Test Item	**: PETEC WINDSHIELD ADHESIVE 83310 and 83400**
Vehicle	**: Ford Mondeo**
Applicant	**: PETEC Verbindungstechnik GmbH, D-96132 Schlüsselfeld**

Documentation

Tests Windshield Mounting

according to

Federal Motor Vehicle Safety Standard

49 CFR 571.212

(FMVSS 212)

This test report is for documentation of measuring results only and shall not be deemed legally binding within the German StVZO/EG-FGV.

Test Item : PETEC WINDSHIELD ADHESIVE 83310 and 83400
Vehicle : Ford Mondeo
Applicant : PETEC Verbindungstechnik GmbH, D-96132 Schlüsselfeld

1. Introduction

This test report describes the test of the windshield retention for motor vehicles during a crash-test.

Upon request of the applicant, TÜV Rheinland Kraftfahrt GmbH has tested PETEC screen bonding products used for the fixation of a windscreen in a vehicle with regard to the FMVSS 212.

The tests were conducted to determine if the screen bonding products meet the requirements specified under item 3. of this test report.

1.1. Name and address of the applicant : PETEC Verbindungstechnik GmbH
Wüstenbuch 26
D-96132 Schlüsselfeld

1.2. Name and address of the manufacturer : PETEC Verbindungstechnik GmbH
Wüstenbuch 26
D-96132 Schlüsselfeld

2. Description of the test object

Technical description : The tests were performed on a Ford Mondeo 4 door saloon with twin airbags. The vehicle was soaked prior to the windshield installation and stored 40 min after the installation at an average temperature of 23°C and a relative humidity of 50%. The installation was carried out by 24 Screen Savers Ltd. according to the PETEC installation procedure (see Appendix 2, Appendix 3 and Appendix 4).

Characteristics : Right hand driven vehicle with driver and passenger airbag system. 50% Hybrid-III Dummy on driver and passenger side.

Test vehicle : Ford Mondeo 4 door saloon
VIN: WF05XXGBB56P67719
Test weight in test condition including 93% fuel, nominal fluids and 2 occupants 1.849,5 kg

The vehicle was subjected to a 100% frontal impact by being propelled into a immovable crash block at 48,6 km/h, as per FMVSS 212 Section 5 (≥ 48 km/h).

The crash test dummies were restrained by means of the vehicle's seat belts and the airbags were triggered by the impact.

The vehicle was impacted within 1 hour after the windscreen was fitted.

Specimen description and part numbers : PETEC WINDSHIELD ADHESIVE Art.-No. 83310 and 83400 (batch 84675), PETEC Primer (Art.-No. 82410, 82330 and 82430) (on blank metal only and all over the contact area on the glass) & Aktivator (Art.-No. 82230) (Manufacturer documentation see Appendix 2, Appendix 3 and Appendix 4).

3. Test basis and test equipment

3.1. Test basis
Federal Motor Vehicle Safety Standard 49 CFR 571.212 (FMVSS 212) at last amended by 60 FR 13639 – 13649 (1995-03-14)

3.2. Testing device (s),
Crash-test laboratory and climatic chamber of:
HORIBA MIRA Ltd.
Watling Street
Nuneaton
Warwickshire CV10 0TU
England

Used equipment and calibration see Appendix 1

4. Description of the test

4.1. Date of the test : 2017-11-30

4.2. Place of the test : Nuneaton, England

4.3. Scope of the test : The objective of the tests was to verify if the test object is able to guaranty the retention of the vehicle windshield during a crash.

5. Test results

Windshield periphery:

Pre test measurement	Right side	2090	mm
	Left side	2090	mm
	Total	4180	mm
Post test measurement	Right side	2090	mm
	Left side	2090	mm
	Total	4180	mm
Width of molding		38	mm
Temperature of the windshield molding during test		20	°C

Area of retention failures : no failures occurred

Remarks : none

Fotos : see Appendix 1

The test object is able to guaranty the retention of the vehicle windshield during a crash according to FMVSS 212 Section 5.

6. Appendices

1. MIRA test Result report MIRA-1215763 03 — page 1 to 33
2. Manufacturers documentation PETEC WINDSHIELD ADHESIVE Art.-No. 83310 and 83400 (Revision 16.11.2018) — page 1 to 3
3. Manufacturers documentation PRIMER WS PETEC Primer Art.-No. 82410, 82330 and 82430 (Revision 16.11.2018) — page 1 and 2
4. Manufacturers documentation ACTIVATOR Aktivator (Art.-No. 82230) (Revision 23.10.2018) — page 1 and 2

The test report contains page 1 to 5 and Appendices 1 to 4.

It is only permitted to publish this report formal and in content unchanged and completely including all appendices except with the approval of the testing laboratory TÜV Rheinland Kraftfahrt GmbH, Am Grauen Stein, 51105 Cologne in writing.

Cologne, 2019-01-29
rg

Rudolf Gerlach
Technical Expert

1215763 03

Test Results

S9109 Windscreen Retention Test 1 Hour Soak

Customer: Thomas Kügel
PETEC Verbindungstechnik GmbH
Wüstenbuch 26
96132 Schlüsselfeld
Germany
Thomas.Kuegel@petec.de

Contact: William Martin
HORIBA MIRA Ltd
Safety Development Dept
Watling Street
Nuneaton
Warwickshire
CV10 0TU, UK
+44(0)24 7635 5000

Test Date(s): 30 November 2017

Witnesses: Rudolf Gerlach - TUV Rheinland

Test Objective / Method / Specification No

To assess windscreen bonding product performance according to FMVSS212. Vehicle was soaked at 23°C and 50% relative humidity. The test was conducted 1 hour after the windscreen was fitted. MIRA Test Number S9109.

Specimen Description / Part No(s)

PETEC Glass Bonding Sealant PETEC Scheibenkleber, PETEC Multiaktiv Primer and PETEC Aktivator

Part Description	Part Number	Date Received
PETEC Scheibenkleber	83310 - 83400	27 & 28/11/17
PETEC Multiaktiv Primer	82330 / 82410 / 82430	27 & 28/11/17
PETEC Aktivator	82230	27 & 28/11/17

Test vehicle:

Make	Ford
Model	Mondeo
Drive hand	RH Drive
VIN	WF05XXGBB56P67719

Test Results Summary

Results only relate to items tested. The subject was tested in accordance with the test specification ~~with~~ without deviation. The acceptance criteria of the test specification were:	Met	✓	Not Met		See comments		

Prepared By:

William Martin
Crash Test Engineer

Approved By:

Colin Smith
Head of Crash

UKAS TESTING 1105

Date: 03/12/18

Tests marked "Not UKAS Accredited" in this report are not included in the UKAS Accreditation Schedule for this laboratory. Opinions and interpretations expressed herein are outside the scope of UKAS Accreditation

Test Results Detail

The test vehicle was soaked at a 1 hour average temperature of 23˚C and relative humidity 50% after windscreen installation, which was carried out by 24 Screen Savers Ltd. It was then subjected to a 100% frontal impact by being propelled into a rigid crash block at 30mph (48km/h), as described in FMVSS212 Section 5. The ATDs were restrained by the vehicle's standard seat belts and the airbags triggered by the vehicle standard system.

Test Conditions				
Tyre Pressure (bar)	Front	2.4	Rear	2.2
Vehicle modifications	None			
Steering Column	Mid position			
Windows	Down			
Seatbelt Height Adjust	Mid position			
Doors	Unlocked			
Parking Brake	Off			
Ignition	On			
Seat Adjustment - Driver	Mid Fore/Aft – Lowest Height			
Seat adjustment – Passenger	Mid Fore/Aft – Lowest Height			
Restraint system specification	Driver and passenger airbag			

Vehicle mass details	**Front (kg)**	**Rear (kg)**	**Total (kg)**
Unloaded vehicle mass	944.5	554	**1498.5**
Test Weight (in test condition, including 93% fuel, nominal fluids, instrumentation, ballast and 2 occupants)	994.5	855	**1849.5**

Assessment against Legislative Criteria		
Impact Velocity (Target 48.3 +1 / -0 km/h)	48.6 km/h	Complied
Impact Alignment (target <5°. Approx. ± 235mm for 2700mm wheelbase)	9 mm left	Complied
Performance assessment: (Max 25% detachment on each side of windscreen perimeter)	LH perimeter 0%	Complied
	RH perimeter 0%	Complied

Test Equipment

Rigid Barrier with plywood facing

2x Hybrid III 50%ile ATDs (Anthropomorphic Test Devices) – un-instrumented for ballast only

