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Electrical safety is one of the core activities of the IEC. IEC standards and conformity assessment activities help governments protect populations from risk, provide consumers with proof of a product or system's safety, performance, and reliability, and promote trust in the technologies we all rely on every day, around the world.

FOCUS ON: SAFETY & SECURITY

IEC TC 61 – Safety of Appliances

By Tom Blewitt, PE, Technical Advisor, U.S. TAG to IEC TC 61; Director of Principal Engineers, Appliance and Lighting, UL

Closing in on the 50th anniversary of its first meeting in February 1967, IEC Technical Committee (TC) 61 has a long history of accomplishment in the field of electrical appliance safety. The committee is responsible for the IEC 60335, *Household and similar electrical appliances*, series of standards, which has 113 Parts 2 (not all still active). The appliances include those we all use in our homes for cooking, refrigerating, cleaning, comfort heating, and cooling. They also include appliances for commercial catering and refrigeration, water heaters, pool and spa equipment, and a large variety of specialty appliances for personal grooming, tanning, sleeping, and so on. If an electrical product heats, cools, or moves something in a household or similar use environment, it very likely is an appliance handled by IEC TC 61.

Perhaps a little less well-known, IEC 62115, *Electric toys - Safety*, and IEC 61770, *Electric appliances connected to the water mains*, are also handled by IEC TC 61. The electric toy standard is an especially active standard with the increasingly widespread use of more powerful battery technology enabling new functions and more interactive toys. One of the IEC 60335 Parts 2 standards (2-29) covers chargers for electric toys, appliances, tools, and even small vehicles such as electrical bicycles. So when TC 61 meets twice a year, usually during the May/June and October/November time periods, the agenda is typically quite diverse and always interesting.

SC Structure

In reality, such technical diversity means that the TC requires experts who can help develop and maintain safety requirements for all the different appliances. For this reason, TC 61 relies upon five Subcommittees (SCs) that semi-autonomously are responsible for groups of appliance standards:

- IEC SC 61B, *Microwave Appliances*
- IEC SC 61C, *Refrigeration Appliances*
- IEC SC 61D, *Appliances for Air Conditioning*
- IEC SC 61H, *Electrically Operated Farm Appliances*
- IEC SC 61J, *Electrical Motor-Operated Cleaning Machines for Commercial Use*

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IN THIS ISSUE

IEC symbols for electrical current: ALTERNATING CURRENT (AC) DIRECT CURRENT (DC) AC/DC

IEC TC 61 – Safety of Appliances *(continued)*

Each subcommittee manages its own agenda of standards development activity, coordinating with TC 61 to align with the general electrical safety requirements for all appliances. As is apparent from the areas of responsibility of each subcommittee, the technical challenges of each can be quite unique. For instance, containment of microwave energy and making sure an "uncontained" electric fence won't cause electrocution probably couldn't be more different. The mechanical refrigeration subcommittees also has a containment challenge – containment of flammable refrigerant gasses.

MT Activities

Every other appliance not handled within one of the aforementioned SCs is directly handled by TC 61 – with help from its eight Maintenance Teams (MTs) and five Working Groups (WGs) composed of experts from the member National Committees. Some of the MTs specialize in product types, such as door, window, and gate operators or commercial catering equipment. Others focus on technical subject areas and help advise TC 61 on its decision making. Two notable Maintenance Team activities are that of MT 23, *Functional Safety,* and MT 4, *Thermal Burn Injury.*

As in a great many fields, electronic circuits are extensively relied upon in appliances. The technology makes appliances even more useful and convenient. It also greatly complicates the appliance design, and, if not well executed, can increase the risk of fire, electrical shock, or personal injury under fault conditions. MT 23 has been considering the consequences of electronic and micro-electronic faults in appliance electronics and has been preparing revisions to all of the IEC 60335 Parts 2. In the recent past, MT 23 developed requirements for programmable circuits that were added as Annex R in the Part 1. At the moment, the MT is developing requirements for remote access and authorizing of modification of appliance software by the manufacturer, while continuing to assure safety is not compromised.

MT 4 was established many years ago to address the effects of heat and fire on appliances. However, when IEC Guide 117, *Temperatures of touchable hot surfaces,* was published, MT 4 was also tasked with implementing requirements for all Parts 2, taking into account the particular function of the appliance and how the appliance is handled and used to perform its function. This may not sound like a daunting challenge, but protecting the user against a thermal burn injury and still enabling the appliance to curl hair or cook waffles is not that easy when space is limited or where contact with the appliance is required to make it work as intended.

JUST A FEW OF THE APPLIANCES WITHIN THE BROAD SCOPE OF TC 61

PROTECTING THE USER AGAINST INJURY AND STILL ENABLING THE APPLIANCE TO CURL HAIR OR COOK WAFFLES IS NOT THAT EASY WHEN SPACE IS LIMITED OR CONTACT WITH THE APPLIANCE IS REQUIRED TO MAKE IT WORK AS INTENDED.

WG Expertise

TC 61 Working Groups are formed for a limited product or technology purpose. WG 30 is developing a Part 2 for cosmetic and beauty appliances incorporating lasers and intense light sources. While these light sources can offer some cosmetic benefit, they can also, if not appropriately designed, be a source of radiation hazard to the skin and eyes. Experts in optical radiation contribute to the work of WG 30.

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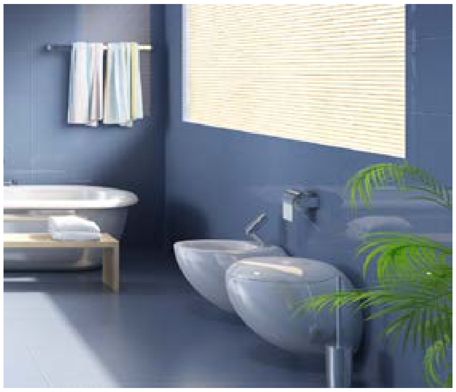
IEC TC 61 – Safety of Appliances *(continued)*



JAPAN HAS PERFECTED ELECTRIC TOILETS THAT PACK MORE ELECTRONICS THAN THE NASA LUNAR ORBITER.

