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2008-08-08T11:54:39Z
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CREATION OF A BENCHMARK SAMPLE TO FACILITATE GAP ETCHING ANALYSIS OF PRE–PAYMENT METER SURGE ARRESTERS REMOVED FROM THE FIELD

Arend Jan Koert

A research report submitted to the Faculty of Engineering and the Built Environment, University of the Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Science in Engineering.

Johannesburg, 2004

DECLARATION

I declare that this research report is my own, unaided work. It is being submitted for the Degree of Master of Science in Engineering at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any other University.

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Arend Jan Koert

_____ day of _____ 2004

ABSTRACT

Comparison of the etchings on the gap plates of a gapped SiC surge arrester removed from the field - to a benchmark sample - yields a measure of the peak lightning current discharged by the arrester during its service life.

A benchmark sample for pre-payment meter surge arresters was created using the industry standard 8/20 μs lightning impulse waveform with peak current range: 2 to 53 kA, and a non-standard 4/70 μs waveform with peak current range: 0.4 to 10 kA. Using a 2nd-order lightning impulse generator, the current range per waveform was achieved by designing and constructing five resistive inductors in conjunction with three different capacitor configurations.

Analysis of the benchmark sample demonstrates gap etching area repeatability, and the existence of empirical linear relationships between gap etching area and peak current for gap etchings constrained to the central hub area of the gap plate.

To my family

Yvonne, Martin and Ashley

ACKNOWLEDGEMENTS

The support, advice and assistance of the following persons and organisations is gratefully acknowledged:

- Dr John van Coller (University of the Witwatersrand) for MSc supervision and technical guidance;
- Dr Hendri Geldenhuys (Distribution Technology, Eskom) for technical guidance;
- Andreas Beutel (University of the Witwatersrand) for initial operational support on the impulse generator;
- Harry Fellows and his personnel in the Electrical Engineering Department Workshop (University of the Witwatersrand) for construction of test jig components, construction of busbars for the capacitor bank, and as a source of materials;
- Dirk C Human (Technology Services International, Eskom Enterprises) for measurement of the gap etching areas;
- Eskom Resources and Strategy Research Division for financial assistance and permission to publish.

CONTENTS **Page**

DECLARATION ii
ABSTRACT iii
ACKNOWLEDGEMENTS v
CONTENTS vi
LIST OF FIGURES viii
LIST OF TABLES ix
LIST OF NOMENCLATURE x

1 INTRODUCTION 1

1.1 Background to the Problem 1
1.2 Problem Statement 2
1.3 Objective of this Work 3
1.4 Gapped SiC Surge Arrester – Principle of Operation 5
1.5 Approach to Creating a Benchmark Sample 6

2 LITERATURE REVIEW 8

2.1 Gap Etching Analysis 8
2.2 Surge Arrester Specifications and Characteristics 11
2.3 Power-frequency Follow Current 12
2.4 Lightning Parameters – Field and Laboratory 13
2.5 LV Surge Environment 14
2.5.1 Computer simulations 14
2.5.2 IEC 62066:1998 16
2.6 Discussion 17
2.6.1 Applicable waveforms 17
2.6.2 Peak-current range 18
2.7 Conclusion 19

3 DEFINING THE TEST SPACE 21

3.1 Lightning Impulse Generator 21
3.1.1 Description and principle of operation 22
3.1.2 Quantifying the waveform & circuit parameters 23
3.2 Etching Repeatability 26
3.3 Conclusion 27

4 DESIGN AND CONSTRUCTION OF RESISTIVE INDUCTORS 29

4.1 Quantifying Stray Resistance and Stray Inductance 29
4.2 Design Approach 32
4.2.1 Resistance R 32
4.2.2 Inductance L 34
4.3 Selecting Optimum s and l_s per Available Nichrome Wire 39
4.4 Resistive Inductor Construction and Verification 40
4.5 Conclusion 46

CONTENTS **Page**

5	**CREATING AND ANALYSING THE BENCHMARK SAMPLE**	**48**
5.1	**Quantifying I vs. V_s per Component**	**48**
5.2	**Defining the Peak-Current Ranges**	**49**
5.3	**The Reduced Benchmark Sample**	**50**
5.3.1	Select gap etching examples	51
5.3.2	Preliminary visual inspection	53
5.4	**Measurement of Gap Etching Area**	**53**
5.4.1	Ellipsoid approximation	54
5.4.2	Gap etching area measurement guideline	55
5.5	**Gap Etching Area Analysis**	**57**
5.5.1	Central hub limit	57
5.5.2	Gap etching area statistical spread	58
5.5.3	Dependency of A_e on I per waveform	59
5.5.4	Benchmark sample - further considerations	60
5.6	**Conclusion**	**62**
6	**CONCLUSIONS AND RECOMMENDATIONS**	**64**
6.1	**Summary and Conclusions**	**64**
6.1.1	Literature review	64
6.1.2	Defining the test space	65
6.1.3	Design and construction of resistive inductors	65
6.1.4	Creating and analysing the benchmark sample	66
6.2	**Recommendations for Future Work**	**67**
6.2.1	Lightning impulse generator	67
6.2.2	Resistive inductor components	68
6.2.3	Potential effect of power-frequency follow current	68
APPENDIX A	**2ND-ORDER CURRENT IMPULSE CIRCUIT**	**69**
APPENDIX B	**DERIVING R_{sys} & L_{sys}**	**71**
APPENDIX C	**R_{stray} & L_{stray} DATA PER CAPACITOR CONFIGURATION**	**74**
APPENDIX D	**LOW RESISTANCE SHUNTS - MORE CONSIDERATIONS**	**76**
APPENDIX E	**s & l_s CALCULATIONS FOR SIX COMPONENTS**	**82**
APPENDIX F	**QUANTIFICATION OF I vs. V_s PER COMPONENT**	**88**
APPENDIX G	**BENCHMARK SAMPLE TEST SHEET**	**90**
APPENDIX H	**GAP ETCHING MEASUREMENT DATA**	**92**
REFERENCES		**98**

