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the UL 1244... FINALLY

REVISED UL1244 AVAILABLE

WHAT'S HAPPENING?

A final draft of the Underwriter's Laboratories 1244 standard is now available. The UL 1244 is a safety standard for test and measurement instruments. Underwriter's Lab is an independent organization that certifies products for safety.

UL 1244 BACKGROUND

The UL 1244 standard was triggered by the Occupational Safety and Health Act of 1970, which states that electrical equipment an employee uses must be tested for safety by a third party testing agency if an applicable standard exists. At that time there were no standards for evaluating test and measurement equipment. Toasters and calculators, yes, but not voltmeters and scopes.

Tektronix first became interested in the UL standard when some customers asked for UL-listed equipment. Having an UL listing for a product makes it easier to sell because the listing means that there is third-party verification of the instrument for safety features.

Tektronix became actively involved in helping write the standard when UL proposed a first draft of the UL 1244 to industrial representatives. Industry response (especially Tektronix' 23-page criticism—the longest that UL received) convinced UL there should be a revision. WEMA (Western Electronics Manufacturers Association) selected a committee to represent the industry to UL. Rich Nute, Tektronix Product Safety, is the chairman of that committee.

The final draft of the much-revised UL 1244, now available. Call extension 5483 for a copy.

also in this issue

BARRIE GILBERT RETURNS

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TEKTRONIX and the IEC

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the UL 1244...

SPECIAL PROBLEMS

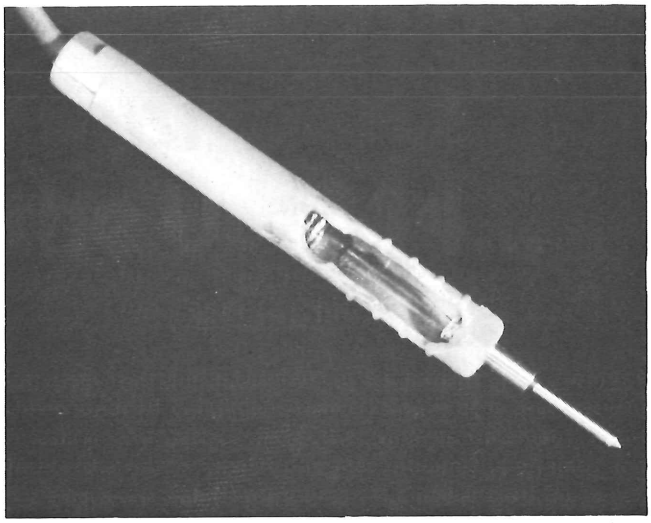
What sets test and measurement equipment apart from the other kinds of equipment that UL looks at is that test and measurement devices have two sources of energy input rather than only one. (Consumer products like radios and TV's have one significant source: the power cord.)

For example, a scope may be used to measure the voltage of the electrical distribution bus that routes power through our buildings. That's 480 volts with hundreds of amperes behind it.

Current safety standards are very clear about what to do with the power coming into the instrument from the wall socket. But they aren't always clear about defining protection from the power coming in through the measurement ports.

The problem of safety of test and measurement instruments is important. In one case, people in an aluminum plant used a voltmeter on a pot line. Some pretty dramatic things happened to them and to their equipment. We're talking about 480 volts with megawatts of power.

If the measurement instrument is not designed properly for the application, it may literally explode. The instrument can't safely dissipate that much energy fast enough. The measurement industry needs to look at its instruments from that point of view: extreme applications of basic measurements.



A probe misapplied to a 480 volt, megawatt line. "If the measurement instrument is not designed properly for the application, it may literally explode" —Rich Nute.

The test and measurement industry's products are unique to UL's experience in another way. UL deals mostly with consumer products that undergo evolutionary design changes from year to year. The UL can easily keep up with that kind of gradual change. The test and measurement industry is more characterized by dramatic new designs that represent significantly new measurement capabilities. For example, in the last few years we've moved from conventional attenuators to the CAM switch (which UL engineers haven't seen before) to attenuators built on ceramic substrates with fired-on components. UL may have had experience with some of those components but hasn't seen them used like we are using them.

THE LATEST DRAFT

The most recent draft of the UL 1244 is in the format of the International Electrotechnical Commission. The draft is the United States proposal for a revision of the IEC-348.

The final version of the UL 1244 and the IEC document should be out in the fall of this year.

According to Rich Nute, Product Safety, there are four major points to look at in the newest draft: markings, protections from electric shock, testing under fault conditions, and protections from fire.

MARKINGS

The latest draft clears up some of the requirements for markings that appear on the instrument. First in line are **product identification** markings. The UL, obviously, needs to identify the product before verifying it for safety features. There have been a few cases where Tektronix' products were not identified at all on the front panel.

