Volume 13, No 3

PRODUCT SAFETY ENGINEERING NEWSLETTER

What's Inside

Editor's Message

Dear Readers,

I hope you all had a great summer vacation! I met other Board members in San Jose and we experienced a wonderful meeting time. I believed with our excellent teamwork, we will bring you more inspiring as well as interesting information in the coming issues! For other networking opportunity, you do not want to miss the 2nd 2017 ISPCE-TW at the end of this year. Check us on the website: http://soc.aet.ntnu.edu.tw/ieeeispcetw/index.php

This issue presents a new topic, a book review by Elya Joffe, the Past President of both IEEE EMC Society and IEEE PSES. The author is Mark I. Montrose and as a pleasant introduction, this book simplifies both theory and application of applied EMC engineering. As well, the regular updates on our Chapters, the Technical Activity Committees, the Senior Member were included. For the technical papers, an exploration of Machine Safeguarding Requirements is presented and Peter E Perkins continued to bring us his second part of TOUCH CURRENT measurement, thanks to his assiduous work!

It is always welcomed to any kinds of participation to the Newsletter. Above all, the contributions of articles with exciting issues are encouraged. We need your co-operation to improve the quality and the value of the Newsletter. Before that, welcome to join our symposium in Taiwan in various ways, such as paper submission, giving the talks or just being an attendee. I look forward to meeting you all in Taiwan in December!

Please feel free to communicate with me at any time.

Wen-Chung Kao
jungkao@ntnu.edu.tw

Newsletter Committee

The Product Safety Engineering Newsletter is published quarterly during the last month of each calendar quarter. Closing dates for articles, news items, and advertising:

1Q issue: February 15
2Q issue: May 15
3Q issue: August 15
4Q issue: November 15

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President's Message

Hi,

There is so much happening with the Society, I'm excited and proud to report to you that your Board is very hard at work.

First - Wow, what a conference in San Jose!! ISPCE 2017 was a huge success in so many ways. Congratulations and thank you to the Conference Committee. If you missed it, we hope to see you in Boston, Taiwan and/or back in San Jose in May 2018. See Stefan's column for details on upcoming conferences.

My attendance at the IEEE's Technical Activity Board (TAB) meeting series proved to be successful and enlightening. Successful in that we met several new leaders of Societies and Councils that want to collaborate on various levels. The Council on Electronic Design Automation (CEDA) is an example. Once I explained PSES, our vision and how Compliance 101 can help their members, has asked us to present Compliance 101 at their upcoming meeting, and also to provide an article on Compliance 101 in their Design and Test publication.

I also requested and hope to be a part of the Industry Advisory Board Ad Hoc Committeet. IEEE is losing membership. Much of what I hear is because the value is not there. It's there for Professors, and academia, but what's the value for Practitioners/Industry folks?? Of course we have huge value for Practitioners. I hope to be a part of this and help re-shape IEEE. Ultimately, that will help PSES.

Furthering our collaboration with the EMC Society, we recently signed an MOU. Grant Schmidbauer is our Representative and will take the lead in expanding our efforts together.

All the Presidents of Division VI had dinner at TAB one evening and discussed various ways of collaborating. To begin we're having a joint booth at Sections Congress in August, 2017. Look for more cooperation and events coming with other Division VI Societies.

We also recently submitted a proposal to present Compliance 101 at the Applied Power & Electronics Conference & Exposition (APEC). This conference is sponsored by the IEEE's Industrial Application Society, Power Electronics Society and the Power Sources Manufacturers Association. Last year brought over 5000 attendees and would be great exposure for us. We'll learn if the proposal is accepted in September.

Compliance 101 is beginning to catch on and will help increase our exposure, bring more value and grow membership. I continue to be excited about our future and honored to be leading the charge.

Be Safe,

John Allen

Chapter News

By Murlin Marks,
Life Senior IEEE, Past President PSES

2016 Chapter of the Year: Madras, India

As reported in the June PSES Newsletter, Dr. V. Jayaprakasan has led the Madras Chapter to an impressive program. On this basis, our VP of Member Services, Mariel Acosta-Geraldin selected the Madras Chapter as the winner of the 2016 PSES Chapter of the Year.

(photo from Madras Chapter)

The Madras Chapter was honored at the ISPCE2017 Awards Ceremony. The Award (with the Chapter of the Year Banner, and $250) will be formally presented by the Madras Section.

We had several good submittals this year. I'm hoping that all chapters will submit the form (http://ewh.ieee.org/soc/pses/chapters.html) for the 2017 award early next year. I'm here to help every chapter have a great program, so let's work together to make Mariel's selection of the best PSES chapter for 2017 really difficult!

(left to right: Ken Kapur, Azim Karimi, Cherie Forbes, Ken Gross, Murlin Marks, and Elizabeth Perrier – photo by R. Georgerian)

2017 Chapter Annual Meeting at ISPCE2017 in San José, California, Boston, Central Texas, Chicago, Israel, New Jersey, Orange County, Oregon, San Diego, Santa Clara Valley, and Sydney Chapters were represented at the hour-long meeting.

From the round the room intros: Much of the discussion focused on chapters getting resources to build membership. In summary – Some chapters receive funding, some don't. One used to get $3 per member, and was able to build up its bank account. Some chapters don't have bank accounts, some are sponsored by companies. One section treasurer allocates $500 per year for a chapter. Each section is different, based on submitting forms. You also can ask for money when doing something special. Taiwan does not get any money. Australia when having a distinguished speaker can get funding. Harry Jones (Chicago) collects $10 at the door. Countries outside the U.S. are treated differently that in the U.S. IEEE sections get funding out of IEEE dues. Henry Benitez reported that the EMC society has a section coordinator; perhaps our society should consider such a role. Many chapter meeting attendees are not IEEE or PSES members. We should try to identify non-members, including members of other IEEE societies. We can charge non-members for refreshments to encourage people to join.

All chapters are encouraged to build a good relationship with their local IEEE sections, and to determine their options for funding. Most sections will have processes in place and will provide leadership training and other support. Also, in some areas you may find a local agency or other company willing to act as a host or sponsor. My role as chapter coordinator is to help share ideas and best practices. Issues with specific sections can be discussed with the chapter coordinator, who will work with Mariel and the PSES Board of Governors to help. It's best to try to build a program with the help of the section as that is aligned with the IEEE organizational process.

Harry Jones gave a quick overview of chapter practices (see http://ewh.ieee.org/soc/pses/chapters.html)

How can chapter websites be interesting and up to date? One possible starting point is to dovetail with the respective IEEE section. Keep in mind that our activities are of interest to a wide range of IEEE members and groups. Try to make announcements about upcoming meetings early enough for people to plan to attend.

Perhaps – in addition to the technical information – the best benefit of having chapter meetings is building leadership skills. We've all seen how effective and confident, experienced IEEE speakers are at communication. IEEE and PSES provide a forum for all levels of experience. Your society and your IEEE section are there to nurture your professional career.

Speaking of nurturing, the need for elections every year or two also came up at the meeting. Some chapters have their ups and downs due to an individual who runs the chapter and then "moves on." In our dynamic profession, we need a flow of leadership through chapters with at least several people in the wings. Based on the Santa Clara Valley EMC Society Chapter, the SCV TC-8 (the pre-PSES) practice was to elect a new secretary every year, and for that person to move up to vice-chair in charge of the program and then up to chair. This is a three-year commitment that provides mentorship and experience.

At the meeting, it was also suggested that all chapter chairs or secretaries be on each chapter mailing list. Murlin will be providing a list of current chairs to each chapter.

(Harry Jones [Chicago], Mariel Acosta-Geraldino [VP Member Services], Shirley Tarantino [Santa Clara/scribe], Dan Roman [New Jersey], Steve Brody [Boston], Leszek Langiewicz [San Diego], Homi Ahmadi [Orange County, California], and Cherie Forbes [Santa Clara] – Photo by M. Marks)

(Behind Homi: Henry Benitez [Oregon], in doorway, Richard Georgrian [Colorado], Stefan Mozar [Sydney, Australia], Wan-Chung Kao [Taipei, Taiwan], Steli Loznen [Israel], and Gary Schrempp [Central Texas] – photo by M. Marks)

News from our Chapters –

Central Texas

June 21 meeting. Daniece Carpenter reports that the meeting opened with Gary Schrempp introducing the DVD that he was loaned by one of the presenters at the Product Safety Engineering Society Symposium in May. It provided a great lesson in product safety and liability at

the symposium and posed serious questions about how far is far enough when making a product safe for use. What happens when you think you've done everything you can to design and produce a safe product, yet a jury in a lawsuit brought by a harmed owner of your product says you didn't? There was no final decision presented in this specific example, but the open question of prevention vs. production raised several questions that were discussed at length after the video was over. The meeting was adjourned after the discussion ended.

Madras, India

Dr. V. Jayaprakasan reports that Technical Seminar "Challenges and Importance of E-waste Management and Environment Issues" was organized on 20th April 2017 at Narayana Engineering College, Nellore – 524004, Andhra Pradesh in association with IEEE Product Safety Engineering Society, Madras Chapter. Dr. B. V Ramana Reddy, Principal, welcomed the guest and delivered the Presidential address. Mr. Y. Vinay Kumar, Academic Director delivered the welcome speech.

Dr.V.Jayaprakasan, Chairman, IEEE PSES (Madras Chapter) presented a session on "Challenges in E-waste Management". During his presentation he explained that, E-wastes are considered dangerous, as certain components of some electronic products contain materials that are hazardous, depending on their condition and density. The hazardous content of these materials pose a threat to human health and environment. Discarded computers, televisions, copiers, fax machines, electric lamps, cell phones, and batteries if improperly disposed can leach lead and other substances into soil and groundwater. Many of these products can be reused, refurbished, or recycled in an environmentally sound manner so that they are less harmful to the ecosystem.

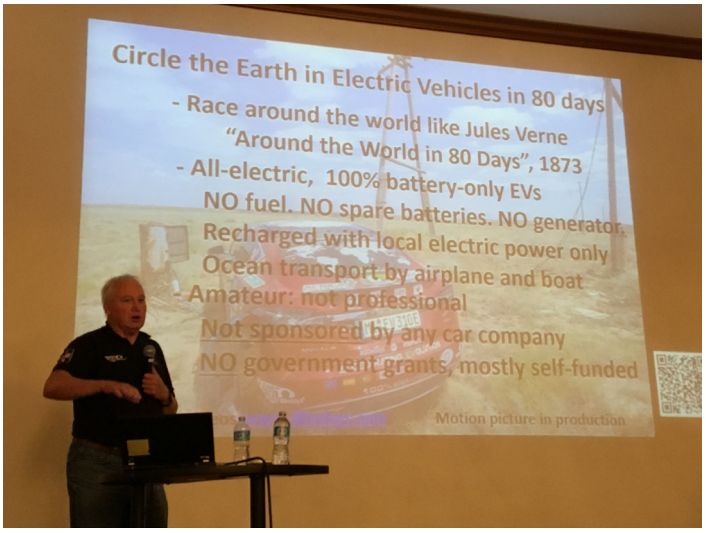
Finally, he highlighted the hazards of e-wastes, the need for its appropriate management and options that can be implemented. In addition, he elaborated the causes of Environment issues and provided the highlights of the IEEE Membership benefits to both the students and faculty members and motivated the participants to become members of IEEE and societies of their professional interest.

Mr.K.Murali, HOD/ECE delivered the vote of thanks. More than 200 students attended and got benefited through this seminar programme.

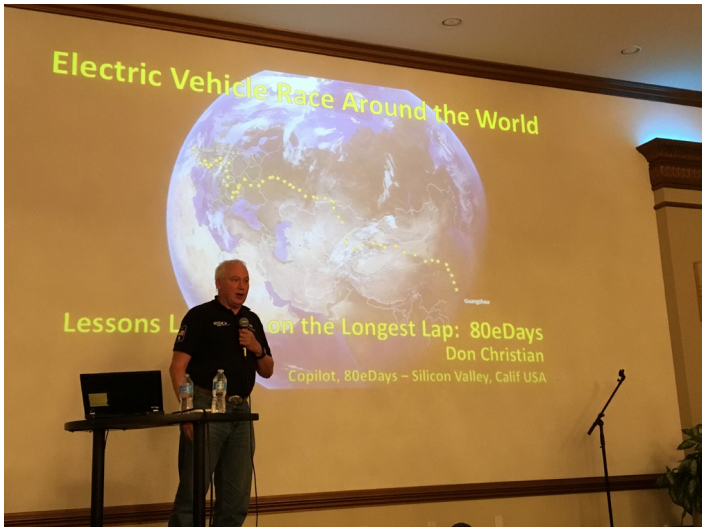
Regarding the Chapter of the Year 2016 award, here in our team all are happy and in Madras Section, they congratulated our team. When we receive the awards from the IEEE Madras Section … the banner and prize money... we will plan some events.

