GARDCO CALIBRATED

S90/ZAHN SIGNATURE DIP VISCOSITY CUPS

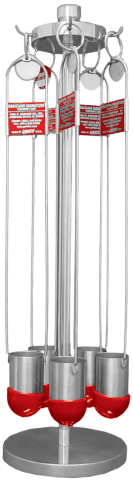
ALL STAINLESS STEEL

- S90/Zahn Signature Dip Viscosity cups are an improved version of the time honored Zahn Signature viscosity cups. GARDCO is the only producer authorized to use the Zahn name and has added the S90 designation to identify the improved viscosity cups manufactured on new state-of-the-art equipment to insure optimum quality and uniformity.
- Calibration of the S90/Zahn cups match the earlier Zahn Signature cups.
- Conversion formulas and tables relating cup efflux time in seconds to viscosity in centistokes are identical for both series of cups.
- S90/Zahn cups qualify for certification under **ANSI/NCSL Z540-1** or **ISO/IEC 17025:2005, ISO 9001:2008**, as applicable.
- S90/Zahn cups are calibrated with standard "G" series oils traceable to the National Institute of Standards & Technology.
- "G" series calibration oils are produced in accordance with **ISO 9002**

NOTE: Efflux time from these cups does not meet ASTM specifications, but tables are available for converting S90/Zahn cup efflux time to EZ™ Zahn cup efflux time which complies with **ASTM D 4212**.

- Cup flow characteristics are defined by a mathematical

Made In the USA



Set of 5 S90/Zahn cups in Carrousel Stand (VI-2018)

ADVANTAGES

mula and standard "G" series oils.

- Furnished with each S90/Zahn cup is a conversion table relating cup efflux time to the nearest tenth of a second to viscosity in centistokes.
- S90/Zahn cups, with the above advantages, cannot be confused with other, lesser defined cups as they are produced, calibrated and sold only by Paul N. Gardner Company and authorized dealers.
- Ransom & Randolph recommends the S90/Zahn cups as the most reliable viscosity cups to measure and control the consistency of ceramic shell slurries.

S90/ZAHN VISCOSITY CUPS ORDERING INFORMATION

Set of 5 S90/Zahn cups in wood stand (VI-2015)

RANGE SPECIFICATION

S90/Zahn **Catalog Number**	Cup No.	Seconds Range	Centistoke Range
VI-2101	1	31 to 60	15 to 78
VI-2102	2	19 to 60	39 to 238
VI-2103	3	11 to 60	63 to 604
VI-2104	4	10 to 60	97 to 899
VI-2105	5	10 to 60	219 to 1627

CONVERSION FORMULAS

Cup Number	Efflux Time Seconds "T" from Centistokes "V"	Centistokes "V" from Efflux Time in seconds "T"
1	$T = (V + \sqrt{V^2 + 6805}) \div 3.18$	$V = 1.59T - 1070 \div T$
2	$T = (V + \sqrt{V^2 + 12707}) \div 8.36$	$V = 4.18T - 760 \div T$
3	$T = (V + \sqrt{V^2 + 23529}) \div 20.46$	$V = 10.23T - 575 \div T$
4	$T = (V + \sqrt{V^2 + 32983}) \div 30.26$	$V = 15.13T - 545 \div T$
5	$T = (V + \sqrt{V^2 + 58903}) \div 54.54$	$V = 27.27T - 540 \div T$

Note: Furnished with each cup is a conversion table for each tenth of a second within the cup range.