Plug-in identification is another category of markings defined in the standard. Why is it important to mark plug-ins? To make sure they are electrically compatible and therefore less likely to be a hazard. This isn't a big problem for Tektronix, because most of our plug-ins are mechanically compatible only with the mainframes they are designed to be used with. For example, you can't put a 5000 series plug-in into a TM series product.

Ratings should be clearly marked on the instrument too. (Ratings are sometimes called "specifications" around Tektronix.) UL's tests are based on those ratings. For example, the rating for the power input voltage may be 115 volts. UL assumes that the operating range is ±10% to establish worst-case operating conditions for the tests it makes.

Measurement terminals, as well as power input terminals, should be rated on test and measurement equipment. Unfortunately, most instruments are not clearly rated for the maximum voltage that can be applied to the measurement terminals. On an oscilloscope, for example, the vertical input terminal may have a "5v/DIV" label over it.

Let's say there are eight divisions. Does that mean that the rating is 40 volts? Is it forty volts peak-to-peak? Peak? Dc? A certifying agency like UL needs an unambiguous rating before it can test the electrical insulation and spacing for the instrument.

The new standard states the requirements for **warnings** more clearly now.

OSHA 1970 (the Occupational Safety and Health Act of 1970) triggered the work that led to the **UL 1244**. The act requires that any electrical equipment that an employee uses be tested for safety by a third party testing agency if an applicable standard exists. **WEMA** (Western Electronics Manufacturers Association) formed a committee to review the UL 1244. Participants in the committee included representatives of the electronics industry (**Tektronix, Alcoa, Fluke,** and **Hewlett-Packard**) as well as **Underwriters' Laboratories, Inc.** ANSI (American National Standards Institute) is the organization that will promote the UL 1244 as a national standard. **SAMA** (Scientific Apparatus Makers Association) handles the publication mechanics for ANSI. U.S. representatives will propose the ANSI standard to the **IEC** (International Electrotechnical Commission), the principal international standardizing body for the electronics industry.

SHOCK

Discussions of shock hazards have been extensively revised and then pulled together into one section. Different designs afford varying degrees of protection. The shock hazard section is divided into categories that tell how to measure the protection provided by each type of design. To illustrate, most of our products are **protectively grounded**: the third wire (ground) in the power cord provides protection from shock. But our 200 series oscilloscopes are **protectively insulated**, rather than protectively grounded. There are two hot wires with two independent systems of insulation in the instrument. (IBM typewriters are another example of the double-insulation system.) That provides the same degree of protection as the three-wire system with one insulation system.

Protective spacing is another requirement for certain circuits. Distance between conductors, rather than insulating material, provides protection. Primary circuits, safety circuits, and other relatively high-energy circuits may need to employ protective spacing.

In this section, the standard also clarifies the definition of **leakage current.** Leakage currents can be dangerously high. On the primary side of a transformer, distributed capacitance may create a capacitive voltage divider between the two conductors of the power cord. That may cause the transformer core to float to a level high enough to cause a shock.

Rich Nute believes that one of the most important advances of the standard is that it clarifies the procedures for measuring the leakage currents. Schematics have been added to illustrate the measurements. Another change is that now leakage current measurements will have to be made at frequencies higher than 60 Hz, in fact, up to 100 kHz. (Frequencies higher than that may cause RF burns rather than shocks.)

The last topic under shock hazard that deserves special attention in the new standard is **insulation and spacing stress testing.** Every product or circuit operates at some nominal voltage level. Each should also be able to operate (for short periods of time) within some margin higher than the nominal value. The rule-of-thumb stress test is to put a voltage across the insulation (or space) that's equal to twice the nominal voltage plus 1000 volts. That would be 1220 volts for a power circuit (operating on 110 volts).

TESTING UNDER FAULT CONDITIONS

Clause 10 of the new standard defines the procedures for testing the instrument if there is a fault. In the test, one at a time, all the electrolytic capacitors and all the semiconductors in unlimited energy circuits are shorted out. An "unlimited energy circuit" is a circuit in which there is a voltage higher than 42.4 volts peak, or the available current exceeds 8 amperes.

The purpose of the test is to see if the fault causes a fire or shock. An example of a component that may be shorted out is a series-pass transistor in a power supply circuit. Unacceptable results of the component failure test are:

- a temperature rise beyond a certain point.
- flame.
- an accessible part becomes live.

Another test is disabling temperature control devices such as fans. Without the fan, the instrument may go out of spec, and the component failure rate may rise, but will there be a fire or shock hazard?

