Volume 1, Issue 1

January 2006

electrostatic solutions

INSIDE THIS ISSUE:

It's a first....

Well OK, so it may not be the first newsletter in the world—but it's our first newsletter….We hope you enjoy it.

We are planning to bring out newsletters about 3 times per year, bringing you a mixture of technical articles, news and events, standards news, and of course details of our new products, services and activities—and anything else we can think of that could be of interest.

Every issue will have a feature article, dealing with some aspect of electrostatics or ESD issues that should be helpful to our clients. If you have an idea for an article, email me and suggest it.

In the meantime, we're

wishing you a happy New Year celebration and prosperous 2006!

Dr Jeremy Smallwood

jeremys@electrostatics.net

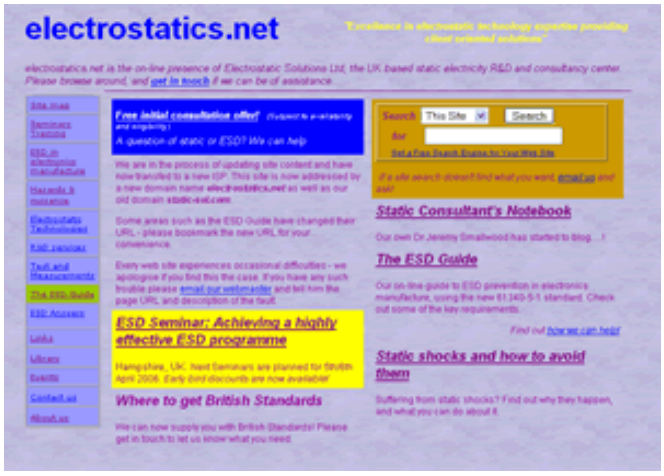
Introducing electrostatics.net

Introducing our new domain name for our on-line presence—

electrostatics.net

The update forms part of our commitment to using the web as an important and convenient means of providing top quality information and services to our clients. It forms part on our on-going development programme on our web site which will update and bring a new look, new information and features to the site.

Our old domain name and email addresses will remain working for the foreseeable



future, with the domain name pointing to the same web pages, so your existing bookmarks will continue to work.

Car park shocks caused by floor materials

Over the last few years we have investigated several cases where car drivers suffered static shocks when halted at entry or exit barriers, while leaning to operate ticket machines on entering or leaving the car park. Typically the problem is dependent on the weather, with wet weather normally alleviating the problem.

In most cases a site survey with measurements confirms the cause to be due to particular floor materials or conditions. Often the problem starts when the floor is given a coating such as epoxy as part of refurbishment.

Cars rolling on a surface will naturally generate static electricity at a rate increasing with their speed. Cars are normally grounded effectively through their tyres, which are slightly conductive due to their carbon content. Providing the ground surface is sufficiently conductive charge is dissipated within seconds after the car is stopped. Some modern surfaces, however, are highly insulating and do not allow the charge on the car to dissipate—the car can remain at high voltage for some time. When the driver leans to the ticket machine the entire charge held on the car can discharge through the driver's arm. The stored energy and shock can be quite severe. The problem can usually be prevented by using an earthed conductive floor before the barrier, allowing the car to be earthed and the charge to dissipate as it approaches .

Drivers at this car park experienced shocks mainly during sunny weather

Here comes the shocking season

December to March—the winter months. Cold and dreary outside—and ideal for causing increased static electricity problems inside.

We get a larger number of enquiries about shocks in offices and workplaces at this time of year than at other times. Facilities and processes which may have worked trouble free since April suddenly can suffer from static problems. Why should this be?

The answer lies in relative humidity (r.h.) — the amount of moisture held in the air, compared to the amount it could hold at that temperature. Moisture conducts electricity, and if r.h. is above about 30% the moisture layer on material surfaces helps static charges to dissipate.

If you take air and heat it, the r.h. nearly halves for every 10 °C rise in temperature. Take air near 0°C and 60%r.h. and heat it to 20°C for your workplace, and the r.h. can drop as low as 15%. Not good if you suffer from shocks, but great for doing static electricity demonstrations!

Car fuelling fire caught on CCTV

Last December in the USA a car fuelling fire, thought to be caused by static electricity, was filmed by the garage CCTV. The video can be seen on the internet—fortunately the victim appears to have been unharmed.

In some parts of the USA the driver is able to latch the fuelling dispenser and leave the tank filling. The victim stopped to fuel her car and, after setting the nozzle in the tank and fuel flowing, returned to the driver's seat. A few moments later she is seen to get out of the car and return to the dispenser. At the moment she touched the nozzle a flame appeared from the tank opening. Fortunately the flames went out as she removed the nozzle from the tank. This type of incident is much less likely where latching fuel dispensers are not used.