WG 31 is in the process of rewriting the existing battery requirements of the IEC 60335 Part 1 to accommodate additional safety concerns of lithium technology battery charging and discharging. That WG meets regularly via web-conferencing to conduct its work.

Global Leadership

With just this small sampling of the work of IEC TC 61, it should be readily apparent that the scope of the TC encompasses many appliance industries, most forms of electrical technology, and a myriad of product purposes and functionality. In addition, though, what makes the work especially interesting is the unique appliances and variety of appliances used around the world. Some examples include:

- The Korean *ondol* bed is one such appliance. TC 61 was fascinated to learn of the Korean *ondol* tradition of heating for comfort and cooking. The modern implementation of the tradition is a form of heated bed for which TC 61 developed a Part 2 standard for safety. If you like a firm "mattress," this is the bed for you!
- Unlike the decidedly "low-tech" American toilet, Japan has perfected electric toilets that pack more electronics than the NASA lunar orbiter. TC 61 has been able to address the safety of water and electricity in close proximity; it has not tackled the seat-up vs. seat-down controversy.
- The UK tea kettle comes in many varieties, most all of which are quite functional with an economy of technology. In contrast, many Swiss, German, and Italian coffee makers are loaded with electronics and moving parts all dedicated to preparing the perfect brew, whether it is in a small cup or a tall latte.

IEC TC 61 is well led by its chair of 21 years, Derek Johns of New Zealand. The United States holds the Secretariat for the TC and is represented by Sonya Bird of Underwriters Laboratories Inc. Sonya is assisted by Margie Burk, also of UL. As noted earlier, TC 61 meets twice a year; its agendas are packed with new and revised standards documents to discuss, and with oversight reports from the SCs, WGs, and other committees that are guided by TC 61. The TC devotes the last day of its five-day plenary meetings to the review of interpretation requests and the development of interpretations that it publishes for access by members of the participating National Committees. The Chairman's Advisory Group, of which the author is a member, makes preliminary recommendations between meetings for decisions on the requests.

U.S. Engagement

Keeping track of all of these standards documents and advising the USNC on technical positions to take within IEC TC 61 is the U.S. Technical Advisory Group (TAG) for IEC TC 61. The author is Technical Advisor for the U.S. TAG, which is

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composed of U.S. appliance stakeholders representing manufacturers, trade associations, government and regulatory entities, academia, test laboratories, and the standards development organization for comparable (to IEC 60335) electrical safety standards, UL. It meets twice a year, typically two months in advance of the IEC TC 61 plenary meetings.

TAG meetings are open to all members of the U.S. TAG; participation can either be in person at the Melville, NY, location of UL or via web-conferencing. While the primary purpose of the TAG meetings is to prepare the U.S. delegation for the positions to take at the IEC TC 61 plenary, the meetings are also an opportunity to become familiar with the IEC standards development process. Discussions on standards proposals are also educational, as insight on the intent of requirements and their nuances are often part of the discussion. **Anyone interested in participating in the USTAG for TC 61 should contact Margie Burk for more information at** margie.m.burk@ul.com.

There is, of course, much more that can be told of the work done by TC 61. I hope this brief overview provides enough insight for the reader to appreciate the technical challenges and accomplishment of the TC, as well as how interesting and varied are the products handled that collectively are called "appliances."

Why 500VA for Hipot Testers? And What's a Hipot Test?
A TC 66 Investigation into One of the Most Common Electrical Safety Tests

By Nicholas Piotrowski, Associated Research Inc.

IEC Technical Committee (TC) 66, *Safety of Measuring, Control and Laboratory Equipment*

The IEC 61010-1:2010, *Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements*, standard stipulates that a 500 volt-ampere (VA) dielectric withstand tester must be used to test product insulation as part of testing for electrical hazards. This requirement harks back to a time when most withstand tester outputs were unregulated and could cause problems with load regulation. Advancements in withstand tester technology include testers with regulated outputs. This calls into question the need for a 500VA requirement in IEC 61010-1:2010.

What's a Hipot Test?

The dielectric withstand test, commonly referred to as the high potential or "hipot" test, is an electrical safety test designed to stress the insulation of a device beyond what it would encounter during normal use. If A device can withstand a hipot test, it should be able to operate at rated voltage without posing a shock hazard.

The Hipot Test

Safety agencies create standards outlining testing requirements for electrical products before a product is considered safe for the consumer market. These agencies implement and enforce electrical safety testing to protect consumers from fire hazards and, potentially, fatal electric shock. Such agencies and testing laboratories include the IEC, Underwriters Laboratories (UL), TUV Rheinland, the Canadian Standards Association (CSA) and Intertek (ETL) *(Fig. 1)*.

One of the most commonly specific electrical safety tests is the dielectric withstand or "hipot" test. The logic behind running such a test is that if the device can handle the force of high potential for a short duration, it should be able to operate at rated voltage without posing a shock hazard to the user.

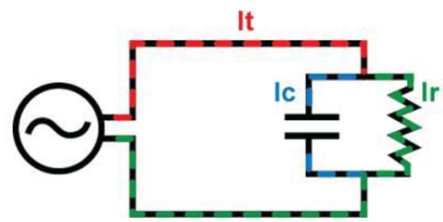
The hipot test is a versatile electrical safety test. Not only is the test designed to find weak points in the insulation, it can also be used to measure excessively high leakage current, workmanship defects such as pinholes and scrapes, improper spacing with respect to a grounding point, and degradation due to environmental conditions. The method of running a hipot test involves applying the high voltage across the current carrying conductors with a return point on a conductive chassis. The hipot unit will measure the resulting leakage current flowing through the insulation. A diagram of the hipot test is shown in *Fig. 2*, where *It* represents the total leakage, *Ic* represents the capacitive leakage current, and *Ir* represents the resistive leakage current element.

