

**Elcometer 106**

**Adhesion Tester**

**Operating Instructions**



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A Material Safety Data Sheet for the araldite epoxy adhesive supplied with the Elcometer 106 and available as an accessory is available to download via our website:

[www.elcometer.com/images/MSDS/araldite\\_epoxy\\_adhesive.pdf](http://www.elcometer.com/images/MSDS/araldite_epoxy_adhesive.pdf)

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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 106 Pull Off Adhesion 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 106 Pull Off Adhesion 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](http://www.elcometer.com)

## **1 ABOUT YOUR TESTER**

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The Elcometer 106 Pull Off Adhesion Tester is designed to measure the bond strength of applied coatings. A wide range of coatings can be tested including paint, plastic, sprayed metal, epoxy, wood veneers, laminates on wood, metal or plastic.

The Adhesion Tester employs a pull-off method to determine the force required to pull an area of coating away from the base material.

The surface under examination is prepared and then a test dolly is attached by adhesive. When the adhesive is cured the Adhesion Tester claw is engaged onto the dolly and a force is applied by tightening a wheel/nut on the top of the tester. The force is recorded by means of a dragging indicator on an engraved scale. The indicator retains the value at which the dolly and the coating separate from the surface.

There are five different ranges available. Each range is expressed in imperial and metric units and is directly related to the area of the standard dolly.

## 1.1 STANDARDS

Your Elcometer 106 Pull Off Adhesion Tester can be used in accordance with the following National and International Standards ASTM D 4541, AS/NZS 1580.408.5, EN 13144, ISO 4624 supersedes EN 24624 & NF T30-062, ISO 16276-1, JIS K 5600-5-7 & NF T30-606.

## 1.2 THESE INSTRUCTIONS

These instructions describe the operation of the following models of the Elcometer 106:

Elcometer 106/1 Scale 1(0) to 3.5 N/mm<sup>2</sup> (500 psi)

Elcometer 106/2 Scale 2(0) to 7 N/mm<sup>2</sup> (1000 psi)

Elcometer 106/3 Scale 3(0) to 15 N/mm<sup>2</sup> (2000 psi)

Elcometer 106/4 Scale 4(0) to 22 N/mm<sup>2</sup> (3200 psi)

Elcometer 106/5 Scale 5(0) to 0.2 N/mm<sup>2</sup> (30 psi)

## 1.3 WHAT THE BOX CONTAINS

- Elcometer 106 Pull Off Adhesion Tester (Scale 1, 2, 3, 4 or 5)
- 20 Dollies
- Pack of Araldite Adhesive
- Base Support Ring
- Magnetic Dolly Clamp
- Dolly Cutter
- Ratchet Spanner (Scale 3 and 4 only)

- Polypropylene Carrying Case
- Operating Instructions

## **2 USING YOUR TESTER**

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### **2.1 SECURING THE DOLLY - HORIZONTAL SURFACES**

The surface of the dolly and the test area should be abraded and be free from oil, moisture and dust to ensure a good bond between the dolly face and the coating.

1. Prepare the surface of the dolly and the coating where the dolly is to be applied by roughening with an abrasive paper. Then de-grease these areas by using a suitable solvent to clean both surfaces.
2. Mix a small quantity of adhesive and apply an even film to the prepared surface of the dolly.
3. Place the dolly onto the prepared test surface and apply pressure to squeeze out excess adhesive which should then be removed. Allow the adhesive to cure for the recommended time - see “Adhesives” on page 7.

Dollies can be re-used after cleaning. Additional dollies are available from Elcometer or your local supplier - see “Spare parts and accessories” on page 12.

### **2.2 SECURING THE DOLLY - VERTICAL SURFACES**

A magnetic dolly clamp is included with your Elcometer 106 kit of parts.

Follow the instructions given in section 2.1 above, but use the magnetic dolly clamp to hold the dolly in place while the adhesive cures. Ensure the ‘keeper’ disc is removed from the magnet prior to use.

