IEEE EMC SOCIETY

The Product Safety Newsletter

Vol. 10, No. 1 January - March, 1997

What's Inside

Chairman's Message

Where Are We Headed?


Brian Claes

The major topic for discussion during our Annual Meeting at the 1996 International EMC Society Symposium dealt with what TC-8 should take on in the future. Those of you who have been regular readers of this newsletter for the last two or three years are aware that TC-8 has a plan to reform itself as an IEEE Technical Council with the ultimate goal of becoming an honest-to-goodness society. We've discussed the challenges associated with this plan before; they are not inconsequential and frankly we have had difficulty pulling together the resources and energy required to execute the plan. So, rather than commit to mount another effort to pulling it off, we discussed alternative paths for us to take. I'd like to share the key points of the discussion with you and solicit your response.

1. Lead by Example. We continue to be in a unique position to promote the practice of product safety. However, it was felt that as a whole we need to vigorously promote mentorship and leadership by example to inspire professional growth and development. One activity that was specifically mentioned was that of peer-reviewed papers. The first priority of IEEE societies is to promote and advance the state of knowledge and practice

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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.

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The following is a brief overview of recent and planned activities for the various Local Groups around the USA. If you are aware of any 'activities' information that may be of interest to readers, please forward it to the above address and I will try to include the information in the next issue.

Central Texas Chapter

Jack Burns
voice: (512) 248-2851

Meetings are the last Wednesday of each month.

Chicago Area

John Allen
voice: (708) 238-0188

Colorado Chapter

Richard Georgerian
voice: (303) 417-7537
fax: (303) 417-7829
e-mail: richard@exabyte.com

January Meeting: Planning meeting facilitated by Richard Georgerian.

March Meeting: March 5, 1997 at Exabyte - details to be announced.

September Meeting: September 3, 1997

November Meeting: November 5, 1997

Northeast Product Safety Society

Mirko Matejic
voice: (508) 549-3185
web site: http://www.safetylink.com/npss.html

Orange County, Southern CA

Charlie Bayhi
voice: (714) 367-0919

Beginning in January 1997, the 'Test of the Month' show and tell at each meeting where practical safety topics will be discussed.

January Meeting: Gil Walter - Safety & Compliance Engineering - Demonstration of BAPCO Model IEC601L Universal Safety Tester.

Pacific Northwest Area

Scott Varner
voice: (360) 817-5500 ext. 55613
fax: (360) 817-7829
e-mail: 4777294@mcimail.com

Continued on next page

Santa Clara Valley

Edward Karl
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Meetings are on the fourth Tuesday of each month.

November Meeting: Bob Weiner, Bob Weiner Associates - Laser Requirements. Bob discussed US and Euro requirements and similarities/differences between the two. He also spoke on recent developments that will bring US requirements into closer harmonization with international requirements. (see “Laser Safety Update” column in this issue.)

December, 1996: Combined With EMC Society Meeting at Apple Computer

January 28, 1997: Bob Garrett, Fluke Corporation. Bob gave an excellent presentation on Harmonics and the safe use of meters. Bob may be contacted at bgarrett@pc.fluke.com. Nominees were also solicited for the PSTC Chapter Level Award to be presented next Month.

February 25, 1997: Geoffry Hutto, Machinery Directive

March 25, 1997: Richard Pescatore, Developments related to IEC 950

April 22, 1997: Larry Holbrook, Global Environmental Requirements

May 27, 1997: Alan Flandez, Product Safety of Hardware/Software

June 24, 1997: Michael Royer - Part 6 of IEC 950, Third Amd.

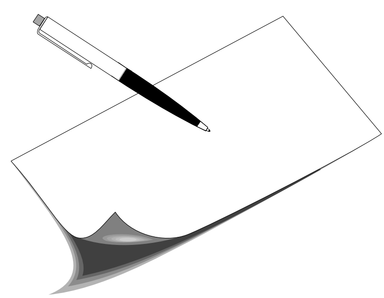
That is it for now. Please remember to forward any information that may be of interest for next time.

