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Elcometer 2250

Krebs Viscometer

Operating Instructions

This product meets the Electromagnetic Compatibility Directive and the Low Voltage Directive.

The product is Class B, Group 1 ISM equipment according to CISPR 11.

Group 1 ISM product: A product in which there is intentionally generated and/or used conductively coupled radio-frequency energy which is necessary for the internal functioning of the equipment itself.

Class B product are suitable for use in domestic establishments and in establishments directly connected to a low voltage power supply network which supplies buildings used for domestic purposes

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

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Thank you for purchasing this Elcometer Krebs Viscometer. 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.

The Elcometer Krebs Viscometer is a world beating product. With the purchase of this product 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 VISCOMETER

The Elcometer Krebs Viscometer measures the viscosity of paints, varnishes, adhesives, pastes and liquid inks in accordance with ASTM D 562 and other standards.

This simple-to-use instrument consists of a paddle mounted on the end of a rotating spindle. The paddle is immersed in the sample and rotated at a constant speed of 200 revolutions per minute. The viscometer automatically calculates the viscosity value from the power required to maintain the speed of rotation of the spindle.

A digital display shows the viscosity of the sample in Krebs units, centipoise or grams.

The Elcometer Krebs Viscometer features manual or automatic operation. In automatic mode, at the press of a button:

- the spindle lowers into the sample to a pre-set depth
- the instrument waits to allow turbulence in the sample to subside (the wait time is adjustable)
- the spindle rotates and the measurement is taken (the measurement rotation time is adjustable)
- the spindle rises out of the sample.

The operation of the Elcometer Krebs Viscometer is based on the Stormer mechanical system. In this system a blade rotates at a constant angular velocity and the variation of viscosity between products is determined by modifying the weight (in grams) needed to maintain this constant velocity.

1.1 What the box contains

Note: *When removing the viscometer from the packaging box, hold the viscometer by the base and the column - do not lift it by the head.*

- Viscometer
- Drive coupling protection cap, plastic
- Krebs spindle
- Sample container support, large, for 600 ml glass beaker and 1 pint (USA) can
- Sample container support, small, for ½ pint (USA) can
- Locating plug for sample container support
- Sample container, 600 ml, glass
- Hexagonal wrench, 1.5 mm
- Power supply cable
- Calibration certificate
- Operating instructions

Your Elcometer Krebs Viscometer 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.

1.2 Standards

Your Viscometer can be used in accordance with the following National and International Standards:

- AS/NZS 1580.214.1
- ASTM D 562
- ASTM D 1084-C

1.3 Krebs units

The Elcometer Krebs Viscometer is suitable for measuring in Krebs units (KU) the viscosity of paints, varnishes, adhesives, pastes, liquid inks and other similar substances.

The Krebs unit scale is commonly used to refer to viscosity or consistency of paints that are applied by brush or roller.

The Krebs unit is defined by following equation:

- For viscosity in the range from 200 cP to 2100 cP

  $KU = 1.1187 + 0.8542 \ln (0.1938 v + 36) - 0.0443 [\ln (0.1938 v + 36)]^2$
- For viscosity in the range from 2100 cP to 5000 cP

  $KU = 1.8118 + 0.596 \ln (0.1938 v + 36) - 0.0206 [\ln (0.1938 v + 36)]^2$

where:

- KU is viscosity in Krebs units
- v is viscosity in centipoise (cP)

Note: *The equivalent viscosity in cP given by the instrument should only be used for comparison between one sample and another; it must* ***never*** *be used for quantitative measurement of viscosity.*

To maximise the benefits of your new Elcometer Krebs Viscometer please take some time to read these Operating Instructions. Do not hesitate to contact Elcometer or your Elcometer supplier if you have any questions.

