The Product Safety Newsletter

Vol. 6, No. 5 October-November 1993

What's Inside

Chairman's Message 1
Officers of the PSTC's 2
Letters to the Editor 3
Electronic Standards 4
Impedance Tests... 5
News and Notes 6
Area Activities 7
IEC 364-4-41 Electric Shock 9
Institutional Listings 22
Employment Wanted .... back page

Chairman's Message

Symposium 1993 Report
by Brian Claes

The Product Safety Technical Committee (PSTC), otherwise known as the IEEE EMC Society Technical Committee #8 (TC-8), sponsored two events at the annual International EMC Symposium in Dallas: our annual meeting and a special workshop. Both events were very successful.

The workshop was an unqualified success. We had excellent attendance and participation, although it was held as the last event of the Symposium, after the exhibits and paper sessions closed. Murlin Marks, workshop chairman, did a great job of planning and staging the event. The program topics included product environmental attributes, international harmonization, product safety techniques for the EMC professional, and accident investigation and casualty hazard analysis. Interest among audience members was high, judging from the energy and volume of questions and discussion during the presentations, during the breaks and after the workshop's conclusion!

Continued on page 8

The Product Safety Newsletter

The Product Safety Newsletter is published bimonthly by the Product Safety Technical Committee of the IEEE EMC Society.

Opinions expressed in this newsletter are those of the authors and do not necessarily represent the opinions of the Technical Committee or its members. Indeed, there may be and often are substantial disagreements with some of the opinions expressed by the authors.

Subscriptions are free. To receive a subscription, send your request to:
PSN Subscriptions,
Dave McChesney
1865 Farndon Avenue
Los Altos, CA 94024
fax: (408) 296 3256

Comments and questions about the newsletter may be addressed to:
The Product Safety Newsletter,
Roger Volgstadt (Loc. 55-53)
c/o Tandem Computers
10300 North Tantau Avenue
Cupertino, CA 95014
Fax No. (408) 285 2553

Editor: Roger Volgstadt
News Editor: David Edmunds
Activities Editor: John Reynolds
Page Layout: Ken Warwick
Subscriptions: Dave McChesney
Institutional Listings: Ervin Gomez
Distribution: John McBain

Officers of the Product Safety Technical Committees

Central

Chairman	Brian Claes	(408) 578 5035
Vice-Chair	Richard Pescatore	(408) 447 6607
Secretary-Treasurer	John McBain	(408) 746 5016
		(408) 746 5258 (fax)
Standards	Paul McDonald	(415) 592 5111
		(415) 592 6052 (fax)
Paper Review	Mike Harris	(707) 258 1360

Local

Chicago		
Chair	John Allen	(708) 238 0188
		(708) 238 0269 (fax)
Orange County/Southern California		
Chair	Charlie Bayhi	(714) 367 0919
Vice-Chair	Ercell Bryant	(714) 966 3459
Secretary/Treasurer	Deborah Tinsley	(714) 773 7977
Program Co-Chair	Michael Dastmalchian	(310) 604 8739
Program Co-Chair	Ray Jimenez	(619) 726 9303
Portland		
Chair	Jim Pierce	(503) 626 6694
Secretary-Treasurer	Scott Varner	(503) 656 8841
Santa Clara Valley		
Chairman	Mike Campi	(408) 987 6527
Vice/Program Chair	Murlin Marks	(408) 985 2400 X2353
Treasurer	Mark Montrose	(408) 247 5715
Secretary	Travis Lee	(408) 294 7600
Seattle		
Chairman	Walt Hart	(206) 356 5177
Membership Chair	John Quigley	(206) 226 1660

Letters to the Editor

Dear Editor:

In response to Brian Donnelly's question and Rich Nute's response about UL 1262's compatibility with the NEC [PSN, Vol. 6, No. 3], it may help to know that UL Safety Standards are written to insure that a product is suitable for installation in accordance with the applicable installation code. In the case of the Standard for Laboratory Equipment, UL 1262, that code is the National Electrical Code (NEC). Products evaluated under UL 1262 are suitable for connection to a branch circuit complying with the NEC.

The Requirements in UL 1262 assure that the equipment's actual current draw is compatible with the product rating, cord size and attachment plug size by the following:

1. Equipment shall bear a current or power rating (5.3.4).
2. The measured supply-circuit current shall not exceed 110 percent of the marked current rating (5.3.4).
3. The cord shall have an ampacity, in accordance with NEC Table 400-5A, not less than the marked current rating (15.2.1).
4. The attachment plug shall be rated not less than 100 percent of the marked current rating (15.2.2).

Now let's look at UL 1262's compatibility with the NEC. The configuration of the attachment plug dictates the size of the branch circuit. The size of the branch circuit dictates the size of the branch circuit overcurrent device. The size of the overcurrent device is important for two reasons:

1. The product under normal operation should not cause the branch circuit overcurrent device to operate. If this occurs, the product user may try to bypass the branch circuit overcurrent device to get the product to operate.
2. An abnormal test may be terminated by the operation of the branch circuit overcurrent device. The overcurrent device used during the test program must be representative of what the product will be connected to in the field. If it isn't, the product may produce a hazardous condition when a fault condition occurs.

To evaluate these concerns, UL tests the product on a branch circuit representative of what the product will be connected to in the field. The product must be able to operate under normal conditions without causing the branch circuit overcurrent device to operate. Under abnormal conditions the branch circuit overcurrent device is allowed to clear the circuit. As long as the product is evaluated for these concerns, there is compatibility between UL 1262 and the NEC.

Continued on page 19

Increasing Productivity Through The Use of Electronic Standards

by Patricia Mack
Expert Application Systems, Inc.

[*New and revised standards are continuously appearing, but what about new ways to use them? Patricia Mack comments on the advantages of using electronic standards. Readers who have used them, please send us your comments! - Ed.*]

Manufacturers today are subject to a host of regulations and standards from government agencies and private organizations. For example, many electronic products must be certified by a Nationally Recognized Test Laboratory as meeting applicable safety standards. This certification has advantages for the manufacturer, beyond checking the product safety. It can significantly broaden a product's potential market by creating competitive advantages over products which are not certified. It also helps companies avoid criminal, civil, and private actions.

According to the American Tort Reform Association, the number of product liability cases filed has increased by 700% during the past decade. High dollar damages and litigation expenses resulting from such cases have promoted a worldwide focus on product safety. In addition, global markets for electrical and electronic products require manufacturers importing products into Europe to be aware of Europe's strict product liability system. Under this system, "user negligence" is no longer a defense. This means that manufacturers and their distributors are presumed to be guilty of making and/or selling a defective product if someone is injured or killed while using the product, and a trial is used only to determine the extent of liability. Product liability is a serious concern for manufacturers and must be treated as such, both to avoid lawsuits and to ensure the safety of product users.