Support your local Chapter by getting involved!

Live Long and Prosper,

Kevin L. Ravo ■

We are looking for Product Safety Articles!



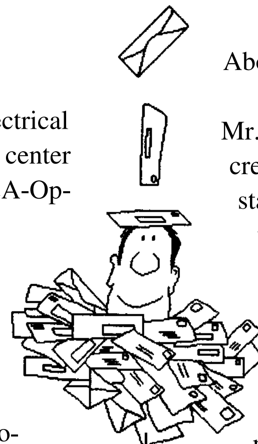
Please send your articles to:
Roger Volgstadt
Tandem Computers
M/S 55-53
10300 N. Tantau Ave.
Cupertino, CA 95014

Letters to the Editor

Dear sir,

I am the head of the department for electrical safety in the Austrian research and test center Arsenal. I am also chairman of the CCA-Operational-Staff-Meeting for electronic equipment. This body has issued the decisions which are mentioned in the article "Application of IEC and US Overcurrent Protection Devices in Electrical and Electronic Equipment" [by Lal Bahra of Underwriters Laboratories, in the July-September 1996 issue of the *Product Safety Newsletter]*. The Table 2 on pages 20 and 21 is part of these decisions. My comment is on the title of this table. There is the impression that this is an official acceptance by authorities of the mentioned countries. This table was originally introduced in the list of decision as a guidance for the test-houses. It was also moved into an annex because it is no longer up to date and should be revised. So I hope your readers will not take this table as a sort of "legal" acceptance of the relevant country. All these decisions by the CCA-Operational-Staff-Meeting are only to create uniform testing in different test-houses. This I wanted to clarify. Nevertheless I am very interested in your brochure and would like to ask you if you could provide me with the already published issues and with the future ones.

Best regards
R.A.Wunderer
wunderer@yzes1.arsenal.ac.at



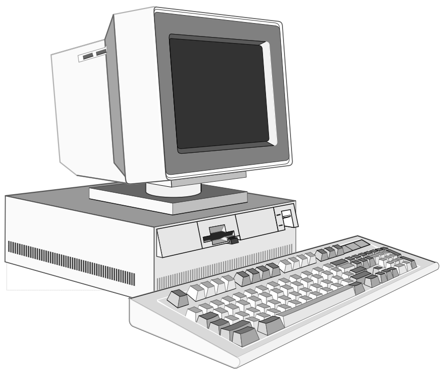
About Those Questions...

Mr. Claes raises good questions about the creation, need for, and utilization of safety standards. His final point falls quite short of what safety, product safety and safe design is all about though. Electrical safety is one small part of the much larger picture. Besides the electrical shock safety of Mr. Claes' example, hazards like fire, explosion, chemicals, mechanical, EMI radiation, electrical breakdown, failing safe, cautions, warnings and danger signs, safety interlocking, non-electrical radiation, energy storage, environment, workplace, food handling, drugs, and automobiles are examples of a few of the factors that go to make up the whole safety picture. Anybody entering the field of safety, product or otherwise, must be well versed in may different fields. Standards serve to provide some guidelines about what constitutes "safe enough."

The whole field of safety has roots well into concepts of social responsibility and legal liability. A person entering the field of safety and those in the field must be cognizant of the many and varied sources of the tools of their trade of which standards is only one important part. Students of safety must keep the broad view in sight, rejecting myopic views imposed by blinders.

Thank you.
John H. Rolleston

Safety Net — News from the Internet



John Quinlan
quinlanj@voicenet.com

The subject matter for this issue's column was extracted from a discussion which appeared on the EMC-PSTC forum. The discussion was initiated by Dick Kool <dick.kool@midilink.nl> on 11/18/96, and elicited responses from Patty Elliot <Elliot@tuv.com> and Steve Costello <Steve.Costello@natinst.com>.

