

# **Elcometer 141**

## **Paint Inspection Gauge**

### **Operating Instructions**



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A copy of this Instruction Manual is available for download on our Website via [www.elcometer.com](http://www.elcometer.com).

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Thank you for your purchase of this Elcometer 141 Paint Inspection Gauge. 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.

Your Elcometer 141 Paint Inspection Gauge 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](http://www.elcometer.com)

## **1 ABOUT THIS INSTRUMENT**

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Destructive thickness measurement is sometimes the only method available to test certain coating/substrate combinations, such as paint applied to concrete, wood or plaster, and for testing single coat thicknesses in a multi-coat application.

The Elcometer 141 Paint Inspection Gauge offers a quick, versatile method of coating examination and measurement in a portable, easy to use instrument.

The Elcometer 141 measures total film thickness as well as individual layers in a multi-coat system, when colour or texture of the underlying coats is identifiable. Paint film thickness can be measured on all substrates including steel, wood, plastic and concrete. Additionally, microscopic examination for craters, small blisters, pores, cracks, scaling, adhesion, flexibility, adhesion of separate coats to each other and substrate cleanliness can be carried out.

The Elcometer 141 uses a principle of basic trigonometry. A cut is made at a known angle by the instrument cutter. The coating thickness is then determined from the width of the cut, which is measured using the graticule scale in a microscope.

Elasticity of the coating, cleanliness of the substrate and adhesion of the individual coats can be assessed from the appearance of the cut.

The Elcometer 141 Paint Inspection Gauge is supplied with three cutting tips, Nos. 1, 4 and 6.

## 1.1 STANDARDS

The Elcometer 141 can be used in accordance with the following National and International Standards: AS 1580.108.2, ASTM D 4138-A, DIN 50986, ISO 2808-6B *supersedes BS 3900-C5-5B & ISO 2808-5B*, NF T30-123.

## 1.2 CHECKING THE CONTENTS OF THE BOX

- Elcometer 141 Paint Inspection Gauge
- x50 microscope
- 3 Cutters
- Black felt marker pen
- Hexagonal wrench
- Carrying case
- Operating instructions

The Elcometer 141 Paint Inspection Gauge 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.

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

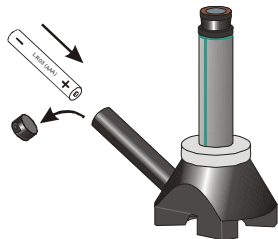
## 2 GETTING STARTED

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### 2.1 FITTING A BATTERY

1. Unscrew lamp end-cap.
2. Insert 1x LR03 (AAA) alkaline dry battery taking care to ensure correct polarity.
3. Replace lamp end-cap.

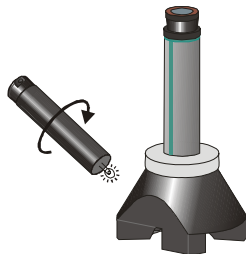
If the microscope is to remain unused for long periods of time, remove the battery and store it separately. This will prevent damage to the microscope in the event of malfunction of the battery.



### 2.2 REPLACING A BULB

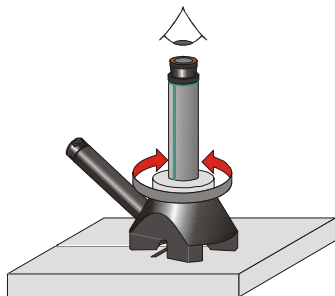
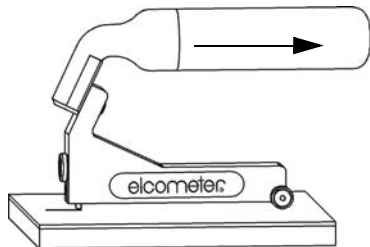
A replacement bulb is stored inside lamp end-cap.

1. Unscrew lamp end-cap and remove spring and bulb.
2. Replace spring and lamp end-cap.
3. Rotate lamp barrel anticlockwise three complete turns until barrel is released from body of microscope.
4. Pull out bulb and push in replacement bulb.
5. Replace lamp barrel.



### 3 TAKING A MEASUREMENT

1. Mark the surface to be tested with a stroke of the black felt-tipped pen provided with the test kit. There should always be a marked contrast between the pen ink and the coating colour. Different pen ink colours may be required.
2. With the cutter tip on the surface to be tested, cut at right angles to the pen mark by drawing the gauge towards you and applying a little pressure. Slight pressure is normally sufficient to penetrate to the base of the material. Heavier pressure may be required for very thick coatings and very hard surfaces.
3. Put the cutter to one side, take the microscope and place it so that the lens is over the cut with the base touching the surface.
4. To focus the microscope, hold the black base and rotate the knurled ring.



