Nominal Viscosity Range	Midrange Sensitivity	Recommended Calibration Oil / Centistokes
3 mm	27–120 seconds	4.6–52 cSt	0.5 cSt/second	G-10, nominally 19 cSt
4 mm	21–120 seconds	19–163 cSt	1.4 cSt/second	G-35, nominally 68 cSt
6 mm	17–120 seconds	84–823 cSt	7.1 cSt/second	G-100, nominally 233 cSt
8 mm	10–120 seconds	187–2,611 cSt	22 cSt/second	G-350, nominally 878 cSt

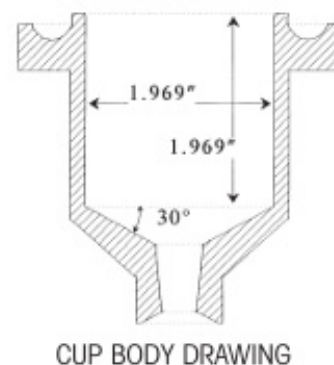
Nominal centistoke values are shown. Refer to the standard-oil bottle label for the actual viscosity value.

Midrange sensitivity is stated as centistokes per second of efflux time.

Cup Construction

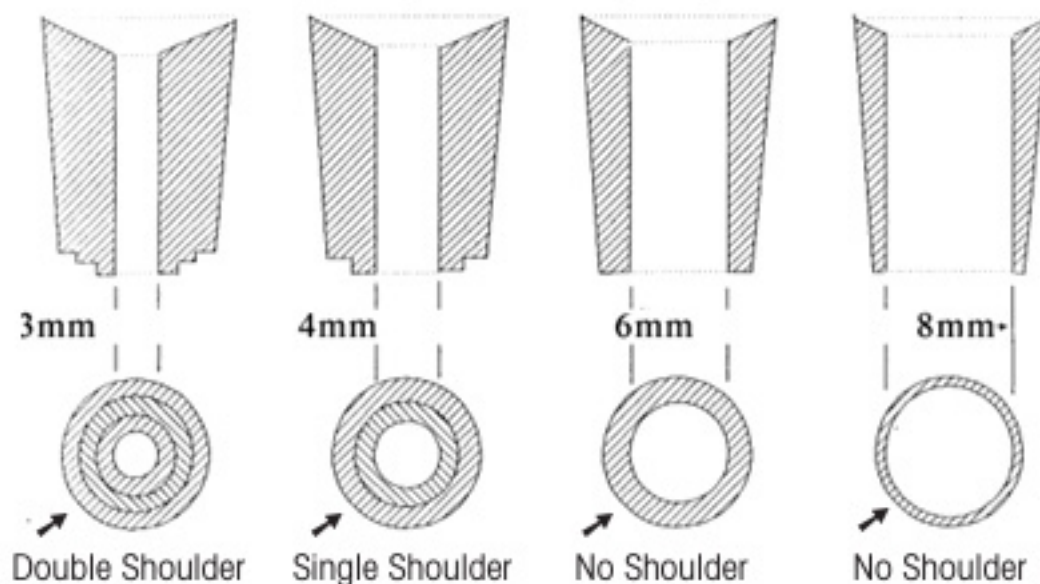
The cup body is machined from solid aluminum bar stock. A deep well surrounding the top of the cup captures overflow during filling. The conical opening in the base of the cup permits gentle installation or removal of the orifice.

The removable stainless steel orifice extends below the cup body. This design protects the orifice and helps prevent interference with the efflux stream from material that may collect around the cup outlet.



Orifice Identification

Each removable orifice is identified by its shape at the base:



Understanding Centistokes

Efflux cups measure the time required for a liquid to flow through a specified orifice under gravity. The resulting time is called efflux time and is recorded in seconds.

Kinematic viscosity is commonly expressed in centistokes, abbreviated cSt. Kinematic viscosity accounts for the relationship between a liquid's resistance to flow and its density.

Use the cup specific formula, conversion table, or [GARDCO Viscosity Calculator](#) to convert between efflux time and centistokes.

ISO Standard Cup



Instructions for Use

1. Select the cup and orifice size appropriate for the expected viscosity range.
2. Inspect the cup and orifice to ensure they are clean, dry, and free of damage, residue, or dried test material.
3. Bring the test material to the specified measurement temperature. Record the temperature before beginning the test.
4. Place the selected cup in a suitable level holder. Position a receiving container beneath the orifice.
5. Cover the orifice with a finger and fill the cup slowly with the test material until the meniscus at the cup sidewall disappears. Allow any air bubbles to rise and dissipate.
6. If the cup is overfilled, remove excess material with a cover plate or straight edge.
7. Remove your finger from the orifice and start the timer simultaneously.
8. Hold a thermometer in the efflux stream to verify the temperature of the test material during the measurement.
9. Stop the timer at the first definite break in the efflux stream, approximately 1–2 in. below the orifice.
For the 8 mm cup: A sharp stream break may not occur. Stop timing when a distinct change in flow indicates the transition from a filled-orifice stream to drainage from the cup sidewall.
10. Record the cup/orifice size, test-material identification, material temperature, and efflux time in seconds.
11. Clean the cup promptly after use unless it will be used immediately for a repeat measurement of the same material.



Temperature Control

Viscosity is temperature dependent. A material's efflux time can change significantly when its temperature changes, even if the material itself has not changed.

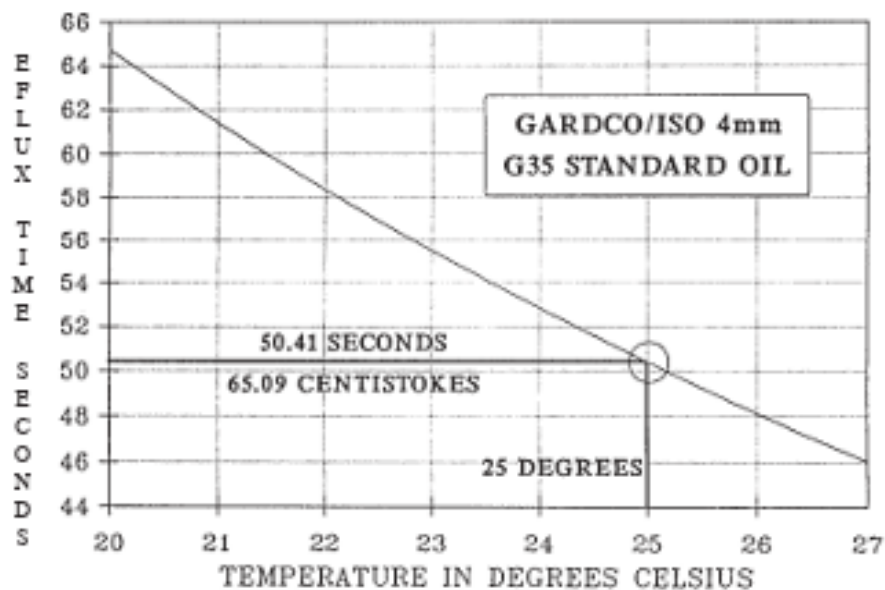
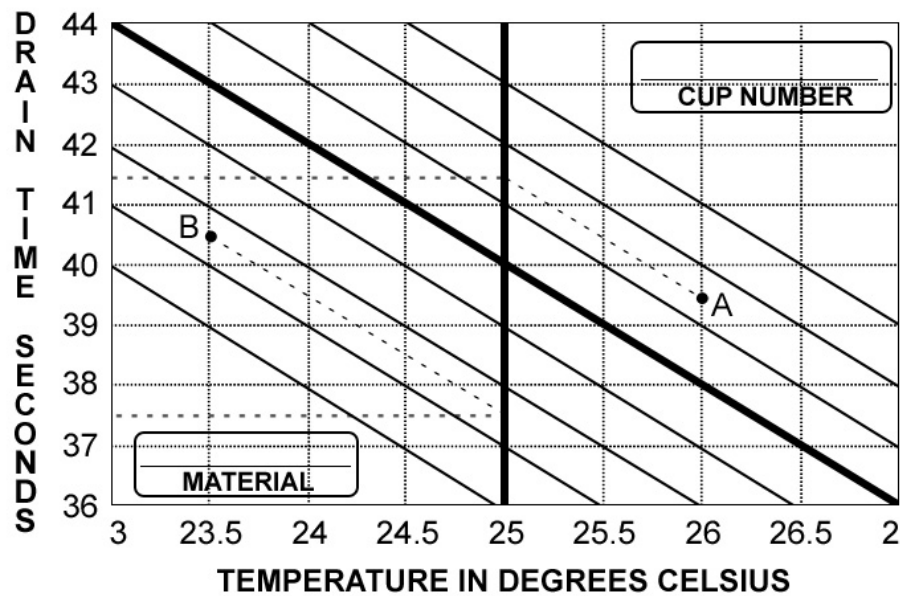
Many materials measured with viscosity cups change in viscosity by approximately 3–8% for every 1 °C change in temperature. For repeatable and meaningful results, measure and record the material temperature with every efflux time result.