Dick Kool poses the question:
As an electronic designer for laboratory devices, my designs must comply with the requirements of the IEC 1010 safety standard. I want to use an Industrial Personal Computer (IPC) for laboratory measurement and control, but I have only found IPCs that comply with IEC 950. Is IEC 950 compliance acceptable in this situation?

Patty Elliot responds:
The scope of IEC 1010 applies to "computers which form part of the equipment within the scope of the standard or are designed for use exclusively with the test equipment." Therefore most computers will comply with IEC 950, the generic computer standard. As far as temperature limits and creepage/clearance requirements, IEC 950 is more stringent than IEC 1010, so using a 950 computer in a 1010 system should not be a problem.

Steve Costello concurs:
Check out the note on section 1.1.3 of IEC 1010. It states that equipment complying with the requirements of IEC 950 are considered suitable for use with equipment within the scope of Part 1 of IEC 1010. ■

Coming up in the next issue of the *Product Safety Newsletter*:

- ☞ "Safer By Design," an article to aid designers on designing safer products.
- ☞ "The UL Articulated Accessibility Probe," the technical rationale behind the probe.

News and Notes

by John Rolleston

EMF Found Harmless (Again)

The National Research Council, after examining 500 studies spanning 17 years, has found that there is no conclusive evidence that 60 Hz electromagnetic fields play a role in development of cancer or other health problems. (Reference NEMA and the EI Electroindustry Newsletter of November, 1996). Contact Doug Bannerman (703-841-3237) for futher details.

ISO Workshop on Occupational Health and Safety Meets with Resistance

In September of last year, ISO held a workshop to assess and gain opinions from constituents about ISO involvement in further OH&S management systems standards. The general response that ISO was not the organization to provide such standards and that regulatory bodies should promote legislation for OH&S. The effect on the use of popular ISO 9000 and the recently introduced ISO 14000 series is still under study. See the ISO bulletin of November, 1996 for further details.

ASTM Promotes Safety in Sports Equipment

ASTM, in cooperation with the Sporting Goods Manufacturers Association (SGMA) are looking at all sports in an effort to reduce injuries through the use of better protective materials. Sports growing in popularity like roller hockey and in-line skating have increased the need for improved materials to protect against injuries like asphalt rips, grinds and tears. SGMA has publisehd four reports dealing with such topics as standards in sports litigation, product labeling and warnings, ecological and environmental awareness. Further details are available from Maria Dennison Stefan, ASTM Standardization News, November, 1996.

Single European Plug Still Out of Reach

CENELEC, after 5 years of debate and study, has been unable to reach agreement on a single 230/250 volt plug for all of Europe. IEC has proposed an IEC 906-1 plug but the European Union demurred as members could not agree on adoption of the single plug. In contrast, 34 countries now use the 125 volt receptacle used in the USA. Travelers and exporters continue to be faced with having to accomodate the many different plugs in use. Contact Ken Gettman at 703-841-3254 for further details.

Common Declaration of Conformity (DOC) Mark Proposed

With the proliferation of product certification marks, Hewlett-Packard, along with the Information Technology Industry Council (ITIC), the Information Technology Association of Canada, and the Canadian Standards Association have proposed a single new mark to be used world-wide.
ISO/IEC Guide 22 described the DOC and would include an as yet to be devised single mark for world-wide use. (Reference NEMA and EI Electroindustry, November, 1996) Contact Cynthia Van Renterghem at 703-841-3290.

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News and Notes
Continued from previous page

USNC/IECEE Elections:

The former Chairman and founding member of the Product Safety Technical Committee, Richard Pescatore of Hewlett-Packard, was recently elected Chairman of the United States National Committee of the International Electrotechnical Commission System for Conformity Testing to Standards for Safety of Electrical Equipment (USNC/IECEE for short).

