

# **elcometer® 510 Automatic Pull-Off Adhesion Tester**

Can be used in accordance with :

**ASTM C1583, ASTM D4541, ASTM D7234-12, AS/NZS 1580.408.5, BS 1881-207, DIN 1048-2, EN 1015-12, EN 12636, EN 13144, EN 1348, EN 1542, EN 24624, ISO 16276-1, ISO 4624, NF T30-606, NF T30-062**



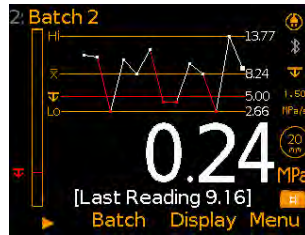
The Elcometer 510 Automatic Pull-Off Adhesion Gauge accurately measures the strength of the bond between the coating and the substrate.

- Automatic hydraulic pump ensures smooth and continuous pressure application for consistent, repeatable results
- Fully adjustable pull rates 0.1-1.4MPa/s to meet National and International Standards
- Can be used with 10, 14.2, 20 and 50mm diameter dollies
- User definable limits with unique pressure hold and release function
- User definable measurement range with an accuracy of  $\pm 1\%$  of full scale:
  - 10mm dolly: 100 MPa
  - 14.2mm dolly: 50 MPa
  - 20mm dolly: 25 MPa
  - 50mm dolly: 4 MPa
- Dust and water resistant rugged design to IP64
- Interchangeable units: MPa, psi, N/mm<sup>2</sup> and N
- A range of standard and thin substrate actuator skirts (compatible with Elcometer 506) available for testing coatings on thick, thin, flat or convex substrates
- Store up to 60,000 readings with individual pull graphs in up to 2,500 alpha numerical batches, complete with attribute failure information
- USB and Bluetooth® data output - Compatible with ElcoMaster™ App for iPhone, iPod, iPad and Android mobile devices

## Key Features Explained



Automatic adhesion tester with selectable pull rates for 10, 14.2, 20 & 50mm diameter dollies.



View trend graphs or live statistics alongside the reading value.



Individual user definable pull rate graphs can be saved with each reading.



Stores individual readings and pull rate graphs in up to 2,500 alpha numeric batches, together with date, time and attribute information.



Either pull to maximum or pull to preset limit. Unique time hold feature allows users to set a delay before pressure returns to zero.



Save cohesive and adhesive failure attributes alongside your adhesion pull data in accordance with National and International Standards.



Powered by either standard rechargeable batteries or AC mains\*. Each battery charge performs up to 200 pulls. Battery recharge time less than 300 minutes.



Transfer data to your PC via USB or Bluetooth® for further analysis with ElcoMaster™ software or view live pull rate graphs in ElcoMaster™ during the test.



Using wireless Bluetooth® communication link the gauge to an Android™ or iPhone® mobile device. Live GPS coordinates from your mobile device can be added to reports and emailed instantly.



A range of standard and thin substrate actuator skirts allow each gauge to be use with 10, 14.2, 20 or 50mm diameter reusable dollies, ideal for testing coatings on thick, thin, flat or convex substrates.



The optional magnetic anchor clamp ensures the actuator doesn't fall during tests on vertical surfaces or testing at height.



Supplied in a robust plastic carry case for easy transportation to and around the job site.