A hipot tester's VA rating describes its output power. It can be calculated by taking the product of the hipot tester's maximum output voltage and maximum output current:

Hipot VA = Max Voltage × Max Current

FIG. 1. SAFETY AGENCY EXAMPLES: UL, TUV, CSA, ETL, IEC

Many of the standards written by these agencies require the use of a hipot tester with as much as a 500VA power output. Several important specifications that call for a hipot tester with a 500VA output are IEC 61010-1, as mentioned; IEC 60335-1, *Safety of household appliances;* and IEC 60204-1, *Safety of machinery*. These standards cover a wide range of products, and the 500VA requirement has implications on the manufacturer as well as the end user.



It = Ic + Ir

FIG. 2. DIELECTRIC WITHSTAND CIRCUIT DIAGRAM

Why 500VA?

The reason that product safety standards require the use of a 500VA hipot instrument is to ensure that the full test voltage is maintained under varying load conditions. Earlier generations of hipot testers had unregulated outputs. The problem with unregulated output is that if the hipot tester is heavily loaded (for example, a highly capacitive load), the output voltage will drop. If the test voltage falls below the specified

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Why 500VA for Hipot Testers? And What's a Hipot Test? *(continued)*

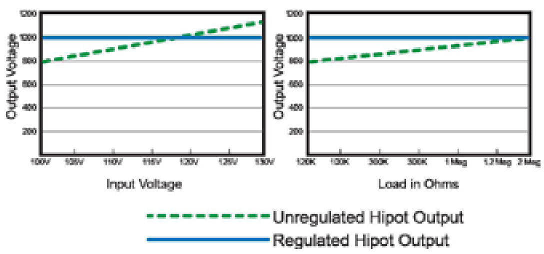

FIG. 3. LINE AND LOAD CONDITIONS FOR REGULATED AND UNREGULATED HIPOT TESTERS

satisfy the majority of hipot testing applications. However, there are two main issues that arise when dealing with 500VA hipot testers. The first and most important is that these testers are more dangerous to use as a result of the increased power. The second is that they are more expensive.

NICK PIOTROWSKI

setting, then the electrical product was not properly tested at full voltage.

An example of a regulated vs. unregulated hipot output is shown in *Fig. 3.* Varying input voltage values, as well as the testing load, affect the output of an unregulated hipot instrument.

Dwayne Davis, a technical service manager at Associated Research Inc., has worked with hipot testers for over 45 years. In a technical paper about 500VA output on hipot testers, he discussed why 500VA units solve the loading problem:

> "A hipot with 500VA should provide enough output power to test a device under a loaded condition without allowing the output voltage to fall below the specified setting. The application most commonly requiring a 500VA rating are those in which an AC hipot voltage must be applied to a highly capacitive load."

A 500VA hipot instrument with a 5000VAC output would have an output current rating of 100mA. An output current rating of 100mA would be enough to

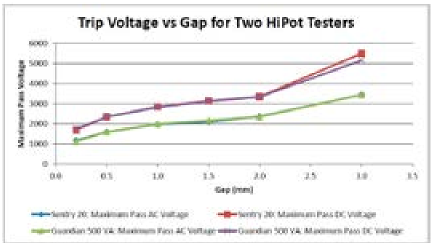

FIG. 4. TRIP VOLTAGE VS. GAP FOR TWO HIPOT TESTERS

Disadvantages of 500VA Hipot Units

Unfortunately for a hipot operator, a higher output current makes for a more dangerous hipot tester. An electrical safety testing workstation contains a number of hazards, and requiring a 500VA hipot tester only increases the risks involved. According to Mr. Davis, "A potential of 600 volts or less, as little as 30mA of current, can stop a person from breathing; 75mA can cause cardiac arrest and is often fatal." A hipot tester with a 100mA output rating would be enough to cause a fatal electric shock.

Another downside is that 500VA hipot testers are more expensive than the lower-VA-rated hipot testers. In many applications, the leakage current produced by such devices does not exceed 10mA. As a result, manufacturers are forced to purchase more expensive equipment that exceeds their testing needs.

Advancements in hipot technology have made the requirement for a 500VA output come into question. Most modern-day hipot testers have regulated outputs and feedback circuits that maintain the output voltage under any line and load condition.

Experiments Using Regulated Hipot Testers

This section outlines various experiments run to test hipot testers with regulated outputs. These experiments were run on hipot testers with various VA ratings, as well as from different manufacturers.

The first experiment was run by a lab to compare 500VA against lower VA ratings on both AC and DC hipot tests. Trip voltage was measured against an air gap distance between two electrodes on two separate hipot testers (Quadtech Sentry 20 and Quadtech Guardian 500VA Tester). *Fig. 4* illustrates the results.

The results clearly show that the breakdown voltage through air tracks closely between the two hipot testers. There is a small difference when the gap is 3.0mm, but this is only a 5% variation.

The next set of experiments compared breakdown voltage vs. breakdown current for hipot testers of three separate VA ratings: 150VA (Associated Research 7650 Tester), 250VA (Associated Research 8204 Tester), and 500VA (Associated Research 8257). Three types of solid insulation were used: for the first set of tests, a 0.27mm-thick sheet of paper was used as solid insulation. For the second and third sets, 0.05-mm-thick plastic sheets and 48-gauge mylar sheets were used to compare breakdown voltage values.