2 CAUTION

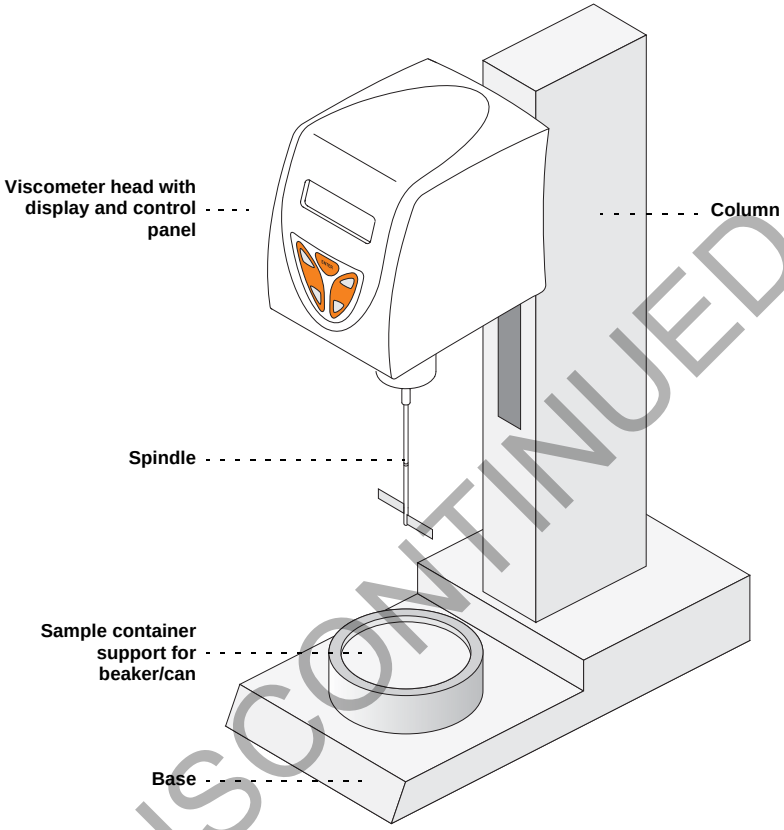
The Elcometer Krebs Viscometer has been manufactured with your safety in mind. However, improper use can result in damage to the machine.

Please observe the precautions discussed in these operating instructions.

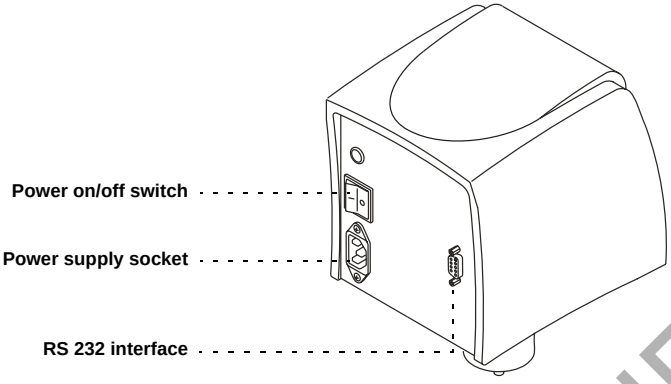
- To reduce the risk of electric shock, do not open the Viscometer. There are no user-serviceable parts inside.
- To reduce the risk of fire or electric shock, do not expose the Viscometer to rain or excess moisture.
- The mains plug on your Viscometer may be fitted with a fuse. When replacing this fuse, ensure a fuse of the correct rating is used.
- Do not use the Elcometer Krebs Viscometer in hazardous environments.

3 GETTING STARTED

3.1 The parts of the instrument



3.2 Rear connections

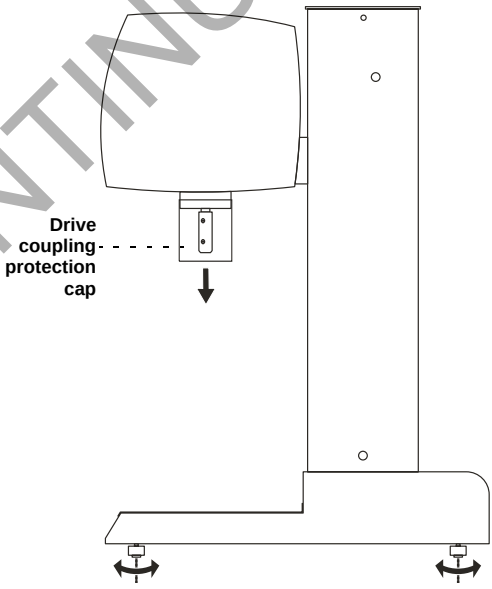


3.3 Installing the Viscometer

To install your Viscometer:

1. Place the base on a stable and flat surface.
2. Rotate the adjustable feet under the base until the instrument is level; use a bubble level placed on the base of the instrument as a guide.
3. Remove the plastic drive coupling protection cap from the bottom of the Viscometer; pull the cap vertically down until it is well clear of the drive coupling and then remove to one side.