One-pint container of "G" series calibration oil

STANDARD "G" SERIES CALIBRATING OILS

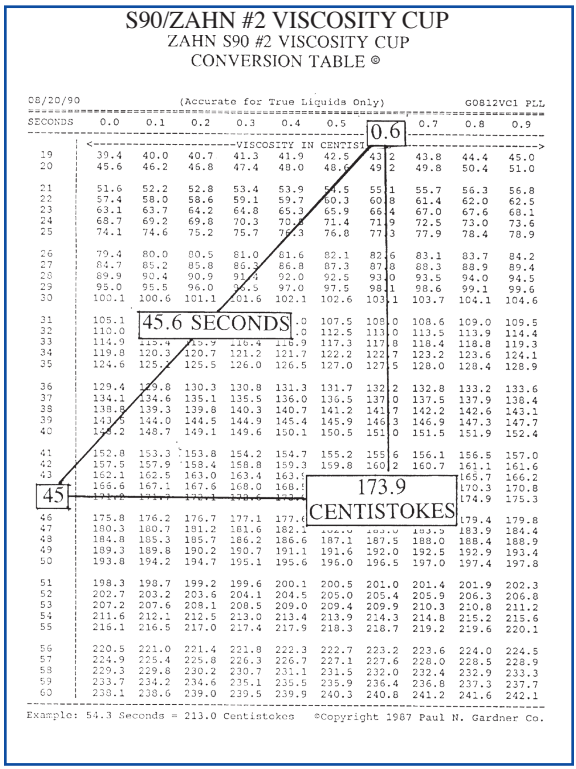
Catalog Number	Oil Number	Use With Cup Number	Nominal Centistokes* at 25°C., 77°F.
VI-3805	G-20	1	35
VI-3815	G-60	2	120
VI-3820	G-100	3	230
VI-3825	G-350	4 and 5	880

*Certified value is printed on container label.
Note: A graph is furnished with each cup showing efflux time of the "G" oil from 20 to 27 degrees Celsius.

These standard oils prepared expressly by the Cannon Instrument Company for the Paul N. Gardner Company are produced in accordance with **ISO/IEC 17025:2005, ISO/IEC Guide 34:2009, ISO 9001:2008.**

Caution: Silicone fluids should not be used to calibrate viscosity cups. These materials change the interface between the cup surface and the test material and therefore change the cup calibration. The following is taken from ASTM D 445: Viscometers used for silicone fluids should be reserved for the exclusive use of such fluids. Solvent washings from these viscometers should not be used for cleaning other viscometers.

CONVERSION TABLE
BETWEEN EFFLUX TIME IN SECONDS AND CENTISTOKES
(PROTECTED BY COPYRIGHT)