The magnetic dolly clamp will only work on ferrous substrates.

## 2.3 APPLYING LOAD TO THE DOLLY

1. Cut around the base of the dolly very carefully using the dolly cutter. This is only necessary when lateral bonding in the coating is greater than adhesion, for example, elastomeric coatings. Place the base support ring over the dolly ensuring that it lies flat on the surface<sup>a</sup>.
2. Slacken the handwheel or nut on the Adhesion Tester. Set the dragging indicator to zero (0) on the scale and engage the claw carefully with the dolly, ensuring that the alignment pin is aligned with the hole in the base of the body.
3. Hold the Adhesion Tester steady with one hand to prevent rotation and tighten the handwheel or nut slowly and evenly to apply an increasing force to the dolly and hence stress to the coating. Continue until the coating fails and the dolly is removed from the surface, or until the specified stress is reached. The value is read from the position of the dragging indicator after the test is complete.

**Note:** According to Standards, the load should be applied uniformly. The handwheel can be turned in four or five stages to make a complete revolution. The wrench should be rotated without



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- a. The support ring need only be used with substrates which may distort due to the force applied during adhesion testing and typically is not required for structural steel.

stopping. Calculate the time the stress should be increased over and practice before testing. The table shows how many seconds each turn should take - see Table 1. Some Standards allow a slower rate (more seconds) up to a maximum time.

**Table 1:**

Elcometer 106			Stress Rate, s/turn (see Standard)	
Scale	Max MPa	MPa/turn	1MPa/s	0.2MPa/s
1	3.5	0.21	0.2	1.1
2	7	0.42	0.4	2.1
3	15	1.82	1.8	9.1
4	22	3.75	3.8	18.8



**WARNING:** *There will be a loud bang and the Adhesion Tester may jump up a few centimetres as the dolly and coating detach and the energy in the tester is released. For personal safety it is recommended that the operator does not lean over the Adhesion Tester during use.*

4. Immediately after the test is complete and the pull-off force has been recorded, slacken the handwheel or nut to remove all the force from the unit.

## 2.4 ASSESSING THE RESULTS

To record the result, first inspect the face of the dolly. In most cases the coating will fully adhere to the dolly and the test can be claimed as 100% valid. In some cases, the coating will cover only part of the area of the dolly and a partial adhesion failure should be recorded.



If no coating is present on the dolly this must be recorded as a failure of the adhesive (or glue). This is normally due to incorrect or insufficient mixing of the component parts of the adhesive, or incompatibility of the adhesive and the coating.

Observing the test area will give additional information about the type of failure; adhesion and cohesion between different layers of the coating.

### 3 ADHESIVES

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The adhesive supplied with the instrument is Regular Araldite which is a two component epoxy paste. When mixed, it is to be used within 1 hour. The two components should be mixed in roughly equal portions.

Curing Times:

- 24 hours at 25°C
- 3 hours at 60°C

Suitable for warm and hot environments. Lower temperatures require extended curing times of up to 3 days or more.

Rapid Araldite is a fast setting two pack epoxy paste. It should be mixed for 30 seconds and used within 2 minutes.

Curing Times:

- 8 hours at 25°C
- 4 hours at 10°C
- 2 hours at 23°C
- 1.5 hours at 40°C

Suitable for cold and warm environments.

Other adhesives include acrylic types with much faster setting times. **Loctite Multibond** is well suited for low temperature and fully cures in 24 hours. **Scotch-weld M2000** will reach a high strength after 30 minutes. The suitability of any adhesive should be determined by the User. Some coatings can be adversely affected by adhesives. Some adhesives can be contaminated by coating environments, solvents etc.

The adhesive supplied with this product must be disposed of as special waste unless it has been fully cured. To dispose of excess adhesive at the end of its shelf life simply mix the remaining material and allow it to cure before disposal.