Santa Clara Valley

SCV's May meeting covered an adventure straight out of a movie adventure – and it will be a movie! Don Christian presented the challenges and his experiences on around the world trek in his Tesla. He put a whole new slant on getting your battery charged in the middle of nowhere.



(photos by M. Marks)



June's meeting was back to more mundane matters – Regan Arndt spiced it up with chocolate! His presentation discussed the issues with new technologies and their impact on emissions and susceptibility. To motivate his audience, he tossed a candy bar to each person who asked a question. Clever and tasty!

(photo by Ken Kapur)

Photo by M. Marks

Summer is typically a quiet time for chapters. Towards the end of the season, we plan for the new year. Please think about how we can build the programs for our members. Encourage everyone to join us for the 2018 Chapter Annual Meeting in San José (http://2018.psessymposium.org/), and to submit papers for the conference. Those who attended this year's event will tell you how great a professional experience the whole conference was.

Interested in Starting a New Chapter?

From time to time, Mariel and I are asked how a new PSES chapter can be started. IEEE society chapters are organized under the local IEEE section. A good portion of IEEE dues goes to sections to nurture technical chapters. The process varies in the details from section to section, but the key thing is to work with your section.

Check out the PSES chapter web page http://ewh.ieee.org/soc/pses/chapters.html to see whether there already is a PSES chapter in your area. Click on "Interested in Starting a New Chapter?" to see if someone is already working on a chapter in your area.

You will need to have a petition with at least twelve PSES member. There is some variance between sections in whether all the signatories must be society members or just IEEE members, as well as how long they've been members. Be sure to confirm the rules with your section. As you go through the process, let me know so that I may add you to the chapter start up page.

Ideally, you will line up a sponsor or host for your chapter. It's very helpful for a company/agency to provide support and resources. Some sections may be able to help you to find a meeting location, and get the word out to the local IEEE members. It might be easier to form a joint chapter with one or more other IEEE societies. The chapter web page shows some of the relationships that our chapters have.

From my own experience, I know that regular chapter meetings are the most rewarding part of IEEE membership, both from a technical and a professional perspective. So starting a new chapter is a really worthwhile endeavor. Good luck!

News about Technical Activity Committees

By Silvia Díaz Monnier,
VP of Technical Activities, IEEE PSES

If you are interested in becoming involved in any technical issue, let me know, and we can discuss how you might get involved. You can contact me at silviadiazmonnier@ieee.org. Take advantage of this great opportunity for your professional growth!

Technical Activities General Meeting and Technical Committees annual meetings

The Technical Activities General Meeting took place on Tuesday at ISPCE 2017 in May.

It was a very productive meeting, with the participation of members of the technical committees and also PSES members interested in taking part in technical activities. A representative of each active technical committee spoke about the activities they carry out and future ones.

Future actions for Technical Activities were also discussed and it was concluded it is necessary to provide greater visibility for TC activities and to the purpose and goals.

On Wednesday at ISPCE 2017, we had our first Technical Committee Luncheons. We had four separate tables: Forensic & Failure Analysis (Daren Slee, Chair); Telecom Safety (Don Gies); IT (Gary Schrempp) and Risk Analysis/Medicine/Education/other topics. Each TC had a reserved table and enjoyed the conversation and good wine.

News about Technical Activity Committees

We currently have four Technical Activities Committees: Forensic & Failure Analysis; Telecom Safety; Information Technology, Risk Analysis. To see current Technical Activity Committee information, please go to the Technical Activities page at: http://ewh.ieee.org/soc/pses/technical.html

Some topics on which there is interest to start Technical Committees are : Medical Product Safety, Education, and Industrial Equipments and Controls

If you are interested in taking part of a technical committee or looking to start a new one, please contact me (Silvia Díaz Monnier) at silviadiazmonnier@ieee.org.

The more people who participate the more we can accomplish as professionals and as a society. Spread the word - invite others to join PSES technical activities!

Education Activities

The committee started his activities after the Symposium. Steve Brody (sbrody@ieee.org) is the chair of the committee. The activities will cover the needs for education and training in Product Compliance and Product Safety.

Telecom Safety Technical Committee

The Telecom Safety TC meets via conference call monthly. For information about the TSTC, contact Don Gies at don.gies@nokia-bell-labs.com. Meetings are generally held on the second Wednesday of the month.

Information Technology Technical Committee

The IEEE PSES Technical Committee for Audio/Video, Information and Communication Technology Equipment continues to meet regularly via teleconference on the 3rd Monday of each month. For information about the ITTC, contact Gary Schrempp at Gary_schrempp@dell.com.

Forensic and Failure Analysis Technical Committee

The Forensic and Failure Analysis TC meets via conference call monthly. Meetings are generally held on the last Wednesday of the month, 11 AM Pacific Time / 2 PM Eastern Time. For information about the FFATC, contact Daren Slee at DSlee@case4n6.com.

Senior Member News

By Mariel Acosta, VP of Member Services, IEEE PSES

In June's IEEE Senior member review, two of our society's member elevated their status to IEEE Senior member. Congratulations to our newly elevated IEEE seniors!

Werner Drexel
Vijayajumar Shanmugam

The main complaint I hear when I ask society members why they do not consider elevating their status, is that they do not know any IEEE senior members who could sponsor them. A good way to increase your visibility in the society is to become involved. You do not have to run for officer or become a member of the board to achieve higher visibility. There are many different areas where volunteers are needed… different roles to fit different interests and personalities. Do you get panic attacks when talking in front of people? You could help reviewing technical papers. If you are a confident public speaker, you could host a room and introduce speakers at one of our symposiums. If you are unsure of what opportunities are there, and/or wonder what would be the best one for you, send me an email, I can help you find something that would be a good fit to your interest/personality.

It is OUR society, get involved.

IEEE PSES member spotlight-Meet your IEEE PSES colleagues!

As part of a new initiative, we will be highlighting some of our colleagues in IEEE PSES. On this installment you will find 3 of our newer IEEE PSES senior members.

Julio Posse

Julio Posse has worked for Sony Electronics Inc. since 1990 and has spent the last 13 years serving as the company's Director of Corporate Product Safety. He first began working in the design, manufacture, and service of audio-visual products and components in his hometown of Montevideo, Uruguay, where he studied electronics engineering at Institute of Electronics Technology, and obtained a diploma in radio and television repair at the Institute of Applied Electronics. During his 40-year career, he has been committed to staying abreast of technology developments and maintaining hands-on experience. He has taken courses and gained certifications from such organizations as the International Association of Arson Investigators; National Electronics Sales and Service Dealers Association, Inc.; Defense Research Institute, and many others.

Julio is an active member of many professional organizations, including the IEEE, NFPA; the Product Safety Working Group of the Consumer Technology Association (CTA); the International Consumer Product Health and Safety Organization (ICPSHO) and the International Electrotechnical Commission (IEC). It is with the latter group that he has had the opportunity to travel the world as a United States representative for TC 108 and to work with the Hazard-Based Standard Development Team and the Maintenance Team for the IEC 60065 International Safety Standard. He has brought his expertise and experience to several Underwriters Laboratories Standards Technical Panels on topics related to the safety of consumer and professional electronics products. In addition, he has developed and provided product safety and product liability risk reduction training for the design and manufacturing staff at several companies throughout Asia.

Frank Dominguez

While attending the University of Texas at El Paso (UTEP), I was a student member of the IEEE. After graduating from UTEP, I accepted an engineering position with IBM in Boulder, Colorado. I was a design engineer for IBM in several capacities: chip design, analog design and power supply design. It was during my power supply design stage of my career that I started to learn about product safety. When an op-

portunity came up in the field, I applied for the position. I learned about product safety from the older safety standards such as IEC 380, IEC 435, UL 478 and CSA C22.2 and I was fortunate enough to have a safety engineer by the name of Jim Green, who became my mentor. It was around that time that I got introduced to the IEEE Product Safety newsletters.

After leaving IBM, I worked for TUV Product Service in Boulder, Colorado for a couple of years and broadened my product safety background. When an opportunity came up with Hewlett-Packard in Greeley, Colorado, I accepted a product regulatory position with HP in Greeley, Colorado and finally in Fort Collins, Colorado when I retired in 2015. It was during my HP career where membership with IEEE membership was strongly encouraged due to the heavy involvement of certain HP safety engineers in the PSE group of IEEE. After retiring from HP, I accepted an engineering position with Avery Dennison, where I am currently a product regulatory engineer.

William Bisenius

William Bisenius is President and co-founder of Educated Design & Development, Inc. “Bill” has worked in the regulatory compliance field for over 33 years and is considered to be an international expert in the field of Product Safety. Mr. Bisenius has written and presented many training seminars in his fields of expertise. Throughout his compliance career, William has worked closely with some of the top names in technology, including NASA, IBM, Dell, Philips, and Siemens.

Bill is also President of CertifiGroup, Inc. a Product Test & Certification Lab. CertifiGroup provides US, Canadian, CE, & International Product Certifications to UL, CSA, EN, IEC, and ISO standards. CertifiGroup has expertise in most product categories including ITE, Medical, Lab, Lighting, and Hazardous Location Products. CertifiGroup is also well known for its Compliance Consulting Practice which has customers that range from Hi-Tech Startups to Global 500 manufacturers.

Bill grew up in the Silicon Valley region of California. He graduated from San Jose State University in 1984 with a degree in Electrical Engineering, where he also served as the President of the student chapter of the IEEE. Upon graduation, he went to work for Underwriters Laboratories (UL). When UL built a new facility in RTP, Bill relocated to North Carolina. William left UL in 1992 to pursue ED&D full-time where he has been performing Consulting Services, Designing Product Safety Test Equipment, and Teaching manufacturers how to design their products for compliance.

Bill is a NARTE certified NCE and NCT and a Trial Experienced Expert Witness.

Wondering how to take the next step to elevate your status to Senior?

If you want to start the membership elevation process to senior member grade, you will need:
-IEEE member grade level. (Affiliate and associate are not IEEE members and are not eligible for membership elevation to Senior IEEE members)
-10 years working on IEEE designated field AND at least 5 years of significant experience.
-3 references of IEEE senior members. You will need their IEEE numbers. I recommend you have an updated resume at hand, so you can send it to your references so they can write better recommendations.
-Log on to your IEEE account and start the process.

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Meet the Board

By Mike Nicholls, VP of Communications Services, IEEE PSES

Meet the PSES Board of Governors
This issue we will meet the 4 new Board of Governor members at large who started their 3 year term effective January 1 2016.

Harry Jones

Current IEEE Position:
Member PSES Board of Governors at Large

Current Employment:
Retired

Education:
Harry is a Licensed Professional Engineer with a BSEE from Michigan Technological University and an MS in Business Management from Aurora University.

Technical and Professional Experience:
Harry Jones has been with Underwriters Laboratories, Inc. (UL) for nearly 42 years, and retired November, 2013. Over the years, he has held assignments ranging from safety investigations, standards work, management, technical research, and new program service development. He has been involved with IT, electrical and combustion heating appliances, power tools and other motor operated appliances, combustion and commercial kitchen venting equipment, and health affects issues for commercial cooking appliances. Harry has been active in the area of lithium-ion battery safety research with a focus on developing internal short circuit tests and collaborating with various national and international laboratories.

Harry is married with five children and very much involved with five grandchildren, yoga, amateur radio, and an avid sports fan for the local ice hockey and baseball teams. Harry is involved with part time product safety consulting, and volunteer work with IEEE PSES and Consultants' Network Affinity Group.

