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Elcometer 3086

Motorised Pencil Hardness Tester

Operating Instructions

This product meets the Electromagnetic Directive and the Machinery 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.

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

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Thank you for your purchase of this Elcometer 3086 Motorised Pencil Hardness Tester. 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 3086 Motorised Pencil Hardness Tester 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 PENCIL HARDNESS TESTER

Your Elcometer 3086 Motorised Pencil Hardness Tester provides a rapid method for determination of the comparative scratch resistance and hardness of a coating.

This test is known as the Wolff-Wilborn method and is fully described in BS 3900 - E19, ISO 15184 and ASTM D 3363 - 92a. A coated panel is placed on a firm horizontal surface and the pencil lead is held firmly against the coating, point away from the operator, at a 45° angle. The Pencil Hardness Tester travels across the coating sample. The hardness of the pencil lead is increased until one or both of the following defects mark the coating:

1. Plastic deformation; a permanent indentation in the paint surface without cohesive fracture.
2. Cohesive fracture; the presence of a visible scratch or rupture in the surface of the paint film, material having been removed from the paint film.

   (Above definitions are taken from ISO 15184.)

***Note**: For the ASTM method D 3363, the test is started using the hardest pencil lead and continued down the scale of hardness to determine the two end points*:

1. The pencil lead that will not cut or gouge the coating.
2. The pencil lead that will not scratch the coating.

The Elcometer 3086 is motor driven; this helps to eliminate any variation in test results which may occur due to operator technique.

Your Pencil Hardness Tester uses standard black leads, and is supplied with 14 grades of lead, covering 6H (very hard) to 6B (very soft).

1.1 Standards

Your Elcometer 3086 Motorised Pencil Hardness Tester can be used in accordance with the following National and International Standards:

ASTM D 3363, BS 3900-E19, EN 13523-4 *supersedes ECCA T4*, ISO 15184, JIS K 5600-5-4.

1.2 What the box contains

- Elcometer 3086 Motorised Pencil Hardness Tester
- Lead-holder
- Lead set (14 cases of leads, grades 6H to 6B)
- Setting block (gauge)
- Abrasive paper
- Operating instructions

The Elcometer 3086 Motorised Pencil Hardness Tester 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 your new Elcometer 3086 Motorised Pencil Hardness Tester please take some time to read these Operating Instructions. Do not hesitate to contact Elcometer or your Elcometer supplier if you have any questions.

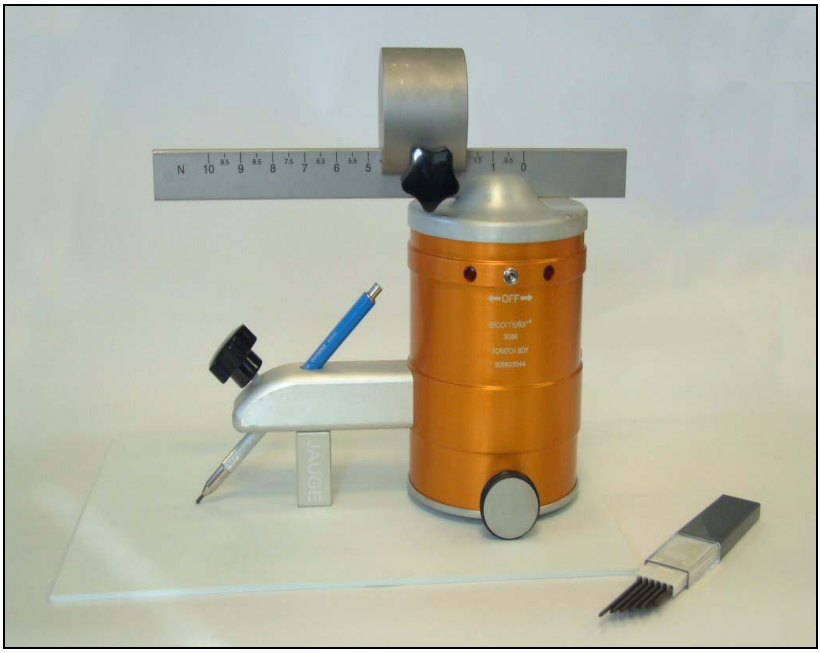

Figure 1. Elcometer 3086 Motorised Pencil Hardness Tester

Note: Instruments are now supplied with a metal pencil lead holder instead of the plastic holder illustrated in Figure 1.

2 GETTING STARTED

2.1 Before you start

The test should be carried out at 23°C ± 2°C (73.5°F ± 3.5°F) and 50% ± 5% relative humidity, unless otherwise agreed.

2.2 Prepare the lead

1. Place a sheet of abrasive paper (400 grade) on a flat, smooth surface.
2. Mount the lead in the lead-holder and place the tip of the lead onto the abrasive paper.

3. Hold the lead-holder at an angle of 90° to the abrasive paper and abrade the lead by moving the lead-holder back and forth until preparation is completed (Figure 2).

