Annex C Distribution Subcommittee – Chair: Stephen Shull

April 5, 2017
New Orleans, LA, USA

Chair: Stephen Shull
Vice-Chair: Jerry Murphy

C.1 General Opening

Steve opened the meeting welcoming everyone to the meeting. Jerry circulated the rosters. To establish a quorum, a list of members were displayed and a count of was made. We did have a quorum with 43 of the 63 members in attendance by count of those identified on a slide presented in the meeting. Recorded attendance gave 151 in attendance, 46 members and 22 requesting membership with 15 being eligible.

The agenda was reviewed and motion made by Gael Kennedy, seconded by Dan Sauer and approved by unanimous acclamation of the members in attendance.

The Fall 2016 meeting minutes were reviewed and motion made by Ron Stahara, seconded by Dan Sauer and approved by unanimous acclamation of the members in attendance.

C.2 Working Group and Task Force Reports

C.2.1 C57.15/IEC 60076-21 – Step-Voltage Regulators – Craig Colopy

Craig presented the following minutes from the working group meeting on April 3, 2017 at 4:45 p.m. with 35 people in attendance.

1. Craig Colopy opened the meeting and introductions were made by the attendees.
2. Distribution of attendance sheets. Essential Patent call made by Craig Colopy - None received from attendees. Check for Quorum was made, 22 from card reader vs. 25 visual count, Members in attendance. Quorum was achieved (38 members). 15 members attended the Saturday working session - 1 April 2017.
3. Approval of agenda - Dan Sauer made Motion, Steve Shull seconded, no opposition to approval.
4. Approval of minutes from Spring meeting in Vancouver BC, Canada - Motion for approval by Fred Friend and second by Steve Shull , no opposition to approval.
5. Discussions/ decisions with regard to a majority of the comments from Draft 2.0 ballot resulted in the completion of Draft 2.2. Discussions/ decisions with regard to the balance of the comments as well as the comments from IEC generated Draft 2.3.

Summary of work completed from Saturday's all day session was presented. The following was submitted for review:

a. New subclause, Over-Excitation, was created from text taken from previous clause.
b. Added detail in the document on the difference between the thermal and mechanical force short-circuit test requirements with regard to the 25X requirement.
c. Separated out the routine and type testing of the complete voltage regulator from the key components. Clause identified as components added to Draft 2.3 covering tank integrity, control and on-load tap-changer.

d. Added additional requirement from IEC for nameplate data (weight of fluid when specified).
e. Note added for Lifting Lug Section regarding the possible need of a spreader bar when lift the complete unit.
f. Clarified the need to perform dielectric testing before visual inspection after a short circuit test.

8. Unanimous decision from committee members was received to have Draft 2.3 go for recirculation and formation of IEC CDV after final review by the working group.
9. Move for Adjournment - Fred Friend made Motion, Steve Shull seconded, no opposition to approval. Close of meeting.

Recorded and submitted by: Craig A Colopy/Gael R Kennedy

C.2.2 C57.12.20 – Overhead Distribution Transformers – Al Traut

Al presented the following minutes from the working group meeting on April 3, 2017 at 11:00 a.m. with 69 in attendance.

The patent policy was reviewed and upon asking for essential patents none were brought forward.

Based on the WG members listed on the roster and projected at the meeting a quorum was declared after a count was made.

The Chair asked if any member objected to the proposed agenda as displayed to the Working Group. No objections were brought forward so the agenda was approved as submitted.

The Chair asked if any member objected to the F16 (Vancouver BC, CANADA) minutes as submitted to the Working Group. No objections were brought forward; therefore, the F16 Minutes were unanimously approved.

The basic work at this meeting was to continue to review and address all comments received from the initial ballot as detailed below.

- Clause 7.5
  - Comment that Lifting Lugs should be moved to this section based on the 5-times safety factor
  - Recommendation by Chair to remain as is for now and considered for the next revision.
- Clause 7.5.4.3
  - Grounding connection only applies to the 120/240 connection for clarification
- Section 9.6
  - Replaced oil with liquid for clarification
- Table 3
  - No content changes only minor changes for clarification
  - Use of delta symbol to differentiate from “Y”
- Tables:
  - Based in comment Al adjust the format for consistency table to table on voltages
- Figure 1 & 2
  - Changed maximum voltage for 95BIL applications from 12,000 to 13,800v.
  - Comment on 30” creep bushings was rejected as this is outside the scope of this standard.
- Figure 6

  - Eliminate note “e”
- Figure 7
  - Eliminate note “e”
- Figure 9
  - The word “two” was added in the description for clarification
- Figure 10
  - Item 4 the hand hole provision was missing. Added it to be consistent with the other Figures
- Figure 12
  - Item 4 was missing again
- Figure A1
  - Note 4 - Added the previous requirements for the “C” support lug.
  - Note 6 – Added tolerance information

With all comments reviewed and resolved, a motion made by Steve Shull and seconded by Ron Stahara to approve all resolved comments and move forward with the recirculation ballot of D5. Motion passed unanimously.