IEEE/PSES Activities:
COMMITTEE/BOARD:
He has been a member of over 30 technical committees developing codes and standards for such equipment as fuel cells and hydrogen, appliances, batteries, and others. He was for over ten years the IEC TC105-WG8 Convener that lead the development the of the International Electrotechnical Commission standard for Micro Fuel Cells – Safety, IEC 62282-6-100. Harry is a Licensed Professional Engineer with a BSEE from Michigan Technological University and an MS in Business Management from Aurora University. Harry twice received UL's Professional Engineers Award. He is a Life Senior Member of IEEE. He is a member of the IEEE Product Safety Engineering Society, and currently on the PSES Board of Governors, and Chair of the IEEE PSES Chicago Chapter. Harry is an ASTM Fellow and has received the IEC 1906 Award.

Grant Schmidbauer

Current IEEE Position:
Member PSES Board of Governors at Large

Current Employment:
Nemko

Education:
Graduate from the British Columbia Institute of Technology (BCIT), Vancouver BC, in Power Electronics

Technical and Professional Experience:
Grant has more than 34 years of experience in the field of International Product Compliance and Global Market Access covering product areas Information Technology, Medical, Telecom, Power Supplies, Laboratory, Test and Measurement, Household/Commercial and Audio/Video.

Employment includes CSA (11 years), TUV Product Service (2 years) and Nemko (21+ years).

Grant is the Sr. Vice President, Region North America, in the Nemko Group, and the President of Nemko North America, Inc., and Nemko USA, Inc.

Grant is responsible for Region North America including Nemko USA with operations in San Diego CA, Dallas TX and Salt Lake City UT; and Nemko Canada with operations in Ottawa Ontario and Montreal, Quebec (Canada).

IEEE/PSES Activities:
Grant is an IEEE Sr. member in the Product Safety Engineering Society (PSES). Grant is also on the Board of Governors of the PSES and serves on the Technical Committee for the ISPCE Symposium.

Ken Kapur

Current IEEE Position:
Member PSES Board of Governors at Large

Current Employment:
Thermo Fisher Scientific Chromatography and Mass Spectrometry Organization based in Sunnyvale, CA.

Education:
Electrical Engineering Degree from the University of the Pacific in Stockton, CA Electronics

Technical and Professional Experience:
Mr. Ken Kapur is currently leading Global Compliance for the Thermo Fisher Scientific Chromatography and Mass Spectrometry Organization based in Sunnyvale, CA. Mr. Kapur is responsible for a wide range of Product Compliance areas including Product Safety, EMC, Environmental and Chemical Compliance for scientific instruments. Mr. Kapur has an extensive background and experience in product compliance in the areas of Life Sciences, Semiconductor Equipment, Consumer Electronics and Information Technology Equipment.

Mr. Kapur has an Electrical Engineering Degree from the University of the Pacific in Stockton, CA. He started his work in the area of product safety with Underwriters Laboratories (UL) where he 7 spent years focusing on Information Technology Equipment while being exposed to many other UL categories. He has expanded his expertise to cover a wide range of compliance requirements from Product Safety to EMC, Ergonomics and also Environmental Compliance.

IEEE/PSES Activities:
Active Member of IEEE PSES

IEEE/PSES Accomplishments and Recognitions/ Awards:
Ken has been invited to speak at a number of worldwide industry organizations on various regulatory topics including WEEE, RoHS, REACH, Product Safety, Design for Compliance, Turning Compliance into an Opportunity, and emerging product compliance regulations.

John Allen

Current IEEE Position:
IEEE PSES President;
Member PSES Board of Governors at Large

Current Employment:
President of Product Safety Consulting

Education:
BS in Electrical Engineering from Southern Illinois University

Technical and Professional Experience:
John Allen is the Founder and President of Product Safety Consulting. In 1988, John's experience working with one of America's leading inventors led him to the realization that product designers needed expert advice on not only how to navigate the often confusing and changing product compliance environment, but how to design products with safety and compliance in mind. Just two years after graduation, while working as a compliance engineer for Mitsubishi Electric, John quit his job and never looked back starting the company from his garage. John's first projects were in the personal care industry working for the Epilady. He soon was deeply involved in a wide range of consumer, medical, and industrial products, working with clients such as SC Johnson, Colgate, Alkco Lighting, Dial Corporation, KaVo Dental, CR Baird,

Gendex, Cleveland Motion Controls, Hamilton Beach, Singer, Conair, Helen of Troy and many others. In fact PSC has helped over 3000 companies with product certification, compliance and testing.

Today, John is a recognized expert in Lighting, Medical, and Industrial Controls compliance standards.

IEEE/PSES Activities:
IEEE PSES President
Member PSES Board of Governors at Large

John also has been in leadership roles in the IEEE's Product Safety Engineering Society since 1988. He started the PSES Chicago Chapter back in 1988 and recently steps down as Pasts Chair.

IEEE/PSES Accomplishments and Recognitions/ Awards:
He joined the Board of Directors in 2016 and is now serves as the Society's President. John is also on PSES's Risk Assessment Technical Committee and leads the Compliance 101 Track at PSES's conferences.

He is a sought-after public speaker and serves as a senior adviser on product safety to a number of global consumer products companies.

In addition to his technical leadership, John is active in Project Lead-the-Way, a national organization dedicated to preparing high school students to be future leaders in Science, Technology, Engineering, and Mathematics. He is also sits on the Board of Directors for the Small Business Growth Corporation.

Conference News

By Stefan Mozar,
VP of Conferences, IEEE PSES

Upcoming Product Safety Symposia

This year we have planned a roaming conference, as the society's flagship Symposium (ISPCE) is located in San Jose for the next two years. Steve Brody has taken leadership of the Boston Symposium (SPCE 2017) which will be held during 6 and 7 November. The call for presentations is included in this newsletter. We are very excited about this new event, and it will provide more opportunities for our society to serve our members on the East Coast. It will also provide an opportunity to reach out and engage with our members. Many of our established and highly regarded sessions will be available in Boston. These sessions provide opportunities to learn new things, and to build networks in the product safety community. So, mark your calendars and join us for two fantastic days in Boston.

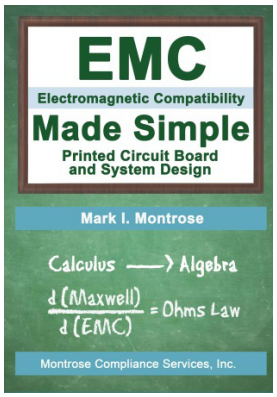
As you may have heard, during December we will host our Taiwan conference. On the day before the conference, we will have some workshops. The Taiwan Symposium will have an exhibitor area as well. We are expecting participants from other Asian countries such as China, Hong Kong, Singapore, Korea, and Japan. If your organization is doing business in these countries you may want to have a presence at this Symposium (ISPCE-Taiwan). It will be held from the 21-22 December 2017, on the campus of the National Taiwan Normal University's brand new conference centre. Our newsletter editor, Professor Kao, is the General Chair for this event. Professor Tseng from City University, Hong Kong is the Technical Chair. The call for presentations is in this newsletter. I look forward to welcoming you in Taiwan.

Volunteers Wanted

Our conference committee is constantly on the lookout for volunteers. No experience is required, just a willingness to learn and get involved in making our symposia successful. The more of us that roll up our sleeves, the less we have to do individually. Volunteering is a great way to make friends, grow your professional network, gain leadership skills, and above all to have fun! So why not send me an email (s.mozar@ieee.org) and get involved volunteering at our conferences.

We are also looking for locations where our roaming conference can be held, and for Chapters willing to host our roaming conference.

Book Review : EMC Made Simple-Printed Circuit Board and System Design



Author: Mark I. Montrose
Publisher: Montrose Compliance Services, Inc.

Reviewed by Elya Joffe
Past President-
IEEE EMC Society
Past President-IEEE Product Safety Engineering Society

Mark Montrose, a world-class EMC consultant and expert authored his fifth popular textbook guaranteed to be a best seller. *EMC Made Simple®-Printed Circuit Board and System Design* uses a totally unique style of discussion from other books that attempt to describe the field of electromagnetic compatibility to those with an interest in the subject. These books are nearly identical in content without presenting something new and exciting and are generally more academic than practical. In addition, they do not address real-world applied EMC engineering to a significant degree for the working engineer. Mark uses visual concepts to simplify both theory and application, especially for those who do not work in the field of EMC on a full-time basis or have limited knowledge in electromagnetics and its relationship to circuit and system designs.

Keith Armstrong provided an endorsement about the book. He said "People who communicate about EMC are experts in some way or another, and they mostly write for other EMC experts. When they try to communicate EMC to electronic designers, most of them fail to 'connect'. But not Mark Montrose–whose new book "*EMC Made Simple®*" lives up to its title and should be on every designer's desk"! I fully agree with what Keith stated.

Many authors attempt to describe field propagation and system engineering design, using only Maxwell's equations at an academic level along with complex math. They usually ignore the larger, general engineering population who are at a junior/entry level or have minimal practical experience with electromagnetics. Mark recognized that missing from bookshelves was information that focused on the need to simplify the field of electromagnetics and its relationship to compatibility. His approach was to not only preach to those working in the field of EMC, but to educate everyone on applied EMC design and testing. There are few books that focus on this subject in a simplified, easy to read style of presentation. Every item discussed is fully justified with sound theory and physics.

The basic concept of making *EMC Made Simple®* is understanding transmission line theory in the time domain. Mark clearly states that when he has an EMI problem, he identifies the source of undesired RF energy creation using an oscilloscope. A spectrum analyzer only tells us the presence of an electromagnetic field, not what *caused* the field to be created. Undesired field creation occurs from any type of signal loss within a transmission line, easily measured with an oscilloscope or using computational analysis. He illustrates clearly that it is easier to solve problems in the time domain instead of frequency domain.

If there is any signal loss within the transmission line, the magnitude of this loss is the magnitude of common-mode current that gets developed. This is Kirchhoff's law in action yet we rarely think about Kirchhoff as our focus on working with electromagnetic has been almost exclusively on Ampere's law. Current is described within Maxwell's equation, not voltage? If there is any voltage loss in a transmission line due to an impedance mismatch in the time domain, this lost electromagnetic energy will propagate somehow using a third [parasitic] transmission line path which is generally free space (radiated EMI) or a metallic interconnect (cable). This is Kirchhoff law related to conservation of energy. This never before published concept in an EMC book is extremely elegant. Since Kirchhoff is not mentioned by Maxwell, this law is what causes job security for those working in the field of EMC.

The book contains six chapters, each with a focus on a particular aspect of printed circuit board and system level design with the words "*Made Simple*" in each chapter title.

Chapter 1 is the most exciting part of the book titled "*EMC or Maxwell Made Simple®".* In this chapter, Mark explains electromagnetics in a unique manner that has never been presented with a twist. He walks the reader through field theory using a *visual approach* by converting the calculus of Maxwell into simplified algebra. Too much emphasis is placed on solving Maxwell's equations using computational analysis with minimal relationship to applied engineering applications. What engineers need to understand is "What does Maxwell's tell us, not how to solve equations". Mark figured out a way to explain what each equation represents using a single sentence that anyone can easily comprehend. Equations tell a story. If we understand what the story says the field of electromagnetics becomes easy to work with. Mark also explains, for the first time again in any published book, how undesired common-mode current is actually created, not just the well-known fact that common-mode current flows in a return path in the same direction as the signal path. He figured a way to elegantly describe the physical mechanism that causes current flow to convert from differential-mode to common-mode. I have never seen published, or taught by academic professors in this explanation. This visualization is so unique that I am surprised that nobody has figured out how to explain this type of mode conversion.

Chapter 2 is the smallest chapter of the book. "*Inductance Made Simple*" is an examination on what inductance is without heavy math. It details the fact that every transmission line contains inductance which is the primary contributor to the creation of undesired common-mode current. We must minimize total loop inductance during any printed circuit board layout. Computational analysis or simulation helps determine if there is too much loop inductance and the potential magnitude of any signal integrity problem created.

Chapter 3 is "*Transmission Line Theory Made Simple*". Electrical engineering involves sending an electromagnetic field from driver to receiver through some form of a transmission line. Mark explains the difference between lossy and lossless transmission lines in a simplified manner. If there is any loss of propagated electromagnetic energy in a transmission line, the magnitude of this loss becomes undesired common-mode current. An extensive discussion follows on how to minimize signal propagation losses within the printed circuit board's material and to enhance signal integrity.

Chapter 4 "*Power Distribution Networks Made Simple*" is exciting to read and one of the largest chapters. He explains what capacitive structures are with various design concerns and parameters that most engineers take for granted or are forgotten. Almost everything associated with creating a stable power distribution network, including power and return planes is presented. I found the section on rules-of-thumb interesting. He clearly investigates many rules to determine if each rule is valid or not. The correct answer of "*It depends*" applies for each rule.