Each sample of solid insulation was placed between two 1.5-inch diameter spherical conductors. High voltage was applied to one side of the sample, and the return path was placed on the opposite side. The voltage was ramped up from 0.0 to 5000VAC over a period of 20 seconds, or until the sample *(continued)*

Why 500VA for Hipot Testers? And What's a Hipot Test? *(continued)*

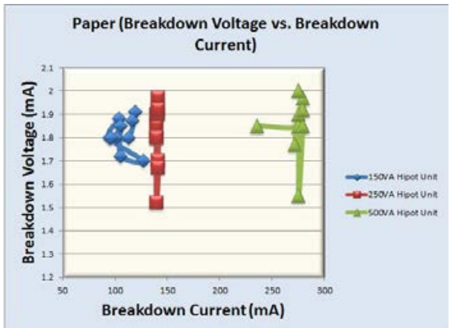

FIG. 5. TEST RESULTS FOR PAPER SAMPLES

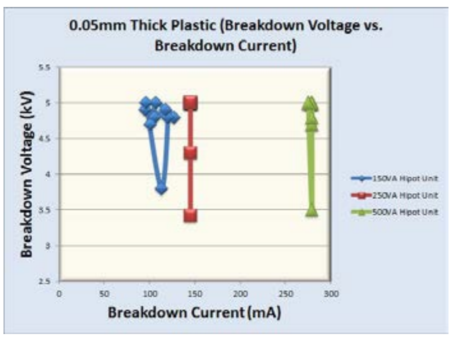

FIG. 6. TEST RESULTS FOR PLASTIC SAMPLES

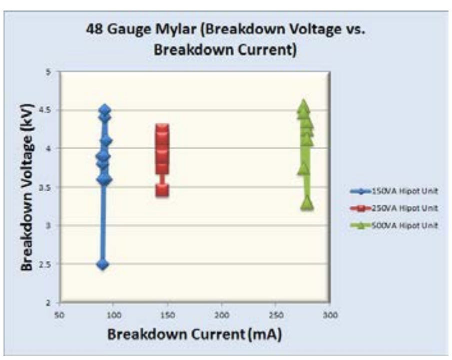

FIG. 7. TEST RESULTS FOR MYLAR SAMPLES

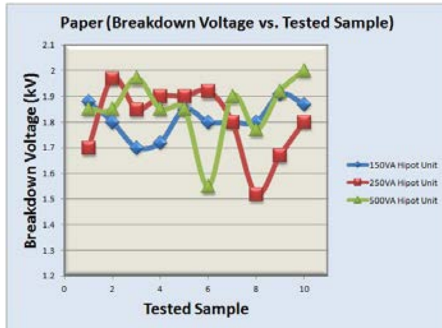

FIG. 8. PAPER BREAKDOWN VS. TESTED SAMPLE

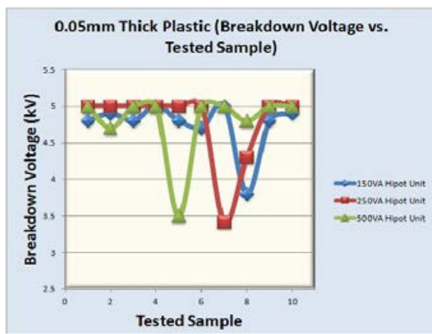

FIG. 9. PLASTIC SHEET BREAKDOWN VS. TESTED SAMPLE

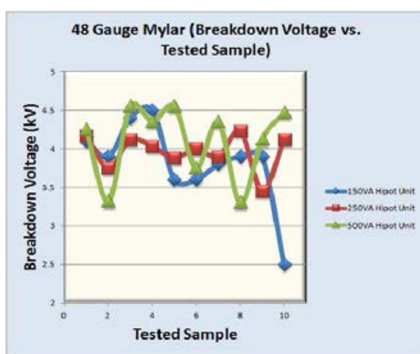

FIG. 10. MYLAR SHEET BREAKDOWN VS. TESTED SAMPLE

experienced electrical breakdown. The breakdown voltage and corresponding breakdown current were recorded for each tester on each sample type. A total of 10 samples of each solid insulator were used for this experiment (total of 90 samples).

Figs. 5-7 show the results comparing breakdown voltage vs. breakdown current on all three instruments. *Figs. 8-10* show breakdown voltage vs. tested samples (1-10 on each type). The results indicate that the breakdown voltage value is independent of the breakdown current value on all three sample types. It is noted that there is a variation over the course of testing the samples. Each sample has a range of breakdown voltage values. This can be attributed to imperfections in the samples themselves that caused breakdown at an earlier point than other samples. These imperfections were noticed with other samples. Severe imperfections caused premature breakdown in several instances, but these results were not included with this data.

Conclusion

When many of the safety testing standards were written, regulated outputs on hipot testers were a rarity. As a result, the technical committees had to compensate by requiring higher output power. This ensured that the dielectric withstand test was run properly. With the advent of regulated outputs on hipot testers, the need for a 500VA requirement is becoming obsolete. Hipot testers with regulated output do not suffer the same line and load problems faced by hipot testers with unregulated outputs. Not only are 500VA hipot testers more dangerous to use, they're also more expensive.

The reality is that most applications do not require a high power output from a hipot tester. The experiments run by TC 66 members illustrate that breakdown voltage is independent of output power capability on a hipot tester with a regulated output. As long as the hipot tester has a regulated output, a 500VA output should not be required per the testing standards. It is the suggestion of members of TC 66 that the 500VA requirement be eliminated and replaced with a requirement that the hipot tester must have a regulated output capable of maintaining the specified test voltage throughout the duration of the hipot test.

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Corson, Ray (2013). *Specifications for AC Voltage Testers*. TC 66 U.S. TAG for IEC 61010-1: Asheville, NC. TC 66 WG 1 (Asheville/Corson): 1A.

How Can We Write a Product Standard before the Products Exist?

By Frank Webster, Technical Advisor, U.S. TAG IEC TC44; Vice President, Standards Development, Omron STI

IEC TC 44, *Safety of machinery, Electrotechnical aspects,* took a flexible, long-view approach to the development of specifications related to vision-based protective devices (VBPD).

This project started with research conducted by the Japan Machinery Federation (JMF). The Japanese developed a vision-based safeguarding system consisting of an array of cameras placed above uniquely patterned flooring. The system was able to prevent collisions between persons and machines moving in the guarded area. In October 2001, the JMF report was published as an IEC Technical Report (TR, IEC/TC44/343/INF, "Development for the International Standards in the field of Safety of Machinery – A vision-based protective device."

This TR generated a lot of interest. At about the same time, the French Institute for Research and Security (INRS) helped to develop a vision-based system for safe guarding escalators – to detect the presence of a persons on the escalator before it could start moving.

Several security-related and consumer-related stereo vision systems were available that appeared to have the functionality to be useful for machine safety. We knew that people wanted to use vision technology to develop protective devices for machinery, and that there was insufficient technical guidance for the evaluation of the safety integrity of such devices. What was unusual about this proposed project is that the requirements were going to be created in anticipation that products would be developed and would need guidance.

