

IEEE PES Transformers Committee

DISTRIBUTION TRANSFORMER SUBCOMMITTEE

TASK FORCE TRANSFORMER TANK TOUCH TEMPERATURE

WELCOME

Monday October 17 , 2022





Review & Approval of Agenda

Agenda – Review and Approval

1. 4:45 Call to Order
2. Review and Approval of Agenda
3. Chair's Remarks
 - a. Welcome & Introduction
 - b. Attendance & Contact Sheets
 - c. Participant Behavior
 - d. Essential Patent Claims
 - e. IEEE Copyright Policy
4. Chair's Brief History Leading to Today's Meeting
5. Review of Task Force Directive
6. Open Discussion
7. 5:45 Next Steps
8. 6:00 Adjournment

Are there any requested changes to the Agenda?

Chair's Remarks and Housekeeping

Welcome & Introduction
Attendance & Contact Sheets
Participant Behavior
Essential Patent Claims
IEEE Copyright Policy

Chair's Remarks

Attendance Rosters

- Please sign in and indicate whether you would like to become a member of this TF.
- Since this is the first meeting, any people expressing interest will be granted membership.
- After this meeting, attendance at two consecutive meetings (and a formal request to the Chair) will be required to attain membership.
- ***Please note that I have asked for your email address on the roster form. If you would like to be a member but do not want to put your contact information on the roster, please see me after the meeting.***

Chair's Remarks

Officer Introductions

Chair

Name: **Bruce Webb**
Affiliation: Knoxville Utilities Board
Email: bruce.webb@kub.org
Role: My role is to lead the discussions in an unbiased manner. I will not vote unless my vote will change the outcome.

Vice-Chair

Name: **Ali Ghafourian**
Affiliation: H-J Enterprises, Inc.
Email: Asghar.ghafourian@gmail.com
Role: To serve as interim-Chair if the Chair is unable to participate.

Secretary

Name: **Albert Sanchez**
Affiliation: Knoxville Utilities Board
Email: albert.Sanchez@kub.org
Role: To capture and record attendance, major discussion topics, and decisions made during meetings.

Chair's Remark - *Participant Behavior* (1 of 3)

Participant behavior in IEEE-SA activities is guided by the IEEE Codes of Ethics & Conduct.

- All participants in IEEE-SA activities are expected to adhere to the core principles underlying the:
 - [IEEE Code of Ethics](#)
 - [IEEE Code of Conduct](#)
- The core principles of the IEEE Codes of Ethics & Conduct are to:
 - *Uphold the highest standards of integrity, responsible behavior, and ethical and professional conduct.*
 - *Treat people fairly and with respect, to not engage in harassment, discrimination, or retaliation, and to protect people's privacy.*
 - *Avoid injuring others, their property, reputation, or employment by false or malicious action.*
- The most recent versions of these Codes are available at <http://www.ieee.org/about/corporate/governance>

Chair's Remark - *Participant Behavior* (2 of 3)

Participants in the IEEE-SA “individual process” shall act independently of others, including employers.

- The [IEEE-SA Standards Board Bylaws](#) require that “*participants in the IEEE standards development individual process shall act based on their qualifications and experience*”
- This means participants:
 - **Shall act & vote** based on their personal & independent opinions derived from their expertise, knowledge, and qualifications.
 - **Shall not act or vote** based on any obligation to or any direction from any other person or organization, including an employer or client, regardless of any external commitments, agreements, contracts, or orders.
 - **Shall not direct** the actions or votes of other participants or retaliate against other participants for fulfilling their responsibility to act & vote based on their personal & independently developed opinions.
- By participating in standards activities using the “*individual process*”, you are deemed to accept these requirements; if you are unable to satisfy these requirements then you shall immediately cease any participation.

Chair's Remark - *Participant Behavior* (3 of 3)

IEEE-SA standards activities shall allow the fair & equitable consideration of all viewpoints.

- The [IEEE-SA Standards Board Bylaws](#) (clause 5.2.1.3) specifies that *“the standards development process shall not be dominated by any single interest category, individual, or organization”*
 - This means no participant may exercise *“authority, leadership, or influence by reason of superior leverage, strength, or representation to the exclusion of fair and equitable consideration of other viewpoints”* or *“to hinder the progress of the standards development activity”*
- This rule applies equally to those participating in a standards development project and to that project's leadership group.
- Any person who reasonably suspects that dominance is occurring in a standards development project is encouraged to bring the issue to the attention of the Standards Committee or the project's IEEE-SA Program Manager.