PROTECTION FROM FIRE

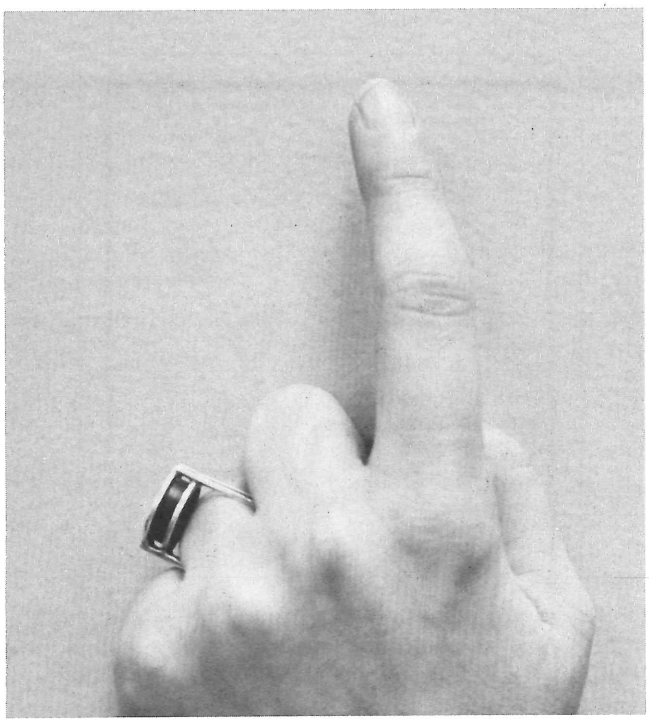
The fourth major point to look at in the new standard is Clause 12. It brings together pieces that were previously scattered throughout the standard. Clause 12 describes tests of enclosure materials, insulating materials, and etched circuit boards. The tests for flammability are summarized in one table for easy comparison and reference.

WHAT THE STANDARD DOESN'T SAY

The words "safety" and "hazard" have been removed from the standard. They're impossible to define for all contexts. Here is a for-instance. Most safety agencies throughout the world consider 42.4 volts peak (30 volts rms) to be a "shock." Actually, only a few people can feel a shock at that voltage level. On the other hand, there was a case on the East Coast recently where a man was killed by a 15 volt potential from a calculator battery charger. What then is a "safe" voltage? What is a "hazard?" Is a kitchen knife safe or dangerous? It all depends on how it is used.

What the standard does say is that there should be protection from fire and shock, that the protection is measurable, and that there are specific ways of making those measurements.

"Shock from accessible parts" is one such measurable item. The first step is to measure the accessibility. The UL defines a standard finger (an "accessibility probe"!) and applies it to all surfaces of the instrument with the covers on. Once you know what's accessible, you can then measure the voltage at those points. If the voltage is greater than 42.4 volts peak, and there is more than half a milliampere of current, then there is a shock condition. But that doesn't say the instrument is safe or not. The courts must define "safe" and "hazardous."



The original accessibility probe. The UL defines a standard finger (an "accessibility probe") and applies it to all surfaces of the instrument with the covers on. Once you know what's accessible, you can then measure the voltage at those points. If the voltage is greater than 42.4 volts peak, and there's a half a milliampere of current, then you have a shock condition.

FOR MORE INFORMATION

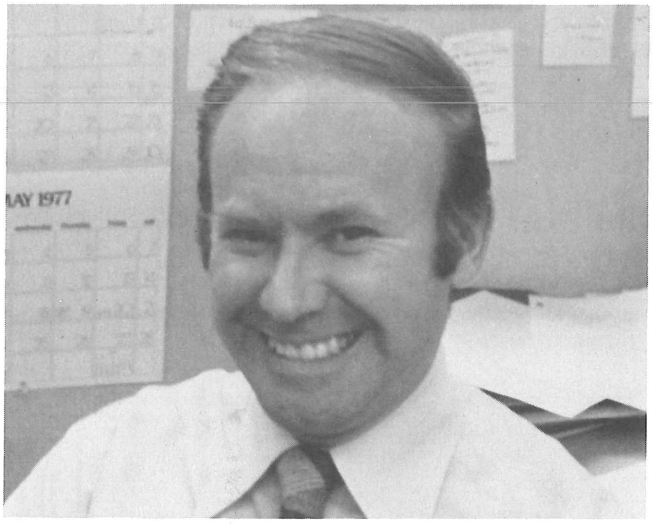
For more background, see these 1976 back issues of **Engineering News**:

February	–	UL 1244: Final Form for 1976?
March	–	UL Affects Tek.
April	–	Tek Changes T&M Instruments to Fit UL 1244.
May	–	Industry to Rewrite UL 1244.
August	–	UL 1244: New Draft Available.

COPIES OF THE NEW STANDARD

For a copy of the new standard, call Lucy Boge (5483). For questions about the standard, call Rich Nute (6649) or drop by 58-262.

Welcome Back, Barrie!