There were a few others items that were captured to place on the list for future consideration.

- Review low voltage grounding as may be shown in Figure 10
- Look at the “T” (Scott Connected Transformer) connection for the three phase transformer connection
- Review the proximity of the lifting lugs to the low voltage bushings as referred to in Section 7.2.4

The next meeting will be held October 2017 in Louisville, KY.

The meeting was adjourned at 11:43am, Ed Smith recording.

C.2.3 C57.12.28, .29, .30, .31 & C57.12.32 – Enclosure Integrity – Dan Mulkey

Jerry Murphy presented the following minutes from the working group meeting on April 4, 2017 at 8:00 a.m. with 58 in attendance.

A call for was made for essential patent statement and responses. None were raised.

Introductions were performed and membership changes were noted. Quorum was verified. The working group consisted of 42 members, requiring 21 for quorum. 22 members were confirmed at the time of counting. Jerry Murphy made the call for any opposition to unanimous approval of the minutes. No opposition was raised so the minutes were unanimously approved.

The Status of Standards covered by this working group was made by the Chair:

a. C57.12.28 Standard for Pad-Mounted Equipment – Enclosure Integrity, Published July15, 2014, Revision Due: 12/31/2024
b. C57.12.29 Standard for Pad-Mounted Equipment – Enclosure Integrity for Coastal Environments, Published August 8, 2014, Revision Due date 12/31/2024
c. C57.12.31 Standard for Pole Mounted Equipment – Enclosure Integrity, Published September 20, 2010, Revision Due: 6/17/2020, Corrigenda approved May16, 2014
d. C57.12.32 Standard for Submersible Equipment – Enclosure Integrity, Reaffirmed 3/7/2008, Revision Due: 12/31/2018, PAR expiration: 12/31/2019

Under Old Business, a report on accelerated UV testing was presented by Scott Abbott, PPG with an introduction by Rebecca Giang, Sherwin-Williams. Rebecca provided an overview of

the coatings test that had been run using the FS-40, QUV-A and QUV-B bulbs since the last WG meeting in Vancouver. She mentioned that one driver for the test is that the FS-40 bulb is an old technology which will not work in the new test chambers. Scott Abbott presented detailed results from the coatings test. The following conclusions were given in his presentation:

- Variability observed between panels exposed to different bulbs
- Results indicate that longer test duration and/or higher % gloss retention requirements beyond the current 500 hour duration and 50% gloss retention requirement using FS-40 bulbs would be recommended if using UVA-340 bulbs
- Additional test results are needed before proposing a test method specification requirement using UVA-340 bulbs