S90/ZAHN #2 VISCOSITY CUP
ZAHN S90 #2 VISCOSITY CUP
CONVERSION TABLE ©

08/20/90 (Accurate for True Liquids Only) G0812VC1 PLL

SECONDS	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
	<-------- VISCOSITY IN CENTIST									-------->
19	39.4	40.0	40.7	41.3	41.9	42.5	43.2	43.8	44.4	45.0
20	45.6	46.2	46.8	47.4	48.0	48.6	49.2	49.8	50.4	51.0
21	51.6	52.2	52.8	53.4	53.9	54.5	55.1	55.7	56.3	56.8
22	57.4	58.0	58.6	59.1	59.7	60.3	60.8	61.4	62.0	62.5
23	63.1	63.7	64.2	64.8	65.3	65.9	66.4	67.0	67.6	68.1
24	68.7	69.2	69.8	70.3	70.8	71.4	71.9	72.5	73.0	73.6
25	74.1	74.6	75.2	75.7	76.3	76.8	77.3	77.9	78.4	78.9
26	79.4	80.0	80.5	81.0	81.6	82.1	82.6	83.1	83.7	84.2
27	84.7	85.2	85.8	86.3	86.8	87.3	87.8	88.3	88.9	89.4
28	89.9	90.4	90.9	91.4	92.0	92.5	93.0	93.5	94.0	94.5
29	95.0	95.5	96.0	96.5	97.0	97.5	98.1	98.6	99.1	99.6
30	100.1	100.6	101.1	101.6	102.1	102.6	103.1	103.7	104.1	104.6
31	105.1	45.6 SECONDS				107.5	108.0	108.6	109.0	109.5
32	110.0					112.5	113.0	113.5	113.9	114.4
33	114.9					117.3	117.8	118.4	118.8	119.3
34	119.8	120.3	120.7	121.2	121.7	122.2	122.7	123.2	123.6	124.1
35	124.6	125.1	125.5	126.0	126.5	127.0	127.5	128.0	128.4	128.9
36	129.4	129.8	130.3	130.8	131.3	131.7	132.2	132.8	133.2	133.6
37	134.1	134.6	135.1	135.5	136.0	136.5	137.0	137.5	137.9	138.4
38	138.8	139.3	139.8	140.3	140.7	141.2	141.7	142.2	142.6	143.1
39	143.6	144.0	144.5	144.9	145.4	145.9	146.3	146.9	147.3	147.7
40	148.2	148.7	149.1	149.6	150.1	150.5	151.0	151.5	151.9	152.4
41	152.8	153.3	153.8	154.2	154.7	155.2	155.6	156.1	156.5	157.0
42	157.5	157.9	158.4	158.8	159.3	159.8	160.2	160.7	161.1	161.6
43	162.1	162.5	163.0	163.4	163.9				165.7	166.2
45	166.6	167.1	167.6	168.0	168.5	173.9 CENTISTOKES			170.3	170.8
									174.9	175.3
46	175.8	176.2	176.7	177.1	177.6				179.4	179.8
47	180.3	180.7	181.2	181.6	182.1				183.9	184.4
48	184.8	185.3	185.7	186.2	186.6	187.1	187.5	188.0	188.4	188.9
49	189.3	189.8	190.2	190.7	191.1	191.6	192.0	192.5	192.9	193.4
50	193.8	194.2	194.7	195.1	195.6	196.0	196.5	197.0	197.4	197.8
51	198.3	198.7	199.2	199.6	200.1	200.5	201.0	201.4	201.9	202.3
52	202.7	203.2	203.6	204.1	204.5	205.0	205.4	205.9	206.3	206.8
53	207.2	207.6	208.1	208.5	209.0	209.4	209.9	210.3	210.8	211.2
54	211.6	212.1	212.5	213.0	213.4	213.9	214.3	214.8	215.2	215.6
55	216.1	216.5	217.0	217.4	217.9	218.3	218.7	219.2	219.6	220.1
56	220.5	221.0	221.4	221.8	222.3	222.7	223.2	223.6	224.0	224.5
57	224.9	225.4	225.8	226.3	226.7	227.1	227.6	228.0	228.5	228.9
58	229.3	229.8	230.2	230.7	231.1	231.5	232.0	232.4	232.9	233.3
59	233.7	234.2	234.6	235.1	235.5	235.9	236.4	236.8	237.3	237.7
60	238.1	238.6	239.0	239.5	239.9	240.3	240.8	241.2	241.6	242.1

Example: 54.3 Seconds = 213.0 Centistokes ©Copyright 1987 Paul N. Gardner Co.

Flow characteristics of S90/Zahn cups are accurately defined by mathematical formula relating cup efflux time to viscosity. The formula for each cup in the series is shown in the Conversion Formula table. For convenience, the formula for each cup has been solved for each tenth of a second within the normal cup range. Results are available in table form as shown greatly reduced at the left and are furnished with each cup. They are also available in sets for each cup in the series.

Use the table as follows: Assume an efflux time of 45.6 seconds. Read down the left column to the 45 line and then to the right on this line to the 0.6 column. The value at the intersection is 173.9 centistokes. The table may be read in reverse to find efflux time in seconds from a known centistoke value.

INSTRUCTIONS FOR USE

- Select the cup to be used from the Range Specification table.
- Insure that the cup is clean, especially around the orifice.
- Adjust temperature of the material to be tested, if necessary.
- Holding the cup by the ring, immerse it into the test material.
- Measure and record temperature of material encompassed by cup.
- Hold cup vertically by inserting index finger into handle ring. In a quick, steady motion, lift the cup out of the sample material, starting the timer when the top edge of the cup breaks the surface. During the flow time, hold the cup no more than 6" above the level of the sample material.
- Stop the timer when the first definite break in the stream at the base of the cup is observed.
- Record cup name, number and efflux time in seconds with temperature.
- Promptly clean the cup taking care not to abrade orifice. Use a length of nylon fishing line to clean the orifice.

CARE OF CUP

GARDCO produced and calibrated S90/Zahn viscosity cups are made of stainless steel except for the name plate. These cups will give years of satisfactory service requiring only thorough cleaning following each use. Even so, it is good practice to periodically confirm cup calibration. This is easily done with use of appropriate "G" oil listed in the Calibrating Oils table. Centistoke label value of the oil is traceable to the National Institute of Standards and Technology.

Guide for removing the G-series calibrating oil from Gardco viscosity cups.