Measurement equipment as listed in Appendix 6

6 high speed digital cameras

Attachments

Appendix 1 - Test Photographs

Appendix 2 - Quality Assurance of Measurements

Appendix 1 Test Photographs

Photo 1
LH General view – Pre-Test

Photo 2
LH General view – Post-Test

Photo 3
Front view – Pre-Test

Photo 4
Front view – Post-Test

Photo 5
RH General view – Pre-Test

Photo 6
RH General view – Post-Test

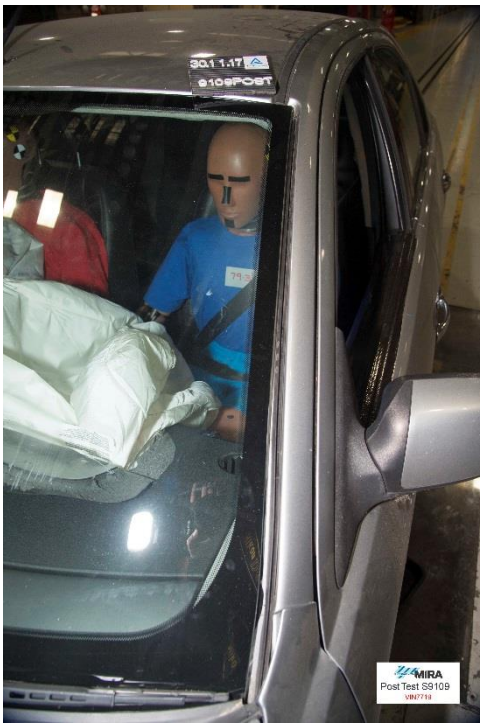

Photo 7
Close front view of LH A-pillar / windscreen LH edge – Post-Test

Photo 8
Close front view of RH A-pillar / windscreen RH edge – Post-Test

Photo 9
Close front view of header rail / windscreen top edge – Post-Test

Photo 10
Close front view of scuttle / windscreen lower edge – Post-Test

Photo 11
Post-test LHF ATD side view – Post-Test

Photo 12
Post-test RHF ATD side view – Post-Test

Appendix 2 Quality Assurance of Measurements

All instrumentation, high speed images and associated analysis contained in this report conforms to the requirements within SAE J211 July 2007.

The test equipment is checked on a regular schedule to traceable standards in an International Assurance of Measurements (QAM) procedure. Each item of equipment is issued with a QAM number.

The numbers for the equipment used in these tests were:-

Item	QAM number	Cal due date
ATD Identification – LHF HIII 50%ile No 138	N/A	N/A
ATD Identification – RHF HIII 50%ile No 270	N/A	N/A
Weigh Scales	38720-23 38724-27	29/06/2018 20/08/2018
5m Steel Tape Measure	34848	07/11/2022
Digital Level	33520	18/01/2018
Stop Watch	34851 38460	15/12/2018 17/05/2018
Tyre Pressure gauge	39679	09/03/2018
Impact Speed Measure (fixed)	8167	26/02/2018
Impact speed measure (mobile)	17921	29/07/2018
Climatic Control Temperature Probe	39704-07, 39785-88	03/01/2018
Climatic Control Humidity Probe	31995-96 31997-98	18/08/2018 19/01/2018
32ch Thermocouple Amplifier	30279	03/01/2018
Climactic Chamber Controller	34000	05/01/2018

Camera ID	View	QAM number	Cal due date
1	F01 LH View – Whole Vehicle	37921	01/08/2018
2	F02 LH View – Front Half of Vehicle	37924	13/07/2018
3	F06 RH View – Whole Vehicle	37938	17/08/2018
4	F07 RH View – Front Half of Vehicle	37922	22/11/2018
5	F14 Overhead View – Whole Vehicle	37919	18/07/2018
6	F11 Front View – Front Half of Vehicle	37917	18/07/2018
7			
8			

Channel Sample Rate: N/A

Weigh Scales

CALIBRATION CERTIFICATE

Issued by HORIBA MIRA Ltd

Issue date: 29 Jun 2017 **Cert No :** 33720170617

A HORIBA COMPANY MIRA

Watling Street, Nuneaton
Warwickshire. CV10 0TU. UK.
Telephone : +44 (0)24 7635 5225
Facsimile : +44 (0)24 7635 8225
http://www.horiba-mira.com

Approved Signatory

[] Mark Pickering – Department Manager
[✓] Philip Macleod – Supervisor – Instrument Calibration
[] Dominic Mhandu - Metrologist

Client:	Test Operations FG	**Manufacturer:**	Intercomp
Section:	Safety, Crash Off-Board Instruments	**Model:**	170127-WPC
Address:	Watling Street Nuneaton Warwickshire --	**Description:**	Weigh Pads
		Serial No:	0216MC15008
		Calibration Date:	29 Jun 2017
		Calibration Procedure:	QA4299/C/07
Client ID:	--	**Equipment used:**	Page 2-5
MIRA ID:	Q38720 to Q38723	**Measurement Results:**	Page 2-5
Date received:	17 Jun 2017	**Measurement Uncertainty:**	Page 2-5
Dallas ID:			

Condition of Instrument: Used, in good condition

Within specification on receipt, at the points measured subject to the measurement uncertainty	Yes
Adjusted during calibration	No
Repaired prior to or during calibration	No
Within specification on completion, at the points measured subject to the measurement uncertainty	Yes

The reported values are the result of measurements taken at the time of calibration within the environment stated and do not carry any implication regarding the long term stability or environmental performance of the instrument. All measurements detailed within this Calibration Certificate relate only to the instrument detailed above on the dates specified.

The instrument was allowed to acclimatise in an environment of 20°C ± 2°C and 50%RH ± 25%RH, for a minimum of 12 hours before commencing the calibration. The electrical supply within the laboratory is 240 Volts ± 15 Volts and 50 Hz ± 0.5Hz with a total harmonic distortion of less than 3%.

This Instrument was calibrated by comparison with force measurement reference standards using a MIRA procedure. Where the instrument has an electrical output and this has been calibrated, the output has been measured using electrical reference standards.

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

TC0032b Issue 20

CALIBRATION CERTIFICATE

Issued by HORIBA MIRA Ltd

Issue date: 20 Aug 2017 **Cert No :** 38724170817

Approved Signatory

Watling Street, Nuneaton
Warwickshire, CV10 0TU, UK.
Telephone : +44 (0)24 7635 5225
Facsimile : +44 (0)24 7635 8225
http://www.horiba-mira.com

- Mark Pickering – Department Manager
- Philip Macleod – Supervisor – Instrument Calibration
- Dominic Mbardu - Metrologist

Client:	Test Operations FG	**Manufacturer:**	Intercomp
Section:	Safety, Crash Off-Board Instruments	**Model:**	170127-WPC
Address:	Watling Street Nuneaton Warwickshire --	**Description:** **Serial No:** **Calibration Date:** **Calibration Procedure:**	Weigh Pads 0216MC15003 20 Aug 2017 QA4299/C/07
Client ID:	--	**Equipment used:**	Pages 2 to 5
MIRA ID:	Q38724 to Q38727	**Measurement Results:**	Pages 2 to 5
Date received:	17 Aug 2017	**Measurement Uncertainty:**	Pages 2 to 5
Dallas ID:			

Condition of Instrument: Used, in good condition

Within specification on receipt, at the points measured subject to the measurement uncertainty	Yes
Adjusted during calibration	No
Repaired prior to or during calibration	No
Within specification on completion, at the points measured subject to the measurement uncertainty	Yes

The reported values are the result of measurements taken at the time of calibration within the environment stated and do not carry any implication regarding the long term stability or environmental performance of the instrument. All measurements detailed within this Calibration Certificate relate only to the instrument detailed above on the dates specified.

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This Instrument was calibrated by comparison with force measurement reference standards using a MIRA procedure. Where the instrument has an electrical output and this has been calibrated, the output has been measured using electrical reference standards.

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

TC0002b Issue 20

5m Steel Tape Measure

CALIBRATION CERTIFICATE

Issued by HORIBA MIRA Ltd

Issue date: 08 Nov 2017 **Cert No :** 34648181017

Page 1 of 2 Pages

Approved Signatory

Watling Street, Nuneaton
Warwickshire. CV10 0TU, UK.
Telephone : +44 (0)24 7635 5225
Facsimile : +44 (0)24 7635 8225
http://www.horiba-mira.com

Mark Pickering – Department Manager
Philip Macleod – Supervisor – Instrument Calibration
Dominic Mbandu - Metrologist

Client:	Test Operations FG	**Manufacturer:**	Assist
Section:	Safety, Crash Off-Board Instruments	**Model:**	32G-5019
Address:	Watling Street	**Description:**	5m Steel Tape Measure
	Nuneaton	**Serial No:**	--
	Warwickshire	**Calibration Date:**	08 Nov 2017
	--	**Calibration Procedure:**	QA3105/C/03
Client ID:	--	**Equipment used:**	Page 2
MIRA ID:	Q34648	**Measurement Results:**	Page 2
Date received:	18 Oct 2017	**Measurement Uncertainty:**	Page 2
Dallas ID:			

Condition of Instrument: Used, in good condition

Within specification on receipt, at the points measured subject to the measurement uncertainty	Yes
Adjusted during calibration	No
Repaired prior to or during calibration	No
Within specification on completion, at the points measured subject to the measurement uncertainty	Yes

The reported values are the result of measurements taken at the time of calibration within the environment stated and do not carry any implication regarding the long term stability or environmental performance of the instrument. All measurements detailed within this Calibration Certificate relate only to the instrument detailed above on the dates specified.

The instrument was allowed to acclimatise in an environment of 20°C ± 2°C and 50%RH ± 25%RH, for a minimum of 12 hours before commencing the calibration. The electrical supply within the laboratory is 240 Volts ± 15 Volts and 50 Hz ± 0.5Hz with a total harmonic distortion of less than 3%.

This Instrument was calibrated by comparison with length measurement reference standards using a MIRA procedure which incorporates limits based on the tolerances contained in document NIST handbook 44 section 5.52.

