



# TRANSFORMERS COMMITTEE



March xx, 2006

To: IEEE SA Standards Board

Re: IEEE SA Standards Board Metrification Policy  
and the Use of Industry Accepted Terminology in the Development of IEEE Standards

On behalf of the Transformers Committee (PE/TR), and the Power Engineering Society (IEEE/PES) we request the IEEE SA Standards Board (the Board) to provide explicit written acceptance on 1) the use of dual-dimensioning in the IEEE SA Standards Board Implementation Plan for Metrification Policy 9.19<sup>1</sup>, and 2) the use of long established definitions, terminology, and methods of expressing quantities used in IEEE/PES standards and well understood in the power industry.

In recent years, IEEE/PES technical committees, particularly PE/TR, have worked diligently to implement metrification policy, but at the same time have recognized that very serious safety issues will result if non-metric units are completely eliminated from our standards. Varying interpretations in the implementation of the metrification policy during the review process have presented significant challenges to the completion of several of our documents. Furthermore, we have had to address significant comments during the balloting process suggesting that long-established industry-accepted standard terminology and notation practices in the description of power engineering quantities and values were incorrect<sup>2</sup>. While most of these comments were not technically incorrect, many appear to result from taking the actual text of the standards paragraph out of context. Our working groups have concluded that these comments do not reflect the standard knowledge and practical experience gained from years of working in the power engineering field. These ballot challenges have resulted in unproductive use of hundreds of hours of precious volunteer resources that are critical in the development of power engineering standards. Instead of making meaningful progress towards the development of the standards, these valuable resources were consumed in the mandatory recirculation process required to address these many well intended but impractical comments. We urge the Board to take decisive action to stop the continuous draining of these valuable resources by addressing the following two issues explicitly.

## ISSUE #1 – METRIFICATION POLICY

Through our recent discussion with IEEE SA staff and SCC 14 leadership<sup>3</sup>, we confirmed our understanding that the use of the US customary units of measurement is permitted as the alternate units of measure in the normative portion of the standards text, including tables, figures, and graphs.

The need for dual dimensioning has been discussed at length in many previous occasions and accepted by IEEE SA Board representatives in the past. As you will see in the attachments, the safety risks of not having dual dimensioning in the standards are just overwhelming. The potential for catastrophic loss of lives and the liability for IEEE would simply be too great to continue to ignore this urgent need.

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<sup>1</sup> The current implementation plan can be found on the IEEE website at <http://standards.ieee.org/announcements/metric.html>. The text of this implementation plan is included in Appendix I.

<sup>2</sup> Example of these ballot comments can be found in recent ballots for PC57.12.01, PC57.12.20, PC57.12.37, PC57.12.40. An example is attached in Appendix II

<sup>3</sup> Teleconference on 11/29/2005. Participants were: S. Vogel, A. Ortiz, S. Tatiner, M. Ceglia, Vidas, Y. HoSang, B. Barrow, J. Thomas, K. Hanus, and B. Chiu.

We ask the Board to make this ruling explicitly in writing. Even though this issue has already been discussed on many previous occasions, the lack of explicitly written implementation policy has resulted in interpretations that swing with the preference of the individuals enforcing this policy. In moving forward, we request that the Board explicitly states that dual dimensioning be allowed in all PES standards, with the SI system as the primary units of measurements and the US customary units of measurements (in, lbs) as the alternate units of measurement in parentheses.

## ISSUE #2 - INDUSTRY ACCEPTED DEFINITIONS, TERMINOLOGY, AND METHOD OF EXPRESSING QUANTITIES

It is also our position and understanding that the sponsoring technical committee represents the best consensus knowledge needed in the determination on the correct use of terminology and methods of expressing quantities. The sponsoring committee and its designated working groups therefore shall be the authority in determining the appropriate use of the terminology and expression of the quantities.<sup>4</sup> In moving forward, we request the Board to grant this authority to the technical committee explicitly in writing.

The requested actions have become an absolute necessity in providing our working group volunteers the tools necessary to effectively and expeditiously address some of the comments in the balloting process of the standards sponsored by IEEE/PES technical committees.

These recent events, while unfortunate, pale in comparison to the long term risks of exposure to the IEEE SA if left unchecked. Suggestions have already surfaced amongst our constituents that a boycott of the IEEE standards is in the realm of possibility if the standards continue to be developed under the current environment which simply does not recognize legitimate needs and concerns of the industry.

As a convenience to the Board, selected relevant documents from past discussions relating to these issues are included in the appendices<sup>5,6,7,8</sup>. We look forward to working with the Board to resolve these issues and to provide these explicit directions expeditiously. Please feel free to contact us if we could be of any assistance to the Board in this matter.

Sincerely,

Bill Chiu, Chair  
Standards Subcommittee/Standards Coordinator  
IEEE/PES Transformers Committee  
[bill.chiu@ieee.org](mailto:bill.chiu@ieee.org)

Jim Thomas, Chair  
Standards Coordinating Committee  
IEEE Power Engineering Society  
[jim.thomas@ieee.org](mailto:jim.thomas@ieee.org)

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<sup>4</sup> Examples of these industry accepted practice include the use of "kVA rating of a transformer," the expression of 120/240 V as a voltage designation for the 120 volts phase-to-ground voltage and 240 volts phase-to-phase voltage of a single-phase, three-wire system.

<sup>5</sup> Letters (dated 4/30/2002) from H. Jin Sim, IEEE PE/TR Chair to IEEE Standards Board requesting acceptance of dual-dimensioning. The text of the letter is attached verbatim in Appendix III.

<sup>6</sup> Letters (dated 5/6/2002) from H. Jin Sim, IEEE PE/TR Chair to Bruce Barrow requesting acceptance of dual-dimensioning. The text of the letter is attached verbatim in Appendix IV.

<sup>7</sup> See letter dated 8/25/2003, from IEEE/PES and IAS President Mr. John Estey and Mr. Jerry Hudgins to the IEEE SA Board, request acceptance of dual dimensioning in IEEE/PES and IAS standards. The text of the letter is attached verbatim in Appendix V.