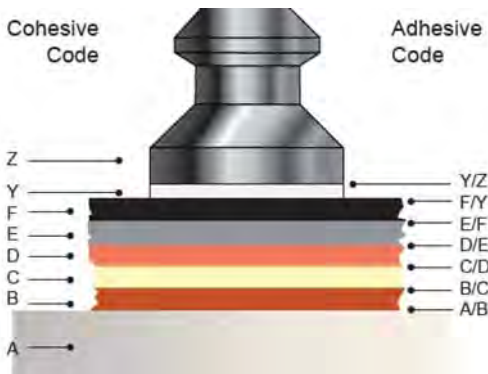
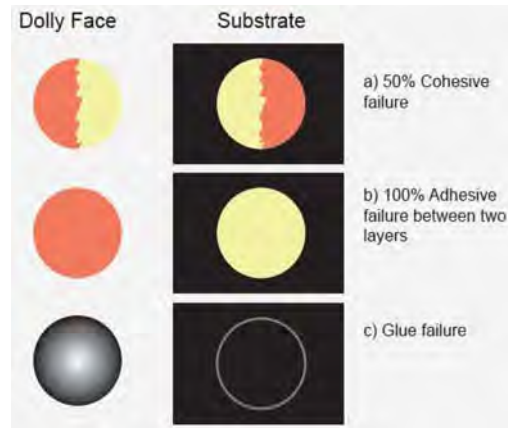
\* Model T only. † iPod, iPhone and iPad compatible

## Assessing The Results - Failure Attributes

Many National and International Standards, including ISO 4624 & ASTM D4541, require the user to record not only the pull-off force but also the nature of the failure. This is done by examining the bottom of the dolly and assessing the failure. In 'Advanced' mode on the Elcometer 510 it is possible to select the 'Attributes' feature (Menu/Setup/Gauge Mode/Advanced) allowing the nature of the fracture to be recorded against each reading and stored within the batch.

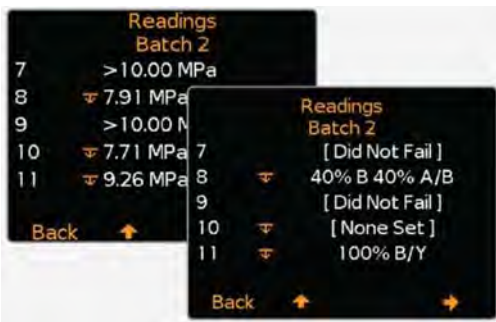
### Examining The Dolly

- a) Cohesive Failure: The coating fails within the body of a coating layer leaving the same coating on the surface and on the dolly face.
- b) Adhesive Failure: Failure occurs at the interface between layers (intercoat) where one pulls away from the other. The "coating" on the dolly face will not be the same as that on the test area.
- c) Glue Failure: When no coating is present on the dolly it must be recorded as a failure of the glue. This maybe due to incorrect or insufficient mixing of the component parts of the adhesive, incompatibility between the adhesive/coating/dolly/test surface.



### Cohesive Failure Layer<sup>d</sup>      Adhesive Failure Layers

Code	Description	Code	Description
A	Substrate	A/B	Substrate & Layer 1
B	Layer 1	B/C	Layer 1 & Layer 2
C	Layer 2	C/D	Layer 2 & Layer 3
D	Layer 3	D/E	Layer 3 & Layer 4
E	Layer 4	E/F	Layer 4 & Layer 5
F	Layer 5	F/Y	Layer 5 & Glue
Y	Glue	Y/Z	Glue & Dolly



The data is saved in the batch and can be viewed at any time displayed as

##.## MPa<sup>e</sup> N% A M% A/B, where;  
 ##.## MPa<sup>e</sup> = Pull Force in MPa or other measurement units (psi, Newtons or Nmm-2)

N% = Cohesive failure percentage<sup>f</sup>  
 A = Cohesive failure layer  
 M% = Adhesion failure percentage<sup>f</sup>  
 A/B = Intercoat adhesive failure layers

<sup>d</sup> The number of layers can be user defined for each batch via Batch/New Batch/Number of Layers. This will affect the number of layers available for selection during attribute recording. The maximum number of layers available is five, excluding the substrate and glue.

<sup>e</sup> Or equivalent units.

<sup>f</sup> To the nearest 10%, in line with International Standards.

