C57.104 – IEEE Guide for the Interpretation of Gases Generated in Oil – Immersed Transformers
Tuesday, March 9, 2010
Houston, Texas
Minutes of WG Meeting

The meeting was called to order by Chair Rick Ladroga at 1:50pm. Secretary Susan McNelly and Claude Beauchemin, who has agreed to be Vice-Chair of the WG, were also present.

There were 35 of 94 members present, 48 guests, and 10 guests requesting membership. A membership quorum was not achieved. The membership roster will be pared down before the next meeting based on attendance and participation.

Guests requesting membership were:

John Crotty	Pierre Feghali
Shawn Luo	Libin Mao
Terence Martin	Hali Moleski
Arturo Nunez	Robert Rasor
Andy Speegle	Peter Zhao

Agenda

1. Welcome & Roll Call
2. Introduction

Approval of Minutes from Fall 2009 Lombard, Illinois meeting

3. Patent Disclosure
4. Revised PAR
5. Task Force Reports:
    - DGA in Arc Furnace Transformers - Tom Lundquist
    - Framework Structure - Jim Dukarm
    - Data - Norman Field
    - Case Studies (Q – Existing – SDM, ABB, DOBLE, WEIDMANN, etc) - Brian Sparling
    - Diagnostic Studies – open
6. New Business

Approval of minutes from the Fall 2009 Lombard, Illinois meeting was requested. Since a quorum was not present, approval of the minutes will be deferred to the next meeting.

The IEEE Patent disclosure requirements were discussed and a request was made for disclosure of any patents that may be related to the work of the WG. There were no responses to the request for disclosure.

Rick announced that the request for the PAR for the revision of C57.104 was approved by NESCOM in December. The PAR will expire in December of 2014.

Task Forces:

Rick went through the TFs that are in place and the present chairs for each. He then indicated a desire to have vice-chairs assigned to most of the task forces to ensure that the work keeps progressing. Dave Hanson was asked to be vice-chair of the Framework TF. Paul Boman has agreed to chair the Case Studies TF.

He also indicated that anyone wishing to participate in the TFs should contact the Chairs of each.

1. Arc Furnace – Chair Tom Lundquist
2. Framework – Chair Jim Dukarm, Vice-Chair Dave Hanson
3. Data – Chair Norman Field, Vice-Chair Pierre Feghali
4. Case Studies – Chair – Paul Boman, Vice-Chair Arturo Nunez
5. Diagnostic Methods – Chair Michel Duval, Vice-Chair Dave Wallach
6. Bibliography – Chair Jerry Murphy

There is an extensive Bibliography in the present Guide. The question was asked if there is anyone that feels we do or don't need the Bibliography. A comment was made that if there is something that is no longer valid, it should probably be removed, but otherwise they should stay. Jerry Murphy agreed to Chair a TF on review of the Bibliography

Schedule:

Rick indicated a need to keep the revision process moving. The following are the planned dates for information to be provided:

1. Diagnostic Methods – final input by Friday, April 30, 2010
2. Statistical analysis - Friday, May 28, 2010
3. Issue compiled draft for TF Review by Friday, June 25, 2010
4. Continue meeting bi-weekly, editing and refining the document in preparation for the Fall 2010 WG meeting in Toronto.
5. Provide draft to entire WG for review and comment – Monday, Sept 13

Task Force reports:

Presentation on Diagnostic Methods Questionnaire – Michel Duval

A copy of Michel's presentation is included at the end of the minutes.

There was much discussion on whether the concentration or rate information should be the primary focus. There seemed to be much consensus that relying on a single sample and result would not be advisable and that the rate of gas increase is the primary tool for determining whether there is a problem.

Rick asked for a poll on whether people would prefer to see the Concentration values 1st and the rates second in the Guide or vice versa. The concensus was that the Concentration limits should be listed first with the generation rates as second.

Other issues:

A question was raised for concentration values for distribution units based on volume of oil. There are differing opinions on this topic and Rick requested data be submitted so that this can be actively investigated.

The meeting was adjourned at 3:00 pm.

Rick Ladroga
WG Chair

Susan McNelly
WG Vice-Chair and Secretary

IEEE C57.104
QUESTIONNAIRE ON DIAGNOSTIC METHODS

COMPILATION OF ANSWERS
Prepared by M.Duval, TF on Diagnostic Methods
March 7, 2010

