The Product Safety Newsletter

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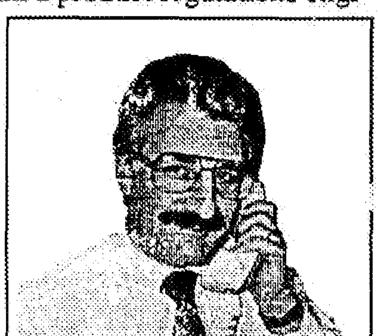
Vol. 2, No. 2 March/April 1989

Chairman's Message

Upon review of our mailing list, I have come to the realization that we have grown a significant amount. As a result, I do not know many of you. Likewise, you may not know your national officers and committee leaders other than by name. Therefore, I thought it worthwhile to use this opportunity to give you a short profile of each of them.

Let me start with myself. My educational background has resulted in an Electrical Engineering Degree from California Polytechnic State University and an MBA from the University of Santa Clara. I am a product regulations engineering manager working for Hewlett-Packard in Cupertino, California. I have been involved in product safety for about 16 years, working for UL and several other firms, both large and small. Much of my product safety experience has revolved around information technology equipment and the worldwide marketplace. In addition to my normal day-to-day activities, I am involved in several standards-making bodies, both national and international. My motivation in helping found this organization stems from recognition of the need for a professional group to study and carry out the principles of product safety engineering. My noncareer interests include my wife Sharon and our two children, a '50 Chevy pickup, my other car, and remodeling our house.


Rich Pescatore

Jim Norgaard serves the PSTC in two capacities—as our vice chairman and as chairman of the Northeastern Chapter. He holds BS and MS degrees from Illinois Institute of Technology and has been through the CSS business program at Harvard. Prior to college, and before getting a real job, Jim played tennis professionally. For the past ten years, he has been involved in the high tech environment, holding various positions. Jim has been vice president at Dash, Straus and Goodhue for the past three years, where he holds responsibility for the Product Safety Division. Jim, his wife, and three children reside in the Northeastern portion of the United States.

Jim's photo unavailable.

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The Product Safety Newsletter

Vol. 2, No. 2 March/April 1989

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

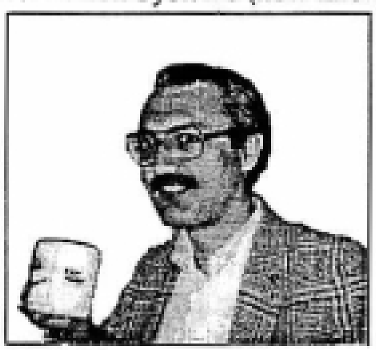
Comments and questions about the newsletter may be addressed to the *Product Safety Newsletter*, Attention: Roger Volgstadt, LOC. 103, c/o Tandem Computers, 2550 Walsh Ave., Santa Clara, CA 95051-1392, Fax No. (408) 748-2137.

This newsletter is prepared by the Corporate Graphics Group of Tandem Computers Incorporated. The editor wishes to extend a special thanks to Annie Valva and Jodi Elgin of Tandem Computers for their work in preparing this newsletter.

Chairman's Message

Continued

John McBain, our secretary/treasurer, is working as a product regulations engineer at Hewlett-Packard, also in Cupertino. John has responsibility to establish regulatory compliance for some of the H-P computer line. This includes product safety evaluation and certification, EMC compliance, ergonomics, and datacom licensing. His product safety experience includes four years at Underwriters Laboratories in Santa Clara, California, and three years at ITT Information Systems (now known as Alcatel). He has a BS in math and physics from the University of Alberta in Edmonton, Canada. John formerly taught secondary school in Edmonton. His outside interests include fencing, science fiction, and trying to buy a house. I should also point out that John has played a major role as one of the founding participants of the PSTC.

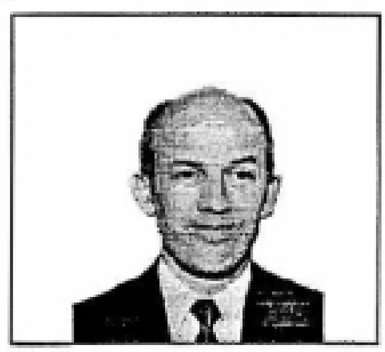


John McBain

Tania Grant, who has recently volunteered to chair the Standards Committee, attended U.C. Berkeley where she focused on Slavic language and literature, with cultural anthropology thrown in. Tania has worked as assistant research librarian for medical and technical libraries (Cutter Laboratories, FMC Central Engineering Laboratory). After "a childbearing hiatus and 'putting hubby through'," says Tania, she re-entered the work force as an electronics inspector for Kaiser Aerospace. She then went on to work her way to a QA engineering position for ISS-Sperry Univac and Intel. It was at Intel that Tania broke into the world of product safety. Tania now works in Milpitas, California, for Octel Communications Corporation as a safety engineer, but also dabbles in EMI work.

Tania's photo unavailable.

Mike Harris serves our group as paper review chairman. His career



Mike Harris

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experience includes six years in QA at the C.P. Clare Division of General Instruments, nine years in product safety and engineering with Square Company, four years with a large consulting firm as vice president of product safety, and four years founding and presiding over Teccom Company, a product safety and EMI consulting firm. Mike's personal interests include sailing and cross-country skiing. Married 20 years to Susan, they are raising Matthew (15), Kim (14), and Alex (7) in Foster City, California.

Roger Volgstadt, who, more than anyone else, makes this newsletter happen, has the appropriate title of newsletter chairman. Roger is a graduate of California Polytechnic State University and began his career with Underwriters Laboratories Inc. After six years in industry,

Roger Volgstadt

Roger returned to school for some nontechnical education (a one year Certificate program in the Bible). He then joined Qume Corporation, where he ultimately assumed their worldwide product safety responsibilities. Roger is now part of the product safety team at Tandem Computers in Cupertino, California.

YOUR NAME HERE is our symposium liaison chairperson.

Your Name Here.

Yes, we still need a volunteer for this important position. There are people waiting in the wings to represent the PSTC at the 1990 IEEE EMC Symposium in Washington, D.C. But we need someone to coordinate this activity. If you want to support the PSTC by filling this position or helping in any other way, please contact one of us. (A listing of where we can be reached follows.)

Well, now you have some insight into who we are. We'll be working hard to make the PSTC successful. But, we need your help. Please, let us know who you are and your areas of interest.

Best regards,
Rich Pescatore, *Chairman*

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Technically Speaking
Rich Nute

Characteristics of Air as an Insulator

Hello from Vancouver, Washington, USA:

A few months ago, we built a clear plastic box containing a four-inch square steel plane, a two-inch diameter steel sphere, and a micrometer drive to precisely adjust the distance between the plane and the sphere.

Recently, we finally had the time to do some testing. We set the distance to a known value and then slowly applied the voltage from a hi-pot tester until the tester tripped. We repeated the process for increasing distances. At each distance, we repeated the test at least once to determine consistency. The repeatability was about 50 volts rms or dc. (Subsequently we learned that the repeatability was related to the resolution of the hi-pot voltage control itself.)

We performed the test data with both dc and 60 hertz sinusoid waveforms.

The table gives our test data. For ac, we measured the rms value and then calculated the peak value as 1.414 times the rms value. (We confirmed that the ac waveform was sinusoidal by observing the waveform with an oscilloscope.)

The table includes ac (50 Hz) and 1.2 x 50 impulse breakdown voltages data from IEC 664.

Plotting these data, we find that the ac peak and dc lines virtually overlay each other.

Conclusion: In air, there is no difference in breakdown voltage between ac peak and dc voltages (for mains ac frequencies). This conclusion is incontrovertible.

Note that this experiment is a 60 hertz test, while IEC Publication 664, Table AII, is a 50 hertz test. The 60 hertz peak breakdown voltage is in good agreement with the 50 hertz peak breakdown voltage up to about 5 kilovolts.

Further note in IEC 663, Table AII, that the 50 hertz peak breakdown voltage closely agrees with the 1.2 x 50 impulse breakdown voltage.