Good Temperature-Control Practices

- Use the temperature specified by your test method or product specification.
- Allow the cup and test material to reach the same temperature before testing.
- Use a thermometer that provides sufficient resolution for your required accuracy.
- Compare results only when they are measured at the same specified temperature.
- Develop a material specific temperature correction chart when frequent measurements are required across a limited temperature range.

Temperature Control (continued)

The reference charts below show the relationship between temperature and efflux time for selected GARDCO ISO cup and G Series standard oil combinations. They can be used as examples when developing temperature correction references for a specific material.



ISO Standard Cup



Care of Cup

The ISO Standard Viscosity Cups are precision instruments. With proper care and thorough cleaning after each use, they will provide many years of reliable service.

- Clean the cup and orifice thoroughly after each test.
- Do not use metal tools, abrasive materials, or any method that can scratch internal orifice surfaces.
- Do not strike the orifice directly when removing it from the cup.
- To remove an orifice, place the supplied dowel against the orifice and tap the dowel gently with a suitable object. Catch the orifice as it is released.
- Before inserting an orifice, make sure that the outside of the orifice and the receiving cone of the cup are clean.
- Store cups and orifices dry and protected from damage.

Cleaning Procedure

1. Allow remaining material to drain from the cup.
2. Flush the cup and orifice with a solvent compatible with the test material.
3. Wipe the cup dry with a soft, lint-free cloth.
4. Use a second, volatile solvent if necessary to remove remaining solvent residue.
5. Dry the cup thoroughly using a low-velocity stream of clean air or allow it to air-dry completely.
6. Avoid rapid cooling caused by excessive solvent evaporation, which can create condensation on the cup surface.

Caution: Do not use wire, metal pins, or abrasive materials to clean the orifice. Nylon fishing line may be suitable for removing residue from an orifice when used carefully.

G Series Viscosity Standards

GARDCO viscosity cups are calibrated using G Series Viscosity Standards. The centistoke viscosity of these standards is traceable to the National Institute of Standards and Technology.

G Series Viscosity Standards are used to periodically verify the performance of GARDCO viscosity cups. Select the standard oil recommended for the cup/orifice size being checked.

ISO Cup Orifice	Recommended Standard Oil	Nominal Viscosity at 25 °C
3 mm	G10	19 cSt
4 mm	G35	64–68 cSt
6 mm	G100	230–233 cSt
8 mm	G350	878–880 cSt

G Series Viscosity Standards (continued)

- Use only clean cups, containers, thermometers, and stirring devices with viscosity standards.
- Return the standard oil to its labeled bottle immediately after use and secure the cap.
- Avoid contamination with water, solvents, dust, or test material.
- Replace the standard if contamination is suspected or if the expiration date has passed.
- Do not use silicone fluids to calibrate cups intended for non-silicone materials.

Important: Use GARDCO G Series standards only with GARDCO cups unless the other cup manufacturer has supplied compatible conversion formulas and cup tolerance information.

Available Accessories



ISO Standard Cup Bracket Stand

Supports the cup in a level position during testing. The bracket stand may be used with a glass cover plate, bubble level, and receiving beaker to support repeatable measurements.

[Buy at gardco.com](http://gardco.com)



ISO Standard Cup Tripod Stand

Portable tripod stand for supporting the cup during testing. Use with a cover plate and bubble level to verify proper leveling before starting the efflux measurement.

[Buy at gardco.com](http://gardco.com)



Glass Scraper Plate & Level

Helps remove excess material from the cup surface and confirms that the cup is level before the test begins.

[Buy at gardco.com](http://gardco.com)

ISO Standard Cup



Available Accessories (continued)



Stainless Steel Griffin Beakers

Collects test material during the efflux measurement.

[Buy at gardco.com](https://www.gardco.com)



Certified Pro Ultimate Stopwatch

Measures efflux time to the required resolution for accurate testing and conversion.

[Buy at gardco.com](https://www.gardco.com)



Stem Precision Thermometer

Measures test material temperature during viscosity cup testing. Available with 8 in and [12 in](#) stems.

[Buy at gardco.com](https://www.gardco.com)



Dial Thermometer

Measures test material temperature during viscosity cup testing. Available in Fahrenheit or [Celsius](#) versions.

[Buy at gardco.com](https://www.gardco.com)

Available Accessories (continued)



ISO Cup Orifice

Replacement stainless steel orifices are available for 3 mm, [4 mm](#), [6 mm](#) and [8 mm](#) ISO Cups.

[Buy at gardco.com](#)



G Series Viscosity Standards

G10, [G35](#), [G100](#), and [G350](#) Viscosity Standards are available for periodic cup verification.

[Buy at gardco.com](#)

ISO Standard Cup



ISO 3 mm Cup — Efflux Time to Centistokes Conversion Table

ISO viscosity cups are designed to comply with requirements of International Standard ISO 2431 and ASTM Solvent Separation Test Method D5125. Cup dimensions are carefully controlled and cup calibration conditions comply with MIL STD 45662A. Standard viscous oils traceable to the National Institute of Standards and Technology are used in calibration procedures to insure specified efflux time tolerance.

Use this formula, derived by Paul N. Gardner Company research, to find viscosity (V) in centistokes when cup efflux time in seconds (T) is known:

$$V = 0.443T - 200 \div T$$

Use this formula to find cup efflux time in seconds (T) when viscosity (V) in centistokes is known:

$$T = (V + \sqrt{V^2 + 354}) \div 0.886$$

Results from the above formulas, solved for each tenth of a second within the cup range, are shown in the following conversion tables. To find centistoke viscosity for a given cup efflux time in seconds, read down the column on the left to find the nearest second. Then, read to the right to the nearest tenth of a second column to find centistoke value. The chart may be read in reverse to find efflux time in seconds when viscosity is known.