   Approximately 6 mm (1/4”) of lead should be exposed after preparation.

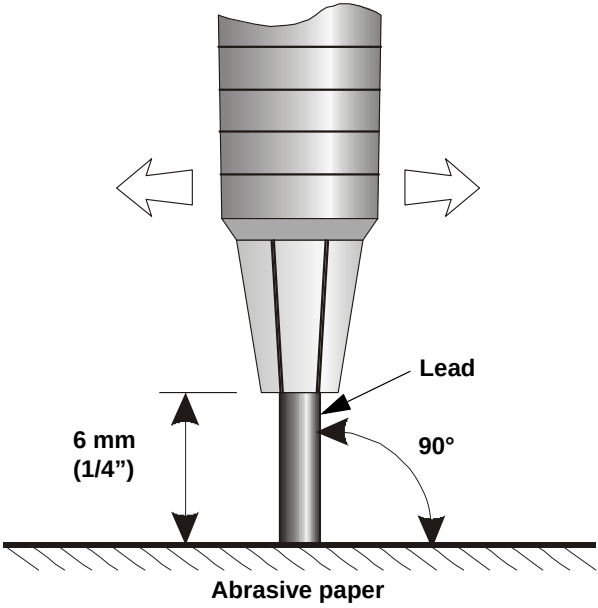

Figure 2. Prepare the lead at 90° to the abrasive paper

4. Successful preparation is indicated by the end face of the lead being flat, smooth and having a circular cross-section. The edge of the lead must be free of chips or nicks (Figure 3). If necessary, use the supplied abrasive sharpener to complete the preparation to a smooth finish.

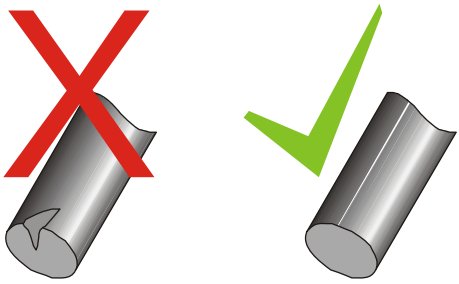

Figure 3. Edge of lead must be free of chips or nicks

2.3 Caution

The Elcometer 3086 has been manufactured with your safety in mind, however, improper use can result in damage to your Pencil Hardness Tester.

Please observe the precautions discussed in these operating instructions.

To reduce the risk of electric shock do not open the housing of the Pencil Hardness Tester. There are no user-serviceable parts inside.

To reduce the risk of fire or electric shock, do not expose the Pencil Hardness Tester to rain or excess moisture.

The mains plug on your Pencil Hardness Tester may be fitted with a fuse. When replacing this fuse, ensure a fuse of the correct rating is used.

3 TEST PROCEDURE

3.1 Mount lead-holder in tester

Referring to Figure 4, place the lead-holder bracket on the top of the setting block. Insert the lead-holder into the hole on the lead-holder bracket and let it slide down slowly until the lead comes into contact with the specimen. Tighten the fixing screw and then remove the setting block.

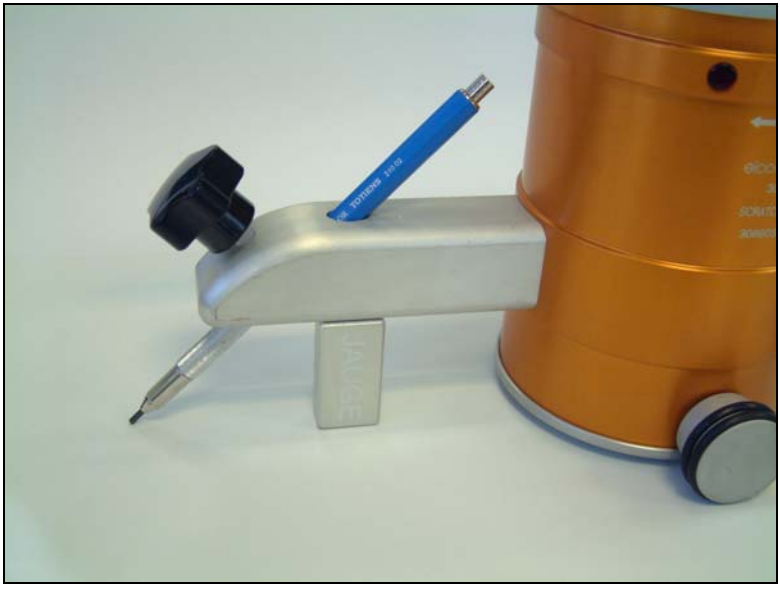

Figure 4. Mounting the lead-holder

Note: Instruments are now supplied with a metal pencil lead holder instead of the plastic holder illustrated in Figure 1.

Place the weight on the graduated scale ensuring that the locking screw is on the rear surface. Slide the weight along the graduated scale until the required force (usually 7.5 N, 1.7 lbf) is indicated (Figure 5). Tighten the locking screw.

