

Elcometer
2210 · 2215 · 2310
2434 · 2435 · 2436 · 2437

Viscosity Dip Cup

Operating Instructions

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A copy of this Instruction Manual is available for download on our Website via www.elcometer.com.

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Thank you for your purchase of this Elcometer Viscosity Dip Cup. Welcome to Elcometer.

Elcometer are world leaders in the design, manufacture and supply of inspection equipment for coatings and concrete. Our products cover all aspects of coating inspection, from development through application to post application inspection.

This Elcometer Viscosity Dip Cup is a world beating product. With the purchase of this Viscosity Dip Cup you now have access to the worldwide service and support network of Elcometer. For more information visit our website at www.elcometer.com

1 ABOUT YOUR VISCOSITY DIP CUP

Elcometer Viscosity Dip Cups are easy-to-use gauges for rapid measurement of viscosity of liquids.

The cup is held by its handle and is dipped into the liquid to be measured. The cup is removed from the liquid and the time taken for the liquid to drain through an orifice in the bottom of the cup is measured.

The measured kinematic viscosity is generally expressed in seconds (s) flow time, which can be converted to Centistokes (cSt). A wide range of cups with different orifices is available for measurements between 2 cSt and 1840 cSt.

1.1 THESE INSTRUCTIONS

These instructions describe the operation of the following Elcometer Viscosity Dip Cups:

Elcometer 2210: Zahn

Elcometer 2215: Lory LCH

Elcometer 2310: Shell

Elcometer 2434/5/6/7: Frikmar

1.2 STANDARDS

The Elcometer Viscosity Dip Cups can be used in accordance with a wide range of National and International Standards.

For full details of which standards are appropriate see “Elcometer viscosity dip cups” on page 10.

1.3 WHAT THE BOX CONTAINS

- Elcometer Viscosity Dip Cup with handle
- Operating instructions
- Storage case

The Elcometer Viscosity Dip Cup is packed in a cardboard and foam package. Please ensure that this packaging is disposed of in an environmentally sensitive manner. Consult your local Environmental Authority for further guidance.

1.4 CAUTION



Take care to avoid damaging your viscosity dip cup. Damage to the orifice, scratches on the internal surface or deformation of the cup will affect the readings and the gauge may have to be replaced.

2 TAKING A READING

2.1 BEFORE YOU START

- Select a cup which gives a flow time of between 30 seconds and 100 seconds.
- Ensure the handle, the cup and the orifice are clean and free of debris, etc.
- The liquid being tested must be homogeneous and must not contain any bubbles.
- Measure and record the temperature of the liquid.

2.2 PROCEDURE

1. Immerse the cup completely into the liquid and twist several times to dislodge any bubbles which may be clinging to the internal surface of the cup (Figure 1, A).
2. Stir the liquid gently to ensure uniform temperature and density.
3. Leave the cup in the liquid for 1 to 5 minutes: For a Zahn cup (which has a low mass) 1 minute will be sufficient; for cups with higher mass, 5 minutes will be better.
4. Lift the cup vertically out of the liquid (Figure 1, B) and start the stopwatch the moment the top of the cup breaks the surface of the liquid.
5. Watch the flow of liquid from the orifice and stop the stopwatch the moment the flow breaks.

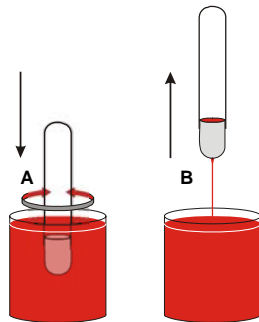


Figure 1. Using the Viscosity Dip Cup

When using a **Lory LCH Viscosity Dip Cup (Elcometer 2215)**, observe the surface of the liquid and stop the stopwatch the moment the top of the spindle appears.



2.3 AFTER THE TEST

Clean the gauge and all equipment.

X Do not use wire brushes, metal scrapers, metal files or other metallic tools for cleaning.

✓ Clean the gauge and all equipment using a suitable solvent only.