ISO 3 mm Cup — Efflux Time to Centistokes Conversion Table (continued)

(Accurate for True Liquids Only)

EFFLUX TIME SECONDS	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	----- VISCOSITY IN CENTISTOKES ----->									
27	4.55	4.63	4.70	4.77	4.84	4.91	4.98	5.05	5.12	5.19
28	5.26	5.33	5.40	5.47	5.54	5.61	5.68	5.75	5.81	5.88
29	5.95	6.02	6.09	6.15	6.22	6.29	6.36	6.42	6.49	6.56
30	6.62	6.69	6.76	6.82	6.89	6.95	7.02	7.09	7.15	7.22
31	7.28	7.35	7.41	7.48	7.54	7.61	7.67	7.73	7.80	7.86
32	7.93	7.99	8.05	8.12	8.18	8.24	8.31	8.37	8.43	8.50
33	8.56	8.62	8.68	8.75	8.81	8.87	8.93	8.99	9.06	9.12
34	9.18	9.24	9.30	9.36	9.43	9.49	9.55	9.61	9.67	9.73
35	9.79	9.85	9.91	9.97	10.03	10.09	10.15	10.21	10.27	10.33
36	10.39	10.45	10.51	10.57	10.63	10.69	10.75	10.81	10.87	10.93
37	10.99	11.04	11.10	11.16	11.22	11.28	11.34	11.40	11.45	11.51
38	11.57	11.63	11.69	11.74	11.80	11.86	11.92	11.98	12.03	12.09
39	12.15	12.21	12.26	12.32	12.38	12.44	12.49	12.55	12.61	12.66
40	12.72	12.78	12.83	12.89	12.95	13.00	13.06	13.12	13.17	13.23
41	13.28	13.34	13.40	13.45	13.51	13.57	13.62	13.68	13.73	13.79
42	13.84	13.90	13.96	14.01	14.07	14.12	14.18	14.23	14.29	14.34
43	14.40	14.45	14.51	14.56	14.62	14.67	14.73	14.78	14.84	14.89
44	14.95	15.00	15.06	15.11	15.16	15.22	15.27	15.33	15.38	15.44
45	15.49	15.54	15.60	15.65	15.71	15.76	15.81	15.87	15.92	15.98
46	16.0	16.1	16.1	16.2	16.2	16.3	16.4	16.4	16.5	16.5
47	16.6	16.6	16.7	16.7	16.8	16.8	16.9	16.9	17.0	17.0
48	17.1	17.2	17.2	17.3	17.3	17.4	17.4	17.5	17.5	17.6
49	17.6	17.7	17.7	17.8	17.8	17.9	17.9	18.0	18.0	18.1
50	18.2	18.2	18.3	18.3	18.4	18.4	18.5	18.5	18.6	18.6
51	18.7	18.7	18.8	18.8	18.9	18.9	19.0	19.0	19.1	19.1
52	19.2	19.2	19.3	19.3	19.4	19.4	19.5	19.6	19.6	19.7
53	19.7	19.8	19.8	19.9	19.9	20.0	20.0	20.1	20.1	20.2
54	20.2	20.3	20.3	20.4	20.4	20.5	20.5	20.6	20.6	20.7
55	20.7	20.8	20.8	20.9	20.9	21.0	21.0	21.1	21.1	21.2
56	21.2	21.3	21.3	21.4	21.4	21.5	21.5	21.6	21.6	21.7
57	21.7	21.8	21.8	21.9	21.9	22.0	22.0	22.1	22.1	22.2
58	22.2	22.3	22.3	22.4	22.4	22.5	22.5	22.6	22.6	22.7
59	22.7	22.8	22.8	22.9	22.9	23.0	23.0	23.1	23.1	23.2
60	23.2	23.3	23.3	23.4	23.4	23.5	23.5	23.6	23.6	23.7
61	23.7	23.8	23.8	23.9	23.9	24.0	24.0	24.1	24.1	24.2
62	24.2	24.3	24.3	24.4	24.4	24.5	24.5	24.6	24.6	24.7
63	24.7	24.8	24.8	24.9	24.9	25.0	25.0	25.1	25.1	25.2
64	25.2	25.3	25.3	25.4	25.4	25.5	25.5	25.6	25.6	25.7
65	25.7	25.8	25.8	25.9	25.9	26.0	26.0	26.1	26.1	26.2
66	26.2	26.3	26.3	26.4	26.4	26.5	26.5	26.5	26.6	26.6
67	26.7	26.7	26.8	26.8	26.9	26.9	27.0	27.0	27.1	27.1
68	27.2	27.2	27.3	27.3	27.4	27.4	27.5	27.5	27.6	27.6
69	27.7	27.7	27.8	27.8	27.9	27.9	28.0	28.0	28.1	28.1
70	28.2	28.2	28.2	28.3	28.3	28.4	28.4	28.5	28.5	28.6
71	28.6	28.7	28.7	28.8	28.8	28.9	28.9	29.0	29.0	29.1
72	29.1	29.2	29.2	29.3	29.3	29.4	29.4	29.5	29.5	29.6
73	29.6	29.6	29.7	29.7	29.8	29.8	29.9	29.9	30.0	30.0
74	30.1	30.1	30.2	30.2	30.3	30.3	30.4	30.4	30.5	30.5
75	30.6	30.6	30.7	30.7	30.7	30.8	30.8	30.9	30.9	31.0

ISO Standard Cup



ISO 3 mm Cup — Efflux Time to Centistokes Conversion Table (continued)

(Accurate for True Liquids Only)

EFFLUX TIME SECONDS	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	<----- VISCOSITY IN CENTISTOKES ----->									
76	31.0	31.1	31.1	31.2	31.2	31.3	31.3	31.4	31.4	31.5
77	31.5	31.6	31.6	31.7	31.7	31.8	31.8	31.8	31.9	31.9
78	32.0	32.0	32.1	32.1	32.2	32.2	32.3	32.3	32.4	32.4
79	32.5	32.5	32.6	32.6	32.7	32.7	32.8	32.8	32.8	32.9
80	32.9	33.0	33.0	33.1	33.1	33.2	33.2	33.3	33.3	33.4
81	33.4	33.5	33.5	33.6	33.6	33.7	33.7	33.7	33.8	33.8
82	33.9	33.9	34.0	34.0	34.1	34.1	34.2	34.2	34.3	34.3
83	34.4	34.4	34.5	34.5	34.5	34.6	34.6	34.7	34.7	34.8
84	34.8	34.9	34.9	35.0	35.0	35.1	35.1	35.2	35.2	35.3
85	35.3	35.3	35.4	35.4	35.5	35.5	35.6	35.6	35.7	35.7
86	35.8	35.8	35.9	35.9	36.0	36.0	36.1	36.1	36.1	36.2
87	36.2	36.3	36.3	36.4	36.4	36.5	36.5	36.6	36.6	36.7
88	36.7	36.8	36.8	36.9	36.9	36.9	37.0	37.0	37.1	37.1
89	37.2	37.2	37.3	37.3	37.4	37.4	37.5	37.5	37.6	37.6
90	37.6	37.7	37.7	37.8	37.8	37.9	37.9	38.0	38.0	38.1
91	38.1	38.2	38.2	38.3	38.3	38.3	38.4	38.4	38.5	38.5
92	38.6	38.6	38.7	38.7	38.8	38.8	38.9	38.9	39.0	39.0
93	39.0	39.1	39.1	39.2	39.2	39.3	39.3	39.4	39.4	39.5
94	39.5	39.6	39.6	39.7	39.7	39.7	39.8	39.8	39.9	39.9
95	40.0	40.0	40.1	40.1	40.2	40.2	40.3	40.3	40.4	40.4
96	40.4	40.5	40.5	40.6	40.6	40.7	40.7	40.8	40.8	40.9
97	40.9	41.0	41.0	41.0	41.1	41.1	41.2	41.2	41.3	41.3
98	41.4	41.4	41.5	41.5	41.6	41.6	41.7	41.7	41.7	41.8
99	41.8	41.9	41.9	42.0	42.0	42.1	42.1	42.2	42.2	42.3
100	42.3	42.3	42.4	42.4	42.5	42.5	42.6	42.6	42.7	42.7
101	42.8	42.8	42.9	42.9	42.9	43.0	43.0	43.1	43.1	43.2
102	43.2	43.3	43.3	43.4	43.4	43.5	43.5	43.5	43.6	43.6
103	43.7	43.7	43.8	43.8	43.9	43.9	44.0	44.0	44.1	44.1
104	44.1	44.2	44.2	44.3	44.3	44.4	44.4	44.5	44.5	44.6
105	44.6	44.7	44.7	44.7	44.8	44.8	44.9	44.9	45.0	45.0
106	45.1	45.1	45.2	45.2	45.3	45.3	45.3	45.4	45.4	45.5
107	45.5	45.6	45.6	45.7	45.7	45.8	45.8	45.9	45.9	45.9
108	46.0	46.0	46.1	46.1	46.2	46.2	46.3	46.3	46.4	46.4
109	46.5	46.5	46.5	46.6	46.6	46.7	46.7	46.8	46.8	46.9
110	46.9	47.0	47.0	47.0	47.1	47.1	47.2	47.2	47.3	47.3

ISO 4 mm Cup — Efflux Time to Centistokes Conversion Table

ISO viscosity cups are designed to comply with requirements of International Standard ISO 2431 and ASTM Solvent Separation Test Method D5125. Cup dimensions are carefully controlled and cup calibration conditions comply with MIL STD 45662A. Standard viscous oils traceable to the National Institute of Standards and Technology are used in calibration procedures to insure specified efflux time tolerance.