<sup>8</sup> Email correspondences between members of SCC14, RevCom, and PE/TR Standards Coordinator (~May/June, 2005) regarding metrification & SCC Issues. See Appendix VI

## Appendix I

### IEEE-SA Standards Board Implementation Plan for Policy 9.19

The IEEE-SA Standards Board supports IEEE Policy 9.19, which calls for measured and calculated values of quantities to be expressed in metric units in IEEE publications, following the detailed guidance for SI-based metric practice given in ~~IEEE Standard 268~~ IEEE/ASTM Standard SI 10. Many IEEE standards already conform to this policy. or the remainder, the Standards Board has adopted the following transition schedule:

**Stage I -- After January 1, 1996:** Proposed new standards and revised standards submitted for approval shall include metric units.

**Stage II -- After January 1, 1998:** Proposed new standards and revised standards submitted for approval may include inch-pound data if that is thought to be necessary, but shall give the metric units in preferred place. As a general rule, "dual dimensioning", the practice of following the metric unit with the inch-pound-based unit in parentheses, should be avoided because it makes text difficult to read. Iternative means of presenting the inch-pound information, such as tables or footnotes, are preferred.]

**Stage III -- After ~~January 1, 2000~~ 11 September 2003:** Proposed new standards and revised standards submitted for approval ~~shall~~ should use metric units exclusively in the normative portions of the standard. ~~Inch-pound data may be included, if necessary, in footnotes or annexes that are informative only.~~

Standards Coordinating Committee 14 shall work with the committees responsible for generating IEEE standards to help them carry out this implementation plan. olicy 9.19 recognizes the need for some exceptions and contains the following statement: "Necessary exceptions to this policy, such as where a conflicting world industry practice exists, must be evaluated on an individual basis and approved by the responsible major board of the Institute for a specific period of time." CC14, as part of the coordination process, shall review requests for individual exceptions and shall report its recommendations to the Board.

***Exceptions:***

- (1) Standard ~~268~~ SI 10 gives a specific exception for trade sizes, such as the AWG wire series and inch-based standards for fasteners. Such data need not be translated into metric terms.
- (2) Also excepted are those cases, such as plugs and sockets, where a mechanical fit to an inch-based product is required.
- (3) This Implementation Plan does not require metric products to be substituted for inch-based products.

**Approved by IEEE-SA Standards Board  
16 March 1995**

**Updated 11 September 2003**

\* The IEEE-SA Standards Board may grant exceptions to the requirements of Stage I for projects authorized before 16 March 1995 based on the judgment of its members or at the request of a working group. In cases where an exception is granted, working groups will be notified that they are expected to comply with the policy as stated herein in future revisions.

## Appendix II

### Example of SCC Comments on PE/TR Standards

-----Original Message-----

**From:** Alan Wilks [mailto:awilks@ermco-eci.com]

**Sent:** Friday, February 18, 2005 2:16 PM

**To:** j.frysinger@ieee.org

**Cc:** Tom Prevost; Tommy Cooper; Ed Smith

**Subject:** Comments on Your SCC14 Issues with PC57.12.20/D10c Recirculation Ballot

Mr. Frysinger,

Thank you for your comments from SCC14 on our PC57.12.20/D10c. I have reviewed your comments and have made my own comments on each of your eight issues.

Attached are my comments underneath each of your issues and our action plans on each. Although I don't agree with some of the issues that you have raised, many of which are out of my control, I will try to get someone in a position of authority to address the more global issues.

Sincerely,

Alan Wilks

Co-Chair, W.G. PC57.12.20

[Comments on Mr. Frysinger's SCC14 Coordination Issues  
by Alan Wilks, W.G. Co-Chairman, PC57.12.20  
2/18/05](#)

Coordination Comments on PC57.12.20TM/D10c

Draft Standard for Overhead Type Distribution Transformers, 500 kVA and Smaller: High Voltage, 34 500 Volts and Below; Low Voltage, 7970/13 800Y Volts and Below  
2005 February 17

1. In the SI a distinction is made between expression of quantities and expression of values. Quantity attributes are included in the expression of quantities and not in the expression of values. In the latter, only the magnitude and the units are expressed.

Because of this, the type of expression seen in "Low Voltages 7970/13 800Y volts" (clause 1.1) is incorrectly constructed. The "Y" portion is a statement of the particular quantity, namely, phase-to-phase voltage in a wye connected three phase system. That is, phase-to-ground potential difference is 7 970 V and phase-to-phase potential difference is 13 800 V. The "Y" should not appear in the expression of the value. There is no unit with a symbol "Y".

Similar comments apply to intercalation of "Grd" in value expressions, as is seen in table 2.

Since the two values are related by the square root of 3, specifying one value should be sufficient to define the other value. This could provide an even simpler solution for the authors.

Compounding the problem is that the example above is actually a statement of two values. The authors may wish to consider using symbology to express this as a pair of numbers such as

$$(V_{\phi-g}, V_{\phi-\phi}) = (7\,970\text{ V}, 13\,800\text{ V})$$

which puts the qualifying indications on the quantity symbols and separates the two value expressions.

[Your suggestion deviates greatly from the practices established many decades ago. As Working Group Co-Chairman, I do not have any authority to make changes of this magnitude. We are referring this suggestion to the IEEE Transformers Committee.](#)

2. A related problem is seen in 7.1.3 with "120/240 volts" and "240/480 volts", both of which literally work out to 0.5 V. The laws of algebra apply even when expressions are spelled out as well as when put symbolically. Again, this is due to trying to express two values in one value expression. A non-mathematical separator would work here, rather than the solidus (which indicates division). For example, one might write "120 V, 240 V". Note that each value is given its own unit (symbolically, here).

The “/” used in this draft is not a division symbol. It is a delimiter, just as commas are sometimes used as delimiters. Again, your suggestion deviates greatly from the practices established many decades ago. As Working Group Co-Chairman, I do not have any authority to make changes of this magnitude. We are referring this suggestion to the IEEE Transformers Committee.

3. Each value expression consists of a numerical magnitude and the units which are “counted” by to obtain the magnitude. A space should appear between the numerical portion and the unit symbols. For example, write 65 °C, not 65°C, as is seen in clause 4.1. Note that the raised circle is part of the unit symbol for degree Celsius so the space precedes it.

Your suggestion is valid and changes will be made accordingly to our draft. Since these are editorial in nature, we would not recommend a recirculation ballot based on this change.

