

The



EMC  
SOCIETY

# Product Safety Newsletter

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## Area Activities

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### GROWTH

How to achieve it and sustain it? We all want our local groups to grow and to be successful, but what are we doing to accomplish this? I firmly believe we can not achieve the goal of growing the local groups unless they are helping their members to be better at their profession (notice I did not use the word "empower", or some other trendy phrase....I hate that stuff) .

How can this column help? It can go beyond reporting what happened at the most recent meeting of the Central Texas Group, or the biography of the Santa Clara Valley Group's last speaker. Not that the meet-

ings are not worth reporting, but I think you want something more. You can't have growth without change.

My first attempt at change is going to be a bit of a survey. Please write back to me and share your thoughts, ideas, gripes, whatever about your meetings (too technical, not technical enough, subjects you wish they would cover) and I'll publish your remarks. Let me know if you want to remain anonymous and I'll give you a fake name or whatever. But write me....

I would also like to publish topics and speakers for your future meetings for a three month period. I will be sending you a quick form to fill out. By filling out this form you will help me to highlight your Group's activities. Look for it in the mail soon!

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# The Product Safety Newsletter

*The Product Safety Newsletter* is published bimonthly by the Product Safety Technical Committee of the IEEE EMC Society. No part of this newsletter may be reproduced without written permission of the authors. All rights to the articles remain with the authors.

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# Letters to the Editor



*[We hear a lot about the Regulatory changes in Europe and North America, and information is arriving about new requirements in places like Mexico and South Korea. Here is a glimpse of what is happening in the People's Republic of China. I expect that keeping in touch with product safety developments in the rest of the world can be more difficult for Yan Yumin than for most of our readers. If you would like to help him by sending him reference materials his address is: Yan Yumin, North China Institute of Computing Technology, Box 619, Beijing 100083, The People's Republic of China. — Ed.]*

Thank you very much for your Newsletters and friendship. In fact, I am very interested in electrical/electronic product safety, precisely because of this point I am very also interested in your PS Newsletters and it is sincerely hoped that we will keep close in contact with each other for our undertaking of common

interest.

Now, I am trying to introduce our working situation about safety standard for IEC950 (=GB4943 [Standard in PR of China - Ed.]) to your Newsletters.

1. At present, I and several other safety engineers have been writing a Recommended Practices Guide that means how to carry out safety standard IEC950 "Safety of information technology equipment including electrical business equipment", and that index is as follows:

(1) General:

To state the production and development about IEC950, and how did it harmonize IEC435 with IEC380, and relationship between UL1950, ECMA129, EN60950, CSA950, and so on, and IEC950.

(2) General technical requirements (some basic concepts), to interpret as follows:

- \* Scope of this standard
- \* Definitions concerned (for example, electrical shock, electrical shock protection and its classification, accessibility, insulation system and insulation classification, leakage, working voltage, tracking, safety isolating transformation, type test, and so on)
- \* General requirements
- \* Components
- \* Tests

(3) Safety design and check, to interpret and require as follows:

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# Changes to CE Marking Requirements

by Richard Hughes

**A**fter many years of waiting, the European Community legislation intended to harmonise requirements for CE Marking (previously called the CE Mark) has now been published in the Official Journal of the European Community. Has the wait been worth it? Read on....

First some history.... It all started with a concept; to provide all government inspectors (customs, consumer protection, workplace safety, etc.) in all Member States, with a method of easily identifying those products that comply with product specific EC Directives. Hence, the CE Mark (as it was called then) was born. Unfortunately, the exact parameters that characterised the CE Mark were not written down (at least, not in a way that was transparent to all). This did not prevent the CE Mark from being incorporated into a number of “new approach” directives; many seemed to have the odd ‘embellishment’ that made the CE Mark different from before. It became clear that legislation was needed to remove anomalies in existing directives and lay down a common framework for the future and that is what has just been published.

Two documents have been published:

## **93/68/EEC**

### **CE Marking Directive**

This *Directive* is intended for Member States (eg, national governments within the EC). Detailed modifications aimed at reducing differences in CE Marking requirements across 12 named Directives are described. Each Member State has to modify their existing (or planned) laws that implement the named Directives.

## **93/465/EEC**

### **CE Marking Decision**

This *Decision* is intended for the European Commission. It details requirements to be included in future “new approach” Directives, the intent being to ensure consistent requirements regarding CE Marking. It replaces the existing “modular approach” Decision (90/683/EEC).

Directives are not directly binding on companies or individuals; they are instructions to the 12 Member States of the EC to implement national legislation. The implementation date for 93/68/EEC is 1 January 1995, with a transition period that extends to 1 January 1997.

As mentioned previously, the fitting of a single CE Marking indicates compliance with *all* applicable CE Marking Directives. Sometimes, Directives requiring the CE Marking include a transition period; within this period a manufacturer has the choice of either (i) complying with the harmonised requirements of that Directive (and so fit the CE Marking) or (ii) complying with the existing national legislation in each Member State (and so not fit the CE Marking). Where equipment is covered by one or more such Directives it is necessary to supply information detailing which Directives the CE Marking refers to. Such information must be given in the documents, notices or instructions required by the Directives and accompanying the equipment.

Of the 12 Directives listed in 93/68/EEC, the following Directives do/may affect the IT industry:

i) 73/23/EEC

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# Technically Speaking



by Richard Nute  
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## LEAKAGE CURRENT MEASURING CIRCUITS

A colleague asks "As you know, the leakage current test in the 950 based standards requires measuring leakage current in single phase equipment to line and neutral, rather than to a ground conductor. Is this done because earth and neutral are the same at the distribution panel and this is the way Europe did it, so the US/Canada just followed along?"