Chair's Remarks – *Essential Patent Claims* (1 of 4)

Participants Have A Duty To Inform The IEEE

- Participants shall inform the IEEE (or cause the IEEE to be informed) of the identity of each holder of any potential Essential Patent Claims of which they are personally aware if the claims are owned or controlled by the participant or the entity the participant is from, employed by, or otherwise represents.
- Participants should inform the IEEE (or cause the IEEE to be informed) of the identity of any other holders of potential Essential Patent Claims.

**Early identification of holders of potential
Essential Patent Claims is encouraged**

Chair's Remarks – *Essential Patent Claims* (2 of 4)

Ways To Inform The IEEE

- **Cause an Letter of Assurance (LOA) to be submitted to the IEEE SA (patcom@ieee.org); or**
- **Provide the chair of this group with the identity of the holder(s) of any and all such claims as soon as possible; or**
- **Speak up now and respond to this Call for Potentially Essential Patents.**

If anyone in this meeting is personally aware of the holder of any patent claims that are potentially essential to implementation of the proposed standard(s) under consideration by this group and that are not already the subject of an Accepted Letter of Assurance, please respond at this time by providing relevant information to the TF Chair

Chair's Remarks – *Essential Patent Claims* (3 of 4)

Other Guidelines for IEEE Working Group Meetings

- All IEEE SA standards meetings shall be conducted in compliance with all applicable laws, including antitrust and competition laws.
 - **Don't discuss the interpretation, validity, or essentiality of patents/patent claims.**
 - **Don't discuss specific license rates, terms, or conditions.**
 - Relative costs of different technical approaches that include relative costs of patent licensing terms may be discussed in standards development meetings.
 - Technical considerations remain the primary focus.
 - **Don't discuss or engage in the fixing of product prices, allocation of customers, or division of sales markets.**
 - **Don't discuss the status or substance of ongoing or threatened litigation.**
 - **Don't be silent if inappropriate topics are discussed. Formally object to the discussion immediately.**

*For more details, see IEEE SA Standards Board Operations Manual, clause 5.3.10
and Antitrust and Competition Policy: What You Need to Know at
<http://standards.ieee.org/develop/policies/antitrust.pdf>*

Chair's Remarks – *Essential Patent Claims* (4 of 4)

Patent Related Information

The patent policy and the procedures used to execute that policy are documented in the:

- **IEEE SA Standards Board Bylaws**
(<http://standards.ieee.org/develop/policies/bylaws/sect6-7.html#6>)
- **IEEE SA Standards Board Operations Manual**
(<http://standards.ieee.org/develop/policies/opman/sect6.html#6.3>)

Material about the patent policy is available at
<http://standards.ieee.org/about/sasb/patcom/materials.html>

**If you have questions, contact the IEEE SA
Standards Board Patent Committee Administrator
at patcom@ieee.org**

Chair's Remarks – *Copyright Policy* (1 of 2)

- **By participating in this activity, you agree to comply with the IEEE Code of Ethics, all applicable laws, and all IEEE policies and procedures including, but not limited to, the IEEE SA Copyright Policy.**
- Previously Published material (copyright assertion indicated) shall not be presented/submitted to the Task Force nor incorporated into a Working Group draft unless permission is granted.
 - Prior to presentation or submission, you shall notify the TF Chair of previously Published material and should assist the Chair in obtaining copyright permission acceptable to IEEE SA.
- For material that is not previously Published, IEEE is automatically granted a license to use any material that is presented or submitted.

Chair's Remarks – *Copyright Policy* (2 of 2)

- The **IEEE SA Copyright Policy** is described in the *IEEE SA Standards Board Bylaws and IEEE SA Standards Board Operations Manual*
 - IEEE SA Copyright Policy, see
 - Clause 7 of the *IEEE SA Standards Board Bylaws*
<https://standards.ieee.org/about/policies/bylaws/sect6-7.html#7>
 - Clause 6.1 of the *IEEE SA Standards Board Operations Manual*
<https://standards.ieee.org/about/policies/opman/sect6.html>
- IEEE SA Copyright Permission
 - <https://standards.ieee.org/content/dam/ieee-standards/standards/web/documents/other/permissionltrs.zip>
- IEEE SA Copyright FAQs
 - <http://standards.ieee.org/faqs/copyrights.html/>
- IEEE SA Best Practices for IEEE Standards Development
 - http://standards.ieee.org/develop/policies/best_practices_for_ieee_standards_development_051215.pdf
- Distribution of Draft Standards (see 6.1.3 of the IEEE SA Standards Board Operations Manual)
 - <https://standards.ieee.org/about/policies/opman/sect6.html>