Continued

AC and DC Dielectric Breakdown of Air (Homogenous Field)

Distance		Breakdown Voltage, kV			
Inch	mm	Peak	DC	Peak*	1.2x50*
0.004	0.10			0.98	1.03
0.010	0.25	1.77	1.80		
0.020	0.51	2.86	2.85	2.70	2.81
0.030	0.76	3.87	3.90		
0.040	1.02	4.81	4.93	4.50	4.64
0.050	1.27	5.80	5.90		
0.060	1.52	6.80		6.00	6.36
0.070	1.78	7.77			
0.079	2.00			7.50	7.82

*IEC = IEC 664, Table AII, AC, Sphere-to-plane.

Straight-line equations from regression analysis:

kV (peak) = 0.877 + 98.6 x D (1.414 x measured data)
kV (dc) = 0.789 + 102.8 x D (measured data)

kV (peak) = 0.852 + 85.8 x D (IEC data)
kV (1.2x50) = 0.879 + 90.0 x D (IEC data)

Where D is the distance between the plane and sphere, in inches.

When we add these data to the graph, we find that there is still good agreement (although not as good as the dc to ac agreement) between the measured breakdown data and the IEC breakdown data. (We'll examine the degree of disagreement more thoroughly a bit later.)

Conclusion: In air, there is no difference in breakdown voltage between dc, peak ac (either 50 or 60 hertz), and 1.2 x 50 usec impulse voltages.

Hypothesis: The breakdown of air is an absolute function of voltage and is not related to the waveform.

Conclusion: The breakdown of air is a linear function of the distance between the two electrodes.

Conclusion: For voltages below some value, air will not break down regardless of distance.

(IEC 664 data indicates the lowest voltage for air breakdown is 360 volts peak; our test data indicates the lowest voltage is about 800 volts peak. At this time, I cannot explain this difference.)

A Further Look

Let's take another look at what these data imply. Below the breakdown voltage, air is an insulator. Above the breakdown voltage, air is not an insulator. So, air is not always an insulator!

What are the conditions which must be fulfilled for air to be an insulator?

The answer is quite simple: The applied voltage must be less than the breakdown voltage. In mathematical form, this can be expressed:

V (applied) < V (breakdown)

We can see from the graph that the breakdown of air, V (breakdown), seems to be a straight line. The equation of a straight line is of the form:

$$y = ax + b$$

where

y is the dependent variable,
a is the slope of the line,
b is the offset (value of y when x is zero), and
x is the independent variable.

The breakdown voltage for air, assuming a straight line, would be:

V (breakdown) = a x D + b

where

a is the slope of the line in kilovolts/inch,
D is the distance, in inches, and
b is the offset, in kilovolts.

Using regression analysis (a function available in many handheld calculators), we can calculate the constants for the slope and the offset. The offset is about 0.8 kilovolt, and the slope is about 100 kilovolts per inch. So, the breakdown equation becomes:

V (breakdown) =
100 x D + kilovolts

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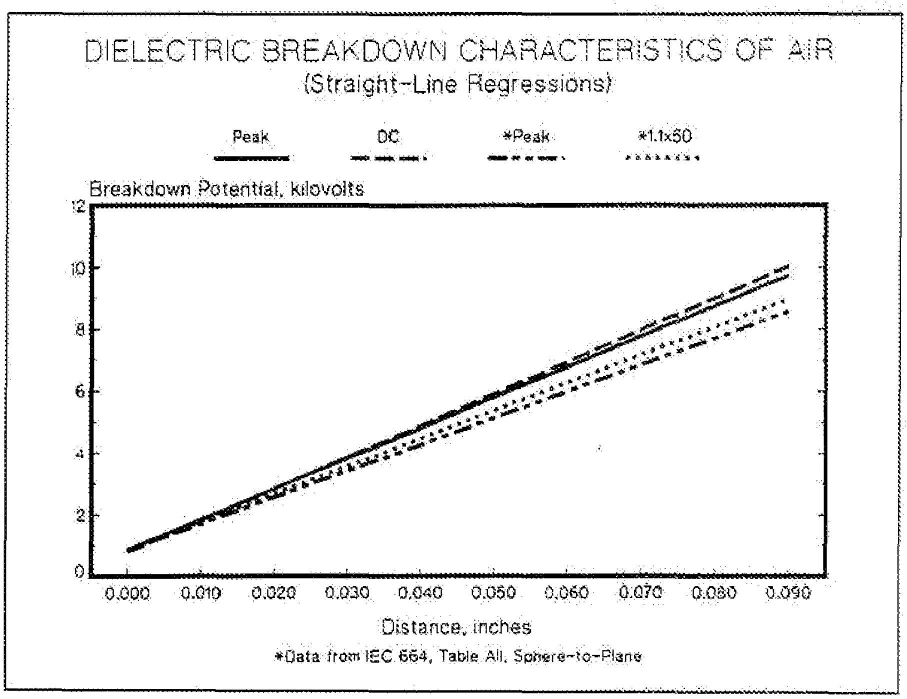
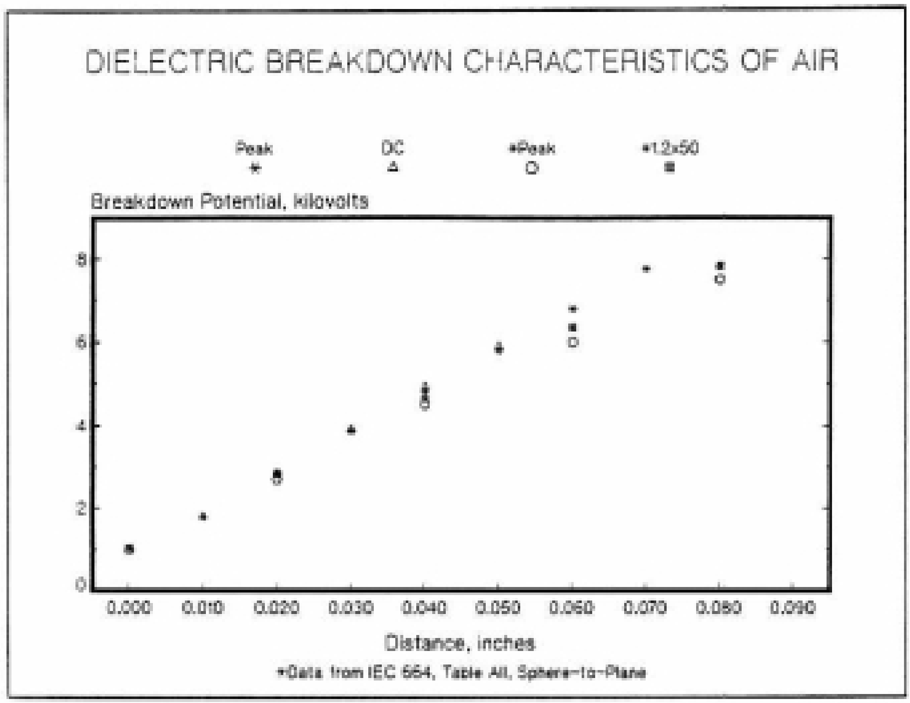




The conditions which must be fulfilled for air to be an insulator are:

V (applied) < V (breakdown)

Therefore,

V (applied) < 100 x D + 0.8 kilovolts

Let's summarize where we are. Air, as an insulator, has some minimum voltage at which it will not break down, regardless of distance. Above that voltage, the breakdown voltage of air is directly proportional to the through-air distance between the two conductors. At any distance, if the applied voltage is less than the breakdown voltage for that distance, the air is an insulator.

Conjecturing about Other Insulating Media

Intuitively, such characteristics should also apply to liquid and solid insulations. That is, for any insulation, there is some minimum voltage at which it will not break down, regardless of distance, and, above that voltage, the breakdown voltage is directly proportional to the distance through the insulating medium. At any distance, if the applied voltage is less than the breakdown voltage for that distance, the material is an insulator.

The statement that there is some minimum voltage at which a material will not break down, no matter how thin, can be supported by the argument that if the solid insulating material is removed and replaced with air, then there is indeed a minimum voltage at which the air will not break down no matter how close the two electrodes. Therefore, a worst case solid insulation cannot have insulation characteristics less than that of air.

Hypothesis: A material is an insulator if its breakdown voltage exceeds the applied voltage.