The leakage current measuring circuits in IEC 950 and those in North America are **EXACTLY THE SAME**.

The difference between measuring circuits is the point in the measuring circuit that is connected to

ground.

Since only one point of the leakage current measuring circuit is connected to ground, there can be no current from the circuit to ground. Therefore, the grounded point of the leakage current measuring circuit plays no part in the leakage current measurement, is arbitrary, and even is unnecessary.

In the North American circuit, the grounded point is the supply side of the leakage current meter. This was chosen to make the measurement setup both simple and convenient.

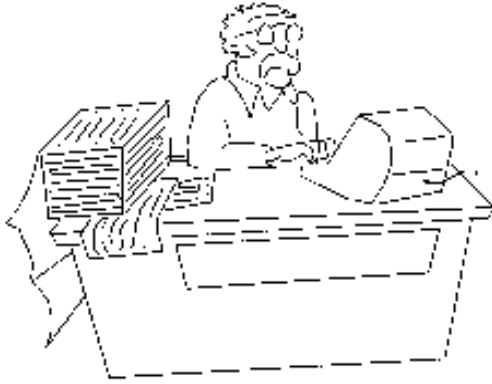
In the IEC circuit, the grounded point is the EUT (Equipment Under Test) side of the leakage current meter. This was chosen to protect test personnel and to have one measuring circuit for measuring leakage current from all the various supply distribution schemes, TN, TT, and IT, and to be independent of whether the supply is polarized at the plug. (Refer to IEC 950, Sub-clause 1.2.12 for definitions of TN, TT, and IT.) Refer to IEC 950, Figures 13 and G1.

In North America, the leakage current meter is inserted in series with the protective grounding conductor. The neutral conductor remains connected to ground. Because the leakage current meter is a 1500-ohm resistance in the protective conductor, the EUT is not grounded during the test, and could be hazardous to the personnel in the test area. This is the situation of the ground being on the supply side of the leakage current meter.

In IEC 950, the leakage current meter is connected in series with the "neutral" grounding connection. (It

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# News and Notes



by Dave Edmunds  
fax: (716) 422-6449

The following information is reprinted with permission from *The Center Report*, a newsletter published by the Center for Office Technology, 1800 N. Kent Street, Suite 1160, Rosslyn, VA 22209.

## **California Appeals Court Upholds Ruling Voiding San Francisco VDT Law**

On August 8, 1993, a unanimous three-judge panel of the State of California Court of Appeals First Appellate District upheld a lower court decision that the San Francisco VDT law, as it applied to the private sector, was preempted by state law on both express and implied grounds.

Plaintiffs' counsel Jeffery Tanenbaum was thrilled by the ruling. "I believe this decision means local governments cannot impose occupational safety and health ordinances on the private sector without express approval from Cal OSHA". Unless the City of San Francisco elects to appeal the decision, this ruling

limits the coverage of the San Francisco VDT law to only City and County employees.

## **UL 1950 for Computers**

The Northbrook Office has UL Standards -on - Disk for use on a PC DOS system running Wordperfect 5.1 or later. A three disk package of UL 1950 including a 3 year subscription to changes is available for a client price of \$425.00. Contact Carol Parsin at the Northbrook Office (708) 272-8000 Ext 43331 or FAX (708) 559-1849.

## **IEC 825-2 Published**

Technical Committee 76 of the IEC has issued IEC 825 -2 dated 1993-09, titled "Safety of optical fiber communication" . "This document is available for purchase from ANSI for \$56.00. The document IEC 825, "Radiation safety of laser products, equipment classification, requirements user guide", will be numbered IEC 825 -1 in the second edition. This edition is in the process of printing.

## **Conferences**

The American National Standards Institute's (ANSI) Annual conference is scheduled for March 3-4, 1994. It will be held at the ANA Westin Hotel in Washington, DC and will address many issues of relevance to the "customers" of the voluntary standardization system. To provide input on issues you would like to see discussed, contact Jennifer Ward via fax at ANSI's headquarters in New York (212) 398-0023.

Compass 94 a conference bringing together

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# Double Insulation



by Paul W. Hill & Associates  
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*[We are grateful to the author for providing this forth installment condensed from his book "Product Safeness As A Design Parameter", 2nd Edition, 1990. The text is a registered copyright of Paul W. Hill & Associates, Inc., and is reproduced with permission. We hope to be able to provide further sections from the book in future issues of PSN. Details about the purchase of the book may be obtained by calling (407) 368 2538 - Ed.]*

**D**ouble insulation is an insulation system in which protection from electric shock is provided by two independent insulation systems. The second level of protection is called supplemental insulation, the first level being basic insulation. No earth ground is provided. Double insulation systems are called Class II and are identified by the symbol of a square within a square on the equipment rating plate.

The concept of double insulation is that accessible conductive surfaces, or dead metal parts which might become live, are insulated by both basic and supplemental insulation. When it is impractical to use supplemental insulation it is acceptable to use one robust insulation which has dielectric strength properties equivalent to supplemental insulation. A single insulation, equivalent to supplemental, is called reinforced insulation.

## **1 Design Concept.**

A double insulated system can be obtained by the following techniques:

1. Basic insulation plus supplemental insulation.
2. Reinforced insulation in situations in which supplemental insulation is not practical.
3. Spacings, creepage and clearance distances meeting the requirements for supplemental or reinforced insulation.

Since much dependence is placed on the insulation for protection from electric shock, considerable attention must be given to the preservation of insulating properties over the operational life of the equipment. Mechanical abuse, thermal excursions and aging affects on insulation are critical considerations in double insulated or Class II equipment.