Section of Gas Guide	Changes/investigations proposed	I agree	I disagree
4.2	Re-write this section along the lines of Draft C57.104-C8	**MW**	
Table 1, condition 1 (concentrations limits)	Use average US values of Table A1 for condition 1 of Table 1, if no other typical values of gas concentrations are available from the US.	**MWCD**	
	Request TF on Data to calculate typical values of gas concentrations on other US networks.	**WC**	**M**
	Use ranges of values in Table 1 rather than single average values.	**WC**	**M**
New Table 1a, condition 1 (gassing rates limits)	Use CIGRE/IEC typical values of gassing rates in Table A2 for new Table 1a, condition 1, if no values from the US are available	**MCD**	**W**
	Request TF on Data to calculate typical values of gassing rates on some US networks.	**WC**	
Table 1, conditions 4,3,2 (concentration limits)	Use pre-failure concentration values of CIGRE in Table A3 for condition 4, if no such values can be calculated in the US.	**MWCD**	
	Request TF on Data to calculate pre-failure values of gas concentrations on some US networks, following CIGRE method.	**WC**	**M**
New Table 1a, conditions 4,3,2 (gassing rate limits)	Use pre-failure gassing rates of CIGRE in Table A2 for condition 4, if no such values can be calculated in the US.	**MWCD**	
	Request TF on Data to calculate pre-failure values of gassing rates on some US networks, following CIGRE method.	**WC**	**C**
Table 3	Replace by Table A4, based on limits for individual gases rather than TDCG	**MW**	
Table 2	Delete Table 2		
4.5 Key gas method	Delete this method		**MWC**
	Keep this method but indicate its limitations	**MWC**	
4.6.1 Dornenburg method	Delete this method	**MWCD**	
4.6.2 Rogers method	Delete this method	**M**	**WC**
	Keep this method but indicate its limitations	**WCD**	
	Delete fault 0 in Table 6	**C**	
	Delete Figures 5 and 4	**C**	

4.6.3 New Triangle method	Introduce the general Triangle method (Triangle 1)	**MWCD**	
	Introduce the new versions of the Triangle for low temperature faults	**MWC**	
	Introduce the new versions of the Triangle for non-mineral oils	**WC**	**M**
4.6.4 Other ratios	Introduce the CO2/CO ratio with its limitations	**MWCD**	
	Introduce the C2H2/H2 ratio	**MWCD**	
	Introduce the O2/N2 ratio	**MWC**	
	Introduce new section on stray gassing of oil and catalytic reactions	**MWCD**	
5. Gas monitors	Re-write this section indicating the capabilities and limitations of commercial monitors	**WC**	**MK**
	Other changes that you would like to propose: **-use rates as primary indicator and concentrations as secondary one (D).** **-consider using histograms for Table 1 to show distributions (W).** **-differentiate between routine and very frequent sampling (C).** **-indicate minimum levels to attempt Triangle and Rogers diagnosis (C).** **-indicate that Rogers and IEC have same limitations (C).** **-move less used methods to an Annex rather than delete them (W).** **-describe how to follow fault evolution with Triangle (D).** **-section 5 on gas monitors should be deleted (MK).**		

ANNEX A

Table A1
90% Typical concentration values observed in the US

		H_2	CH_4	C_2H_4	C_2H_6	C_2H_2	CO	CO_2	TDCG
IEEE Table 1	Condition 1	100	120	50	65	2	350	2500	687
California	Weidmann	96	88	57	79	3	613	5990	936
Arizona	APS	80	45	70	30	2	950		1177
	GE	80	50	73	28	2	950		1183
	Average US	85	61	67	46	2.5	840	(5990)	1101

Table A2
Sampling intervals and **gassing rates limits in ppm/ year**
calculated for an average CIGRE/ IEC power transformer

Gassing rate	H_2	CH_4	C_2H_4	C_2H_6	C_2H_2	CO	CO_2	TDCG	Sampling intervals
Typical	85	65	89	47	2	660	5850	948	Yearly
Level 2	180	175	220	175	7	1740	15380	2500	Monthly
Level 3	280	315	370	380	20	3050	27010	4415	Weekly
Level 4	510	680	745	1075	50	6490	57350	9950	Daily
Pre-failure	1095	1825	1825	4015	182	17000	150000	26000	Hourly

Table A3
Sampling intervals and **gas concentration limits in ppm**
calculated for an average US power transformer

Concentration	H_2	CH_4	C_2H_4	C_2H_6	C_2H_2	CO	CO_2	TDCG	Sampling intervals
Typical	85	61	67	46	2.5	840	5990	1101	Yearly
Level 2	165	115	140	120	10	1050	11280	1600	Monthly
Level 3	240	160	210	200	30	1250	16300	2090	Weekly
Level 4	390	240	380	390	100	1570	26700	3070	Daily
Pre-failure	725	400	800	900	450	2100	50000	5380	Hourly

Table A4
Sampling Intervals based on Combined Gassing Rates and
Gas Concentrations Levels of the Individual Gases

		Sampling Intervals based on Combined Gas Rate and Concentration Levels				
Rate Level #	**Conc. Level #**	**Daily**	**Weekly**	**Monthly**	**Quarterly**	**Yearly**
4	**4**	**X**				
4	**3**	**X**				
4	**2**		**X**			
4	**1**		**X**			
3	**4**	**X**				
3	**3**		**X**			
3	**2**		**X**			
3	**1**			**X**		
2	**4**		**X**			
2	**3**			**X**		
2	**2**			**X**		
2	**1**				**X**	
1	**4**			**X**		
1	**3**			**X**		
1	**2**				**X**	
1	**1**					**X**