(Obviously, this is not a complete definition, but it is an absolutely necessary part of any definition.)

Conversely, a material is not an insulator if its breakdown voltage is less than the applied voltage.

Hypothesis: For any insulating material, whether solid, liquid, or gas, voltage breakdown is a straight line of the form:

V (breakdown) = a x D + b

where

a is the slope of the line in kilovolts/inch,
D is the distance, in inches, and
b is the offset, in kilovolts.

Continued

Experience tells us that solid insulators are much "better" than air. "Better" is taken to mean that, for the same distance, D, the breakdown voltage of solid insulation is very much greater than that of air. To satisfy the equation, "better" would mean that the value of "a," in volts per unit distance, must be very much greater than that of air.

One of the current controversies is whether there is any difference in the breakdown voltage of solid insulation when the applied voltage is dc, ac, or the 1.2 x 50 usec impulse. I'll reserve discussion of this issue for another time.

Experimental Variables

In performing this experiment, there are a number of variables that must be controlled. The first is the shape of the electric field and the consequent uniformity of the equipotential lines. The second is the detection of the breakdown of air. The third is the measurement of voltage at the instant of breakdown.

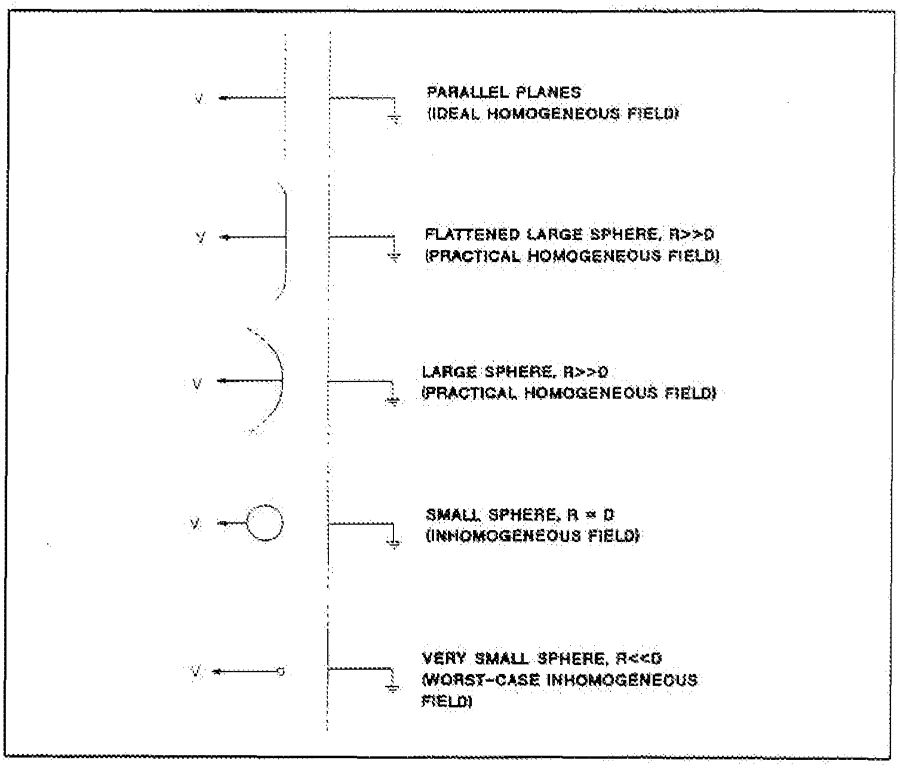
When conduction occurs (a breakdown), the conduction will be along a line of force between the two conductors. Indeed, the breakdown will occur on the line where the electric force is greatest among all the lines of force that exist between the two conductors. The greatest electric force is on the shortest line of force.

In this experiment, it is essential that the electric force between the two conductors is uniform and that the equipotential lines between the two conductors are as uniformly spaced as possible. The electric field that produces uniformly spaced equipotential lines is described as a homogeneous field.

The electric field is comprised of the lines of force between conductors. These lines of force emanate normal (at right angles) to the surfaces of the respective conductors. For each line of force, the potential between the two conductors divides uniformly along the line.

If we divide each line of force in half, and connect those points, we have an equipotential line, which represents one half the potential between the two conductors. Using this process, we can develop the pattern of equipotential lines between the conductors.

We can achieve a perfectly uniform electric field and, consequently, perfectly uniform equipotential lines if the two conductors are planes. But, the field at the edges of the planes would be rather nonuniform, and would therefore need to be accounted for in any experiment. To minimize the field distortion, we could



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gradually bend one plane away from the other. This would be done along the entire periphery of one plane; the resulting surface would be a plane with a spherical periphery (what you get at the instant a basketball bounces from the floor). The size of the plane is not at all critical, since the size of the electric field is not critical. Thus, the electric field resulting from a sphere in very close proximity to a plane approaches uniformity.

We used a 2-inch diameter steel sphere at distances from 0.01 inch to 0.10 inch from the plane. The distance ranged from 1% to 10% of the radius of the sphere. The scale illustration indicates the worst-case appearance of the two conductors.

The second variable is the detection of the breakdown of air. Fortunately, modern hi-pot testers have electronic trip mechanisms which are uniform in tripping when an arc occurs. Any trip current is acceptable provided an arc truly occurs just before the trip. This is easy to confirm visually.

The third variable is the measurement of voltage at the time of trip. Here, a digital meter can be very helpful if the voltage is increased very slowly when approaching the breakdown.

Discrepancies with IEC 664
After performing the experiment and experiencing the repeatability, it seems appropriate to hypothesize why the differences between our data and the IEC data.

When the IEC data is plotted point-by-point, the data agrees below 5 kV or so, and diverges seriously at 6.5 kV. This could be explained if the IEC had used a sphere where the ratio of distance to sphere radius was more than 10%. (The hi-pot tester available to me was limited to 6 kV rms and 6 kV dc, so we could not collect data as the ratio increased.) One hypothesis could be that nonlinearity can occur as the ratio increases.

At the lower voltages, the IEC data is not as precisely linear as our measurements. This could be explained by nonuniform observations of the breakdown or by poor control or measurement of the voltage. With the experience of performing the measurement, we found that these are critical to the uniformity and repeatability of the measurement.

There is still one more factor. We chose steel as the material for the electrodes. Massive, thick steel. Whenever an arc occurs, the power dissipated in the arc can melt the metal at either end of the arc. But, with a good thermal conductor and lots of thermal mass, this is minimized. (In attempting to do the point-to-plane test, we burned up a hardened steel needle when the hi-pot failed to trip and let the arc continue for an undue amount of time.)

The Nonuniform Electric Field
The other extreme is the perfectly nonuniform field and, consequently, nonuniformly distributed equipotential lines. Such a field is that resulting when the diameter of the sphere approaches zero.

A practical point is an extremely small sphere compared to the distance between the sphere and the plane.

Since the lines of force must emanate at right angles to the surface of the small sphere, they are bent in the region of the small sphere and are therefore longer than the single line of force at the end of the sphere. Because the equipotential lines must be normal to the lines of force and equally spaced along the lines of force, the equipotential lines are severely bent near the small sphere. This bending of the equipotential lines increases the total force on any charged particle in the region of the point as compared to a homogeneous field.

Continued

We also repeated the same test with a point-to-plane system. Immediately, we see significant differences. The first is a current indication well below breakdown. The second is lack of repeatability. The third is the slope of the line is about one fourth that of the sphere-to-plane.

Why these differences?

First, the highly bent equipotential lines lead to partial discharge at voltages very much less than the breakdown voltage. What happens is that the air actually breaks down in the region very near the point, but not across the entire gap. This is the same phenomenon as St. Elmo's fire and the streamers that emanate from a Tesla coil, except on a much smaller scale.

Second, because the point has a very small thermal mass, the breakdown arc actually melts the steel at the point, and therefore changes the shape of the point. Thus, the next breakdown is at a slightly higher voltage because the point is less sharp and the equipotental lines in the region of the point are not as severely bent.

The effect of an imperfect electric field is to reduce the breakdown voltage at any given distance. The worst-case reduction seems to be about one fourth of the best-case.