Obtaining product certification can be a time-consuming and costly process that has the potential to affect product quality, design, and time-to-market. Manufacturers typically devote substantial manpower and funds to the product certification process to ensure the safety of product users. For example, according to the August 1991 issue of PC Magazine, the cost of product certification for a complete personal computer system starts at approximately $10,000 and can increase dramatically if the original design is particularly poor for product safety. However, even after manufacturers spend time and money on product certification, there is no guarantee that their products will be certified the first time through, or at all. These failed and repeated product submittals can result from the intricacy of standards and the large volume of information the standards contain.

While adhering to regulations and standards is a competitive necessity - and potentially severe penalties exist should manufacturers' products not comply and subsequently cause injury or death - the regulations and standards can be lengthy, highly detailed, and a challenge to integrate into the product development cycle. Manufacturers clearly need simple, effective, value-added tools which facilitate the effective transfer of large volumes of information and provide quick access to the details of standards. These tools should be designed for use by manu-

Continued on page 12

Impedance Tests on Electrical Products

by Lal Bahra, P. Eng.
Canadian Standards Association

Electrical equipment can present a shock hazard if exposed metal parts or accessible secondary circuits get connected to primary or shock hazardous voltages. Protection against shock hazard is necessary and is usually provided by either connecting the accessible metal parts to ground (protective earth PE) or by insulating such parts from hazardous voltages by double insulation.

Approximately 80 to 90% of equipment is connected to ground (PE) for protection against shock hazard. The method of connection to ground, the size of the grounding conductor, test criteria, etc., must be such that exposed metal parts don't become a shock hazard when a fault occurs.

Following are some examples of different earthing requirements and acceptance criteria. For the purpose of this article the term "earth" (IEC terminology) has been used to mean "ground" (North American terminology).

<u>IEC Requirements</u>:
IEC requires the resistance of a bond (from earthing terminal to part required to be earthed) to be less than or equal to 0.1 ohm when a max. current of 25A (using a 12V source) is passed through the earth path. The 0.1 ohm resistance criteria (as given in IEC Publication 950 and other IEC Standards) is acceptable to IEC for all products having 15A or higher branch circuit overcurrent protection. Acceptance of the 0.1 ohm impedance criterion means that the permissible voltage drop across a bond will increase as the current rating of the equipment is increased, as the fault current will become higher (see Figure 1).

It has recently been proposed to IEC TC-74, WG8 that a 12.5V drop across the bond (CSA accepts only 4V) be permitted under the above test i.e. when 25A is passed through the earth path, max. voltage drop shall not exceed 12.5V.

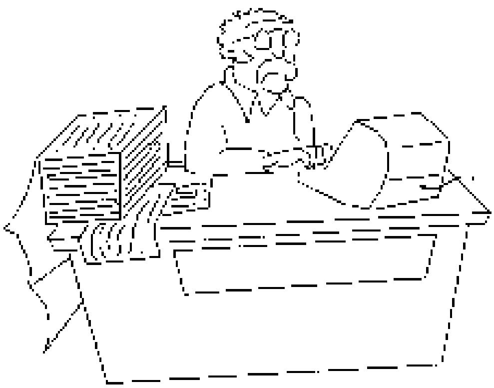
<u>CSA Requirements</u>:
The present edition of CSA Standard C22.2 No. 0.4, Bonding and Grounding of Electrical Equipment (Protective Grounding), requires a bond that is capable of carrying a current of twice the rating of the overcurrent protective device prescribed by Part I of the C.E. Code for a branch circuit needed to supply the equipment, and to have an impedance that will not cause a voltage drop across the bond to exceed 4V, when measured from the earthing terminal (where the earthing conductor of the power supply cord is terminated in the equipment) to the accessible conductive surface that is required to be connected to earth.

So we have three different criterion, 0.1 ohm, 12.5V drop and 4V drop.

<u>Bonding of Different Exposed Conductive Surfaces</u>:
The requirement of a good bond is that all exposed conductive surfaces of an electrical product are suitably connected to the earthing terminal of the equipment, so that no hazardous voltages result in the event of an electrical fault in the equipment. Both IEC and North American (UL and CSA) standards consider that 30V rms (or lower) is safe to touch if the

Continued on page 14

News and Notes



by Dave Edmunds
fax: (716) 422-6449

UL RECOGNIZED IN ONTARIO
According to a recent press release by Underwriters Laboratories, Inc. UL has announced that the province of Ontario will now officially recognize the UL Mark for Canada on electrical and electronic products used in that province. UL says they are now recognized in 9 of 10 provinces, the Northwest Territories and the Yukon Territory. Quebec needs only to complete the necessary actions for the UL Mark for Canada to be recognized in all Canadian provinces and territories.

UL gained Ontario recognition after a nine month process which culminated in a revision to the Ontario Electrical Safety Code. The Ontario Electrical Safety Code now includes the name of "Underwriters Laboratories Inc." as a recognized organization for certifying and labeling electrical and electronic products used in Ontario.

UL was the first organization outside of Canada to be granted Certification Organization (CO) and Testing Organization (TO) accreditations by the Standards Council of Canada (SCC).

CSA RECOGNIZED IN LOS ANGELES
The following News bite is extracted from the M.A. Lamothe & Associates/Ultatech newsletter of Sept/Oct, 1993:
CSA Receives the Blessing of Los Angeles!
The City of Los Angeles,California recently completed an on-sight evaluation of CSA in Rexdale.Peter Ridout of CSA in Rexdale advised us that they received the official acceptance from Los Angeles on August 18, 1993.

ARTICLES OF INTEREST
The Rheinland Record, published by TÜV Rheinland of North America, has articles on CE marking of products in April and July issues. Their phone number is (203) 426-0888.

Machine Design, July 23, 1993 issue, page 68, discusses a positive operating safety switch. While intended for the Machine Safety Directive, it may have application in other areas. Please contact the PSN Editor if you would like further information.

CONFORMANCE REPORT
A draft document issued by IEC TC66 (sec.) 76, is a verification procedure to be used as a checklist to determine if equipment meets the requirement of IEC1016-1. This checklist will be issued and maintained by TC66 that is responsible for the base safety document. The comments close of the draft date is 31

Continued on page 21

Area Activities

by John Reynolds
381 Los Pinos Way
San Jose, CA 95123-5118
fax: 415-962-9439
e-Mail:reynolds@esd.sgi.com

September is the beginning of the new year for most of our groups. This is when we see how well the person in charge of setting up the agenda for the coming year has done his or her job. The Ideal is to have a full booking of interesting subjects and dynamic speakers, designed to please everyone and cause the attendance to grow. Well, anyone who has volunteered (or been volunteered) for this position knows how hard this job is. Finding speakers that stimulate discussion, provide needed information to improve our skills, and challenge us is a difficult task at best. Yet this is the most important activity of our local technical committees.

I spoke with Debbie Tinsley of the Southern California Group who mentioned the need for help in this area. She suggested a directory of speakers that would list the speakers and their topics. I know this idea has been spoken of before but not developed. I think this is a perfect job for the central committee to coordinate. We would of course want the permission of the speakers and the list would be limited in its distribution. I will take on this project and see how we can provide this valuable information to our groups. To start with, please send me information on the speakers you have had in the past with names, addresses, phone, fax, topic(s), etc. and notes as to availability, etc. This will be a great help to all the groups.