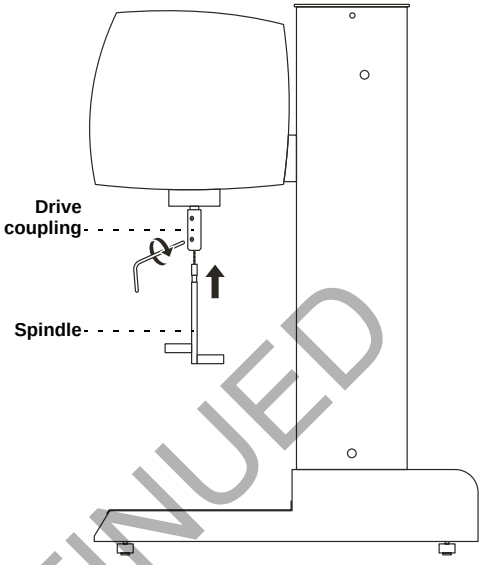
   Do not dispose of the protection cap. To prevent accidental damage to the drive coupling, always replace the cap when the instrument is not in use.
4. Connect the instrument to the mains.



3.4 Fitting the spindle

Note: *This operation must be done very carefully to ensure that the spindle is not bent and the motor drive coupling or internal components are not damaged.*

1. Check that the connecting surfaces of the spindle and the motor drive coupling are clean.
2. Insert the spindle as far as it will go up into the motor drive coupling.
3. Using the hexagonal wrench supplied, rotate the retaining screw until it just makes contact with the spindle.
4. Pull down on the spindle until its movement is stopped by the retaining screw.
5. Tighten the retaining screw.



3.5 Fitting a sample container support

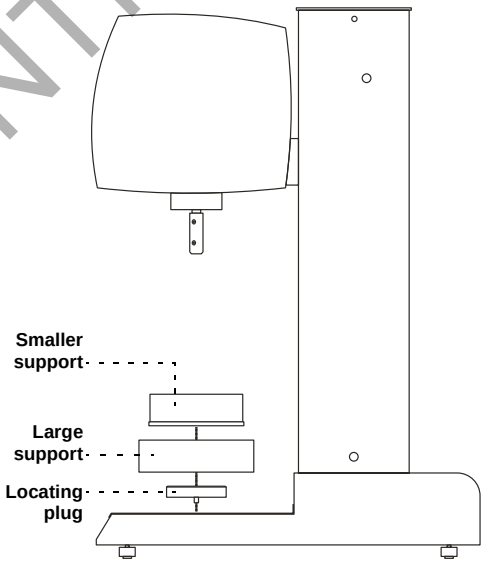
During a test, the sample container (glass beaker or can) is held in position at the correct height by the sample container support. Two supports are supplied with the instrument - a large one and a smaller one. Which support you use depends upon the size of the sample container.

The sample container support is held in position on the base by the locating plug.

To fit the sample container support:

When using the glass beaker supplied with the instrument, or a 1 pint (USA) can

1. Place the locating plug into the recess on the base of the instrument.
2. Place the large sample container support onto the locating plug.