4. Unit names are not used as proxies for quantity names. In clause 4.1, for instance, the phrase “Kilovolt-ampere ratings” appears. We speak of voltage ratings, not volt ratings and air temperatures, not air degrees. Here, “Total power ratings” or “Apparent power ratings” would be appropriate. A similar problem occurs with “shall be at rated kilovolt-amperes” in clause 4.2 and elsewhere.

Your suggestion deviates greatly from the practices established many decades ago. As Working Group Co-Chairman, I do not have any authority to make changes of this magnitude. We are referring this suggestion to the IEEE Transformers Committee.

5. Now that IEEE Metric Policy has reached Phase III, non-SI indications should not appear in the normative text body (except for trade sizes such as “1/4 inch or larger NPT” in clause 7.2.5.1). Parenthetical expression of non-SI indications were part of Phase II but that has passed now. So the parenthetical expressions in clause 7.2.5.1 and elsewhere should be removed. In the rare event that the reader needs help with an SI unit, a conversion factor or a non-SI equivalent could be presented in a footnote (informative in IEEE standards).

The IEEE Transformers Committee has resolved this metrification issue with IEEE. Because of safety concerns related to having only metric units of measure, IEEE agreed with the Transformers Committee that dual dimensioning in accordance with Phase II would be acceptable for the product standards within the IEEE Transformers Committee. This draft is following the agreed upon procedure. Therefore, no action is planned regarding this issue.

6. One trade size that is used is the AWG gage system. Since this is predominately a North American standard and since IEEE standards often receive an international audience, the authors ought to consider also providing wire diameters in millimeters or provide citation of the seminal standard. For AWG gage this is ASTM B258-02 (for solid wire) and related documents (for other wires), though at least one other IEEE standard cites a derivative joint standard, NEMA WC70/ICEA S95-658-1999.

This suggestion will be discussed during the upcoming meeting of the Working Group in Jackson, MS on March 14, 2005. I do not have access to NEMA WC70/ICEA S95-658-1999 and therefore cannot comment on its use in this document.

7. Unit names (including prefixed unit names) are not capitalized unless they start a sentence. For example, “Millimeters” in table 6 should be “millimeters”.

Thank you for pointing out the capitalization issue. These changes will be made in the draft. Since they are editorial in nature, we would not recommend a recirculation ballot based on the change.

8. Quantity symbols should be in slanted typeface, not upright. See the “L”, “Z”, and “A” in figure 2, for example.

This issue may be valid and will be discussed during the next meeting of the Working Group on March 14, 2005. Again, since these are editorial in nature, we would not recommend a recirculation ballot based on the change.

**Summary:**

Some major work seems to be required here and decisions will need to be made by the authors on how they wish to do that in dealing with some of the comments. This document should be recirculated after that is done.

The Working Group Chair is strongly encouraged to correspond with me about these comments if there are any questions relating to them or to discuss particular ways to resolve these issues. Obviously this review represents a lot of needed work and yet we at SCC14 share the Working Group's desire to get this document through the approval process as quickly as possible. In that vein I have tried to present some clear options and would be glad to discuss others that the Chair may have in mind.

James R. Frysinger  
Vice Chair, SCC14  
j.frysinger@ieee.org (aliased to frysingerj@cofc.edu)

DRAFT

### Appendix III

#### Letters (dated 4/30/2002) from H. Jin Sim, IEEE PE/TR Chair to IEEE Standards Board requesting acceptance of dual dimensioning

#### **To: IEEE Standards Board**

The IEEE Transformers Committee members have significant concerns regarding the IEEE requirement to change our product specification standards to use metric units. This document outlines our issues and proposes a solution.

It has been IEEE's direction to phase in a conversion to metric units over the last several years, with the intent to just having metric units in the text of our standards for all standards published after Jan. 1, 2000. Prior to this we were using a "dual" system with both inch/pound and metric units together in the text, the tables, and the diagrams. This proved satisfactory to our members.

Several of our product specification standards are coming close to their final drafts or are close to beginning the balloting stage. Metrification became a significant issue at our recent Committee meetings in Vancouver (April 14 to 18, 2002). In particular, C57.12.34 Requirements for Pad-Mounted, Compartmental-Type, Self-Cooled, Three-Phase Distribution Transformers is being balloted with a close date of May 13 and based on User feedback this ballot is clearly expected to fail over metric safety concerns. This will cause this standard to be indefinitely delayed and other similar standards will likewise be affected. It is our desire to be proactive and resolve this issue before an impasse is created.

A large percentage of our Users (primarily electrical utilities) have indicated that their companies have very significant safety concerns. It should be noted that although we like to refer to our transformer product standards as being international, in the most part they are not used outside of North America. To narrow this down, the use of our product standards is primarily by American end users, the suppliers of those end users, their consultants, and their contractors. Generally, metric measurements are not in common use in the United States. In particular, most trained linemen are not familiar with metric measurements and this introduces significant safety and consistency of application issues. The safety of those that work with and within our transformer standards must not be compromised.

We have explored the options available to us under the IEEE metrification rules such as footnotes and annexes that would allow inch/pound units; however, the safety risk of a mistake over rides these options. Additionally, these options create issues related to the practical use of our standards for the purposes that they are intended.

It is our strong desire and **recommendation** to use a **dual system** in our standards where bracketed inch/pound units directly follow the metric measurements. We feel that this respects globalization and the IEEE direction to move to the metric system while at the same time results in standards that are safe and useful in the United States.

We look forward to your acceptance of our recommendation.



H. Jin Sim,  
Chair, IEEE/PES Transformers Committee

## Appendix IV

### Letters (dated 5/6/2002) from H. Jin Sim, IEEE PE/TR Chair to Bruce Barrow requesting acceptance of dual dimensioning.

#### **To: Bruce Barrow**

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It is our strong desire and **recommendation** to use a **dual system** in our standards where bracketed inch/pound units directly follow the metric measurements. We feel that this respects globalization and the IEEE direction to move to the metric system while at the same time results in standards that are safe and useful in the United States.

We understand that for an exception to the metric policy a definitive timeframe is required. Our problem will take at least one generation to solve depending on metrification in our schools and the gradual retirement of linemen trained only in the inch/pound method. A one or two year exception is not practical. We will need at least 10 years and then may have to apply for a further extension.

We look forward to your support and your acceptance of our recommendation.



H. Jin Sim,  
Chair, IEEE/PES Transformers Committee



**Appendix V**

Letters (dated 8/25/2003) from IEEE/PES and IAS President J. Estey and J. Hudgins to the IEEE SA Board requesting acceptance of dual dimensioning.