SANTA CLARA VALLEY GROUP
The Santa Clara Valley PSTC will meet September 28 at Apple Computer for a social and planning meeting. Everyone should attend, because more input received on topics and speakers will help to make the meetings more appealing. Contact Murlin Marks at UL Santa Clara for reservations and meeting details. The speaker for the October 26th meeting will be Mr. Bill Devereux, Topic: Telecom Topics.

SOUTHERN CALIFORNIA GROUP
The Product Safety Group, Southern California met on Tues, Aug. 3rd at FileNet Corp., 1550 Scenic Ave., Costa Messa, CA, Building 3. Meeting time 6:00 pm.

The following Notes are courtesy of the Secretary/ Treasurer Ms. Deborah M. Tinsley, PE of Beckman Instruments, Inc.:

Continued on page 20

Chariman's Message
Continued From page 1

The PSTC annual meeting also was very successful. Attendance was double that of last year and participants came prepared with proposals and ideas for improvements. One proposal for expansion of our official charter was unanimously adopted. Changes included broadening our focus beyond electrical safety and published standards. This change reflects the increasing importance of product and system safety across many disciplines represented within the IEEE. I will report details in the next PSN issue.

An ambitious proposal for the 1994 EMC Symposium commits the PSTC to sponsor a formal paper session, either with or in lieu of a workshop. This plan involves development of something that has been in short supply: presentation grade papers on product safety topics. I believe the readers of this newsletter, participants in PSTC activities and even product safety professionals not yet affiliated with the PSTC, have a lot to offer. You should seriously consider doing work that would culminate in peer-reviewed papers covering current, even leading-edge, developments in product safety.

I strongly encourage each of you to consider what presentation you might make - but don't delay too long in consideration. The "call for papers" has been made [see below] and initial abstracts are due before long. We can't have a paper session without papers, so be bold and give it a serious shot! If you need additional information, please give me a call at 510-659-6574 or fax me at 510-659-68852. ❑

IEEE 1994 INTERNATIONAL SYMPOSIUM ON ELECTROMAGNETIC COMPATIBILITY
August 22 - 26, 1994, Chicago, Illinois
1994 CALL FOR PAPERS

The IEEE EMC Society seeks original, unpublished papers on all aspects of EMC including, but not limited to, the following technical areas:

Filters, ESD, Med/Biological Effects,
Standards & Regulations, Test Sites,
PRODUCT SAFETY

Paper formats:
Formal paper with 20 minute presentation, or Poster paper with informal presentation (limit 6 pages)

Author's schedule:
November 5, 1993 – Abstract and 500-700 word summary (with up to 5 illustrations)
January 15, 1994 – Notification of acceptance
March 1, 1994 – Camera-ready copy

NOTE: Submit 3 copies of summary and abstract. Prospective authors should submit abstract and summary outlining their contribution, its originality, and its relevance to an area of EMC [or Product Safety].

Please indicate the desired format of the paper, formal presentation or poster. Poster papers will be displayed for several hours with the author present to make informal presentations and answer questions. Promotional and commercial presentations are not acceptable either in poster or regular sessions. For those papers accepted, the author will receive an author's kit for preparing the manuscript for the symposium record.

Advance symposium registration will be required for all authors at time of submission of camera-ready copy. Abstract and summary should be sent to: Dr. Clifford Kraft AT&T Bell Laboratories Room IH 2B-222 2000 N. Naperville Road Naperville, IL 60566 ❑

IEC 364-4-41
Protection Against Electric Shock

a review by Peter E. Perkins, PE

No one ever expects to be shocked by a piece of electrical equipment. Electric shock protection is a real issue; it does not just happen as a by-product of equipment design. In the end, the engineering community needs to understand the range of choices available in providing electric shock protection. The protection coverage and alternatives, as laid out by IEC 364-4-41, are presented here to develop that understanding.

The traditional approach of evaluating the product near the end of the design process has been to let the safety lab engineer tell the designer where the product fails to meet the requirements, without acting as a product design consultant. This method does nothing to transfer knowledge of basic practice or alternatives available to the designer. The better approach of understanding the basics provides this information to the engineering community at the design level which should provide better products in a more cost effective way since the designer can make the cost performance trade-offs early in the design while it is inexpensive to change.

The fundamental requirements are:

1) **Electric shock protection is essential in design of equipment.**
The danger of electrical shock is commonly known; anecdotal stories are commonplace, stories of serious (usually fatal) shocks are carried in the daily press. Protection of the user from hazards is a concept from common law. We are marrying the technical and legal concepts here, protection must be provided from hazardous electric shocks.

2) **Protection must be provided in both normal operation and under fault conditions.**
The user would not expect a shock under conditions of normal use. A thorough safety evaluation of the equipment at the design stage will verify whether or not a shock hazard is present. A good strategy, being used more and more today, is to keep the equipment voltage below that deemed hazardous, usually 50V or so. The use of small wall mounted, low voltage power sources is the most obvious solution. Under fault conditions, which are not usually obvious, the equipment may appear to be operable and may be put into service. A shock is not desired or permitted under these conditions either. Safety evaluation usually introduces faults and checks for fault voltages or leakage currents.

3) **Basic protection from direct contact must be provided under normal service.**
Some form of protection must be supplied to keep the user from contacting dangerous voltages or high leakage current from conductive surfaces. The usual insulation found on wiring is the most common form of basic protection, although barriers and obstacles, etc. may be used. Insulation is preferred in that it usually can only be removed by destruction, rather than some deliberate circumvention of a barrier.

4) **Protection from indirect contact must be provided in case of any fault.**
Protection from indirect contact usually includes automatic disconnection of the supply (which requires equipotential bonding to earth), double insulation of the product, a completely non-conducting

location, use of an earth-free local equipotential bonding, or electrical separation from the remainder of the electrical system.

To summarize, there are two overlapping sets of conditions under which protection must be provided. Protection against electric shock is needed in both normal operating conditions and under fault conditions. Protection needs to be provided for both direct contact and indirect contact.

Electric shock is an insidious hazard; it cannot be seen, it comes as a surprise. The user is unaware that the hazard exists. Protection needs to be provided at all times, even if the equipment is not working properly.

Since there are no warning signs, a person can be severely shocked, or even killed, from equipment that does not provide proper protection. Remember, a killer shock happens in a very short time period - a fraction of a heartbeat. This period is so short, that it is instantaneous from a human point of view. We cannot react fast enough to avoid the consequences.

Almost everyone has had an electric shock. The most frequent case comes from walking across a rug and building up an electrostatic charge that sparks to the doorknob as you reach out to open the door.

This coordinated approach is not obvious from looking at equipment. Every product safety engineer needs an understanding of this basic information. Let's look at them.

There are many ways to provide protection for the user. These range from insulating parts to barriers to placing the energized part out of reach. Additionally, the use of Ground Fault Circuit Interrupters (GFCI's; also known as ELCB's - or Earth Leakage Circuit Breakers - in Europe) quickly limit the current flowing in a fault.