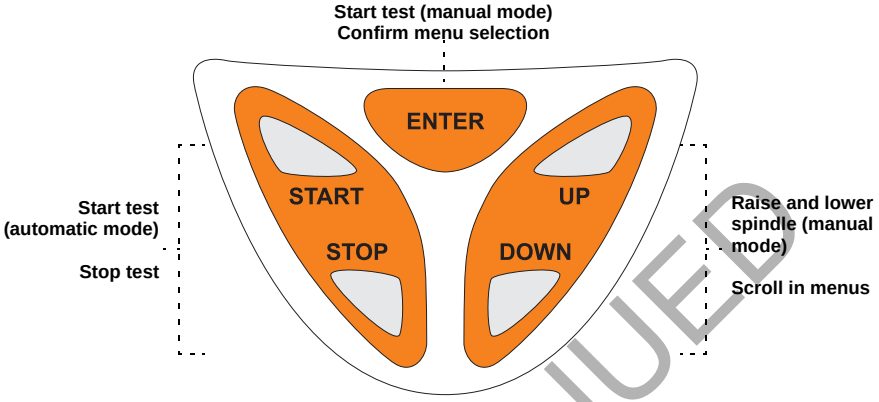


When using a ½ pint (USA) can

1. Place the locating plug into the recess on the base of the instrument.
2. Place the large sample container support onto the locating plug.
3. Place the smaller sample container support into the recess on the top of the large sample container support.

3.6 Control panel

Your Viscometer is controlled using the five buttons on the control panel on the front of the Viscometer head.



4 THE SAMPLE

4.1 Sample quantity

To maximise the accuracy and consistency of test results, always use the same quantity of sample for each test.

To determine the correct quantity of sample, do the following:

1. Place the sample container on the sample container support.
2. Attach the spindle to the drive head (see “Fitting the spindle” on page 8).
3. Switch on the instrument and select manual mode (see “Taking a measurement in manual mode” on page 14).
4. Press [DOWN] until the spindle reaches the lowest position (the instrument will sound an audible beep when the spindle reaches the lowest position).
5. Pour the sample into the container. Stop pouring when the surface of the sample reaches the notch on the spindle shaft. If using the 600 ml glass beaker supplied with the instrument, 450 ml to 460 ml of sample will be required to reach this level.
6. Make a record of the quantity of sample used.

Whenever you conduct a test, always use this same quantity of sample. By doing this, you will be able to perform different measurements with the same working conditions, therefore permitting reliable comparisons between test results to be made.

4.2 Sample temperature

The temperature of the sample has a significant effect upon its viscosity. Always check the temperature of the sample before conducting a test. The temperature of the sample must be stable and at the value specified in the test standard.

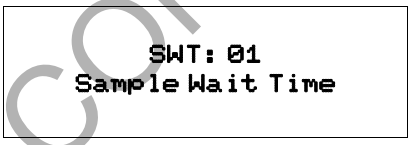
5 CONFIGURING YOUR VISCOMETER

To configure your Elcometer Krebs Viscometer ready to take measurements, do the following:

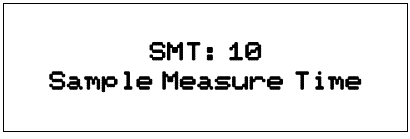
1. Switch on the Viscometer (use the power on/off switch at rear of head).
   The instrument displays:

2. While the welcome message is displayed (5 seconds), press [START] and then [ENTER].
   The instrument displays the ***viscosity units*** selection screen:

3. If necessary, press [UP] or [DOWN] to select the working units: Ku (Krebs units), cP (Centipoise) or g (grams).
4. Press [ENTER] to confirm your selection.
   The instrument displays the ***SWT (sample wait time)*** selection screen:



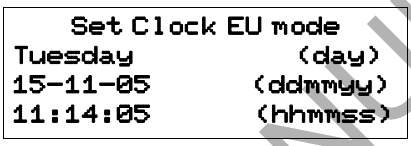
5. If necessary, press [UP] or [DOWN] to select the sample wait time: minimum = 1 second, maximum = 99 seconds, default = 1 second.
6. Press [ENTER] to confirm your selection.
   The instrument displays the ***SMT (sample measure time)*** selection screen:



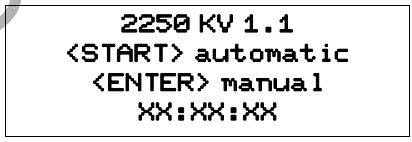
7. If necessary, press [UP] or [DOWN] to select the sample measure time: minimum = 5 seconds, maximum = 99 seconds, default = 10 seconds.