25 August 2003

To: Don Wright, Chair, IEEE-SA Standards Board

Subject: Proposal: Exceptions to IEEE Metric Policy

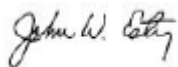
Below please find a statement on behalf of IAS and PES requesting exceptions to the metric policy in matters where safety may be compromised by implementing the policy as it is now being interpreted. This proposal states that if the metrication policy poses a safety hazard, an exception should be granted. It is hoped that the IEEE Standards Association and the Standards Board can relate to this principle where such a prospect could certainly expose the IEEE to unwanted litigation. In addition, it is hoped that agreement can be gained where we need to produce standards with the industry workers' interests at heart.

As an example, consider the case of an Air Canada plane a few years ago that had to make a dead-stick emergency landing on an abandoned air force base in Manitoba because the fuel order was made in kilograms but the workers misunderstood and filled the tanks using pounds as the unit of measure. Needless to say, they ended up with less than half the fuel needed for the trip and the crew had to land that plane using procedures they improvised since the aircraft manufacturer never conceived that total fuel exhaustion could happen in a jetliner. It was a true miracle that no one was killed as a result of this misinterpretation of the units. It would be unfortunate if there were a similar incident in our industry.

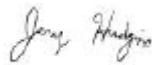
Therefore, the Industry Applications Society and the Power Engineering Society respectfully request approval by the IEEE-SA Standards Board to grant exceptions to the IEEE Metric Policy, as stated in the following proposal:

The IEEE Power Engineering Society (PES) and Industry Applications Society (IAS) acknowledge the wide use of metric units and the reasons that IEEE developed the Metric Policy. There are, however, segments of the US electric power industry that have long used the inch-pound unit system and the workers in that industry are not well trained nor very familiar with metric units. As a consequence, there are a number of areas where safety may be compromised by insisting on the use of metric units in the body of the standard and relegating inch-pound units to footnotes and annexes. In those cases, it is the recommendation of PES and IAS that inch-pound units be permitted to be used in parentheses following the metric units in the body of the standard.

Respectfully submitted,



John Estey  
President, Power Engineering Society



Jerry Hudgins  
President, Industry Applications Society

Cc: Lowell Johnson, Chair, IEEE-SA Procedures Committee  
Gary Engmann, Member-At-Large, PES Governing Board  
Tom Prevost, Chair, Power Engineering Society Standards Coordinating Committee  
Howard Wolfman, Chair, IAS Standards Department  
Rich Hulett, Chair IAS PCIC Standards Subcommittee

## Appendix VI

Email correspondences between members of SCC14, RevCom, and PE/TR Standards Coordinator (~May/June, 2005) regarding metrification & SCC Issues  
Please note this email also contains several attachments.  
These attachments are also included as Appendix V-1 through V-#.

Bill Chiu/SCE/EIX  
06/03/2005 12:19 PM

To

"Engmann, Gary" <gengmann@burnsmcd.com>, b.barrow@ieee.org, "John Scott" <john.t.scott@verizon.net>, j.frysinger@ieee.org, m.v.thaden@ieee.org

cc

edsmith@h-jenterprises.com, ken.hanus@ieee.org, donald.fallon@ieee.org, TPREVOST@EHV-WEIDMANN.COM, s.vogel@ieee.org, Jin.Sim@WaukeshaElectric.spx.com, j.haasz@ieee.org, d.ringle@ieee.org, y.hosang@ieee.org, jthomas@mpr.com, sa@ieee.org, mdbowman@ieee.org, dennisb@model.com, joe.bruder@gtri.gatech.edu, flatland@compuserve.com, bob@scsi.com, g.engmann@ieee.org, wgoldbach@danaher-DPS.com, karady@asu.edu, David\_Law@eur.3com.com, nader.mehravari@lmco.com, g.robinson@computer.org, Frank.Stone@Shell.com, Joe\_Watson@fpl.com, awilks@ermco-eci.com

Subject

Re: IEEE Exception - Metrification & SCC Issues

June 3, 2005

To: IEEE-SA SCC Members and RevCom Members

From: Bill Chiu, PE/TR Standards Coordinator  
With support from Transformers Committee Officers:  
Ken Hanus, Chair  
Don Fallon, Vice Chair  
Tom Prevost, Secretary  
Jin Sim, Past Chair

Dear IEEE Colleagues:

I have read the previous email exchanges with great interests. I believe we all stride towards fulfilling our pledge as members of this great engineering organization. Many of you gave, and continues to give, countless hours of personal time towards this noble cause.

Given my role as the standards coordinator on behalf of the PE/TR, I feel compelled to weight in on this issue because the outcome of these discussions could have far reaching implication to the US electric power industry.

I believe the initiating event that led to these discussion is the PC57.12.20 currently under RevCom consideration. My position and those of the officers of the PE/TR are aligned in that first and foremost, we want to adhere to the correct established procedure in responding to comments in the balloting process and other coordination reviews.

On behalf of the officers of PE/TR, below are three areas of concern I wish to share with all of you - - with the intent of bring about a greater understanding of both sides of the coin on these important issues. Please take a few moments to consider the points presented below. I know it is a bit long, but I felt necessary to get my points across. Let me thank you each in advance of reading it through the end.

1. The use of metric units on transformer standards.

There is no objection to use the SI units of measurement on transformer standards. Our IEEE working group volunteers want and deserve the best possible standards that can be easily understood by the stakeholders that are

impacted by these documents. The PE/TR standards follow the established guideline on the implementation of IEEE Policy 9.19 and the IEEE Std C57.144 - 2004 - IEEE Guide for Metric Conversion of Transformer Standards, which also addresses these metrification issues. Our standards include the use of SI units as the primary units of measure, follow by the US Customary (inch-pound) units in parentheses as backup information for the benefit of the end users.

While all of us benefited from the rigorous math and science training which affords us the ability to transition from one system to another with great ease, this is not the case for majority of the US workforce in the field turning our engineered projects into reality. I have personally witnessed the struggles by field technicians converting from one system to another while working on commissioning power transformers in the field. The inclusion of the US Customary units are absolutely necessary since the great majority of the workforce are illiterate when it comes to these conversion.