**Chair's Brief History
Leading to Today's
Meeting**

Chair's Brief History Leading to Today's Meeting (1 of 2)

Tank Touch Temperatures

- ***Westinghouse Electric Transformer Design Engineer***
 - Standards requirements for tank touch temperature limits?
- ***Open Letter to the C57.154 Standard for Liquid-Immersed Transformers Designed to Operate at Temperatures Above Conventional Limits Using High-Temperature Insulation Systems***
 - This document made available upon request to the Chair, and will be added to the website following the F22 meeting
- ***C57.12.38 IEEE Standard for Pad-Mounted-Type, Self-Cooled, Single-Phase Distribution Transformers...***
 - Tank Temperature Presentation... already available on the Committee website

Brief History Leading to Today's Meeting (2 of 2)

Tank Touch Temperatures

- ***C57.12.30, 31, 32 IEEE Standards for Transformer Enclosure Integrity...***

- A safety Warning Note was developed:

WARNING

Users should take care when deploying pad-mounted transformers in publicly accessible locations as operational and environmental factors may cause the equipment's exterior metal surfaces to reach excessive temperature which could result in burns to an individual who comes in contact with their surfaces

- Additional discussion by the WG took place that addressed potential for elevated transformer tank temperatures with possible solutions to consider for their elimination

- ***Distribution Transformer Subcommittee***

- Creation of TF Tank Touch Temperature in S22 Denver Committee Meeting and moving it from C57.12.38

TF Directive

The image features a dark green rectangular background. A diagonal line runs from the bottom-left corner towards the top-right corner. The area above and to the right of this line is filled with a white-to-gray gradient, while the area below and to the left of the line is solid dark green. The text "TF Directive" is positioned in the upper-left portion of the green area.

TF Directive

... from Annex C.4 New Business Distribution Transformer SC Report S22

‘... the Task Force is to further investigate perceived safety concerns regarding tank touch temperatures for transformers that are accessible to the public by...

- 1. exploring input and feedback from outside resources and experts,**
- 2. evaluating opportunities to specifically address such concerns, and**
- 3. making recommendations to the SC for next steps, if any.’**

Why Tank Touch Temperature Is Important?



Source:

https://www.army.mil/article/234846/ground_transformers_designed_to_be_safe_not_for_childs_play

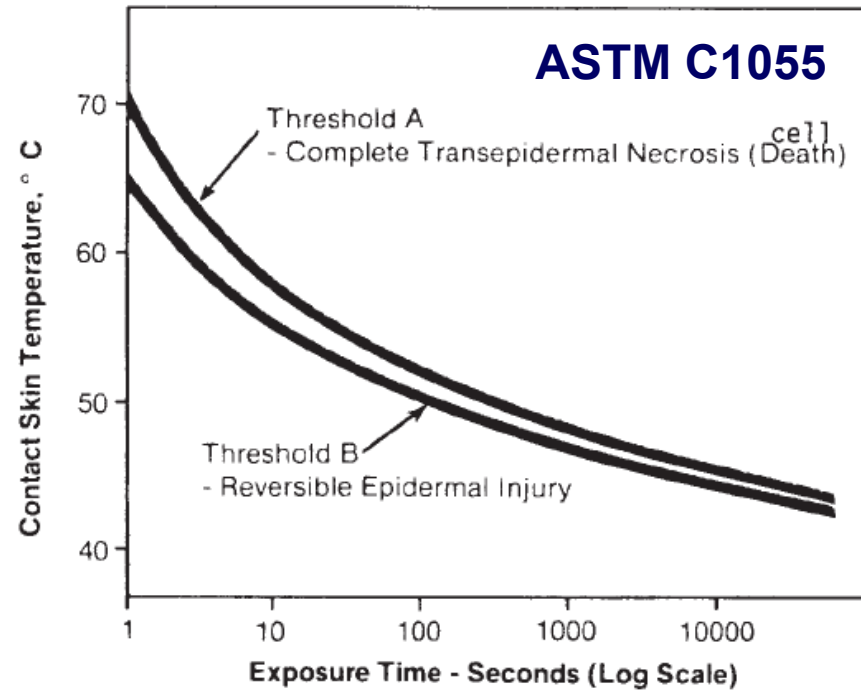


FIG. 1 Temperature-Time Relationship for Burns

NEETRAC's Project on Padmounted Tank Temperatures

Project Goals

Validate a transformer tank temperature thermal model with actual data from both 50 and 167 kVA units. Investigate the affect of covering a padmounted transformer with a fake rock on estimated lifetime.