## **2 Design Considerations.**

Class II equipment is required to satisfy all mechanical, materials flammability, abnormal testing and

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# The German Appliance Safety Law (GSG) (or, The CE Mark Comes - The GS Mark Stays!)

by Helmut Landeck,  
R&L Ingenieur Consulting GmbH

This article does not relate to the EMC directive 89/336 EEC which mandates (with national grandfather clauses up to December 31, 1995) the CE Marking.

The new version of the German Appliance Safety Law (GSG) was published in the [German] Federal Gazette, part I, no. 49, on October 30th, 1992. It is an amendment to the German Appliance Safety Law issued on August 13, 1979. It has been enforced since January 1, 1993.

The modifications mentioned in the amendment are done due to the harmonization development in the European Community.

Following is a short review of the new GSG. In Paragraph 2 (2a) the equipment and installations which mandate surveillance are mentioned:

1. Steam vessels
2. Pressure vessels
3. Installations handling compressed gas
4. Pipes with compressed flammable or poisonous gases, steam or liquids
5. Elevator installations
6. Electrical installations in hazardous environments
7. Installations to manufacture or handle carbonated beverages
8. Acetylene installations and calcium carbide storage
9. Installations to store, fill and move flammable liquids
10. Medical appliances

In accordance with Paragraph 11, Clause 1, special regulations apply for the above list.

Previously, components such as screws, switches, disk drive units without housing, power supply units (intended to be built in), etc. were exempt from the law. The new law, Paragraph 2b, specifies that parts of appliances and equivalent parts also require compliance.

The EC Directives for the generally recognized rules of technology (Clause 3, subclause 1) are preferred for compliance.

The GS Mark is still retained (Clause 3, subclause 4). It will be issued by an "authorized body" on request of the manufacturer or his EC representative. The "authorized body" was previously called "test institutes".

In accordance with Paragraph 3, subclause (a), products are allowed to be displayed in EC trade shows (outside the retail trade) even though they do not comply with the technical regulations as long as there is a clearly visible label which explains that the product is not for sale and can only be sold after it has been manufactured in compliance with the technical regulations.

The GS marking is required in addition to the marking requirements of the different EC Directives.

The following is the entire translation of Clause 3, subclause 4, on the ruling for the GS Mark:

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# Getting Your Product Safety and Liability Under Control By Defining "Unreasonable Risk" Up Front

by Keith Pfundstein  
KPS Technology

**T**he bad news is—it is not possible to avoid all accidents or eliminate all liability risk losses. It may not even be good business to try.

The good news is—it is both possible and practical to eliminate all “unreasonable risk” in our products. It’s good ethics—it’s what society and the courts demand—and it’s good business.

When this is done, accidents are reduced, risk of large litigation losses and punitive damages is greatly reduced, liability is controlled, and insurance made affordable.

After some 30 years of intense accident injury litigation pressure in the U.S., development of hundreds of voluntary industry safety standards, much governmental regulation, accident injury rates remain unacceptably high. Equally disturbing—the combined payment to lawyers for the plaintiff and the defense is substantially more money than the injured person receives. Obviously, our system is out of control. Years of effort to improve it with federal tort reform legislation has produced little, except perhaps loss of respect for many plaintiffs’ lawyers.

Is there a solution to the manufacturer’s dilemma while the turmoil drags on? Yes, there is. Two actions are necessary:

1. Join the growing nationwide campaign to carry the safety awareness and avoidance story to your dealers and customers. Many are deeply involved, including

a number of trade associations.

2. Find out how to define/control “unreasonable risk” up front in your own management/ design program, instead of waiting for the courts to do it for you (to you).

The first requires some inquiry and only a modest effort, often in cooperation with your trade association.

The second requires more effort, starting with a management commitment that says, “Product safety in this company is a high priority and fully integrated part of every product decision.” It is a practical business goal that is not nearly as difficult to achieve as the plaintiffs’ bar wants you to think.

Five subject areas make up a strong corporate definition of “controlling unreasonable risk”:

## **Voluntary Industry Safety Standards**

Contribute to their creation/updating, and implement a policy - “to comply with or surpass the intent of all applicable voluntary industry safety standards.” Be diligent about finding out which safety standards apply to your product(s).

## **Duty-to Warn (Safety Signs and User’s Manuals)**

Follow industry safety standards and professionalism in content and format.

Safety Signs should be part-numbered, available/

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rective” (TTED)

the “Low Voltage Directive” (LVD)

Looking at the above list, only in the case of the EMC Directive is it clear that CE Marking *may be* fitted today (for IT equipment); even then it is not *required*, due its transition period.

ii) 89/106/EEC  
the “Construction Products Directive” (CPD)

The Low Voltage Directive is the primary product safety legislation for mains powered electrical equipment (although it does overlap with the Machinery Safety in some areas, more on this later). The 20 year old LVD currently does not require the CE Marking; this will change with the implementation of the CE Marking Directive. Once the CE Marking is affixed to indicate conformance with the LVD, it will be necessary to have “Technical Documentation” that

iii) 89/336/EEC  
the “EMC Directive” (EMCD)

iv) 89/392/EEC  
the “Machinery Safety Directive” (MSD)

v) 91/263/EEC  
the “Telecommunications Terminal Equipment Di-

	LVD	MSD	CPD	EMCD	TTED
Minimum Size of 5mm waiverable?	No	Yes	No	No	No
Two digit date code required?	No	No <sup>1</sup>	Yes Year in which marking affixed	No <sup>1</sup>	No
Notified Body number required?	No	Yes & No <sup>2</sup>	Yes	No	Yes
Additional symbols?	No	No	No	No	Yes
Where marking affixed					
- Product	Yes <sup>1</sup>	Yes	Yes	Yes	Yes
- Packaging	Yes <sup>1</sup>	No	Yes	Yes	No
- Instructions for use	Yes <sup>1</sup>	No	Yes	Yes	No
- Guarantee Certificate	Yes <sup>1</sup>	No	No	Yes	No
Other Information required	None	-Type / Model - Serial No. - Name & Address of manufacture -Year of Construction <sup>1</sup>	Name / Mark of producer	None	-Type / Batch and / or Serial No. - Name of Manufacturer or Supplier

Notes:

<sup>1</sup> Indicates a change compared to original Directive

<sup>2</sup> Certain types of machinery, listed in the MSD, require approval by a Notified Body.