For further guidance on the disposal of adhesives contact your local environmental authority.

## 4 DOLLIES

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Dollies can be re-used after cleaning.

### Large dollies

Coatings on concrete, cementitious layers and uneven surfaces can be tested more effectively with a large dolly. This has twice the diameter and so 4 times the area of the standard dolly. The scale readings of the Elcometer 106 must be divided by 4 to compensate.

The large dolly is taller than the standard dolly. A special base ring is used to support the instrument to enable correct operation. The large dollies and base ring are available from Elcometer or your local supplier - see "Spare parts and accessories" on page 12.

## 5 MAINTENANCE

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The Elcometer 106 Pull Off Adhesion Tester is designed to give many years service under normal operating and storage conditions.

Lubricate the screw threads with light machine oil on a regular basis.

### **Pull-off force**

The pull-off force is provided by the progressive compression of Belleville washers.

After considerable heavy use the washers may age and no longer have their original characteristics. The washers may also become distorted and permanently damaged if the tester is tightened fully, beyond the length of the engraved scale on the barrel.

In this instance the force recorded by the tester should be checked and, if necessary, the tester should be returned to Elcometer for fitting of a new set of Belleville washers and re calibration.

### **Calibration**

Calibration checks to ensure that the correct load is being applied to the dolly will be required periodically. Elcometer can conduct these checks and a calibration certificate traceable to national standards can be issued.

**6 TECHNICAL SPECIFICATION**

Scale	Range		
	N/mm <sup>2</sup> (MPa)	kg/cm <sup>2</sup>	lb/in <sup>2</sup>
1	0.5 to 3.5	5 to 35	100 to 500
2	1 to 7	10 to 70	200 to 1000
3	3 to 15	30 to 150	500 to 2000
4	5 to 22	50 to 220	500 to 3200
5	0.05 to 0.2	0.5 to 2.0	5 to 30

Scale	Height mm (inch)	Diameter mm (inch)	Weight	
			Net mm (lb)	Gross <sup>a</sup> mm (lb)
1	155 (6.1)	76 (3)	0.96 (2.1)	2.14 (4.7)
2	155 (6.1)	76 (3)	1.02 (2.24)	2.18 (4.8)
3	165 (6.5)	76 (3)	1.62 (3.56)	3.54 (7.79)
4	165 (6.5)	76 (3)	1.84 (4.05)	3.74 (8.23)
5	155 (6.1)	76 (3)	0.96 (2.1)	2.14 (4.7)

a. Gross weight includes case and accessories

Accuracy:	< 15% of reading
Material:	Anodised aluminium body, steel feet
Test dolly diameter:	20mm (standard dolly) 40mm (large dolly)
Test dolly material:	High tensile aluminium
Base support ring <sup>b</sup> :	Plated steel
Adhesive:	Regular Araldite

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b. Prevents bending of thin samples, prevents indentation and maintains orientation

## 7 SPARE PARTS AND ACCESSORIES

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The Elcometer 106 Pull Off Adhesion Tester is complete with all the items required to get started and take measurements, however over the life of the tester replacement items may be required. The following items are available from Elcometer, or your local supplier.

T1062895-	Dollies, standard (Pack of 100)
T1062895-10	Dollies, standard (Pack of 10)
T1062914-	Dollies, large (Pack of 5)
T1062915-	Large Dolly Support Ring
T99912906	Pack of Araldite adhesive
T1062923-	Magnetic Dolly Clamp
T1062904-	Basic Support Ring
T99914009	Dolly Cutter
T1065367-	Polypropylene Carrying Case

*Please state scale when ordering spares.*

## 8 RELATED EQUIPMENT

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Elcometer produces a wide range of adhesion gauges and associated inspection equipment. Elcometer 106 users may also benefit from the following Elcometer products:

- Hygrometers, Dewpoint Meter, Thermometers
- Coating Thickness Gauges
- Cross Hatch Cutters

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