First Stages

Based on the JMF project, it was decided to publish a Technical Specification (TS) as part of the IEC 61496, *Safety of machinery - Electro-sensitive protective equipment,* series of standards describing a vision-based protective device (VBPD) using a passive reference pattern. For the purpose of developing a first draft, the working group planned to use the results of a Japanese research project as a first example of a VBPD.

The first formal meeting took place at the INRS office in Paris in June 2002. The attendees included 20 members of an ad-hoc group appointed by their National Committees and about 20 observers. Six subsequent meetings were held, but we soon ran out of ideas. We needed examples to help define requirements. Without them, progress was very slow and interest dropped off. But we wanted to preserve all the good work that had been done. Five remaining members of the working group met one last time to clean up the draft TS and change the style and format to create a Technical Report ready for publication.

In July 2007, IEC TR 61496-4, *Safety of machinery – Electro-sensitive protective equipment – Part 4: Particular requirements for equipment using vision based protective devices (VBPD),* was finally published. At the time, no such systems existed.

Flexible and Responsive

Standardization defines requirements based on industry-accepted practice resulting from experience with existing products. But if there is only one example, then what is accepted practice, and how can there be a consensus among the users? After 2007, the Working Group decided to suspend any further activity until there were at least two products on the market.

During the pause, the Institute for Occupational Safety and Health of the German Social Accident Insurance (IFA) continued to evaluate technology at an experimental level and was gaining a significant knowledge base.

Also during this time, the BGHM in Germany was working with the Pilz company to develop and approve a practical system using stereo vision technology to provide personnel protection for applications in the automotive industry. Pilz was enthusiastic about developing an IEC

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How Can We Write a Product Standard before the Products Exist? *(continued)*

document to support their product, so they volunteered to share their experience and develop the first draft of a new TS for systems using stereo vision technology. Pilz persuaded us to resume the project.

By 2011 the Pilz company had several systems installed in the field. There was still only one product, but at least we now had some experience in the field.

The Pilz system used stereo vision techniques that had some similarities with the imaging part of the original TR, but were sufficiently different such that we decided to split the project into two parts based on the two technologies currently being discussed – passive pattern and stereo vision. And since we still did not have real experience with these systems, we compromised and decided to publish both documents as Technical Specifications.

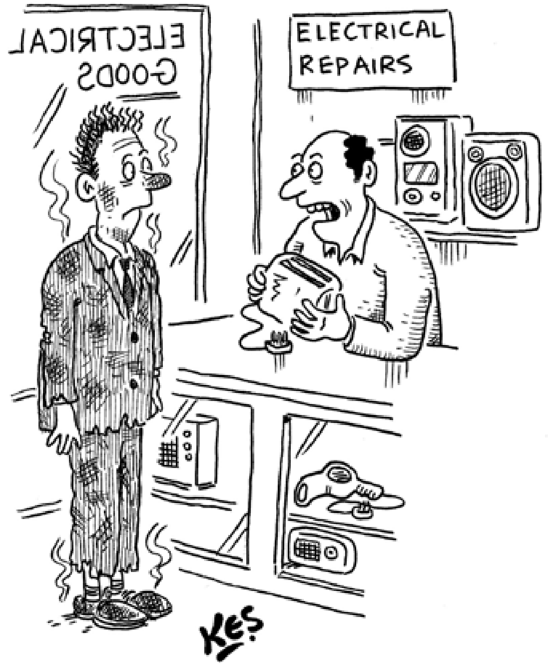
It was decided to finish Part 4-2 first because it was closest to the original TS, it seemed to be simpler, and there was a product on the market to use as an example. The SICK company was developing a system that used the passive pattern technique, so they did a substantial amount of the work to finish the final draft. Part 4-3 was far more complex, and we relied on the Pilz company to provide most of the technical examples and figures necessary to finish the documents.

FRANK WEBSTER

Growth Opportunities

As of December 2014, there was still only one product on the market using the passive pattern technique and one product using stereo vision technique. But now we have IEC TS 61496-4-2:2014 *Safety of machinery – Electro-sensitive protective equipment – Part 4-3: Particular requirements for equipment using vision-based protective devices (VBPD) – Additional requirements when using reference pattern techniques (VBPDPP)*, and IEC TS 61496-4-3:2015, *Safety of machinery – Electro-sensitive protective equipment – Part 4-3: Particular requirements for equipment using vision-based protective devices (VBPD) – Additional requirements when using stereo vision techniques (VBPDST)*, published. Perhaps now the products will come.

LAUGH TRACK



"Have you been trying to fix this yourself?"

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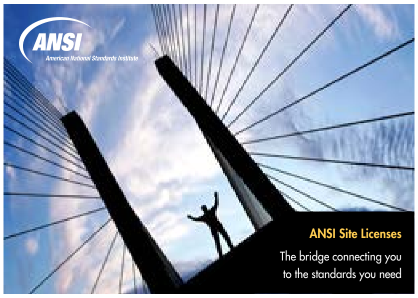

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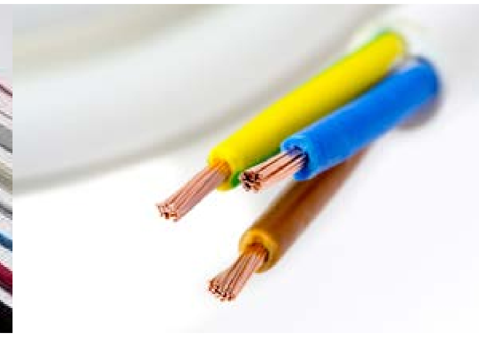
Global Harmonization of Conductor Sizes

By Sam Friedman, Director of Engineering and Codes and Standards, General Cable,
and Ronald Lai, Consultant, BURNDY LLC



Many have asked why there is not more harmonization of North American (UL/CSA) and European (IEC) electrical products standards. In fact, although there are different electrical systems in Europe and North America, many of these product standards are harmonized. However it has been extremely difficult to harmonize certain product groups due to philosophical and technical differences. One such difference is the designation and construction of metallic conductors. This has specifically affected the worldwide harmonization of wire and cable as well as connector standards.