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would enable the conformity of the equipment to the LVD to be established. This information (or a copy thereof) must be kept within the EC for at least 10 years after the last product has been manufactured. The CE Marking Directive detail requirements for "Technical Documentation"; the list includes drawings, a list of standards complied with (eg, EN 60950 / EN 41003) and test reports (which could be the manufacturer's own data or an agency report). The Commission of the European Communities is required, by the CE Marking Decision, to report on any special problems raised by incorporation of the LVD into the CE Marking scheme (a provision no doubt included to appease those Member States who wished to see more restrictive approval requirements).

The applicability of certain Directives to IT products is currently unclear. In the case of the Machinery Directive there is some debate regarding whether this Directive covers certain types of IT Equipment with moving parts; this is because this Directive states "Where, for machinery, the risks are mainly of an electrical origin, such machinery shall be covered exclusively by Council Directive 73/23/EEC..." The Construction Products Directive covers mains wiring and may cover certain uses of IT cabling, but clear guidelines are not presently available. The Telecommunications Terminal Equipment Directive is awaiting approved Common Technical Regulations (CTRs).

Thanks to 93/68/EEC, the two letter combination "CE" will be harmonised across all Directives, but there are still many differences that remain. Clearly, the ambiguity regarding the applicability of certain Directives needs to be resolved.

See the chart on the previous page for a summary of the "new, improved, harmonized" CE Marking requirements.

*Richard Hughes is an independent consultant specialising in conformity assessment. For many years he managed the European Product Safety Laboratory at Digital Equipment Corp., Reading, England. He is a NAMAS registered assessor for electrical laboratories and is member of both IEC TC74 WG7 (responsible for the telecoms requirements in IEC 950) and WG8 (responsible for the main body of IEC 950). He may be contacted (telephone and fax) on +44 734 884521. □*

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Getting Your Product Safety...  
Continued From page 9

applied to used products when sold, and included on appropriate repair parts. Never allow a sign to substitute for a "good" design.

Manuals should address all known and reasonably foreseeable safety hazards, show all safety signs, and be readily available to dealers and to rent/lease outlets.

### **State-of-the-art**

Make a reasonable effort to understand and apply the latest available technology in design, manufacturing, and human factors. Utilize up-to-date/professional policy and control procedures in such areas as field safety modification, product literature and advertising, warranties, audits, risk analysis, and product safety committee consensus process. Meet or exceed your industry's level of modem/quality design by checking competitors' products at trade shows and by attending seminars.

### **Risk Analysis**

Corporate safety decisions made without benefit of

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some formal risk analysis procedure, and an objective committee consensus, are often suspect and hard to defend —easily challenged as self-serving, or reflecting a conflict of interest. Both accident prevention and liability control improve with a system that quantifies a hazard's importance, then buffers the plaintiffs' arguments with a quasi-legal rationale which maximizes the reduction of any unreasonable risk toward a reasonable risk level. This rationale takes a hazard/part or system failure through "the likelihood of a hazardous situation developing," then to "the likelihood of an accident," then to "the likelihood of injury," then to "the likelihood of a minor/moderate/severe injury." An admitted failure rate of, e.g., 1 in 200 products sold, might thus reduce to a potential severe injury rate of 1 in 800,000—often defensible as a reasonable risk.

### Accident Information

An understanding of the frequency and nature of user accident experience with our product promotes minimal-risk designs. Liability control is strengthened when records show that this experience (with accident investigation) is utilized by the designer and the product safety committee in recommending a particular design or action, and in documenting reasons for the choice. Serious litigation defense breakdown may occur when a plaintiff's lawyer recites a number of accident/injury episodes with our product which we are unaware of—information obtained during visits with our dealers and customers.

Manufacturers can take back the management and engineering battleground from the plaintiff's bar/courts by first, a decision to do so, then a supportive in-house effort structured on the above premise. Enhancement of a company's image, increased profitability, and a clear conscience on accident reduction are all products of such a program. □

Double Insulation  
Continued From page 7

general requirements of a Class I device. In addition, double insulated devices must satisfy certain parameters unique to Class II insulation systems, which are:

1. **Spacings.** Spacings are double those of basic insulation.
2. **Accessibility.** Parts insulated by basic insulation only must not be accessible to operators.
3. **Leakage Current.** Maximum ground leakage currents are set at 0.25 mA (one quarter of one milliampere). To make this determination the earth ground must be simulated with a metal foil wrapping of the device, metal plate, or access to interior parts by a test probe via openings.
4. **Insulation Resistance.** Standards do not always require this test for Class I devices, but do require it for double insulated Class II devices.
5. **Dielectric Strength.** Minimum dielectric strength levels are twice those for Class I devices.
6. **Markings.** Double insulated devices designated as Class II equipment carry a symbol on the rating plate of a square within a square. (Symbol #5172, IEC Publication 417).