Use this formula, derived by Paul N. Gardner Company research, to find viscosity (V) in centistokes when cup efflux time in seconds (T) is known:

$$V = 1.37T - 200 \div T$$

Use this formula to find cup efflux time in seconds (T) when viscosity (V) in centistokes is known:

$$T = \left(V + \sqrt{V^2 + 1096} \right) \div 2.74$$

Results from the above formulas, solved for each tenth of a second within the cup range, are shown in the following conversion tables. To find centistoke viscosity for a given cup efflux time in seconds, read down the column on the left to find the nearest second. Then, read to the right to the nearest tenth of a second column to find centistoke value. The chart may be read in reverse to find efflux time in seconds when viscosity is known.

ISO Standard Cup



ISO 4 mm Cup — Efflux Time to Centistokes Conversion Table

(Accurate for True Liquids Only)

EFFLUX TIME SECONDS	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	←----- VISCOSITY IN CENTISTOKES ----->									
21	19.2	19.4	19.6	19.8	20.0	20.2	20.3	20.5	20.7	20.9
22	21.0	21.2	21.4	21.6	21.8	21.9	22.1	22.3	22.5	22.6
23	22.8	23.0	23.2	23.3	23.5	23.7	23.9	24.0	24.2	24.4
24	24.5	24.7	24.9	25.1	25.2	25.4	25.6	25.7	25.9	26.1
25	26.3	26.4	26.6	26.8	26.9	27.1	27.3	27.4	27.6	27.8
26	27.9	28.1	28.3	28.4	28.6	28.8	28.9	29.1	29.3	29.4
27	29.6	29.7	29.9	30.1	30.2	30.4	30.6	30.7	30.9	31.1
28	31.2	31.4	31.5	31.7	31.9	32.0	32.2	32.4	32.5	32.7
29	32.8	33.0	33.2	33.3	33.5	33.6	33.8	34.0	34.1	34.3
30	34.4	34.6	34.8	34.9	35.1	35.2	35.4	35.5	35.7	35.9
31	36.0	36.2	36.3	36.5	36.6	36.8	37.0	37.1	37.3	37.4
32	37.6	37.7	37.9	38.1	38.2	38.4	38.5	38.7	38.8	39.0
33	39.1	39.3	39.5	39.6	39.8	39.9	40.1	40.2	40.4	40.5
34	40.7	40.9	41.0	41.2	41.3	41.5	41.6	41.8	41.9	42.1
35	42.2	42.4	42.5	42.7	42.8	43.0	43.2	43.3	43.5	43.6
36	43.8	43.9	44.1	44.2	44.4	44.5	44.7	44.8	45.0	45.1
37	45.3	45.4	45.6	45.7	45.9	46.0	46.2	46.3	46.5	46.6
38	46.8	46.9	47.1	47.2	47.4	47.6	47.7	47.9	48.0	48.2
39	48.3	48.5	48.6	48.8	48.9	49.1	49.2	49.4	49.5	49.7
40	49.8	49.9	50.1	50.2	50.4	50.5	50.7	50.8	51.0	51.1
41	51.3	51.4	51.6	51.7	51.9	52.0	52.2	52.3	52.5	52.6
42	52.8	52.9	53.1	53.2	53.4	53.5	53.7	53.8	54.0	54.1
43	54.3	54.4	54.6	54.7	54.8	55.0	55.1	55.3	55.4	55.6
44	55.7	55.9	56.0	56.2	56.3	56.5	56.6	56.8	56.9	57.1
45	57.2	57.4	57.5	57.6	57.8	57.9	58.1	58.2	58.4	58.5
46	58.7	58.8	59.0	59.1	59.3	59.4	59.6	59.7	59.8	60.0
47	60.1	60.3	60.4	60.6	60.7	60.9	61.0	61.2	61.3	61.4
48	61.6	61.7	61.9	62.0	62.2	62.3	62.5	62.6	62.8	62.9
49	63.0	63.2	63.3	63.5	63.6	63.8	63.9	64.1	64.2	64.4
50	64.5	64.6	64.8	64.9	65.1	65.2	65.4	65.5	65.7	65.8
51	65.9	66.1	66.2	66.4	66.5	66.7	66.8	67.0	67.1	67.2
52	67.4	67.5	67.7	67.8	68.0	68.1	68.3	68.4	68.5	68.7
53	68.8	69.0	69.1	69.3	69.4	69.6	69.7	69.8	70.0	70.1
54	70.3	70.4	70.6	70.7	70.9	71.0	71.1	71.3	71.4	71.6
55	71.7	71.9	72.0	72.1	72.3	72.4	72.6	72.7	72.9	73.0
56	73.1	73.3	73.4	73.6	73.7	73.9	74.0	74.2	74.3	74.4
57	74.6	74.7	74.9	75.0	75.2	75.3	75.4	75.6	75.7	75.9
58	76.0	76.2	76.3	76.4	76.6	76.7	76.9	77.0	77.2	77.3
59	77.4	77.6	77.7	77.9	78.0	78.2	78.3	78.4	78.6	78.7
60	78.9	79.0	79.2	79.3	79.4	79.6	79.7	79.9	80.0	80.1
61	80.3	80.4	80.6	80.7	80.9	81.0	81.1	81.3	81.4	81.6
62	81.7	81.9	82.0	82.1	82.3	82.4	82.6	82.7	82.9	83.0
63	83.1	83.3	83.4	83.6	83.7	83.8	84.0	84.1	84.3	84.4
64	84.6	84.7	84.8	85.0	85.1	85.3	85.4	85.5	85.7	85.8
65	86.0	86.1	86.3	86.4	86.5	86.7	86.8	87.0	87.1	87.2
66	87.4	87.5	87.7	87.8	88.0	88.1	88.2	88.4	88.5	88.7
67	88.8	88.9	89.1	89.2	89.4	89.5	89.7	89.8	89.9	90.1
68	90.2	90.4	90.5	90.6	90.8	90.9	91.1	91.2	91.3	91.5
69	91.6	91.8	91.9	92.1	92.2	92.3	92.5	92.6	92.8	92.9
70	93.0	93.2	93.3	93.5	93.6	93.7	93.9	94.0	94.2	94.3

ISO 4 mm Cup — Efflux Time to Centistokes Conversion Table (continued)

(Accurate for True Liquids Only)

