elcometer®

User Guide

Elcometer 108

Hydraulic Adhesion Tester

CONTENTS

Section		Page
1	Overview	en-2
2	Box Contents	en-2
3	Getting Started - Digital Pressure Gauge	en-3
4	Securing the Dolly	en-4
5	Preparing the Gauge for Test	en-5
6	Performing the Test	en-6
7	Assessing the Results - Destructive Testing	en-7
8	After Test	en-7
9	Using a Dolly Plug	en-8
10	Spares & Accessories	en-9
11	Warranty Statement	en-14
12	Technical Specification	en-14
13	Legal Notices & Regulatory Information	en-15

For the avoidance of doubt, please refer to the original English language version.

Tester Length: 520mm (20")

Tester Weight: 1.4kg (3lb)

Material Safety Data Sheet for the adhesives supplied by Elcometer can be downloaded via our website:

Cyanoacrylate Adhesive:
www.elcometer.com/images/MSDS/elcometer_cyanoacrylate_adhesive.pdf

Araldite® Standard Two Part Epoxy Adhesive:
www.elcometer.com/images/stories/MSDS/araldite_epoxy_adhesive.pdf

1 OVERVIEW

Available with an analogue or digital pressure gauge, the Elcometer 108 Hydraulic Adhesion Tester is an easy to operate and fully portable Type III adhesion gauge for measuring the bond strength of a range of applied coatings.

The surface under examination is prepared and then a test dolly is attached by adhesive. When the adhesive is cured, the tester is attached to the dolly and a force is applied by turning the handle.

When the stress exceeds the adhesion of the coating, the dolly and coating detach from the substrate. The maximum value of hydraulic pressure during the test is recorded and is equivalent to the adhesion of the coating to the substrate.

2 BOX CONTENTS

- Elcometer 108 Hydraulic Adhesion Tester
- Heating Tongs (if ordered[a])
- Standard Flat Dollies (x5)
- Dolly Plugs (x5)
- Dolly Tool
- Cyanoacrylate Adhesive (50g)
- 2 x AA Batteries (digital gauges only)
- Transit Case
- Calibration Certificate (if ordered)
- User Guide

[a] The Elcometer 108 is supplied with or without heating tongs depending on the part number ordered. Heating tongs are also available to purchase separately, see Section 10.7 on page en-13 for details.

3 GETTING STARTED - DIGITAL PRESSURE GAUGE

3.1 FITTING THE BATTERIES

1 Peel the protective rubber boot forward to expose the battery compartment cover at the rear of the gauge.
2 Rotate the battery compartment cover anti-clockwise to the 'unlock' position.
3 Identify correct polarity and fit 2 x AA alkaline dry batteries.
4 Replace battery compartment cover and rotate clockwise to the 'lock' position.
5 Replace protective rubber boot taking care not to damage the front panel of the display.

The battery symbol at the bottom right hand side of the display indicates the battery condition.

Note: 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.**

3.2 SWITCHING THE GAUGE ON AND OFF

To Switch On: Press ⏻↵. The gauge displays the version of software fitted (e.g. 1.04.03 IDENT) followed by the MIN and MAX range in MPa.

To Switch Off: Press ⏻↵ and hold for a second. The gauge will switch off when the button is released.

Note: When the digital pressure gauge is switched off, "OFF" is permanently displayed.

Automatic Switch Off: The gauge has a timer function and can be set to switch off automatically after 1, 5 or 20 minutes of inactivity. The gauge default setting is NONE.

1 Press MENU△ until TIMER is displayed followed by ⏻↵ to select.
2 Press MENU△ or ▽MAX to toggle between the options; NONE, 1 MIN, 5 MIN, 20 MIN.
3 Press ⏻↵ to select the setting required.

3 GETTING STARTED - DIGITAL PRESSURE GAUGE (continued)

3.3 SELECTING THE UNITS

The gauge can display readings in MPa (Megapascals) or PSI (Pounds per Square Inch).