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

TC0032b Issue 20

Digital Level

CALIBRATION CERTIFICATE

Issued by HORIBA MIRA Ltd

Issue date: 18 Jan 2017 **Cert No :** 33520130117

A HORIBA COMPANY MIRA

Watling Street, Nuneaton
Warwickshire, CV10 0TU, UK.
Telephone : +44 (0)24 7635 5225
Facsimile : +44 (0)24 7635 8225
http://www.horiba-mira.com

Approved Signatory

|| Mark Pickering – Head of Instrument Calibration & Repair
|| Philip Maclean – Supervisor – Instrument Calibration
|| Dominic Mbandu – Metrologist

Client:	Test Operations FG	**Manufacturer:**	Smarttool
Section:	Safety, Crash Off-Board Instruments	**Model:**	--
Address:	Watling Street Nuneaton Warwickshire --	**Description:** **Serial No:** **Calibration Date:** **Calibration Procedure:**	Digital Level -- 18 Jan 2017 QA3129/C/03
Client ID:	--	**Equipment used:**	Page 2
MIRA ID:	Q33520	**Measurement Results:**	Page 2
Date received:	13 Jan 2017	**Measurement Uncertainty:**	Page 2
Dallas ID:			

Condition of Instrument: Used, in good condition

Within specification on receipt, at the points measured subject to the measurement uncertainty	Yes
Adjusted during calibration	No
Repaired prior to or during calibration	No
Within specification on completion, at the points measured subject to the measurement uncertainty	Yes

The reported values are the result of measurements taken at the time of calibration within the environment stated and do not carry any implication regarding the long term stability or environmental performance of the instrument. All measurements detailed within this Calibration Certificate relate only to the instrument detailed above on the dates specified.

The instrument was allowed to acclimatise in an environment of 20°C ± 2°C and 50%RH ± 25%RH, for a minimum of 12 hours before commencing the calibration. The electrical supply within the laboratory is 240 Volts ± 15 Volts and 50 Hz ± 0.5Hz with a total harmonic distortion of less than 3%.

Instrument calibrated by comparison with angular reference standards using MIRA Procedure QA3129/C.

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

TQU002b Issue 20

Stop Watch

CALIBRATION CERTIFICATE

Issued by MIRA Ltd

Issue date: 18 May 2015 **Cert No :** 38460230315

Approved Signatory

P. MacLeod

Watling Street, Nuneaton
Warwickshire, CV10 0TU, UK.
Telephone : +44 (0)24 7635 5225
Facsimile : +44 (0)24 7635 8225
http://calibration.mira.co.uk

[] Mark Pickering – Head of Instrument Calibration & Repair
[] Philip Macleod – Supervisor – Instrument Calibration

Client:	MIRA, Test Operations FG	**Manufacturer:**	RS
Section:	Vehicle Env & Aero, Climatic Chamber	**Model:**	811-1818
Address:	Watling Street	**Description:**	Stop Watch
	Nuneaton	**Serial No:**	--
	Warwickshire	**Calibration Date:**	18 May 2015
	--	**Calibration Procedure:**	QA2113/C/02
Client ID:	--	**Equipment used:**	Page 2
MIRA ID:	Q38480	**Measurement Results:**	Page 2
Date received:	23 Mar 2015	**Measurement Uncertainty:**	Page 2

Condition of Instrument: New

Within specification on receipt, at the points measured subject to the measurement uncertainty	Yes
Adjusted during calibration	No
Repaired prior to or during calibration	No
Within specification on completion, at the points measured subject to the measurement uncertainty	Yes

The reported values are the result of measurements taken at the time of calibration within the environment stated and do not carry any implication regarding the long term stability or environmental performance of the instrument. All measurements detailed within this Calibration Certificate relate only to the instrument detailed above on the dates specified.

The instrument was allowed to acclimatise in an environment of 20°C ± 2°C and 50%RH ± 25%RH, for a minimum of 12 hours before commencing the calibration. The electrical supply within the laboratory is 240 Volts ± 15 Volts and 50 Hz ± 0.5Hz with a total harmonic distortion of less than 3%.

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

TC0032b Issue 17

CALIBRATION CERTIFICATE

Issued by HORIBA MIRA Ltd

Issue date: 16 Dec 2015 **Cert No :** 34851251115

Approved Signatory

P. MacLeod

Watling Street, Nuneaton
Warwickshire, CV10 0TU, UK.
Telephone : +44 (0)24 7635 5225
Facsimile +44 (0)24 7635 5225
http://www.horiba-mira.com

|| Mark Pickering – Head of Instrument Calibration & Repair
|| Philip Macleod – Supervisor – Instrument Calibration
|| Mirosław Pałucki – Metrologist

Client:	Mechanical Engineering FG	**Manufacturer:**	RS
Section:	Braking	**Model:**	699-9259
Address:	Watling Street	**Description:**	Digital Stopwatch
	Nuneaton	**Serial No:**	--
	Warwickshire	**Calibration Date:**	15 Dec 2015
	--	**Calibration Procedure:**	CA2113/C/02
Client ID:	--	**Equipment used:**	Page 2
MIRA ID:	Q34851	**Measurement Results:**	Page 2
Date received:	25 Nov 2015	**Measurement Uncertainty:**	Page 2
Dallas ID:			

Condition of Instrument: Used, in good condition

Within specification on receipt, at the points measured subject to the measurement uncertainty	Yes
Adjusted during calibration	No
Repaired prior to or during calibration	No
Within specification on completion, at the points measured subject to the measurement uncertainty	Yes

The reported values are the result of measurements taken at the time of calibration within the environment stated and do not carry any implication regarding the long term stability or environmental performance of the instrument. All measurements detailed within this Calibration Certificate relate only to the instrument detailed above on the dates specified.

The instrument was allowed to acclimatise in an environment of 20°C ± 2°C and 50%RH ± 25%RH, for a minimum of 12 hours before commencing the calibration. The electrical supply within the laboratory is 240 Volts ± 10 Volts and 50 Hz ± 0.5Hz with a total harmonic distortion of less than 3%.

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

TC3032b Issue 17

Tyre Pressure Gauge

CALIBRATION CERTIFICATE

Issued by HORIBA MIRA Ltd

Issue date: 09 Mar 2017 **Cert No :** 38679/00117

Approved Signatory

P Macleod

Watling Street, Nuneaton
Warwickshire, CV10 0TU, UK.
Telephone : +44 (0)24 7635 5225
Facsimile : +44 (0)24 7635 8225
http://www.horiba-mira.com

[] Mark Pickering – Head of Instrument Calibration & Repair
[✓] Philip Macleod – Supervisor – Instrument Calibration
[] Dominic Mhandu – Metrologist

Client:	Test Operations FG	**Manufacturer:**	PCL
Section:	Safety, Crash Off-Board Instruments	**Model:**	AFG1H03
Address:	Watling Street Nuneaton Warwickshire --	**Description:** **Serial No:** **Calibration Date:** **Calibration Procedure:**	12 bar Tyre Inflator 141121095 09 Mar 2017 QA4097/C/03
Client ID:	--	**Equipment used:**	Page 3
MIRA ID:	Q39679	**Measurement Results:**	Page 2
Date received:	10 Jan 2017	**Measurement Uncertainty:**	Page 2
Dallas ID:			

Condition of Instrument: Used, in good condition

Within specification on receipt at the points measured subject to the measurement uncertainty	Yes
Adjusted during calibration	No
Repaired prior to or during calibration	No
Within specification on completion, at the points measured subject to the measurement uncertainty	Yes

The reported values are the result of measurements taken at the time of calibration within the environment stated and do not carry any implication regarding the long term stability or environmental performance of the instrument. All measurements detailed within this Calibration Certificate relate only to the instrument detailed above on the dates specified.

The instrument was allowed to acclimatise in an environment of 20°C ± 2°C and 50%RH ± 25%RH, for a minimum of 12 hours before commencing the calibration. The electrical supply within the laboratory is 240 Volts ± 15 Volts and 50 Hz ± 0.6Hz with a total harmonic distortion of less than 3%.

This Instrument was calibrated by comparison with pressure measurement reference standards using a MIRA procedure which incorporates limits based on the applicable standard, BS EN 12645:1999.

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

TC00626 Issue 20

9 Beam Speed Measurement Laser

CALIBRATION CERTIFICATE

Issued by HORIBA MIRA Ltd

Issue date: 19 Apr 2017 **Cert No :** 0816/190417

Page 1 of 5 Pages

Approved Signatory

A HORIBA COMPANY MIRA

Watling Street, Nuneaton
Warwickshire, CV10 0TU, UK.
Telephone : +44 (0)24 7635 5225
Facsimile : +44 (0)24 7635 8225
http://www.horiba-mira.com

[] Mark Pickering – Head of Instrument Calibration & Repair
[] Philip Macleod – Supervisor – Instrument Calibration
[X] Dominic Mhandu - Metrologist

Client:	Test Operations FC	**Manufacturer:**	MIRA
Section:	Safety, Crash Off-Board Instruments	**Model:**	--
Address:	Watling Street	**Description:**	9 Beam Speed Measurement Sys
	Nuneaton	**Serial No:**	--
	Warwickshire	**Calibration Date:**	20 Apr 2017
	--	**Calibration Procedure:**	QA2361/C/05
Client ID:	--	**Equipment used:**	Page 5
MIRA ID:	Q08167	**Measurement Results:**	Pages 2 to 4
Date received:	19 Apr 2017	**Measurement Uncertainty:**	Page 6
Dallas ID:			

Condition of Instrument: Used, in good condition

Within specification on receipt, at the points measured subject to the measurement uncertainty	No
Adjusted during calibration	No
Repaired prior to or during calibration	Yes
Within specification on completion, at the points measured subject to the measurement uncertainty	No

The reported values are the result of measurements taken at the time of calibration within the environment stated and do not carry any implication regarding the long term stability or environmental performance of the instrument. All measurements detailed within this Calibration Certificate relate only to the instrument detailed above on the dates specified.