EFFLUX TIME SECONDS	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	←----- VISCOSITY IN CENTISTOKES ----->									
71	94.5	94.6	94.7	94.9	95.0	95.2	95.3	95.4	95.6	95.7
72	95.9	96.0	96.1	96.3	96.4	96.6	96.7	96.8	97.0	97.1
73	97.3	97.4	97.6	97.7	97.8	98.0	98.1	98.3	98.4	98.5
74	98.7	98.8	99.0	99.1	99.2	99.4	99.5	99.7	99.8	99.9
75	100.1	100.2	100.4	100.5	100.6	100.8	100.9	101.1	101.2	101.3
76	101.5	101.6	101.8	101.9	102.1	102.2	102.3	102.5	102.6	102.8
77	102.9	103.0	103.2	103.3	103.5	103.6	103.7	103.9	104.0	104.2
78	104.3	104.4	104.6	104.7	104.9	105.0	105.1	105.3	105.4	105.6
79	105.7	105.8	106.0	106.1	106.3	106.4	106.5	106.7	106.8	107.0
80	107.1	107.2	107.4	107.5	107.7	107.8	107.9	108.1	108.2	108.4
81	108.5	108.6	108.8	108.9	109.1	109.2	109.3	109.5	109.6	109.8
82	109.9	110.0	110.2	110.3	110.5	110.6	110.7	110.9	111.0	111.2
83	111.3	111.4	111.6	111.7	111.9	112.0	112.1	112.3	112.4	112.6
84	112.7	112.8	113.0	113.1	113.3	113.4	113.5	113.7	113.8	114.0
85	114.1	114.2	114.4	114.5	114.7	114.8	114.9	115.1	115.2	115.4
86	115.5	115.6	115.8	115.9	116.1	116.2	116.3	116.5	116.6	116.8
87	116.9	117.0	117.2	117.3	117.4	117.6	117.7	117.9	118.0	118.1
88	118.3	118.4	118.6	118.7	118.8	119.0	119.1	119.3	119.4	119.5
89	119.7	119.8	120.0	120.1	120.2	120.4	120.5	120.7	120.8	120.9
90	121.1	121.2	121.4	121.5	121.6	121.8	121.9	122.1	122.2	122.3
91	122.5	122.6	122.8	122.9	123.0	123.2	123.3	123.4	123.6	123.7
92	123.9	124.0	124.1	124.3	124.4	124.6	124.7	124.8	125.0	125.1
93	125.3	125.4	125.5	125.7	125.8	126.0	126.1	126.2	126.4	126.5
94	126.7	126.8	126.9	127.1	127.2	127.3	127.5	127.6	127.8	127.9
95	128.0	128.2	128.3	128.5	128.6	128.7	128.9	129.0	129.2	129.3
96	129.4	129.6	129.7	129.9	130.0	130.1	130.3	130.4	130.5	130.7
97	130.8	131.0	131.1	131.2	131.4	131.5	131.7	131.8	131.9	132.1
98	132.2	132.4	132.5	132.6	132.8	132.9	133.1	133.2	133.3	133.5
99	133.6	133.7	133.9	134.0	134.2	134.3	134.4	134.6	134.7	134.9
100	135.0	135.1	135.3	135.4	135.6	135.7	135.8	136.0	136.1	136.3
101	136.4	136.5	136.7	136.8	136.9	137.1	137.2	137.4	137.5	137.6
102	137.8	137.9	138.1	138.2	138.3	138.5	138.6	138.8	138.9	139.0
103	139.2	139.3	139.4	139.6	139.7	139.9	140.0	140.1	140.3	140.4
104	140.6	140.7	140.8	141.0	141.1	141.3	141.4	141.5	141.7	141.8
105	141.9	142.1	142.2	142.4	142.5	142.6	142.8	142.9	143.1	143.2

ISO Standard Cup



ISO 6 mm Cup — Efflux Time to Centistokes Conversion Table

ISO viscosity cups are designed to comply with requirements of International Standard ISO 2431 and ASTM Solvent Separation Test Method D5125. Cup dimensions are carefully controlled and cup calibration conditions comply with MIL STD 45662A. Standard viscous oils traceable to the National Institute of Standards and Technology are used in calibration procedures to insure specified efflux time tolerance.

Use this formula, derived by Paul N. Gardner Company research, to find viscosity (V) in centistokes when cup efflux time in seconds (T) is known:

$$V = 6.90T - 570 \div T$$

Use this formula to find cup efflux time in seconds (T) when viscosity (V) in centistokes is known:

$$T = \left(V + \sqrt{V^2 + 15732} \right) \div 13.8$$

Results from the above formulas, solved for each tenth of a second within the cup range, are shown in the following conversion tables. To find centistoke viscosity for a given cup efflux time in seconds, read down the column on the left to find the nearest second. Then, read to the right to the nearest tenth of a second column to find centistoke value. The chart may be read in reverse to find efflux time in seconds when viscosity is known.

ISO 6 mm Cup — Efflux Time to Centistokes Conversion Table (continued)

EFFLUX TIME SECONDS	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	<----- VISCOSITY IN CENTISTOKES ----->									
17	84	85	86	86	87	88	89	90	91	92
18	93	93	94	95	96	97	98	99	99	100
19	101	102	103	104	104	105	106	107	108	109
20	110	110	111	112	113	114	114	115	116	117
21	118	119	119	120	121	122	123	123	124	125
22	126	127	128	128	129	130	131	132	132	133
23	134	135	136	136	137	138	139	139	140	141
24	142	143	143	144	145	146	147	147	148	149
25	150	150	151	152	153	154	154	155	156	157
26	157	158	159	160	161	161	162	163	164	164
27	165	166	167	167	168	169	170	171	171	172
28	173	174	174	175	176	177	177	178	179	180
29	180	181	182	183	183	184	185	186	186	187
30	188	189	190	190	191	192	193	193	194	195
31	196	196	197	198	199	199	200	201	201	202
32	203	204	204	205	206	207	207	208	209	210
33	210	211	212	213	213	214	215	216	216	217
34	218	219	219	220	221	222	222	223	224	224
35	225	226	227	227	228	229	230	230	231	232
36	233	233	234	235	236	236	237	238	238	239
37	240	241	241	242	243	244	244	245	246	246
38	247	248	249	249	250	251	252	252	253	254
39	254	255	256	257	257	258	259	260	260	261
40	262	262	263	264	265	265	266	267	268	268
41	269	270	270	271	272	273	273	274	275	276
42	276	277	278	278	279	280	281	281	282	283
43	283	284	285	286	286	287	288	288	289	290
44	291	291	292	293	294	294	295	296	296	297
45	298	299	299	300	301	301	302	303	304	304
46	305	306	306	307	308	309	309	310	311	311
47	312	313	314	314	315	316	316	317	318	319
48	319	320	321	321	322	323	324	324	325	326
49	326	327	328	329	329	330	331	331	332	333
50	334	334	335	336	336	337	338	339	339	340
51	341	341	342	343	344	344	345	346	346	347
52	348	349	349	350	351	351	352	353	354	354
53	355	356	356	357	358	358	359	360	361	361
54	362	363	363	364	365	366	366	367	368	368
55	369	370	371	371	372	373	373	374	375	376
56	376	377	378	378	379	380	380	381	382	383
57	383	384	385	385	386	387	388	388	389	390
58	390	391	392	392	393	394	395	395	396	397
59	397	398	399	400	400	401	402	402	403	404
60	405	405	406	407	407	408	409	409	410	411
61	412	412	413	414	414	415	416	416	417	418
62	419	419	420	421	421	422	423	424	424	425
63	426	426	427	428	428	429	430	431	431	432
64	433	433	434	435	436	436	437	438	438	439
65	440	440	441	442	443	443	444	445	445	446

ISO Standard Cup



ISO 6 mm Cup — Efflux Time to Centistokes Conversion Table (continued)

EFFLUX TIME SECONDS	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	<----- VISCOSITY IN CENTISTOKES ----->									
66	447	447	448	449	450	450	451	452	452	453
67	454	454	455	456	457	457	458	459	459	460
68	461	462	462	463	464	464	465	466	466	467
69	468	469	469	470	471	471	472	473	473	474
70	475	476	476	477	478	478	479	480	480	481
71	482	483	483	484	485	485	486	487	487	488
72	489	490	490	491	492	492	493	494	494	495
73	496	497	497	498	499	499	500	501	501	502
74	503	504	504	505	506	506	507	508	508	509
75	510	511	511	512	513	513	514	515	516	516
76	517	518	518	519	520	520	521	522	522	523
77	524	525	525	526	527	527	528	529	529	530
78	531	532	532	533	534	534	535	536	536	537
79	538	539	539	540	541	541	542	543	543	544
80	545	546	546	547	548	548	549	550	550	551
81	552	553	553	554	555	555	556	557	557	558
82	559	560	560	561	562	562	563	564	564	565
83	566	567	567	568	569	569	570	571	571	572
84	573	574	574	575	576	576	577	578	578	579
85	580	580	581	582	583	583	584	585	585	586
86	587	587	588	589	590	590	591	592	592	593
87	594	594	595	596	597	597	598	599	599	600
88	601	601	602	603	604	604	605	606	606	607
89	608	608	609	610	610	611	612	613	613	614
90	615	615	616	617	617	618	619	620	620	621
91	622	622	623	624	624	625	626	627	627	628
92	629	629	630	631	631	632	633	633	634	635
93	636	636	637	638	638	639	640	640	641	642
94	643	643	644	645	645	646	647	647	648	649
95	650	650	651	652	652	653	654	654	655	656
96	656	657	658	659	659	660	661	661	662	663
97	663	664	665	666	666	667	668	668	669	670
98	670	671	672	672	673	674	675	675	676	677
99	677	678	679	679	680	681	682	682	683	684
100	684	685	686	686	687	688	688	689	690	691
101	691	692	693	693	694	695	695	696	697	698
102	698	699	700	700	701	702	702	703	704	704
103	705	706	707	707	708	709	709	710	711	711
104	712	713	714	714	715	716	716	717	718	718
105	719	720	720	721	722	723	723	724	725	725