5. Align the graticule scale until it is at right-angles to the cut and the scale divisions are parallel to the cut. Note that one side of the cut will have a straight edge and the other side is likely to be ragged.
6. Measure the width of the cut coating (or coatings) by counting the number of graticule divisions.  
To convert the width of the cut coating into coating thickness, either:  
Multiply the number of graticule divisions by the graticule scale factor shown in Table 1.

**Table 1: Graticule Scale Factor**

Cutting tool #	Practical maximum thickness <sup>a</sup>		Cutting angle	Graticule scale factor	
	( $\mu\text{m}$ )	(mils)		mm scale ( $\mu\text{m}$ )	inch scale (mils)
1	1600	64	45°	20	1
4	800	32	26.6°	10	0.5
6	160	6.4	5.7°	2	0.1

a. Based on using 80% of cutter width

In the example shown, the coating thickness using cutting tool #4 is:

42 divisions x 10 $\mu\text{m}$  per division = 420 $\mu\text{m}$  or;

33 divisions x 0.5mils per division = 16.5mils, see Figure 1 on page 7.

Or alternatively, calculate the coating thickness using the Table 2, "Additions Table," on page 8.

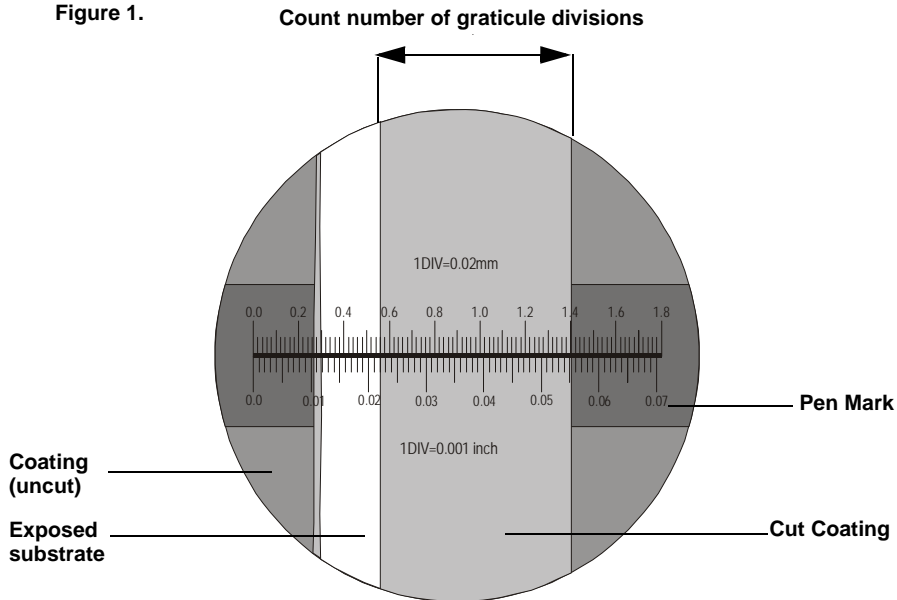
In the example shown, the coating thickness using cutting tool #4 is:

42 divisions = 40 divisions; 400 $\mu\text{m}$  plus 2 divisions; 20 $\mu\text{m}$  = 420 $\mu\text{m}$

33 divisions = 30 divisions; 15mils plus 3 divisions; 1.5mils = 16.5mils, see Figure 1 on page 7.



Figure 1.



**Table 2: Additions Table**

Graticule Divisions	Cutting tool #1		Cutting tool #4		Cutting tool #6	
	µm	mils	µm	mils	µm	mils
1	20	1	10	0.5	2	0.1
2	40	2	20	1.0	4	0.2
3	60	3	30	1.5	6	0.3
4	80	4	40	2.0	8	0.4
5	100	5	50	2.5	10	0.5
6	120	6	60	3.0	12	0.6
7	140	7	70	3.5	14	0.7
8	160	8	80	4.0	16	0.8
9	180	9	90	4.5	18	0.9
10	200	10	100	5.0	20	1
20	400	20	200	10	40	2
30	600	30	300	15	60	3
40	800	40	400	20	80	4
50	1000	50	500	25	100	5
60	1200	60	600	30	120	6
70	1400	70	700	35	140	7
80	1600	80	800	40	160	8

### 3.1 MULTI-LAYER COATINGS

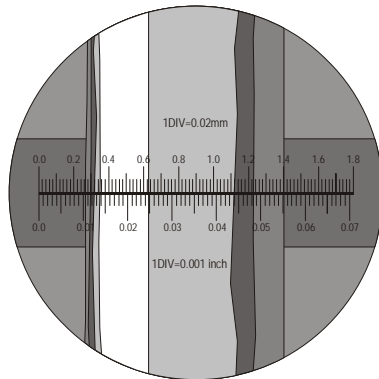
The thickness of individual layers can be calculated by measuring each layer (see illustration of typical multi-layer opposite).

