

Elcometer 501

Pencil Hardness Tester

Operating Instructions

elcometer® is a registered trademark of Elcometer Limited.

All other trademarks acknowledged.

© Copyright Elcometer Limited. 2009.

All rights reserved. No part of this Document may be reproduced, transmitted, transcribed, stored (in a retrieval system or otherwise) or translated into any language, in any form or by any means (electronic, mechanical, magnetic, optical, manual or otherwise) without the prior written permission of Elcometer Limited.

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

CONTENTS

Section	Page
1 About your gauge	2
2 Test procedure	4
3 Storage and transit	7
4 Maintenance	7
5 Technical specification.....	8
6 Spares	9
7 Related equipment	10

Thank you for your purchase of this Elcometer 501 Pencil Hardness Tester. Welcome to Elcometer.

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

This Elcometer 501 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 GAUGE

The purpose of the Elcometer 501 Pencil Hardness Tester is to provide a rapid, inexpensive method for determination of the comparative scratch resistance and hardness of a coating.

This test is known as the Wolff-Wilborn method. A coated panel is placed on a firm horizontal surface and the pencil is held firmly against the coating, point away from the operator, at a 45° angle. The pencil is then pushed away from the operator. The hardness of the pencils 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.

The Elcometer 501 Pencil Hardness Tester is designed to use a standard wooden black lead pencil, and is supplied with a full set of fourteen, covering 6H (very hard) to 6B (very soft).

1.1 WHAT THE BOX CONTAINS

- Elcometer 501 Pencil Hardness Tester
- Pencil Set (14 pencils, grades 6H – 6B)
- Setting Block
- Pencil Sharpener x 2
- Abrasive Paper Block
- Operating Instructions
- Carrying Case

The Elcometer 501 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.

1.2 STANDARDS

The Elcometer 501 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.

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

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

2 TEST PROCEDURE

2.1 BEFORE YOU START

The test should be carried out at $23^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ($73.5^{\circ}\text{F} \pm 3.5^{\circ}\text{F}$) and $50\% \pm 5\%$ relative humidity, unless otherwise agreed.

2.2 PREPARE THE PENCIL

1. Prepare the pencil using the special pencil sharpeners supplied.
Use sharpener T501190451 for pencils 6H, 5H, 4H, 3H, 2H, H, F, HB, B and 2B.
Use sharpener T501190452 for pencils 3B, 4B, 5B and 6B.
Sharpen until approximately 5 mm to 6 mm (0.25") of lead, is exposed taking care to leave the exposed lead unmarked.
2. Hold the pencil at 90° to the abrasive paper and rub the lead until a flat, smooth and circular cross-section is achieved. Ensure that the edge is free of chips or nicks (Figure 1).

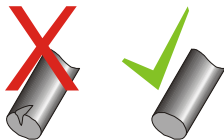


Figure 1. Edge of lead must be free of chips or nicks

2.3 MOUNT PENCIL IN TESTER

Support the Pencil Tester on the setting block (Figure 2). Fit the softest pencil, 6B, into the body of the tester, with the tip of the pencil resting on the surface of the paint film. Lock the pencil in place with the thumbscrew and then remove the setting block.

2.4 PREPARE THE SCRATCH

Place the test panel on a level, firm, horizontal surface. Place the Pencil Tester with the pencil facing away from you and push the Tester a distance of approximately 6 mm (0.25"). Apply the push force to the back of the unit, between the wheels, so as not to contribute to the load on the pencil. The speed of the Pencil Tester should be between 0.5 mm/s to 1 mm/s.

2.5 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.