After the presentation, a discussion took place. Mike Thibault asked how 1200 hours of testing compared to 1200 hours of "real life" usage. Scott Abbott mentioned that this is very difficult to determine. Rebecca Giang added that typically this type of test gives comparative results between different coating systems. Carlos Gaytan asked if the 70% retention criteria for the QUV-A test method came from the test results or from another source. Scott Abbott responded that it had come from the test results, and that when they were looking at the data it became apparent that 70% was a reasonable value. Dwight Parkinson asked how it was possible to have a gloss retention result above 100%, as some of the test results indicated. Scott Abbott mentioned that it could be a result in variability in the measurements, or in the smoothness or flatness of the samples. He also mentioned that it may be possible they're being polished during the test cycle. Rebecca Giang added that there is a large range in the metal profiles. A question was asked if there was any correlation between how much gloss the panels started with versus how much gloss was retained. Rebecca Giang commented that it doesn't seem to have had an effect, except in the case of the negative controls. When the coating is not performing well, it doesn't matter if the initial gloss is high or low, the final result will not be good. Scott Abbott added that typically there would be better gloss retention in a high gloss coating than a low gloss coating with all other things being equal. The question was asked if the standard should switch to the QUV test, and if the black panels would need a different standard. Scott Abbott mentioned that if a switch to the QUV test method was done, the test duration would need to increase as well as the baseline level. He also mentioned that we needed more test results to comment on the black data. Rebecca Giang agreed that the test should be run out to 1500 or 2000 hours as is currently planned. Jerry Murphy commented that black coatings are typically used in underground applications, and therefore light exposure might be limited. It was mentioned that these transformers may still be exposed to significant levels of UV while they are in a yard or during field use such through gridding in underground vaults. Mike Thibault asked how the high QUV exposure affects the durability of the coating. Rebecca Giang commented that it tends to make it more brittle with a higher chance of peeling off the substrate. Scott Abbott agreed that long term exposure to the extreme conditions may result in flaking off. QUV looks at UV, temperature and humidity, but does not include rainfall and environmental effects. There are other tests to simulate these items, but they are longer tests with more expensive equipment. Rebecca Giang commented that one motivation to change to the QUV-A or B bulbs is that the FS-40 bulb doesn't have irradiant control as it is old technology. As a result, it is unknown what type of intensity is hitting the panel. A new method would result in more consistent data. Jerry Murphy added that the investigation into alternate test methods initially came up from a comment indicating the FS-40 bulb may not be available. Since then it's been discovered that the FS-40 bulb is available, but the question has been asked if that the use of this bulb still makes sense to determine the effect of light on the coating finish since the bulb is obviously moving toward obsolesce. Rebecca Giang and Scott Abbott agreed that the QUV-A340 bulb would better fit for the coatings test.

In new business, the group continued to review the document. The draft standard was reviewed beginning with Paragraph 4.5.6 Ultraviolet accelerated weathering test (QUV). Rebecca Giang commented that the recommendation in the ballot comment "Working to see if we have an equivalent – potentially QUVA-303 with lower irradiance level" is not correct. The bulb being investigated is the QUV-A340. Someone asked how condensation mentioned in the paragraph would be addressed. Scott Abbott mentioned that adding condensation is part of the QUV cycle. Mike Thibault suggested that it might better if the test was run until the coating systems failure, recording where this occurs. A **motion** was made by Steve Shull and seconded by Carlos Gaytan to table the discussion on paragraph 4.5.6 until the next meeting. The motion passed with unanimous approval.

Next, paragraph 4.5.7 Simulated corrosive atmospheric breakdown (SCAB) was reviewed by the working group. The original paragraph and a proposed new paragraph by Dan Mulkey were reviewed. A **motion** was made by Rebecca Giang and seconded by Steve Shull to delete the original paragraph in the section. A friendly amendment was made by James Gardner and accepted by Rebecca and Steve to accept the paragraph as revised by Dan Mulkey and delete the second paragraph. Another friendly amendment was made Darren Brown and accepted by Rebecca and Steve to remove the words "both the exterior and interior cabinet / frontplate surfaces of the pad-mounted" from the first sentence of the paragraph. A third friendly amendment was made by Steve Shull and accepted by Rebecca to add dates to the references of ASTM D1654 in the paragraph. There was discussion about whether or not the # of cycles should be reduced to 15 or left at 20 as in the original paragraph, but no further friendly amendments were made. The motion passed unanimously.

With this the meeting was adjourned due to time. The next meeting will be held in Louisville, KY, USA.

The meeting adjourned at 9:15am, Jeremy Van Horn recording.

C.2.4 C57.12.34 – Three Phase Pad-Mount Transformers – Ron Stahara

Ron Stahara presented the following minutes from the working group meeting on April 3, 2017 at 3:15 p.m. with 84 in attendance.

Ron Stahara called the meeting to order and introductions were made. The rosters were circulated. The names of those in attendance are recorded in the AM system. To establish a quorum, a members list was displayed on the screen and those who saw their names were asked to hold up their hand. From this count of hands, it was determined that a quorum was established. A motion was made by Alex Macias and seconded by Brian Klaponski to accept the agenda as shown. The motion passed unanimously. The Patent Slide statement calling for Essential Patent Claims was read and no new patents were brought up but it was noted that the "third door" patent which was held by ComEd and was brought up last time has yet to be resolved. (As a side note, Martin Rave had an LOA form delivered to him at the last meeting and even though it was delivered to ComEd's legal department, no comment had been received from ComEd's legal department. So even though a number of attempts had been made by Martin, the status of this has yet to be determined). A motion was made by Jerry Murphy to accept the minutes of the Fall 2016 meeting as amended since were a few spelling/grammar errors brought forth by Fred Friend. This was seconded by Ed Smith. The motion passed unanimously.