These common sense approaches are carefully outlined in IEC 364-4-41, Protection against Electric Shock. They have provided this organized framework for us. Although the safety of equipment is essential, the basics - such as described here - are not taught in any formal course at the technician or engineering school level. This material is presented to bring it to the attention of engineering staff in order that they can design safe products.

Everyone believes that equipment should be safe. The specific knowledge as to how to design and manufacture safe equipment has not been widely disseminated. Fortunately, the IEC has had the foresight to develop this information and make it available through this standard.

Although the requirements stem from good sense, the specifics are not obvious. Safety of products is an engineering discipline and requires some study and experience to do it well. This review of these basics, as applied to electric shock protection, is part of that learning.

There are so many different components and assembly techniques that the application of good practice has a lot of variations in it. Here in the US, we are used to using UL standards for components and equipment. UL does not have a published comprehensive, basic description of the protection schemes as found in the IEC. Therefore perusing one piece of equipment will not derrive the broad set of requirements.

Fortunately, the IEC has brought together much of the 100 years of experience with electrical protection in their standards. The delineation of these methods of protection against electric shock in IEC 364-4-41 shows the full range of methods available for use.

Here is a comprehensive review of protection against electric shock as presented by the IEC. Hopefully, as a professional group, we can influence other technical safety requirements, such as those of UL and CSA, to soundly build from the basics on a worldwide basis.

The professional product safety community wants sound information that will help them in their task of seeing that safe equipment is provided by their company. Test lab engineers want to be knowledgeable as they review and certify equipment. Safety standards writers, both from industry and test houses, want a sound basis from which to develop their standards.

Businesses today recognize their responsibility to provide safe equipment. Product liability demands it; cities and states require it; OSHA demands it. The EC is demanding demonstrably safe products in their 1992 thrust. Each business' well organized effort, accompanying knowledgeable product safety engineering staff, are the foundation for meeting these safety requirements.

Protection from electric shock is a basic requirement for all electrical installations and electrical equipment. The IEC has a well coordinated approach to providing protection. Understanding this basis is fundamental to the work of the product safety engineer.

Product Safety Engineers, as professional employees are just beginning to develop as a discipline in the US. Training in the fundamentals is meager, in my experience. This discussion of one basic aspect sets a cornerstone for growth and development.

All of this information comes from IEC 364 Part 4, Chapter 41 Protection Against Electric Shock.

IEC 364-4-41 is the background material for this discussion. Each engineer responsible for the safety of products should have this standard as part of their resource library. It is one of the IEC's basic safety standards. It is available from either ANSI in the US or the IEC office in Geneva.

Understanding this logical approach gives the product safety engineer a spectrum of tools to deal with any electric shock protection issue that arises in equipment evaluation.

Basic protection, against direct contact can be provided by any of the following ways: insulation of live parts, use of barriers or enclosures, use of obstacles, placing hazardous voltages out of reach, or use of residual current devices (GFCI's). Protection in case of a fault, against indirect contact, can be provided by: automatic disconnection of the supply, double insulation of equipment, use of a non conducting location, use of local equipotential bonding, or providing electrical separation from other voltages.

This logical approach to electric shock protection is well done. It is the foundation for a series of related topics; protection from electric shock, then effects of electric current on the human body and finally, measurement of touch current and protective conductor current.

The application of these principles across component and equipment lines needs to be more broadly understood. The application of these principles to components, from capacitors to complex filters or laser isolators should be done in a uniform way. It not clear that this has been done, especially here in North America.

One of our goals is to broaden the base of knowledgeable engineers in this business. This is good for our business and for our profession. The professional development of product safety engineers is in its infancy. Each one of us in this profession has a responsibility to build up the professional reputation of product safety engineering. Having a better understanding of the basic concepts enhances our reputation. Product safety engineering has been a closet discipline for most of the last 100 years, locked up in the inner sanctums of a few test houses and safety standard committees. It's a wonder that it has taken this long to begin to develop product safety as an engineering discipline. The public cry for accountability, as evidenced by the changes in the liability of manufacturers over the last 25 years, has pushed this professional discipline ahead - usually unprepared. Here is a small step in that preparation. o

Electronic Standards
Continued From page 4

facturers seeking product certification. They would result in saving time and money as well as increasing productivity.

Paper-based processes and systems no longer adequately address the needs of today's environment, in which manufacturers are dealing with global markets, high-level industry competition, a decreasing employee base, and the need for immediate access to information. A new approach to effectively accessing large volumes of product standards information - at any time and in any place - is needed. The new approach which meets this tremendous industry need is that of electronic standards. Electronic standards are a technological solution to the critical problem of the effective transfer and use of large volumes of information. Electronic standards increase productivity by improving the management of the standards certification process, decreasing the probability of failed product submittals, shortening product time-to-market and improving access to standards updates.

Understanding standards can be difficult for non-experts. Electronic standards address this issue by providing information to users in an easy to understand format, using features such as appropriate keywords and hypertext capabilities. Simple menu-driven, point-and-click graphical user-interfaces, in conjunction with features such as modules allowing users to pull up any section of a standard at will, provide significant advantages over paper standards.

Electronic standards have product features such as accurate and comprehensive information, instantaneous and flexible search-and-retrieval mechanisms, and timely updates. A comprehensive electronic format includes exact replications of the standards (full text, tables, graphs, and figures), has sophisticated search capabilities and has the ability for information to be shared among multiple staff members. Manufacturers should be able to pick and choose the standards appropriate to their products and to obtain those standards in electronic form. Finally, a user-friendly graphics environment (such as Windows or Macintosh OS, etc) provide a flexibility and ease-of-use to manufacturers which has been unavailable. Electronic standards meeting the above specifications will meet the critical product certification process needs in the most effective manner.

Although large manufacturers typically have a distinct department that handles all product certifications, they still face delays in bringing products to market. Large manufacturers can use electronic standards during the product design process as a quick, easy reference for product designers to reduce the need for costly product changes after design and development completion. For small- and medium-sized companies, an in-house product certification staff typically is cost-prohibitive. Therefore, a design or manufacturing engineer likely has product certification responsibility in addition to other duties. This individual may not be familiar with all certification specifications. This can lead to costly product changes and time delays for the manufacturer. It is evident that the user base for electronic standards covers virtually all organizations that regularly use standards. Private companies (from small to large), government agencies, universities, libraries, and standards developers are all candidates for the use of electronic standards because all these entities must deal with the effective transfer and use of large volumes of information and are looking for ways to increase productivity while saving time and money.

Underwriters Laboratories Inc. (UL) is one organization currently involved in the move toward electronic standards. UL's license agreements with companies such as Expert Application Systems, Inc. (individual standards on floppy disks) and Information Handling Services (bulk standards on CD-ROM) allow for the effective transfer and use of large volumes of information at considerable manpower and cost savings. Other standards organizations, including the American Society for Quality Control and the Canadian Standards Association, are currently evaluating the feasibility and viability of individual standard, PC-based Windows products for their standards.