The instrument was allowed to acclimatise in an environment of 20°C ± 2°C and 50%RH ± 25%RH, for a minimum of 12 hours before commencing the calibration. The electrical supply within the laboratory is 240 Volts ± 15 Volts and 50 Hz ± 0.5Hz with a total harmonic distortion of less than 3%.

This speed measurement system was calibrated by comparison with distance and time measurement reference standards using a MIRA procedure which incorporates limits based on client requirements detailed in request for service document CR225072012A.

This calibration certificate includes the laser speed measurements taken after repair.

Laser speed set C1 still does not conform to specification.

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

TC0032b Issue 20

Mobile Speed Measurement Laser

CALIBRATION CERTIFICATE

Issued by HORIBA MIRA Ltd

Issue date: 21 Jun 2017 **Cert No** : 17899250317

Page 1 of 2 Pages

Approved Signatory

Watling Street, Nuneaton
Warwickshire, CV10 0TU, UK
Telephone : +44 (0)24 7635 5225
Facsimile : +44 (0)24 7635 8225
http://www.horiba-mira.com

[] Mark Pickering – Department Manager
[] Philip Macleod – Supervisor – Instrument Calibration
[] Dominic Mhandu - Metrologist

Client:	Test Operations FG	**Manufacturer:**	MIRA
Section:	Safety Crash Off-Board Instruments	**Model:**	TDS90
Address:	Watling Street	**Description:**	Vole Speed Measurement Unit, Cable & Frame
	Nuneaton	**Serial No:**	--
	Warwickshire	**Calibration Date:**	04 Apr 2017
	--	**Calibration Procedure:**	QA2517/C/03
Client ID:	--	**Equipment used:**	Page 2
MIRA ID:	Q17898 to Q17901	**Measurement Results:**	Page 2
Date received:	25 Mar 2017	**Measurement Uncertainty:**	Page 2
Dallas ID:			

Condition of Instrument: Used, in good condition

Within specification on receipt, at the points measured subject to the measurement uncertainty	Yes
Adjusted during calibration	No
Repaired prior to or during calibration	No
Within specification on completion, at the points measured subject to the measurement uncertainty	Yes

The reported values are the result of measurements taken at the time of calibration within the environment stated and do not carry any implication regarding the long term stability or environmental performance of the instrument. All measurements detailed within this Calibration Certificate relate only to the instrument detailed above on the dates specified.

The instrument was allowed to acclimatise in an environment of 20°C ± 2°C and 50%RH ± 25%RH for a minimum of 12 hours before commencing the calibration. The electrical supply within the laboratory is 240 Volts ± 15 Volts and 50 Hz ± 0.5Hz with a total harmonic distortion of less than 3%.

This instrument was calibrated by comparison with time and displacement measurement reference standards using a MIRA procedure which incorporates limits based on client requirements. These requirements are specified in document CR225072012B.

This certificate includes all component parts list.
This certificate is a replacement for Certificate number 17899250317.

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

TC3032b Issue 20

Climatic Temperature Probes

CERTIFICATE OF CALIBRATION

ISSUED BY: **Universal Instrument Services Ltd.**

Date of Calibration: 3rd January 2017
Date of Issue: 6th January 2017 Certificate Number: 00048454

UKAS CALIBRATION 0125

Universal

UNIVERSAL INSTRUMENT SERVICES Ltd.
Unit 69 The Whittle Estate, Cambridge Road,
Whetstone, Leicester LE8 6PA
Tel: 0116 275 0123 Fax: 0116 275 0282
Website: www.uiscal.com
Email: sales@uiscal.co.uk

Page 1 of 2 Pages
Approved Signatory
J.Bruce

Customer: HORIBA MIRA LIMITED
WATLING STREET
NUNEATON
WARWICKSHIRE
Operator: JKB
Our Ref: 361434

Manufacturer: Not Known
Description: "T" Thermocouple
Model: T-TYPE
Serial No: Q39704
Asset No: Q39704
Order No: 263528
Date Received: 19th December 2016

CONDITION OF UNIT UNDER TEST
The Thermocouple was visually inspected prior to calibration YES/NO Y

ADDITIONAL COMMENTS

STABILITY
The readings given are the results at the time of calibration and do not carry any implication regarding the long term stability of the unit under test.

ACCREDITATIONS
UIS is accredited by UKAS to BS EN 17025:2005 to undertake the calibration presented in this certificate.

ENVIRONMENT
The instrument was calibrated in our laboratory with the ambient conditions stated on the results page.

PROCEDURE
UIS procedure CP7.5.3

UNCERTAINTIES
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

TEST EQUIPMENT USED

Asset No.	Description	Certificate No.	Expiry date
ID3156	Hart 1590 Super Thermometer II	296385	21/MAR/2017
ID3051	Tinsley Std Resistor 25 ohms	UKAS 0361304	09/NOV/2018
ID3032	PRT (25 ohms)	UKAS 47039	14/JUL/2017
ID3269	PRT (25 ohms)	UKAS 47042	14/JUL/2017
ID3247	PRT (25 ohms)	UKAS 47018	12/JUL/2017
D3245	PRT (25 ohms)	UKAS 47020	12/JUL/2017
D3276	Fluke 1586-2588 Multiplexer	UKAS 47348	25/FEB/2017

CERTIFICATE OF CALIBRATION

ISSUED BY: **Universal Instrument Services Ltd.**

Date of Calibration: 3rd January 2017
Date of issue: 5th January 2017 Certificate Number: 00040455

UKAS CALIBRATION
0125

Universal

UNIVERSAL INSTRUMENT SERVICES Ltd.
Unit 69 The Whittle Estate, Cambridge Road,
Whetstone, Leicester LE8 6PA
Tel: 0116 275 0123 Fax: 0116 275 0262
Website: www.uiscal.com
Email: sales@uiscal.co.uk

Approved Signatory
J.Bruce

Customer:	HORIBA MIRA LIMITED WATLING STREET NUNEATON WARWICKSHIRE	Manufacturer:	Not Known
		Description:	'T' Thermocouple
		Model:	T-TYPE
		Serial No:	Q39705
Operator:	JKB	Asset No:	Q39705
Our Ref:	331435	Order No:	263528
		Date Received:	19th December 2016

CONDITION OF UNIT UNDER TEST

	YES/NO
The Thermocouple was visually inspected prior to calibration	Y

ADDITIONAL COMMENTS

STABILITY
The readings given are the results at the time of calibration and do not carry any implication regarding the long term stability of the unit under test.

ACCREDITATIONS
UIS is accredited by UKAS to BS EN 17025:2005 to undertake the calibration presented in this certificate.

ENVIRONMENT
The instrument was calibrated in our laboratory with the ambient conditions stated on the results page.

PROCEDURE
UIS procedure CP7 5.3

UNCERTAINTIES
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

TEST EQUIPMENT USED

Asset No.	Description	Certificate No.	Expiry date
ID3156	Hart 1590 Super-Thermometer II	293335	21/MAR/2017
ID3051	Tinsley Std Resistor 25 ohms	UKAS 0361304	09/JUL/2018
ID3032	PRT (25 ohms)	UKAS 47039	14/JUL/2017
ID3269	PRT (25 ohms)	UKAS 47042	14/JUL/2017
ID3240	PRT (25 ohms)	UKAS 47018	12/JUL/2017
ID3245	PRT (25 ohms)	UKAS 47020	12/JUL/2017
ID3276	Fluke 1568-2588 Multiplexer	UKAS 47348	25/FEB/2017

CERTIFICATE OF CALIBRATION

ISSUED BY: **Universal Instrument Services Ltd.**

Date of Calibration: 3rd January 2017
Date of issue: 6th January 2017 Certificate Number: 00046456

UKAS CALIBRATION
0125

Universal

UNIVERSAL INSTRUMENT SERVICES Ltd.
Unit 69 The Whittle Estate, Cambridge Road,
Whetstone, Leicester LE8 6PA
Tel: 0116 275 0123 Fax: 0116 275 0282
Website: www.uiscal.com
Email: sales@uiscal.co.uk

Approved Signatory
J.Bruce

Customer: HORIBA MIRA LIMITED
WATLING STREET
NUNEATON
WARWICKSHIRE
Operator: JKP
Our Ref: 331436

Manufacturer: Not Known
Description: "T" Thermocouple
Model: T-TYPE
Serial No: Q39706
Asset No: Q39706
Order No: 263528
Date Received: 19th December 2016

CONDITION OF UNIT UNDER TEST

	YES/NO
The Thermocouple was visually inspected prior to calibration	Y

ADDITIONAL COMMENTS

STABILITY
The readings given are the results at the time of calibration and do not carry any implication regarding the long term stability of the unit under test.