Task force reports were given on the following items.

- **Existing Standards - Dan Mulkey, Task Force Chair**

Since Dan was unable to attend, the Vice Chair of the Working Group reported for Dan. This task force found that there were a number of standard updates and corrections that should be made from the standard references found in the current draft. These standards were ASME B30.9™, *Slings: Safety Standard for Cableways, Cranes, Derricks, Hoists, Hooks, Jacks, and Slings*, IEEE Std 386™, *Separable Insulated Connector Systems for Power Distribution Systems above 600 V*, IEEE Std C57.12.00™, *General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers*, IEEE Std C57.12.28™, *Pad-Mounted Equipment—Enclosure Integrity*, IEEE Std C57.12.70™, *Terminal Markings and Connections for Distribution and Power Transformers*, IEEE Std C57.12.90™, *Test Code for Liquid-Immersed Distribution, Power, and Regulating Transformers* and a pending standard IEEE PC12.39, *Standard for Distribution Transformer Tank Pressure Coordination*. All of these suggested corrections were provided to the Chair with the exception of the review of ASME B30.9 and IEEE C57.12.90. After some discussion, Carlos Gaytan and Israel Barrientos volunteered to review ASME B30.9 and IEEE C57.12.90 for any changes that would need to be included in the new document. As well, with the resignation of Justine Pezzin from the Working Group, Israel was appointed to this task force.

- **Figure Review - Gary King, Task Force Chair**

  As Gary and his team combed through these, they found a number of inconsistences, as well as editorial, and technical errors. Gary illustrated a number of these for the group so the Working Group would have an understanding of what the task force had encountered. One of the items was the use of a different dimension for an interface that was using a bail as compared to not using a bail. It was commented that the standard needs a default position on this item so that it will be clear what will be specified unless specially called out in a user's specification. The task force's work to date was turned over to the chair.

- **Informative Annex – Items to Consider Steve Shull**

  The following list was presented and a hard copy provide to the Working Group.

  - Fusing
    - Weak Link
    - Current limiting
      - Underoil
      - Drywell
    - Combo – Weak Link and partial range current limiting
  - Under-oil MOV arrester
  - Under-oil Primary Switch
  - Under-oil Secondary Breaker
  - Oil Sampler and Combination Drain Valve
  - Oil level Gauge
  - Temperature Gauge
  - Third Door Compartment- access to various accessories
  - Optional barriers for the compartments

  Steve stated the hard copy could used as a talking and thinking document. He suggested that as the group reviewed this list that they use the document as a scratch pad to note thinks that may need to be added or removed or placed into the standard. He asked that these be provide back to him so that they could consider when the Annex was created. The discussion led to the discovery that IEEE C57.12.24 had a number of these items incorporated into this standard's body as opposed to an informative annex. One other

item that was mentioned was the addition of an explanation of the use of the interface bail that is referred to in some of the drawings and clearances tables.

The chair stated that rather than present a detail listing of each of these items, he would suggest that these be incorporated into a new draft which would denote them as changes. He would hope that this draft could be presented at the next meeting which would occur in the fall of 2017.

With this, the meeting was adjourned, Stephen Shull recording.

C.2.5 C57.12.36 – Distribution Substation Transformers – Jerry Murphy

Jerry reported the working group met Tuesday, April 4, 2017 at 1:45pm with 45 people in attendance.

Jerry Murphy called the meeting to order at 1:45 PM. Introductions were made. The names of the members were projected on the screen. By a show of hands the quorum was not reached since there were 10 out of the 21 members present. Later another member joined the meeting and the quorum was reached.

After Jerry asked the question, there were no patent claims brought up to the attention of the working group.

Once quorum was established, Wally Binder moved to approve the agenda for the meeting and the minutes of the last meeting in Vancouver. Steve Shull seconded and the motion was approved with unanimous consent.

Jerry reviewed the one comment received from the latest ballot recirculation. It was related with the reference to PC57.12.39. Since this same issue had been discussed and approved at the previous meeting in Vancouver, Lee Mathews made a motion to reject the comment from the recirculation. It was seconded by Steve Schroeder. The motion was approved by unanimous consent.

Jerry informed that he would send the document to RevCom, expecting to get approval for publication of the document.