Forcing the power industry to drop the conventional inch pound measures is analogous to forcing the adoption of an universal language for the entire population of the human race and forbid the use of their native language in their home country. This is not just about an academic discussion. It is about a very profound change to culture of an industry that has served us all very well. To expect the elimination of an entire culture built over hundreds of years in a few years, is at best, idealistically naive.

An example of practicality of dual dimensioning is the IEC standards - - where dual languages exist. Keep in mind that PE/TR is on the forefront of the IEEE's effort in pushing for dual logo IEEE/IEC standards - - our C57.135 is the very first dual logo standard adopted by IEC. The point is all of us are for change - when it makes good sense and support the interests of our constituents. In this case, dropping the inch pound units of measure do not make sense, at least not yet.

One of the key considerations that have been left out is the consequential impact to the stakeholders. Using the examples referenced in previous email exchanges, soft drink bottling company could change their volume from fl. oz to ml, with very little impact to the consumer. I'm fairly certain that most people buy by the relative "gut" feel on the size of the cans or bottles, without an actual conversion between fl. oz. to ml. This same relative "gut" feel does not work in situation when dealing with potential loss of lives. In fact as demonstrated by several of the examples and feedback from the stakeholders of transformer standards - the dual dimensioning is a must.

For your reference, attached are several documents that have been presented to SCC and other IEEE SA Board and committees in the past.

  
Metric\_20020430.pdf Metric\_20020506.pdf 0309sbd\_3-1.pdf User\_Comments.pdf  
  
Mars Weather Orbiter Lost by NASA (fwd).htm Metric Conversion Blamed for Canadian Jet's Forced Landing.htm

## 2. The Role of PES and IAS in Training the Power Industry on SI units.

While I agree the training is an important step towards eventual elimination of the inch pound units of measurement, I'm convinced that for the infrastructure industry to shift away from the nomenclature of 2x4 lumber, or 16d nail, or 12/2 AWG romex wires we use to build and maintain our homes is a very, very unlikely event in our life time. I'm hopeful some day in the future, perhaps even in my life time, the technicians that replace my vehicle tires will inflate them using KPa rather than psig. However, I don't have any realistic expectation that these changes will take place any time soon.

Again, I not advocating against change. I am merely pointing out some real barriers that we, as leaders of this great organization, must recognize and factor into our plan for change.

The training needs to start early on in the education process - - pre-elementary school. When I take my kids in for a medical check up, they get their height and weight measurements in inches and lbs, not cm and kg. My four-year old son, eager to grow up taller, asks me to measure his height from time-to-time in inches rather than centimeters, not because he thinks one is better than the other, but because that is what he has been exposed to earlier.

I believe PES/IAS, with the help of IEEE SA, could play a role in shaping the education policy of various federal, states, and local authorities. However, the direct training of the industry workforce is beyond of the scope of PES/IAS - we

simply don't have the financial resources to even make a tiniest of a dent on the enormous size of workforce impacted by this change.

These changes will take time - a long, long time. Those of us in position of leadership has the responsibility to explain the need for change, to lead by examples, and to sustain the momentum of these changes through encouragement and provision for learning about the change. I believe by adopting the SI system as the primary unit of measurement is a giant step towards demonstrating that change. Dropping the US Customary units now will take away the learning opportunities. Let's have patience as we work together toward sustaining these momentum of change. Our roles as leaders of this great engineering organization is to recognize the changes that are already taking place and not be too critical of the changes that has not materialize yet. It is only through these continual acceptance of reality and encouragement of our constituents that eventual long-lasting changes are sustained.

3. Terminology used in Transformer Standards

The terminology used by the hundreds of thousands of professional are developed over the years. The PE/TR did not make up these terminology, rather these nomenclatures and expression of quantity and values are accepted industry practice, and recognized not just by those in the US, but also internationally.

Rather than addressing each of the points raised by the SCC 14 here, I've attached a copy of the correspondence between PE/TR Working Group Chair and the SCC 14. Please open the attached document and read through these discussion.

Items 3, 6, 7, and 8 are good catches by Mr. Frysiner. Because of editorial nature, the document will be corrected as indicated without recirculation.

Items 1, 2, 4 and 5 - while not incorrect - are not the accepted industry practice. The proposed changes will cause great confusion in the industry, not to mention a very awkward way of expressing standard three-phase voltages and power ratings.

In closing, I thank you for your contributions. For us to have truly successful long-lasting changes that are embraced by the industry, we must be patient and give recognition to those who worked hard at promoting changes - one step at a time. The industry has already taken a giant step toward metrification. Let's work together to resolved our differences. If there is any shortcomings in the way we handled the coordination, please let us know so we could adhere to the proper procedure.

Again, thank you for your time.

Best Regards,

\*\*\*\*\*

Bill Chiu  
Chair, Standards Subcommittee/Standards Coordinator  
IEEE/PES Transformers Committee  
626.308.6086  
bill.chiu@ieee.org

\*\*\*\*\*

b.barrow@starpower.net

05/27/2005 07:23 AM

To

James Frysiner <frysinerj@cofc.edu>, "Engmann, Gary" <gengmann@burnsmcd.com>

cc

j.frysiner@ieee.org, bill.chiu@ieee.org, m.v.thaden@ieee.org, b.barrow@ieee.org, John Scott

<john.t.scott@verizon.net>

Subject

Re: ieee exception

Jim and Gary,

I do remember the PES/IAS letter to the Standards Board, dated 25 August 2003. While I cannot lay my hands on meeting minutes, I believe that I was not able to attend the September meetings of RevCom and the Standards Board that followed.

It seemed to me at the time that the combined weight of Estey and Hudgins, whether expressed in kilograms or newtons, exceeded mine.

Be that as it may, I believe it was their 25 August letter that prompted the IEEE-SA Board to amend the Implementation Plan a few weeks later, on 11 September, replacing "shall use metric units exclusively in the normative portions of the standard" by "should use metric units exclusively . . ." and deleting the requirement that inch-pound units be relegated to the informative portions.

The revised Implementation Plan does not give guidance as to when and how exceptions to the "should" phrase may be invoked, but I believe the PES/IAS letter does give such guidance: (1) "areas where safety may be compromised;" and (2) then "inch-pound units [are] permitted to be used in parentheses following the metric units in the body of the standard."