## Product Features

	Model S	Model T
Repeatable & reproducible measurements	•	•
Easy to use menu structure; <i>multiple languages</i>	•	•
Tough, impact, waterproof & dust resistant; <i>equivalent to IP64</i>	•	•
Bright LCD colour screen; <i>with ambient light sensor</i>	•	•
Scratch & solvent resistant display; <i>2.4" (6cm) TFT</i>	•	•
Calibration certificate	•	•
2 year gauge warranty	•	•
Automatic rotating display; <i>0°, 180°</i>	•	•
Data output via USB (Live readings - and batch)	•	•
Data output via Bluetooth®		•
PC command; <i>start &amp; stop gauge from a PC with live readings (USB only)</i>		•
Switchable Units (mPa, psi, N, N/mm <sup>2</sup> )	•	•
On-Screen Statistics ( $\eta$ , x, $\sigma$ , hi, lo, COV, N>hi limit*)	•	•
Trend Graph	•	•
Pull Rate Graph ( <i>Load v Time</i> )		•
Interchangeable Dolly Selection; <i>10, 14.2, 20 &amp; 50mm</i>	•	•
User Selectable Pull Rates; (Model S & Model T Standard Mode) <sup>+</sup>		
10mm: 1.00, 2.00, 3.00, 4.00, 5.00 MPa/s		
14.2mm: 0.4, 0.7, 1.4, 2.0, 2.5 MPa/s		
20mm: 0.2, 0.3, 0.7, 1.0, 1.2 MPa/s	•	•
50mm: 0.04, 0.08, 0.12, 0.16, 0.20 MPa/s		
User Selectable Pull Rates; (Model T Advanced Mode) <sup>+</sup>		
10mm: 0.4 - 5.60 MPa/s		
14.2mm: 0.2 - 2.80 MPa/s		
20mm: 0.1 - 1.40 MPa/s		•
50mm: 0.02 - 0.22 MPa/s		
User Selectable Limit & Limit Hold Time		•
Gauge Memory; <i>maximum number of readings</i>	60	60,000*
Number of Batches ( <i>Alpha Numeric - Model T</i> )	1	2,500
Attribute Modes to meet National & International Standards		•
Display Modes		
Readings, Selected Stats & Run Chart (last 20 readings)	•	•
Pull Rate Graphs		•
Batch Review		•
Power; <i>Battery (B), AC Mains Power (M)</i>	B	B, M
USB Cable & ElcoMaster™ 2.0 CD	•	•
Power Cable with Multi International Plug Adaptor (UK, EU, US, AUS)		•
Plastic Transit Case		•
Date & Time		•
In Field Adhesion Calibration Verification Mode		•

♦ Model T only

\* When 'Rate Graph' is enabled, the number of readings which can be stored is reduced depending on the graph resolution selected

<sup>+</sup> Please refer to the User Guide for further information on all units

## Technical Specifications

Part Number	Description	Certificate	
F510-20S	Elcometer 510 Model S Automatic Adhesion Gauge; 20mm Kit	•	
F510-20T	Elcometer 510 Model T Automatic Adhesion Gauge; 20mm Kit	•	
F510-50S	Elcometer 510 Model S Automatic Adhesion Gauge; 50mm Concrete Kit	•	
F510-50T	Elcometer 510 Model T Automatic Adhesion Gauge; 50mm Concrete Kit	•	
Pressure Accuracy	±1% of full scale	Pull Rate Accuracy	±(2.5% + 0.3 seconds)
Pressure Resolution	0.01MPa	Pull Rate Resolution	0.01MPa
Dolly Diameter	<b>10mm</b>	<b>14.2mm</b>	<b>20mm</b>
Operating Range	8 to 100 MPa	4 to 50 MPa	2 to 25 MPa
Pull Rate Range	0.4 - 5.6MPa/s	0.2 - 2.8MPa/s	0.1 - 1.4MPa/s
Gauge Dimensions	260 x 100 x 66mm		
Actuator Height	85mm	85mm	85mm
Instrument Weight	2.9kg	2.9kg	2.9kg
Kit Weight	-	-	6.1kg
Power Supply	8 x AA NiMH/Alkaline batteries (16 rechargeable batteries supplied complete with charger) or AC mains power (Model T only)		
Battery Life	~200 pulls per charge up to 25MPa at 1MPa/s, recharge time less than 5 hours		

• Calibration Certificate supplied as standard.