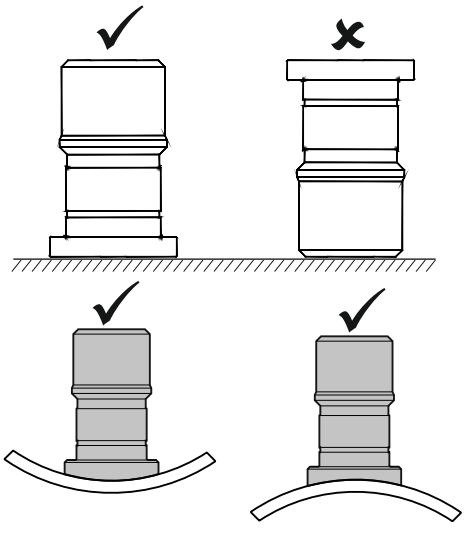
1 Press MENU until UNITS is displayed followed by ⏻ to select.
2 Press MENU or MAX to toggle between MPA and PSI.
3 Press ⏻ to select the units required.

3.4 RESETTING THE GAUGE

The gauge has a gauge reset function which restores the original factory settings.

1 Press MENU until RESET is displayed followed by ⏻ to select.
2 Press ⏻ again to confirm the reset. The gauge will reset and switch off.
3 To cancel the reset request, press MENU or MAX to toggle to 'CANCL' followed by ⏻ to confirm.

4 SECURING THE DOLLY



1 Identify the dolly test surface.
2 Ensure test surface of dolly is clear of old adhesive - see Section 8.2 'Cleaning the Dolly' on page en-7.
3 Wipe dolly test surface and sample area with a solvent to remove oil and grease.
4 Apply a thin, even coat of adhesive to dolly test surface. If adhesive is low viscosity, see Section 9 'Using a Dolly Plug' on page en-8.
5 Press dolly on to sample for about 10 seconds.
6 Leave dolly undisturbed for at least 15 minutes (preferably for 2 hours or more), to allow the adhesive to harden.
7 If required, score the coating around the dolly using a dolly cutter - see Section 10 'Spares & Accessories' on page en-9.

5 PREPARING THE GAUGE FOR TEST

5.1 PREPARING THE GAUGE FOR TEST

1 Turn the handle anti-clockwise until it is fully unwound to release any pressure in the tester.
2 Zero the pressure gauge, see Section 5.2.
3 Select the measurement units; MPA or PSI (digital pressure gauge only) - see Section 3.3 on page en-4.

5.2 ZEROING THE PRESSURE GAUGE

To zero the analogue pressure gauge:
Rotate the knob on the front of the pressure gauge to turn the red drag indicator to ‘0'.

To zero the digital pressure gauge:

1 Press ⏻ to switch the gauge on.
2 Fully unwind the handle (anti-clockwise) to release all pressure.
3 Press ▽MAX to zero the gauge and set the gauge to store the maximum force recorded during test, known as ‘Max Hold’.

Max Hold: The display holds the maximum value until the ▽MAX button is pressed for a second time. ‘Max Hold’ should be switched on before undertaking an adhesion test, signified on the display by either MAXMPA or MAXPSI. The ‘Max Hold’ feature is switched off when the gauge is switched off.

Note: “RLOCK” will be displayed if the gauge zero has failed. This is due to the pressure not being fully released from the instrument. If this occurs, release all the pressure by turning the crank handle followed by the coarse adjustment screw anti-clockwise until fully unwound and press ▽MAX to repeat the gauge zero.

5.3 ATTACHING THE GAUGE TO THE DOLLY

1 Ensure the pin is pushed fully upwards towards the coupling.
2 Pull coupling sleeve up and insert pin into centre of dolly.
3 Release coupling sleeve.
- The instrument should grip the dolly firmly. If the coupling does not grip the dolly firmly, there may be excess adhesive in the centre of the dolly. Use the dolly tool supplied to remove excess adhesive.

6 PERFORMING THE TEST

1 Hold the gauge steady with one hand and turn the handle clockwise slowly and evenly to apply an increasing force to the dolly and hence stress to the coating.

- The rate at which the force is applied (the speed of rotation of the handle) should be in accordance with the relevant Standard.

Continue until either;

(a) the coating fails and the dolly is removed from the surface (destructive testing) or;

(b) the minimum specified pressure value is reached (non-destructive testing).

2 Record the pressure indicated on the display and unwind the handle.

The operating range of the Elcometer 108 is 2 to 18 MPa (290 to 2600psi). **DO NOT exceed the operating range as overloading could damage the gauge.**

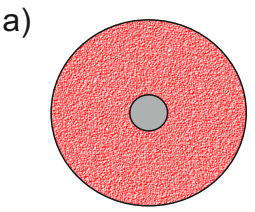
Note: The oil inside the Elcometer 108 is incompressible and therefore any leakage due to catastrophic failure of the gauge will result in an almost instantaneous drop in pressure to atmospheric level.