Barrie Gilbert

Barrie Gilbert Returns to Tek

Join **Engineering News** in welcoming Barrie Gilbert back to Tektronix. Barrie returned February 28 after 6 1/2 years spent in his native England.

Barrie worked at Tektronix from November of 1964 to September of 1970 in what was then Wim Velsink's New Generation Group. During that time, he developed, among other things, the readout system IC's for the New Generation instruments (7000 series).

In England, Barrie worked a couple of years for Plessey Research Labs in Poole. Plessey is a large company (85+ kilo-employees), which manufactures a broad line of electronic items, from components to complete systems. At Plessey, he was Group Leader for several projects, including an advanced optical character recognition system, hybrid data modems, and a memory-technology team developing plated-wire and MOS memories. While with Plessey, he tried unsuccessfully to get them to adopt some Tektronix policies and procedures, such as open engineering stock and a more informal atmosphere. He was not successful.

Later, Barrie set up and ran an IC design laboratory in England for IC's to be manufactured by Analog Devices in Boston, Massachusetts. Here, Barrie did everything himself, from product proposal, through design and layout, prototype evaluation and even a little marketing. His specialty is precision analog integrated circuits, especially laser-trimmed monolithic devices.

Barrie is now working in George Wilson's Integrated Circuit Design group on the third level of Building 50.

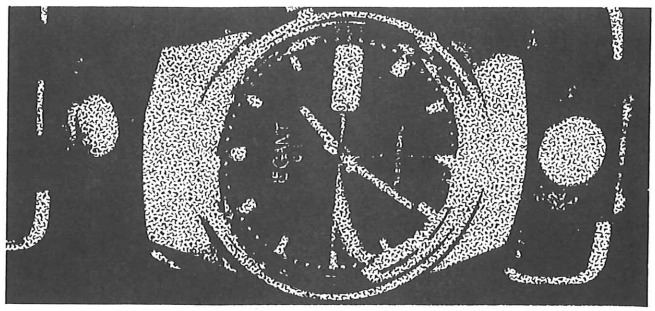
19760101181236

That series of numbers means 12 minutes and 36 seconds past 6 pm on January 1, 1976 . . . according to American National Standard BSR X3.43 (X3L8/177), revised June 11, 1976. The title of the standard is "Representations of the Local Time of the Day for Information Exchange.

If it were noon, you would have 19760101120000. If it were midnight, it would be 19760101000000.

However, this time-of-day identification applies only to the 24-hour system. The 12-hour system adds an "A" or "P" suffix. For example: 19760101120000P.

If you would like a copy of the BSR X3.43 standard, call Technical Standards on extension 7976 or drop by 58-187.



Call For PAPERS

The **Third International Conference on Electrophotography** will be held in Washington, D.C. on November 15-18, 1977.

The sponsors (the Society of Photographic Scientists and Engineers) are inviting papers on the following subjects: electrophotographic processes, photoconductor materials (fabrication, mechanisms and limitations), developer materials, electrophotographic systems, new marking technologies, and applications.

The sponsors would like to see an abstract first. It's due July 15, 1977.

If this call for papers interests you, give us a call (ext. 6071). We will provide all the details you need (length and format of the paper, and where to send it). We can also help you with the writing, illustrations, typing, and mailing.

Tektronix & the IEC

The IEC (International Electrotechnical Commission) is assuming a growing importance as the major international standardizing body for our industry. The international standards developed by the IEC play a significant role in the buying habits of most European countries. Tektronix actively supports and participates in the development of these standards.

For example, we have worked for several years on the recently published IEC 351 Cathode Ray Oscilloscopes, and Morris Engelson is now participating in the development of the IEC Spectrum Analyzer standard. Additionally, we are helping to define the General Safety Standard and the GPIB Standard. We expect to begin work on an IEC Logic Analyzer Standard this year. These documents are the products of multinational committees and are by no means ideal. They are usually difficult to read and frequently omit characteristics we consider important while over-emphasizing others.

As a matter of policy, Tektronix believes it is in our long-term interest to adhere to existing IEC standards within the limits of practicality. Where there is no Division Engineering Department the determination should be made by division or business unit engineering managers.

IEC standards are available on request from Chuck Sullivan at extension 7976. I urge those of you whose products will be affected by them to order the appropriate standards and use them.

—Bill Walker

IN PRINT

The International Electrotechnical Commission has just published Expression of the Properties of Cathode-Ray Oscilloscopes. There are two parts:

Part 1: General
Part 2: Storage oscilloscopes

The purpose of the books is to standardize (internationally) the way manufacturers describe the various properties of cathode-ray oscilloscopes. In particular, they define the special terminology and the catalogue data used with the scopes. The books also define the conditions and methods used for testing scopes for the performance levels claimed by the manufacturers.

If you would like a copy of either or both of these books, call Technical Standards at extension 7976.

Maureen Key
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