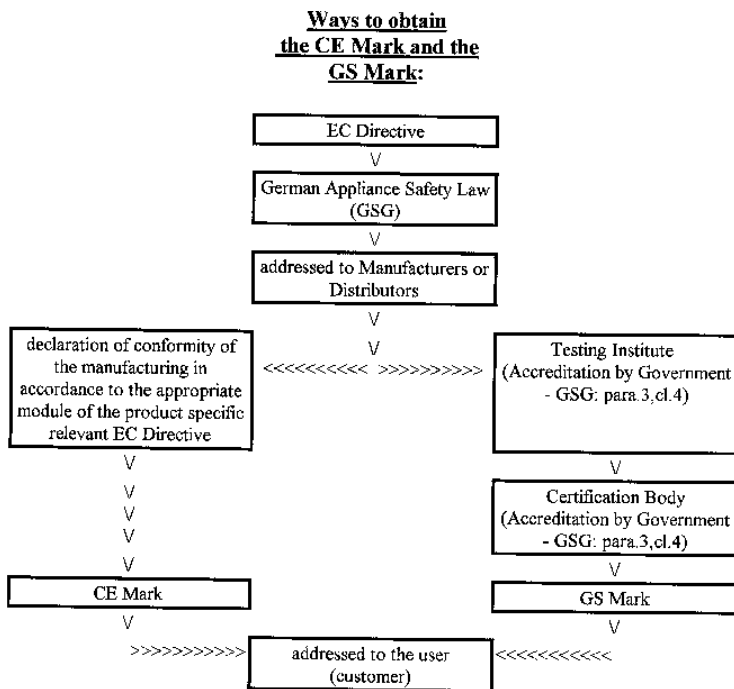
Standards rarely separate Class I from Class II requirements in the body of the standard. When additional requirements for Class II are called for, standards will treat them as an exception, or as an addition, or as a notation. For example, a standard will state a general requirement and add a phrase such as: "For Class II equipment ....."

Comprehensive coverage of the requirements for double insulated equipment can be found in the Underwriters Laboratories publication UL 1097, "Double Insulation Systems for Use in Electrical Equipment".

Double insulation should be considered in equipment for which an earth safety ground is not considered reliable, or may not always be present at the equipment installation or point of use. For example, if the equipment is moved often, such as a hand tool, or often used with an extension cord, double insulation is a good design option.

It is possible to have Class I equipment with certain elements within the equipment having Class II characteristics. For example, due to the large percentage of residences and small commercial units which may lack provision for acceptable earth ground, the isolation transformer of Class I equipment marketed in this environment might be constructed to Class II dielectric strength and insulation resistance requirements. The earth grounding screen remains in the transformer, and it remains a Class I device, but has the safety characteristics of a Class II transformer. Its double insulation properties provides the second level of protection from electric shock when the safety earth ground is missing or inoperative. □

German Appliance Safety...  
Continued From page 8



"Provided that legal regulations according to Clause 4 do not state otherwise, appliances may be marked with the symbol 'GS' (Gepufte Sicherheit - tested safety) as published by the Federal Minister for Labor and Social Affairs in the Federal Labor Gazette. The use of this symbol may be permitted by an authorized body upon application by the manufacturers or their authorized agents based in the 'European Communities' if the authorized body has issued a certificate of compliance for the appliance on the basis of a type test. The contents of the certificate must be such that:

- (1) The tested sample complies with the requirements identified in Paragraph 1.
- (2) There is compliance with

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those requirements to which attention must be given during the manufacture of the appliance in order to guarantee its conformity with the tested sample.

- (3) The authorized body executes control measures for monitoring the manufacturer and legitimate use of the mark.
- (4) The organization responsible for manufacture has committed itself to adherence to the conditions according to (2) and acceptance of the control measures.
- (5) The authorized body withdraws the permit for the use of the GS Mark if the requirements of Paragraph 1 have changed or if the requirements of (2) have not been complied with.

The GS Mark referred to in sentence 1 of Clause 3, subclause 4, may be used and may only be advertised when the requirements stated in sentence 1 are fulfilled.

The accreditation system for authorized bodies is regulated in Paragraph 9. Per Paragraph 19, subclause 1, GS Marks issued by the previously named test institutes are valid to January 1, 1998. After that, the GS Mark can only be used if the former test institute becomes an authorized body. □

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Technically Speaking  
Continued From page 5

is not inserted in series with the protective grounding conductor.) The neutral conductor must be disconnected from ground. (This disconnection is facilitated by the use of an isolation transformer). The EUT remains grounded via the protective conductor. This means that the EUT is grounded during the test, and is not hazardous to personnel in the test

area. This is the situation of the ground being on the EUT side of the leakage current meter.

In other words, IEC 950 inserts the leakage current meter between the "neutral" and ground. In North America, the leakage current meter is inserted between the EUT and ground.

IEC 950 did it this way because (1) some supply systems do not maintain polarity at the plug, (2) some supply systems use the IT system where the neutral is not directly grounded, (3) some supply systems use the TT system where the neutral and protective conductors have independent connections to ground (which would add resistance into the leakage current measurement), and finally and most important, (4) the work area remains safe during the test.

In either leakage current measuring circuit, IEC 950 or North American, you get EXACTLY THE SAME VALUE of leakage current.

The other switch positions in IEC 950 (greater than 1 in the Figures) provide the equivalent to the North American polarity reversal switch.

In other words, the IEC 950 scheme is a general scheme independent of the supply circuit, while the North American scheme is a simplified scheme suitable for use only on a TN supply with a polarized plug.

This discussion raises the question of what is leakage current and where does it come from?

The use of the word "leakage" to describe this phenomenon is probably a misnomer. If we think of a leaky bucket, we tend to think of a bucket with small holes through which water leaks out. The

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word implies some sort of faulty situation.