Application

For a typical 120-volt rated product, the required clearance (UL and CSA) is 3/32 inch (0.094 inch). According to these data, and extrapolating the worst-case point-to-plane, 3/32-inch clearance should break down at no less than 3.47 kilovolts peak or dc. The hi-pot potential specified by UL and CSA is either 1000 or 1500 volts rms (1414 or 2121 volts peak, respectively). So, 3/32-inch clearance is more than adequate for the test voltage.

What clearance is necessary to withstand 2121 volts peak? Working backwards, we find that 0.041 inch (less than 1/2 millimeter) will withstand 1500 volts rms! This is less than one half the distance required by UL and CSA standards!

We can only conclude that the requirements for clearances in various safety standards must be based on some parameter other than that of air as an insulator.

Acknowledgments

Impetus for this investigation was triggered by my friend and colleague, Jerry Blanz, who also participated in the experiment. Jerry is with Hewlett-Packard in Fort Collins, Colorado, and sits on CSA Subcommittee on No. 220, and Working Group 2 of IEC SC28A.

The required inequality of applied voltage and breakdown voltage was provided by another friend and colleague, Joe Neshiem. Joe is with Hewlett-Packard in Loveland, Colorado. Joe sits on CSA Subcommittee on No. 231, and on the US TAG to IEC 66E.

Editorial

Reading Can Be Fun

As product safety professionals, we certainly know that words can, unfortunately, have a variety of meanings depending on the source and the need of the moment. Read and chuckle at the following article which appeared in the March 31, 1988 edition of *EDN* magazine. This material has been reproduced by permission for your entertainment. The editor wishes to thank Jon Titus, editor of *EDN* and author of the editorial, for his permission.

Roger Volgstadt, *Editor*

WHAT THEY SAY:	**WHAT THEY MEAN:**
We can show that...	Well, it's not at all clear to us, but we're shaming you into taking it for granted.
It didn't operate as was predicted...	It burst into flames.
A high transient thermal effect...	We burned our fingers on the 2N3055.
After many experiments, we found a solution...	We fiddled with it for a long time and finally got it to work.
A typical sample...	The only time it did more or less what we wanted it to.
We ran transient tests...	The fuse blew every time we turned it on.
As a first approximation...	This value is flagrant guesswork.
You can improve this method...	Nothing we tried had a hope of working.
Here are the fundamental engineering principles...	We lifted this from another article.
You can solve the equation numerically...	We got eight answers that look vaguely right.
It's interesting to compare...	It isn't of the slightest interest, but it fills more space, we'll get paid more, and we can take a shot at Fred's article published in...
However, you can't reach the theoretical maximum power output...	You'll destroy all the output buffers if you adjust R, when the power is on.

Editorial
Continued

The gain figure is suboptimal...	It has no gain and the noise figure is 22 db.
We haven't optimized the amplifier's efficiency...	It's giving 2W out for 10W in and the output transistors are glowing red.
Performance is extremely good...	It worked for three hours and then died.
We thank Joe Smith for his comments about our manuscript...	Joe Smith completely rewrote the article at the last minute.
The authors wish to thank Chris Hendrie for his comments about the manuscript...	Chris gave us hell for using his dot-matrix printer so often.
The authors want to thank Elizabeth Scott for her assistance...	Ms. Scott finally got the circuit to work.

Well, I must confess a lack of originality. I've reproduced the comments above—with permission—from the December 1987 issue of *Radio Communication*, the journal of the Radio Society of Great Britain. The idea originated in *FM News*, the Central Scotland FM Group's newsletter. —John Titus, *EDN*

Ask Doctor Z

In the world of Product Safety and Certification, there are many pitfalls for the unwary. If you have a problem that seems insoluble, then it's time to ask Doctor Z! He has the answers, derived from his many years of training and experience in the Science of Product Safetiology. Pitfalls hold no terrors for Dr. Z, since he is on a first name basis with most of them. Any resemblance to persons, places, products, agencies, or good advice is purely coincidental, but don't let that stop you. Write to Dr. Z today.

Doctor Z regrets his absence in this issue of the *Product Safety Newsletter*, but prior commitments made it impossible for him to provide his guidance this month to less enlightened product safety individuals. He certainly hopes to be back next issue.
Dr. Z

[Actually, the real reason is that nobody wrote to Dr. Z this month. Would someone please write him a letter soon, so he will quit calling me up asking for his mail? Thanks! —Ed.]

Insulation Systems

Jerry Blanz, Hewlett-Packard, Fort Collins, Colorado

Solid insulation as such and the physics of failure of solid insulation is a subject clothed in mystery except for the high voltage power transmission people. Even then, the view of such insulation tends to look at macro-failure or, alternatively, catastrophic failure. For those of us who practice safety in the lower voltage world of electronics, little has been known about how and why solid insulation fails or how to design for nonfailure of solid insulation.

This lack of understanding is in the process of being replaced by some recent innovative work embodied in the documents being created in Working Group 2 of IEC SC28A. Modern research has provided the insights which were missing for so long.

Before getting these insights into view, let us review what we mean by "solid insulation." Clearly, solid insulation (s/i) is not a gas nor is it a liquid. In other words, it is not capable of quickly healing a failure of electric strength. So solid insulation must be rigid enough to have dimensional predictability and stability without the need of an auxiliary container. Does the surface of the solid insulation have any significance here? None at all. Does the surface of solid insulation ever have any significance, per se? None at all, but the rationale for that is beyond the scope of the current discussion (another article?). In short, the term "solid insulation" is here construed to mean the bulk material of a nonconductor which is rigid enough to be identifiable alone.

Any piece of solid insulation has inclusions of foreign matter—something other than the intended homogeneous material. These can be voids containing a gas (usually air) or pockets of foreign matter whose electrical traits are often different than the parent material. Note that the origins of these inclusions are a result of the fabrication process and are not the same for the individual units within a fabrication batch.

Because the electrical properties of these inclusions are invariably different than the bulk material, when subjected to an electric field, the field distribution and hence the field intensity is not uniform but crowds toward the micro-region of the least permittivity—normally air in the form of a micro-void. It should be noted that the physics we are talking about here is on a very tiny level; microscopic and even verging toward the molecular.

These little pockets of higher field intensity are normally also pockets of the least electric strength. At some overall level of impressed electric field, these pockets will break down and exhibit a micro-discharge across the pocket of the "funny stuff." The amplitude which just causes this "partial discharge" to occur is called the "inception voltage." Each piece of solid insulation has one of these. But note carefully that this value is not a characteristic of the material but only a characteristic of that particular piece, because other pieces (of the same sort) will have a different degree of inhomogeneity. Which is to say that a batch of the same components, like opto-isolators for example, will test out as having a whole range of inception voltages—a statistical distribution.

Now, let us consider the effect of hi-pot testing of insulation of completed electrical equipment in a production environment. If the voltage used for dielectric testing exceeds the inception voltage for that particular piece(s) of insulation, *it will go into partial discharge*. But the sneaky thing about this event is that there is no way that its occurrence is apparent on the outside. It's hidden. The aggregated current from all the little partial breakdowns within the material is very small: microamps at best, in the beginning. But the important point to observe is that each time this occurs, the inclusion is eroded, making it a little bit bigger. It's cumulative! Eventually the region across which the discharge is occurring will expand out into a "dendritic" tree. This is a sign that the piece of insulation in question is getting close to catastrophic failure which is total

Continued

punch-through. It can easily be seen that an insulation system can be significantly damaged by repeated dielectric testing, without the damage showing itself on a macro-basis for a long time. In other words, it *seems* as though no damage has occurred, but the death knell of the insulation has been sealed unless its exposure to further high voltage is eliminated. Caution: "further exposure to high voltage" includes all transient overvoltages appearing on the power line (for insulation in mains-connected circuitry) or any self-generated transients during the life of the product.

Paschen's law tells us that this phenomenon of partial discharge cannot occur below a level of about 350 volts. It also turns out that the likelihood of incidence increases exponentially with voltage. Therefore, a reasonable question would be: how often does this occur in electronic equipment as we know it today using the kinds of components that we know today? Little is currently known about the answer to that. Some work is underway which is attempting to get an insight into the answer but meanwhile it is difficult to estimate from field repair reports and component autopsies because the average technician is not familiar with the symptoms or appearance of insulation which has sustained significant damage from partial discharge. End-of-life through catastrophic failure of insulation rarely leaves enough evidence to enable failure analysis.