The USNC/IECEE provides the US input to the IECEE, which is the body within the IEC that operates the increasingly well known "CB Scheme." In the CB Scheme, the IECEE accredits national certification bodies (NCBs) to certify conformity of electrical equipment with internationally harmonized product safety standards. Results of submittal to one NCB will be a CB Test Certificate and a CB Test Report which will be accepted at any other NCB in over 30 countries. By reducing duplicate testing the CB Scheme facilitates obtaining multiple national certifications.

Rich replaces Frank K. Kitzantides, who became Chairman of the IECEE in January, 1997. Other newly elected officers of the USNC/IECEE are Donald A. Mader of UL and William F. Hanrahan of ITI, both Vice Chairmen, and David F. Rundle of AMP, Treasurer.

Rich is still in the process of determining his main objectives for his four-year term. However, he has stated that he would like to see an increase in industry representation and input into the IECEE. He would also like to achieve "better balance of influence between the users (industry) and participants (certification organizations) of the CB Scheme." ■

Chairman's Message
Continued from Page 1

by publishing peer-review papers, either in official transactions or via symposia presentations and subsequent inclusion in symposia proceedings. To date, we've average two to four such papers a year, but most have come from outside our immediate constituency. It's possible that the "pure" technological content of the vast majority of EMC Society papers may make product safety discussions seem a bit out of place. While it may be that we don't have a "technology" of our own, we certainly have definitive approaches to applying technology and social factors to products and systems. The challenge I'd like to put forth is that if you'll write the professional paper we will find the appropriate forum within the IEEE to publish it.

2. While our sphere of influence is unusually large for a technical committee, we still are largely unknown within the IEEE. Rather than approach this organizationally, we can promote improved product safety practice through our own individual memberships and involvement in societies with related interests. These societies include Reliability, Social Implications of Technology, Industry Applications among others. As we have discussed before, these organizations do not have critical

While our sphere of influence is unusually large for a technical committee, we still are largely unknown within the IEEE.

mass in areas in product safety but all have pockets of interest. Let's increase participation in these as individual members; our organization can serve as a coordinating function to keep all apprised of progress. This will also have the effect of counterbalancing our frequently-observed bias toward issues surrounding the information technology industries.

3. It was noted that quite a few universities have EMC programs, while only a few have programs in safety (and none that we could recall focused on product safety). It has been our collective experience that product safety is learned after graduation on the job. While this sounds like a chicken-and-egg situation, a local college or university could be approached with a proposal to initially develop and deliver such a course. IEEE has established capability to promote education-oriented activities at colleges and universities in areas where IEEE has a presence. Do you have a vision for educating others in our field? If so, we should be able to promote this to become a reality.

Do you have a vision for educating others in our field? If so, we should be able to promote this to become a reality.

Toward this end of focusing on professional education, TC-8 recently formed the Education Subcommittee under the leadership of Murlin Marks. This subcommittee is still in its formative stages. If you are interested in finding out more about this new opportunity, have ideas or are interested in getting involved please get in touch with Murlin at (408) 985-2400, extension 32353 (murlinm@ix.netcom.com).

4. One of the most effective programs we support is the IEEE "emc-pstc" bulletin board. With the explosion of electronic networking, other vehicles (Web pages, etc.) may offer additional opportunities to promote product safety practice. Many safety and regulatory entities currently maintain Web pages and other internet information vehicles. While many are promotional tools with purely commercial goals, there are many still that largely exist for pure information exchange. While creating and maintaining such a resource is no small undertaking, if the interest and energy are there, IEEE can be approached to sponsor such an effort.

The consensus of the committee members present was that there was a lot we could do without focusing a lot of precious time and energy on organizational change. While we do need to encourage activities that are self-sustaining, it seems that much of that will come with the synergy that exists between the various activities discussed above and others not covered. The IEEE is an excellent organization and infrastructure to both promote professional practice while both providing a framework for individuals to develop their talents and interests while helping others.

As we look ahead to the upcoming annual meeting in August, I'd like to see some concrete proposals for furthering existing activities or developing new ones. The above are just a few proposals. Please let me know what your ideas and interests are and how you think they might be brought to fruition.