The phenomenon we commonly call "leakage current" is NOT due to the equivalent of small holes in a bucket. "Leakage current" is NOT due to any sort of a fault. "Leakage current" is due to normal and predictable circuit parameters.

"Leakage current" arises from two physical phenomena: (1) insulation resistance, and (2) capacitance.

In constructing electrical and electronic equipment and products, it is quite common to use metal parts which are not part of the circuit. Over the years, UL has referred to these parts as "dead metal parts."

These "dead metal parts" are insulated from the active circuits by a combination of air and solid insulations.

Insulations do not have infinite resistance. Their resistance is very high and can usually be ignored, but they do have a finite value of resistance. This resistance can be measured with meters called insulation resistance meters.

Since insulations have resistance, they will conduct current in proportion to the source voltage and the value of the resistance. This current is the first source of "leakage current."

The same "dead metal parts" separated from "live" parts by insulation, by definition, constitute a capacitor. Their capacitance cannot be ignored as such capacitance is distributed throughout the equipment and appears as a single capacitor.

Since capacitors have reactance, they will conduct current in proportion to the source voltage and the

value of the reactance. This current is the second source of "leakage current."

In most situations, insulation resistance is so high that it can be ignored as a source of leakage current. Most leakage current is due to the distributed capacitance of mains circuits to "dead metal parts." (In products with EMI filters, most leakage current is due to the real mains-to-ground capacitors of the EMI filter.)

Note that the source of leakage current is the mains voltage. If the voltage is known, and if the capacitance to "dead metal parts" is known, then leakage current can be predicted with reasonable accuracy.

(It is interesting to contemplate on whether leakage current can or does arise from non-mains voltage sources in primary circuits or from secondary circuits.)

Or, putting it another way, the maximum value of capacitance can be calculated knowing the maximum allowable leakage current and the mains voltage.

If the leakage current limit is 0.5 milliamperes, and the mains voltage is 120, 60 Hertz, then the capacitive reactance cannot be less than:

$$X = E/I$$

$$X = 120V/0.5mA = 240 \text{ k}\Omega$$

The capacitance cannot be more than:

$$C = 1/2\pi fX$$

$$C = 1/(2)(3.14)(60)(240,000) = 0.011\mu F$$

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On the other hand, if the leakage current limit is 3.5 milliamperes, and the mains voltage is 250, 50 Hertz, then the capacitive reactance cannot be less than:

$$X = E/I$$

$$X = 250V/3.5mA = 71.4k\Omega$$

The capacitance cannot be more than:

$$C = 1/2\pi fX$$

$$C = 1/(2)(3.14)(50)(71,400) = 0.045\mu F$$

These values of capacitance are not likely in ordinary equipment and product construction. These values arise when there is a need for discrete capacitance between mains and "dead metal parts" as in an EMI filter.

For the most part, the phenomenon known as leakage current approaches a current source. A current source is a source which provides a constant current regardless of load. Unfortunately, we have unduly complicated the measurement of leakage current by requiring a network across which we measure voltage and then calculate current. As a result, many errors are incurred in the measurement.

I advocate a simple measurement of the current in the grounding wire for determination of leakage current. Just put an ammeter in series with the ground wire. Unfortunately, this won't give an accurate measurement when the current is from a voltage source rather than a current source. (A 1.5 volt battery will measure 1 milliamperes leakage current using the traditional leakage current measuring schemes.) Some experts hypothesize that some of the leakage

current in certain switching-mode power supplies is from a voltage source rather than a current source. Some leakage current measuring circuits have been devised to bypass current from a high-frequency voltage source. But, to my knowledge, no one has yet studied or published data on whether or not some leakage current is from a voltage source.

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Your comments on this article are welcome. Please address your comments to *The Product Safety Newsletter*, Attention Roger Volgstadt, c/o Tandem Computers Inc., 10300 N. Tantau Avenue, Location 55-53, Cupertino, California 95014-0708.

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Letters to the Editor  
Continued From page 3

- c. Prevention of electric shock and energy hazards
- d. Touch-current and protective conductor current
- e. Capacitor discharge test at power input terminal
- f. Insulation system
- g. Electric strength test
- h. Provisions for protective earthing
- i. Temperature test
- j. Primary power isolation, connections and terminations
- k. Mechanical strength and stress relief
- l. Abnormal operating and fault tests

(4) To give emphasis on relationships between IEC950 and UL1950:

- a. To state about two standard systems (IEC and UL) for safety standards in the world
- b. To state correspondence relationship between



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IEC950 and UL1950

- c. To state deviations between UL1950 and IEC950
2. An annual meeting of Chinese Technical Committee of the Safety Standardization in Electronic Products will be held at CHONG QING CITY in SI CHUAN PROVINCE. One of [the] proposals for discussion at the meeting will be how [to draft] a "Safety Designer Guidelines for the Product (according to IEC950=GB4943)". This document will be for design engineering to design products (including information technology equipment, electrical business equipment, telecommunication equipment, and systems [that] will be composed of them) to meet IEC950=GB4943 requirements, as well as Recommended Practices Guide.

So, would [you] please be able to help me to get (sell or [donate]) some information, reference material or books concerned, as well as your Newsletters, for example:

- \* "Product Safeness as a Design Parameter" by Paul Hill (2nd ed., 1990)
- \* "Product Safety Designer's Guide" by Mrs. N. Araway and several other safety engineers (Data General and other companies in the Eastern Massachusetts area)
- \* "IEEE Standards Manual" by the Product Safety Technical Committee (see PSN, Vol. 5, no. 2, second half 1992) [*Unfortunately, this item is still in the development stages. - Ed.*]
- \* And others would be supplied for reference.