A familiar issue now suggests itself: is DC dielectric testing "equivalent" to AC dielectric testing? Historically, the answer has been "No" because of AC heating of dielectrics due to the loss tangent. As we understand electronic equipment today, that is unlikely to be a significant factor, given the quality of the insulation materials available. So we might look to the partial discharge viewpoint to check for fresh insights.

DC testing which is high enough amplitude to cause partial discharge (p/d) will accumulate micro-erosion during the entire duration of the test. AC testing will accumulate micro-erosion only during the portion of the sine wave (or whatever waveshape is used) which is above both the inception voltage and the extinction voltage (which is a value somewhat smaller than the inception value). So for equal amplitudes, AC testing will accumulate erosion and, therefore, shorten lifetime, far less than DC testing as long as the amplitudes involved are only moderately into the p/d inception zone.

Where is p/d most likely to show up in conventional electronic equipment? In inductive circuits where switching of high voltage is going on, such as in certain areas of switching power supplies and deflection circuits in CRT devices. Also in the main circuits of ANY equipment where external transients are induced in the conductors. (Which, by the way, is the principal reason for the current wave of interest in surge limiters on power inputs—where p/d-causing transients can be clipped/absorbed so that the equipment circuits are free from overvoltage, permitting much simpler and inexpensive insulation.)

Meanwhile, the concept of mandating repeated dielectric testing of products is clearly the wrong answer if the voltage is very high—let's say, 1 kV or higher. Such repeated testing will accelerate the progressive destruction of the solid insulation, hastening the demise of the equipment, without the bill being paid by the responsible party!

News and Notes

Technical/Trade Shows

ELECTOR—sponsored by Region 1 of IEEE, April 11-13 at Jacobs Javits Convention Center, New York City, 900 exhibitors and 25 technical sessions. Many technical topics will be covered, with emphasis on video and communications.

National Design Engineers Show, April 24-27, McCormick Place, Chicago, 675 exhibitors, technical topics on materials, CAD/CAM, fluid power, electronics.

Conference on Laser and Electro-Optics (CLEO), April 24-28 Baltimore Convention Center, co-sponsored by IEEE Electro-Optical Society and ASO.

National Association of Relay Manufacturers, April 11-14, Stillwater, OK.

Proposal to Withdraw IEC 380 & 435

A Central Office Document TC(CO)99, draft proposal, indicates that September 1, 1990, would be the earliest date for withdrawal of IEC 380 and IEC 435. Some countries will withdraw these publications at an earlier date.

IEC 950 Amendment No. 1

Copies of Amendment No. 1 to publication IEC 950 (1986) dated November 1988 are available from ANSI at a cost of $57.00 plus shipping and handling.

UL Representative to CBEMA ESC-2

Mr. M. Demartini, of UL's Santa Clara office, has been promoted to the position of managing engineer, Electrical Department. His position as a representative to CBEMA ESC-2 will be filled by Steve Undorte, associate manager, Electrical Engineer Dept., Santa Clara.

IEC Publications

Three IEC publications—a *Yearbook, Catalog* and *Annual Report*—are available from ANSI at a cost of $31.00, $12.00, and $10.00 respectively.

The *Yearbook* contains a listing of IEC approved standards, as well as work in progress and subjects under consideration. Names of the TC chairman and subcommittee secretariats are provided.

The *IEC Catalog* features a listing and description of all IEC approved standards and a listing of IEC guides and publications of IEC sponsored activities of CISPR and IECQ.

The *Annual Report* covers activities in the nine basic areas such as materials, general safety, measurement control and general testing, telecommunications and information technology.

CENELEC Laser Standard Status

CENELEC has started work to convert HD482-S1 (IEC 825 1984) with revisions to an EN document as soon as possible. CENELEC HD482-S1 was approved in January 1988.

Effects on the Human Body of Electromagnetic Fields and IEC

ACOS has recommended that IEC wait until further information and conclusions are available before taking further action on non-ionizing radiation from 50-60 Hz to 300 GHz. If future data shows that safety risks are involved, ACOS is prepared to initiate standardization work on measurements.

UL Announces New PWB Recognization Service

In a letter dated January 31, 1989, UL has announced a new category entitled Printed Wiring Assemblies (ZPV12). This category is created to address traceability resulting from the practice of assembling and/or soldering components to PWB at facilities other than the end product factory where Follow-Up Services inspects. More detail can be obtained from contacting any UL office.

IEEE Continues to Grow

In the March issue of *The Institute*, the President's Column, there were some figures that indicate the size of the IEEE. The membership is now 300,000, with more than 30,000 members actively involved in IEEE projects. There are 66 magazines and journals and nearly 300 yearly technical conferences. In 1988, 80 new standards were developed. There are 36 Societies, 754 Society Chapters, 268 Local Sections, and 614 Student Branches.

Area Activity Reports

Northeastern Chapter
The February meeting of the Northeastern Chapter was held on February 22. The principal speaker was Mr. Louis Favoi, who covered CSA Bulletins 1402 A, B, and C, and their effect on power supply and approval requirements. Thirty-eight were in attendance.

The next meeting will be March 22, at the Sheraton Boxborough at 7:00 p.m. Mr. Dan Barbini from CSA will be the featured speaker. He will cover the changes and directions in CSA EDP and Power Supply Standards.

Questions about the chapter may be addressed to Jim Norgaard at Dash, Straus and Goodhue, (508) 263-2662.

Pacific Northwest Chapter
Our February meetings were a shocking success! We are now holding consecutive meetings (one in Portland, one in Everett), on the third Tuesday and Wednesday of every month. Rich Nute from Hewlett-Packard was our speaker and he gave a presentation on the variable impedance of the human body. It was amazing to see how changes in voltage, current, and frequency can affect the type and severity of the shock one receives. Rich's presentation included several hands-on exhibits that really gave you a feeling for the shocking truth.

Regarding Tech Committee business, we discussed the fact that we must soon vote on permanent officers now that we are affiliated with the IEEE. It was noted that only members of the IEEE can vote and/or become officers. An encouragement to join IEEE was included with a circulated questionnaire regarding the format and topics of our meetings.

The responsibility of videotaping the meetings for our members in Spokane, Boise, and Vancouver, B.C., was also discussed. It was unknown if the majority of the speakers would allow such a thing.

The next Seattle area meetings will be held on March 22 and April 19 at 7:00 p.m. at John Fluke Mfg. Company in Everett as before. The next Portland area meetings will be on March 21 and April 18 at 7:30 p.m. The location for the Portland area meetings is still undetermined, and all area members will be notified via a separate mailing. The officers are looking for a new location, as the location at Tektronix did not work out.

The speakers will be Gene Bockmier of UL in March to speak on their new facility in Camas and how it will affect the West Coast. In April we will have Jim DeVriesi of CSA speak on their new bulletin, 1402C, concerning power supplies.

Questions about the Pacific Northwest Chapter may be directed to Al Van Houdt, Spacelabs, (206) 882-3700.

Orange County Chapter
With the start of the Los Angeles Chapter of the Product Safety Technical Committee, the Southern California Chapter has been renamed the Orange County Chapter.

Charlie Bayhi opened the Tuesday, March 7 meeting with 20 members in attendance. Jim DeVries, Serge Bousquet, and Phil Cooper from CSA presented a CSA Category Certification Workshop, detailing the CSA category certification process. The CSA questionnaire and checklist for category certification were also presented and explained.

News of interest included the announcement that UL has begun a Power Supply Cord Assurance Program (POCAS). Details are available from UL.

The next EMC Society meeting will be March 14, 1989, at the Holiday Inn in Fullerton. For reservations, call Michele at (714) 732-5691. The next Product Safety meeting is scheduled for 6:00 p.m. Tuesday, April 4, 1989, at MAI Basic Four. The program is to be on the UL Compass Program.

Those interested in the activities of the Orange County Chapter are encouraged to contact Paul Herrick at Gradco Systems Inc., (714) 770-1223.