IEC standards specify the use of square millimeters (mm^2), also called "metric," while North American Standards use the American wire gauge (AWG/kcmil) system for designation of wire sizes. Although the latter can be converted to metric sizes, the IEC standards only permit certain square-millimeter-size conductors to be used, and, therefore, will not permit the use of the converted AWG sizes. As a result, for many years there was no possibility for harmonization of wire and cable or connector products. However, after ten years of attempting to change this rejection of AWG conductors, IEC Technical Committee (TC) 20, *Electric Cables,* has agreed to issue a new standard that will include AWG conductors that may be referenced in product standards.

So how did we get to this point, and what does it mean for harmonization of connector and wire and cable standards?

Historical Background

Prior to the year 2000, a number of IEC standards, including those developed by Subcommittee (SC) 23F, *Connecting devices*, included products that accommodated the AWG/kcmil electrical wire sizes used in many of the countries in the Americas and other parts of the world. This was accomplished by U.S. experts, representing the USNC attending and participating in many working group meetings beginning in the 1980s.

In 19070, prior to joining the European Economic Community, the UK abandoned the British Wire Sizes in favor of mm^2 electrical conductors. In the 1990s, the thought in Europe was that if the world could not move to a global cable system, then the IEC standard should document the major electrical cable systems in use.

The E.U. members of SC 23F changed, and the new members began questioning why there were products in the standards that did not accommodate the conductors in the Normative Reference IEC 60228, *Conductors of insulated cables*. The SC then began removing those products not covered by the Normative Reference and relegated them to an informative annex, against the objections of U.S. experts. Note that an informative annex has no weight in the standard.

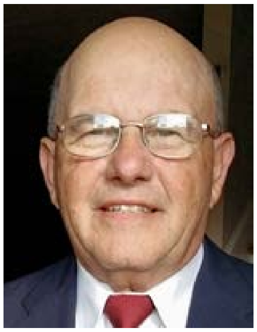
Because of this action, a strategy was formulated by the USNC to include AWG/kcmil sizes in IEC 60228. To do this, the USNC formed a U.S. Technical Advisory Group (TAG) to IEC TC 20. Shortly after its formation, the TAG learned that a revised IEC 60228 was in the process of revalidation and was at the Committee Draft Vote (CDV) stage. Coordination of the North American vote with Canada and Mexico quickly ensued, with the U.S. and Mexican National Committees voting negatively. Canada elected to follow a different path; it asked for an "In Some Countries" clause, which would force the TC to include the proposed tables in an informative annex. The TC balked at the idea, and the only reference to the AWG/kcmil system is an acknowledgement and a simple mm^2-to-AWG/kcmil conversion table in the foreword. Another thought was to use the essential Differences in Requirements (EDR) and Global Relevance (GR) processes, but it was known that very few are successful. The decision was made by the TAG to work within the TC, knowing it would be a long journey, rather than using the EDR and GR "hammers."

The 2004 TC 20 biennial General Meeting was held in Berlin.The position taken by the USNC was that the world's conductors should be included in IEC 60228 to make it a truly international document that can be used around the world. Discussion ensued and a document was prepared laying out the direction to be taken by the Committee.

TC 20 formed a Study Group to determine how to accommodate both conductor systems. Members were from Germany, Italy, the United

(continued)

Global Harmonization of Conductor Sizes *(continued)*

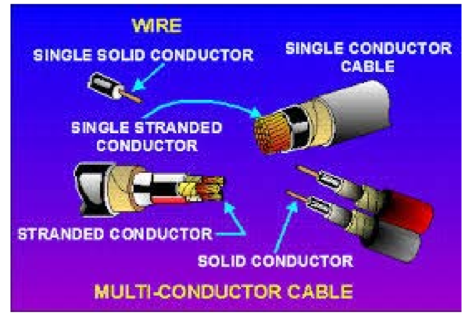



SAM FRIEDMAN RONALD LAI

Kingdom, the United States, and Zaire. The final result was IEC Technical Report (TR) 62602, *Conductors of insulated cables – Data for AWG and kcmil sizes*. This report provided technical information (dimensions, construction, resistance, etc.) for a full range of AWG/kcmil conductors. As a result, a three-step harmonization of the "world's conductor systems" was proposed. Stage one was to produce a technical report that defines the range of AWG/kcmil sizes that are to be considered in the harmonization process. Stage two was to start the rationalization process, the test methods and requirements to be aligned with those in IEC 60228. And the third and final stage was to produce a harmonized standard, based on IEC 60228 and the work of the first two stages, with a single, rationalized range of conductors.

The U.S. (NEMA Wiring and Wiring Devices) did not accept the three-step harmonization plan. Points made were that new products would have to be able to accommodate the yet-to-be-developed harmonized wire system and to be backwards compatible with conductors of the AWG/kcmil system for retrofits. Qualification tests of new products would require testing with both wire systems and entail maintaining both systems' wire and cable. Eventually, the supply of old wire would run out (e.g., aluminum branch circuit wire, used in the 1970s, and still required for qualification), leaving no way to qualify products for revising old circuits other than to pull new wire. Education of the industry (electricians, electrical contractors, design engineers, etc.) would be paramount to avoid mishaps, both minor and life threatening. The greatest danger, especially, would be the do-it-yourself market, where the consumer would have no knowledge of the wire systems. If the electrical components are to be used in mm^2-wired countries, the products would then need to be tested on a third system of cables.

In consideration of the rejections, in 2014 the USNC submitted a comment to TC 20 requesting that TR 62602 be added to IEC 60228 as a Normative Annex. This was discussed by TC 20 Working Group (WG) 19, and was referred to TC 20 for resolution. At the 2014 Biennial General Meeting in Paris, TC 20 reviewed the matter and decided not to append the TR to IEC 60228, but agreed that it could stand alone as a separate standard. As a result, IEC WG 19 requested that the USNC develop an AWG/kcmil proposal. This will now establish a path to permit AWG/kmil conductor sizes to be used in IEC standards. Metric sizes are already permitted in North American standards.



