Technical Report

FROM: Shaun Tibbals

DATE: 2nd April 2003

SUBJECT: CTI Test Results of EMP110 Photoimageable Soldermask

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Background
EMP110 Photoimageable soldermask has been tested by Trace Laboratories Incorporated in accordance with IEC112 – Comparative Tracking Index (CTI).
Tests were conducted on laminate types with varying CTI grades. Isola was selected as a generic FR4 grade laminate and Sumitomo as a high grade CTI600 base material. In all cases the laminate CTI values were measured with and without EMP110 soldermask.

Conclusion
It can be concluded from the test results in figure 2 that EMP110 has a CTI value of ***minimum 430*** when tested on standard FR4 base material.
If coated on high grade CTI material (Sumitomo, see figure 3) EMP110 was found to give a CTI value ***equal to that of the laminate – CTI600***.

It is important to note that electrical erosion often takes place on all polymeric soldermask coatings when conducting this test. Therefore, if the soldermask deposit is low it is possible that the material may erode through to the underlying material. If this occurs then the CTI value attained during the test is likely to be equal to the CTI of the base laminate.
It is believed that electrical erosion is one of the reasons why the IEC112 specification for CTI states that the material under test should be 3mm thick. This is obviously not a practical thickness for soldermask application. All Electra test pieces had a cured soldermask thickness of approximately 20 microns.