Los Angeles Chapter
The Los Angeles Chapter began its first meeting on March 6, 1989, with Rolf Burckhardt, the Chapter's

Continued

founder, welcoming everyone. Rolf gave a presentation on the conception, history, and scope of the Society, assisted by Serge Bousquet of CSA. Eleven members were in attendance.

The Chapter's program included a presentation by Serge Bousquet, Jim DeVries, and Phil Cooper of CSA on the history of CSA. They also enlightened members about the variety of certification programs available to them. Other items discussed were the CSA standard C22.2, No. 950, which is expected to be published in June 1989 and the U.S./Canadian Free Trade agreement with its provisions to be implemented over a period of 10 years. The new GI4 method for evaluating operator access areas and primary to secondary isolation was presented by Jim DeVries, while Phil Cooper presented the function of CSA's Information Services which are available to answer any type of questions, technical or otherwise, to CSA's clients and prospective clients.

Rolf Burckhardt gave a brief presentation on U.S. Testing Company, which is one of the many alternatives to UL, ETL, etc. The U.S. Testing Company will be asked to give an in-depth presentation at some future date.

Charlie Bayhi, chairman of the Orange County Chapter, was present and gave a brief presentation on the new UL POCUS program from Follow-Up Services. The program allows the power supply cord to be supplied in distribution rather than with the labeled product. The UL notice on the POCUS program was also distributed.

Members were asked for their opinions of the Chapter meeting time and day of the week, and members were in agreement to keep the Monday meeting, but with a change in time from 6:00 to 6:30 p.m. Members were also in agreement to hold the L.A. Chapter meeting the day prior to the Orange County Chapter meeting so that both Chapters may share the same speakers when possible. This may change from time to time.

An announcement was made that the Orange County Chapter would hold its meeting March 7, at 6:00 p.m. at MAI Basic Four in Tustin. The meeting's program was a workshop given by CSA on CSA's Category Certification program [see Orange County Chapter report—Ed.].

The next meeting is tentatively scheduled for Monday, April 10, at 6:30 p.m. at Harman Electronics in Northridge. The program will be a CSA workshop on CSA's Category Certification program.

Contact Rolf Burckhardt at (818) 368-2786 for more information about the Los Angeles Chapter.

Santa Clara Valley Chapter

At January's meeting, Serge Bousquet of CSA gave a presentation on new proposals for harmonization to IEC 950. He also informed us about the new EMI marking requirements and provided copies of the bulletin explaining the requirements.

At the February meeting, Graham Wallace, of Ford Aerospace, gave a slide and talk show on Metrology and Calibration. His talk focused on what the standards and measurements are based on, how calibration labs calibrate your equipment, and how often equipment should be calibrated.

Chris Kendall of CK Consultants will be the guest speaker at our next meeting, which will be held Tuesday, April 27, 1989, at 7:00 p.m. at Apple Computer, 20525 Mariani Avenue, Cupertino, on the corner of De Anza Blvd. (just south of Hwy. 280). Chris will discuss several topics relating to EMI requirements for FCC, CSA, and Europe, and of course, will be available for questions.

In May, Mike Hopkins of Key Teck will be the guest speaker at our May meeting, which will be held at the new meeting location on Tuesday, May 25, 1989, at 7:00 p.m. at Apple Computer, 20705 Valley Green Drive (turn right from De Anza Blvd. one block south of Hwy. 280). Mike will discuss ANSI C62.41 and .42 concerning power line transients, and will be available

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for questions.

We are looking for volunteers to help put on seminars on product safety. If you have any questions regarding this or the Santa Clara Valley Chapter, please direct them to Mike Campi, (408) 773-0770.

[News Flash: The May meeting of the Santa Clara Valley Chapter will be at a new location: 20705 Valley Green Drive, one block from the present location. A map will be included in the local meeting announcement sent for May.—Ed.]

Chicago Chapter

The first meeting of the Chicago Area Chapter was held on March 7, 1989, at Mitsubishi Electric Sales America. Twenty-four people attended the meeting to hear Mr. Stan Savic, of Zenith Radio, speak on the topic of Product Liability. Mr. Savic presented a short video and then opened the meeting for further discussion. That discussion centered around preventing product liability lawsuits. Personal experiences were shared by the attendees.

The time, place, and topic of the next meeting will be determined in the near future. Local members should watch for the local newsletter, *SCANFAX*, and the May/June issue of the National newsletter. Questions about the Chicago Chapter can be addressed to John Allen at Mitsubishi Electric Sales America, (312) 699-4414.

Austin Chapter

The first meeting of the Austin Area Chapter occurred March 23, 1989. George Jurasich chaired the meeting and introduced the function of the Product Safety Technical Committee. The main topic of the meeting included a presentation about TUV Rheinland, including a history of the agency. Tom Lorensen of TUV also made a short presentation about the differences between IEC 380 and EN 60950. Tom hopes to make a more detailed presentation of these differences at the next meeting.

The time, place and topic of the next Austin area meeting are yet to be determined. Local members will be advised of the meeting in a local announcement mailer. Questions can be addressed to George Jurasich at TUV Rheinland, (512) 343-6231.

The 5th Wave

"YOU KNOW THE RULES, COMRADE. SMUGGLED AMERICAN COMPUTERS CANNOT BE EXAMINED UNTIL KGB REMOVES ALL 'ESCAPE' BUTTONS."

Product Safety: A Primer

by Rolf-Dieter Burckhardt

Product safety is often regarded as a part of the product design/release cycle that produces negative costs due to the time and expense involved. Experience shows, however, that complete and accurate preparation can significantly reduce the overall time and cost involved when applying.

As with almost anything else, the first time is the most difficult. Product safety will require company-wide involvement from the CEO to the shipping and receiving department. But ultimately, a single person must be the focal point, i.e., responsible for product safety and dealing with the approvals laboratories.

You will need a copy of the safety standard that pertains to the product your firm produces or plans to produce. In the United States these standards are created by Underwriters Laboratories Inc. (UL). Many standards are also approved by the American National Standards Institute (ANSI). An indication of this will appear on page 1 as ANSI/UL (standard number—year) if this is the case. ANSI is also the official distributor of most foreign standards in the United States.

In Canada, the Canadian Standards Association (CSA) is responsible for setting standards, and in Europe and most of the rest of world it is the International Electrotechnical Commission (IEC), which is a conglomerate of 44 countries. Certain organizations, such as West Germany's Verband Deutscher Elektrotechniker (VDE) and Sweden's Svenska Elektriska Materielkontrollanstalten (SEMKO), use the IEC's standards as a basis and supplement them with their own set of published requirements.

If it is unclear which standard pertains to your equipment, the testing laboratories can often be of assistance in helping you make a determination. For information on purchasing standards documents see page 21. In terms of lead time and cost, UL has proven to be the best bet for U.S. standards. However, I advise checking price and lead times carefully, especially on foreign standards.

After you have received the standards document, take time to read and understand it. With a notepad and the piece of equipment in question, peruse the document while making general notes and questions on items which you do not understand or that seem vague. After you have accumulated a number of these notes, address your questions in a letter to the laboratory. If time is of the essence, give the laboratory a call after carefully thinking about each point of concern. It is most important to be brief and to the point. Do not inundate the test engineer with a long list of questions. All of the aforementioned applies to international laboratories as well, which usually have some English-speaking personnel to assist you.

Essentially, the laboratory investigates your product by reviewing and testing to the particular standard. The standard may encompass various products which fall into a specific category. The entire standard may not concern your product, but the pertinent sections will be used as a basis for the review.

During this review, a great amount of information is needed to determine that the components that make up the product are suitable in their particular application. Normally, the information would be given in the form of dozens of vendor specification sheets. The end result is that someone, whose time you have to pay for, has to wade through all of this information. Do not send anything that can't be used! Too much information costs you money. Ask what type of information the lab would like, and send only what is required.

The simplest procedure you can take is to create a chart, which for all intents and purposes we will call the Component Verification. On this chart, list the components and materials that the laboratory is concerned with. Structure the chart in columns and list your in-house part number, the vendor name and part number (list all sources!). Give a description of the part with applicable ratings and, finally, list

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the agency approval file numbers. (See Table 1.)