Next is Chapter 5, "*Referencing Made Simple (a.k.a Grounding)"* was my favorite. Mark clearly describes that fact that ground is an invalid word when applied to electrical engineering. The only time we can use the word ground is with a prefix to describe exactly what is being referenced and to clearly describe its' functional use. We must reference RF field propagation to a return or reference path, not something associated with the ground or a ground plane. Various grounding methodologies are presented, including breaking up ground loops, which is one cause common-mode current generation.

Chapter 6, "*Shielding, Gasketing and Filtering Made Simple*" is the largest chapter. What I did not realize, until reading the book, is that a metallic shield is actually a transmission line with high impedance to the propagating field. This is uniquely described for the first time in any book that I am aware of. This chapter covers many aspects of system design and is a must read. This is because printed circuit boards are usually installed an enclosure where shielding, gasketing and filtering may be required for compliance purposes.

The book concludes with several Appendixes. Appendix A presents his famous five algebraic equations that can help identify or fix EMC problems quickly. Other Appendixes include Understanding Fourier Analysis, Using the Decibel, Conversion Tables, and extensive Glossary with unique descriptions that really clarifies word(s) instead of a typical dictionary description plus References.

This book simplifies both theory and application of applied EMC engineering, avoiding complicated math unlike other books on EMC. It is easy to follow, pleasant to read and a must have on the desk. The content is based on many years of practical experience with "real-world" design cases presented. I found it to be an excellent reference, useful for any design engineer who has to get the job done quickly and at low cost, especially those not educated or well-versed in the field of electromagnetics or electromagnetic compatibility.

Selecting Safety Standards for Machine Safeguarding Requirements

Part 1 of 5 in a series addressing the primary milestones to a safe machine

Introduction

When embarking on a path to implement machine safeguarding (protective) measures, one cannot dismiss the influence and importance of documented safety requirements – whether they are man datory versus voluntary; normative opposed to informative; and regardless of their designation as a law, directive, regulation, harmonized standard, consensus standard, technical guideline, or merely best practice [herein referred to simply as 'safety standards'].

"Safety standards" are requirements designed to ensure the safety of people around products, activities, or processes. They may be advisory or compulsory and are typically laid down by either a voluntary or statutory body that may be advisory or regulatory.

When it comes to safety standards, there is no shortage of documentation outlining specific requirements. Before defaulting to a laundry list of requirements that your organization has bought into for guidance, it is important to first understand why referencing specific sources is important to an organization.

Why Reference Standards?

Generally speaking, we reference documented material as a measurement we can compare to. In terms of machine safety, this is a sort of litmus test; selecting appropriate standards will clearly define the minimum allowable requirements, specifications and expectations for comparison, which in turn will ease the burden of determining if those goals have been achieved – either by internal team members retrofitting equipment or external suppliers contracted to provide equipment with appropriate safeguards.

Identifying EH&S Goals

Before we can get into which safety standards are 'right' for an organization, we must also address what the goals of the organization are. There are many different factors that influence the needs and desires to provide a safe workplace (which we won't address here), but understanding the intentions will provide guidance throughout the process.

One of the major factors to consider is if the organization is striving for compliance, safety, or a combination of the two. While at first glance, these aspects may appear to be one and the same, they are in fact very distinctive. 'Compliance' is the practice of adhering strictly to published standards and could be viewed as a reactive or defensive approach to safety, in that the primary purpose is to evade prosecution – either in a court of law or in the court of public opinion. 'Safety,' on the other hand, is viewed as a proactive approach to provide protection from danger or to achieve a condition with as little risk as possible, or as low as reasonably practical (ALARP).

It is important to recognize that 'compliant' equipment is not always 'safe' and that 'safe' equipment is not always 'compliant', leading many of us to desire BOTH 'safety' and 'compliance.' While it could be argued that as long as the true goal of providing a safe workplace is maintained, compliance may not truly matter. For many, however, compliance is extremely relevant because it provides a decisive result regarding how safe is 'safe enough' while also protecting organizations from further liability.

Clearly understanding your organization's view on this issue will provide great assistance with this endeavor.

Types of Standards

The primary purpose of most safety standards is to provide the audience (readers) with an overall framework and guidance for decisions during the entire life cycle of machinery to enable them to maintain machines that are safe for their intended use. Many standards developing organizations (SDOs) use the following structure (also see Figure 1):

Type-A standards (basic safety standards) giving basic concepts, principles for design and general aspects that can be applied to machinery;

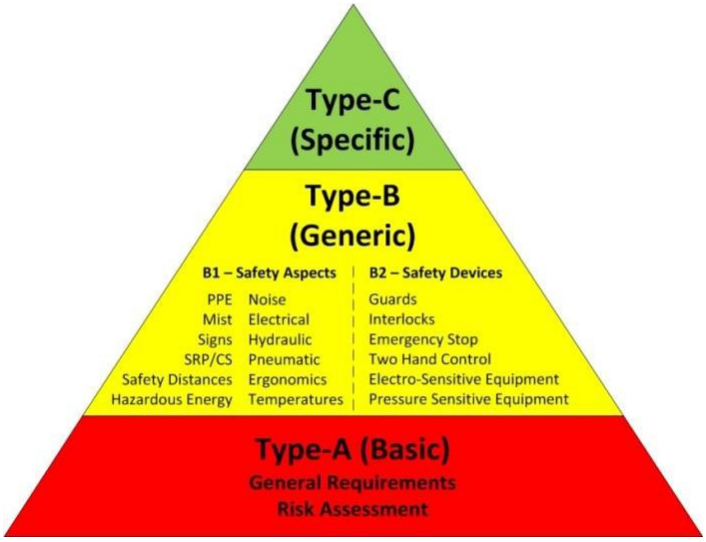


Figure 1: Structural Organization of Standards

Type-B standards (generic safety standards) dealing with one safety aspect or one type of safeguard that can be used across a wide range of machinery:

Type-B1 standards on particular safety aspects (e.g., safety distances, surface temperature, noise);

Type-B2 standards in safeguarding device (e.g., two-hand controls, interlocking devices, pressure-sensitive devices, guards);

Type-C standards (machine safety standards) dealing with detailed safety requirements for a particular machine or group of machines.

Often, safety professionals either focus on one of two ends of the spectrum. Some will gravitate to the type-A and -B standards (often referred to as 'horizontal standards' because of their broad application across industries and machine types), assuming general requirements applicable to all machines will address most concerns. Others will focus only on the type-C standards (sometimes labeled as 'vertical standards' due to their depth of focus on a specific topic), in hopes that the panel of experts who created the standard addressed all possible scenarios and provided clear direction regarding how to abate any resulting risks.

In reality, however, it is imperative to use all applicable standards together – both horizontal and vertical – to ensure the most thorough approach to risk identification and mitigation in order to achieve the safest equipment and workplace attainable. As shown in Figure 2, type-A standards provide a general overview of hazard identification and type-B standards provide typical requirements addressing the conventional application of safety aspects or devices, while type-C standards probe deeper into the respective details as they apply to a specific industry or machine group. It is important to note that when a type-C standard deviates from one or more technical stipulations addressed by a type-B standard, the type-C standard takes precedence. Additionally, there may be instances where type-C standards do not exist within a region for specific equipment, in which case the type-A and -B standards become even more significant.

Figure 2: Coordinated Application of Standards

Regulatory Requirements

When determining which standards to apply, the organization must consider a number of factors. First, there are local regulatory (legal) requirements which are mandatory and must be met. For organizations that operate only in a specific country or region of the world, the list of possible standards to choose from is somewhat more limited. If your organization operates internationally, the catalog of potential standards is extended in comparison.

Regardless of the function of your organization – either as a machine builder (OEM), integrator, or end-user – it is important to understand the governing obligations

that apply. For global organizations, it is worth mentioning the Agreement on Technical Barriers to Trade (TBT) developed by the World Trade Organization (WTO). This agreement strives to ensure that regulations, standards, testing and certification procedures do not create unnecessary obstacles, while also providing member countries with the right to implement measures to achieve legitimate policy objectives, such as the protection of human health and safety, or the environment.

The CE Mark

Even with a global initiative toward harmonization, however, various regions still stipulate additional requirements that exceed expectations of other regions. For instance, one of the most well-known regional requirements is the CE mark, which includes mandatory conformity marking for certain products sold within the European Economic Area (EEA). The CE mark on a product or machine confirms compliance with the valid European regulations

in order to achieve free movement and sale of the product throughout the EEA. The most straightforward method for OEMs to meet the essential health and safety requirements of the Machinery Directive involves manufacturing the equipment in conformity with harmonized standards, as published in the *Official Journal of the European Union*, to achieve a presumption of conformity. For machine builders and rebuilders (including end-users who modify their own equipment), it is important to know these requirements when moving machinery into and within the EEA.

Inspection Requirements in the Americas

Examples of additional requirements include the obligation for a Pre-Start Health & Safety Review (PSR) in the Canadian province of Ontario in accordance with Section 7 of the Regulation for Industrial Establishments, and the responsibility to provide a Technical Responsibility Annotation (ART) for equipment in Brazil as a function of the Regional Council of Engineering and Architecture (CREA). In both instances, the requirements apply to new equipment, as well as when there is substantial transformation of the operating system of a machine – including retrofitting. Furthermore, the review and documentation can only be performed by a legally qualified professional – a Professional Engineer (PE) licensed in the applicable region. In these instances, it is in the best

interest of the machine manufacturer/rebuilder/modifier and the end user (employer) to work together to ensure the statutory requirements are managed.

OSHA and ANSI

In many regions of the world, there are also expectations placed on the employer. In the United States, the Occupation Safety & Health Administration (OSHA) places the legal burden for safety on the employer. The Occupation Safety and Health (OSH) Act of 1970 includes the General Duty Clause, which states, in Section 5(a) (1):

Each employer shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees.

Furthermore, it is also important to note that 27 states and jurisdictions have approved State Plans as encouraged by Section 18 of the OHS Act of 1970 (see Table 1). Under the Act, jurisdictions which create State Plans must set job safety and health standards that are "at least as effective as" comparable federal standards. Most states adopt standards identical to federal ones, but they also have the option to advocate standards covering hazards not addressed by federal standards.

Alaska	Indiana	Nevada	Oregon	Vermont
Arizona	Iowa	New Jersey *	Puerto Rico	Virgin Islands *
California	Kentucky	New Mexico	South Carolina	Virginia
Connecticut *	Maryland	New York *	Tennessee	Washington
Hawaii	Michigan	North Carolina	Utah	Wyoming
Illinois *	Minnesota	* State plans cover public sector (state & local government) employees only		

Table 1: States and Jurisdictions with State OSHA Plans

To confuse the issue further within the United States, it is not sufficient to simply read all of the OSHA regula-

tions, standards, and state laws. To determine the legal obligations, employers must also account for the technical safety standards published by organizations such as the American National Standards Institute (ANSI). While OSHA laws typically set out only a general framework, procedure or set of standards to guard against a hazard, many ANSI standards go much further toward protecting workers, taking into account current state of the art practices and technologies. Additionally, they provide the technical details regarding performance requirements that OSHA typically omits.

In order to stay current with best practices used within the industry, ANSI requires that each ANS shall be revised, reaffirmed, or withdrawn after a five year period, unless an extension has been granted. While this ongoing maintenance of ANSI standards ensures that commonly used and time-tested approaches to achieving safety are included and shared with the public, it also adds a level of uncertainty because the requirements of the standards selected by an organization could change from one revision to the next.

While some ANSI standards have been directly adopted into the Code of Federal Regulations (CFR) as OSHA standards (and therefore legally mandatory as law), some can be 'incorporated by reference,' meaning they have been sited within an OSHA regulation and are therefore enforceable by OSHA. All other ANSI standards are generally considered voluntary – but even this is misleading. OSHA standards typically establish the general expectations each employer must meet and gives the employer discretion to decide how best to achieve the stated goals. Employers are expected to use this latitude to consider any existing consensus standards, including non-legislative standards adopted by industry and other non-governmental organizations. Even though these standards are not legally enforceable as part of an OSHA inspection, they represent a consensus on what experts consider safe. In the event that an incident were to occur, OSHA might (and often does) regard an employer's failure to adopt a voluntary standard relating to an OSHA requirement as evidence that it did not take reasonable actions to comply with the expectations of the General Duty Clause.