ACCREDITATIONS
UIS is accredited by UKAS to BS EN 17025:2005 to undertake the calibration presented in this certificate.

ENVIRONMENT
The instrument was calibrated in our laboratory with the ambient conditions stated on the results page.

PROCEDURE
UIS procedure CP7.5.3

UNCERTAINTIES
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

TEST EQUIPMENT USED

Asset No.	Description	Certificate No.	Expiry date
ID3156	Hart 1590 Super-Thermometer II	296385	21/MAR/2017
ID3051	Tinsley Std Resistor 25 ohms	UKAS 0361304	09/JUL/2018
ID3032	PRT (25 ohms)	UKAS 47039	14/JUL/2017
ID3250	PRT (25 ohms)	UKAS 47042	14/JUL/2017
ID3240	PRT (25 ohms)	UKAS 47018	12/JUL/2017
ID3245	PRT (25 ohms)	UKAS 47020	12/JUL/2017
ID3276	Fluke 1586-2588 Multiplexer	UKAS 47348	25/FEB/2017

CERTIFICATE OF CALIBRATION

ISSUED BY: **Universal Instrument Services Ltd.**

Date of Calibration: 3rd January 2017
Date of Issue: 5th January 2017 Certificate Number: 00048457

UKAS CALIBRATION 0125

Universal

UNIVERSAL INSTRUMENT SERVICES Ltd.
Unit 69 The Whittle Estate, Cambridge Road,
Whetstone, Leicester LE8 6PA
Tel: 0116 275 0123 Fax: 0116 275 0252
Website: www.uiscal.com
Email: sales@uiscal.co.uk

Approved Signatory
J.Bruce

Customer: HORIBA MIRA LIMITED
WATLING STREET
NUNEATON
WARWICKSHIRE
Operator: JKB
Our Ref: 351437

Manufacturer: Not Known
Description: "T" Thermocouple
Model: T-TYPE
Serial No: 039707
Asset No: 039707
Order No: 263528
Date Received: 19th December 2016

CONDITION OF UNIT UNDER TEST

	YES/NO
The Thermocouple was visually inspected prior to calibration	Y

ADDITIONAL COMMENTS

STABILITY
The readings given are the results at the time of calibration and do not carry any implication regarding the long term stability of the unit under test.

ACCREDITATIONS
UIS is accredited by UKAS to BS EN 17025:2005 to undertake the calibration presented in this certificate.

ENVIRONMENT
The instrument was calibrated in our laboratory with the ambient conditions stated on the results page.

PROCEDURE
UIS procedure CP7.5.3

UNCERTAINTIES
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2 providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

TEST EQUIPMENT USED

Asset No.	Description	Certificate No.	Expiry date
ID3156	Hart 1590 Super-Thermometer II	296385	21/MAR/2017
ID3051	Tinsley Std Resistor 25 ohms	UKAS 0391304	09/JUL/2018
ID3052	PRT (25 ohms)	UKAS 47039	14/JUL/2017
ID3239	PRT (25 ohms)	UKAS 47042	14/JUL/2017
ID3240	PRT (25 ohms)	UKAS 47019	12/JUL/2017
ID3245	PRT (25 ohms)	UKAS 47020	12/JUL/2017
ID3276	Fluke 1586-2588 Multiplexer	UKAS 47343	25/FEB/2017

CERTIFICATE OF CALIBRATION

ISSUED BY: **Universal Instrument Services Ltd.**

Date of Calibration: 3rd January 2017
Date of Issue: 5th January 2017 Certificate Number: CC048450

UKAS CALIBRATION
0125

Universal

UNIVERSAL INSTRUMENT SERVICES Ltd.
Unit 68 The Wrekin Estate, Cambridge Road,
Whetstone, Leicester LE8 6PA
Tel: 0116 275 0123 Fax: 0116 275 0262
Website: www.uiscal.com
Email: sales@uiscal.co.uk

Approved Signatory
J.Bruce

Customer: HORIBA MIRA LIMITED
WATLING STREET
NUNEATON
WARWICKSHIRE
Operator: JKB
Our Ref: 361430

Manufacturer: Not Known
Description: "T" Thermocouple
Model: T-TYPE
Serial No: Q39785
Asset No: Q39785
Order No: 263528
Date Received: 19th December 2016

CONDITION OF UNIT UNDER TEST
The Thermocouple was visually inspected prior to calibration YES/NO: Y

ADDITIONAL COMMENTS

STABILITY
The readings given are the results at the time of calibration and do not carry any implication regarding the long term stability of the unit under test.

ACCREDITATIONS
UIS is accredited by UKAS to BS EN 17025:2005 to undertake the calibration presented in this certificate.

ENVIRONMENT
The instrument was calibrated in our laboratory with the ambient conditions stated on the results page.

PROCEDURE
UIS procedure CP7.5.3

UNCERTAINTIES
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

TEST EQUIPMENT USED

Asset No.	Description	Certificate No.	Expiry date
ID3156	Fluke 1590 Super-Thermometer II	286365	21/MAR/2017
ID3051	Tinsley Std Resistor 25 ohms	UKAS 0381304	09/JUL/2018
ID3032	PRT (25 ohms)	UKAS 47039	14/JUL/2017
ID3269	PRT (25 ohms)	UKAS 47042	14/JUL/2017
ID3240	PRT (25 ohms)	UKAS 47014	12/JUL/2017
ID3245	PRT (25 ohms)	UKAS 47020	12/JUL/2017
ID3276	Fluke 1586-2588 Multiplexer	UKAS 47348	26/FEB/2017

CERTIFICATE OF CALIBRATION

ISSUED BY: **Universal Instrument Services Ltd.**

Date of Calibration: 3rd January 2017
Date of Issue: 5th January 2017 Certificate Number: 00049453

UKAS CALIBRATION
0125

Universal

UNIVERSAL INSTRUMENT SERVICES Ltd.
Unit 69 The Whittle Estate, Cambridge Road,
Whetstone, Leicester LE8 6PA
Tel: 0116 275 0123 Fax: 0116 275 0282
Website: www.uiscal.com
Email: sales@uiscal.co.uk

Approved Signatory
J.Bruce

Customer:	HORIBA MIRA LIMITED WATLING STREET NUNEATON WARWICKSHIRE	Manufacturer:	Not Known
		Description:	'T' Thermocouple
		Model:	T-TYPE
		Serial No:	Q39786
Operator:	JKB	Asset No:	Q39786
Our Ref:	361433	Order No:	203528
		Date Received:	15th December 2016

CONDITION OF UNIT UNDER TEST — **YES/NO**
The Thermocouple was visually inspected prior to calibration — Y

ADDITIONAL COMMENTS

STABILITY
The readings given are the results at the time of calibration and do not carry any implication regarding the long term stability of the unit under test.

ACCREDITATIONS
UIS is accredited by UKAS to BS EN 17025:2005 to undertake the calibration presented in this certificate.

ENVIRONMENT
The instrument was calibrated in our laboratory with the ambient conditions stated on the results page.

PROCEDURE
UIS procedure CP7.6.3

UNCERTAINTIES
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

TEST EQUIPMENT USED

Asset No.	Description	Certificate No.	Expiry date
ID3156	Hart 1590 Super- hermometer II	295385	21/MAR/2017
ID3051	Tinsley Std Resistor 25 ohms	UKAS 0391304	09/JUL/2018
ID3032	PRT (25 ohms)	UKAS 47039	14/JUL/2017
ID3269	PRT (25 ohms)	UKAS 47042	14/JUL/2017
ID3240	PRT (25 ohms)	UKAS 47018	12/JUL/2017
ID3245	PRT (25 ohms)	UKAS 47020	12/JUL/2017
ID3276	Fluke 1586-2588 Multiplexer	UKAS 47348	25/FEB/2017

CERTIFICATE OF CALIBRATION

ISSUED BY. **Universal Instrument Services Ltd.**

Date of Calibration: 3rd January 2017
Date of issue: 5th January 2017 Certificate Number: U0048452

UKAS CALIBRATION
0125

Universal

UNIVERSAL INSTRUMENT SERVICES Ltd.
Unit 68 The Whittle Estate, Cambridge Road,
Whetstone, Leicester LE8 6PA
Tel: 0116 275 0123 Fax: 0116 275 0262
Website: www.uiscal.com
Email: sales@uiscal.co.uk

Page 1 of 2 Pages
Approved Signatory
J Bruce

Customer: HORIBA MIRA LIMITED
WATLING STREET
NUNEATON
WARWICKSHIRE
Operator: JKB
Our Ref: 361432

Manufacturer: Not Known
Description: "T" Thermocouple
Model: T-TYPE
Serial No: Q39787
Asset No: Q39787
Order No: 263528
Date Received: 19th December 2016

CONDITION OF UNIT UNDER TEST

	YES/NO
The Thermocouple was visually inspected prior to calibration	Y

ADDITIONAL COMMENTS

STABILITY
The readings given are the results at the time of calibration and do not carry any implication regarding the long term stability of the unit under test.

ACCREDITATIONS
UIS is accredited by UKAS to BS EN 17025:2005 to undertake the calibration presented in this certificate.

ENVIRONMENT
The instrument was calibrated in our laboratory with the ambient conditions stated on the results page.