ISO 8 mm Cup — Efflux Time to Centistokes Conversion Table

ISO viscosity cups are designed to comply with requirements of International Standard ISO 2431 and ASTM Solvent Separation Test Method D5125. Cup dimensions are carefully controlled and cup calibration conditions comply with MIL STD 45662A. Standard viscous oils traceable to the National Institute of Standards and Technology are used in calibration procedures to insure specified efflux time tolerance.

Use this formula, derived by Paul N. Gardner Company research, to find viscosity (V) in centistokes when cup efflux time in seconds (T) is known:

$$V = 21.78T - 306 \div T$$

Use this formula to find cup efflux time in seconds (T) when viscosity (V) in centistokes is known:

$$T = \left(V + \sqrt{V^2 + 26659} \right) \div 43.56$$

Results from the above formulas, solved for each tenth of a second within the cup range, are shown in the following conversion tables. To find centistoke viscosity for a given cup efflux time in seconds, read down the column on the left to find the nearest second. Then, read to the right to the nearest tenth of a second column to find centistoke value. The chart may be read in reverse to find efflux time in seconds when viscosity is known.

ISO Standard Cup



ISO 8 mm Cup — Efflux Time to Centistokes Conversion Table (continued)

EFFLUX TIME SECONDS	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	<----- VISCOSITY IN CENTISTOKES ----->									
10	187	190	192	195	197	200	202	204	207	209
11	212	214	217	219	221	224	226	229	231	233
12	236	238	241	243	245	248	250	253	255	257
13	260	262	264	267	269	271	274	276	278	281
14	283	285	288	290	292	295	297	299	302	304
15	306	309	311	313	316	318	320	322	325	327
16	329	332	334	336	339	341	343	345	348	350
17	352	355	357	359	361	364	366	368	370	373
18	375	377	380	382	384	386	389	391	393	395
19	398	400	402	404	407	409	411	414	416	418
20	420	423	425	427	429	432	434	436	438	441
21	443	445	447	450	452	454	456	459	461	463
22	465	467	470	472	474	476	479	481	483	485
23	488	490	492	494	497	499	501	503	506	508
24	510	512	514	517	519	521	523	526	528	530
25	532	534	537	539	541	543	546	548	550	552
26	555	557	559	561	563	566	568	570	572	575
27	577	579	581	583	586	588	590	592	594	597
28	599	601	603	606	608	610	612	614	617	619
29	621	623	625	628	630	632	634	637	639	641
30	643	645	648	650	652	654	656	659	661	663
31	665	668	670	672	674	676	679	681	683	685
32	687	690	692	694	696	698	701	703	705	707
33	709	712	714	716	718	720	723	725	727	729
34	732	734	736	738	740	743	745	747	749	751
35	754	756	758	760	762	765	767	769	771	773
36	776	778	780	782	784	787	789	791	793	795
37	798	800	802	804	806	809	811	813	815	817
38	820	822	824	826	828	831	833	835	837	839
39	842	844	846	848	850	853	855	857	859	861
40	864	866	868	870	872	875	877	879	881	883
41	886	888	890	892	894	896	899	901	903	905
42	907	910	912	914	916	918	921	923	925	927
43	929	932	934	936	938	940	943	945	947	949
44	951	954	956	958	960	962	965	967	969	971
45	973	975	978	980	982	984	986	989	991	993
46	995	997	1000	1002	1004	1006	1008	1011	1013	1015
47	1017	1019	1022	1024	1026	1028	1030	1032	1035	1037
48	1039	1041	1043	1046	1048	1050	1052	1054	1057	1059
49	1061	1063	1065	1068	1070	1072	1074	1076	1078	1081
50	1083	1085	1087	1089	1092	1094	1096	1098	1100	1103
51	1105	1107	1109	1111	1114	1116	1118	1120	1122	1124
52	1127	1129	1131	1133	1135	1138	1140	1142	1144	1146
53	1149	1151	1153	1155	1157	1160	1162	1164	1166	1168
54	1170	1173	1175	1177	1179	1181	1184	1186	1188	1190
55	1192	1195	1197	1199	1201	1203	1205	1208	1210	1212

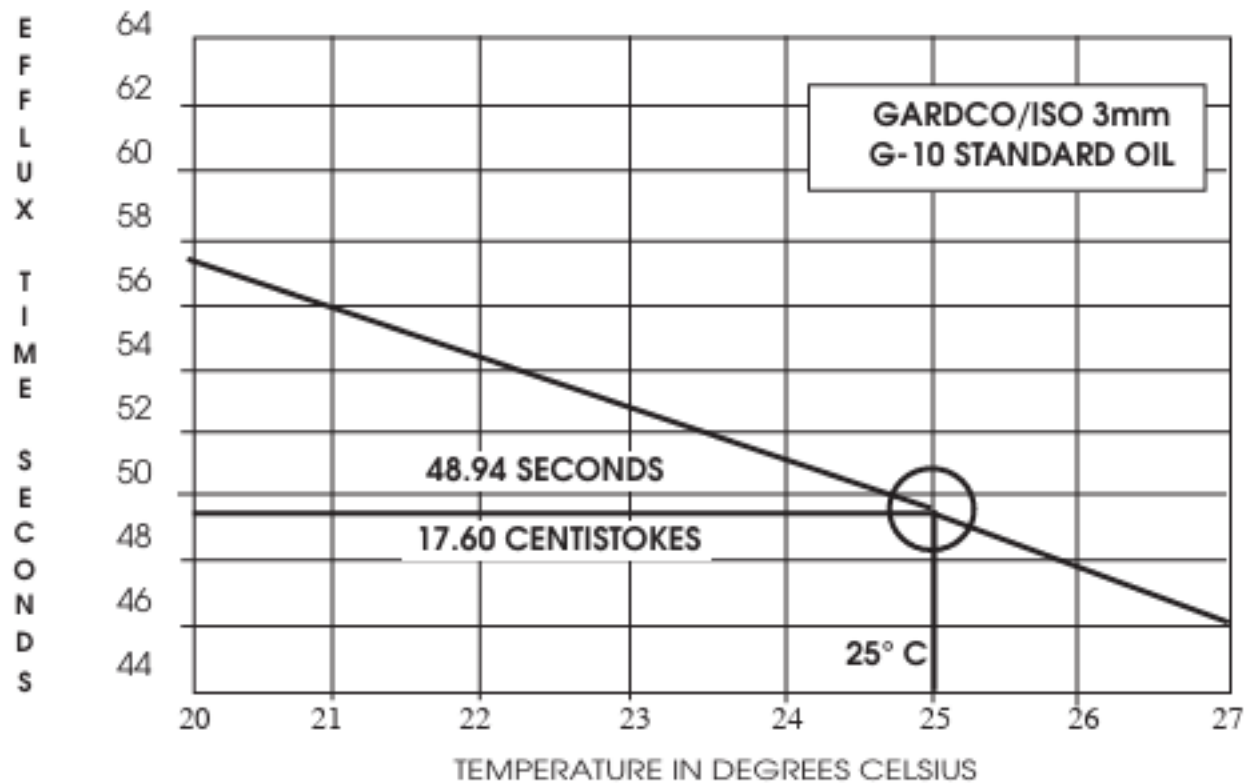
ISO 8 mm Cup — Efflux Time to Centistokes Conversion Table (continued)

