IEEE/PES TRANSFORMERS COMMITTEE

Working Group on Semiconductor Power Transformers – C57.18.10

Unapproved Meeting Minutes

Louisville Downtown Marriott Hotel, Louisville, KY
Marriott 5 Room
11:00 am, October 31, 2017

The Working Group met in the Marriott 5 meeting room

Sheldon called the meeting to order at 11:06am

There were 19 members and 24 guests present. A quorum was present (19 of 27 members).

The patent call was given. Nobody replied with any patent issues.

The agenda was approved unanimously.

The minutes of the March, 2017 meeting in New Orleans were unanimously approved as written.

Old Business

- Sheldon pointed out changes to draft standard and asked for comments to the changes on non-traditional harmonics and breaker/transformer interactions.
- Showed section on non-traditional harmonics. Don Ayers asked if this belonged in the Standard or in an annex. Sheldon felt that it belonged in the standard because this is where the discussion of harmonics was.
- Moved old section on separating eddy current and stray losses (Section 8.6.2.f/g) to an annex and added a section from Subhas Sarkar on FEA methods. Joe Foldi raised questions about eddy losses in bus bars being treated as eddy losses versus stray losses. Chuck Johnson pointed out difference between eddy and stray losses in bus bars. Simulation may be the only way to determine these losses and their thermal impact. Don Ayers commented that section was more about winding temperature changes due to strays and eddy currents than things external to the winding. Paul Buddingh also agreed along these same lines. Sheldon said that electrical design focused on core/coil. Chuck Johnson mentioned that 3D simulation for bus bars needed to be 3D. David Walker talked about bus temperature affected winding temperature measurement and that 3D simulation is needed. Joe Foldi mentioned that heatrun is at 60Hz and that behavior at harmonic frequencies are different and hard to simulate in a 60H heatrun. Calculating current distribution in bus bars is complex and hard to capture in a standard. And that new harmonic distributions are more complex and you can't use previous experience as much as a guide for design. Sheldon asked for volunteer to write up tutorial on this subject- David Walker, John John, Stefan Voss, and Sheldon Kennedy volunteered to help with writing a section on this. David Walker to compile and edit. Rick Marek suggested asking Hasse Nordman for input.
- Sheldon asked if there were any comments about examples in Standard. No comments. On hold for now.

- Short Circuit on multi-phase winding. Nothing currently in standard. Should we add anything? In particular, drives are different in behavior. Jeremy Smith volunteered to work on this. And Sheldon will also add input.
- Paul Buddingh previously asked about common mode voltage for high resistance grounded circuits. He commented that he isn't sure where it fits in. David Walker mentioned that a lot of drives have stacked secondary windings and high common mode voltages. Need to consider effect on hipot testing. Phil Hopkinson asked if inverter transformers are in scope. Sheldon said that they are. Phil has seen failures in inverter transformers in solar with 3kHz clock frequency in a 380-34.5kV transformer. Looked at transients at 380V winding and seeing 150V spikes at zeroes of waveform and a 50V spike at each 3kHz edge. 5-15% voltage spikes are outside of IEEE 519. Is it legitimate? Also see 5% spikes at 9kHz (3rd harmonic of clock). Do we need to anticipate this in transformer designs or should transformer designers push the inverter designer do better filtering? Better filtering in the future might help. However, we need to deal with what is currently present in the design of the transformer. We need to get spike/noise information from the inverter supplier. Abe Shahrodi- used to be an inverter designer. He said that is a common phenomenon with IGBT switching. Some inverter designers add filters. IEEE519 was relating to rectifiers and not inverters and levels reflect that. 3kHz is a low switching frequency. Can be 5-10kHz these days. They produce voltage transients on transformer inputs. Sheldon mentioned that IEEE519 is more about power line effects not about transformer itself. Abe and Phil to submit comments. Phil thinks that transformers may need to be designed differently in the future to account for this. He feels that this should be mentioned in Standard. David W mentioned that drives also have similar spikes. Vijay Tendulkar- inverters and transformers have had problems with sine wave transients for a long time and they cause problems with motors being driven by the inverter. Switching spikes are seem on the sine wave outputs. Distance between inverter and motor (cable length) can exacerbate these problems. Phil H said filters are present but don't perform very well. Phil has wave shapes as examples. Vijay mentioned that transients are in the nanosecond range and not microsecond range and a lot of HV filter capacitors are not very good at these frequencies.
- Sheldon brought up traction duty transformers and that we should add references to 1653.1. Bill Whitehead to add reference to draft.

New Business:

- Dinesh Sankarakurup- Standard refers to 12.90 and 12.91 for LV impulse testing. Should we mention LV impulse testing because rectifier transformers with multiple LV sections are often tested in non-standard ways? Should we cover how you test this type of LV winding? What about testing in cases where secondary impedance was too low to get a good impulse waveform? No answer to these questions at this time.

With no further business, the meeting was adjourned at 12:11.

The Working Group will meet again at the Spring 2018 meeting in Pittsburgh, PA

Chairman: Sheldon Kennedy

Vice Chairman: Bill Whitehead

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Secretary: David Walker