Background

Padmounted transformers in residential neighborhoods are often located within easy reach of children. Concerns have been raised on liability from burns from elevated transformer tank temperatures. Utilities have also reported crews replacing existing transformers with larger units simply because they were “hot”.

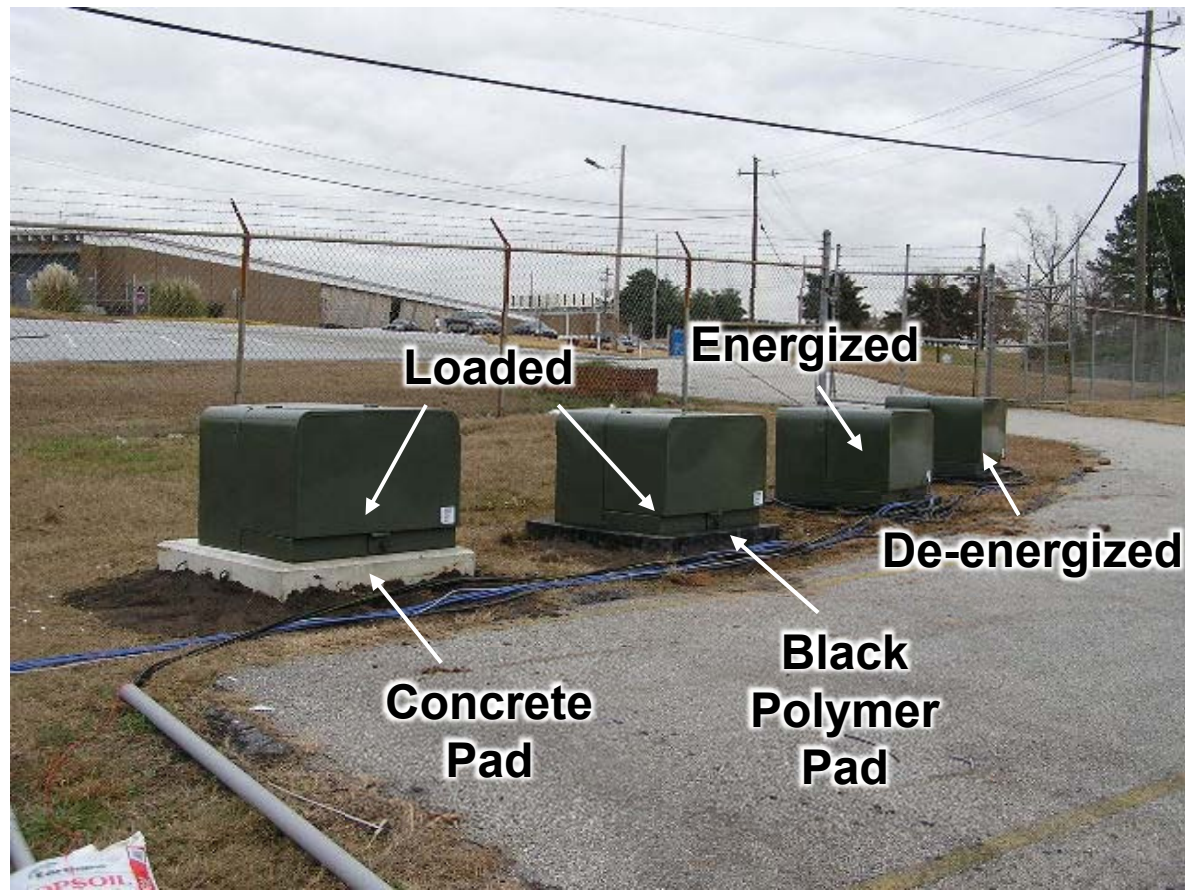
Principal Investigators: Tom Champion & Frank Lambert (1951-2021)

Literature Search Main Takeaways

- Severity of burns is dependent on surface temperature and composition, as well as duration of contact.
- Age, portion of body affected, perspiration, and individual variance all affect burn severity.
- At 44 ° C, damage occurs only after 6 hours.
- For bare, uncoated metals at 70 °C, damage begins to occur in less than 1 second (less than reaction time).
- Paint layer exhibits reduced thermal conductivity and increases the time to injury for high surface temperatures.