EFFLUX TIME SECONDS	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	<----- VISCOSITY IN CENTISTOKES ----->									
56	1214	1216	1219	1221	1223	1225	1227	1230	1232	1234
57	1236	1238	1240	1243	1245	1247	1249	1251	1254	1256
58	1258	1260	1262	1265	1267	1269	1271	1273	1275	1278
59	1280	1282	1284	1286	1289	1291	1293	1295	1297	1300
60	1302	1304	1306	1308	1310	1313	1315	1317	1319	1321
61	1324	1326	1328	1330	1332	1334	1337	1339	1341	1343
62	1345	1348	1350	1352	1354	1356	1359	1361	1363	1365
63	1367	1369	1372	1374	1376	1378	1380	1383	1385	1387
64	1389	1391	1394	1396	1398	1400	1402	1404	1407	1409
65	1411	1413	1415	1418	1420	1422	1424	1426	1428	1431
66	1433	1435	1437	1439	1442	1444	1446	1448	1450	1453
67	1455	1457	1459	1461	1463	1466	1468	1470	1472	1474
68	1477	1479	1481	1483	1485	1487	1490	1492	1494	1496
69	1498	1501	1503	1505	1507	1509	1511	1514	1516	1518
70	1520	1522	1525	1527	1529	1531	1533	1536	1538	1540
71	1542	1544	1546	1549	1551	1553	1555	1557	1560	1562
72	1564	1566	1568	1570	1573	1575	1577	1579	1581	1584
73	1586	1588	1590	1592	1594	1597	1599	1601	1603	1605
74	1608	1610	1612	1614	1616	1619	1621	1623	1625	1627
75	1629	1632	1634	1636	1638	1640	1643	1645	1647	1649
76	1651	1653	1656	1658	1660	1662	1664	1667	1669	1671
77	1673	1675	1677	1680	1682	1684	1686	1688	1691	1693
78	1695	1697	1699	1701	1704	1706	1708	1710	1712	1715
79	1717	1719	1721	1723	1725	1728	1730	1732	1734	1736
80	1739	1741	1743	1745	1747	1749	1752	1754	1756	1758
81	1760	1763	1765	1767	1769	1771	1773	1776	1778	1780
82	1782	1784	1787	1789	1791	1793	1795	1798	1800	1802
83	1804	1806	1808	1811	1813	1815	1817	1819	1822	1824
84	1826	1828	1830	1832	1835	1837	1839	1841	1843	1846
85	1848	1850	1852	1854	1856	1859	1861	1863	1865	1867
86	1870	1872	1874	1876	1878	1880	1883	1885	1887	1889
87	1891	1894	1896	1898	1900	1902	1904	1907	1909	1911
88	1913	1915	1918	1920	1922	1924	1926	1928	1931	1933
89	1935	1937	1939	1942	1944	1946	1948	1950	1951	1955
90	1957	1959	1961	1963	1966	1968	1970	1972	1974	1976

ISO Standard Cup



Efflux Time Versus Temperature



GARDCO produced viscosity cups are calibrated with standard G Series standard oils. Centistoke viscosity of these oils is traceable to the National Institute of Standards and Technology.

The graph above identifies the cup orifice size and the standard G Series standard oil used for calibration. Normally, cup calibration is at 25°C, shown on the graph by bold lines intersecting with the curve in the circle.

The viscosity of most liquids, including the standard oils, is dependent on temperature. Efflux time in seconds for the indicated cup-oil combination from twenty (20) to twenty-seven (27) degrees Celsius is shown in the above graph. The cup may be checked with the indicated G Series standard oil with reasonable accuracy within these limits. For best accuracy, the viscosity of the standard oil in Centistokes, as printed on the standard oil bottle label, at a temperature of 25° Celsius should be used. Use the formula or table supplied with the cup to convert viscosity to efflux time in second.

Efflux Time Versus Temperature (continued)

Temperature Scale Conversion Between Celsius and Fahrenheit

DEGREES		DEGREES	
CELSIUS	FAHRENHEIT	CELSIUS	FAHRENHEIT
20.0	68.0	23.6	74.5
20.1	68.2	23.7	74.7
20.2	68.4	23.8	74.8
20.3	68.5	23.9	75.0
20.4	68.7	24.0	75.2
20.5	68.9	24.1	75.4
20.6	69.1	24.2	75.6
20.7	69.3	24.3	75.7
20.8	69.4	24.4	75.9
20.9	69.6	24.5	76.1
21.0	69.8	24.6	76.3
21.1	70.0	24.7	76.5
21.2	70.2	24.8	76.6
21.3	70.3	24.9	76.8
21.4	70.5	25.0	77.0
21.5	70.7	25.1	77.2
21.6	70.9	25.2	77.4
21.7	71.1	25.3	77.5
21.8	71.2	25.4	77.7
21.9	71.4	25.5	77.9
22.0	71.6	25.6	78.1
22.1	71.8	25.7	78.3
22.2	72.0	25.8	78.4
22.3	72.1	25.9	78.6
22.4	72.3	26.0	78.8
22.5	72.5	26.1	79.0
22.6	72.7	26.2	79.2
22.7	72.9	26.3	79.3
22.8	73.0	26.4	79.5
22.9	73.2	26.5	79.7
23.0	73.4	26.6	79.9
23.1	73.6	26.7	80.1
23.2	73.8	26.8	80.2
23.3	73.9	26.9	80.4
23.4	74.1	27.0	80.6
23.5	74.3		