3. I know how busy you must be with your work, but I do hope you will be able to find time to help us. Thank you very much again. Looking forward to hearing from you soon. With best regards.

Sincerely yours,  
Yan Yumin

Dear Editor

First, let me say how much I enjoy your newsletter. We use it with our safety and ethics activities in the American Society of Agricultural Engineers, and elsewhere. You may not remember, one of my papers was carried in your July/August 1990 (and subsequent) issues.

In reading the May-June (1993) issue, I was reminded of some experience with several clients that had difficulty focusing on a realistic objective for their product safety/liability control program until I steered them to the bottom-line concept of defining unreasonable risk up front. This really works for many manufacturers. I've enclosed a brief summary of this premise in case you are interested. If so, feel free to print it. [*We did. See his article entitled, "Getting Your Product Safety and Liability Under Control By Defining 'Unreasonable Risk' Up Front", starting on Page 9 -Ed.*]

Keep up the good work in your newsletter.

Cordially,  
KEITH L. PFUNDSTEIN  
KPS TECHNOLOGY ☐

**Dave Lorusso is back!** He plans to resume his Product Safety Abstracts column. Please help by sending any safety related information or articles to him. He can be reached at:

Dave Lorusso, EMC Corporation,  
171 South Street, Hopkinton, MA  
01748  
508-435-1000, x2130 (phone) or  
508-435-5222 (fax)

NOTE: Area contacts not listed below may be found on page 2 of this newsletter.

**PORTLAND/SEATTLE GROUP:**

The last meeting this year was on November 17th at Fluke Corp. at 7:30PM in Everett, Washington. The speaker was Mr. Burk A. Brandt of TÜV Product Service, on the topic "Ergonomics".

Mr. Brandt opened the first safety test house in the Northwest in 1989, TÜV Product Service NW regional office and continues as manager. Mr. Brandt has 20 plus years of industry experience in product design and world wide regulatory engineering & management prior to joining TÜV. His work experience includes component design, ITE products and medical devices. In addition Burk received ISO 9000 training through TÜV CERT and is currently a TÜV CERT auditor.

Due to the Holiday Season there was no meeting in December.

The topic for the January 1994 meeting will be "Environmental Issues That Affect Electronic Products" which includes recycling, batteries, banned materials, CFCs, etc.

**SANTA CLARA VALLEY GROUP:**

The Santa Clara Valley group met on November 23rd at Apple Computer in Cupertino, California. The topic was "New requirements for equipment designed for connection to telecommunications circuits in UL1950 Second Edition" by Mr. Shaun Nolan of UL Santa Clara Office. These new requirements (noted in Clause 6) have a future effective date of March 15, 2000. Mr. Nolan presented a summary

of the Clause 6 rational, requirements, and their application to Information Technology Equipment (ITE).

The SCV group met with the SCV EMC Society for the December meeting.

For the January meeting a tour of Dolby Labs in San Francisco is planned, hosted by Bill Wray. Contact Murlin Marks at 408-985-2400 X2353 for details (reservations are required).

The Santa Clara Valley group is looking for a new home (after 7 years!). If you are interested in hosting future meeting in the area, please contact one of the Officers (listed on Page 2).

**CHICAGO GROUP:**

Back in August we were encouraged to hear Chicago was trying to start up the product safety group again. How is it going? Any meetings yet? Let us know if we can help.

If you are in the Chicago Area and want to be part of the Product Safety local group contact John Allen at: voice 708/238-0188, fax 708/238-0269.

**SOUTHERN CALIFORNIA/ORANGE COUNTY GROUP:**

The Southern California Group met on Tuesday November 2nd at QSC Audio in Costa Mesa, CA (note the new location). The meeting consisted of a presentation of UL's International Services by Erin McLaughlin of UL Santa Clara, CA.

Ms. McLaughlin is an engineer in the International Compliance Services department, at UL's Santa Clara Office. Erin discussed UL's technical assistance to exporters services, the CB Scheme, UL's Mutual Recognition Partners, and UL-C (UL approval for Canada). UL can provide assistance to exporters in

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the areas of safety, EMI, ergonomics, and European Directives. UL is a member of the CB Scheme for IEC 950 only. UL's Mutual Recognition Partners are: VDE (Germany), TÜV, KEMA (Netherlands), SEMKO (Sweden), and MITI (Japan). Under the Mutual Recognition scheme, a manufacturer can submit a product to either UL or one of its mutual recognition partners, and receive both approvals. UL has been accredited by Canada, and is now accepted by all provinces except Quebec.

After the meeting, everyone was treated to a very interesting tour of QSC Audio by Mr. Hal Keeling. Many thanks to Hal for hosting the meeting.

Additional Discussion Items:

- Elections for 1994 Officers - Nominations for the 1994 Officers will be accepted at the January meeting. If you wish to serve as Chairman, Vice-Chair, Program, or Secretary/Treasurer, please submit your name.
- Deborah Tinsley is stepping down from her post as Secretary/Treasurer due to her school schedule. If you are interested in this position please contact Deborah at (714) 773-7977.

*[Editorial Note: Deborah has been especially helpful to me with the coverage of her group's activities. Without her timely and extensive information I would not be able to adequately present the Southern California Group's activities. Thank you Deborah! - Ed.]*

- UL/CSA Bi-National Standard - A UL/CSA Bi-National Standard for ITE/Telecom equipment is currently being developed. The next industry meeting to discuss this new standard is scheduled for the week of March 14, 1994.