LIST OF FIGURES

Figure		Page
1.1	Connectivity between lightning events and gap etching analysis	4
2.1	Current impulse definition as per IEC 60-1:1989	13
2.2	Test space framework (not necessarily to scale)	19
3.1	Combination generator in current mode	22
3.2	$V_{s,max}$ per capacitor configuration	24
3.3	Test space showing I_{max} and $Q_{g,max}$ for each waveform per C_c	25
4.1	Bundle of resistance wire strands	32
4.2	Bifilar winding	36
4.3	Melaia's inductance-reducing method	36
4.4	Novel inductance-reducing method – anti-parallel strand loops	37
4.5	Low resistance shunt geometry	37
4.6	Components 1, 2 and 3	42
4.7	Components 4, 5 and 6	42
4.8	Component 1: 8/20 μs waveform (normal and zoomed views)	43
4.9	Component 2: 8/20 μs waveform (normal and zoomed views)	43
4.10	Component 3: 16/36 μs waveform (normal and zoomed views)	44
4.11	Component 4: 4/70 μs waveform (normal and zoomed views)	44
4.12	Component 5: 4/70 μs waveform (normal and zoomed views)	44
4.13	Component 6: 5/72 μs waveform (normal and zoomed views)	45
5.1	Test jig to hold surge arrester gap sets	50
5.2	Gap etchings for 7.4 kA, 8/20 μs waveform (sample 3)	51
5.3	Gap etchings for 52.6 kA, 8/20 μs waveform (sample 10)	51
5.4	Gap etchings for 0.4 kA, 4/70 μs waveform (sample 46)	52
5.5	Gap etchings for 2.0 kA, 4/70 μs waveform (sample 51)	52
5.6	Gap etchings for 7.0 kA, 5/72 μs waveform (sample 56)	52
5.7	Ellipsoid Cartesian co-ordinates; imaginary ellipsoid approximation	54
5.8	Visual gap etching area measurement guideline	56
5.9	A_e vs. I per waveform	57
5.10	Standard deviation as a percentage of mean gap etching area	58
5.11	A_e vs. I per waveform – censored data	59
A1	2nd-order impulse circuit (combination generator in current mode)	69
B1	Impulse generator (Figure A1) with R_m, L_r and DUT replaced by shunts	71
B2	Under-damped current waveform	72
D1	Low resistance shunt geometry	76
D2	Shunt in very low (electrical) conductivity / high heat capacity fluid	78
D3	Tube cross-section with uniformly-spaced wire strands in fluid	79

LIST OF TABLES

Table		Page
2.1	Q matrix: peak-current vs. waveform	9
3.1	Circuit parameters and T_{Wg} for chosen waveforms	23
3.2	Calculated R_m and L_r with associated I_{max} for each waveform per C_c	25
3.3	I_{min} and G_{max} for each waveform per available C_c due to V_{so} = 2.5 kV	27
4.1	Selection of R_{stray} and L_{stray} per C_c	31
4.2	Calculated R and L for each waveform per available C_c	31
4.3	Available Nichrome wire	33
4.4	Required (minimum) component mass for various conductors per C_c	34
4.5	Required l_{shunt} and A_{shunt} for various conductors	38
4.6	I_{max}, R and L for C_c = 102.3 μF	41
4.7	Summary of constructed component parameters	41
4.8	Resultant circuit parameters and waveform per component	43
5.1	I/V_s, I_{max} and T_{Wg} per component	49
C1	R_{stray} & L_{stray} data per capacitor configuration	75
D1	Required (minimum) m for graphite	77
D2	Required l_{shunt} and A_{shunt} for graphite	77
D3	Example 1: Results per Nichrome wire reel	80
D4	Example 2: Results per Nichrome wire reel	81
E1	Component 1: Nichrome reel data sorted by s then l_s	82
E2	Component 2: Nichrome reel data sorted by l_s	83
E3	Component 3: Nichrome reel data sorted by l_s	84
E4	Component 4: Nichrome reel data sorted by s then l_s	85
E5	Component 5: Nichrome reel data sorted by l_s	86
E6	Component 6: Nichrome reel data sorted by l_s	87
F1	Quantification of I vs. V_s for components 1, 2, 4, 5 & 6	89
G1	Test sheet for reduced benchmark sample	91
H1	Gap etching data (8/20 μs, 2.0 to 13.0 kA)	93
H2	Gap etching data (8/20 μs, 13.4 to 52.6 kA)	94
H3	Gap etching data (4/70 μs, 0.4 to 1.7 kA)	95
H4	Gap etching data (4/70 μs, 2.0 to 6.0 kA)	96
H5	Gap etching data (5/72 μs, 7.0 to 10.2 kA)	97

LIST OF NOMENCLATURE

ABC	Aerial Bundle Conductor
BIL	Basic Insulation Level
DUT	Device Under Test
EMTP	Electromagnetic Transients Program
EPRI	Electric Power Research Institute
IEC	International Electrotechnical Commission
L-N	Live to Neutral
LV	Low (network) Voltage ($U_n \leq 1$ kV)
MEN	Multiple-Earthed Neutral
MOV	Metal Oxide Varistor
MV	Medium (network) Voltage (1 kV < $U_n \leq 44$ kV)
SABS	South African Bureau of Standards
SiC	Silicon-Carbide
SPE	Single-Point Earth
Trfr	Transformer
TSI	Technology Services International (a subsidiary of Eskom Enterprises)
ZnO	Zinc-Oxide