Note: Dollies can be reused after cleaning until either the top of the dolly is severely deformed or the dolly surface is no longer flat, see Section 8.2 ‘Cleaning the Dolly’ on page en-7. Additional dollies are available from Elcometer or your local supplier - see Section 10 ‘Spares & Accessories’ on page en-9 for details.

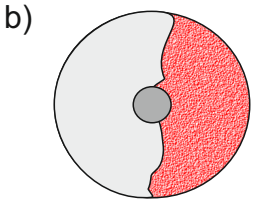
7 ASSESSING THE RESULTS - DESTRUCTIVE TESTING

Once pulled from the surface, examine the bottom of the dolly to assess the results.

a) ***Successful Test:*** In most cases the coating will fully adhere to the dolly and the test can be claimed as 100% valid.



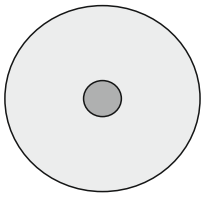
b) ***Partial Failure:*** In some cases, the coating will cover only part of the dolly face. A partial adhesion / coating failure should be recorded if the coating covers more than 50% of the dolly face.
Cohesive Failure: When the coating fails in the body of the coating layer leaving some coating on the surface and some coating on the dolly face.



7 ASSESSING THE RESULTS - DESTRUCTIVE TESTING (cont.)

c) ***Adhesive Failure:*** 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, incompatibility of the adhesive and the coating or the dolly and / or test surface has not been properly prepared before test - see Section 4 ‘Securing the Dolly’ on page en-4.

c)



8 AFTER TEST

8.1 AFTER TEST

Analogue pressure gauge:

1 Fully unwind the handle (anti-clockwise) to decrease the pressure to zero.
2 Pull up the coupling sleeve to release the dolly.

Digital pressure gauge:

1 Fully unwind the handle (anti-clockwise) to decrease the pressure to zero.
2 Pull up the coupling sleeve to release the dolly.
3 Press ▽MAX to release the ‘Max Hold’.
4 Press ▽MAX again to zero the gauge and reset ‘Max Hold’.

Note: Failure to release the ‘Max Hold’ and zero the gauge before each adhesion test will result in an invalid adhesion measurement.

8.2 CLEANING THE DOLLY

⚠ Cleaning the dolly produces unpleasant fumes - ensure that the work area is extremely well ventilated. DO NOT inhale the fumes.

⚠ HOT! Exposed very hot surfaces. Use great care when handling or placing the tongs. Allow to cool before storing.

8 AFTER TEST (continued)

1 Plug the heating tongs[a] into the mains supply and leave to warm up for 5 minutes.
2 Heat the dolly with the tongs for 3 to 5 minutes. This will soften the adhesive.
3 Using a sharp blade, remove the adhesive/coating from the test surface of the dolly.
4 Drop the dolly into water or allow to cool naturally. Do not put the heating tongs into water.
5 To remove any remaining adhesive, rub the dry, cool dolly with fine sandpaper or similar.
6 Use the dolly tool to clear any adhesive from the dolly centre.
7 Wipe the dolly test surface with a solvent to remove oil and grease.

9 USING A DOLLY PLUG

Particularly in the case of low viscosity adhesives it is advisable to place a nylon plug in the centre of the dolly before gluing it to the surface.

This dolly plug stops glue going up the centre of the dolly, which can impede the pin and prevent the test being carried out properly. Careful cleaning of the centre hole increases the adhesion values for tests on a given coating.

Each gauge is supplied complete with five dolly plugs. Additional plugs are available to purchase separately, see Section 10.4 ‘Dolly Plugs’ on page en-13.

To use the dolly plug:

1 Place the dolly plug through the centre hole on the dolly so that the tip protrudes just below the test surface.
2 Apply the adhesive to the dolly test surface, see Section 4 ‘Securing the Dolly’ on page en-4, taking care not to get adhesive on the plug.
3 Press the dolly and dolly plug onto the sample area for about 10 seconds.
4 Remove the dolly plug from the centre of the dolly and wipe the end clean using tissue soaked in a suitable solvent. If the dolly plug becomes stuck to the dolly, use pliers to remove it.
5 Complete the test as described in Sections 5 to 6.

[a] The Elcometer 108 is supplied with or without heating tongs depending on the part number ordered. Heating tongs are also available to purchase separately, see Section 10.7 on page en-13 for details.

