MATERIAL TEST REPORT

STATIC DECAY, SURFACE RESISTANCE AND SURFACE RESISTIVITY TESTING OF I.C. WORKSTATION CLEANER

R&R LOTION, INC.

FEBRUARY 5, 2007

MATERIAL EVALUATION REPORT
Static Decay and Surface Resistance/Resistivity Testing of I.C. Workstation Cleaner
R&R Lotion, Inc.
February 5, 2007

GENERAL

Characterization tests were performed by ETS Testing Laboratories on I.C. Workstation Cleaner samples submitted by R&R Lotion. Static decay and surface resistivity indication testing was performed on four different surfaces to evaluate the impact of the workstation cleaner on the samples being cleaned.

TEST CONDITIONS

The samples were tested at ambient laboratory conditions on February 5, 2007 at a relative humidity of 14% and a temperature of 76°F.

TEST APPARATUS

STATIC DECAY

An ETS Model 406 Static Decay Meter is used to perform static decay measurements. An ETS STM-1 System Test Module is used to verify the calibration of the Static Decay Meter.

SURFACE RESISTIVITY/SURFACE RESISTANCE

Surface resistivity and surface resistance measurements of planer material are performed using a Dr. Thiedig Milli-TO-2 Wide Range Resistance Meter in conjunction with an ETS Model 803B Surface/Volume Resistivity Probe. An ETS Model 809B Calibration Check Fixture is used to verify the calibration of the resistance test set-up.

TEST METHODS

The following test methods and specifications were used in the evaluation of the test material:

STATIC DECAY

CALIBRATION CHECK

Prior to a static decay evaluation, a performance system check is made on the 406 using the ETS Model STM-1 System Test Module. The STM-1 is placed in the Faraday Test Cage in lieu of a test specimen. It produces a known decay time when plus and minus 5kV is applied. This test checks both the accuracy of the decay time measurement and the balance in decay times between positive and negative charging voltage polarities.

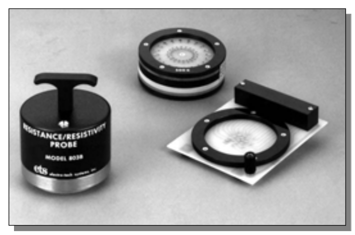
INITIAL CHARGE AND ACCEPTED CHARGE

Material that is static dissipative or conductive will have no measurable static charge on the surface and will be able to conduct the 5kV charging voltage across the surface when applied. A sample that has a measurable initial charge prior to applying the charging voltage indicates that the sample is either insulative or contains both dissipative and insulative characteristics on the surface. The magnitude of the initial charge is listed in the *IC Volts* column of the data sheet. Generally, a material that has both an initial charge and accepts the applied 5kV will not have a measurable decay time if the cutoff selected is below the level of the initial charge.

Material with an initial charge, a very long or no charge/decay characteristics can be evaluated by noting the amount of charge conducted across the surface of the test material after applying 5kV for one (1) minute. The more charge accepted after one minute, the more dissipative the material. This value is listed in the *AC Volts* column of the data sheet. No readings would be recorded under *Decay Time*.

SURFACE RESISTIVITY/SURFACE RESISTANCE

Surface resistivity per ASTM-D 257 has generally been the property used to describe the conductive, dissipative or insulative range of static control material. The ETS Series 800 probes conform to the concentric ring design specified. The ratio between the inner and outer electrodes results in a surface resistivity equal to 10X the measured resistance. It should be noted that surface resistivity is expressed in ohms per square, without regard to the size of the square.



Surface resistance per ESD S11.11 is used to evaluate static dissipative material. This resistance is equal to the actual resistance measured with the Model 803B Probe. A test voltage of 10 volts is specified for resistances between 10^4 and 10^6 ohms. A test voltage of 100 volts is required for resistances between 10^6 and 10^{11} ohms. Surface resistance is expressed in ohms. Resistance measurements below or above these values may require different test voltages. Conductive materials (those materials with surface resistances below 10^4 ohms) are measured using either a current source (cs) or voltages equal to or less than 10 volts.

<u>TEST PROCEDURE</u>

The technician prepared two identical sets of samples. These included an insulative film, static dissipative acrylic, a conductive tablemat and computer display screen. One sample from each pair was thoroughly sprayed with the workstation cleaner and then immediately cleaned with a general purpose low lint wipe. The other samples was not cleaned in any manner. The samples were then tested side by side and the measurements recorded. Due to the nature of the test, static decay testing could not be performed on the computer screen. The results are as follows:

STATIC DECAY

The samples were charged to ±5kV and the time to dissipate 90% of the charge (10% cutoff) when grounded was measured.

Material	**MIN**	**MAX** (Time in Seconds)
Dissipative Acrylic		
Control Sample	Less than 0.01	0.01
Workstation Cleaner Sample	0.01	0.02
Insulative Film		
Control Sample	No measurement as expected due to the insulative nature of the film.	
Workstation Cleaner Sample	No measurement as expected due to the insulative nature of the film.	
Workstation Mat		
Control Sample	0.01	0.01
Workstation Cleaner Sample	0.01	0.01

As expected, the dissipative acrylic and mat samples exhibited no initial charge and were able to accept and decay the applied voltage. An initial charge was observed on the insulative film with no external voltage applied.

SURFACE RESISTIVITY

GROUP	**MEASUREMENNT** (Ohms/Square)
Dissipative Acrylic	
Control Sample	1.09×10^{8} Ω/sq.
Workstation Cleaner Sample	2.97×10^{8} Ω/sq.
Insulative Film	
Control Sample	1.00×10^{15} Ω/sq.
Workstation Cleaner Sample	3.94×10^{14} Ω/sq.
Workstation Mat	
Control Sample	7.50×10^{8} Ω/sq.
Workstation Cleaner Sample	1.67×10^{6} Ω/sq.
Computer Monitor Screen	
Control Sample	7.50×10^{5} Ω/sq.
Workstation Cleaner Sample	4.80×10^{5} Ω/sq.

Testing was performed using test voltages of 10, 100 and 500 volts.

SURFACE RESISTANCE

GROUP	MEASUREMENT (Ohms)
Dissipative Acrylic	
Control Sample	1.09×10^{7} Ω/sq.
Workstation Cleaner Sample	2.97×10^{7} Ω/sq.
Insulative Film	
Control Sample	1.00×10^{14} Ω/sq.
Workstation Cleaner Sample	3.94×10^{13} Ω/sq.
Workstation Mat	
Control Sample	7.50×10^{7} Ω/sq.
Workstation Cleaner Sample	1.67×10^{5} Ω/sq.
Computer Monitor Screen	
Control Sample	7.50×10^{4} Ω/sq.
Workstation Cleaner Sample	4.80×10^{4} Ω/sq.

Testing was performed using test voltages of 10, 100 and 500 volts.

CONCLUSIONS

The purpose of this indication testing was to evaluate the impact of the I.C Workstation Cleaner on the samples being cleaned. Static Decay testing shows no difference between the control samples and the cleaned samples. Surface resistance and surface resistivity testing showed that the measurements correlated for all samples except the static dissipative workstation mat. The control mat sample was approximately two decades higher than the cleaned sample. This was most likely due to the cleaner removing dirt from the surface of the specimen or an inherent difference between the two samples. It should be noted that both readings were well within the dissipative range.

In conclusion, testing indicates that the I.C. Workstation Cleaner did not degrade the performance of any of the materials that were cleaned and should be acceptable for use in ESD Safe applications without fear of altering the characteristics of the material being cleaned.