Jerry announced that considering that this approval from RevCom would be accomplished, the WG would not meet in the Fall in Louisville.

The meeting adjourned at 2:10 pm, Carlos Gaytan recording.

C.2.6 C57.12.38 – Single-Phase Pad-Mounted Transformers – Ali Ghafourian

Ali Ghafourian presented the following minutes from the working group meeting on April 3, 2017 at 1:45 p.m. with 55 in attendance.

The meeting was called to order at 1:45 p.m. by Ali Ghafourian.

A quorum was established with 19 of 27 working group members present.

The agenda for the meeting was presented and unanimously approved.

The minutes of the Fall 2016 meeting in Vancouver have been posted on the website since shortly after that meeting for the working group members to review. There were no suggested changes to the meeting minutes, and the meeting minutes were unanimously approved.

A call for essential patents was made as required using the statement provided in the general session. No essential patents were brought forward.

The Chair informed the working group members a complimentary PDF of the recently approved Corrigendum 1 had been e-mailed to them.

There was a discussion of proposed changes to be included in the next revision of the standard:

- The Chair proposed adding a table (Table 5) with minimum percent impedances identical to the table in C57.12.20.
- A question was raised as to why the Phase-to-Ground clearances in Table 2 were smaller than the Phase-to-nonhygroscopic insulating barrier clearances. It was noted that this was actually only true for the first three lines of the table. After comparing this table to the similar table in C57.12.34, it was determined that the first three lines should not have contained values. They should have been grayed out as in C57.12.34 to indicate that values are not applicable for these system voltages. This will be corrected.
- Giuseppe Termini presented a list of transformer accessories the Task Force developed for working group consideration to be included in the next revision of the standard. The transformer accessories discussed included an oil sightglass, fuses, liquid thermometer, HV tap changer, one inch drain plug, one inch fill plug, loadbreak switch, and arresters. Giuseppe Termini suggested following the same format used in C57.12.24 regarding transformer accessories in the next revision of C57.12.38. Steve Shull recommended the transformer accessories function and purpose be listed in an informative annex. Steve Shull highlighted, as an example, the difficulty in providing too much specificity regarding fuses because fuse TCC curves, transformer impedance, and system available fault current need to be taken into consideration.
- As a member of the transformer accessories Task Force, Giuseppe Termini stated he will issue a survey to working group members to solicit feeback on what transformer accessories should potentially be included in the next revision of the standard.
- Jerry Murphy offered a motion with a second from Martin Rave to change the last sentence of the Scope to “This standard does not cover all electrical and mechanical requirements of accessory devices that may be supplied with the transformer.”. This motion passed with unanimous consent.
- Steve Shull offered a motion with a second from Jerry Murphy for the Chair to apply for a PAR with the same Purpose as in the current revision of the standard and the revised Scope (per the bullet above) as discussed in the working group meeting. This motion passed with unanimous consent.

The Chair adjourned the meeting at approximately 2:45 pm. A meeting will be required for the Fall meeting.

Submitted by Martin Rave

C.2.7 C57.12.39 – Tank Pressure Coordination – Carlos Gaytan

Carlos reported the working group met Tuesday afternoon at 4:45 p.m. with 37 in attendance.

The meeting was called to order at 4:45 PM. Quorum was reached by having 17 of 26 members present. After Carlos asked the question, there were no patent claims brought up to the attention of the working group. The approval of the agenda was moved by Said

Hachichi, seconded by Steve Shull, and the motion was approved unanimously. The approval of the minutes from the Fall 2016 meeting was moved by Ron Stahara, seconded by Cory Morgan, and the motion was approved unanimously. On chair remarks, Carlos informed that a PAR extension was approved, with new Expiration date of Dec. 31, 2017. There were 13 comments that would be discussed at the meeting.

On the review of the comments from the ballot, after a long discussion on the comment to add a PRV to section 4.2.2.5 of Pressure Vacuum Bleeder Valve, the group realized that this comment was addressed on Sect. 4.2.2.4 Pressure Relief Device, Brian Klaponski moved to eliminate 4.2.2.5; Anil Dhawan seconded, and the motion was approved with unanimous consent.

The following comments reviewed were related with Sect. 4.2.2.4 of the PRD. A motion was made by Brian Klaponski, seconded by Steve Shull, to modify the 2nd paragraph to say: "If a PRD is required or specified, the tank shall also have a PRV to relieve the tank pressure manually, or a pressure-vacuum bleeder valve."