Any remaining material in the cup must be removed by flushing with a suitable solvent. Light naphtha, heptane, octane, highly aromatic solvents, and or any other petroleum-derived hydrocarbon solvent can be used. Varsol® is a commercial solvent that works very well for this purpose.

Completely dry the viscosity cup with a lint free cloth. Use a highly volatile solvent for a second cleaning as since any remaining hydrocarbon solvents from the first process will evaporate quickly after the sample has been flushed from the cup. Hypersolve, MEK and Alcohol can be used in aluminum cups and Hypersolve and Alcohol for the stainless steel cups. Acetone is commonly used as the second solvent because of its high volatility and its ability to dissolve traces of petroleum solvents and water.

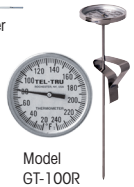
In the third process a low velocity stream of clean air will be sufficient to evaporate remaining traces of any volatile solvent. Be aware, avoid rapid evaporation of these solvents as this can cool the surface to such an extent that humid air may be brought below the dew point, causing a film of water to form on the cup.

Varsol is a registered trademark of the Exxon Company

ACCESSORIES

Model AX705
Stopwatch

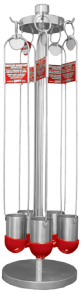
Glass Thermometer
Blue Spirit Filled
(20°-30° C) 4.5"



Model
GT-100R
Dial Thermometer

Platinum RTD
Dial Thermometer

Wood Stand
w/Cups



Aluminum Carrousel
Stand w/Cups

VI-2101	No. 1 S90/Zahn Viscosity Cup .....(Each)	$123.00
VI-2101/C	Certified No. 1 S90/Zahn Viscosity Cup .....(Each)	283.00
VI-2102	No. 2 S90/Zahn Viscosity Cup .....(Each)	123.00
VI-2102/C	Certified No. 2 S90/Zahn Viscosity Cup .....(Each)	283.00
VI-2103	No. 3 S90/Zahn Viscosity Cup .....(Each)	123.00
VI-2103/C	Certified No. 3 S90/Zahn Viscosity Cup .....(Each)	283.00
VI-2104	No. 4 S90/Zahn Viscosity Cup .....(Each)	123.00
VI-2104/C	Certified No. 4 S90/Zahn Viscosity Cup .....(Each)	283.00
VI-2105	No. 5 S90/Zahn Viscosity Cup .....(Each)	123.00
VI-2105/C	Certified No. 5 S90/Zahn Viscosity Cup .....(Each)	283.00
VI-2100/C	**NIST & ANSI/NCSL Z540-1 or ISO/IEC 17025:2005, ISO 9001:2008**, as applicable, Calibration Certificate	160.00
VI-3805	G-20 Certified Viscosity Standard –Pint	84.00
VI-3815	G-60 Certified Viscosity Standard –Pint	84.00
VI-3820	G-100 Certified Viscosity Standard –Pint	84.00
VI-3825	G-350 Certified Viscosity Standard –Pint	84.00
PU-G205	S90 Manual	20.00

Equivalent Charts cover Gardco Calibrated Viscosity Cups and are based on conversion formulas of a type & with parameters as referenced in The Encyclopedia of Polymer Science & Engineering (Vol. 4, Second Edition, John Wiley & Sons, Inc.). Standard oils traceable to the National Institute of Standards & Technology were used in experimental development of these formulas.

VI-VCC	Viscosity Cup Equivalent Wall Chart	FREE
VI-2015	Wood Stand to Hold Five Cups	39.95
VI-2018	Aluminum Carousel Stand w/5 Hooks	245.00
TM-AX705	Ultimate Stopwatch, 1/100 Second	32.00
TM-AX705/C	Certified Ultimate Stopwatch, 1/100 Second, Traceable to N.I.S.T	54.00
TH-0482	Thermometer, Glass, blue spirit filled, 4-1/2", 20° to 30°C	36.00
TH-16100860	GT-100R Thermometer, Stainless, 8" Stem, 25° to 125°F	32.74
TH-16100875	GT-100R Thermometer, Stainless, 8" Stem, 0° to 50°C	32.74
TH-36036-FC	Platinum RTD Thermometer System (-76° to 500°F/-60° to 260°C)	398.00
LA-2029060	Griffin Beaker, 600 ml	21.00

Viscosity Cups are non-returnable items. Subject to final sale.

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