Today and Tomorrow

Though differences endure, worldwide harmonization of wire and cable and connector standards is now closer than ever. With more and more global commerce and interaction, the need continues to grow. One day, when both AWG and metric conductors may be used by design engineers, they may decide to take on the idea of worldwide harmonization of conductor standards.

As the power tool industry continues to expand, cordless tools will eventually overtake corded. Following this trend, IEC TC 116, *Safety of motor-operated electric tools*, is studying the possibility of increasing battery capacity, as global markets are constantly on the look out for higher performing, more efficient products. It will also carry on its work to ensure hobbyists and professionals alike have the safest possible tools at their disposal.

DOCUMENTS OF INTEREST

Stay up on the latest policies, documents, and other offerings from the USNC, IEC, and ANSI by clicking on the titles below.

- Functional Safety
- IECEE PV Certification: The sure way to safety, quality and performance
- The Car… safety and more
- Using & Referencing ISO/IEC Standards to Support Public Policy
- Smart Grid Standards Map

Staving Off the Dangers of DIY: Hammering Home "Safety First"

By Antoinette Price, originally published in IEC *e-tech*

In an age of innovation and constant technological evolution, the availability of a wide variety of affordable and easy-to-use power tools enables many people to maintain their homes and gardens rather than calling in the professionals.

Tools for Tinkering

Whether you are trimming the lawn, hanging a picture, cutting through metal, or sanding a surface, there's a tool for just about every job, ranging from electric-powered and roboti battery-powered lawn mowers, edge trimmers, garden vacuums, and blowers, to hand-held motor-operated or magnetically driven electric tools, including drills, screwdrivers, impact wrenches, grinders, planers, polishers, and disk-type sanders, hammers, spray guns for non-flammable liquids, shears and nibblers, and an array of saws (arm, band, bench, chain, circular, reciprocating jig, and sabre). Also on the list are drain cleaners, cut off machines, diamond drills with water supply, and threading machines. A large number of IEC international standards contribute towards the technical, functional, and safety aspects of all these products.

Following the Fads

IEC Technical Committees (TCs) have played a significant role in delivering these any many other technologies, through the preparation of international standards for components and parts used in these appliances, as well as of safety standards.

IEC TC 116, *Safety of motor-operated electris tools*, was established in 2008 to manage the expanding scope of international standards needed for the safety of hand-held motor-operated electric tools, transportable motor-operated electric tools, and garden appliances, while keeping pace with new technologies. Previously this work fell to a Subcommittee of TC 61, *Safety of household and similar electrical appliances*.

With a view to harmonizing its wide-ranging work, TC 116 began publishing a suite of international standards in 2014. Unifying the three areas under IEC 62841, *Electric motor-operated hand-held tools, transportable tools and lawn and garden machinery - Safety*, with around 90 publications, the standard covers general and specific safety requirements of electric motor-operated hand-held tools (part 2), transportable tools (part 3), and lawn and garden machinery (part 4). It is expected to eventually replace the three standards that preceded it.

Running through the Safety Drill

As well as taking full account of these standards, users must take additional precautions to operate power tools as safely as possible. They include reading instruction guidelines, wearing protective clothing (footwear, goggles, masks), and being aware of their immediate working environment (water, heat, or potentially explosive atmospheres). Some of the safety points in the standard include:

- Markings and instructions - warnings are marked on tools and contained in instruction manuals. There are also verbatim warnings, meaning these same warnings must be used by all manufacturers worldwide.
- Avoiding mechanical hazards, such as providing adequate blade guards for circular saws. This is a very important section of the standard since there are specific requirements for different tools.
- Ensuring mechanical strength, so that the equipment endures during use.
- Protecting against electric shock.
- Testing equipment to avoid overheating, which could lead to fire or hazard.
- Making sure the tools are resistant to external heat, if so exposed.
- Testing in conditions of high moisture or dust.
- Providing adequate safety circuit breakers for cutting tools such as hedge trimmers.

Future Trends

As the power tool industry continues to grow, cordless power tools will eventually overtake the corded segment. Following this trend, TC 116 is currently studying the possibility of increasing battery capacity for global markets which are constantly on the look out for higher performing, more efficient products. It will also carry on its work to ensure hobbyists and professionals alike have the safest possible tools at their disposal.

USNC Names Participants for 2015 IEC Young Professionals Workshop

The USNC congratulates the U.S. winners of its 2015 Young Professionals Workshop Competition. Recipients will attend the workshop on October 12–16, 2015, in Minsk, Belarus, in conjunction with the 79th IEC General Meeting (GM).

The IEC Young Professionals Workshop, in its sixth year, unites professionals from around the world who are at the start of their careers in the fields of electrotechnical standardization and conformity assessment. The workshop is intended to cultivate long-term national involvement in the international arena, strengthen technology transfer, and encourage the participation of emerging professionals in shaping the future in these areas. For more details, visit www.iec.ch/members_experts/ypp/.

As in previous years, the USNC received applications reflecting well-qualified candidates, resulting in a challenging selection process. The 2015 winners were selected based on their demonstrated leadership and dedication in connection with standardization and/or conformity assessment activities, as well as their vision of the larger commercial and strategic impact of standards and conformance work, and their accomplishments in their chosen field of activity.

Joseph M. Spossey

Mr. Spossey is a technical expert at Intertek Energy in Duluth, GA. A graduate of the Rochester Institute of Technology with a B.S. in mechanical engineering technology, he has been involved in wind turbine standards development for several years, holding positions as co-chairman of DWEA Standards Committee, alternate member of IECRE U.S. National Committee for wind, and alternate voting member of the AWEA Wind Standards Committee.

Christopher R. Dorr

Mr. Dorr is a senior hardware engineer at Rockwell Automation, a position he's held since 2009. He is a graduate of Case Western Reserve University, where he received his bachelor's and master's degrees in electrical engineering. Mr. Dorr has been designing industrial and communications products for almost 8 years and has collaborated with teams at Rockwell Automation that ensure that its products conform to IEC standards.