10 SPARES & ACCESSORIES

10.1 ADHESIVES

The adhesive supplied with the Elcometer 108 is Cyanoacrylate Adhesive.

Cyanoacrylate adhesives are normally recommended for gluing dollies to the sample area due to their relatively quick curing time. However, there are a number of coatings for which the cyanoacrylate adhesives may not be suitable. These are:

1 Thermoplastics, celluloses, vinyl, chlorinated rubbers and some acrylics, due to the possibility of the glue reacting with the coating.

2 Porous coatings e.g. some metal spraying, in which case the glue, due to its low viscosity will travel into the coating, sticking particles together and possibly altering its adhesion.

A two-pack epoxy such as Araldite® or a modified acrylic gel-type adhesive should be used with the coatings described in (1) and (2) above.

If in doubt as to the type of adhesive to use, please contact the coating manufacturer for advice.

Description	**Part Number**
Cyanoacrylate Adhesive[b], 50g	T99911135
Araldite® Standard Two Part Epoxy Adhesive; 2x15ml Tubes	T99912906

Material Safety Data Sheets for the adhesives supplied by Elcometer can be downloaded via our website:

Cyanoacrylate Adhesive:
www.elcometer.com/images/MSDS/elcometer_cyanoacrylate_adhesive.pdf

Araldite® Standard Two Part Epoxy Adhesive:
www.elcometer.com/images/stories/MSDS/araldite_epoxy_adhesive.pdf

Note: Other suitable adhesives include Loctite® Hysol® 907 and Araldite® Standard. 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.

[b] Supplied as standard with each gauge.

10 SPARES & ACCESSORIES (continued)

10.2 DOLLIES

The Elcometer 108 is supplied with five standard flat dollies with an outside diameter of 19.4mm (0.76"). Additional dollies are available to purchase separately together with dollies for measuring on curved surface - see Section 10.3.

Description	Part Number
Standard Flat Dolly, 1 off	T9999646-

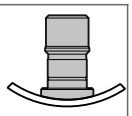
10.3 DOLLIES FOR CURVED SURFACES

Using a flat dolly on a curved surface can produce misleading results. The gap between the flat and curved surfaces will not be filled by the adhesive, resulting in one or more of the following effects:

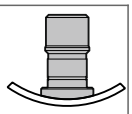
- The dolly may peel or twist off instead of being pushed off.
- The surface area to which pressure is applied, will be modified. This will lead to results from different curvatures not being comparable.
- The amount of adhesive may not be sufficient to withstand the exerted force, resulting in the adhesive breaking before the coating separates from the substrate.

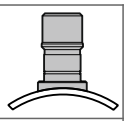
These difficulties are overcome by using curved dollies on diameters of less than approximately 2m (6' 7"). An extensive range of curved dollies is available.

Curved and flat dollies are all used in the same way, matching the marks on the dollies with the longitudinal axis on the curved surface.

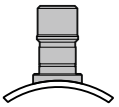
CONVEX DOLLIES FOR CONCAVE SURFACES 			
Part Number	**Dolly Radius (mm)**	**Internal Diameter**	
		Min (mm)	**Max (mm)**
T999122741	940	1880	FLAT
T999122742	470	940	1880
T999122743	313	626	940
T999122744	235	470	626
T999122745	188	376	470

10 SPARES & ACCESSORIES (continued)

CONVEX DOLLIES FOR CONCAVE SURFACES 			
Part Number	**Dolly Radius (mm)**	**Internal Diameter**	
		Min (mm)	**Max (mm)**
T999122746	157	314	376
T999122747	135	270	314
T999122748	118	236	270
T999122749	105	210	236
T9991227410	94	188	210
T9991227411	85	170	188

CONCAVE DOLLIES FOR CONVEX SURFACES 			
Part Number	**Dolly Radius (mm)**	**External Diameter**	
		Min (mm)	**Max (mm)**
T999121401	940	940	1880
T999121402	470	626	940
T999121403	314	472	628
T999121404	236	378	472
T999121405	189	316	378
T999121406	158	272	316
T999121407	136	238	272
T999121408	119	212	238
T999121409	106	192	212
T9991214010	96	174	192
T9991214011	87	160	174
T9991214012	80	148	160
T9991214013	74	138	148
T9991214014	69	130	138
T9991214015	65	121	130
T9991214016	61	116	121
T9991214017	58	110	116