See the video: http://www.pei.org/static/static.avi (Real Player is required)

Petroleum Equipment Institute safe refuelling pages:
http://www.pei.org/static/index.htm

Case study

"The winter months—cold and dreary—and ideal for causing static problems inside"

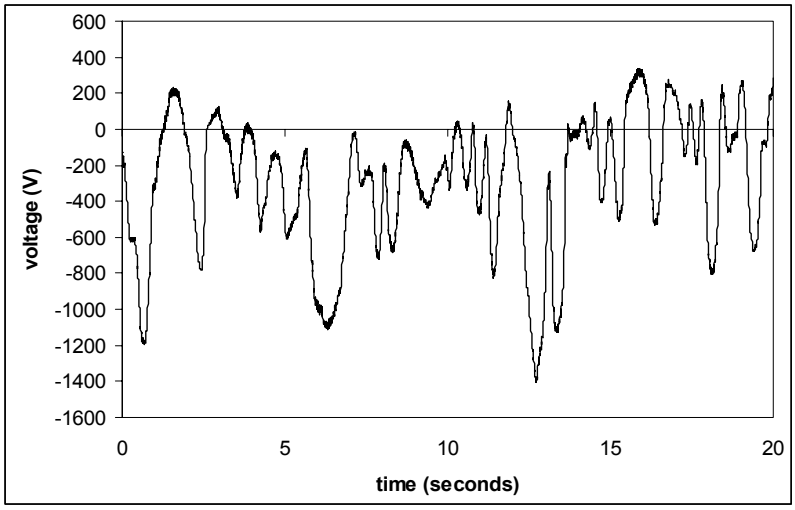
Grounding people in manual assembly: Possibly the best ESD investment you can make!

When ESD emerged as an issue in the late 1970's one early experiment looked at failure rates in a bipolar transistor during manual assembly. Two batches of identical boards were handled separately - one assembly batch used no ESD measures, for the other batch operators were grounded via wrist straps. The final test failures were 2.7 times greater for the unprotected batch, 6.2% against 2.3% for the protected batch!

The real cost of these ESD failures, of course, is not only the component cost - it is in the wasted production time and rework time, possible delays to achieving the required output, and so on. At worst, if a component sustains latent damage it can pass final test and fail in operation in the field. Costs then escalate dramatically and can include service engineer's time as well as replacement costs, customer service costs, irate customers and possible lost future reputation and sales. In some cases lives may be put at risk.

So why is personnel grounding so important? Any two materials in contact generate static electricity. People move around a lot and so generate large amounts of static electricity. This is due to contact between the materials of people's footwear and clothing with the flooring and furniture in their workplace. In an uncontrolled environment, a person's body may rise to several thousand volts without them noticing – it requires less than 100 Volts to damage some electronic components.

In manual assembly, ungrounded charged people are the biggest ESD risk. In one study, 66% of the final test failures were due to non-grounded people. This is the reason that the primary measure of ESD sensitivity of a component is the "Human Body Model" ESD sensitivity test. A "100 V ESD sensitive" device is likely to be damaged by ESD from a person charged to over 100 V. In ESD terms 100 V is very little - as you read this you may have varying static voltages of up to 1000 V on your body, and not be aware of it. As technology has advanced, many components have become smaller and more ESD sensitive.



Voltages measured on the author's body as he moved around his office. 15th February 2005, atmosphere 19.7 °C, 37% r.h.

Generation of static electricity cannot be avoided - but it can be made to flow away harmlessly rather than build up to high voltages. This can be done by grounding the people handling ESD sensitive devices either by using wrist straps, or conductive footwear and floors, to provide an electrical path for the charge to flow to earth.

Experiments have shown that the maximum voltage on a person's body is dependent on the resistance between their body and ground. The EN 61340-5-1 ESD standard aims to limit body voltage to 100 V, and so recommends a maximum resistance of 35 MΩ from a person's body to ground. Standard wrist straps give a resistance to ground around 1MΩ, and are well within this limit, and above a 750 kΩ limit recommended for electrical safety.

If personnel are sitting while working, then using wrist straps is probably the only way to ensure that grounding is reliably achieved—and are required by 61340-5-1. If they are standing while handling sensitive devices, then wrist straps may not be convenient. Using ESD footwear, with a conductive floor, may become an attractive way of grounding personnel. The same resistance-to-ground range of 750 kΩ to 35 MΩ applies. (Higher values may be ac-

(Continued on page 4)

The Inside Story

"In an uncontrolled environment, a person's body may rise to several thousand volts without them noticing – it requires less than 100 Volts to damage some electronic components."

(Continued from page 3)

ceptable for footwear-flooring in the ESD Protected Area (EPA) if sensitive product is not being handled while standing).