To make matters even more complicated, ANSI is not actually responsible for the content of each individual American National Standard (ANS); rather, they are a private non-profit organization which coordinates, facilitates, and promotes the development of voluntary consensus standards through its accreditation of the procedures of participating SDOs. With nearly 220 SDOs and approximately 10,000 ANS, ANSI Essential Requirements expect a "good faith effort to resolve potential conflicts between and among existing and candidate American National Standards." In reality, this means that each SDO is somewhat responsible for self-governance, sometimes resulting in possible overlap with the scope of other standards, causing confusion. Two examples where multiple documents address the same core topic are risk assessment and robot safety, as shown on the next page in Table 2

Use of Work Equipment Directive

In Europe, the Use of Work Equipment Directive (UWED) is aimed at users of machinery (employers) and is in addition to the Machinery Directive, which is directed toward suppliers. The UWED covers all industrial sectors and places general duties on employers along with minimum requirements for the safety of work equipment. All European Union countries enact their own form of legislation to implement this Directive. For organizations that operate as users of equipment in the European Union, it is important to be aware of the local legislation intended to meet this requirement, understanding that each country has developed their own requirements.

Expectations in Asia

Conversely, many Asian countries apply expectations of safety to the employee, either through documented standards or cultural expectations. Some Asian countries – including Japan, China and Korea – continue to develop or adopt standards related to safety of machinery. However, adherence to and enforcement of these standards are still somewhat arbitrary at this time.

Global Approach

Region / Function	Europe	North America	Asia	GLOBAL
Manufacturer / Supplier	☑	☐	☐	☑
End User / Employer	☑	☑	☐	☑
Employee	☐	☑	☑	☑

Table 3: Comparison of Primary Obligations by Region

Understanding the legal ramifications of local laws and customs is essential to making an educated decision regarding which standards to

RISK ASSESSMENT

Standard	Title	Scope
ANSI B11.0	Safety of Machinery – General Requirements and Risk Assessment	Power driven machines, not portable by hand, used to shape and/or form metal or other materials by cutting, impact, pressure, electrical or other processing techniques, or a combination of these processes.
ANSI/ISO 12100	Safety of machinery – General principles for design – Risk assessment and risk reduction	Machines assembled, fitted with or intended to be fitted with a drive system consisting of linked parts or components, at least one of which moves, and which are joined together for a specific application. This also covers an assembly of machines which, in order to achieve the same end, are arranged and controlled so that they function as an integral whole.
ANSI/ PMMI B155.1	Safety Requirements for Packaging Machinery and Packaging Related Machinery	Packaging, processing and packaging-related converting machinery.
ANSI/AIHA/ ASSE Z10	American National Standard for Occupational Health & Safety Management Systems	Policy, organization, planning & implementation, evaluation, and action for improvement of employee health and safety.
ANSI/ ASSE Z590.3	Prevention through Design: Guidelines for Addressing Occupational Hazards & Risks in Design & Redesign Processes	Design / redesign of work premises, tools, equipment, machinery, substances and work processes.
AWS D16.3M/ D16.3	Risk Assessment Guide for Robotic Arc Welding	Arc welding robot sytems.
SEMI S10 *	Safety Guideline for Risk Assessment and Risk Evaluation Process	Micro- and nano-electronics industries, including: • semiconductors; • photovoltaics (PV); • high-brightness LED; • flat panel display (FPD); • micro-electromechanical systems (MEMS); • printed and flexible electronics; • related micro- and nano-electronics.

ROBOT SAFETY

Standard	Title	
ANSI/RIA R15.06	Safety Requirement for Industrial Robots and Robot Systems	Automatically controlled, reprogrammable multipurpose manipulator, programmable in three or more axes, which can be either fixed in place or mobile for use in industrial automation applications.
ANSI/RIA/ISO 10218-1 **	Robots for industrial environments – Safety requirements – Part 1:Robot	Manufacture of automatically controlled, reprogrammable multipurpose manipulator, programmable in three or more axes, which can be either fixed in place or mobile for use in industrial automation applications.
ANSI/SPI B151.27	Safety Requirements for the Integration of Robots with Injection Molding Machines	Plastics machinery.
ANSI/UL 1740	Standard for Safety – Robots and Robotic Equipment	Robotic equipment and systems intended for indoor and outdoor use in applications including: • parts assembly; • parts transfer; • automated material handling; • inspection; • loading; • die-casting; • deburring; • welding; • paint spraying; • clinical/diagnostic systems; • pharmaceutical applications; • commercial food processing; • automated vehicle refueling systems; • library book handling/ sorting; • clean room applications; • medical use for surgery; • mobile robots; • automated guided vehicles; • automated storage/ retrieval systems.
AWS D16.1M/ D16.1	Specification for Robotic Arc Welding Safety	Arc welding robot systems and anci lary equipment.

NOTES

*SEMI is not an ANSI accredited SDO.

**To be withdrawn in December 2014.

Information listed is believed to be accurate at time of publication; subject to change at any time. Check with appropriate SDO for additional information regarding scope and content of standards listed.

Table 2: Examples of American Standards with Possible Overlap in Scope

select for your organization. Although many companies do not operate globally, there is a strong case to be made to implement a combined approach, establishing a holistic policy to share the responsibilities surrounding safety with all stakeholders. Many proactive companies – especially end users – are applying this approach by establishing clear requirements for the acquisition of new equipment (affecting suppliers), for upgrading and maintaining existing equipment (affecting plant level management), and setting expectations of their employees. Manufacturers and suppliers who wish to transact with forward looking companies should read the writing on the wall and make efforts to stay relevant and competitive in the marketplace by applying best practices from all world regions, as shown in Table 3.

Relevancy of Standards

In addition to the regulatory requirements of each region, organizations should also consider the expectations of the consumers and the local market. No entity wishes to be perceived as one with little or no regard for the local population and the environment; this is one reason why so many companies today make great efforts to give back through charitable and philanthropic activities in their communities. Equal attention and investment should be made internally to ensure that the safety and welfare of the employees are adequately addressed and maintained. In the global marketplace that exists today, any competitive advantage is considered a leg up. While cost is always important, forward thinking companies look beyond the initial cost of acquisition and consider the total cost of ownership – including legal liability, public perception, and future costs (both direct and indirect) which would come into play if an incident were to occur. For progressive organizations, the value of human life is equal in all parts of the world, regardless of legal requirements.

Differences between Standards

Aside from the obvious differences stated above regarding which entities are held responsible by various standards, there are also technical differences that exist within various industries and regions. For instance, when applying electro-sensitive protective equipment (ESPE) such as light curtains to protect people from identified hazards, their effectiveness relies upon the device being located (mounted) at an appropriate distance from the hazard such that the hazardous motion or situation is prevented, completed or stopped before the individual can be harmed. In order to determine the minimum safe distance, a formula must be applied. As shown in Table 4, the theory behind the formula is exactly the same in Europe and North America; only the identifiers for the variables are different. For applications with the device used in a vertical orientation (or the detection zone orthogonal to the direction of approach) the respective formulae are:

	Europe (ISO 13855)	**United States** (ANSI B11.19)
Formula	**$S = (K * T) + C$**	**$D_S = (K * T) + D_{pf}$**
With the following variables:		
Minimum Distance	S	D_S
Approach Speed	K	K
Total Stopping Time	T	T
Intrusion Distance / Depth of Penetration	C	D_{pf}

Table 4: Minimum Distance Formulae for Vertical ESPE

A cursory examination would lead to the conclusion that there is global harmonization with respect to minimum safe distance calculations for safeguarding devices – and in fact there is, but only in the theoretical approach. When deeper investigation is performed, however, safety professionals see that the values and rules applied to the formula result in different final values, as shown in Figure 3.

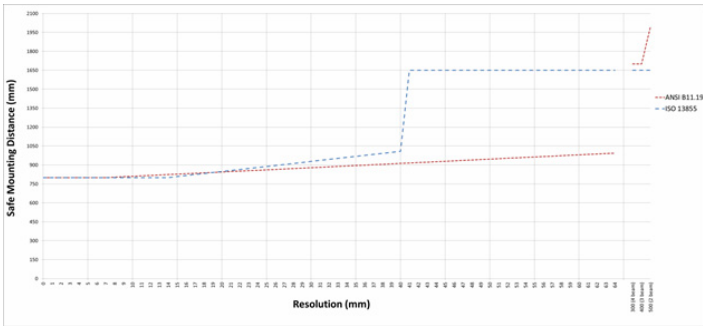


Figure 3: Comparison of Minimum Distance Calculations for Vertical ESPE Based on Device Resolution [T = 500 ms]

It is difficult to claim that one formula is 'safer' than the other when both regions have thousands – if not millions – of compliant installations where personnel have been effectively protected from harm. A brand new ma-

chine installed in North America with a CE Mark can be considered safe when used within the appropriate parameters, and it carries with it a declaration of conformity and compliance with the Machinery Directive through the application of harmonized standards, including ISO 13855 for calculating minimum safe distances. Once installed, though, the local requirements should also be considered, such as ANSI B11.19 for determining the safe mounting distance of safeguarding devices. So even with a CE Mark and a declaration of conformity, a new machine may still not be compliant with local requirements. We can clearly see in this example that 'compliance' and 'safety' are two separate concerns.

For organizations operating globally, which standard should be selected? It is clear that one standard cannot be selected as the most conservative, because both standards require a greater distance at different intervals. One could create an internal requirement that the most conservative value always be applied, thus ensuring ease of use in terms of auditing to a consistent standard and providing for the possibility of global relocation of equipment. However, this approach may cause undue restrictions in various world regions, including use of extra floor space that would not otherwise be required.

Selecting Standards

The balance between ease of use and cost of implementation is ultimately what must be determined for each organization. While establishing a list of requirements to be used globally may have select benefits, so does the regionalized management of local requirements.

Regional Requirements (when available)	**Global Standards** (when established)
Expectation to meet compliance with local regulatory requirements	Expectation to meet (or exceed) local regulatory requirements
Requires monitoring of changes to local regulatory requirements	Requires monitoring of changes to global regulatory requirements
Prevents over-designed solutions compared to local expectations	Easy training, rollout and auditing for entire organization
Costs controlled through adherence to local requirements only	Consistent global expectations and value for safety of employees
Limited modifications to established requirements	Stable interpretation of ALARP

Table 5: Comparison of Benefits between Local and Global Standards

When determining which standards to apply in a given industry or application, it is important to circle back to the types of standards discussed above and not discount their significance. While type-A and -B standards from various regions can often be boiled down and combined into best practices; type-C standards still address the specific concerns of the application. In some instances, there may simply be no type-C standards in existence for the equipment in question, especially when the machinery is custom built in a very unique process. Sometimes, type-C standards may not exist in the local environment, but do in external regions. In these circumstances, the organization should consider whether or not to apply non-legislative requirements as a best practice approach to reducing risk. In other instances, there may be multiple requirements within a region or across regions. In these scenarios, the organization is most likely better off addressing each situation on a case-by-case basis.

Table 6 below includes an abbreviated list of possible standards which could be selected/applied to two common types of machines; power presses and industrial robots. In the United States, we see that there is more than one standard for robots which could be applied, including industry specific requirements for the welding and plastics industries, as outlined earlier in Table 2.