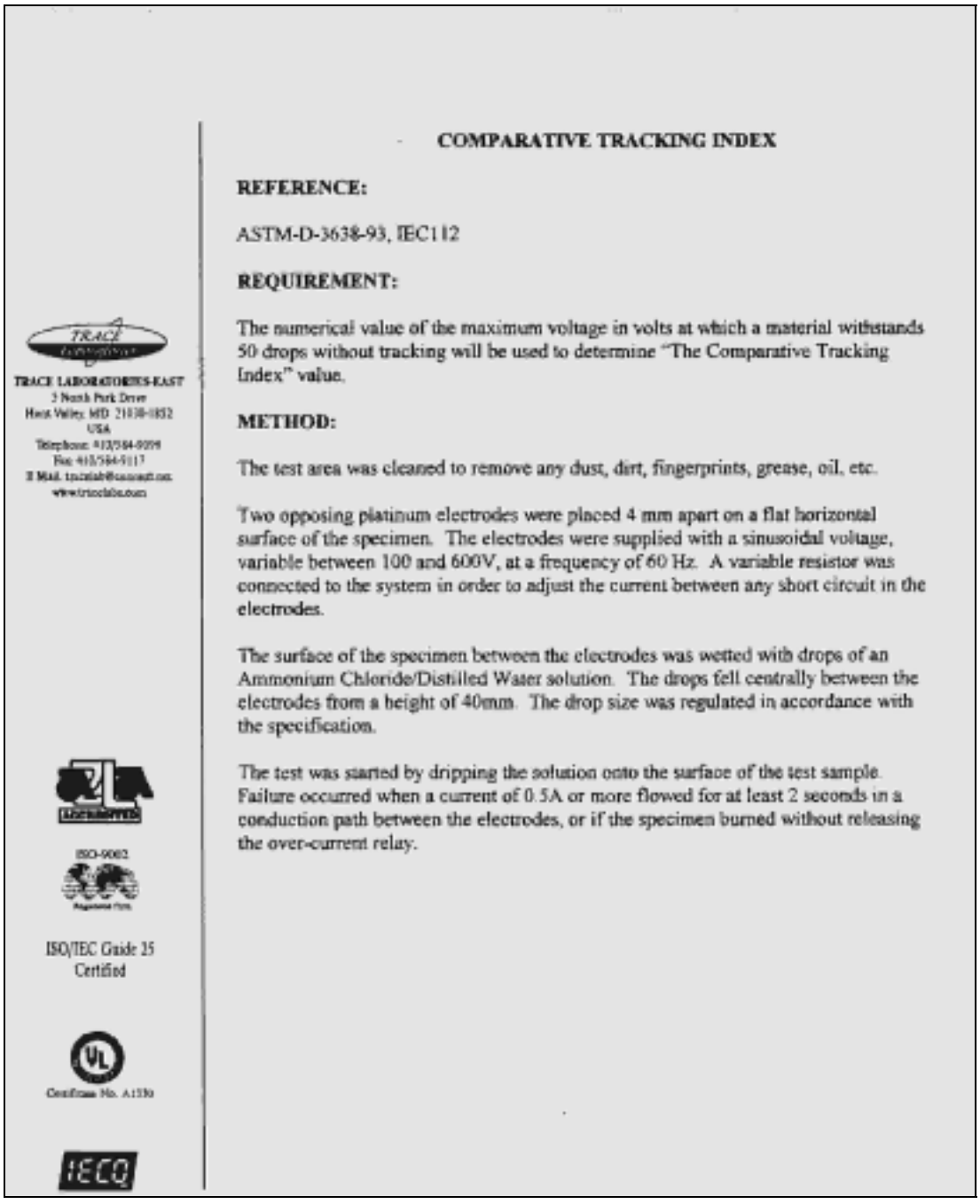
Results

Figures 2 and 3 detail the test results achieved on two types of laminate:

Figure 2: Standard FR4 laminate supplied by Isola with CTI325.
Figure 3: High CTI grade material supplied by Sumitomo with CTI600

Test Method
All tests were conducted in accordance with IEC112. Figure 1 of this document details the test method used by Trace Laboratories.

ELECTRA POLYMERS & CHEMICALS LTD
Roughway Mill, Tonbridge, Kent, TN11 9SG, England. Telephone +44 (0) 1732 811-118 Fax +44 (0) 1732 811-119
www.electrapolymers.com
shaun.tibbals@electrapolymers.com



TRACE LABORATORIES-EAST
3 North Park Drive
Hunt Valley, MD 21030-1852
USA
Telephone: 410/584-9099
Fax: 410/584-9117
E Mail: tracelab@aol.com
www.tracelabs.com

ISO-9002

ISO/IEC Guide 25
Certified

Certificate No. A1330

IECQ

COMPARATIVE TRACKING INDEX

REFERENCE:

ASTM-D-3638-93, IEC112

REQUIREMENT:

The numerical value of the maximum voltage in volts at which a material withstands 50 drops without tracking will be used to determine "The Comparative Tracking Index" value.

METHOD:

The test area was cleaned to remove any dust, dirt, fingerprints, grease, oil, etc.

Two opposing platinum electrodes were placed 4 mm apart on a flat horizontal surface of the specimen. The electrodes were supplied with a sinusoidal voltage, variable between 100 and 600V, at a frequency of 60 Hz. A variable resistor was connected to the system in order to adjust the current between any short circuit in the electrodes.

The surface of the specimen between the electrodes was wetted with drops of an Ammonium Chloride/Distilled Water solution. The drops fell centrally between the electrodes from a height of 40mm. The drop size was regulated in accordance with the specification.

The test was started by dripping the solution onto the surface of the test sample. Failure occurred when a current of 0.5A or more flowed for at least 2 seconds in a conduction path between the electrodes, or if the specimen burned without releasing the over-current relay.

Figure 1 - IEC112 Test Method Used by Trace Laboratories Inc.