PROCEDURE
UIS procedure CP7.5.3

UNCERTAINTIES
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

TEST EQUIPMENT USED

Asset No.	Description	Certificate No.	Expiry date
ID3156	Hart 1590 Super-Thermometer II	295385	21/MAR/2017
ID3061	Tinsley Std Resistor 25 ohms	UKAS 0291304	05/JUL/2018
ID3032	PRT (25 ohms)	UKAS 47039	14/JUL/2017
ID3259	PRT (25 ohms)	UKAS 47042	14/JUL/2017
ID3240	PRT (25 ohms)	UKAS 47018	12/JUL/2017
ID3248	PRT (25 ohms)	UKAS 47020	12/JUL/2017
ID3276	Fluke 1586-2588 Multiplexer	UKAS 47348	25/FEB/2017

CERTIFICATE OF CALIBRATION

ISSUED BY: **Universal Instrument Services Ltd.**

Date of Calibration: 3rd January 2017
Date of Issue: 6th January 2017 Certificate Number: C0048451

UKAS CALIBRATION 0125

Universal

UNIVERSAL INSTRUMENT SERVICES Ltd.
Unit 69 The Whittle Estate, Cambridge Road,
Whetstone, Leicester LE8 6PA
Tel: 0116 275 0123 Fax: 0116 275 0282
Website: www.uiscal.com
Email: sales@uiscal.co.uk

Approved Signatory
J.Bruce

Customer: HORIBA MIRA LIMITED
WATLING STREET
NUNEATON
WARWICKSHIRE
Operator: JKB
Our Ref: 361431

Manufacturer: Not Known
Description: "L" Thermocouple
Model: T-TYPE
Serial No. Q39788
Asset No: Q39788
Order No: 263528
Date Received: 19th December 2016

CONDITION OF UNIT UNDER TEST — **YES/NO**
The Thermocouple was visually inspected prior to calibration — Y

ADDITIONAL COMMENTS

STABILITY
The readings given are the results at the time of calibration and do not carry any implication regarding the long term stability of the unit under test.

ACCREDITATIONS
UIS is accredited by UKAS to BS EN 17025:2005 to undertake the calibration presented in this certificate

ENVIRONMENT
The instrument was calibrated in our laboratory with the ambient conditions stated on the results page

PROCEDURE
UIS procedure CP7.5.3

UNCERTAINTIES
The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, providing a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

TEST EQUIPMENT USED

Asset No.	Description	Certificate No.	Expiry date
ID3155	Hart 1590 Super-Thermometer II	296385	21/MAR/2017
ID3051	Tinsley Std Resistor 25 ohms	UKAS 0391304	09/JUL/2018
ID3032	PRT (25 ohms)	UKAS 47039	14/JUL/2017
ID3239	PRT (25 ohms)	UKAS 47042	14/JUL/2017
ID3240	PRT (25 ohms)	UKAS 47018	12/JUL/2017
ID3245	PRT (25 ohms)	UKAS 47020	12/JUL/2017
ID3276	Fluke 1586-2588 Multiplexer	UKAS 47348	25/[illegible]/2017

Climatic Humidity Probe

31995 (no

CERTIFICATE OF CALIBRATION

Issued by

ABSOLUTE CALIBRATION LIMITED

DATE OF ISSUE 18 August 2017 CERTIFICATE NUMBER 0426395

UKAS CALIBRATION 0078

Page 1 of 2 Pages

Absolute Calibration Limited
14 Murrills Estate, Portchester
Hampshire, England. PO16 9RD
Telephone 023-92321712
Facsimile 023-92210034
Service Facsimile 023-92327100
www.absolute-cal.co.uk

Approved Signatory

M Funnell ☑
S Whittingham ☐
D Kingswell ☐
G Mills ☐
A Francis ☐

Description:	TEMPERATURE/HUMIDITY SENSOR AND ACTIVE ADAPTOR
Manufacturer:	ROTRONIC
Type Number:	HYGROCLIP & MOK-20-XX-010V-2
Serial Number:	60250059
Customer:	HORIBA MIRA LIMITED WATLING STREET NUNEATON WARWICKSHIRE
Instrument Receipt Date:	02 August 2017
Order Number:	271883
Customer Reference:	Q31995
Laboratory Temperature	(20.0 ± 3.0) °C
Laboratory Humidity	(55 ± 20) %rh
Calibration Procedure:	CP 112
Calibration Engineer	S PalaLendi
Calibration Date	18 August 2017
This Report Contains	Recorded results with no adjustments ☑ Pre and post adjustment results ☐ Post repair results ☐ Results recorded at Customer site ☐

CERTIFICATE OF CALIBRATION

Issued by

ABSOLUTE CALIBRATION LIMITED

DATE OF ISSUE 18 August 2017 CERTIFICATE NUMBER 0426394

UKAS CALIBRATION C078

Page 1 of 2 Pages

Absolute Calibration Limited
14 Murrills Estate, Portchester
Hampshire, England. PO16 9RD
Telephone 023-92321712
Facsimile 023-92210084
Service Facsimile 023-92327100
www.absolute-cal.co.uk

Approved Signatory

M Fennell
S Whiffingham
D Kingswell
G Mils
A Francis

Description:	TEMPERATURE/HUMIDITY SENSOR AND ACTIVE ADAPTOR
Manufacturer:	ROTRONIC
Type Number:	HYGROCLIP & MOK-20-XX-010V-2
Serial Number:	60250328
Customer:	HORIBA MIRA LIMITED WATLING STREET NUNEATON WARWICKSHIRE
Instrument Receipt Date:	02 August 2017
Order Number:	271883
Customer Reference:	Q31996
Laboratory Temperature	(20.0 ± 3.0) °C
Laboratory Humidity	(55 ± 20) %rh
Calibration Procedure:	CP 112
Calibration Engineer	S Patabendi
Calibration Date	18 August 2017
This Report Contains	Recorded results with no adjustments ☑ Pre and post adjustment results ☐ Post repair results ☐ Results recorded at Customer site ☐

Q51441 CWO

CERTIFICATE OF CALIBRATION

Issued by

ABSOLUTE CALIBRATION LIMITED

DATE OF ISSUE 19 January 2017 CERTIFICATE NUMBER 0416313

UKAS CALIBRATION 0078

Page 1 of 2 Pages

Absolute Calibration Limited
14 Mumls Estate, Portchester
Hampshire, England. PO16 9RD
Telephone 023-92321712
Facsimile 023-92210034
Service Facsimile 023-92327100
www.absolute-cal.co.uk

Approved Signatory

M Tunnel ☑
S Whittingham ☐
D Kingswell ☐
G Mills ☐
A Francis ☐

Description:	THERMOHYGROMETER PROBE AND ACTIVE ADAPTOR
Manufacturer:	ROTRINIC
Type Number:	HYGROCLIP & MOK-20-XX-010V-2
Serial Number:	55496255
Customer:	HORIBA MIRA LIMITED WATLING STREET NUNEATON WARWICKSHIRE
Instrument Receipt Date:	17 January 2017
Order Number:	264315
Customer Reference:	Q31997
Laboratory Temperature	(20.0 ± 3.0)°C
Laboratory Humidity	(55 ± 20) %rh
Calibration Procedure:	CP 112
Calibration Engineer	S Patabendi
Calibration Date	19 January 2017
This Report Contains	Recorded results with no adjustments ☑ Pre and post adjustment results ☐ Post repair results ☐ Results recorded at Customer site ☐

Q31998 CW Ø

CERTIFICATE OF CALIBRATION

Issued by

ABSOLUTE CALIBRATION LIMITED

DATE OF ISSUE 19 January 2017 CERTIFICATE NUMBER 0416612

UKAS CALIBRATION 0078

Page 1 of 2 Pages

Absolute Calibration Limited
14 Murrills Estate, Portchester
Hampshire, England, PO16 9RD
Telephone 023-92321712
Facsimile 023-92210034
Service Facsimile 023 92327100
www.absolute-cal.co.uk

Approved Signatory

M Funnell ☑
S Whittingham ☐
D Kingswell ☐
G Mills ☐
A Francis ☐

Description:	THERMOHYGROMETER PROBE AND ACTIVE ADAPTOR
Manufacturer:	ROTRONIC
Type Number:	HYGROCLIP & MOK-20-XX-010V-2
Serial Number:	60250104
Customer:	HORIBA MIRA LIMITED WATLING STREET NUNEATON WARWICKSHIRE
Instrument Receipt Date:	17 January 2017
Order Number:	264315
Customer Reference:	Q31998
Laboratory Temperature	(20.0 ± 3.0)°C
Laboratory Humidity	(55 ± 20) %rh
Calibration Procedure:	CP 112
Calibration Engineer	S Patabendi
Calibration Date	19 January 2017
This Report Contains	Recorded results with no adjustments ☑ Pre and post adjustment results ☐ Post repair results ☐ Results recorded at Customer site ☐

FM 8616

32ch Thermocouple Amplifier

CALIBRATION CERTIFICATE

Issued by HORIBA MIRA Ltd

Issue date: 04 Jan 2017 **Cert No :** 30279191216

Page 1 of 5 Pages

Approved Signatory

P. MacLeod

Watling Street, Nuneaton
Warwickshire. CV10 0TU. UK.
Telephone : +44 (0)24 7635 5225
Facsimile : +44 (0)24 7635 8225
http://www.horiba-mira.com

[] Mark Pickering – Head of Instrument Calibration & Repair
[✓] Philip Macleod – Supervisor – Instrument Calibration
[] Dominic Mhandu - Metrologist

Client:	Test Operations FG	**Manufacturer:**	National Instru
Section:	Vehicle Env & Aero, Climatic Chambe	**Model:**	SCXI-1102
Address:	Watling Street	**Description:**	32ch Thermocouple Amplifier
	Nuneaton	**Serial No:**	122578B
	Warwickshire	**Calibration Date:**	04 Jan 2017
	--	**Calibration Procedure:**	QA2656/C/02
Client ID:		**Equipment used:**	Page 5
MIRA ID:	Q30279	**Measurement Results:**	Page 2-5
Date received:	19 Dec 2016	**Measurement Uncertainty:**	Page 2-5
Dallas ID:			

Condition of Instrument: Used, in good condition

Within specification on receipt, at the points measured subject to the measurement uncertainty	Yes
Adjusted during calibration	No
Repaired prior to or during calibration	No
Within specification on completion, at the points measured subject to the measurement uncertainty	Yes

The reported values are the result of measurements taken at the time of calibration within the environment stated and do not carry any implication regarding the long term stability or environmental performance of the instrument. All measurements detailed within this Calibration Certificate relate only to the instrument detailed above on the dates specified.