Region / Standards		EUROPE	AMERICAS				ASIA PACIFIC			
		European Union	USA	Canada	Mexico	Brazil	Australia	China	Korea	Japan
C-Type (examples)	Power Press	EN 692 EN 693 EN 13736 (ISO 16092)	OSHA 1910.217 ANSI B11.1 ANSI B11.2	CSA Z142		NR-12 NT-16 PPRPS EN 693 NBR 13930	AS 4024.3001 AS 4024.3002	GB 11291		JIS B 8433
	Industrial Robot	ISO 10218 (ISO TS 15066)	ANSI/RIA R15.06 UL 1740 AWS D16.1 ANSI/SPI B151.27	CSA Z434			AS 4024.3301	GB 4584		JIS B 6410
B-Type (not all inclusive)		IEC 60204 ISO 4413 ISO 4414 ISO 13849 ISO 13854 ISO 13857 ISO 13855 ISO 14118 ISO 14120 ISO 14119 ISO 13856 IEC 61496 ISO 13851 IEC TS 60246 IEC 61508	ANSI B11.19 ANSI/ASSE Z244.1 OSHA 1910.147 OSHA 1910.219 NFPA 79 ISO 4413 ISO 4414	CSA Z432 CSA Z460	NOM-004-STPS	NR-12 NR-10 EN 60204 NBR 14153 NBR 14154 NBR NM-ISO 13854 NBR NM-ISO 13852 NBR NM-ISO 13853 ISO 13855 NBR 13759 NBR NM 273 NBR NM 272 NBR 14152	AS 4024.1401 AS 4024.1501 AS 4024.1502 AS 4024.1601 AS 4024.1602 AS 4024.1603 AS 4024.1604 AS 4024.1701 AS 4024.1702 AS 4024.1703 AS 4024.1704 AS 4024.1801 AS 4024.1802 AS 4024.1803	GB/T 16855 GB 23821 GB/T 19876 GB 12265 GB/T 8196 GB/T 18831 GB/T 17454 GB/T 19436 GB/T 19671 GB 16754 GB/T 19670 GB 5226	KSC IEC 60204 KSB ISO 13849 KSC IEC 61508 KSC IEC 61496 KSB ISO 13850 KSB ISO 13854 KSB ISO 13852 KSB ISO 13853	JIS B 9703 JIS B 9704 JIS B 9705 JIS B 9710 JIS B 9711 JIS B 9712 JIS B 9714 JIS B 9715 JIS B 9716 JIS B 9717 JIS B 9718 JIS B 9960 JIS B 9961 TR B 025
A-Type		ISO 12100	OSHA 1910.212 ANSI/ISO 12100 ANSI B11.0	CSA Z432	DOF 21.10.1997	NBR NM 213 NBR 14009 NR-12	AS 4024.1101 AS 4024.1201 AS 4024.1202 AS 4024.1301 AS 4024.1302	GB/T 15706 GB/T 16856	KSB ISO 12100 KSB ISO 14121	JIS B 9700

Table 6: Example of Type-A, -B, and -C standards by Country / Region
Information listed is believed to be accurate at time of publication; subject to change at any time.

Check with appropriate SDO for additional information regarding scope and content of standards listed.

Conclusion

As we can see from this discussion, there is no one 'right' choice for every organization when selecting standards to follow for implementing safeguards measures. There are, however, choices which are clearly wrong – such as not doing anything. If the process appears daunting

and overwhelming, do not hesitate to request assistance from outside sources, preferably sources with direct and extensive experience in a wide range of industries and world regions.

This white paper is meant as a guideline only and is accurate as of the time of publication. When implementing any safety measures, we recommend consulting with a safety professional.

For more information about safety standards and regulations, contact SICK Safety Application Specialist Chris Soranno at chris.soranno@sick.com, or visit our web site at www.sickusa.com.

TOUCH CURRENT measurement; Showing how it works

Part 2 of 3 Startle-reaction and

Letgo-immobilization touch current measurements

Peter E Perkins, PE
Life Senior IEEE

The introduction to switching electronics has increased the concern as to the effects of these devices on the electrical infrastructure. There is concern that the switching spikes which are fed back into the supply system are affecting the long-term reliability of the infrastructure; these switching spikes initiate electrical discharge in small voids in insulation and are speeding up the rate of partial discharge which speed up the insulation failure, additionally, the triplen harmonics generated are captured in delta transformer windings and heat the windings which speed up insulation failure. The measurement of TOUCH CURRENT is one important element in measuring these feedback switching events and providing a specified maximum level of feedback from equipment in the earth/ground. Another growing issue relates to electronic protection devices, e.g. GFCIs, don't play well with switching electronic loads and the load won't work in some situations.

The assessment of protection against electric shock includes making a measurement of the accessible residual current available to the user under normal, abnormal and fault conditions. This residual current, TOUCH CURRENT, is limited to a small value protecting harm or damage to the user.

This TOUCH CURRENT measurement limit is specified in product safety standards. Commonly used standards for electronic equipment e.g. IEC/EN/UL 60065 'Audio, Video and Similar Electronic Apparatus - Safety Requirements, IEC/EN/UL 60950 'Information Technology Equipment - Safety Requirements', IEC/EN/UL 61010 'Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use', IEC 62368, 'Audio/Video, Information and Communication Technology Equipment' and IEC 61204-7 'Low-voltage switch mode power supplies – Part 7: Safety requirements'.

All of these product standards draw on the IEC Basic standard IEC 60990, 'Measurement of TOUCH CURRENT and protective conductor current' which describes the measurement circuit details plus the various conditions and details under which the measurement is to be made. The circuit discussion will show how the adjustment has been made for higher frequency current from the traditional electrical body model historically used.

This paper reviews a demonstration showing the setup and conditions for making proper TOUCH CURRENT measurement for some products with emphasis on the proper procedure and interpretation of results; common mistakes in making this measurement will be discussed. The demonstration is augmented by additional examples and explanation.

There is a need to quickly expand peak TOUCH CURRENT measurements to all electronic switching equipment and a maximum limit of 7.1mApk applied in all cases to provide a sound basis for all of these issues.

Moving on from eBurn to TOUCH CURRENT:

Continuing in this discussion from the demonstration; actual TOUCH CURRENTs are measured using the process described.

Although the focus of this discussion using IEC 60990 circuits and techniques focusing on non-sinusoidal TOUCH CURRENT waveforms, the use of these measurement circuits with sinusoidal waveforms also provides proper results.

STARTLE-REACTION TOUCH CURRENT evaluation:

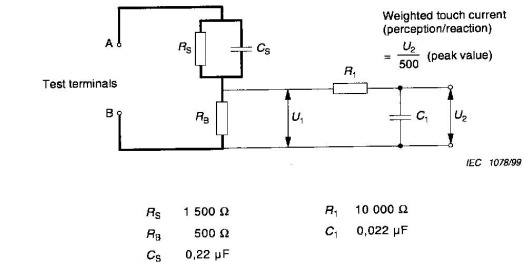


Figure 4 – Measuring network, touch current weighted for perception or reaction

Figure 1: IEC 60990 (Figure 4) - measuring network, TOUCH CURRENT weighted for STARTLE-REACTION

For TOUCH CURRENT cases up to 2mArms the startle=reaction filter is applied. Figure 1 shows the body model circuit plus the output filter for STARTLE-REACTION frequency correction. The filter circuit shown is actually the inverse of the Frequency Factor curve to enable the use of the line frequency limit value as the proper reading for showing compliance, making the process easier for the test lab.

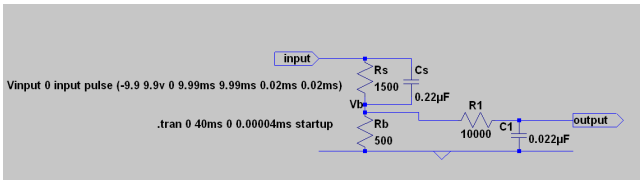


Figure 2: SPICE circuit for the STARTLE-REACTION TOUCH CURRENT measurement

STARTLE-REACTION frequency factor:

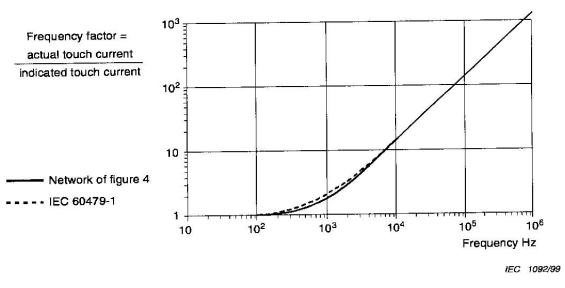


Figure F.2 – Frequency factor for perception or reaction

Figure 3: IEC 60990 (Figure F.2) Frequency factor for STARTLE-REACTION

Here in Figure 3 the basic data curve from IEC 60479 is compared to the output for the filter circuit used in IEC 60990. There is good agreement between the two; the IEC 60990 filtering circuit output represents the curve nicely.

It is obvious that larger TOUCH CURRENTS are allowed at higher frequencies; e.g. for the usual 3.5 mArms line frequency limit it could be larger than 3.5Arms at 1 MHz and still be accessible.

Sinusoidal waveform STARTLE-REACTION TOUCH CURRENT performance vs frequency:

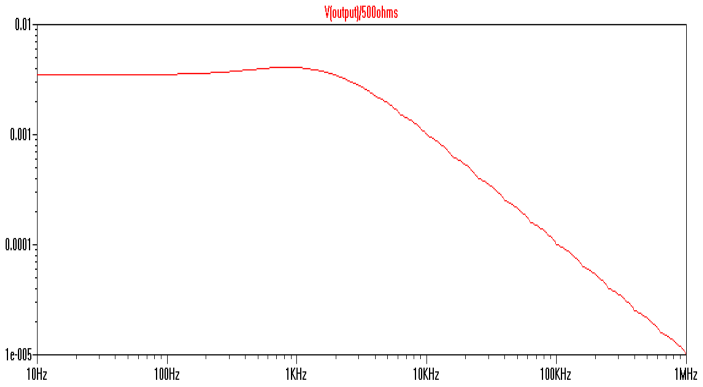


Figure 4:STARTLE-REACTION circuit performance vs frequency

For 3.5mA sinusoidal current the IEC 60990 (Figure 4) STARTLE-REACTION circuit response is shown in Figure 4. The circuit implementation in the meter is the inverse of the frequency factor curve as can be seen here; this has been done to simplify the measurement method. In every case the low frequency limit (e.g. 3.5mA) is the meter reading for the HF components when they are at the limit curve.

Non-sinusoidal STARTLE-REACTION TOUCH CURRENT:

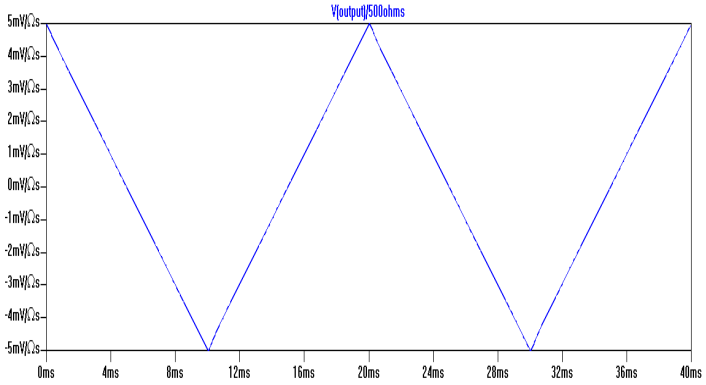


Figure 5: non-sinusoidal triangular wave TOUCH CURRENT example

An example of a simple non-sinusoidal waveform is shown. This is the triangular current waveform seen in Figure 5 and is used for comparison of effects between the measurement circuits.

This waveform calculations give 5mApk/2.87mArms and the pk/rms ratio is 1.742. Note that in order to be within the maximum safe TOUCH CURRENT value of 5mApk specified in IEC 60479, the rms value must be below 2.87mArms as described in the product standards (when it is commonly a 3.5mArms limit).

The measured rms value must be a reduced value from the rms limit for any non-sinusoidal waveform to maintain the needed level of protection desired in the product.

The FFT for this Figure 5 waveform shows the high frequency characteristics of this waveform with harmonics above 10kHz.

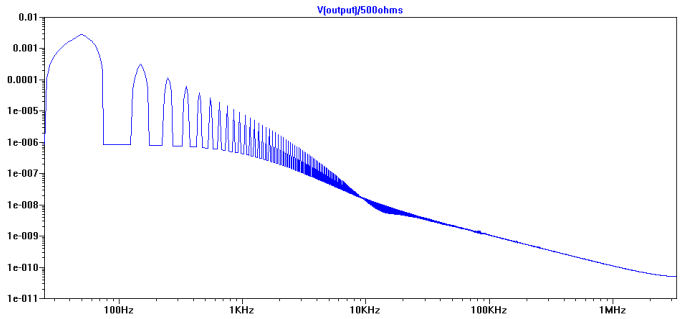


Figure 6: Frequency components of triangular current waveform of Fig 5

Demotest #1: STARTLE-REACTION results from demo:

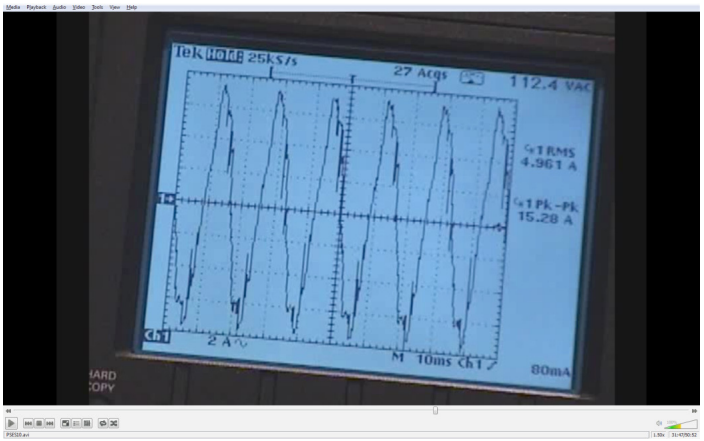


Figure 7: STARTLE-REACTION waveform from demo

This first case again consisted of two laptop computers operated from a PDU panel.