Organizations including IBM Corporation, Dell Computer Corporation, National Instruments, and Underwriters Laboratories are currently using a PC-based, Windows environment electronic standard for the UL 1950 standard. These organizations appear to be realizing benefits of use such as increased productivity, improved management of the standards certification process, decreased probability of failed product submittals, manpower and cost savings, and shortened product time-to-market. Based on the feedback from these users and the realization that electronic standards represent the future direction for the development, production, and delivery of standards and standards-related information, numerous other companies are evaluating the use of such products in their design and development processes.

In summary, electronic standards represent a tremendous step forward in solving the problem of effectively transferring and using large volumes of intricate standards information. The increases in productivity generated by these electronic standards, as well as the manpower and cost savings they provide, allow for increased competitiveness on the part of manufacturers making use of them. Finally, the interest expressed by standards organizations in electronic standards suggests they soon will be the format-of-choice for producing and delivering standards.

[*Patricia Mack works for Expert Application Systems, Inc. (EASI) in Austin, TX. EASI develops user-friendly software programs which facilitate the effective transfer of large volumes of information through the automation of product standards. These programs enhance the users' ability to retrieve information contained within the standards and can help simplify the product certification process. "EASI Solutions - UL 1950", a PC-based software program developed for the Windows environment which automates the UL 1950 standard, is currently available from EASI. For a free demo disk, or for additional information on the product, contact EASI at 512-338-9773 (Voice) or 512-794-9997 (Fax).*] ❑

Impedance Tests
Continued From page 5

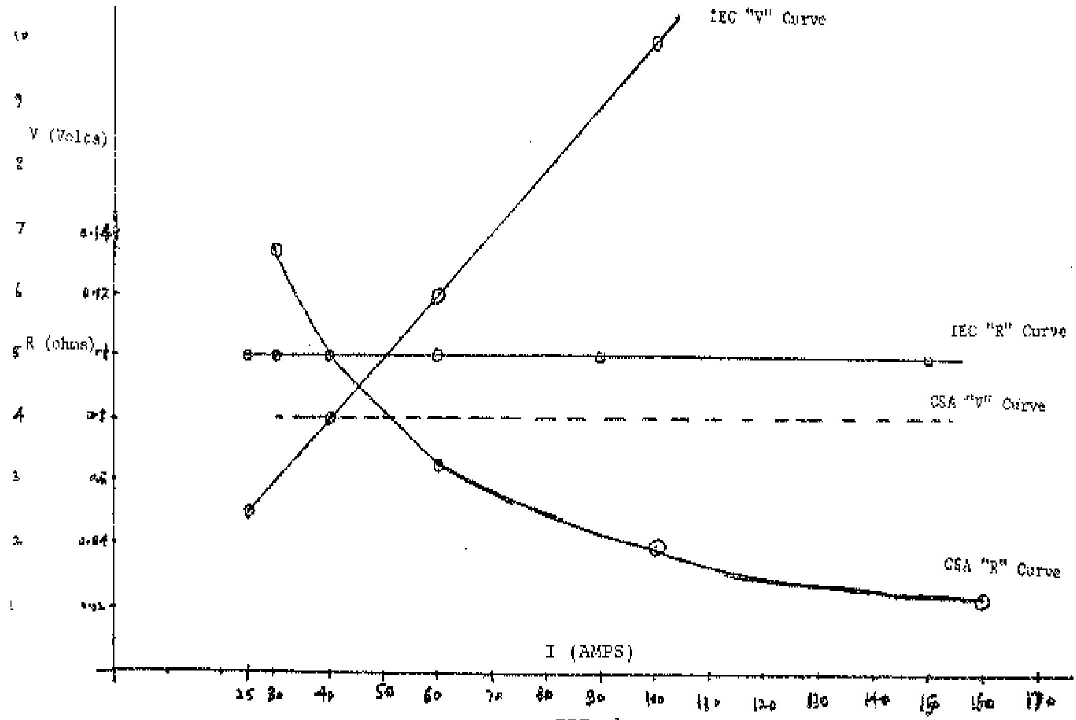


FIG. 1
RESISTANCE AND VOLTAGE CURVES

equipment is located indoors in a dry, non-hazardous location. The voltage that develops between a conductive metal surface of the equipment and the supply system earthing terminal can exceed 30V rms for the duration of a fault, depending upon the total impedance of the earthing circuit, but the branch circuit overcurrent device should open the circuit in the meantime. The major concern is that the potential drop that appears between the conductive exposed metal parts and the supply system earthing terminal must not exceed 30V rms when a fault occurs.

If the impedance of a bond is assumed to be 0 ohm (i.e. a good earth path), then the supply voltage will distribute itself equally between the line and the earth conductor, in case of a fault (ie 60V across the phase conductor and 60V across the earth conductor for a 120V system. See Figures 2A and 2B. This 60V presents a shock hazard to anyone touching an exposed conductive part that has been connected to the equipment earthing terminal. The overcurrent protective device provided in the branch circuit or in the equipment ideally should open in a very short time under these conditions. If the person using the product is standing on an insulated surface, the 60V should not cause excessive leakage current to flow

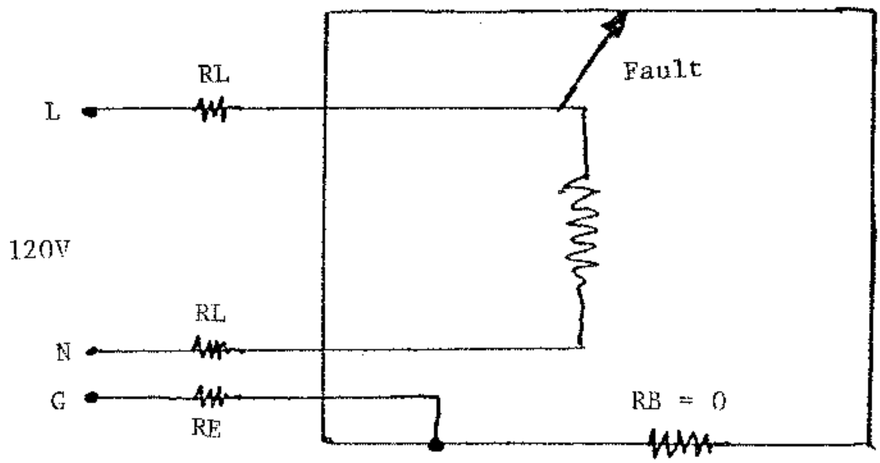


FIG 2A Ideal Earth Path (Zero Bond Resistance)

through his/her body. Outdoor equipment may be provided with larger size earth conductors so as to allow a higher current flow under fault conditions that will cause the overcurrent device to trip almost instantaneously. In smaller indoor equipment it may take more time for the overcurrent device to trip depending on the characteristics of the overcurrent device that is used.

The rationale for bonding different exposed conductive surfaces to a common equipment earthing terminal is based on protecting a person from receiving a shock when two different parts of the same equipment are touched at the same time. The two parts may be an exposed non-current-carrying metal part and the earthing terminal in the equipment, or two adjacent non-current-carrying exposed metal parts that are each bonded to the earthing terminal. In either situation the potential difference must not exceed 30V under fault conditions.