8. Press [ENTER] to confirm your selection.
   The instrument displays the ***time/date*** setup screen:

9. If necessary, press [UP] or [DOWN] to select the time/date mode: EU mode (European mode: day-month-year) or US mode (month-day-year).
10. Press [ENTER] to confirm your selection.
    The instrument displays the ***set clock*** screen:



    The day of the week flashes.
11. If necessary, press [UP] or [DOWN] to change the day of the week.
12. Press [ENTER] to confirm your selection.
    The first digit of the date flashes.
13. If necessary, press [UP] or [DOWN] to change the digit.
14. Press [ENTER] to confirm your selection.
15. Continue adjusting values and confirming with [ENTER] until all date and time values are correct.
    The instrument displays the welcome message again and immediately afterwards the ***working mode selection*** screen:



Your Elcometer Krebs Viscometer is now configured and ready to take measurements in automatic mode (page 12) or in manual mode (page 14).

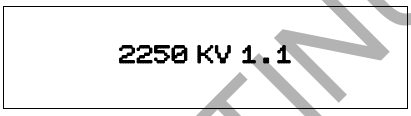
6 TAKING A MEASUREMENT IN AUTOMATIC MODE

Use the automatic mode of your Elcometer Krebs Viscometer for your standard testing - it will help you to conduct tests easily, rapidly and consistently.

Note: *Do not select automatic mode when using a ½ pint (USA) can - the neck of this can is too narrow to allow the spindle blades to pass through without manual intervention; always select manual mode when using a ½ pint (USA) can (see "Taking a measurement in manual mode" on page 14).*

1. Attach the spindle to the drive head (see "Fitting the spindle" on page 8).
2. Fit the large sample container support onto the locating plug on the base of the instrument. Check that the sample container fits into the recess in the top of the sample container support.
3. Pour the correct amount of sample to be tested into the sample container (see "Sample quantity" on page 9).
4. Place the sample container onto the sample container support.
5. Switch on the Viscometer (use the power on/off switch at rear of head).

   The instrument displays:



   After 5 seconds, the instrument displays the ***working mode selection*** screen:

6. Press [START] to select automatic mode.

   The instrument displays:

7. If necessary, press [ENTER] to adjust the values of SWT, SMT or the working units:

   Use the [UP] and [DOWN] buttons to select the value of the parameter and then press [ENTER] to confirm your selection.
8. Press [START] to start the measurement.

   (If necessary, to stop the automatic process at any time, press [STOP])

The instrument displays "Going DOWN" and the head moves down until the spindle reaches its lowest position.

```
automatic process
SWT: 05s. SMT: 10s
Ku: 000.0
Going DOWN
```

When the spindle reaches its lowest position, the sample wait timer starts to count down.

When the sample wait timer reaches zero, the spindle starts rotating and the sample measurement timer starts to count down. While the spindle rotates, the instrument displays the viscosity reading:

```
automatic process
SWT: 05s. SMT: 10s
Ku: 121
<STOP> quit
```

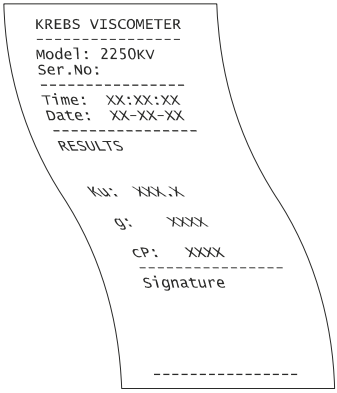
When the sample measurement timer reaches zero, the spindle stops rotating, the head moves up and the instrument displays the final viscosity reading and the option to print the results or quit:

```
automatic process
SWT: 05s. SMT: 10s
Ku: 121
<ENT> print <STP> quit
```

9. If necessary, press [ENTER] to print the results. If your Viscometer is connected to a suitable printer, this provides a quick and easy way to save and document individual test results. See "Spare parts and accessories" on page 17.

   The results from the test are output via the RS232 connection at the rear of the Viscometer head.