Note that this waveform looks somewhat like the triangular waveform just analyzed.

The Simpson 228 meter reading is about 0.5mArms for this test; scope reads 0.4961mArms (adjusted for scale factor). Peak TC = 1.529mApk-pk (scale factor adjusted) or 0.765mApk. Pk/rms ratio = 1.54, near-sinusoidal (~sinusoidal + 10%).

The meter reading is always checked to ensure that the correct scaling factor is applied to the scope readings.

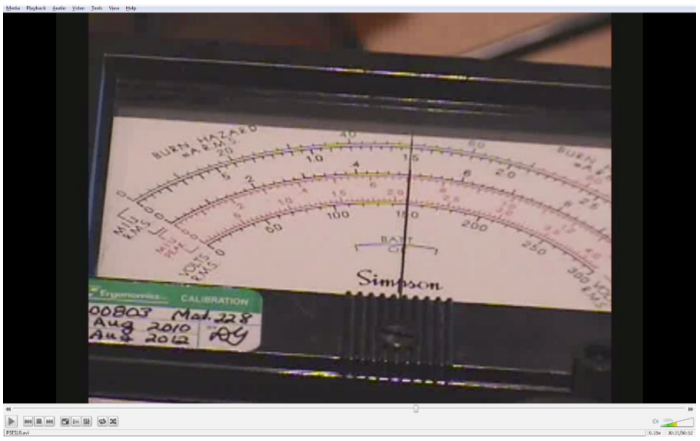


Figure 8: Simpson meter reading for Figure 7 waveform

A second measurement case was done.

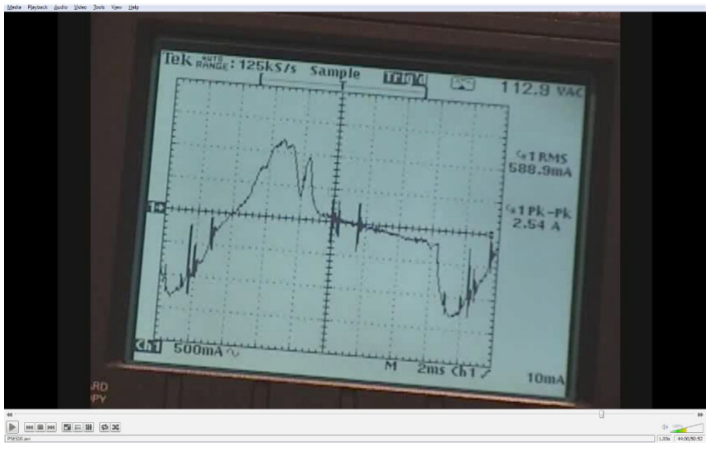


Figure 9: Case 2 STARTLE-REACTION waveform

This second demo case consisted of just a modern laptop operated directly from the line.

Although this unit was also operating in the 1st case, this TOUCH CURRENT is a small part of the total measured there.

Simpson 228 meter reading is about 0.05mArms for this test; scope reads 0.0588mArms (adjusted for scale factor). Peak TC = 0.254mApk-pk (scale factor adjusted) or 0.127mApk. Pk/rms ratio = 2.16, not near-sinusoidal.

This is an example of a product with a small tc value which would provide adequate protection even with a high pk/rms ratio.

Netbook STARTLE-REACTION TOUCH CURRENT example:

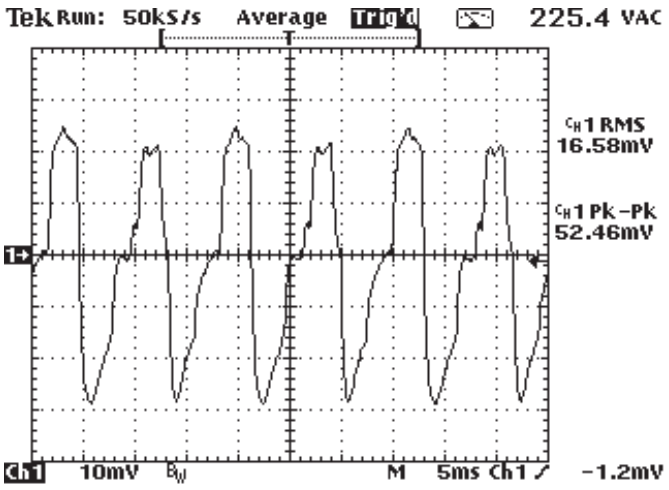


Figure 10: Netbook STARTLE-REACTION TOUCH CURRENT waveform example

This netbook example, Figure 10, was added to the demo data to more completely show a typical TOUCH CURRENT waveform for a small computer product.

The waveform is somewhat triangular with noted distortions. The measured data is 1V output = 1mA; STARTLE-REACTION TOUCH CURRENT: 16.5mVrms*1mA/V = 16.5uArms or 0.016mArms; 52.46mVpk-pk/1mA/V = 52.46uApk-pk or 0.052mApk-pk. tcpk = tcpk-pk/2 = 0.052mA/2 = 0.026mApk. Pk/rms ratio = 1.509; a near-sinusoidal waveform; about 7% over a sinusoid.

The scope harmonics are shown in Figure 11.

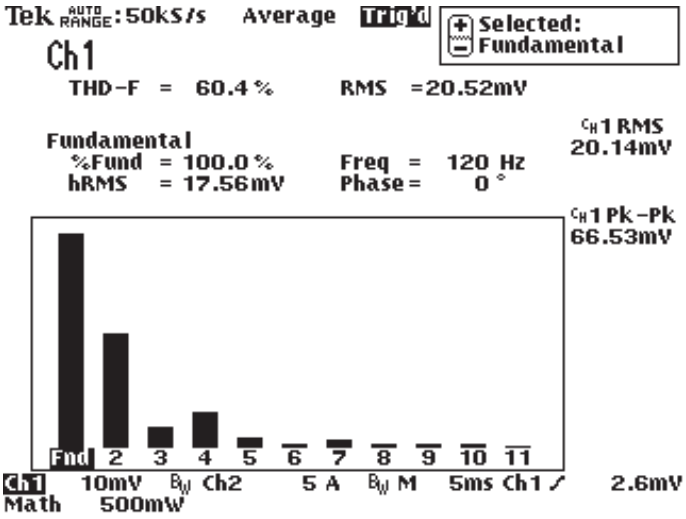


Figure 11: Scope harmonics for Figure 10 TOUCH CURRENT waveform

The larger harmonics for this waveform are concentrated below a kHz, which would be expected for a near sinusoidal waveform.

Demotest # 2: LETGO-IMMOBILIZATION TOUCH CURRENT evaluation:

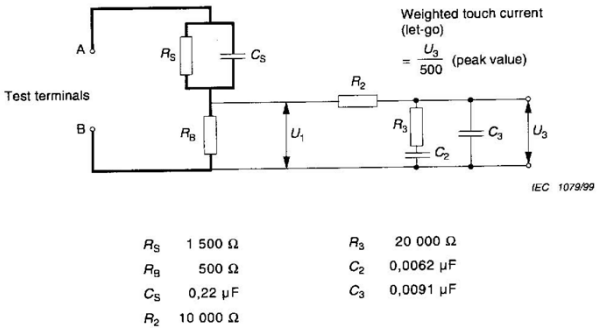


Figure 12: IEC 60990 (Figure 5) LETGO-IMMOBILIZATION circuit

For higher TOUCH CURRENT levels (and limits), above 2mArms the LETGO-IMMOBILIZATION frequency factor filter is to be applied. This is the measuring circuit implementing this filter, as was similarly done for the prior evaluation. The SPICE implementation of this circuit is shown in Figure 13.

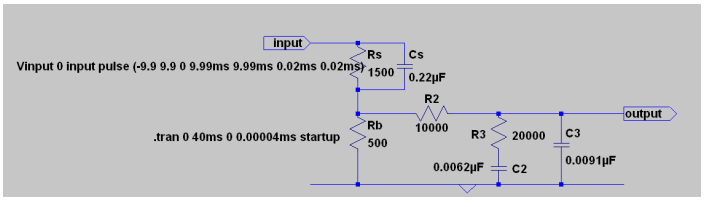


Figure 13:SPICE circuit for LETGO-IMMOBILIZATION circuit

LETGO-IMMOBILIZATION Frequency Factor comparison:

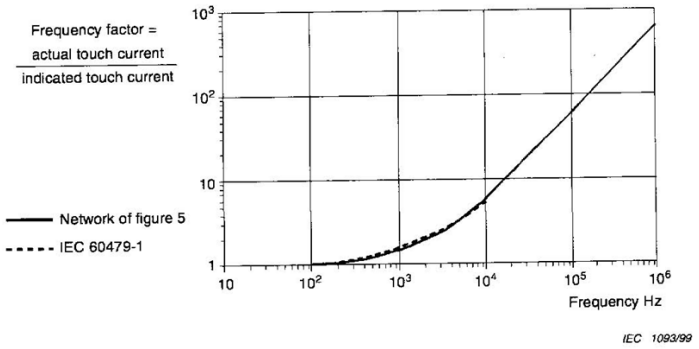


Figure 14: LETGO-IMMOBILIZATION Frequency Factor comparison, IEC 60990 (Figure F-3)

Here, again, the basic data curve from IEC 60479 is compared to the output for the filter circuit used in IEC 60990. There is good agreement between the two; the circuit output represents the curve nicely.

Notice that this body effect requires a lower level at high frequency than the earlier discussion. A product TOUCH CURRENT limit of 3.5mArms at line frequency could be on the order of 2.5mArms at 1 MHz.

Because of the infrastructure issues being raised there is a need to ensure that all electronic system provide an absolute upper limit to feedback emissions. TOUCH CURRENT in products using these techniques, e.g. SMPS or VSDs, need to limit the high frequency components to this curve. This paper demonstrates the methods for properly measuring this effect. A touch current at the 5maRMS/7.1mApk limit would rise to about 5000mApk (5Apk) at 1MHz and still be acceptable.

An interesting observation is that this frequency factor curve can be laid on its side over the 60479 letgo curve and they both exhibit similar action; a low value of current at long time/low frequency exposure and a higher level of allowed current at shorter time/hi frequency. This is understood in the same sense that an FFT shifts the time domain to the frequency domain.

3.5mArms LETGO-IMMOBILIZATION IEC 60990 Figure 5 TOUCH CURRENT performance vs frequency sweep:

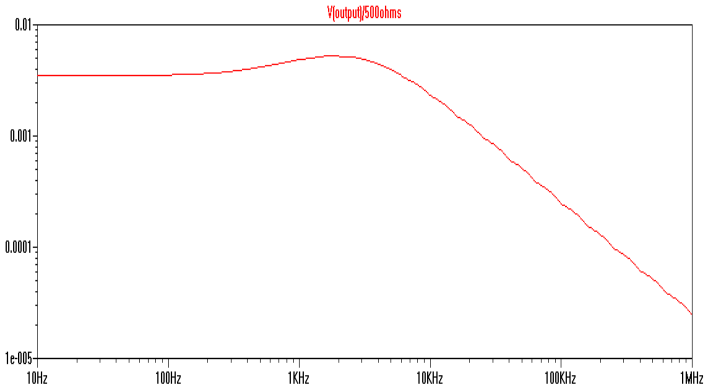


Figure 15: TOUCH CURRENT (A) vs frequency (Hz), IEC 60990 LETGO-IMMOBILIZATION circuit response

SPICE analysis details for Figure 15: input 7v; 3.5mA at 50/60Hz, 5.2mA at 1kHz, 2.3mA at 10kHz

This filter differs from the former example in that there is provision for the needed hump above 1kHz which represents the increased sensitivity of the body at those frequencies as described in IEC 60479.