Let us take various cases and analyze them. The following three assumptions are made:
1. A building installation is designed to allow no more than 5% voltage drop at maximum rated current.

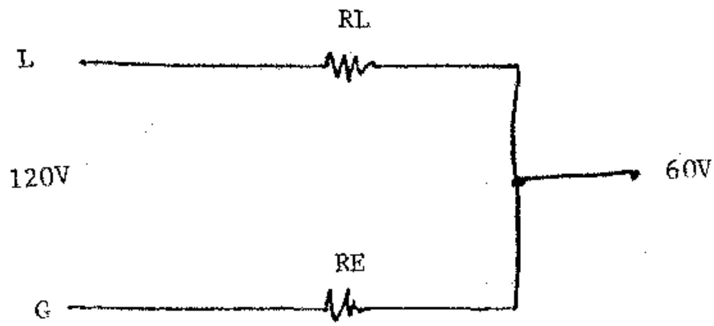


FIG 2B Ideal Earth Path Under Fault Condition

2. The impedance of the phase conductor is equal to the impedance of the neutral conductor which is equal to the impedance of the protective earth conductor.
3. The max current capability of the source is 1000A (for 120V system).

120V System With 15A Overcurrent Protector: (See Figs 3A and 3B).
Overcurrent Protective device rating = 15A
Source resistance (RS) = 120V/1000A = 0.12 Ω.
Voltage drop across the phase conductor = 1/2 x 1/100 x 120 = 3V
Phase conductor resistance (RL) = 3V/15A = 0.2 Ω.
Earthing conductor impedance (RE) = 0.2 Ω.
Resistance of a 6 foot length of No 18 AWG conductor (RP) = 0.038 Ω.
Voltage drop allowed from earthing terminal to bonded exposed conductive surface = 4V.
Bond resistance RB = 4V/30A = 0.133 Ω.
Total resistance = RS + RL + RP + RB + RP + RE (0.729 Ω).
Max current which can flow under fault = 125V/0.729Ω = 171.5A.

In actual practice the contact resistance of the attachment plug and other connectors may offer additional resistance.

For permanently connected equipment, resistance RP = 0Ω.
Max current possible for permanently connected equipment = 125V/0.653Ω = 191A.
Again, for a best possible earth path resistance, RB = 0Ω
Max current which can flow under fault = 125V/0.52Ω = 240A
That means that under a fault condition max current

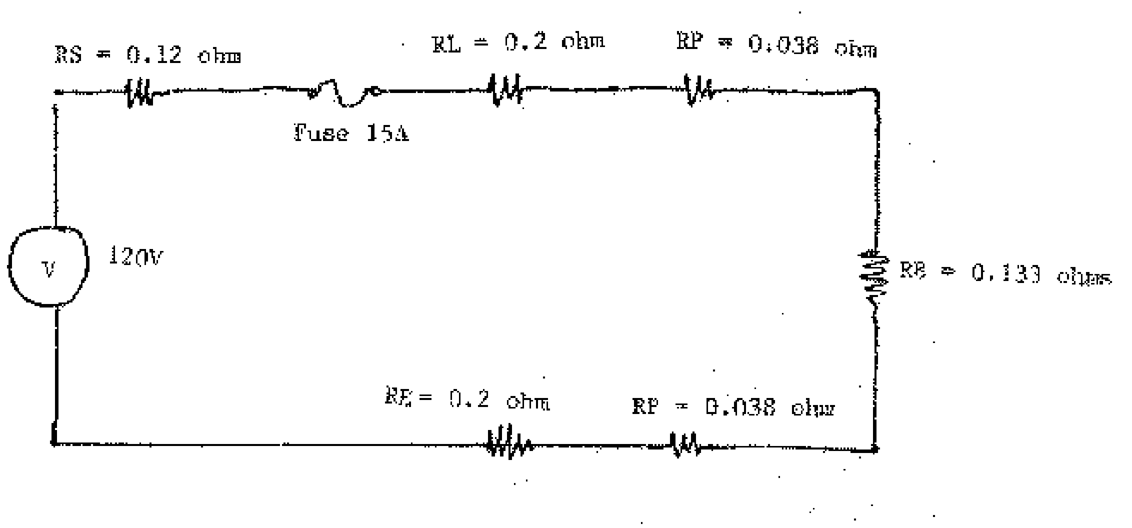


FIG 3A 120V System With Overcurrent Protection

through the earth path can be 171.5 to 240A.

Voltage drop (VB) across the earth path = 22.8 to 25.4V (for 171.5 to l91A fault current). When the bond resistance RB is less than 0.133 Ω then current increases but, the voltage drop VB may decrease as the earth path resistance becomes less, (e.g. if RB = 0.1 Ω, then max voltage drop will be 20V).
So we have to consider only the worst case when RB = 0.133Ω.

<u>120V System With 30A Overcurrent Protector</u>:
Here RS remains the same.
RL = RE = 3V/30A = 0.1Ω.
RB = 4A/60V = 0 . 0667 Ω.
Total resistance = 0.12Ω + 0.1Ω + 0.1Ω. + 0.0667Ω. = 0.3867 Ω.
Max current = 125V/0.3867Ω = 323.25A.
VB = 323.25A x 0.0667 Ω = 21.56V.

<u>120V System With 50A Overcurrent Protector</u>:
Here RS remains the same.
RL = RE = 3V/50A = 0. 06 Ω.
RB = 4V/100A = 0.04 Ω
Total resistance for permanently connected equipment = 0.12Ω + 0.06Ω + 0.06Ω + 0.04Ω = 0.28 Ω
Max current = 125V/0.28Ω = 446A
VB - 446A x 0.04Ω = 17.85V
Let us now perform the same calculations where we allow a 12.5V drop (new proposal to IEC 950) across the bond instead of a 4V drop.

<u>120V System, 15A Overcurrent Protector, 12.5V Drop</u>:
RB = 12.5V/30A = 0.416 Ω
Max current = 125V/(0.52Ω +0.416Ω) = 125V/0.936Ω = 133.6A.
Voltage drop VB = 133.6A x 0.416Ω = 55.6V
This voltage is much higher than 30V so we cannot

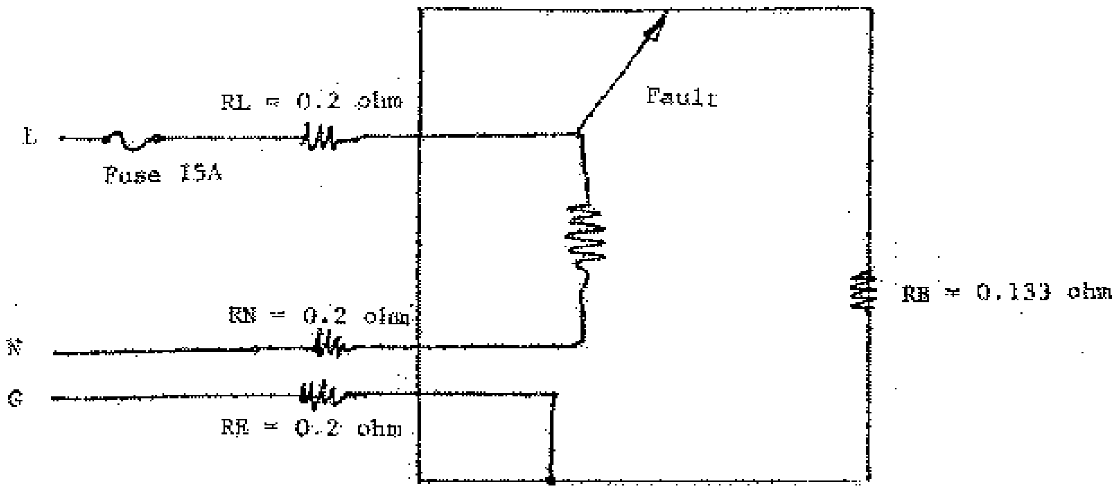


FIG 3B
120V System - Permanently Connected Equipment
(Where Rp = 0)

permit a 12.5V drop across the bond.