Bruce Barrow  
Chair, SCC14

"Engmann, Gary" <gengmann@burnsmcd.com>  
05/26/2005 01:58 PM  
To  
"James Frysinger" <frysingerj@cofc.edu>  
cc  
<j.frysinger@ieee.org>, <bill.chiu@ieee.org>, <m.v.thaden@ieee.org>,  
<b.barrow@ieee.org>, "John Scott" <john.t.scott@verizon.net>  
Subject  
RE: ieee exception

that's klps not kips. I can't speak Britips, or British. gary

-----Original Message-----  
From: Engmann, Gary  
Sent: Thursday, May 26, 2005 3:51 PM  
To: 'James Frysinger'  
Cc: j.frysinger@ieee.org; bill.chiu@ieee.org; m.v.thaden@ieee.org;  
b.barrow@ieee.org; John Scott  
Subject: RE: ieee exception

Jim, I didn't initiate this, so I won't try to explain the safety issue.

I only know that I've been in hospital intensive care (scary place - people die there), and somebody decided in metric, what dose of blood thinner I needed to stay alive.

And that an auto mechanic at Pep Boys adjusted my metric brakes that I hope to be there at 120 kips (80 mph hard conversion??).

I buy my wine in liters, but I'm more concernd with getting enough than I am with my safety. gary

-----Original Message-----  
From: James Frysinger [mailto:frysingerj@cofc.edu]  
Sent: Thursday, May 26, 2005 3:40 PM  
To: Engmann, Gary  
Cc: j.frysinger@ieee.org; bill.chiu@ieee.org; m.v.thaden@ieee.org; b.barrow@ieee.org; John Scott  
Subject: Re: ieee exception

Dear Gary and Bill,

Thanks for forwarding this, Gary! This is the first time that I have seen this request for an exception. According to the IEEE SA Implementation Plan for the IEEE Metric Policy, such requests go to the board via SCC 14. I do not recall this matter ever coming up in an SCC 14 meeting or in discussions we have had outside our meetings. But I am including Bruce Barrow and another SCC 14 member on this reply, in case it rings any bells with them. In the meantime, if you come across any SCC 14 endorsement, whether pro or con, or any SA Board response, please let me know.

In the meantime my curiosity is piqued. What is the plan that the Power Engineering Society and the Industry Applications Society have in mind as an alternative to the SA Board's implementation plan? How do these two societies propose to come into consonance with IEEE Metric Policy and what is the timeline for that?

I note in the letter you forwarded that the underlying justification given in requesting this exception is "There are, however, segments of the US electric power industry that have long used the inch-pound unit system and the workers in that industry are not well trained nor very familiar with metric units." I would expect that the plan your two societies have in mind provides for the requisite training and the time in which to conduct that training. The point, of course, is to solve the lack of training problem by providing training, not by foregoing the move to new procedures. I'm sure that members of your societies continually train their people on new materials, new equipments, and new procedures. This is but one more training issue. Indeed, the story recounted in the letter you forwarded regarding the "Gimli Glider", as it came to be called, was a story that exemplified the need for proper training, not a need to avoid metric units.

For that matter, I assume that this is exactly what IEEE SA had in mind with their multi-phase implementation plan; if no time were needed for training, the implementation would probably have been full-step and at set-date soon after the Metric Policy was issued. So, the next, obvious question is "What training has been done within these two societies during the elapsed time frame of the Implementation Plan to attempt bringing training and knowledge levels up to speed? I think that demonstration of past effort in this regard would go a long way in asking for any extensions, but I am merely taking a guess at how the SA Board might view this. They would have to speak for themselves, obviously.

I am well along life's path and I realize that people often hesitate to change certain things in their lives. But we here all know that motivation and training is usually the key to easing those qualms and bringing about that change. When folks found that the soft drink companies had stopped selling pop in quart bottles, thirst quickly motivated those folks to accept and purchase 1 L and 2 L bottles of pop. For the sake of their health, folks often keep track of the number of grams of fiber, carbohydrate, fat, and sodium in their daily diets. The pharmacy profession has made the shift to metric units and that surely involved safety issues as widespread as those faced in the power and applications industries. Many states design and build their roads and bridges in terms of metric units and clearly safety is an important issue there.

If we all were to wait until everyone else has made the leap, then nobody would do it. As it is, many or perhaps nearly all societies have made the leap. Hopefully your two societies are not far from accomplishing the same leap.

The continual move toward full metrication in our country is undeniable. The fact that over 95 % of the world's population now lives and works in metric units makes that inevitable, though not well documented publicly. I submit, therefore, that the question before us here is not "if" but "when and how?"

Thank you once again for finding and forwarding that letter, Gary. I look forward to hearing more from you on this.

best regards,  
Jim Frysinger

On Thursday 26 May 2005 12:32, Engmann, Gary wrote:  
Bill & Jim,

I've been looking for the metrication agreement between the Standards Board, and the Transformers Committee.

Attached is the document I found on the IEEE SA website.

I believe I was serving on the PES Board at that time, and this is the way I remember the agreement, as presented to the Board by John Estey (then PES President).

As you can see, the exception is for the purposes of safety, and allows the English system in those cases. It doesn't address the use of electrical units, e.g. kVA, as substitutes for definitions of ratings, as has been common PES & IAS practice.

There may be another document that addresses the exception, and I want to find it, if I can. If either of you know of it please tell me.

The agreement is often cited in response to SCC14 comments, and we all would like to lay our hands on it. gary

--

James R. Frysinger  
Lifetime Certified Advanced Metrication Specialist  
Senior Member, IEEE

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DRAFT

**Appendix VI-1**  
**Attachment – User Comments.pdf**

**(This attachment contains a representative sample of comments from the PE/TR ballot group**

June 6, 2002

User Comments on Metrification of Product Standards

**Request:**

As you probably know in a couple of weeks I will be presenting our case for dual units at the standards board meetings. Brian Klaponski and I were discussing this issue yesterday and we felt that it would help our case if we could give "specifics" in regard to how only metric units could be a safety or other significant issue.