The instrument was allowed to acclimatise in an environment of 20°C ± 2°C and 50%RH ± 25%RH, for a minimum of 12 hours before commencing the calibration. The electrical supply within the laboratory is 240 Volts ± 15 Volts and 50 Hz ± 0.5Hz with a total harmonic distortion of less than 3%.

This instrument was calibrated by comparison with electrical measurement reference standards using a MIRA procedure which incorporates limits based on client requirements. These requirements are specified in document MC-15042009A

EG

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

TC0032b Issue 20

Climatic Chamber Controller

CALIBRATION CERTIFICATE

Issued by HORIBA MIRA Ltd

Issue date: 05 Jan 2017 **Cert No :** 34000050117

Approved Signatory

Watling Street, Nuneaton
Warwickshire, CV10 0TU, UK.
Telephone : +44 (0)24 7635 5225
Facsimile : +44 (0)24 7635 8225
http://www.horiba-mira.com

|| Mark Pickering – Head of Instrument Calibration & Repair
|| Philip Macleod – Supervisor – Instrument Calibration
|| Dominic Mbandu – Metrologist

Client:	Test Operations FG	**Manufacturer:**	MIRA
Section:	Vehicle Env & Aero, Climatic Chamber	**Model:**	MI003878
Address:	Watling Street	**Description:**	Climatic Chamber Controller
	Nuneaton	**Serial No:**	I01523
	Warwickshire	**Calibration Date:**	05 Jan 2017
	--	**Calibration Procedure:**	QA5032/C/01
Client ID:	--	**Equipment used:**	Page 3
MIRA ID:	Q34000	**Measurement Results:**	Pages 2 & 3
Date received:	05 Jan 2017	**Measurement Uncertainty:**	Page 3
Dallas ID:			

Condition of Instrument: Used, in good condition

Within specification on receipt, at the points measured subject to the measurement uncertainty	Yes
Adjusted during calibration	No
Repaired prior to or during calibration	No
Within specification on completion, at the points measured subject to the measurement uncertainty	Yes

The reported values are the result of measurements taken at the time of calibration within the environment stated and do not carry any implication regarding the long term stability or environmental performance of the instrument. All measurements detailed within this Calibration Certificate relate only to the instrument detailed above on the dates specified.

This calibration was performed at the client site.

This instrument was calibrated by comparison with Temperature measurement reference standards using a MIRA procedure which incorporates limits based on client requirements as specified in document CW003032015A.

The reported uncertainty is based on a standard uncertainty multiplied by a coverage factor of k=2, providing a level of confidence of approximately 95%.

TC0032b Issue 20

PETEC VERBINDUNGSTECHNIK GMBH

PETEC Verbindungstechnik GmbH
Wüstenbuch 26 · D-96132 Schlüsselfeld
Tel.: +49 95 55-80 99 40 · www.petec.de

WINDSHIELD ADHESIVE „SCHEIBENKLEBER“ Art.-Nr. 83310 + 83400

is an ambient moisture curing one-component polyurethane sealant.
Passes crash test (FMVSS 212) with security dual air bags after 1 hour.

AREAS OF APPLICATIONS :

can be used to bond windshield and side windows of cars with or without a primer. For other applications, refer to our technical service. Using a primer or not depends of the quality of the substrates (refer to Instructions for use).

TECHNICAL DATA :

Appearance	Thixotropic paste
Color	Black
Density at 20°C	1.23 ± 0.02
Application temperature	5 to 35 °C
Skin formation time at 23 °C and 50 % HR	25 to 40 min
Cure time at 23 °C and 50 % HR	> 3.5 mm/24 h
Shore A hardness (internal method IT-20 after ISO 868 - 3 seconds)	60 to 65
Shearing resistance at 5 h at 23 °C and 50 % HR (FORD SAE J 1529)	> 0.9 MPa (> 130 psi)
Shearing resistance at 7 d at 23 °C and 50 % HR (Ford SAE J 1529)	> 3.5 MPa (> 500 psi)
Water and salt spray resistance	Excellent
Specific data	Elongation at break (ISO 37) : > 700 % Modulus at break (ISO 37) : approx 7.5 MPa Tear strength (ISO 34) : approx. 30 N/mm Crash test (standard FMVSS 212) with security dual air bags: resists after 1 hour at 23 °C and 50 % RH

INSTRUCTIONS FOR USE :

Substrate preparation:

The substrates must be clean, even, dry and free of dust.
Carefully respect the evaporation times of the solvents.
When using solvents, extinguish all sources of ignition and carefully follow the safety and handling instructions given by the manufacturer.
In case of windshield replacement, it is not necessary to completely remove the old sealant ; simply trim it off, leaving a 1 to 2 mm thickness.
There is no compatibility problem applying fresh polyurethane sealant to old polyurethane sealant.
Rub down any rusted area. Clean bare areas of the body before applying the PETEC Primer (Art.-Nr. 82410 / 82330 / 82430).
Never clean the old sealant with a solution containing alcohol.

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The windshield has to be treated as follows :

RAW GLASS :

PETEC instructions : Aktivator (Art.-Nr. 82230) / PETEC Primer (Art.-Nr. 82410 / 82330 / 82430) / Windshield sealant (Art.-Nr. 83310 / 83400).

Clean with Aktivator (Art.-Nr. 82230) according to the WOWO (wipe on/wipe off) method with a clean, dry and lint-free cloth (wipe as soon as the solvent is evaporated, i.e. 30 to 60 seconds after application). As the activator is very sensitive to humidity, the bottle must be closed immediately after use. If it is cloudy, do not use it.

For this application, it is possible to use single-use impregnated wipes (kit containing an impregnated wipe and a dry wipe for WOWO).

Let dry between 10 to 60 minutes after application according to temperature.

In case of excessive drying time, repeat a second time.

Then apply a thin and uniform film of Primer (Art.-Nr. 82410 / 82330 / 82430) with an applicator pad (or a 10 ml tube with single-use foam sponge applicator) in order to form a homogeneous film.

Homogenize the product before application.

Shake until agitator ball is moving. Shake another 30 seconds. Close the bottle immediately after use.

Any contact with humidity will make the primer cure. For this reason, the product must be used within 24 hours after opening the bottle.

Let dry between 15 and 60 minutes according to temperature before application of the sealant.

WINDSHIELD WITH CERAMIC FRIT :

PETEC instructions : Cleaning cloth 82111 / Aktivator (Art.-Nr. 82230) / PETEC Primer (Art.-Nr. 82410 / 82330 / 82430) / Windshield sealant (Art.-Nr. 83310 / 83400).

Bonding may be performed with or without primer.

Bonding without PETEC Primer (Art.-Nr. 82410 / 82330 / 82430) must be performed on a windshield with ceramic frit ensuring optimum and uniform opacity to UV and with no silicone residue.

Non compliance with these conditions may cause partial or total loss of adhesion of the sealant on the windshield.

Degrease with Cleaning cloth 82111, abrade with PETEC Multi Cleaner (Art.-Nr. 82100 oder 82200 in order to avoid orange peel effect likely to occur in presence of traces of silicone), degrease a second time with heptane or MEK and respect a drying time of 10 minutes.

Apply Aktivator (Art.-Nr. 82230) according to the method described for raw glass.

Let dry between 10 and 60 minutes before the next step :

- if ceramic frit is sufficiently opaque, application of the sealant ;
- if ceramic frit is not sufficiently opaque, application of PETEC Primer (Art.-Nr. 82410 / 82330 / 82430) with an applicator pad (or a 10 ml tube with single-use foam sponge applicator) followed by a waiting time of 15 to 60 minutes before application of the sealant.
- ENCAPSULATED WINDSHIELD : degrease if needed with Cleaning cloth 82111 or acetone (do not use alcohol) and respect a 10 minutes drying time, then apply PETEC Primer (Art.-Nr. 82410 / 82330 / 82430)
- WINDSHIELD COATED WITH A PRIMER : degrease with Cleaning cloth 82111 or acetone. After about 10 minutes, apply PETEC Primer (Art.-Nr. 82410 / 82330 / 82430)

For other types of substrates, refer to our technical service.