Brian Claes
brian.claes@lamrc.com ■

Technically Speaking

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Richard Nute
richn@sdd.hp.com

The 25-AMP Grounding Impedance Test

High-current grounding impedance tests have been specified in safety standards for many years. There are two, independent sources for these tests.

One source is CSA Standard 0.4, Bonding and Grounding of Electrical Equipment, which specifies a test current of 30 amperes for 2 minutes.

The other source, I believe, came from USA requirements for home appliances such as refrigerators, and specifies a test current of 25 amperes for 1 minute.

Both tests measure the grounding circuit impedance at either 25 or 30 amperes. The 25-amp test requires that the impedance be less than 0.1 ohm at the end of the test period. The 30-amp test requires that the voltage drop across the grounding circuit be less than 4 volts at the end of the test period (less than 0.13 ohm).

(A derivation of the grounding impedance limit value, 0.1 ohm, is presented in Technically Speaking, The Product Safety Newsletter, Volume 9, Number 1, January-March, 1996.)

The grounding circuit impedance tests presume that a fault will occur in a product between the mains live (or line) conductor and grounded parts. This fault will subject the grounding circuit to a very high current until such time as the relevant overcurrent device operates and disconnects the mains.

Overcurrent devices (e.g., fuses, circuit-breakers) do not operate at their rating. For example, a 15-ampere circuit-breaker does not operate at 15 amperes. But, it does operate at currents above the rated current. The operating time of any overcurrent device is a curve relating current and time. The higher the overcurrent, the shorter the operating time. Most overcurrent devices are calibrated at twice rated current. The maximum operating time at twice rated current is either 1 minute, 2 minutes, or 4 minutes, depending on whether the device is a fuse or circuit-breaker or circuit-breaker type.

For the purposes of safety, the construction of a product must enable fuse or circuit-breaker operation in the event of a fault from the live (or line) conductor to grounded parts. Therefore, the construction must be capable of carrying twice rated current of the overcurrent device for at least one minute.

This requirement means that the construction of the product grounding circuit must be reasonably robust. It must be at least as robust as the mains circuits.

The resistance of most electrical conductors is directly proportional to the conductor temperature. That is, as the temperature increases, the conductor resistance increases. For the purposes of safety, the grounding circuit resistance must not exceed the specified value, usually 0.1 ohm. To stay below this value, it is imperative that the conductor temperature be controlled.

Conductor resistance is inversely proportional to the cross- sectional area of the conductor. That is, as the cross- sectional area increases, the conductor resistance decreases. To control the resistance, it is imperative that the wire size be controlled.

And, conductor resistance is directly proportional to the length of the conductor. That is, as the conductor length increases, the resistance increases. In most product constructions, the grounding circuit wires are relatively short, so the length usually is not a significant contributor to the resistance.

So we need to consider the three parameters, temperature, cross-sectional area, and length in order to be assured that the grounding circuit resistance does not exceed the specified value, 0.1 ohm.

When a conductor is subjected to a current, some power is dissipated in the resistance of the conductor according to:

$$\text{Power} = I \times I \times R$$

Power is the measure of the electrical energy converted to heat in the conductor. So, the action of conducting current causes the wire to heat. That heating in turn causes the resistance to increase. If the value of R gets too high, the system can get into a positive feedback mode, where the R continues to increase until the conductor melts and the circuit opens. If this should occur to the grounding circuit, the product will become unsafe because the overcurrent device will not operate.

Typically, mains cords and wiring is No. 18 AWG (approximately 0.75 square millimeters). When subjected to 25 or 30 amperes, the wire will become warm, possibly even too hot to touch. But, it will not exceed the 0.1 ohm limit value. And, it will not cause its insulation to melt.

On the other hand, No. 22 AWG, when subjected to 25 amperes, will get too hot to touch, and will cause its insulation to melt. It will also melt the insulation of adjacent wires, causing unpredictable consequences of short-circuits.