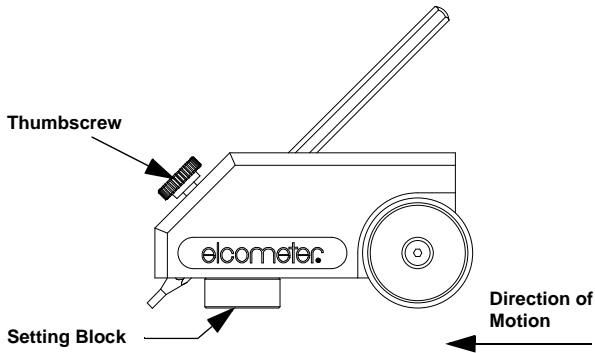


Figure 2. Using setting block to mount pencil in tester

2.6 CHANGE PENCIL HARDNESS

If no marking has occurred repeat the test (2.2 to 2.5) with the next hardest pencil.

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 pencil and repeat the test (2.2 to 2.5).*

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

- Gouge hardness – The hardest pencil that leaves the coating uncut over a stroke length of at least 3 mm.
- Scratch hardness – The hardest pencil that will not rupture or scratch the coating.

2.7 REPEAT THE TEST

The test procedure (2.2 to 2.6) should be repeated 12 mm (0.5") away from the first test.

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

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

2.8 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 gauge” on page 2.
Note: In some cases the two test end points will be the same.
- The make and manufacture of the pencils 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.

3 STORAGE AND TRANSIT

Store the instrument in its case when it is unused for long periods of time, and during transit.

4 MAINTENANCE

The Elcometer 501 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 Hardness Tester does not contain any user-serviceable components. In the unlikely event of a fault, the Elcometer 501 should be returned to your local Elcometer supplier or directly to Elcometer.

5 TECHNICAL SPECIFICATION

5.1 GAUGE

Overall Dimensions (without pencil fitted): 130 mm x 63 mm x 50 mm (5" x 2.5" x 2")

Overall Dimensions (with pencil fitted): 130 mm x 130 mm x 50 mm (5" x 5" x 2")

Material: Powder Coated Steel

Weight (tester and pencil): 2.1 kg (4 lb 10¼ oz)

Load Applied by Pencil: 750 g (7.36 N)

5.2 PENCIL SET SUPPLIED WITH NEW INSTRUMENTS.

Pencil Type: Faber Castell 9000

Quantity: 14

Grades: 6H, 5H, 4H, 3H, 2H, H, F, HB, B, 2B, 3B, 4B, 5B, 6B

5.3 CARRYING CASE

Material: Polypropylene foam-lined with cutouts to store 501 Pencil Hardness Tester and Accessories

Dimensions: 300 mm x 220 mm x 75 mm (11.8" x 8.7" x 3")

6 SPARES

6.1 CONSUMABLE ITEMS

The following items are supplied with the Elcometer 501 Pencil Hardness Tester. Replacements are available from your local Elcometer supplier or direct from Elcometer.

Description

Sales Part No.

Replacement Pencil Set:

T50115771

Individual grades of pencil in boxes of 12

See table below for Sales Part No.

Description	Part Number	Description	Part Number
Hardness Pencils 6B	KT003080P001	Hardness Pencils F	KT003080P008
Hardness Pencils 5B	KT003080P002	Hardness Pencils H	KT003080P009
Hardness Pencils 4B	KT003080P003	Hardness Pencils 2H	KT003080P010
Hardness Pencils 3B	KT003080P004	Hardness Pencils 3H	KT003080P011
Hardness Pencils 2B	KT003080P005	Hardness Pencils 4H	KT003080P012
Hardness Pencils B	KT003080P006	Hardness Pencils 5H	KT003080P013
Hardness Pencils HB	KT003080P007	Hardness Pencils 6H	KT003080P014

6.2 REPLACEMENT ITEMS

The following items can be replaced if lost or damaged and can also be obtained your local Elcometer supplier or direct from Elcometer.

Description	Sales Part No.
Replacement Pencil Sharpener:	T501190451 for pencils 6H to 2B T501190452 for pencils 3B to 6B
Setting Block:	T50119011
Sandpaper Block	T50115779

7 RELATED EQUIPMENT

In addition to the 501 Pencil Hardness Tester, Elcometer produces a wide range of other Hardness Testing Equipment. Users of the Elcometer 501 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