### 3.2 IRREGULARITIES

Irregularities can occur if very hard, brittle films, or films with insufficient adhesion to the substrate are tested. The following can arise and can be avoided as follows.

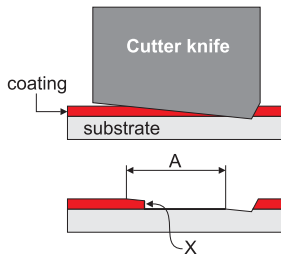
#### IRREGULAR, SHELL-LIKE CUT

Measure to an imaginary straight line through the best estimate of the centre of the irregular cut edge using the graticule scale. This will give a mean value for thickness.



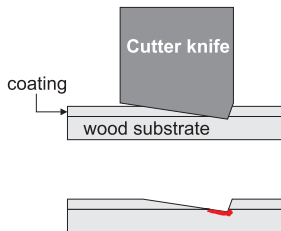
### POOR ADHESION (GIVES THE ILLUSION OF TOO LITTLE FILM THICKNESS)

Despite the fact that the coating may have fractured at point 'X', always measure distance 'A' to obtain the thickness of the coating (single layer of coating in this example).



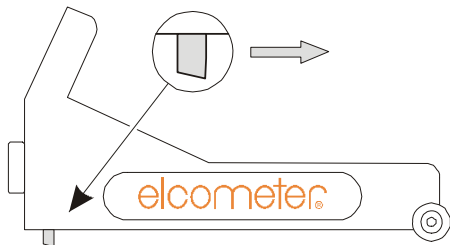
### NO SEPARATION

When measuring the thickness of clear varnish on wood, there may be no visible demarcation between the coating and the substrate. If this is the case, soak the exposed wood grain with a dye solution (fountain pen ink). The coating will not absorb any dye, but the wood cells do. This enables the cut width to be measured.



## 4 CUTTER REPLACEMENT

1. Loosen the grub screw below the storage space thumbscrew using the hexagonal wrench provided.
2. Spare cutters can be stored in the body of the instrument. To remove them, unscrew and remove the thumbscrew and tip the instrument, taking care not to drop the cutters as they slide from the instrument (cutting tips can be damaged by impact). Replace the spare cutters and re-fit the thumbscrew.
3. Replace the cutter with its highest point facing the two rollers on the back of the instrument (see illustration).
4. Provided that the thumbscrew is fitted, push the cutter up until it stops. If the thumbscrew is not fitted, the cutter should protrude from the base of the instrument to the same extent as the rollers. Tighten the grub screw to secure the cutter.



## 5 MAINTENANCE

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Your Elcometer 141 Paint Inspection Gauge is designed to give many years reliable service under normal operating and storage conditions. If necessary, the battery or cutter can be replaced.

The Elcometer 141 Paint Inspection Gauge does not contain any other user-serviceable components. In the unlikely event of a fault, the gauge should be returned to your 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](http://www.elcometer.com)

## 6 TECHNICAL SPECIFICATION

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Material, cutter body:	Aluminium
Material, cutter handle:	Stainless steel and aluminium
Microscope magnification:	x50
Microscope scale range:	Metric: 0 to 1.8mm; Imperial: 0 to 0.07"
Microscope resolution:	Metric: 0.02mm; Imperial: 0.001"
Torch battery:	1.5 V LR03 (AAA) battery <sup>a</sup>
Carrying case dimensions:	300 mm x 220 mm x 75 mm (11.8" x 8.7" x 3")
Weight:	610 g (1 lb 5 oz) (including cutting tips, marker pen, carrying case and operating instructions)

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- a. *Alkaline batteries must be disposed of carefully to avoid environmental contamination. Please consult your local environmental authority for information on disposal in your region.*  
**Do not dispose of any batteries in fire.**

## 7 STORAGE

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Always store the components of the Elcometer 141 Paint Inspection Gauge in the carrying case when the gauge is not being used.

## 8 SPARES

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The Elcometer 141 Paint Inspection Gauge is complete with all the items required to get started and take measurements, however over the life of the kit replacements may be required. The following items are available from Elcometer, or your local supplier.

Tungsten carbide cutter No 1: T99915761-1

Tungsten carbide cutter No 4: T99915761-4

Tungsten carbide cutter No 6: T99915761-6

## 9 RELATED EQUIPMENT

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In addition to the Elcometer 141 Paint Inspection Gauge, Elcometer produces a wide range of other equipment for testing and measuring the characteristics of coatings.

Users of the Elcometer 141 may also benefit from the following Elcometer products:

- Elcometer 195 Säberg Drill
- Elcometer Coating Thickness Gauges, Mechanical
- Elcometer Coating Thickness Gauges, Digital
- Elcometer Adhesion Testers

For further information contact Elcometer, your local supplier or visit [www.elcometer.com](http://www.elcometer.com)