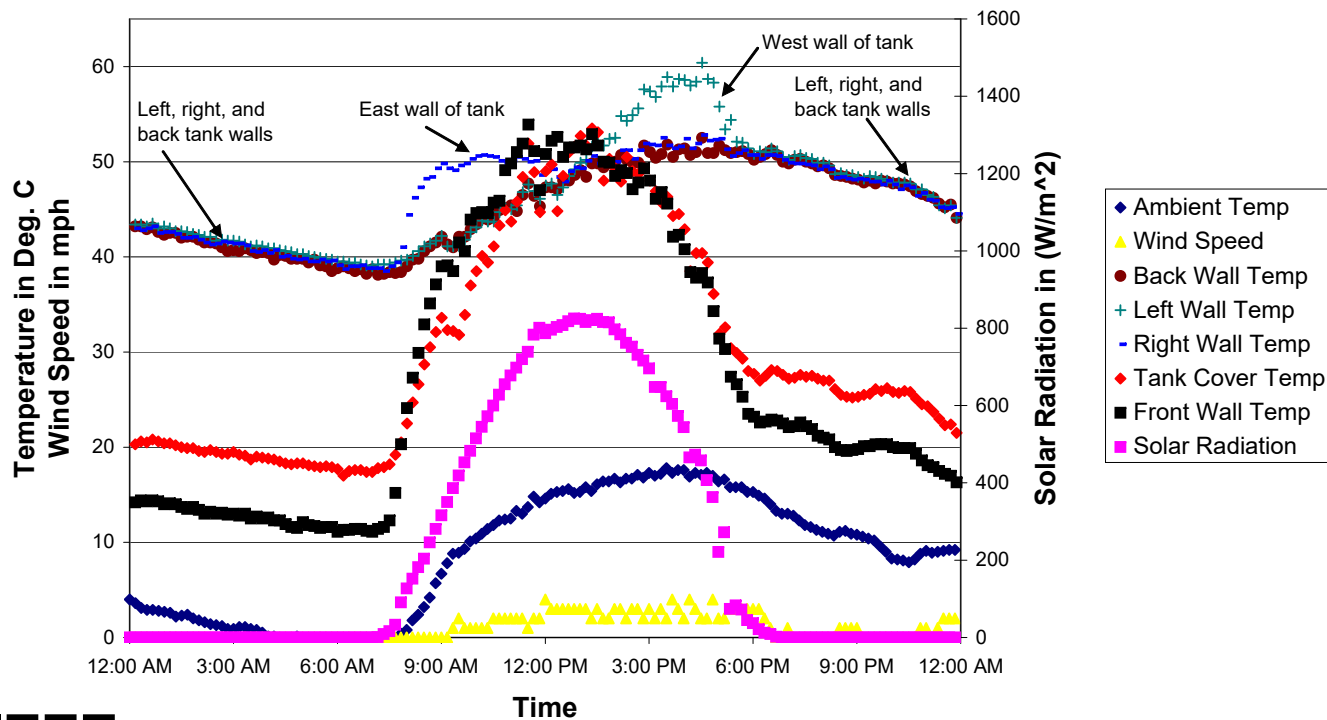
Test Set-up

50 kVA Units
Under Test



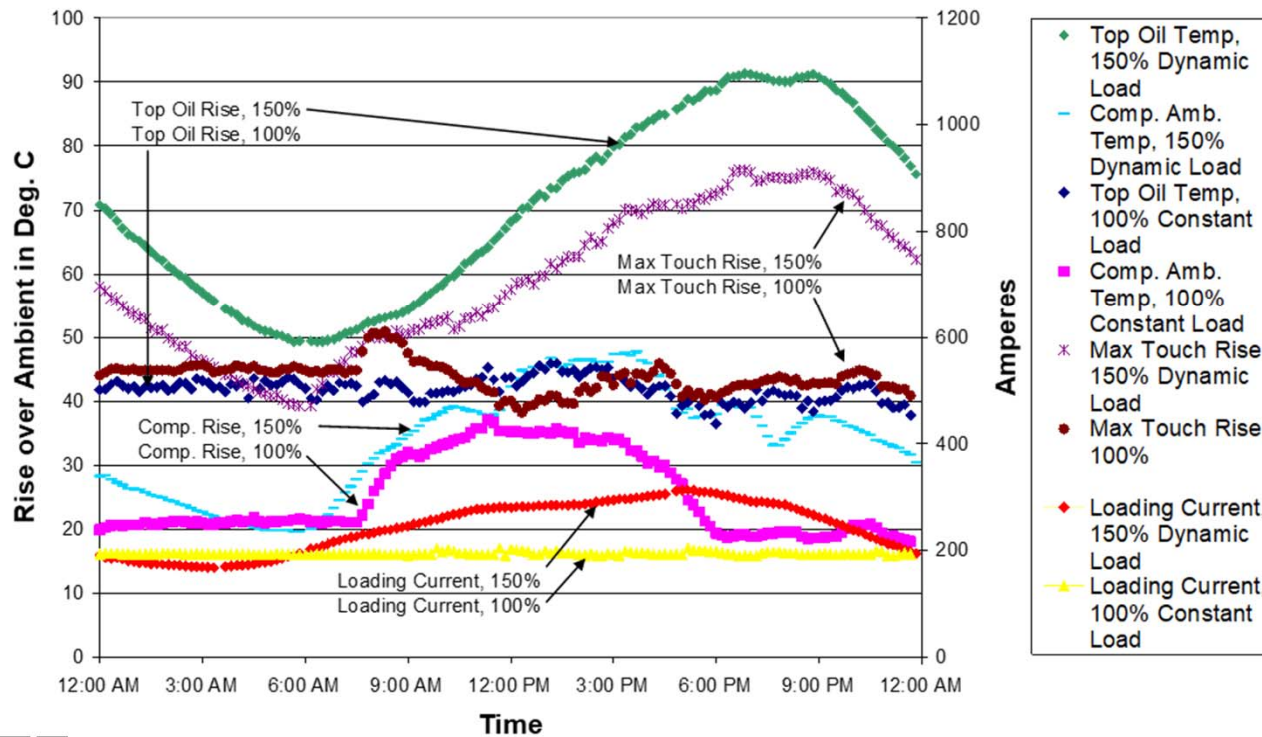
Results – 100 % Constant Loading

04-089 Recorded Touch Temperatures
03-04-05, 100% Loading, Transformer 1



Results – 150% Dynamic vs. 100% Constant Loading

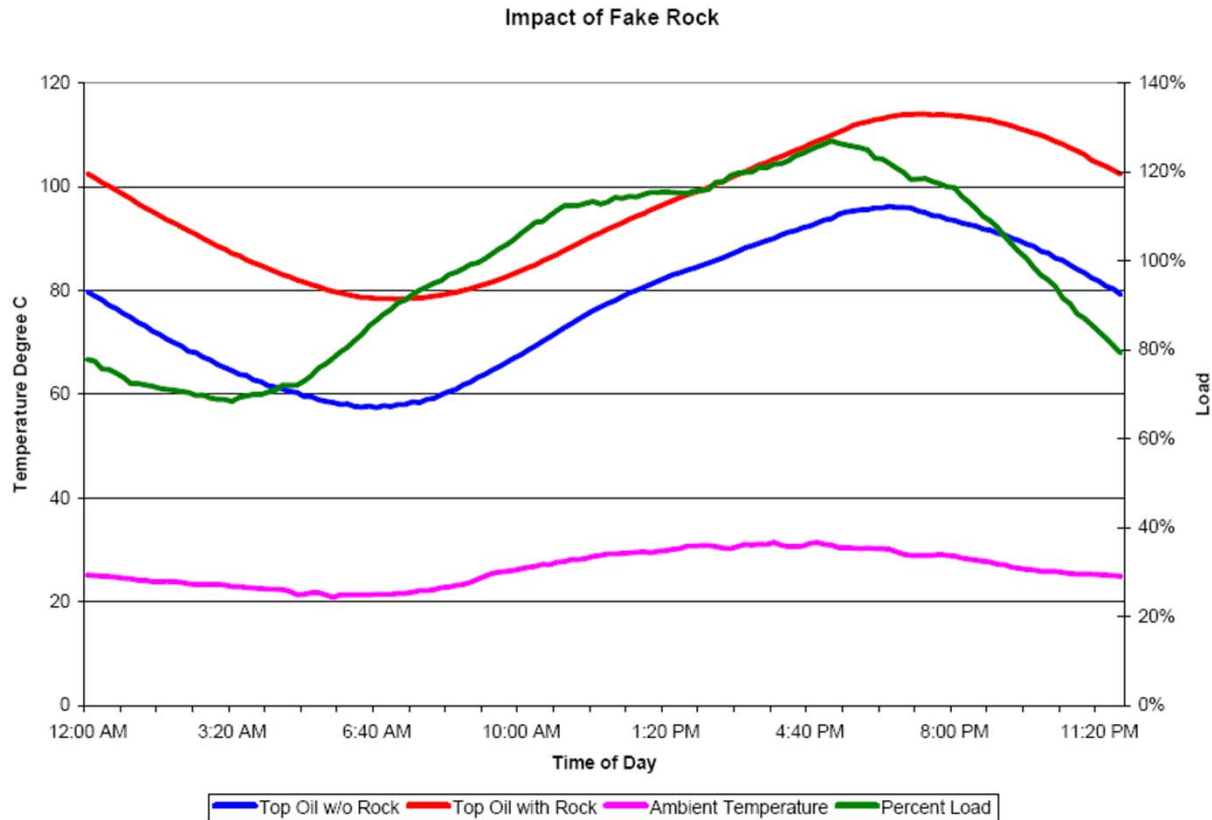
04-089 Transformer 2 Temperatures (Polymer Pad)
150% Peak Dynamic Loading vs. 100% Constant Loading



Impact of Fake Rock



Results – Impact of Fake Rock (1 of 2)



Impact of Fake Rock on June 24, 2005
Peak Ambient Temperature - 31°C

Results – Impact of Fake Rock (2 of 2)

Percent Loss of Life Calculation, IEEE Standard C57.91-1995

| Load Cycle Loss of Life Summary Results: | | per ANSI C57.91-1995 | |
|--|-------------|----------------------|------|
| Without Fake Rock | | | |
| Average Daily Life Consumption | $F_{EQA} =$ | 0.543 | days |
| Average Daily Percent Loss of Life | % loss = | 0.0072 | % |