**Response:**

1)

One of the real life issues with which we deal is leak checking a tank. To do this we will pressurize the tank with a small amount of dry air. With the maximum pressure expressed in kilo-Pascals, there is a good chance service personnel will not know how to do the conversion correctly thus over pressurizing the tank. This would expose them to tank rupture. Another item that can be a problem is the conversion of the weight of the unit. Since all of our boom trucks, fork trucks and cranes lifting capacities are in pounds, there maybe a problem in converting the specified weight in kilograms to pounds. Obviously, a correct conversion is critical to handling the unit safely. Currently all of the feed-throughs and parking stands are manufactured in imperial units. Since all of the receptacles for these items are to be expressed in metric measurements, there could be a problem in getting these items to mate correctly in the field. Since Line personnel are notorious for being can-do-folks, they may attempt to make these devices "work". If the item lets go from its holder, it will let an energized line be uncontrolled thus presenting a real safety hazard to Line personnel.

I hope this reflects, the real seriousness of the situation. Again it is my feeling that the metric units should reflect conversion and the imperial units should be base.

Steve Shull , Empire District

2)

Not having a copy of .34 it will be hard to come up with an example from it. However, we do have an accident that was avoided because the units were readily understood. C57.12.40 - 1994 shows the clearance from the flexible connector to ground as "a minimum of 1" clearance". One of our crews was mounting a network protector to the network transformer. They noticed that the flexible connector seemed quite close to the protector's throat. They checked the standard and found the note about the 1" minimum clearance and realized that there was a problem. They scrounged some older flex connections that gave them the 1" clearance and then finished the installation. They reported the problem and upon investigation we found that the transformer manufacturer had changed the connectors. They worked fine with one manufacturer's protector but not with a competitor's. We also heard that a sister utility was not quite so lucky; they energized into a phase-to-ground fault from the same problem. Now if the standard had said 25mm, our crew would have just kept right on going never realizing the significance of the measurement and we would also have had a nasty explosion. It is not just a matter of training or knowledge. It is a matter of experience. I have the knowledge of how to convert linear dimensions between English and metric. I however, do not have a feel for 40 cm, but 3" I know instantly the rough size. This instinctive feel comes from experience which you gain by time and exposure. Providing both English and metric side by side will give the exposure. Putting only metric or putting English just in annexes will lessen the exposure and delay the experience.

Dan Mulkey  
Sr. Consulting Electrical Engineer, PG&E  
223-4699 inside  
415-973-4699 outside

3)

The two big issues I have are with regard to (1) dimensions and (2) weights on nameplates.



1) To me, it is simply not practical to reference a manufacturer's standard drawing of a two hole spade lug that has two 9/16" holes and 1-3/4" spacing between the two holes and assume that they will match up with an IEEE standard drawing of a spade that has two 14.3 mm holes with a spacing of 44.5 mm. We should not rely on the user to perform a metric to English conversion. To me, it would be practical to show BOTH the metric and the English units on the IEEE standard drawings so that users are sure they are correctly matching up parts. (Eventually, the manufacturer's standard drawings for the lugs may incorporate both dimensions as well. And once all manufacturers have 14.3 mm drill bits, we can remove the English Units.)

2) The weight in pounds is currently imprinted on each nameplate. A 500 KVA padmount we received some time ago had a total weight of 5976, and is entered in a database at our company so that we can use the correct equipment to lift this unit. There is only one place in our database for weight, and everything in that field is in pounds. I am not sure of the status of this issue in 12.00, but all of our standards reference 12.00 for the nameplates. How will weights be listed on the nameplates? If we begin receiving transformers with mass (in kg) on the nameplate, it will create a data mismatch in our database. If the values entered are in kg (2230.5 kg for the previously listed 500 KVA) and it is not VERY apparent that this is kg and not pounds, we may accidentally use equipment capable of lifting 2230 pounds instead of 5976 pounds. This conversion will take an enormous amount of re-training, heightened awareness, and database reconfiguration. These are the things that have come to mind as we have been marching down this road of metrification. We may need a few more years of dual dimensioning before we completely remove the English units from our standards. Thank you for allowing us to comment further on this issue.

Glenn Anderson , Duke Energy

4)

First, I'm sorry about creating a fuss about this but I do not believe the mass of the US utilities are ready to advance to metrification. Simply put, presenting a total metric document to them is a "waste of time". From a Reality standpoint, we, i.e., Progress Energy, will continue to communicate with our suppliers and customers in the familiar "ENGLISH" system and will create our own internal documents and standards as required. At this time I see no justification, political, financial, or otherwise, to motivate change. Weights will be REQUIRED to be presented in US Pounds. I certainly agree that presenting metric weights in Kilograms to a crew familiar only with the traditional "ENGLISH" system could lead to a serious accident. Electricity is a very dangerous and unforgiving product, especially at the levels the line crews work with on a daily basis. Presentation of ANY dimension on clearances to live parts should be made VERY CLEAR to the user. ANY standard providing minimum construction specifications should be perfectly clear to ALL intended users. After thinking about this for a while, the FIX of Dual Dimensioning is wrong. The IEEE and ANSI should follow the lead of the NESC and present a METRIC page (Chart or Drawing) and a separate ENGLISH measurement page. For Product Type standards such as Poletype and Padmount construction specifications, it would be wise to provide an ENGLISH version and a separate METRIC version of the standard.

Don A. Duckett, P.E.  
Lead Engineer  
Progress Energy

5)

I second what Don has presented. If it becomes necessary I also will revise my internal specifications and do away with reference to IEEE standards to avoid confusion, which as Don states could lead to a serious accident.

Carl G. Niemann Engineering Consultant ComEd an Exelon Company  
Phone: 630-437-2921  
Fax: 630-437-3356  
Internet ID: [carl.niemann@exeloncorp.com](mailto:carl.niemann@exeloncorp.com)

6)

PSE&G uses material handler trucks to lift and install pole-type transformers and other equipment. The material handlers, the boom, and the winch line are rated to lift different maximum weights depending on the angle of the boom. There is a gauge on the boom, with a pointer, that indicates the maximum weight that can

be lifted at a particular angle. The indicators weights are in pounds. Having the transformer weight in kilograms would cause us problems. If the crew did not look closely and realize that the nameplate weight is in kilograms, maximum weight limitations could be exceeded. As a result, damage to the truck, boom or winch line, and possibly injury to our personnel, could occur. This is a serious safety issue and it could also be very expensive to PSE&G. We would also have similar problems with the cranes used to lift three-phase padmounted and network transformers. To prevent this problem we would need to retrofit all of our material handlers or lifting trucks with labeling that indicated both pounds and kilograms, since we will always have older transformers where the weight is in pounds. We could still damage the equipment if the line personnel did not pay close attention to pounds versus kilograms on the nameplate. Due to these safety concerns, when revising transformer specifications for pole-type, single-phase and three-phase padmounted, and network transformers, we plan to specify that the manufacturers use only English Units on all drawings and on all transformer nameplates provided to PSE&G. If and when dimension changes are made in standards exclusively using Metric units, another potential problem exists as we may miss accurately translating these changes for our specifications without inconvenient and time-consuming review.