Bonding :

The sealant "Scheibenkleber" can be applied with a hand or pneumatic gun.

The triangle-shaped form of the joint is determined by the nozzle.

If applied in cold weather, store the packagings at about 20 °C before use.

The windshield must be applied and pressed before the end of the skinning time.

Do not apply in the presence of cured or non-cured silicones or hybrid sealants (MS, SPUR or STPE).

Do not apply at temperatures lower than 5 °C.

Note : all times described in the above instructions are valuable for a minimum temperature of 15 °C. In case of lower temperatures (between 5 and 15 °C), drying times must be twice longer.

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Cleaning :
Uncured sealant can be cleaned up with PETEC Multi Cleaner (Art.-Nr. 82100 oder 82200) or acetone.
After curing, abrasion is necessary.

Drive-away time for a car:
60 minutes with air bag

STORAGE AND SHELF LIFE

12 months in closed original packaging stored in dry premises at a temperature lower than 25 °C.
If necessary, gently warm the product before use until it reaches a suitable temperature.
Storage at a temperature over 25 °C will decrease the shelf life of the sealant.

PACKAGING

310 ml aluminium cartridges ;
400 and 600 ml sausages
Contact us for other packaging options.

Provisional technical data sheet

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PRIMER

PETEC Primer (Art.-Nr. 82410 / 82330 / 82430) is an isocyanate and solvent-based primer specially developed to improve the adhesion and maximize the bonding of sealants on low surface energy substrates used in the transportation market and more specifically the glass bonding. This all-in-one primer is also compatible with all PETEC polyurethane and hybrid sealants.

AREAS OF APPLICATIONS:

The surface preparation can be made with the PETEC Primer (Art.-Nr. 82410 / 82330 / 82430) either alone or in combination with the Aktivator (Art.-Nr. 82230) to promote adhesion, improve bond durability and provide optimum protection against UV rays on organic or mineral glass.

PETEC Primer (Art.-Nr. 82410 / 82330 / 82430) is used on glass and silk-screened ceramic frit glass for the bonding of windshield or glass (on cars, trains, buses, trucks and specialty vehicles) as well as on vehicle body frames. It acts as a corrosion inhibitor on metal and can be applied on pinchweld scratches and nicks.

PETEC Primer (Art.-Nr. 82410 / 82330 / 82430) is also recommended in the marine industry (for windshield or porthole bonding) to prime acrylic (PMMA) or polycarbonate windows, fiberglass and polyester.

PETEC Primer (Art.-Nr. 82410 / 82330 / 82430) can also be used as a multipurpose primer on many non-porous substrates used in the transportation market, like aluminium, metals, stainless steel, painted surfaces, ABS, wood and PVC).

For applications other than glass bonding, it is recommended to do preliminary adhesion and compatibility tests - contact our technical service.

TECHNICAL DATA:

Color	Black
Viscosity	DIN cup Ø4 mm, 100 ml: 11 to 14 s
Density at 20°C	0.95 ± 0.05
Application temperature	+5°C bis +35°C
Specific data	Drying time: 10 to 15 min *

* If the temperature is below 20°C, a longer drying time is recommended.

INSTRUCTIONS FOR USE:

Substrates preparation:

The substrates to be treated must be clean, dry, free of dust or grease. Contaminated surfaces must be cleaned beforehand with a solvent-based solution with or without the help of an abrasive like PETEC Multi Cleaner (Art.-Nr. 82100 oder 82200). Let evaporate for 5 minutes before next step.
We preconize to treat the glass with the adhesion promoter AKTIVATOR (Art.-Nr. 82230) see the technical data sheet of the product before applying PETEC Primer (Art.-Nr. 82410 / 82330 / 82430).
Note: when using solvents, extinguish all sources of ignition and carefully follow the safety and handling instructions given by the manufacturer.

Primer application:

To perfectly homogenize the product, shake thoroughly the bottle until agitator ball is moving, then shake additional 30 seconds. Dip a clean felt tip applicator into the bottle, roll it around the edges of the bottle to squeeze out the excess of product.

PETEC Multiaktiv Primer PETEC Primer (Art.-Nr. 82410 / 82330 / 82430) can also be applied with the 10 ml tube with foam applicator. Shake thoroughly the tube for 10 to 15 seconds in order to re-homogenize the product. Exert a uniform and light pressure to get a homogenous and opaque film.

Hermetically seal the container immediately after use as this product is very sensitive to moisture. Any contact with humidity will make the primer cure.

On the glass: after drying (10 to 15 minutes* depending on temperature and moisture conditions) apply the sealant within a one hour deadline, proceeding according to instructions of its technical data sheet. If the deadline is not respected or if the film of primer is contaminated (dust, etc.) lightly sand the primed surface, remove the dust and re-prime with PETEC Primer (Art.-Nr. 82410 / 82330 / 82430).

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On the vehicle: a surface treatment with PETEC Primer (Art.-Nr. 82410 / 82330 / 82430) is recommended on pinch-weld parts scratched during disassembling of the windscreen as well as on areas where traces of rust are visible. After abrasion followed by a cleaning (solvent), apply PETEC Primer (Art.-Nr. 82410 / 82330 / 82430) with a clean felt tip applicator to stop corrosion. Respect a drying time of 10 to 15 minutes*.

* If the temperature is below 20°C, a longer drying time is recommended.

Cleaning:

During the few minutes following the application, it is possible to clean with mineral spirits; beyond that time, it is necessary to use a mixture of methylethylketone and toluene or methylethylketone and xylene.

Limitations:
Do not use if an increase in viscosity or a cured film on surface are observed.
Do not apply on frozen surfaces.
Do not apply PETEC Primer (Art.-Nr. 82410 / 82330 / 82430) to the existing trimmed polyurethane bead (windshield replacement).
Do not reuse the felt tip applicator.
Do not re-dip the felt tip applicator in the bottle (pollution).

CONSUMPTION

Consumption is dependent on the nature of the substrates. Count 80 to 100 ml/m^2 on glass.

STORAGE AND SHELF LIFE

12 months in original and unopened packaging stored between 5 and 25°C.
PETEC Primer (Art.-Nr. 82410 / 82330 / 82430) should be used during the month following the opening of the bottle. This time is reduced if the packaging
remains opened or is not closed properly, and more so if temperature and humidity are high.
PETEC Primer (Art.-Nr. 82410 / 82330 / 82430) in tube is intended for single use only and should be used quickly after opening.

PACKAGING

10 ml tubes
Contact us for other packaging options.

SAFETY

Professional use.
Read the material safety data sheet before use.
Wearing safety glasses and gloves mandatory.

Provisional technical data sheet

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AKTIVATOR

is an organic solvent-based solution specially developed to improve the adhesion of sealants on substrates used in the automotive industry and more specifically the windows bonding.

AREAS OF APPLICATIONS :

AKTIVATOR (Art.-Nr. 82230) is intended for professional use as an adhesion promoter of polyurethane sealants in windshield replacement with or without the use of a black primer.

AKTIVATOR (Art.-Nr. 82230) can also be used on many non-porous substrates (aluminium, metals, painted surfaces, organic and mineral glass of automotive quality).

It is recommended to check the adhesion and the compatibility of the AKTIVATOR (Art.-Nr. 82230) in the terms of use on the site.

For other applications, contact our technical service.

TECHNICAL DATA :

Appearance	Transparent, colorless, extremely fluid liquid
Density at 20°C	0.73 ± 0.02
Application temperature	5 to 35°C
Specific data	Drying time: 10 minutes *

** If the temperature is below 20°C, this time will be increased.*

INSTRUCTIONS FOR USE :

Substrates preparation:

The substrates to be treated must be clean, dry free of dust or grease.

Contaminated surfaces must be cleaned beforehand with a solvent-based solution.

Let evaporate for 5 minutes before applying AKTIVATOR (Art.-Nr. 82230).

Note: when using solvents, extinguish all sources of ignition and carefully follow the safety and handling instructions given by the manufacturer.

Application:

Shake the bottle before use.

Close it immediately after use as this product is very sensitive to moisture.

Do not use if a change of the appearance is observed (presence of particles, cloudy solution, change of color).

AKTIVATOR (Art.-Nr. 82230) can be applied using a felt tip applicator or a lint cloth, in a single pass in order to apply a thin and
uniform layer.

After drying (10 minutes * depending on temperature and moisture conditions), apply sealant within a one hour deadline following the instructions of its technical datasheet.

Do not apply with a brush, roller or by spraying.

** If the temperature is below 20°C, this time will be increased.*

CONSUMPTION :

TECHNISCHES DATENBLATT – PETEC AKTIVATOR

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Consumption is dependent on the nature of the substrates.

STORAGE AND SHELF LIFE :

12 months in the original, hermetically sealed and unopened packaging between 5 and 25°C.
AKTIVATOR (Art.-Nr. 82230) should be used during the month following the opening of the bottle.
This time is reduced if the packaging remains opened or is not closed properly and more so if temperature and humidity are high.

PACKAGING :

30 ml aluminium bottles.
Contact us for other packaging options.

SAFETY :

Professional use.
Read the material safety data sheet before use.
Wearing gloves mandatory.

Provisional technical data sheet