After cleaning, ensure that all materials are removed and that the instrument is dry.

3 CONVERTING TO VISCOSITY

The measured kinematic viscosity is expressed generally in seconds (s) flow time, which can be converted to Centistokes (cSt).

To convert from flow time (s) to kinematic viscosity (cSt), use the Elcometer 2400 Viscosity Disc - see "Related equipment" on page 12.

Alternatively, use the following formula:

$$V = K(t - c)$$

where

V = kinematic viscosity in cSt (mm²/s)

t = flow time in seconds



**Viscosity
Disc**

K and c are constants given in the following table:

Cup	K	c
Zahn Cup 1 ^a	1.1	29
Zahn Cup 2 ^a	3.5	14
Zahn Cup 3 ^a	11.7	7.5
Zahn Cup 4 ^a	14.8	5
Zahn Cup 5 ^a	23	0

Cup	K	c
Shell Cup 1	0.226	13
Shell Cup 2	0.576	5
Shell Cup 2½	0.925	3
Shell Cup 3	1.51	2
Shell Cup 3½	2.17	1.5
Shell Cup 4	3.45	1
Shell Cup 5	6.5	1
Shell Cup 6	16.2	0.5

- a. The constants are given in Patton, T. C., Paint Flow and Pigment Dispersion, second edition, John Wiley & Sons, New York, 1979, page 82.

Please note:

- The formula treats the cups as linear, which they are not.
- The formula is effective for flow times between 20 seconds and 80 seconds^a.

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- a. Zahn Cup 1 - formula is effective between 35 seconds and 80 seconds.

4 STORAGE

Always store the gauge in its case when it is not being used.

5 MAINTENANCE

Elcometer Viscosity Dip Cups are designed to give many years reliable service under normal operating and storage conditions.

Regular calibration checks over the life of the gauge are a requirement of quality management procedures e.g. ISO 9000 and other standards.

To check for wear, use Elcometer 2410 Viscosity Standard Oils^b and measure the drain time. If wear is detected, contact Elcometer or your local Elcometer supplier.

Details of Elcometer offices around the world are given on the outside cover of these Operating Instructions. Alternatively visit the Elcometer website, www.elcometer.com

b. See "Elcometer 2434/5/6/7 Frikmar: Anodised Aluminium" on page 8 for ordering information.

6 ACCESSORIES

Calibration certificate

Elcometer Viscosity Dip Cups are supplied with a Batch Calibration Certificate^c as standard. Individual Calibration Certificates are available^c but must be requested at the time of order as they can not be issued retrospectively.

7 TECHNICAL SPECIFICATION

Elcometer 2210 Zahn, 2215 Lory LCH and 2310 Shell: Stainless steel

Elcometer 2434/5/6/7 Frikmar: Anodised Aluminium

Accuracy	2210 Zahn 2310 Shell	2434 DIN4 2437 ISO	2435 ASTM
		15%	3%

c. Certificates are not available for the Elcometer 2215.