Non-sinusoidal LETGO-IMMOBILIZATION TOUCH CURRENT example:

A non-sinusoidal analytical example again; triangular waveform.

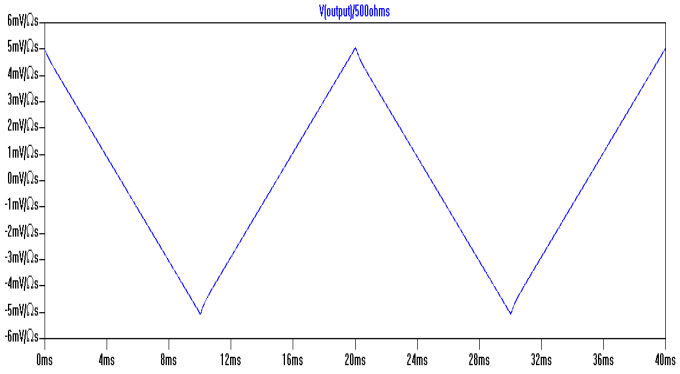


Figure 16: TOUCH CURRENT (mA) ve time (mS) triangular waveform

This line frequency triangular wave is at the maximum safe TOUCH CURRENT value of 5mApk specified in IEC 60479; the calculated rms value is 2.87mArms. The pk/rms ratio is 1.756 for this waveform.

Note that in order to be within the 5mApk limit specified the rms value must be less than 2.87mArms – an almost 20% reduction for this case where the allowed rms limit of 3.5mArms as used in some standards. Without looking at the waveform and making the proper measurement a product could be accepted that is not in conformance with the specified limit. This needed reduction in the allowed rms TOUCH CURRENT has not been clearly recognized by either manufacturers or test houses.

The rms limit value must be reduced from the usually given sinusoidal value for any non-sinusoidal waveform that exceeds the sqrt(2) = 1.414 pk/rms ratio to maintain the needed level of peak current protection desired in the product.

The FFT for this Figure 16 waveform is shown in Figure 17.

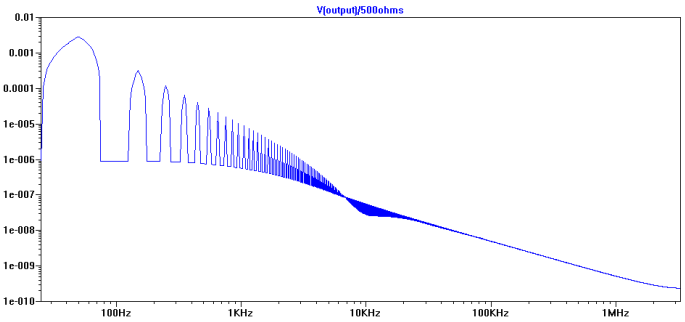


Figure 17: FFT for triangular wave of Figure 16

Note the high frequency components above 10kHz for this line frequency waveform.

LETGO-IMMOBILIZATION waveform measurement: Demo Case 1:

For the waveform shown in Figure 18 the LETGO-IMMOBILIZATION TOUCH CURRENT = U3/500 ohms and is directly read on the Simpson meter.

Simpson 228 meter reading is about 0.5mArms for this test; scope reads 0.4961mArms (adjusted for scale factor). Peak TC = 1.528mApk-pk (scale factor adjusted) or 0.764mApk. Pk/rms ratio = 1.54, ~sinusoidal + 10%.

There is no real difference in the STARTLE-REACTION and LETGO-IMMOBILIZATION readings for this waveform. The waveform does not contain enough significant HF content for that differentiation.

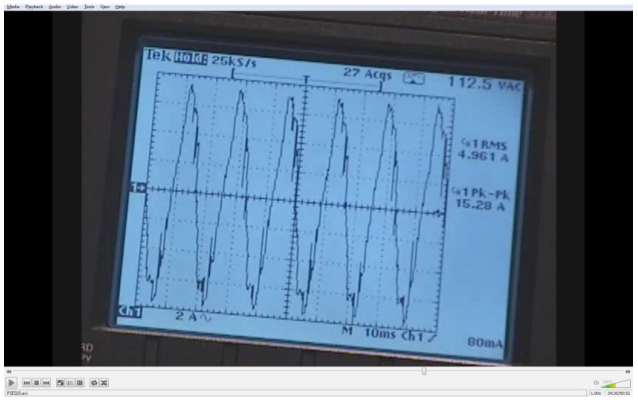


Figure 18: Demo waveform LETGO-IMMOBILIZATION measurement

Demo Case 2:

For the second measurement case one of the loads was disconnected and the TOUCH CURRENT was measured for a recent laptop computer. The waveform result is shown in Figure 19,

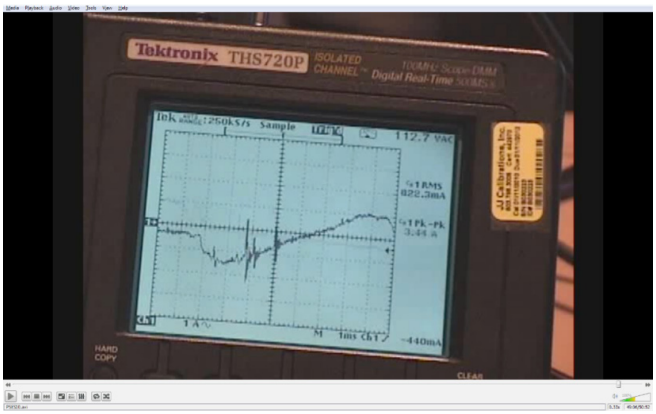


Figure 19: laptop computer TOUCH CURRENT waveform

LETGO-IMMOBILIZATION for second demo case:
Simpson 228 meter reading of about 0.06mArms for this test; scope reads 0.08223mArms (adjusted for scale factor). Peak TC = 0.344mApk-pk (scale factor adjusted) or 0.172mApk. Pk/rms ratio = 2.09, not near-sinusoidal.

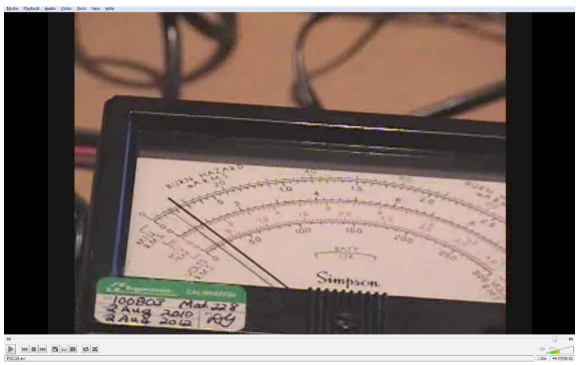


Figure 20: Simpson 228 meter reading for Demo Case 2

Netbook LETGO-IMMOBILIZATION TOUCH CURRENT example:

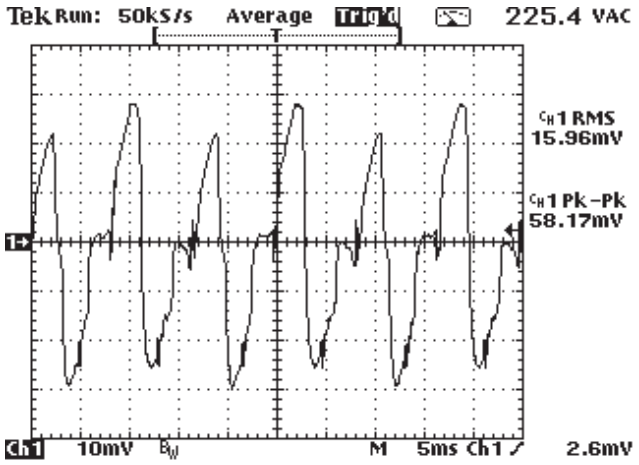


Figure 21: Netbook LETGO-IMMOBILIZATION TOUCH CURRENT waveform example

1V output = 1mA; LETGO-IMMOBILIZATION tc: 15.96mVrms*1mA/V = 15.96uArms or 0.01596mArms; 50.17mVpk-pk/1mA/V = 50.17uApk-pk or 0.05017mApk-pk. tcpk = tcpk-pk/2 = 0.05017mA/2 = 0.02582mApk. pk/rms ratio = 1.822; not near-sinusoidal.

Again, the netbook measurements are added into the discussion to provide additional insight into the measurement process.

The FFT for the Figure 21 waveform are shown in Figure 22. This shows the decrease in the level of the harmonics for this waveform.

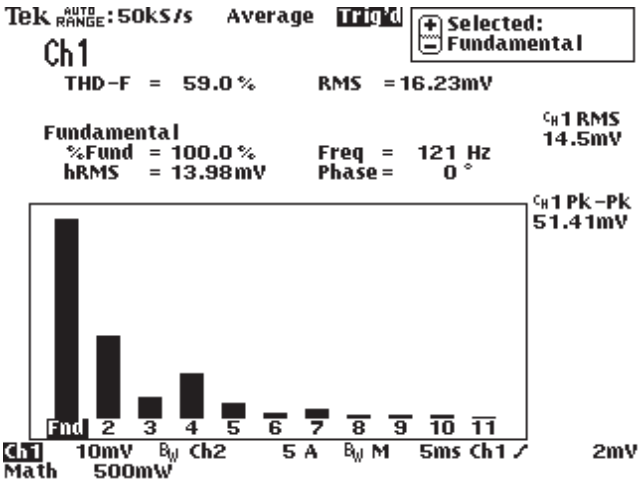


Figure 22: Harmonics for Figure 21 TOUCH CURRENT waveform

Part 3 will discuss testing details and summarize the paper.

Peter E Perkins is convenor of IEC TC108/WG5, which is responsible for IEC 60990, Measurement of touch current and protective conductor current, an IEC Basic Safety Publication applicable to all electrical products and product safety standards. He is a Life Senior member of IEEE, has a BS in Engineering from the University of Portland and MSEE from Oregon State University and is Principal in PE Perkins, PE. He has more than 55 years' experience in the electronics industry, at Tektronix, Inc and now as a consultant to industry, specializing in product safety and regulatory affairs for most of that time. He has been continuously involved in giving technical presentations at PSES/ISPCE from the beginning. He can be reached at p.perkins@ieee.org.

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TOPIC AREAS

The IEEE Product Safety Engineering Society seeks original and unpublished formal papers, presentations (without formal papers), workshops, and tutorials on all aspects of product safety and compliance engineering including, but not limited to:

- **Global Market Access & Regulations, Compliance Management**
- **Environmental & Energy Regulations**
- **Batteries & Energy Storage Systems**
- **Medical Devices**
- **Compliance 101**
- **Hazard Based Safety**
- **Engineering & Safety Science**
- **Forensics, Failure & Risk Analysis, Assessment & Management**
- **Legal, Regulations, Directives & Consumer Protection**
- **Emerging Technologies & Innovations**

PSES

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IEEE 2017 ISPCE-TW

IEEE International Symposium on Product Compliance Engineering-Taiwan

December 21-22, 2017,
National Taiwan Normal University, Taipei, Taiwan

Call for Paper

http://soc.aet.ntnu.edu.tw/ieeeispcetw/index.php

The conference topics involve:

*Inherently safer products and equipment

*Product Safety services

*Training and continuing education

*Regulations and standards

*Risk management

*Workplace product safety

*System and Software safety

*Human factors

There should be some invited speakers, submitted peer reviewed papers, tutorials, and product demonstrations.

The deadline for submitting a full manuscript is November 15. All the submissions will be peer reviewed for the quality and originality. Please consider submitting your papers before the deadline. The conference will be the most important IEEE PSES conference in Asia.

Paper Submission: http://soc.aet.ntnu.edu.tw/2017ISPCE-TW/users/register.php

E-Mail List: http://www.ieee-pses.org/emc-pstc.html
Virtual Community: http://product-compliance.oc.ieee.org/
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Membership: The society ID for renewal or application is "043-0431".

Advantages of Membership in the IEEE PSES

Makes you part of a community where you will:

- Network with technical experts at local events and industry conferences.
- Receive discounts on Society conferences and symposiums registration fees.
- Participate in education and career development.
- Address product safety engineering as an applied science.
- Have access to a virtual community forum for safety engineers and technical professionals.
- Promotion and coordination of Product Safety Engineering activities with multiple IEEE Societies.

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