| ANSI Life (guideline of 180,000 hrs or 20.55yrs) | Life = | 37.8 | yrs |

| Load Cycle Loss of Life Summary Results: | | per ANSI C57.91-1995 | |
|--|-------------|----------------------|------|
| With Fake Rock | | | |
| Average Daily Life Consumption | $F_{EQA} =$ | 3.348 | days |
| Average Daily Percent Loss of Life | % loss = | 0.0446 | % |
| ANSI Life (guideline of 180,000 hrs or 20.55yrs) | Life = | 6.1 | yrs |

Project Takeaways

- Temperatures of electrically loaded transformers rise noticeable as a function of incident light.
- Fake rocks significantly degrade the life of a padmounted transformer at higher loading levels but reduce touch temperatures.
- Opportunities exist to improve the thermal performance of fake rocks.
- For lower loading levels, ambient temperature and solar loading largely determines maximum touch temperature.
- For higher loading levels, ambient temperature and transformer loading and losses determine the maximum touch temperature.
- Maximum tank temperatures may reach 100 °C before the dual element fuse operates.
- Compartment ambient air temperatures can exceed 75 °C under certain conditions significantly impacting cable and accessories ampacity ratings.



Open Discussion

Open Discussion

What Next?

- Open Discussion... things we might consider:
 - Still concerned
 - Standard limit
 - Impact to existing Standard values, if a recommend change is considered
 - Other experts: UL, ASTM, NASA, etc.
 - Protection: design/construction, guarding, labeling, etc.
 - Components, Accessories and Suc : gasketing, bushings, gauges, paint, labeling, etc.
 - Other

Next Steps

- Spring 2023 Meeting, Milwaukee, Wisconsin, USA
 - March 19 -23, 2023
- MS Teams,
- Other

Adjournment

... again,...

Spring 2023 Meeting
Milwaukee, Wisconsin, USA
March 19 -23, 2023

THE END

Thank You for Your Attention!