Table 1

YOUR P/N	VENDOR P/N	VENDOR	PART DESCRIPTION	UL 3	CSA 3
XXXX	XXXX	XYZ Plug Co.	Conn,plug,6P,PM,NAT,94V-0	EXXXX	LRXXXX

wherefore the description

Conn = connector
plug = male type
6P = 6 position
PM = Polyamide
NAT = natural color
94V-0 = flame rating

All of this information should be accumulated during the product's design phase and kept in a file specifically for product safety.

When selecting a component or material, be sure that the source is approved. The same goes for alternate sources. Make sure these are compatible and "approved." (Note: "approved" is being used as a general term here. Depending on the laboratory this may be officially termed as "listed," "recognized," "certified," etc.) Most importantly, do not sole source. Adding an item after your product is approved can be very costly due to the reopening of your file. In the meantime, only those products produced using approved parts, as reflected in the report, may bear the approval label.

Beware of components that are said to have been "designed to meet" a particular standard. Standards exist for components as well as products. This type of "designed to meet" component has not been tested by any laboratory and approved as safe. Purchasing a nonapproved component will require additional testing for that component prior to its acceptance for use in your product. This will increase both your cost and the time required for the process.

Much of the information you may need can be found in the UL "Yellow Books," CSA "Blue Books" or VDE Book 23. These continuously updated publications are manufacturer's lists of components and materials that have undergone review and testing and have met the requirements set forth for those items. Some other safety agencies have similar publications.

Ask the laboratory for a copy of the particular categories review form report and test report. It is perfectly acceptable to submit your own product review report, although it may take some time before the laboratory will accept a self-generated test report. This may involve several visits to your plant to inspect the testing facility, to witness the testing and to evaluate your product safety personnel's knowledge and capabilities.

The product review report may be generated in IBM's DisplayWrite word processing program. Thus far, Versions 3.0 and 4.0 are in use at UL and CSA. In some cases, other programs may be acceptable if converted to an ASCII format. Prior to beginning, you should also request a copy of the laboratory's word processing procedure so that the entire format coincides. Be sure to obtain the form report and the word processing procedure from the office you plan to submit to. Different offices may not necessarily use the same formats. Once you have completed the report, submit a floppy diskette along with a hard copy of the report.

Photographs of the product will be required and used as the pictorial part of the report and are referenced throughout. They are basically used as photographic evidence of the unit's construction and the components used. The standard format is 8" x 10" black and white. UL

Continued

normally requires one set of photos, while CSA may require up to five or six sets. You may either choose to submit your own photos or have the laboratory generate them, at your expense.

The actual photographs are not used in the report. Instead, photocopies marked up with item callouts are included. Because of this second generation use, the photos you submit should be as crisp and clear as possible. Take several photos while the unit is completely assembled—a front view showing all of the controls and a rear view so the external connections may be seen. You may also want to take a view at a 30 degree angle which would show three sides—an overall view of the inside of the unit and several close-up views of various sections. After developing, photocopy your photographs and mark them up with item callouts for switches, transformers, ventilation holes, etc.

An important word about your project: get the questions answered, complete your report, perform your own tests, and complete your work *prior* to requesting an application for submittal from the laboratory. This is the single largest mistake that applicants make.

When you request an application, a file is opened for you, a project number is assigned, and a deposit is requested. Doing this at the start of your project is to your disadvantage, due to file maintenance charges which are incurred during the periodical review of your file's status. After a period of time, your file will take an inactive status and due to this, your file must be reviewed periodically and notices must be sent. Someone has to pay for all of this, and that someone is you.

After the project is complete on your end, ship everything required as soon as you have sent in the completed application and the deposit. Take care to mark all samples, cartons, packing slips and correspondence with the file and project number assigned to you. Most importantly, follow all instructions.

If you are curious as to what the laboratory's lead time to get your project in their queue might be, do not call three or six months ahead of time. Projects seem to come in waves, and the lead time constantly changes. What may be true today may not apply one month from now.

Choosing one of the locations of a particular laboratory may be to your advantage as well. No one says you must deal with the laboratory closest to you. Check around to see what each office's workload is. In some cases, you may have to spend a little more in telephone calls, shipping and related expenses, but the difference in lead time may make up for these other expenses.

If you wish to pursue your options further, you may shop around at other accredited laboratories. Aside from UL, several other laboratories offer the same services—ETL Testing Laboratories, Factory Mutual Research Corp., United States Testing Company, MET Electrical Test Company and others. See the following two pages for locations.

If you wish to gain a deeper understanding and become more involved with product safety, you may consider joining a society which specializes in product safety.

A relative newcomer, but growing rapidly, is the IEEE Technical Committee on Product Safety, formerly the Product Safety Society. This society is made up of roughly 1000 members nationwide from a broad range of manufacturing companies with one common goal—to expand their knowledge due to ever-changing technology and standards. Chapter meetings are held throughout the U.S. with speakers from various national and international agencies and industry specialists.

Another newcomer is the National Sound and Communications Association (NSCA) Product Safety Group which represents a number of professional and commercial audio manufacturers. You may become directly involved in this group to learn about and overcome problems in those particular fields.

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The Electronic Industries Association (EIA) and the Power Sources Manufacturers Association (PSMA) also have product safety committees within their organizations. Contact the central offices of these organizations for further information. (Listing follows.)

A number of books available from publishers such as McGraw-Hill, Prentice Hall, Wiley and other technical and legal publishing houses deal with product safety, system safety, hazard assessment, liability and litigation. These books may be found in technical bookstores or may be purchased directly from the publisher.

In addition, a newsletter is available from the Technical Committee on Product Safety which was still free of charge at the time this paper was prepared. Other information sources you may wish to reference include *Compliance Engineering Magazine*, which covers regulatory compliance as a whole, and *Evaluation Engineering Magazine* which deals with all types of testing. Although the latter scarcely provides articles on product safety, they do run an annual directory of test facilities and consultants.

You may choose to have an outside service handle the entire project for you. These services have the ability and know-how to handle any portion of a project. They may be found listed in the yellow pages under the engineering consulting section, but more often than not are found by word of mouth. Care should be taken in choosing a service—check on experience, services offered, and hourly rates, which can range from $30 for a technician to $120 an hour or more for an engineer. You must keep in mind that the rates are dependent upon whether you contract an individual consultant or a consulting company, taking into consideration overhead and other expenses. And remember, more expensive does not necessarily mean better.

Contact the following list of organizations for more information on product safety rules, regulations and requirements.

Test Laboratories and Offices

Underwriters Laboratories Inc.
333 Pfingsten Road
Northbrook, IL 60062
(312) 272-8800
Melville, NY
Research Triangle Park, NC
Santa Clara, CA

ETL Testing Laboratories
Industrial Park
Cortland, NY 13045
(607) 753-6711
Norcross, GA
So. San Francisco, CA

Factory Mutual System (FM)
1151 Boston-Providence Turnpike
Norwood, MA 02062
(617) 762-4300
Call for additional locations.

United States Testing Company
1415 Park Avenue
Hoboken, NJ 07030
(201) 792-2400
Call for additional locations.

MET Electrical Test Company
916 W. Patapsel Avenue
Baltimore, MD 21230
(301) 354-2200
Call for additional locations.

Canadian Standards Association (CSA)
178 Rexdale Blvd.
Rexdale, Ontario M9W 1R3
(416) 747-4000
Moncton, New Brunswick
Pointe-Claire, Quebec
Winnipeg, Manitoba
Edmonton, Alberta
Richmond, British Columbia

For product safety testing in West Germany contact:
Verband Deutscher Elektrotechniker
Bismarckstrasse 33
D - 1000 Berlin 12
Tel: 011 49 30 34 80 01 1

Verlag Gmbh.
Merianstrasse
D - 6050 Offenbach/Main
Tel: 011 49 69 83 06 1

Or contact the Technische Ueberwachungs Verein (TUV):
TUV Rheinland of North America
108 Mill Plain Road
Danbury, CT 06811
(203) 798-0811
Call for additional locations.