10. When you have finished taking the measurement, press [STOP].
11. After use, clean the instrument and spindle - see "Cleaning" on page 16.

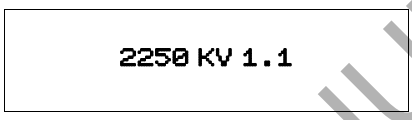


7 TAKING A MEASUREMENT IN MANUAL MODE

If you need to work with a ½ pint (USA) can or alternative containers and sample volumes, the spindle must be positioned manually in order to immerse it in the sample at the correct level. To do this, use your Elcometer Krebs Viscometer in manual mode.

1. Attach the spindle to the drive head (see “Fitting the spindle” on page 8).
2. Fit the appropriate sample container support onto the locating plug on the base of the instrument (see page 8). Check that the sample container fits into the recess in the top of the sample container support.
3. Pour the sample to be tested into the sample container.
4. Place the sample container onto the sample container support.
5. Switch on the Viscometer (use the power on/off switch at rear of head).

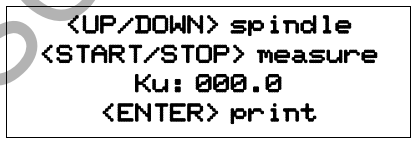
   The instrument displays:



   After 5 seconds, the instrument displays the ***working mode selection*** screen:

6. Press [ENTER] to select manual mode.

   The instrument displays:



7. Press [DOWN] to move the spindle down into the sample.

   Note: *If using a ½ pint (USA) can, the neck of this can is too narrow to allow the spindle blades to pass through. Tilt the can slightly to allow the spindle blades to pass through the neck of the can.*

8. Use the [UP] and [DOWN] buttons to adjust the position of the spindle until the notch on the spindle shaft is level with the surface of the sample.
9. Press [START] to start the spindle rotating.

   The value of viscosity is shown on the display.

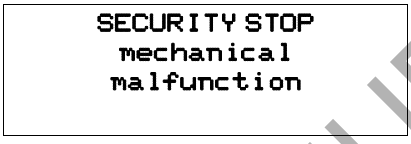
10. When you are satisfied with the result, press [STOP] to stop the spindle rotating.
11. Press [UP] to move the spindle up out of the sample.

12. If necessary, press [ENTER] to send the results to a printer (see page 13 for details).
13. When you have finished taking the measurement, press [STOP].
14. After use, clean the instrument and spindle - see “Cleaning” on page 16.

8 TROUBLESHOOTING

8.1 Security stop

If an obstruction causes the up or down movement of the head to be impeded, or in the unlikely event of a malfunction, an audible alarm sounds, the movement is stopped and the instrument displays the following message:



1. Press [STOP] to switch off the alarm.
2. If appropriate, switch off the instrument, remove the obstruction and then restart the test.
3. If the malfunction persists, contact Elcometer or your local supplier.

8.2 Unstable readings

Unstable viscosity readings may be caused by changes in the temperature of the sample or by the behaviour of the product itself.

Check that the instrument is level. If the readings obtained remain unstable, the temperature of the sample should be controlled and stabilised. If the readings remain unstable the instability is due to the interaction between the product sample and the movement of the spindle.

In this instance, the product is called ‘Non-Newtonian’ and the behaviour of the product can be described as thixotropic, rheoplexic, dilatant, pseudoplastic, etc. The same settings (SWT, SMT and temperature) should always be used to test this type of product.

8.3 Instrument does not zero

When the spindle is rotating in free air (not immersed in a sample), the viscosity reading should be zero. If it is not zero, please contact Elcometer or your local Elcometer supplier.

9 CALIBRATION

Your Viscometer was calibrated at the factory before shipment and a calibration certificate was included in the box. Additional calibration checks at regular intervals over the life of the Viscometer are a requirement of quality management procedures, e.g. ISO 9000, and other similar standards.

Calibration checks may be carried out by the user of the Viscometer (see instructions below), however if the calibration of the Viscometer is found to need adjustment, please contact Elcometer or your local Elcometer supplier.