- UL Client Agent Program - UL has announced a new program to certify agents. The two levels of this program are: a) Administrative, and b) Engineering/Testing. Under part b), the agent performs testing and prepares reports, similar to UL's client data program. The certified agent would have their own UL "Certification Agency" logo, which would appear on their products which they certify. Anyone interested in this program should contact Eric Swerrie, UL Santa Clara, (408) 985-2400, X2225.
- NFPA 75 - A new paragraph (4.3.22) has been added to UL 1950, which references NFPA 75 (Flammable media). Any product containing more than 27 ft. sq. of flammable media must have provisions for connection to a sprinkler system.
- Standards Interpretations - Charlie Bayhi has developed a form for recording and maintaining safety standards interpretations that our members receive from the agencies. A copy of this form will be distributed shortly. Anyone receiving standards interpretations from the agencies that would be helpful to the rest of the group, is urged to fill out the form and send it to Charlie. He will maintain the master notebook of all of the forms.
- December Meeting - Canceled
- Future Presentations - Some of the ideas for 1994 are ISO9000, software safety, product liability, compliance programs.
- List of Translators - The Southern California Group has compiled a list of translators (recommended by their members) for manuals and labels. (If you are interested in this list please

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contact the area activities editor for a copy)

**COLORADO AREA GROUP:**

If you are interested in forming a group in this area, please contact :

Mr. Andrew Doering  
TÜV Product Service  
Boulder, CO 80301  
Tel: (303) 449-4165  
fax: (303) 449-3004

**CENTRAL TEXAS GROUP:**

Great to hear from you! Keep us informed.

The Central Texas Group met on December 1st at ROLM in Austin, Texas. On the agenda was an update on EC by TÜV & and an open Forum. For future meeting details and location please contact Mr. Vic Baldwin at ROLM: voice 512/990-6145, fax 512/990-6335.

**NORTHEAST PRODUCT SAFETY SOCIETY:**

(not affiliated with either the IEEE or the PSTC)  
This group, although not part of the IEEE, is a very active group dedicated to reducing accidents caused by electrical shock and/or fire through education of its members and the public.

If you are in the Taunton, MA area and are interested in joining please contact the NPSS President Mr. Tony Nikolassy @ T-Tech Engineering Laboratories: voice and fax 508/823-0323.

I have been receiving great meeting announcements and information from several groups. In case your group is not one of them, the information I need includes.

- (1) Meeting updates - when, where, who and what topic
- (2) Presentation summaries - at least a few sen-

tences about the presentation. (If you can persuade the speaker to turn the presentation into a full article for the PS Newsletter, all the better!)

- (3) Other activities - dinners, field trips, picnics, workshops, etc. Let me know what's happening and what works well (or not so well) at your meetings, so I can pass it along.
- (4) Contact person - the person to call, fax or write to find out more (plus the contact's phone and fax numbers)

KEEP THOSE CARDS AND LETTERS COMING!

A new PSTC group is forming in Colorado. For details, please contact:

Andrew Doering  
TÜV Product Service  
5541 Central Ave.  
Boulder, CO 80301  
303-449-4165  
303-449-3004 (fax)

The Santa Clara Valley PSTC Group is looking for a new home.

If you'd like to host the meetings, please contact the SCV PSCT

Chairman:

Mike Campi  
(408) 987 6527

researchers, developers, and evaluators who work on problems relating to specifying, building and certifying high assurance computers is scheduled for June 27-30 1994. This is the 9th annual conference on Computer assurance. Papers were due 15 January. For more information, contact Jan Fishinger at (703) 902-5302.

ASSE (American Society of Safety Engineers) 33rd Professional Development Conference and Exposition is scheduled for June 20-25, 1994 in Las Vegas, NV. Conference is open to ASSE members and nonmembers. Contact ASSE, 1800 E. Oakton St., Des Plaines, Ill. 6008-2187 Phone: (708) 692-4121.

### **Safety Courses**

The University of Wisconsin - Madison is offering a series of courses in Product Safety and Liability:

- 1) Compliance with the New European Community (EC) Product Regulations -January 20-21 and June 13-14
- 2) Establishing and Implementing the Product Safety Program - February 1-3
- 3) The Role of Warning and Instructions - March 21-23
- 4) Successful Defense of a Product Liability Lawsuit - April 21-22

For more information contact Program Director Richard A. Moll, College of Engineering, University of Wisconsin - Madison, Department of Engineering Professional Development, 432 N. Lake St., Madison

### **IEEE paperless office and electronic mail**

The November - December issue of the Institute has several articles related to electronic publishing, and e-mail. There is information on how IEEE members can obtain a free copy on e-mail guide and e-mail services.

### **College Degree Survey**

The American Association of Engineering Societies (AAES) released the results for 1992 showing that there was a decrease of 333 bachelors degrees in engineering from the previous year. During the same period the number of M.S. degrees decreased by 2.8 % while Ph.D's increased 278 (4.6%). The degrees in civil, environmental, chemical and petroleum, mechanical and aerospace increased, while there were decreases in electrical, computer, industrial, management and manufacturing engineering. Women earned 15.7 % of 1992 bachelor degrees, 15.5 % of master's degrees, and 9.9% of doctorates. For more information on the survey contact AAES 111 19th Street NW Ste 608, Washington DC 20036-36890; phone (202) 296-2237

### **US/Europe Standard Dialogue**

ANSI announced that the US continued its dialogue with the European standard testing and certification organization December 2-3, 1993 in Brussels. The goal is to promote understanding between US and EC interests. A progress report of this effort is detailed in ANSI Global Standardization Report, for more information contact ANSI (212) 642-4900. □

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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) 553-7684 (phone) or (408) 553-7694 (fax)

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## 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.

Seeking employment as a Regulatory Engineer:

**Bogdan M. Matoga**  
**Hollister, CA**  
**(408) 636 8182**

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

**Wayne L. Glover**  
**Tampa, Florida**  
**(813) 887 2534**