After 2 minutes at 30 amperes, No. 22 AWG is likely to melt.

The high-current grounding circuit test is a good test to confirm the adequacy of the design of the grounding circuit.

The issue I want to address is whether the high-current test is useful as a production-line test.

Almost all safety certification houses demand a production-line test of the grounding circuit. Most do not specify the current for the production-line test. However, some safety certification houses demand that the 25-ampere test be a production-line test.

Can a 25-ampere production-line test find manufacturing defects that cannot be found by a low-current test?

One manufacturing defect is damage to the cutting or breaking of individual strands of a grounding wire when crimped or connected to a terminal. We simulated a bad crimp by cutting individual strands of a 36-strand, No. 18 AWG wire. We stripped the insulation from about 3 mm of the wire, cut one strand and peeled the two ends back to the edges of the insulation. Then, we measured the resistance using an ordinary digital ohmmeter, and the impedance using a high current sourcing milliohmeter (ac). We applied the 25 amperes for two minutes, taking millohmeter readings every 10 seconds.

We repeated the test, cutting one strand at a time.

During the two minutes, the resistance would increase. This is expected because the wire is heating due to the power dissipated in the wire.

As we continued to cut individual strands, the initial resistance increased, but not significantly.

The ohmmeter resistance indicated 0.2 ohms for every test.

The high current sourcing milliohmeter indicated less than 0.1 ohm throughout every test until we cut the 31st strand. With four strands remaining, the strands melted at about 1 minute. (No. 18 AWG wire is comprised of 36 strands of No. 34 AWG copper wire.)

By comparison, No. 30 AWG in free air will melt at 5 amperes.

How can 5 strands possibly carry 25 amperes for 2 minutes without melting?

The answer is that the 5 strands were only 3 mm in length. They were well heatsunk by the remaining strands, which were held next to the 5 strands by the surrounding insulation. Copper is a very good thermal conductor. The heat-sinking kept the strands from reaching the melting temperature.

This test shows that the 25-ampere test is not likely to find a wire with cut or broken strands as may occur due to defective crimping or due to excessive bending.

ACKNOWLEDGMENTS

Thanks to Eric Davis of Hewlett-Packard's San Diego Division for testing the wire.

This work duplicates work done by Hewlett-Packard's Vancouver Division in 1985, supervised by Ken Curtis.

*****

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 56, Cupertino, California 95014-0708. Or, you may send your comments via e-mail to VOLGSTADT_ROGER@Tandem.COM or richn@sdd.hp.com

If you want to discuss this article with your colleagues as well as with the author and editor, e-mail your comments to emc-pstc@ieee.org. ■

Designing Beyond Requirements of Safety Standards

Paul W. Hill

[We are grateful to the author for providing a series of condensed installments from his book "Managing Product Safety Activities." This text is a registered copyright of Paul W. Hill & Associates, and is reproduced with permission. Details about the book may be obtained by calling (704) 892-6982. -ed.]

Industry safety standards are not completely comprehensive in coverage. This becomes obvious when one considers that those preparing the safety standard could not possibly be aware of every hazard associated with current and future technologies or design practices as they prepare the standard. Nor could they be expected to foresee all possible future end uses of products.

Safety standards are not often rewritten or drastically modified, as perhaps they should be, and tend to lag technology, design practices and manufacturing processes by a number of years. The procedure used to develop and modify standards requires a considerable time period for even modest changes. Even though industry safety standards are periodically updated, actual design practices, component and materials applications always remain well ahead of published standards.

Compliance with a safety standard cannot insure the product will not injure individuals or cause property damage. Products in compliance with safety standards can and do cause electric shocks, fires and personal injuries. What then does compliance with a standard mean?

Compliance with an industry safety standard can only indicate that in the professional opinion of the standard's authors the requirements set forth are believed to be adequate to produce a product that is reasonably safe for its intended use.