## Packing List

### 20mm Kit

Elcometer 510 Adhesion Tester

20mm dollies (x10)

standard skirt for 20mm dollies

20mm dolly cutter handle

20mm dolly cutter

Araldite standard two part epoxy adhesive (2 x 15ml tubes)

abrasive pad

shoulder harness

carry case

16 x AA NiMH rechargeable batteries & charger (UK, EU, US, AUS)

mains power supply (UK, EU, US, AUS) (Model T)

ElcoMaster™ CD & USB cable

calibration certificate

operating instructions

### 50mm Kit

50mm dollies (x6)

standard skirt for 50mm dollies

50mm dolly cutter arbor

50mm dolly cutter



## Free ElcoMaster™ 2.0 included

The new ElcoMaster 2.0 is a fast, easy to use software solution for all your reporting requirements



## Create instant reports with ElcoMaster™

***What you do with the collected data is just as important as taking the readings themselves.***

ElcoMaster™ 2.0 is a fast, easy to use software solution for all your data management and quality assurance needs, preparing professional inspection reports at the click of a button.



Whether you are out in the field or on the factory floor, using the ElcoMaster™ Mobile App users can;

- Store live readings directly on to a mobile device and save them into batches.
- View the pull rate graph in real-time for the duration of the test.
- Add attribute data to each individual batch reading.
- Add photographs of the dolly and test surface to each individual batch reading at the click of a button.
- Plot individual readings on to a location map, photograph or diagram.
- Inspection data can be transferred from mobile to PC for further analysis and reporting.
- Generate instant .pdf report for submission.

Combine different inspection parameters (such as dry film thickness, surface profile, salt contamination, climate or adhesion) together with images, notes and other project specific information into customized reports.

Data transferred from the gauge to ElcoMaster™ includes :

- Adhesion Measurements
- Date & Time
- Cohesive/Adhesive Failure Attributes
- Dolly size
- Pull rate graph
- Pull to Limit/Max
- Limit values
- Limit Hold Time
- Cutting Device
- Number of Layers
- Skirt Type/Support Ring Dimensions
- Batch Information & Statistics
- Calibration Information
- Calibration Verification Date/Time



## Accessories

### Dollies



#### Dolly Diameter

10mm  
14.2mm  
20mm  
50mm  
50mm Stainless Steel

#### Pack of 10\*

T5100014AL-10  
T9990014AL-10  
T9990020AL-10  
T9990050AL-4  
T9990050SS-4

#### Pack of 100

T5100014AL-100  
T9990014AL-100  
T9990020AL-100  
-  
-

\*50mm (2") dollies are supplied in packs of 4.

### Dolly Skirts



#### Diameter

10mm  
14.2mm  
20mm  
50mm  
50mm Stainless Steel

#### Standard Skirt

T999101420S  
T999101420S  
T999101420S  
T9990050S  
-

#### Thin Substrate Skirt

-  
T9990014T  
T9990020T  
-  
-

### Adhesion Verification Unit



#### Part Number

T99923924  
T99923924C

#### Description

Elcometer AVU Adhesion Verification Unit  
Elcometer AVU Adhesion Verification Unit - Certified

### Dolly Cutters



#### Diameter

10mm  
14.2mm  
20mm  
50mm  
50mm Stainless Steel

#### Dolly Cutter Handle

-  
T9991420H  
T9991420H  
T9990050H  
-

#### Dolly Cutter

-  
T9990014CT  
T9990020CT  
T9990050CT  
-

### Magnetic Anchor Clamp



#### Part Number

T99923797

#### Description

Magnetic Anchor Clamp - holds actuator securely during tests on vertical surfaces