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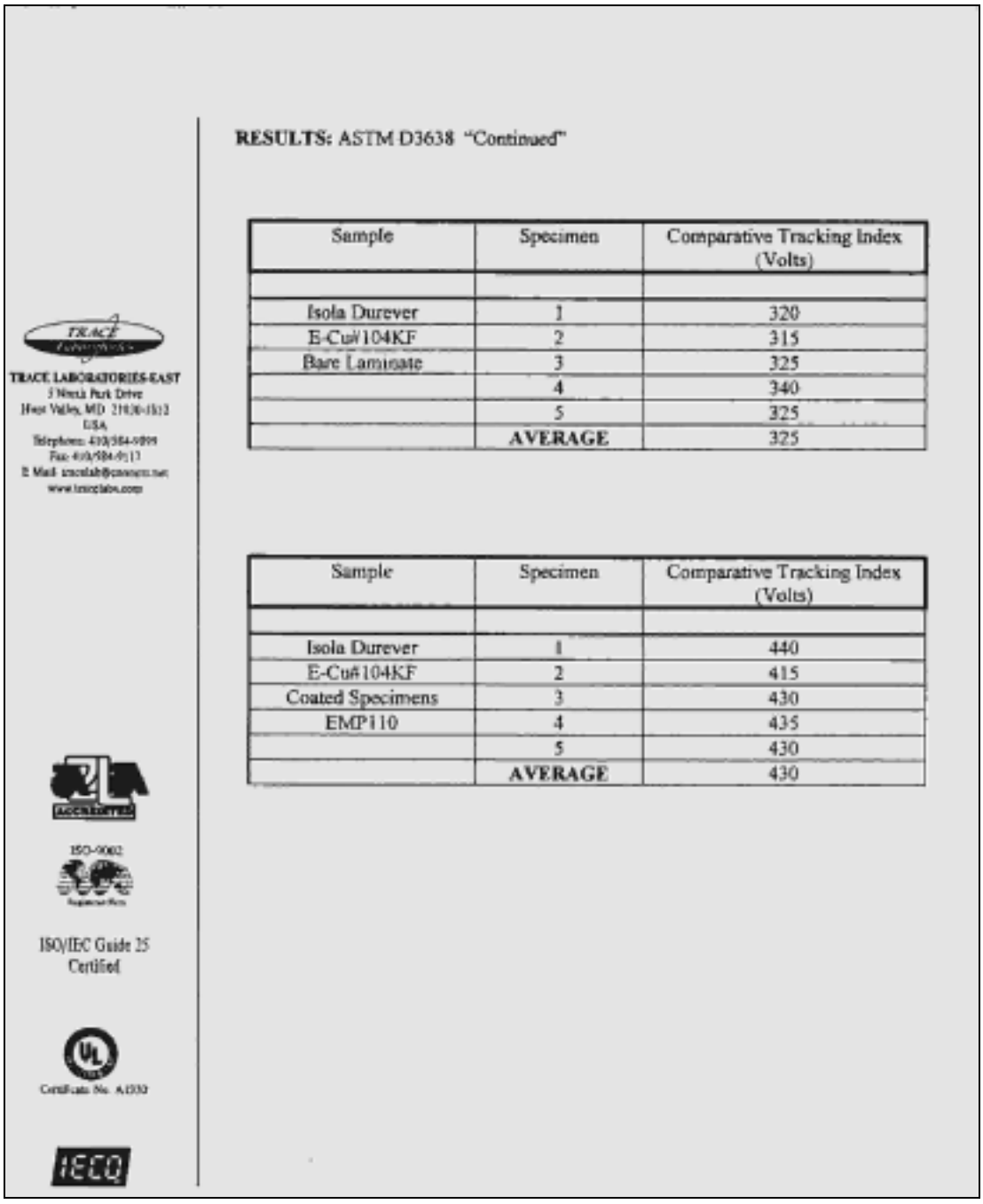
shaun.tibbals@electrapolymers.com



TRACE LABORATORIES-EAST
3 Nitrol Park Drive
[illegible]
USA
[illegible]

ISO/IEC Guide 25
Certified

Certificate No. [illegible]

RESULTS: ASTM D3638 "Continued"

Sample	Specimen	Comparative Tracking Index (Volts)
Isola Durever	1	320
E-Cu#104KF	2	315
Bare Laminate	3	325
	4	340
	5	325
	AVERAGE	325

Sample	Specimen	Comparative Tracking Index (Volts)
Isola Durever	1	440
E-Cu#104KF	2	415
Coated Specimens	3	430
EMP110	4	435
	5	430
	AVERAGE	430