Grounding operators in an EPA via wrist straps and ESD footwear /flooring is an essential and highly effective part of the ESD program. These measures can be highly cost effective, and when correctly used can provide dramatic savings on product damage, giving an excellent financial return on the modest investment required. Getting the best from this investment does, however, require a little care with their use.

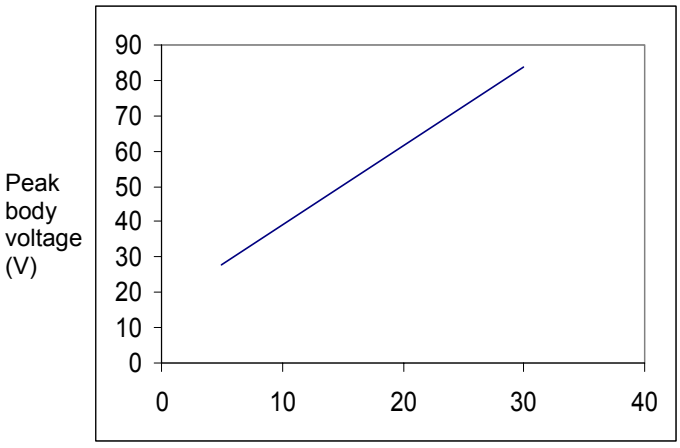
- Check the wrist straps and footwear every shift before use. Continuous monitoring of wrist straps is an alternative. The primary concern here is to make sure it is working - not to create a QA headache! Nevertheless logging the test results for each operator can be an effective way of making sure it really does happen. A defective wrist strap is worse than no wrist strap - it gives a false sense of security while allowing random ESD damage to product to continue. In a recent survey of a site where equipment checks were not regularly made, we found over 50% of personnel were not grounded due to wrist strap or earth bonding point failures.
- Make sure operators are using their wrist straps! The strap must make good close contact with their wrist, and not be loose, or fastened over their coat sleeve, as has occasionally been seen!
- Make sure the earth bonding point, used for wrist strap grounding, is actually earthed. Check this at least monthly at intervals on a sample basis - sampling different places each time!
- If you are using foot strap grounding, wear foot straps on both feet. If only one foot strap is worn, then the person is only grounded when that foot strap is on the floor. The rest of the time static voltages can build up virtually instantaneously.
- Don't rely on footwear & flooring for grounding people when they are seated - they may take their feet off the floor! Always use a wrist strap for seated operations.
- Check all personnel grounding equipment daily - they are too important to be allowed to lapse. Every operator should be aware that checking their personal grounding has a priority.
- Make sure all operators have had adequate ESD training on the equipment and procedures—before they start work in the EPA! Regular refresher training helps them maintain their ESD awareness and enhance knowledge.

A structured regular audit program is also required by 61340-5-1, and is essential for checking that the equipment and procedures are working effectively.

To sum up, effective grounding of personnel who are handling ESD sensitive devices in production is probably the most effective investment in ESD prevention that you can make.

Poor discipline, incorrect equipment usage, and unchecked defective equipment, can render this investment a waste of money. An operator who has a high level of ESD awareness and vigilance is the first line defence against ESD damage, and an extremely valuable asset. The fate of your product and its future reliability is - quite literally - in their hands!

Tip—check wrist and foot straps every day before use. Check wrist strap bonding points monthly, or more frequently.



Peak body voltage typically increases with increasing resistance from body to ground

The Inside Story

"Effective grounding of personnel is probably the best investment that you can make in ESD prevention . Poor discipline, incorrect usage and unchecked defective equipment can render this a waste of money"

EN 61340-5-1? ESD S20:20? MIL-STD-1686?What's it all about?

If you are new to ESD in electronics manufacturing you may be confused by the variety of different ESD standards that you may come across.

In Europe, the major ESD standard for electronic manufacturing is the *EN61340-5-1 Protection of electronic devices from electrostatic phenomena—General Requirements.* This has an excellent *User Guide* EN 61340-5-2, and if you're working with this standard we can highly recommend you get both. Both these documents are derived from IEC work, although the IEC documents do not have standard status at present. When the next version of IEC 61340-5-1 is published within the next few years, it is expected to be as a world-wide standard for the electronics industry. EN61340-5-1 superceded EN100015 in Europe, although references to 100015 are still common.

The North American ESD S20:20 *ESD Association standard for the development of an electrostatic discharge program for protection of electrical and electronic parts, assemblies and equipment (excluding electrically initiated explosive devices)* serves the same function as 61340-5-1, although it is not equivalent. 20:20 also has a user guide in the *Electrostatic Discharge Control Handbook*, also an excellent work guide to ESD control practices. The ESDA standards are mainly used in North America but also spreading to Europe and the Far East in the global electronics markets.

MIL-STD 1686 was an earlier US Military ESD standard which has according to our information been largely superceded by ESD S20:20. The associated handbook MIL-HDBK-256 makes very interesting reading and has a wealth of information.