### Adhesive



#### Part Number

T99912906

#### Description

Araldite Standard Two Part Epoxy Adhesive, 2 x 15ml Tubes

### Dolly Cleaning Heating Tongs

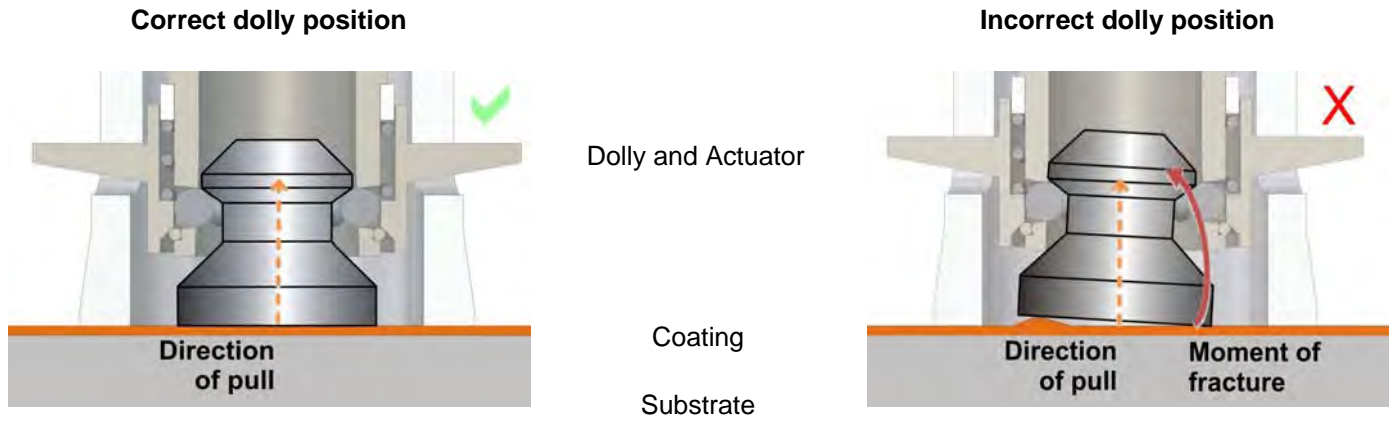
#### Part Number

T99923147

#### Description

Dolly Cleaning Heating Tongs - EUR 220V / UK 240V

# How to Prevent Adhesive and Cohesive Failures



## Preparing the surface and dolly

1. Select an appropriate test area which is flat and has sufficient test area to attach the adhesion gauge.
2. Abrade the dolly and surface, clean both to remove any dust - minimising the risk of an 'adhesive' failure.

## Fixing the dolly

3. Mix the adhesive correctly and apply a uniform adhesive film over the entire dolly face.
4. Test Standards require that the dolly is pulled off perpendicularly to the test surface. The dolly must therefore be adhered on to a prepared flat test surface (see images above). Apply an even pressure to the dolly to ensure that the dolly face is parallel to the test surface.
5. Remove any excess adhesive from around the dolly and allow to fully cure. Tape maybe required when applying dollies to vertical surfaces during the cure process.
6. If required, once the dolly has fully cured, score the coating around the dolly using the dolly cutter provided.
7. Attach the gauge actuator to the dolly and begin test.

## Assessment of the Adhesion Test

For a valid pull test the coating must cover at least 50% of the area of the dolly face. If the glue fails and no coating is present on the dolly, or it covers less than 50% of the dolly face area, the pull-test is invalid and should be repeated.

When the coating has failed within the layer leaving the same coating on both the dolly and the test panel it is known as a 'cohesive failure'.

'Adhesive failures' occur when either the coating has failed at the interface with another coating (leaving a coating on the dolly and another coating on the substrate), or when the coating has failed at the substrate (leaving the coating on the dolly and the substrate is bare).

**NOTE:** If the glue fails at a value above the specification then it can be reported that the adhesion exceeded the specification for this individual test.