On the comment that PRDs were not currently required for 3 phase padmounted transformers, the group agreed to accept the comment, to be consistent with the present C57.12.34 standard.

On the comment about Sect. 4.3.2 Sudden pressure relay, to add "but not limited to" to the operating pressures, the group agreed to reject the comment, because it would cause confusion.

The group again discussed Sect. 4.2.2.4 of the PRD requirements. A motion to change the text in the first paragraph to move the words "when specified for padmounted transformers", after the kVA and BIL requirements for Substation Transformers", was made by Steve Shull, seconded by Ron Stahara, and it was unanimously approved.

A comment about changing the fault current rating from 8 to 10 kA on Sect. 5.4.1 of the fault current capability test was rejected because it would take a significant effort to analyze

The other comments were reviewed and the disposition agreed by the group. Near the end of the meeting a motion to accept the comments incorporated in draft 5 and send it for recirculation ballot, was made by Steve Shull, seconded by Ron Stahara, and it was unanimously approved.

The meeting was adjourned at 5:55 PM, Jeremy Van Horn reporting.

C.2.8 Task Force on Transformer Efficiency and Loss Evaluation – Phil Hopkinson

Phil reported that the task force met Monday morning at 9:30 a.m. This was followed by repeating part of his presentation from the TF meeting. Ron Stahara asked "What is DOE's posture on this?" Phil responded that DOE had a delegate at this meeting and were set to review efficiency levels in 2022. Steve Shull noted that this Subcommittee is looking at this data so we will not be caught by surprise and not to submit anything to the DOE.

Phil Hopkinson welcomed the members to the meeting and noted that the high attendance (107) indicted the level of interest in the topic.

This was the second meeting of the task group. The minutes of the last meeting were uploaded to the IEEE Transformer Committee Website. Also uploaded to the website were data from PG&E provided by Dan Mulkey. The data provides transformer loads recorded an hourly basis

over one year for more than 1 million transformers. It was collected from smart meters from residential, commercial & industrial applications and broken down by transformer type and rating.

There were no additional items for the agenda.

Background

The DOE Energy Efficiency rules will be due for renewal or revision by January 1, 2022. The current loading is estimated at 50% of nameplate rating load for medium voltage transformers and 39% for low voltage transformers. There is a need for real data to replace these estimates. The quality and availability of data have benefited from the expanding use of smart meters. Utilities should be capable of providing data on transformer loading broken down into load types, geographic locations and other useful categories.

PG&E Data

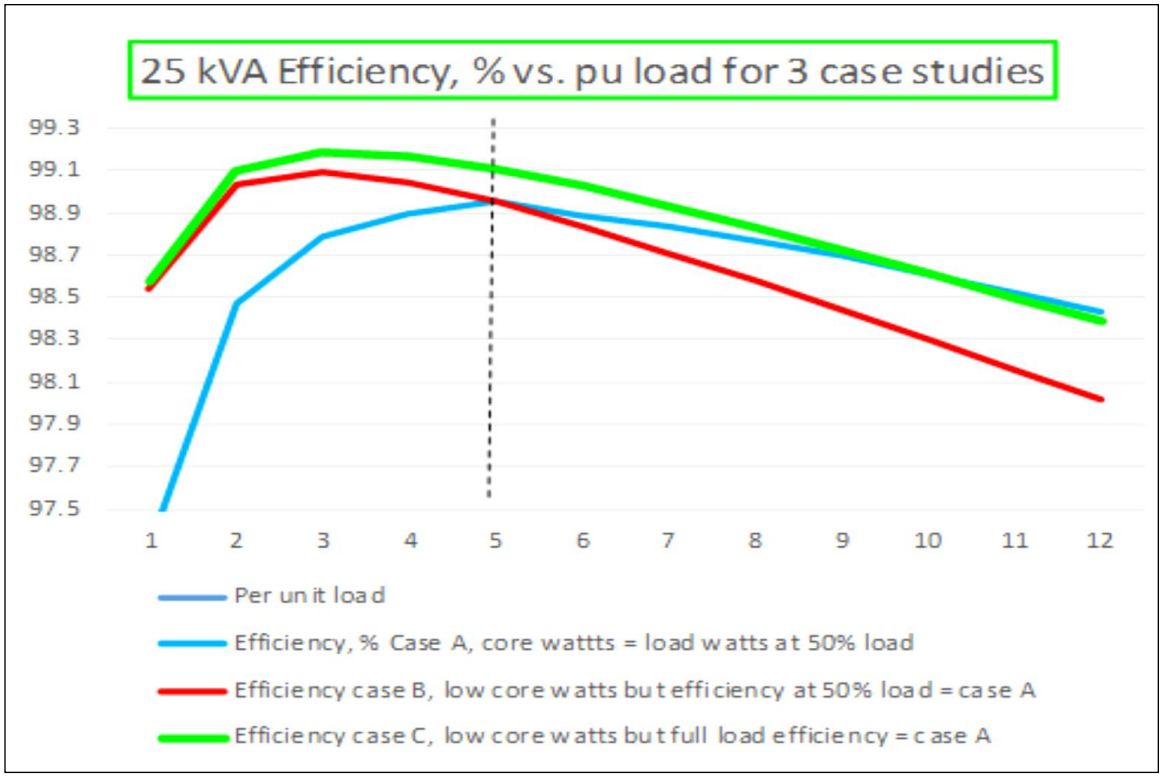
Mr Hopkinson reviewed some of the key features of the PG&E data from a presentation he made to ASEAN.