The instrument is now adjusted.

3.2 Prepare the scratch

Place the test panel on a level, firm, horizontal surface. Connect the Pencil Hardness Tester to the mains supply and place the instrument on the test panel.

Move the switch to the left or to the right. The unit will then move in the chosen direction. For ASTM and ECCA standards, the tester must be set to move forward (move the switch to the left).

When the lead has moved across the test panel, move the switch to the centre position to switch off the Pencil Hardness Tester.

3.3 Inspect the scratch

Check the surface for scratches or gouges by either close visual inspection, by feel using a fingernail or, if agreed, using a microscope with between x6 and x10 magnification.

3.4 Change lead hardness

If no marking has occurred, repeat the test (3.2 to 3.3) with the next hardest lead.

Note: If using the ASTM D 3363 method and the lead has cut through or scratched the surface of the coating, select the next softest lead and repeat the test (3.2 to 3.3).

For ASTM D 3363 identify the end point of the test as follows:

- Gouge hardness – The hardest lead that leaves the coating uncut over a stroke length of at least 3 mm (1/8”).
- Scratch hardness – The hardest lead that will not rupture or scratch the coating.

3.5 Repeat the test

The test procedure (3.2 to 3.4) should be repeated 12 mm (1/2") away from the first test.

When repeating the test, rotate the lead to ensure that the edge of the lead in contact with the test panel is not chipped or crumbled. If necessary the lead should be prepared again (2.2).

If the two test results differ by more than one unit of lead hardness, discard the results and repeat the test.

3.6 Test report

The following information should be contained in any report on the results of the Pencil Test:

- The type of defect resulting from the test; see “About your pencil hardness tester” on page 2.

  Note: In some cases the two test end points will be the same.
- The manufacturer and type of leads used.
- Any deviation from standard conditions including the temperature and humidity conditions of the test and the roughness of the coating surface.
- The magnification of the microscope, if one is used.

4 MAINTENANCE

The Elcometer 3086 Motorised Pencil Hardness Tester is designed to give many years reliable service under normal operating and storage conditions. Special maintenance will not normally be required under these conditions.

An occasional wipe with a dry cloth will help to keep the instrument in good condition.

If dirt or any other contaminant is found on the wheels, it should be removed immediately.

The Pencil Hardness Tester does not contain any user-serviceable components. In the unlikely event of a fault, the Elcometer 3086 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

5 TECHNICAL SPECIFICATION

5.1 Pencil Hardness Tester

Overall dimensions:	280 mm x 140 mm x 240 mm (11" x 5.5" x 9.4")
Material:	Anodised aluminium
Weight: (tester and pencil)	3.8 kg (8.4 lb)
Force applied by pencil:	0 N to 10 N (0 lbf to 2.25 lbf)
Operating voltage:	UK, 240 V AC 50 Hz EUR, 220 V AC 50 Hz US, 110 V AC 60 Hz
Power consumption:	11.5 W
Fuse rating (if fitted):	1 A

5.2 Lead set supplied with new instruments.

Lead type:	2 mm (0.08”) diameter graphite lead
Quantity:	14 cases
Grades:	6H, 5H, 4H, 3H, 2H, H, F, HB, B, 2B, 3B, 4B, 5B, 6B

6 SPARES

The Elcometer 3086 Motorised Pencil Hardness Tester is complete with all the items required to get started and take measurements, however over the life of the Tester replacements may be required. The following items are available from Elcometer, or your local supplier.

Part description	Sales part number
Spare metal lead-holder[a]:	KT003084P220
Case of 12 leads, 6B:	KT003084P001
Case of 12 leads, 5B:	KT003084P002
Case of 12 leads, 4B:	KT003084P003
Case of 12 leads, 3B:	KT003084P004
Case of 12 leads, 2B:	KT003084P005
Case of 12 leads, B:	KT003084P006
Case of 12 leads, HB:	KT003084P007
Case of 12 leads, F:	KT003084P008
Case of 12 leads, H:	KT003084P009
Case of 12 leads, 2H:	KT003084P010
Case of 10 leads, 3H:	KT003084P011
Case of 10 leads, 4H:	KT003084P012
Case of 10 leads, 5H:	KT003084P013
Case of 10 leads, 6H:	KT003084P014

To order spare parts, contact Elcometer, your local supplier or visit www.elcometer.com

7 RELATED EQUIPMENT

In addition to the Motorised Pencil Hardness Tester, Elcometer produces a wide range of other Hardness Testing Equipment. Users of the Motorised Pencil Hardness Tester may also benefit from the following Elcometer product ranges:

- Elasticity and Resistance Deformation Testers
- Appearance Testers
- Washability, Brushability and Abrasion Testers

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

a. Earlier models were supplied with a plastic lead holder. The holders are not interchangeable as this may affect the calibration of the unit. Plastic holders are still available to purchase using sales part number KT003084P020.