8 VISCOSITY STANDARD OILS

Part Number	Range at 25°C (77°F)	Cup Type	Cup No.	Model	Orifice Diameter
K0002410M021	20 - 34cSt	Zahn Dip Cup	1	Elcometer 2210/1	1.8mm
K0002410M022	60 - 120cSt	Zahn Dip Cup	2	Elcometer 2210/2	2.7mm
K0002410M023	100 - 230cSt	Zahn Dip Cup	3	Elcometer 2210/3	3.8mm
K0002410M024	200 - 460cSt	Zahn Dip Cup	3	Elcometer 2210/3	3.8mm
K0002410M025	350 - 850cSt	Zahn Dip Cup	4	Elcometer 2210/4	4.3mm
K0002410M026	600 - 1600cSt	Zahn Dip Cup	5	Elcometer 2210/5	5.3mm
K0002410M021	20 - 34cSt	Shell Dip Cup	2	Elcometer 2310/2	2.4mm
K0002410M022	60 - 120cSt	Shell Dip Cup	4	Elcometer 2310/4	3.8mm
K0002410M023	100 - 230cSt	Shell Dip Cup	5	Elcometer 2310/5	4.6mm
K0002410M024	200 - 460cSt	Shell Dip Cup	6	Elcometer 2310/6	5.8mm
K0002410M022	60 - 120cSt	DIN Frikmär Dip Cup	4	Elcometer 2434/2	4mm
K0002410M023	100 - 230cSt	DIN Frikmär Dip Cup	4	Elcoemter 2434/2	4mm
K0002410M024	200 - 460cSt	DIN Frikmär Dip Cup	4	Elcometer 2434/2	4mm
K0002410M021	20 - 34cSt	ISO Frikmär Dip Cup	3	Elcometer 2437/2	3mm
K0002410M022	60 - 120cSt	ISO Frikmär Dip Cup	4	Elcometer 2437/3	4mm
K0002410M023	100 - 230cSt	ISO Frikmär Dip Cup	6	Elcometer 2437/4	6mm
K0002410M024	200 - 460cSt	ISO Frikmär Dip Cup	6	Elcometer 2437/4	6mm

9 ELCOMETER VISCOSITY DIP CUPS

Elcometer model	Cup No.	Applicable Standards	Range (cSt)	Part number	
				Without Calibration Certificate	With Calibration Certificate
2210/1	1	ASTM D 1084-D	5 - 56	K0002210M001	K0002210M001C‡
2210/2	2	ASTM D 4212	21 - 231	K0002210M002	K0002210M002C‡
2210/3	3		146 - 848	K0002210M003	K0002210M003C‡
2210/4	4		222 - 1110	K0002210M004	K0002210M004C‡
2210/5	5		460 - 1840	K0002210M005	K0002210M005C‡
2215/1	1		-	50 - 1100	K0002215M001
2310/1	1	ASTM D 4212	2 - 20	K0002310M001	K0002310M001C‡
2310/2	2		10 - 50	K0002310M002	K0002310M002C‡
2310/3	3		30 - 120	K0002310M003	K0002310M003C‡
2310/4	4		70 - 270	K0002310M004	K0002310M004C‡
2310/5	5		125 - 520	K0002310M005	K0002310M005C‡
2310/6	6		320 - 1300	K0002310M006	K0002310M006C‡
2434/1	2		-	-	K0002434M001
2434/2	4	DIN 53211	96 - 683	K0002434M002	K0002434M002C‡
2434/3	6	-	-	K0002434M003	K0002434M003C‡‡
2434/4	8	-	-	K0002434M004	K0002434M004C‡‡

Elcometer model	Cup No.	Applicable Standards	Range (cSt)	Part number	
				Without Calibration Certificate	With Calibration Certificate
2435/1	4	ASTM D 1200	70 - 370	K0002435M001	K0002435M001C‡
2436/1	4	NF T30-014	50 - 1100	K0002436M001	K0002436M001C‡‡
2437/2	3	ISO 2431 ^a	7 - 42	K0002437M002	K0002437M002C‡
2437/3	4	ASTM D 5125	34 - 135	K0002437M003	K0002437M003C‡
2437/6	5		91 - 326	K0002437M006	K0002437M006C‡
2437/4	6		188 - 684	K0002437M004	K0002437M004C‡
2437/5	8		-	-	K0002437M005

a. ISO 2431 supersedes DIN 53224, EN535, NBN T22-108, NF T30-070

‡ Efflux Time Certificate

‡‡ Dimensional Certificate

10 RELATED EQUIPMENT

In addition to Viscosity Dip Cups, Elcometer produces a wide range of other equipment for measuring the physical characteristics of surface coatings.

Users of the Elcometer Viscosity Dip Cups may also benefit from the following Elcometer products:

- Elcometer 2410 Viscosity Standard Oils for Calibration
- Elcometer 2400 Viscosity Disc
- Elcometer 7300 Digital Stopwatch
- Elcometer 212/213 Digital Thermometer

For further information contact Elcometer, your local supplier, or visit our website at www.elcometer.com