1. Residential 10% to 78% of nameplate, 50% average
2. Commercial 40% to 80% of nameplate, 60% average
3. Industrial varies 40% to 90% of nameplate, 70% average

Transformers are drawn from stock as needed. There are a limited number of transformer sizes used to reduce the number of transformers needed to be held in inventory.

A transformer may go to any location – residential, commercial or industrial – with loads that could be 10% to 90% of nameplate.

Mr. Hopkinson used the graph below to illustrate efficiency for 3 case studies.



He proposed a new Total Loss Constraint:

1. Basis is total allowable loss at current measurement point for energy efficiency; i.e. at 50% or 35 % load, called "W"
   W= (pu Load) * kVA*1000*(1-PU Efficiency)/Efficiency
2. W/2 is starting assumed load loss.
3. W/2 * (1 /(pu load))^2 / Temperature correction factor = full load loss component = L
4. **Total Loss limit = L + W/2**
5. Suppose real core loss, C, < W/2
6. That is excellent and encouraged.
7. Two constraints must be satisfied.
   a) C < W/2.
   b) L' +C < L+W/2

Discussion

There was much discussion and interesting points were made. Some of the comments are given below:

- Is this intended as a proposal to DoE for the next rule making cycle? The consensus was not to push for any changes to the current requirements. If DoE does decide to revise the requirement this could be an option for a direction to consider.
- Fixing two points on the curve may be limiting the design alternatives.

- This proposal would result in a more expensive transformer that would be larger than presently required. This would increase transport and installation costs.
- Materials other traditional steel core will have different load efficiency curves.
- Number of buckets of transformer sizes – agreed minimum desirable.
- Is PG&E representative of country at large? Is data needed from other geographical regions and smaller utilities?
- The DoE rules of 2010 were better as driving efficiency goals than the 2016 rules.
- Having a smaller number of transformer sizes could result in transformers 2 or 3 sizes larger than necessary in new installations where the customer typically overestimates usage.
- Should there be different efficiency requirements for high voltage and high current applications?
- Reducing energy consumption across system includes energy used in manufacturing, transportation and installation.
- Total lifetime costs (TLC) should be the aim but very difficult to calculate all energy costs.
- New technologies such as electric vehicle charging, solar power and energy storage could have unforeseen impact on transformer loading.

Data Collection

According to Steve Rosenstock of Edison Electric Institute (EEI) residential loads represent 37% of the National Electricity consumption with Commercial at 31% and the balance industrial.

EEI is prepared to compile utility data (on anonymous basis if necessary) to match PG&E and combine if possible.

The chair asked members representing utilities if they were willing to share similar data with the task force. Two members said they were willing to share their data and disclosure of their organization would not be a problem.

Next Meeting

The next meeting will be in Louisville in October 2017.

The meeting was adjourned, Gerard Winstanley recording.

C.3 Old Business

- None

C.4 New Business

- Series Resonance – Phil Hopkinson

  Phil raised a concern regarding series resonance causing failures in distribution transformers related to solar farm inverters.

C.5 Chairman's Closing Remarks and Announcements

Steve had no closing comments to the SC except to see them in Louisville in fall of 2017.

C.6 Adjournment

Steve adjourned the meeting as provided in the meeting agenda at 10:15am.