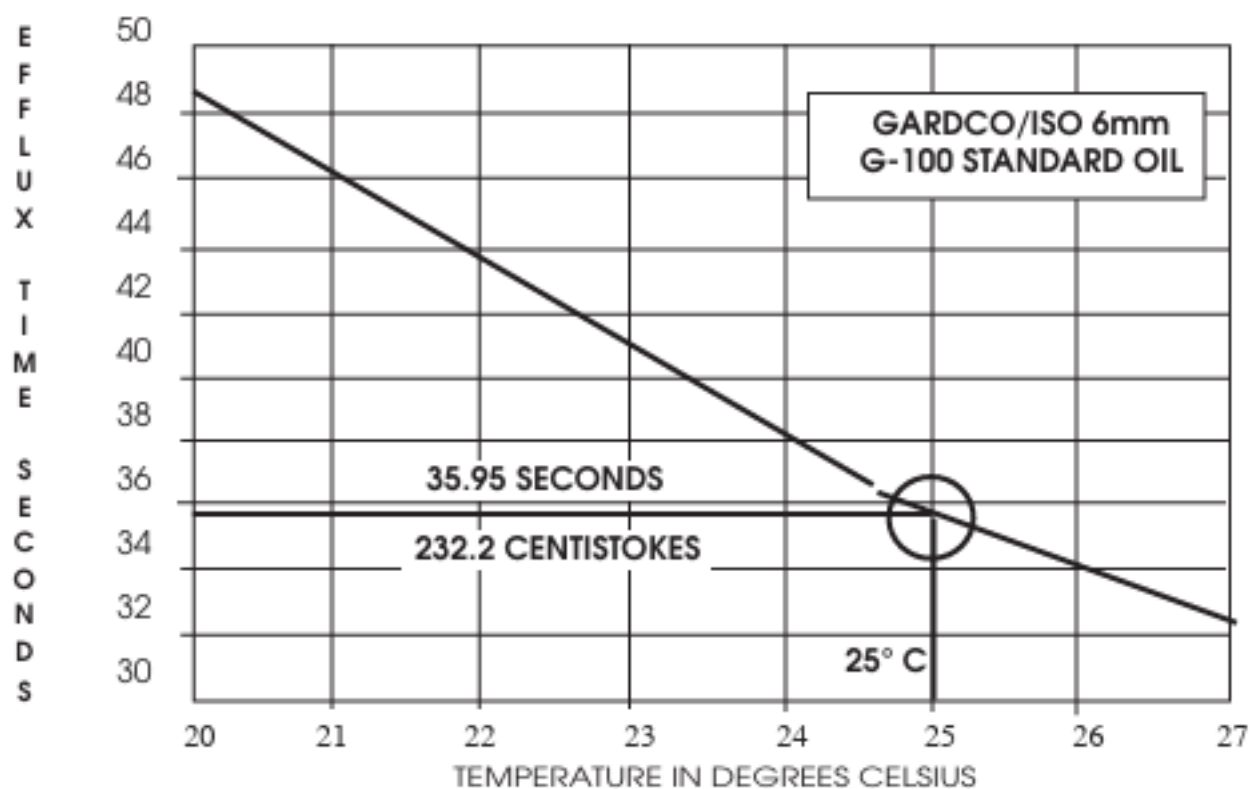
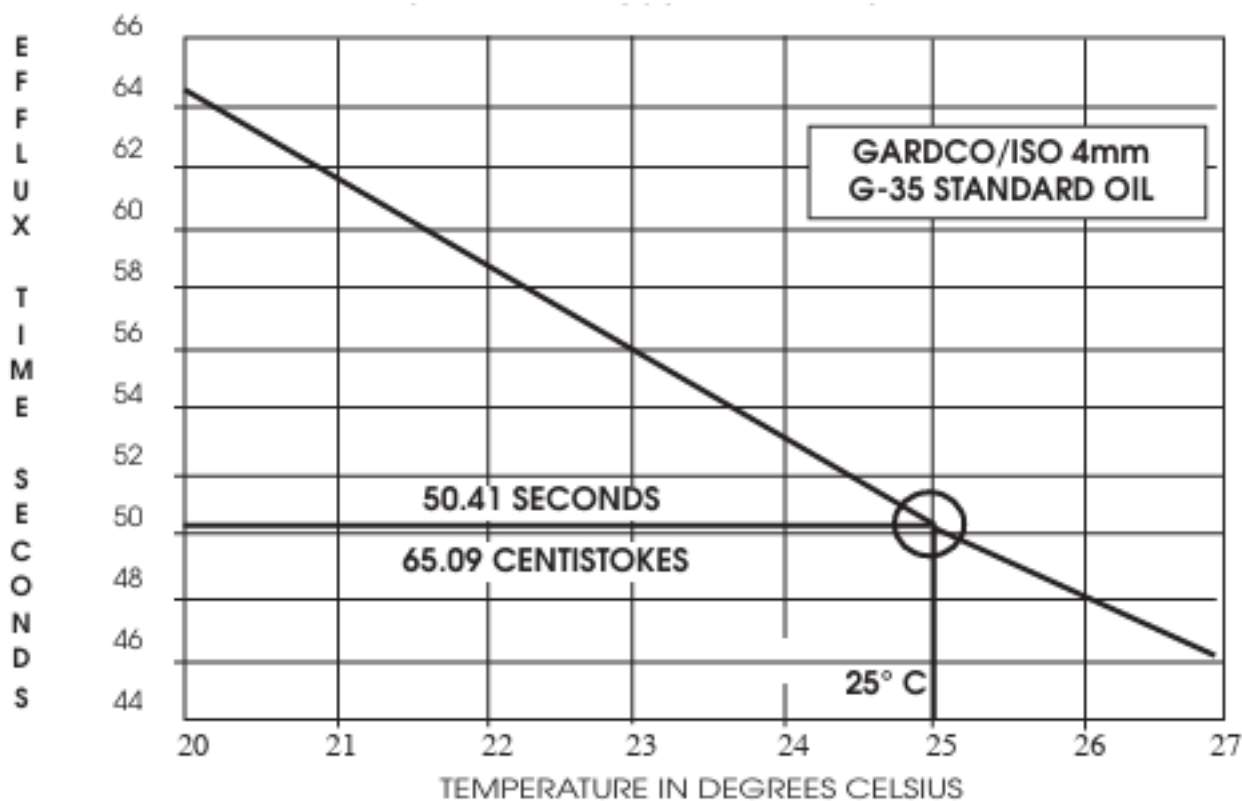
$$F^{\circ} = (C^{\circ} \times 1.8) + 32$$

$$C^{\circ} = (F^{\circ} - 32^{\circ}) \div 1.8$$

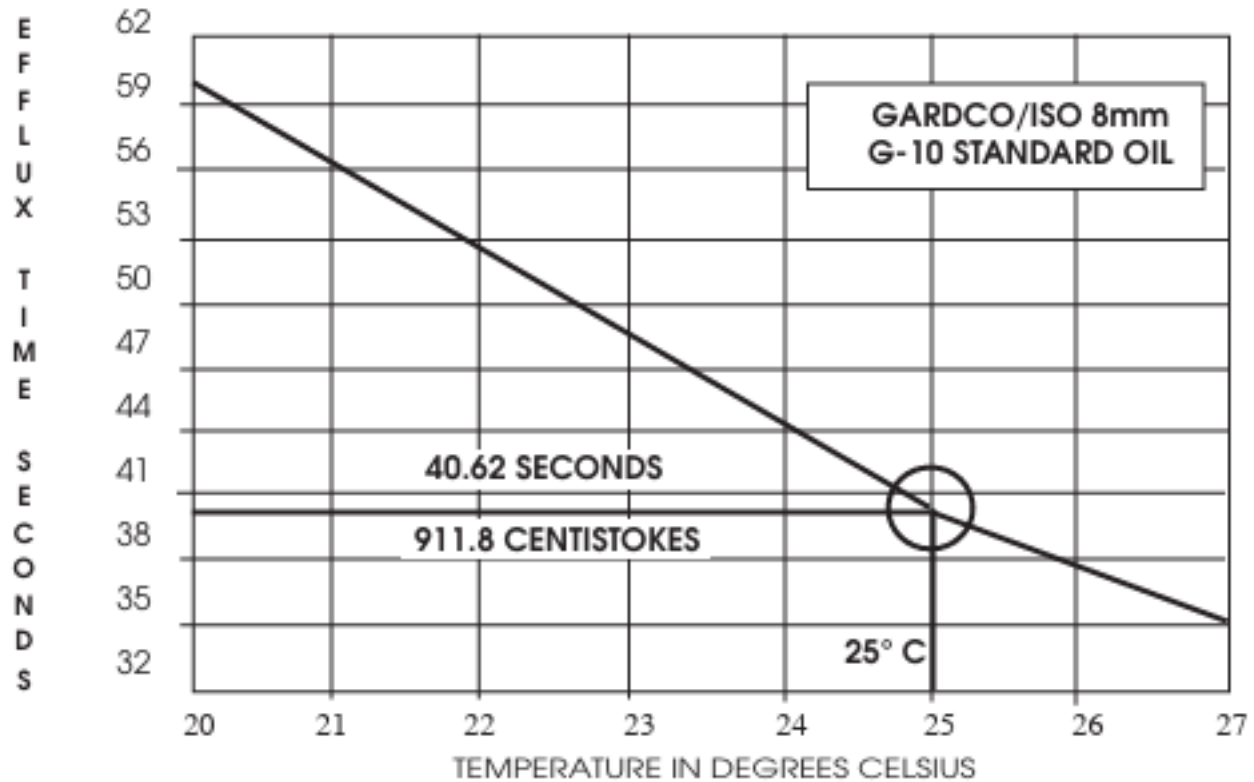
ISO Standard Cup



Efflux Time Versus Temperature (continued)



Efflux Time Versus Temperature (continued)



These charts show the relationship between temperature and efflux time for the designated ISO cup and G Series Viscosity Standard oil. For the best accuracy, use the actual viscosity value shown on the standard oil bottle label at the specified test temperature.