Continued

Product Safety: A Primer
Continued

TUV America
5 Cherry Hill Drive
Danvers, MA 01923
(508) 526-1628

TUV Essen Laboratories
7700 Marine Road
N. Bergen, NJ 07047
(201) 662-9252

For Sweden contact:
Svenska Elektriska Materialkon-trollanstalten AB (SEMKO)
Torshamnsgatan 43
KISTA
Box 1103
S-164 22 Kista Stockholm
Sweden
Tel: 011 46 8 750 00 00

The following organizations can be contacted for complete lists of nationally accredited product safety test laboratories:
U.S. Department of Commerce
National Bureau of Standards—NAVLAP
Office: (301) 975-4016

American Council of Independent Laboratories
(202) 887-5872

National and international standards sales:
American National Standards Institute (ANSI)
1430 Broadway
New York, NY 10018
(212) 642-4900

Global Engineering Documents
2805 McGaw Avenue
Irvine, CA 92714
(800) 854-7179

Publications

Compliance Engineering
271 Great Road
Acton, MA 01720
(508) 264-4208

Evaluation Engineering
2504 N. Tamiami Trail
Nokomis, FL 34257
(813) 966-9521

Societies

Technical Committee on Product Safety (IEEE)
c/o Rich Pescatore
Hewlett-Packard (MS 42LS)
19447 Pruneridge Avenue
Cupertino, CA 95014
(408) 447-6607

National Sound and Communications Association (NSCA)
Product Safety Group
10400 Roberts Road
Palos Hills, IL 60465
(312) 598-7070

Power Sources Manufacturers Association (PSMA)
Agency Liaison Committee
8833 Sunset Blvd., Suite 404
Los Angeles, CA 90069
(213) 652-9108

Electronic Industries Association (EIA)
Product Safety Committee
2001 Eye Street N.W.
Washington, DC 20006
(202) 457-4900

Congratulations to our Editor, Roger Volgstadt, on his marriage April 8, 1989, to Miss Pamela Worlock.

He should be back from his honeymoon in Tahiti in time for the next issue....we hope!

Institutional Listings

The Product Safety Technical Committee of the IEEE EMC Society is grateful for the assistance given by the firms listed below and invites applications for Institutional Listings from other firms interested in the product safety field.

[These two examples show the typical content of Institutional Listings: the contributing company's name, address, perhaps phone and fax numbers, and a brief description of the company's products or services. They are printed in business-card-sized format. —Ed.]

An Institutional Listing recognizes contributions to support the publication of the *Product Safety Newsletter* of the IEEE EMC Society Product Safety Technical Committee. Minimum rates are $100.00 for listing in one issue or $400.00 for six consecutive issues. Inquiries, or contributions made payable to the Product Safety Technical Committee of the IEEE EMC Society and instructions on how you would like your Institutional Listing to appear, should be sent to: PSTC Product Safety Newsletter, c/o John McBain (M/S 42LS), Hewlett-Packard, 19447 Pruneridge Avenue, Cupertino, CA 95014.

Calendar

The Product Safety Technical Committee of the IEEE EMC Society

Austin Chapter
Time, location, and topic to be determined.
Contact: George Jurasich
TUV Rheinland
(512) 343-6231

Chicago Chapter
Time, location, and topic to be determined.
Contact: John Allen
Mitsubishi
(312) 699-4414

APRIL

Monday, April 3
Los Angeles Chapter
Subject: ETL
Speaker: Larry Todd, ETL
Time: 6:30 p.m.
Location: Harman Electronics
8500 Balboa Blvd.
Northridge, CA
Contact: Rolf Burckhardt
(818) 368-2786

Tuesday, April 4
Orange County Chapter
Subject: UL—Compass Program
Speaker: Bruce Santo
Time: 6:00 p.m.
Location: MAI Basic Four
14101 Myford Rd.
Tustin, CA
Contact: Paul Herrick
(714) 770-1223

Tuesday, April 18
Pacific Northwest Chapter
Subject: CSA 1402C
Speaker: Jim De Vries
Time: 7:30 p.m.
Location: TBD
Portland, OR
Contact: Al Van Houdt
(206) 882-3700

Wednesday, April 19
Pacific Northwest Chapter
Subject: CSA 1402C
Speaker: Jim De Vries
Time: 7:00 p.m.
Location: John Fluke
Everett, WA
Contact: Al Van Houdt
(206) 882-3700

Tuesday, April 25
Santa Clara Valley Chapter
Subject: EMI and Product Safety
Speaker: Chris Kendall, CKC
Time: 7:00 p.m.
Location: Apple Computer
(NEW)
20525 Mariani Avenue
Cupertino, CA
Contact: Mike Campi
(408) 773-0770

Wednesday, April 26
Northeast Chapter
Subject: TBD
Speaker: TBD
Time: 7:00 p.m.
Location: Sheraton Boxborough
Intersection of
Rts 495/111
Boxborough, MA
Contact: Jim Norgaard
(508) 263-2662

MAY

Monday, May 1
Los Angeles Chapter
Subject: CSA—Category
Certification Program
Speaker: Jim De Vries
Time: 6:30 p.m.
Location: Harman Electronics
8500 Balboa Blvd.
Northridge, CA
Contact: Rolf Burckhardt
(818) 368-2786

Tuesday, May 2
Orange County Chapter
Subject: EN 60950 Standard
Speaker: Ed Spooner
TUV Rheinland
Time: 6:00 p.m.
Location: MAI Basic Four
14101 Myford Rd.
Tustin, CA
Contact: Paul Herrick
(714) 770-1223

Tuesday, May 16
Pacific Northwest Chapter
Subject: TBD
Speaker: TBD
Time: 7:30 p.m.
Location: TBD
Portland, OR
Contact: Al Van Houdt
(206) 882-3700

Continued

Calendar
Continued

Wednesday, May 17
Pacific Northwest Chapter
Subject: TBD
Speaker: TBD
Time: 7:00 p.m.
Location: John Fluke
Everett, WA
Contact: Al Van Houdt
(206) 882-3700

Tuesday, May 23
Santa Clara Valley Chapter
Subject: Line Transient Testing
Speaker: Mike Hopkins
Keytek
Time: 7:00 p.m.
Location: Apple Computer
(New)
20705 Valley Green Dr.
Cupertino, CA
Contact: Mike Campi
(408) 773-0770

Wednesday, May 24
Northeast Chapter
Subject: TBD
Speaker: TBD
Time: 7:00 p.m.
Location: Sheraton Boxborough
Intersection of
Rts 495/111
Boxborough, MA
Contact: Jim Norgaard
(508) 263-2662

JUNE

Monday, June 5
Los Angeles Chapter
Subject: UL—Compass Program
Speaker: Bruce Santo
Time: 6:30 p.m.
Location: Harman Electronics
8500 Balboa Blvd.
Northridge, CA
Contact: Rolf Burckhardt
(818) 368-2786

Tuesday, June 6
Orange County Chapter
Subject: Product Liability
Speaker: Denise Damrow
Attorney
Time: 6:00 p.m.
Location: MAI Basic Four
14101 Myford Rd.
Tustin, CA
Contact: Paul Herrick
(714) 770-1223

Tuesday, June 20
Pacific Northwest Chapter
Subject: TBD
Speaker: TBD
Time: 7:30 p.m.
Location: TBD
Portland, OR
Contact: Al Van Houdt
(206) 882-3700

Tuesday, June 21
Pacific Northwest Chapter
Subject: TBD
Speaker: TBD
Time: 7:00 p.m.
Location: John Fluke
Everett, WA
Contact: Al Van Houdt
(206) 882-3700

Tuesday, June 27
Santa Clara Valley Chapter
Subject: Hi-Pot and Ground
Testing
Speaker: Roy Clay
Rod-L Electronics
Time: 7:00 p.m.
Location: Apple Computer
(New)
20705 Valley Green Dr.
Cupertino, CA
Contact: Mike Campi
(408) 773-0770

Wednesday, June 28
Northeast Chapter
Subject: TBD
Speaker: TBD
Time: 7:00 p.m.
Location: Sheraton Boxborough
Intersection of
Rts 495/111
Boxborough, MA
Contact: Jim Norgaard
(508) 263-2662

The Product Safety Newsletter
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(See inside for expanded calendar!)