10 SPARES & ACCESSORIES (continued)

CONCAVE DOLLIES FOR CONVEX SURFACES 			
Part Number	**Dolly Radius (mm)**	**External Diameter**	
		Min (mm)	**Max (mm)**
T9991214018	55	104	110
T9991214019	52	100	104
T9991214020	50	96	100
T9991214021	48	92	96
T9991214022	46	88	92
T9991214023	44	84	88
T9991214024	42	80	84
T9991214025	40	77	80
T9991214026	38.5	74	77
T9991214027	37	71	74
T9991214028	35.5	68	71
T9991214029	34	66	68
T9991214030	33	64	66
T9991214031	32	62	64
T9991214032	31	60	62
T9991214033	30	58	60
T9991214034	29	56	58
T9991214035	28	54	56
T9991214036	27	52	54
T9991214037	26	51	52
T9991214038	25.5	50	51

10 SPARES & ACCESSORIES (continued)

10.4 DOLLY PLUGS

Each gauge is supplied complete with five dolly plugs. Additional plugs are available to purchase separately. For information on when and how to use dolly plugs, see Section 9 ‘Using a Dolly Plug’ on page en-8.

Description	Part Number
Dolly Plug, Pack of 5	T99911136

10.5 DOLLY CUTTER

A dolly cutter is available which cuts through the coating to isolate the coating area under the dolly. It should be noted that some coatings will be damaged by such an operation, which may cause micro-cracks. Use of a dolly cutter should be agreed before testing starts.

Description	Part Number
Dolly Cutter	T99914009

10.6 DOLLY TOOL

Supplied as standard with each gauge, the dolly tool is used to remove excess adhesive from the centre of the dolly.

Description	Part Number
Dolly Tool	T9994586-

10.7 HEATING TONGS[a]

Heating tongs are used to soften the adhesive and remove the dolly from the test surface, see Section 8.2 ‘Cleaning the Dolly’ on page en-7 for further information.

Description	Part Number
Heating Tongs; EU 220V / UK 240V	T99923147
Heating Tongs; EU to UK Converter Plug[c]	T99923102
Heating Tongs; US 110V	T99923103

[a] The Elcometer 108 is supplied with or without heating tongs depending on the part number ordered. Heating tongs are also available to purchase separately, see Section 10.7 on page en-13 for details.
[c] Supplied with T99923147.

11 WARRANTY STATEMENT

The Elcometer 108 is supplied with a one year warranty against manufacturing defects, excluding contamination and wear.

12 TECHNICAL SPECIFICATION

Elcometer 108	Analogue	Digital
Standard Flat Dolly	Outside Diameter: 19.4mm (0.76") Inside Diameter: 3.7mm (0.15") Area: 284mm^2 (0.44 sq. inch)	
Scale Range	0 - 25MPa (0 - 3600psi)	0 - 25MPa (0 - 3600psi)
Operating Range (Certified)	2 - 18MPa (290 - 2600psi)	2 - 18MPa (290 - 2600psi)
Scale Resolution	1MPa (100psi)	0.1MPa (1psi)
Accuracy	1MPa (150psi)	±3% or 0.4MPa (60psi)[d]
Power Supply[e]	-	2 x AA alkaline dry batteries
Tester Length	520mm (20")	
Tester Weight	1.4kg (3lb)	
Kit Dimensions	497 x 411 x 140mm (19.6 x 16.2 x 5.5")	
Kit Weight	4.9kg (10.8lb)	
Can be used in accordance with: ASTM D 4541, ISO 16276-1, NF T30-606 Note: The Elcometer 108 Hydraulic Adhesion Tester is a Type III adhesion tester as defined by ASTM D4541.		

[d] Whichever is the greater.
[e] Rechargeable batteries can be used.

13 LEGAL NOTICES & REGULATORY INFORMATION

The Elcometer 108 meets the Electromagnetic Compatibility Directive.

The Elcometer 108 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: 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.

Applicable Patents:

UK: 2,166,875A & 2,166,876A
Germany: P3676087.0 & P3676088.9
Norway: 165,938 & 165,937
US: 4,586,371 & 4,606,225
Canada: 1,272,395 & 1,272,394
Sweden, France and Italy: EP0244518 & 0244519

The Elcometer 108 is packed in a cardboard package. Please ensure that this packaging is disposed of in an environmentally sensitive manner. Consult your local Environmental Authority for further guidance.