The term "reasonably safe" is understood to mean the use of permissible practices in the view of the developers of the standard. The concept of reasonably safe is discussed in Chapter 9, "Determining the Acceptability of Safety Risks" [also reprinted in the October-December 1996 *Product Safety Newsletter*].

This section will consider the deficiencies of industry safety standards and actions which designers and product developers can take to compensate for the shortcomings of safety standards.

Deficiencies in Industry Safety Standards.

The two major shortcomings of safety standards are:

1. The safeness level provided is the absolute minimum acceptable.

Even poor designs and materials can satisfy the requirements and be listed or certified by a testing agency. Industry standards do not separate products into good and bad designs, they differentiate only between those meeting absolute minimum requirements of the standard and those which do not.

Industry standards do not separate products into good and bad designs, they differentiate only between those meeting absolute minimum requirements of the standard and those which do not.

2. Standards always lag technologies, design and industry practices as well as new components and their application.

To fully appreciate these short comings when relying solely on industry safety standards for the safeness of a product, a brief explanation of the causes for these deficiencies is in order.

Industry standards are developed by small groups of safety experts from industry, test and certification agencies, industry associations and from materials and component manufacturers. They are volunteers sponsored by individual manufacturers or safety oriented organizations to advise safety standard publishers on the content of safety standards. These groups represent a broad range of views, interests and technical expertise.

A requirement in a standard represents the collective opinion of such a group. Many times a consensus within the group is very difficult to arrive at. In the process a compromise emerges as a requirement of the lowest common denominator. In the more difficult problem areas a consensus may be impossible and no requirement in the standard results for lack of an acceptable common position. If a change is being considered and no consensus is obtained, the original requirement often remains unchanged or the problem area not addressed. For these reasons industry safety standards tend to be the lowest safeness level acceptable to a group of individuals from widely varying backgrounds, experiences and points of view.

It is clear from the above that the requirements, or lack of requirements, in standards may permit unacceptable safety risks to some manufacturers. Their field experience may indicate a standard is too lax. Fault testing may indicate a standard's requirement is not effective in preventing certain hazardous situations. Under these circumstances many designers and manufacturers will wish to compensate for these deficiencies with supplemental internal company safety standards. Others may issue design or materials directives which increase the margin of safety as a supplement to an industry standard.

In light of the above one might doubt the usefulness of safety standards. Surely, they represent fundamental requirements all safety oriented engineers and product safety practitioners would agree are absolute necessities.

However, most safety standards require additional amounts of sound engineering judgement and safeness confirmation testing to yield products meeting the requirements listed in Chapter 2 in, " How Safe Is Safe Enough?"

Technology lag.

Technology changes proceed at a rate much faster than the rate of response of standards writing groups. It is not uncommon for a safety standard modification to take three to five years from identification of the need to publication as a requirement of the standard.
If the change is significant and requires adjustment by manufacturers with products in the development or production phase, a delay in implementation may be necessary. Implementation periods can range from two to five years or more before the requirement is mandatory for all new production.

It is not uncommon for a safety standard modification to take three to five years from identification of the need to publication as a requirement of the standard.

The steps required to update or significantly modify an industry safety standard are outlined below. The indicated time in months to complete the step is common for both IEC and North American standards.

1. Awareness of need to change or add a requirement. (Start of change cycle).

2. Draft of new requirement which addresses a change or addition to the standard. (12 months, assuming a technical committee or working group exists to undertake the task, otherwise 18-24 months).

3. Industry review and comments on draft of change or addition. (6 months).

4. Incorporate recommendations and comments received from industry review of the draft. (3 to 6 months).

5. Voting on acceptance of change by countries if an IEC standard. (Six months).

6. Publication of the change. This is the first indication most manufacturers have of the change in its official form. (Three months).

7. Implementation period. This is the time set aside for manufacturers to position new products for compliance. (18 to 30 months).

If the change addresses a serious hazard, products already certified to the original standard may require modification by manufacturers and re-certification to the new compliance level.

8. Implementation date. This is the date by which all newly manufactured products must comply with

the change. (One to five years is common practice).