Figure 2 – IEC112 Test Results on Isola FR4 Type Laminate

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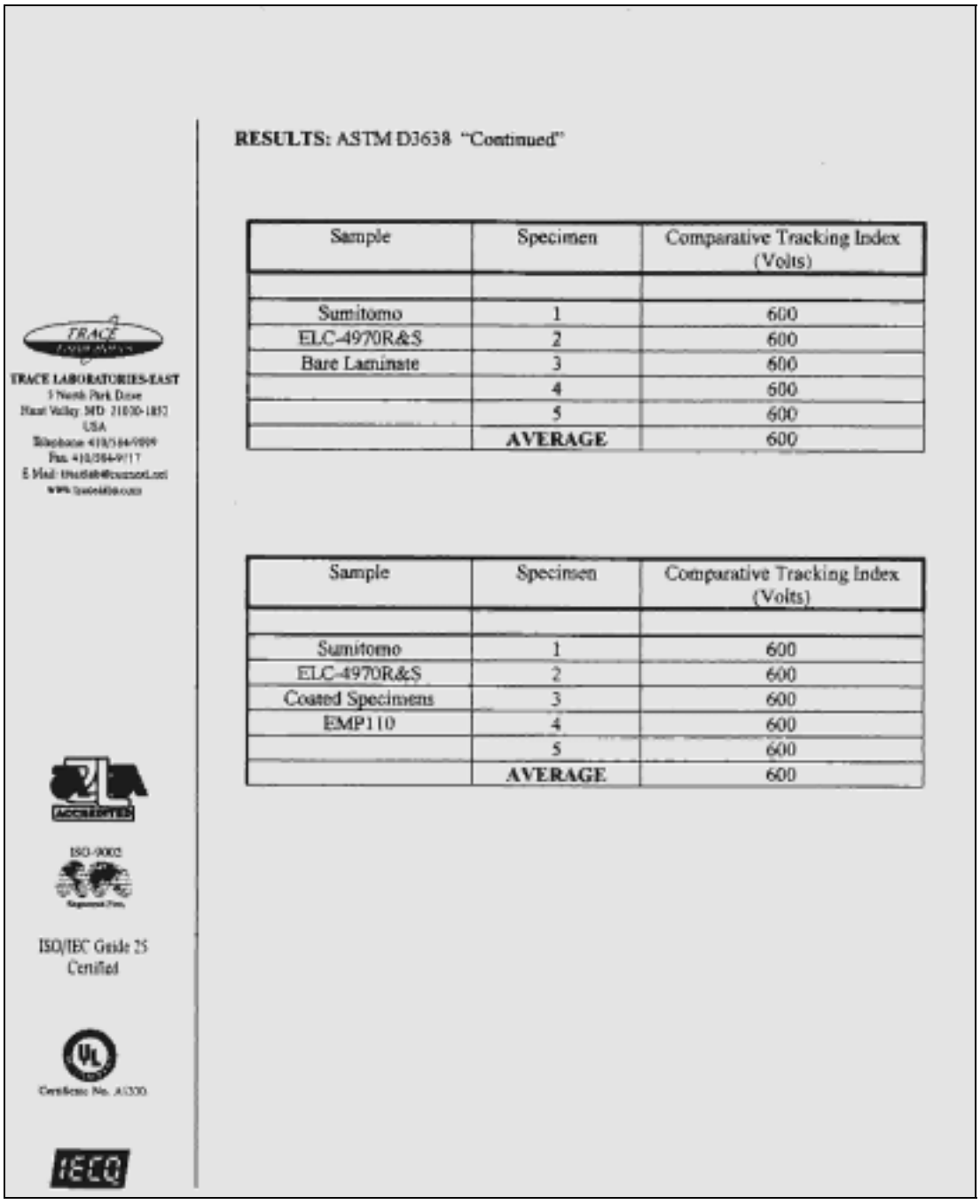
shaun.tibbals@electrapolymers.com



RESULTS: ASTM D3638 "Continued"

Sample	Specimen	Comparative Tracking Index (Volts)
Sumitomo	1	600
ELC-4970R&S	2	600
Bare Laminate	3	600
	4	600
	5	600
	AVERAGE	600

Sample	Specimen	Comparative Tracking Index (Volts)
Sumitomo	1	600
ELC-4970R&S	2	600
Coated Specimens	3	600
EMP110	4	600
	5	600
	AVERAGE	600

Figure 3 - IEC112 Test Results on Sumitomo CTI600 Laminate

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