<u>120V System, 30A Overcurrent Protector. 12.5V drop</u>:
RB = 12.5V/60A = 0.2083 Ω.
Total resistance = 0.12Ω + 0.1Ω + 0.1Ω + 0.2083Ω = 0.5483 Ω.
VB = 29.76V

<u>120V System. With 50A Overcurrent Protector</u>:
RB = 0.1 ý
Total resistance = 0.12Ω + 0.06Ω + 0.06Ω + 0.1Ω = 0.34 Ω
Max current = 125V/0.34Ω = 367.6A
VB = 36.7V
Here the voltage drop across the earth path exceeds 30V and we cannot accept 0.1 ý impedance criterion used by IEC.

Our only concern here will be that according to the fuse or circuit breaker specification, for a 50A overcurrent protective device, it could take up to two minutes for this device to open if the fault current was 100A. Actual fault current may be higher. A 6 foot length of No 18 AWG conductor has a resistance of approx 0.038 ohm which will pass the 0.1 ohm criterion and 25A test but if 100A flows for two minutes, the 18 AWG conductor may open circuit before the overcurrent device operates, causing the full potential to appear at the accessible point. So if the IEC standard is modified to require the earth and bonding conductors to be of the same size as the phase conductor and resistance of the bond not to exceed 0.1 ohm, we will have less than 30V available between the accessible point and earthing terminal under the fault condition.

Also, don't forget the power dissipation across the bond even though it is for a short duration.

For 15A Protective Device:
Power = $I^2R = 191^2$ A x 0.133Ω = 4.852kW (according to CSA Standard C22.2 No. 0.4)
and = 201^2A x 0.1 Ω = 4.04kW (according to IEC 950)

For 50A Protective Device:
Power = $I^2R = 446^2$ A x 0.04Ω = 7.956kW (according to CSA Standard C22.2 No. 0.4)
and = 367.6^2 A x 0.1Ω = 14.175 kW (according to IEC 950)

Limited Short Circuit Test
Clause 4.3 of CSA Standard C22.2 No 0.4 describes a limited short circuit test that is performed to assure that the fault capacity of an earth path is adequate. The test circuit capacity depends upon the nominal voltage rating of the equipment, whether the equipment is single-phase or three phase, and the rated full load amperes. An overcurrent device of the rating required for the equipment is connected in series with the earth path being tested. Providing there is no insulation damage, open circuiting of the earth path, or emission of molten metal from the equipment as a result of this test, the earth path is considered to be adequate.

Earth Continuity Test: Clause 4.2 of CSA Standard C22.2 No 0.4, describes a continuity test that can be performed as a production line test if there is any doubt that an earthing connection may be ineffective, such as in the case of earthing by means of a quick-connect connector or where the connection may be damaged by handling. A current of 1 amp is passed through the earth path. The presence of current will also ensure that there is no cold solder in the earth path which would otherwise show continuity when checked by using ordinary ohmmeter. ❑

Letters to the Editor
Continued From page 3

A question was also raised about why some UL standards require the attachment plug be rated not less than 125 percent of the marked current rating of the product. UL states in the Guide Information for Circuit Breakers that unless otherwise marked, circuit breakers should not be loaded to exceed 80 percent of their current rating, where in normal operation the load will continue for three hours or more. The NEC addresses this concern in Sections 210-21 and 210-22. Therefore, products that operate in normal use for three hours or more at their marked current rating are limited to 80 percent of the branch circuit rating (the attachment plug must be 125 percent of the marked current rating). This limitation is made on a category by category basis, depending on the type of product and its intended use.

UL 1950, the Standard for Information Technology Equipment, the decision was made to assume that all products could be run continuously. However, most cord connected ITE products have a marked current rating of less than 12 amperes (80 percent of 15 amperes) and therefore a 15 ampere attachment plug is sufficient.

It should be noted that although we can ensure that the connection of a single cord connection product to a branch circuit will not cause the branch circuit overcurrent device to operate, the connection of several cord connected products to a single branch circuit may cause this to happen. When this occurs and the branch circuit overcurrent device operates, it is assumed that the user will split the products among several branch circuits.

Robert Pollock
Senior Staff Engineer
Underwriters Laboratories Inc. ❑

Area Activities
Continued From page 7

Program: We had our best turnout so far this year! Twenty five members attended this information session. Ercel Bryant and I discussed the European CE Mark requirements. We covered the various Directives which apply to IT, Medical and Laboratory Equipment, including standards which can be used to show compliance with each Directive. Some of the Directives which you should be aware of: Low Voltage, Electromagnetic Compatibility, Machinery, Telecom, and Medical Device Directives. Please contact me at (714) 773-7977 if you would like a copy of this program.

Discussion Items:

1. *CBEMA Meeting*
2. *Job Openings*
3. *Presentations*
4. *Advertising*
5. *US Battery Disposal Laws*
6. *CSA Bulletin on IT equipment*
7. *UL's 1993 Recognized Component Directory*
8. *Michael Tam, of CSA, was also present to discuss CSA's relationships with European agencies, and their decision to utilize Authorized Testing Laboratories (ATL's) in the US.*

NORTH EAST AREA GROUP (CHICAGO)

Good News! The Chicago Area Group is starting again. I just received a fax from John R. Allen the former Chairman of the Chicago Area Group and he is interested in seeing the group become active. I should let him speak for himself. Here is the text of his fax:

What happened to Chicago?
Good question - long answer. In short, I left Mitsubishi to start PSC, got married, had a beautiful baby girl, and basically had no time to commit. Unfortunately, when I stepped down from Chairman, the Chapter seemed to come to a halt.

Today, 4 years later, I am still married (Liz is a saint), my daughter, Maria, is now 2 1/2, and PSC is busier than ever.

Although I still do not have much time to commit, I would like to see the Chicago area become active again.

Your column seems like a good place to start getting the word out. Would it be possible to ask people to contact me if they have any interest or ideas about the Chicago area?

Please note, the Newsletter has an old phone # and address for me.