The above example requires some four and a half years from awareness of the need to implementation. This period of time may well be two or more product design life cycles for a consumer product. In other electronic markets the period could clearly be at least one whole product generation missing the change to the recognized safety requirement.

Many manufacturers will not wish to operate exposed to a recognized safety need for such a long period of time. Many would chose to comply quickly with internal company, division or departmental safety directives until the change becomes a binding requirement for a product listing or safety certification.

Compensating Actions.

It should be clear from this discussion that designing only to the requirements of industry safety standards will be unacceptable to most engineering and marketing managers. Astute management will require compensating actions which off-set the deficiencies of an industry safety standard. These actions are: a) increased safety margins, b) extensive fault testing with appropriate design, materials or component changes and c) internal company safety standards or self-imposed safety related requirements which supplement industry standards.

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Design safety margins.

A safety margin is the degree of over design intended to account for uncertainties or contingencies associated with unknown or unpredictable factors in a design, materials or application of components. Safety margins are common engineering practices. Bridges have safety factors several times expected operational loads. Aircraft components have safety factors several times the stresses expected in operation. In each case the design exceeds normal loads or stresses to compensate for known, suspected or unanticipated hazardous encounters in actual use.

Product safety has areas of unexpected or unknown conditions of use as well. Some of these factors are day to day manufacturing variability, varying levels of specification compliance in components and materials from suppliers, unanticipated usage and possible incompleteness of industry safety standards.

For these reasons product designs must exceed the minimum requirements of industry safety standards by some factor related to the degree of risk involved. For example, if the dielectric strength of an insulation is required to be 1250 V in a safety standard a design minimum of 1500 V would not be out of order. This represents a safety factor of 20% to compensate for the variables associated with the insulation materials itself, its manufacture and appropriateness of its application in the product. To some designers and product developers this is a conservative safety factor and their experiences may suggest a still higher design value.

The size of the safety factor should have some relation to the risks involved. For example, products associated with industrial or commercial applications where some training and supervision of operators and servicing personnel could be expected, relatively modest safety factors would be applied. By contrast, products associated with the general public, homes or schools would represent a much higher risk of generating injuries, shock, fire and property damage. Such a situation would justify the need for relatively high safety factors.

Fault testing.

Formal fault testing is an excellent way to determine if the equipment needs special attention to one or more safety measures not required by industry safety standards. The primary objective of fault testing is to view the operation of the product from user and servicing points of view. Unlike most engineering tests, fault testing assumes no special skills or knowledge in operation of the equipment and no particular awareness or appreciation of the hazards the equipment might present.

Worst case is associated with performance parameters under extreme operating conditions. Fault testing evaluates the degree of protection the equipment provides to operators and service personnel when hazards are encountered unintentionally in the equipment.

Worst case testing does not relate closely to fault testing, and should not be viewed as equivalent testing capable of evaluating the ability of the equipment to provide protection from shock, fire and personal injury.

Internal company safety standards.

Many organizations find it appropriate to supplement industry safety standards with internal company, division or departmental safety standards. Some may not be comfortable with what are perceived to be loose limits in safety standards which may pose unacceptable business risks in local or foreign markets. Others may wish to limit the use of toxic materials which industry safety standards may not have addressed.

Single incidents of safety standards inadequacy may be handled with design directives. However, when several directives have been issued, or the industry standard is believed to have significant short comings, the development of internal company safety standards for the commodity is recommended. In this approach the internal standard must not conflict with the industry standard but simply supplement or extend it.

Safety items appropriate for internal safety standards are easily obtained. Sources such as field service and repair reports, warranty activities on a product, Consumer Product Safety Commission reports and consumer group publications are useful data sources. News media reports on safety incidents, involving similar or related products, can often suggest areas in which an additional requirement or safeness margin beyond that required by industry standards is appropriate. Taken collectively, including the requirements of the industry standard, these inputs can form the basis for developing meaningful internal safety standards. ■

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