CLC/TR50404:2003 —Code of practice for avoidance of hazards due to static electricity

If you have an industrial process where flammable atmospheres are present, or shocks to personnel could be a problem, then the CLC/TR50404 is probably for you. This Technical Report , published in 2003, covers processes and industrial situations that commonly give problems of static electricity including handling of solids, liquids, powders, gases, sprays and explosive devices. In each case the source of hazard is identified and specific recommendations are given for dealing with the problem.

The TR50404 was extensively based on the earlier R044-001:1999 which itself drew heavily on BS5958 Pt1 and Pt 2 documents, which have now been superceded (although these may still be obtained). The BS5958 material was updated and strengthened by a European CENELEC TC31 team taking into account recent improvements in understanding in the field. We recommend this as an essential reference for anyone undertaking process risk avoidance in flammable atmosphere areas under ATEX.

To get your copy of CLC/TR50404: 2003, email us:

standards@electrostatics.net

Where to get Standards

EN61340-5-1 and other British Standards and European Norms	Phone or email us for prices and availability: standards@electrostatics.net +44 23 98090 5600
ESDA Association Standards	Contact the ESD Association http://www.esda.org
ESD S20:20-1999	These are available on our on-line "Links" page
MIL-STD-1686 and MIL-HDBK-256	http://www.electrostatics.net/library/Links.htm
IEC standards	These may be ordered on-line from the IEC web site http://www.iec.ch

Standards

We can now supply your British Standards and European Norms—call us for prices and availability.

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"Excellence in electrostatic technology expertise providing client oriented solutions"

Electrostatic Solutions Ltd

Electrostatic Solutions Ltd was founded in 1998 to provide top quality electrostatics expertise in R&D and consultancy services. Our main activities are:

- ESD in electronics manufacture
- Seminars and education
- Electrostatic nuisance shocks and hazards avoidance
- Electrostatic applications and new technology development
- Specialist electrostatic R&D support to other organisations
- Electrostatic test and measurements

We are active in British and international standards development and promoting best practice and electrostatic safety in industry.

If you'd like to talk about an electrostatics or ESD issue, phone or email Dr Jeremy Smallwood: jeremys@electrostatics.net +44 23 8090 5600

Achieving a highly effective ESD Program—two day seminar for ESD Coordinators—5th & 6th April 2006

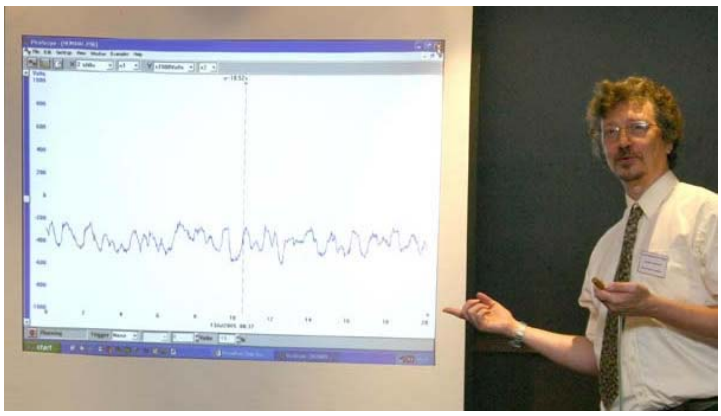
Our two day ESD Coordinator Seminar is now a regular event, attracting delegates from all over Europe.

This course is suitable for engineers and ESD professionals who need to have a good understanding of how to implement an ESD Program in electronics manufacture, including ESD Coordinators, Production engineers, Quality engineers, and anyone who needs to understand how to set up and operate a highly effective ESD program for electronics manufacture.

Delegates gain deeper understanding and awareness of static electricity and its action in the electronics manufacturing environment, and the principles of an effective ESD prevention program.

The seminar covers

- The seven habits of a highly effective ESD program
- How to achieve and assess compliance with an ESD Program
- How to make ESD measurements
- Implementing a checks, test and audit program



Dr Smallwood demonstrates live the voltage developed on a person's body while they walk

On Day 1, Dr Jeremy Smallwood's presentations and practical demonstrations use electrostatic instruments to show the reality of static and ESD. Even experienced ESD practitioners are often surprised and gain better insight from these demonstrations. The key principles of ESD prevention are concisely and clearly expressed as "the seven habits of a highly effective ESD program".

Day 2 focuses on aspects of assessment, checks and audit of the ESD program and ESD measurements required by 61340-5-1.

Delegates use checklists to assess ESD program compliance, and try a selection of the most frequently used test methods "hands on".

Pay before 3rd. Feb 2006 and get an "earlybird" discount!

Email: seminars@electrostatics.net

http://www.static-sol.com/seminars/Seminar101.htm

Register and pay before 3rd. Feb. 2006 and get an "earlybird" discount!

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