Phone: 708/238-0188
Fax : 708/238-0269
605 G Country Club Dr.
Bensenville, IL 60106

Best Regards,
John R. Allen
President

Well, John, as you can see I let you do the talking. In fact I just got a fax from someone in your area, Barbara Kelkhoff from The Chamberlain Group, Inc. in Elmhurst, IL. This is exactly what this column is for, and to see another group come alive is encouraging. Please let us know how we can be of further help, and good luck!

We need to hear from you. Let us know what your group is doing and planning for this next year. If you want to start a group, contact me at the above address

Bye for now.

BTW You probably notice I do not refer to any of the local gatherings as chapters but as groups. Officially we are a technical committee and do not have the status of Society with separate Chapters. ❑

News and Notes
Continued From page 6

Dec 1993.

ANSI SAFETY CATALOG

The American National Standard Institute (ANSI) 1993 Safety and Health Catalogue has 1230 standards listed. Single copies of this index are available free by writing ANSI. Contact ANSI Customer Relations for information, (212) 642 4900.

FLAMMABILITY CLASSIFICATION

An ad hoc committee of TC 74 WG8 has prepared a July 1993 draft that addresses the relationship between temperature and risk of fire. The draft restructures clause 4 and incorporates material from clauses 5.1 and 5.4.10.

IEC 950 AMENDMENTS

Amendment 1 (1992) and Amendment 2 (1993) to IEC 950 2nd edition are available from ANSI for a charge of $29.00 and $110.00 respectively.

An unofficial compiling of TC 76 Secretariat document that may become Amendment 3 will be discussed at its next CBEMA, ESC5 meeting.

IEC NEWS

The scheduled publication of IEC825 Part 1 (Laser Safety) and Part 2 (Fiber Optics) is estimated to be available in early 1994.

The Plenary Session of TC 74 is scheduled to meet September 1994 in Niece and TC 76 in Sweden in October 1994. Exact dates are to be confirmed.

ISO 9000

The August 23, 1993 issue of Machine Design has 2 articles related to ISO 9000. The last column of the article titled "Making Sense of ISO 9000" last columns mentions the NIST (National Institute of Standards and Technology) proposed NVCASE (National Voluntary Conformity Assessment System Evaluation). This program may be required to have the UL recognized as a Notified Body in the EC. Please contact the PSN Editor if you would like further information.

The Federal Register Friday 23 July 1993, pages 39486 to 39488, is the Department of Commerce's proposal to rule for public comment for NIST to implement NVCASE. Public comments are accepted on the proposal until 6 October.

LABORATORY ACCREDITATION PROGRAM

Tuesday's 27 July Federal Register pages 40087 to 40095 has a proposed rule making for a National Voluntary Laboratory Accreditation Program (NVLAP) set up under NIST. The program is to accredit laboratories whose quality system, staff, facilities, equipment calibration protocol, records, and reports are found to meet NVLAP criteria. This certification will be made available on a cost basis to commercial, manufacturers in-house laboratories and federal, state and local governmental laboratories.

These proposed rules will use ISO documents as the basis for operation. The comment period for this proposal ends 12 October. ❑

Institutional Listings

PAUL W. HILL & ASSOCIATES, INC.
601 S.W. 4 th Street
Boca Raton, Florida 33486
(407) 368-2538

PRODUCT SAFENESS

* Seminars for Designers & Product Developers
* Design Reviews * Certification Assistance

R & L Ingenieur Consulting GmbH
Approval Service
for European Safety
and rfi-approval marks

65479 Raunheim
Germany

Phone: 01149 6142 43676
Fax: 01149 6142 41721

contact:
Dipl. Ing. (FH)
Helmut Landeck
(VDE)

15 years experience in product safety consulting inhouse seminars and prototype evaluations.

CE

MET

MET Laboratories, Inc.
The First Nationally Recognized Testing Laboratory Licensed by OSHA
914 W. Patapsco Avenue, Baltimore, MD 21230-3432
(410) 354-3300 (800) 638-6057 FAX (410) 354-3313
NCB Laboratory for Global Certification

MET is the test laboratory for listing, labeling and certification that works with you, for you.

NRTL - CSA - FCC - DOC

EASI SOLUTIONS - UL 1950

EASI

Expert Application Systems, Inc.
8920 Business Park Drive, Suite 377
Austin, TX 78759
(512) 338-9773 (512) 794-9997 (FAX)

CALL TODAY FOR YOUR FREE DEMO DISK OF EASI SOLUTIONS - UL 1950

SOFTWARE FOR STANDARDS

Accessibility & Safety Test Probes
precision made in the U.S.
by
Ergonomics Inc.

Most complete selection of probes
to meet IEC, ISO9000, UL and industry standards
Examples: articulated finger, telecom probes, coin and jewelry probes
Available in kits or individually
For brochure: call 215-357-5124 or fax 215-364-7582
Address: Box 964, Southampton, PA 18966

Worldwide Telecommunication Design Assitance and Agency Submittal

PATTON & ASSOCIATES INC.

4718 W. EL CAMINITO DR
GLENDALE, ARIZONA 85302
TEL (602) 934-5458 – FAX (602) 242-7700

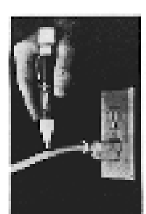
ETL
SINCE 1896

Inchcape
Testing
Services

DAWNA M. URLAKIS
REGIONAL SALES MANAGER

ETL Testing Laboratories, Inc.

260 East Grand Ave. #38 • South San Francisco, CA 94080 • Telephone 415-871-1414
FAX 415-873-7357



FOR LOCATING
Engergized Circuits, Defective Grounds & Induced Voltage
SANTRONICS AC SENSOR
Part # 3115
* 100% American Made
* UL Listed

See Your Safety Products Distributor

SANTRONICS, INC.
P.O. Box 192, Sanford, NC 27331-0192

We are grateful for the assistance given by these firms and invite application for Institutional Listings from other firms interested in the product safety field. An Institutional Listing recognizes contributions to support publication of the Product Safety Newsletter of the IEEE EMC Society Product Safety Technical Committee. Please direct inquiries to:

Ervin Gomez at (408) 447-4070 (phone) or (408) 257-5034 (fax)

Volunteer Needed

Silicon Valley

Distribution Manager. Affix mailing labels and deliver approximately 1000 copies of the PSN to the post office every other month. Contact Editor.

Your Listing Here?

The Product Safety Newsletter

c/o Tandem Computers Incorporated
10300 North Tantau Avenue, Loc 55-53
Cupertino, CA 95014
Attn: Roger Volgstadt

BULK RATE
U.S. POSTAGE PAID
CUPERTINO, CA
PERMIT NO. 138

ADDRESS CORRECTION REQUESTED

Employment Wanted

As a free service to our readers, the Product Safety Newsletter will periodically list Regulatory Compliance professionals who are available for employment. Those with employment opportunities are encouraged to contact the following individuals directly. Those interested in listing their names should contact the Editor.

Seeking employment as a Regulatory Engineer:

Mariano Fe de Leon
Gilroy, CA
(408) 848 3851