Lieutenant William Williams

Lt. Williams is a marine inspector and port state control officer in the USCG Sector in Jacksonville, Fl. A recent graduate of the United States Coast Guard Academy with a B.S. in electrical and computer engineering, he served as the academy's IEEE Club Secretary. He was competitively selected to attend Georgia Institute of Technology where he is enrolled in the Marine Safety Center & Coast Guard Engineering Standards Division. He will obtain a M.S. in electrical power systems and controls upon graduation. Lt. William's expertise and positions within the USCG provide him practice of the standards outlined by such organizations as the IEC and IEEE as it pertains to the safety of commercial shipping.

2015 U.S. YOUNG PROFESSIONALS (L-R) CHRISTOPHER DORR, JOSEPH SPOSSEY, AND WILLIAM WILLIAMS

Alongside recipients from other nations, the USNC's selectees will attend a dedicated workshop where they will learn more about the IEC, standardization strategies, and conformity assessment. They will also have the opportunity to attend technical meetings where standards are developed, observe meetings of the IEC Standardization Management Board (SMB) and the IEC Conformity Assessment Board (CAB), and benefit from extensive networking opportunities in an international setting.

USNC Character Contest

The USNC/IEC needs your creativity – enter now!

Enter the USNC Character Contest by designing a cartoon or illustrated spokesperson or creature to represent USNC work in electrotechnical standardization and conformity assessment. The winner will see his or her work used in USNC-branded materials – and receive a $300-value prize!

ENTRIES CAN BE ANY CHARACTER **OF YOUR OWN ORIGINAL CREATION**, HAND- OR COMPUTER-DRAWN, REPRESENTING THE USNC.

Guidelines for Submissions

- Entries must be an illustrated representation of a character of your own original creation (not your version of one already in existence)
- Entries can be hand drawn or be designed with a computer, and must be submitted as an electronic JPG, PDF, or EPS file
- Submission must include a written description of your character (no more than 50 words)
- Submission must include your name, organization, and relationship to ANSI/USNC
- Entries must be emailed to Tony Zertuche, USNC Deputy General Secretary, at tzertuche@ansi.org, by 31 August 2015. Entries received after the submission deadline will be ineligible.

Criteria and Judging

- Entries will be reviewed and a winner will be chosen by a judging panel consisting of:
  - USNC President
  - USNC General Secretary
  - USNC Deputy General Secretary
  - USNC Communications and Continuing Education Committee Chair
  - USNC Communications and Continuing Education Committee Vice Chair
  - ANSI Senior Director of Communications
- Members of the judging panel will review all eligible entries on the basis of creativity, originality, and relevance to the USNC and/or electrotechnical standardization and conformity assessment.

Eligibility

The contest is open to interested standards and conformity assessment professionals who have a valid e-mail address and are over 18 years of age at the time of entry. Members of the judging panel, ANSI Staff, and members of their immediate family are not eligible.

Awarding of Prize

The winner will receive a $300 gift certificate or gift card. One prize will be awarded. The winner and new character will be announced at the USNC Council Meeting in the fall of 2015. The character will be used for the USNC's various marketing and communications campaigns that target a younger audience to build up early interest in electrotechnical standards and conformity assessment.

Email entries by Monday, 31 August, 2015, to:
tzertuche@ansi.org
Tony Zertuche, Deputy General Secretary, USNC/IEC

Save the date!

Using and **referencing ISO** and **IEC standards** to support **public policy**

Conference and **Training**

2-3 November 2015, Geneva, Switzerland

What: A full-day conference followed by a half-day training course

When: 2-3 November 2015

Who: IEC and ISO members and affiliates along with their regulators and policymakers, plus relevant international organizations

Where: Conference at the Palais des Nations, 1211 Geneva, with UNECE as the host. Training at ISO/CS, 1214 Geneva.

For further information please contact
For IEC: Katharine Fraga **kpe@iec.ch**
For ISO:Belinda Cleeland **cleeland@iso.org**

Learn about the many ways in which International Standards can support public policy goals at this IEC and ISO conference and training course! We will look at how to reference standards in regulations, how standards can help implement policy commitments taken at the global level (e.g. sustainability, resilience and development goals), and much more.

The event is a unique opportunity to connect national and international policymakers with standards developers, in order to share experience and best practices. So bring your national policymakers with you!

More information on the programme and registration will follow. To learn more on how standards can help you: 'Using ISO and IEC standards to support public policy'.

Mark Your Calendar for Upcoming Meetings & Events

2015

3 – 4 September 2015
FINCA Meeting
Cartagena, Colombia

Tuesday – Thursday
22 – 24 September 2015
CAPCC/TMC/Council
AAMI, Arlington, VA

Friday, 25 September 2015
7Th USNC TAG Leadership Workshop
AAMI, Arlington, VA

12 – 16 October
79th IEC General Meeting
Minsk, Belarus
Monday 12: SMB, CAB
Wednesday 14: CB
Friday 16: Council
(Technical meetings 5–16 October)

2 – 3 December 2015
IEC Directives Maintenance Team Meeting
(with ISO/IEC JDMT Meeting)
SAB, Pretoria, South Africa

2016

10 – 14 October
80th IEC General Meeting
Frankfurt, Germany
Monday 10: SMB/CAB
Wednesday 12: CB
Friday 14: Council

2022

86th IEC General Meeting
USNC Expression of Intent submitted to and accepted by IEC Council

For additional event info, visit www.ansi.org/calendar and search for "USNC" or "IEC."

ABOUT THIS PUBLICATION
The USNC Current newsletter is distributed to the constituency of the U.S. National Committee (USNC) of the International Electrotechnical Commission (IEC). It provides updates on technical activities and other information of interest to members of the electrotechnical community. Some articles are reprinted with permission from the IEC News log.

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Contributions are gladly accepted for review and possible publication, subject to revision by the editors. Submit proposed news items to:
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