Checking Viscometer calibration

It is recommended that calibrated Krebs viscosity oil is used for checking calibration - see “Spare parts and accessories” on page 17. Use calibration oil with a Krebs value close to that of the samples you regularly test.

1. Pour the correct amount of calibration oil into the sample container.
2. Check the temperature of the calibration oil; it must be stable and at the value specified in the test standard.
3. Conduct an automatic test of the calibration oil using the values for SWT and SMT specified in the test standard.
4. Once the test has been completed, check the viscosity reading on the display. If the reading is identical to the nominal viscosity of the Krebs calibration oil, your Viscometer is calibrated correctly.

10 MAINTENANCE

The Elcometer Krebs Viscometer is designed to give many years reliable service under normal operating and storage conditions.

10.1 Cleaning

Always clean the instrument and spindle after use.

Always remove the spindle from the instrument before cleaning. The spindle or motor coupling will almost certainly be damaged if attempts are made to clean the spindle while it is still attached to the instrument.

Do not use very aggressive solvents or wire brushes, metal scrapers, metal files or other metallic tools. Do not use excessive force which might otherwise bend delicate spindles.

Clean the spindle and other parts using a suitable solvent only.

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

10.2 Service

The Elcometer Krebs Viscometer does not contain any internal user-serviceable components. In the unlikely event of a fault, the instrument should be returned to your local Elcometer supplier or directly to Elcometer. The warranty will be invalidated if the instrument has been opened.

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

11 TECHNICAL SPECIFICATION

Room temperature:		10°C to 40°C (50°F to 104°F)
Relative humidity:		< 80%
Speed:		200 rpm
Accuracy (speed):		± 1 rpm
Measurements,	KU: g: cP:	range 40.2 KU to 141 KU, resolution 0.1 KU range 32 g to 1099 g, resolution 1 g range 27 cP to 5274 cP, resolution 5 cP
Accuracy (measurement):		± 1% of full scale
Repeatability:		± 0.5%
Maximum altitude:		2 000 m (6 500 ft) above sea level
Ingress protection:		Level 2
Operating voltage:		UK, 240 V AC 50 Hz EUR, 220 V AC 50 Hz US, 110 V AC 60 Hz
Overvoltage category:		Class II (domestic/light industry)
Power consumption:		0.2 A
Dimensions:		500 mm x 325 mm x 190 mm (19.7" x 12.8" x 7.5")
Weight:		8.5 kg (18.7 lb)

12 SPARE PARTS AND ACCESSORIES

The following spare parts and accessories for your Elcometer Krebs Viscometer are available from your local supplier or direct from Elcometer:

Spindle, Krebs, standard	KT00225021791
Special Paste Spindle	KT00225022906
Sample container, 600 ml, glass	KT00225021796
Sample container support, for 600 ml glass beaker and 1 pint (USA) can	KT00225021794
Sample container support, for ½ pint (USA) can	KT00225021795
Locating plug for sample container support	KT00225021793
Hexagonal wrench, 1.5 mm	T9992596-
Power supply cable, European	KT009999P001
Power supply cable, UK	KTUK9999P001
Power supply cable, US	KTUS9999P001

Thermal Printer, 220 V Euro	KT00999920178
Thermal Printer, 240 V UK	KT00999920179
Thermal Printer, 110 V US	KT00999920180
Viscosity oil, Krebs, 64	KT002250N001
Viscosity oil, Krebs, 79	KT002250N002
Viscosity oil, Krebs, 84	KT002250N003
Viscosity oil, Krebs, 95	KT002250N004
Viscosity oil, Krebs, 115	KT002250N005

13 RELATED EQUIPMENT

In addition to the Elcometer Krebs Viscometer, Elcometer produces a wide range of other equipment for determining the physical characteristics of surface coatings.

Users of the Elcometer 2250 may also benefit from the following Elcometer products:

- Elcometer 2300 Rotational Viscometer
- Elcometer 2000 Muller Laboratory Grinder
- Elcometer Fineness of Grind Gauges
- Elcometer Viscosity Cups
- Elcometer Film Applicators

For further information contact Elcometer, your local Elcometer supplier or visit www.elcometer.com or www.elcoship.com.