Ernie Nols  
PSE&G

DRAFT

Appendix VI-2  
Mars Weather Orbiter Lost by NASA (fwd)

## Mars Weather Orbiter Lost by NASA (fwd)

Hasan A. Rizvi [rizvi@sdnpk.undp.org](mailto:rizvi@sdnpk.undp.org)

Tue, 12 Oct 1999 12:24:21 +0500

- Messages sorted by: [\[ date \]](#) [\[ thread \]](#) [\[ subject \]](#) [\[ author \]](#)

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This message is in MIME format. The first part should be readable text, while the remaining parts are likely unreadable without MIME-aware tools. Send mail to [mime@docserver.cac.washington.edu](mailto:mime@docserver.cac.washington.edu) for more info.

-----20E2C361C6417865BBF20A9B  
Content-Type: TEXT/PLAIN; CHARSET=us-ascii  
Content-ID: <[Pine.LNX.3.95.991001102417.30644D@sdnpk.undp.org](mailto:Pine.LNX.3.95.991001102417.30644D@sdnpk.undp.org)>

Somewhat dated but still instructive enough for all interested in space exploration.

NASA Scientists made a costly error (feeding critical orbit data in British units instead of the metric system that the orbiter was programmed for) to lose the Mars Climate Orbiter - costing \$150 Million to U.S. tax payers!

-Hasan Rizvi

-----  
From: [NASANews@hq.nasa.gov](mailto:NASANews@hq.nasa.gov) [SMTP:[NASANews@hq.nasa.gov](mailto:NASANews@hq.nasa.gov)]  
Sent: Thursday, September 30, 1999 11:30 AM  
: *MARS CLIMATE ORBITER TEAM FINDS LIKELY CAUSE OF LOSS*

Douglas Isbell, NASA Headquarters, Washington, DC  
Mary Hardin, Jet Propulsion Laboratory, Pasadena, CA  
Joan Underwood, Lockheed Martin Astronautics, Denver, CO  
PRESS RELEASE # 99-113, Sept. 30, 1999.

MARS CLIMATE ORBITER TEAM FINDS LIKELY CAUSE OF LOSS

A failure to recognize and correct an error in a transfer of information between the Mars Climate Orbiter spacecraft team in Colorado and the mission navigation team in California led to the loss of the spacecraft last week, preliminary findings by NASA's Jet Propulsion Laboratory internal peer review indicate.

"People sometimes make errors," said Dr. Edward Weiler, NASA's Associate Administrator for Space Science. "The problem here was not the error, it was the failure of NASA's systems engineering, and the checks and balances in our processes to detect the error. That's why we lost the spacecraft."

The peer review preliminary findings indicate that one team used English units (e.g., inches, feet and pounds) while the other used metric units for a key spacecraft operation. This information was critical to the maneuvers required to place the spacecraft in the proper Mars orbit.

"Our inability to recognize and correct this simple error has had major implications," said Dr. Edward Stone, director of the Jet Propulsion Laboratory. "We have underway a thorough investigation to understand this issue."

Two separate review committees have already been formed to investigate the loss of Mars Climate Orbiter: an internal JPL peer group and a special review board of JPL and outside experts. An independent NASA failure review board will be formed shortly.

"Our clear short-term goal is to maximize the likelihood of a successful landing of the Mars Polar Lander on December 3," said Weiler. "The lessons from these reviews will be applied across the board in the future."

Mars Climate Orbiter was one of a series of missions in a long-term program of Mars exploration managed by the Jet Propulsion Laboratory for NASA's Office of Space Science, Washington, DC. JPL's industrial partner is Lockheed Martin Astronautics, Denver, CO. JPL is a division of the California Institute of Technology, Pasadena, CA.

- end-

DRAFT

**Appendix VI-3**  
**Metric Conversion Blamed for Canadian Jet's Forced Landing**

## ***Metric Conversion Blamed for Canadian Jet's Forced Landing***

© Copyright 1996, Jim Loy

This was actually the headline for an AP news story, on July 29, 1983. Here is the complete story:

### **Metric Conversion Blamed for Canadian Jet's Forced Landing**

MONTREAL (AP) -- Air Canada said today that a measurement error in the "conversion and communication" of metric weight and volume information caused a fuel shortage that forced a Boeing 767 to make an emergency landing last week.

"Our investigation indicates the fuel shortage was a result of errors during the manual fuel management procedure," said Air Canada spokesman Denis Chagnon.

The plane, with 61 passengers and a crew of eight, went into a powerless glide from 39,930 feet to a bumpy landing on a Gimli, Manitoba airstrip north of Winnipeg. One woman was taken to a hospital for observation, but no one was injured.

Airline workers resorted to a manual fueling procedure when an electronic system on the aircraft -- one of four Air Canada planes that have some metric systems -- failed.

The fuel in the aircraft is measured in centimeters and converted to liters before departure. That figure is converted to pounds and then to kilograms so that the pilot can calculate the flight plan. It was during this procedure that the error was made, the airline spokesman said.

Chagnon said the exact point at which the error occurred has not been established, but an investigation by the Canadian Aviation Safety Bureau will continue.

An Air Canada statement said Friday that it has instituted a new set of preventive and operating procedures for Boeing 767s. These include review of the calculation and manual fuel measurement procedures for planes that have metric systems and a re-examination of training programs and procedures. It said that 767 aircraft will be allowed to depart only when all components of the fuel tank quantity-indication systems are fully operative.

The airline began using Boeing 767s last fall.

Does that story sound stupid to you. Me too. Why don't they throw some more conversion steps in there. There are a few units of measurements that they missed. It seems that centimeters refers to the height of air from the top of the fuel to the top of the fuel tank. They get liters by reading a table that goes with the specific kind of airplane.

This story is a good joke, except that it almost ended in disaster.

I understand that this incident was the subject of a TV movie.