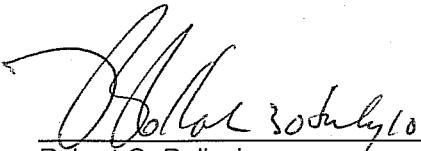


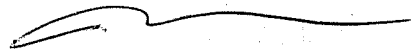
CONTROLLER OSCILLATORY SWC TEST REPORT

| | | |
|--|--|------------------------------|
| Client: G&W Electric Co., 3500 W. 127 th Street, Blue Island IL, 60406 | | |
| Test Date: July 23, 2010 | | Project: 20114-27 (C) |
| Nameplate Data: | | |
| Three Phase Recloser Controller: | | |
| Manufacturer: | SEL | |
| Model: | 0651RR12BAA831123XX | |
| Serial No.: | 2010183448 | |
| Three Pole Switch: | | |
| Manufacturer: | G&W | |
| Catalog No.: | VIP388-ER-12-1-ST | |
| Impulse level (BIL): | 125 kV _{peak} Line-to-Ground; 125 kV _{peak} Line-to-Line | |
| Rated voltage: | 27 kV _{rms} | |
| Rated current: | 800 A _{rms} continuous/12.5 kA interrupting | |
| Serial No.: | 2010 0701 0018 | |
| Test Standard: | IEEE C37.60-2003, Clause 6.13.1: "Oscillatory and fast transients surge tests" | |
| Test Witnesses: | Blair Kerr, G&W Blue Island, IL; Alex Bradley, SEL, Pullman, WA | |
| Atmospheric Conditions: | Temperature | 20.1 °C |
| | Relative humidity | 47% |
| | Barometric pressure | 753.1 mmHg |
| Test Voltage: | 2.5 kV _{peak} | |
| Test Procedure: | Test surges were applied to the control cable in common mode using a capacitive clamp and transverse mode through 1.5 mH coils. Test surges were applied to ac power input in common mode and transverse mode using an external coupling filter. The AC power supplied to the controller was 120 Volts, 60 Hz. | |
| Test Results: | <p>A controller panel mounted GFCI receptacle failed during the EMI tests and was disabled. No other problems were observed.</p> <p>The controller and recloser operated normally following the Oscillatory SWC Test performed in accordance with the test procedures as per the above document. The controller complied with requirements of "IEEE C37.60-2003, Clause 6.13.1".</p> | |

Tested by:

Approved by:


 Robert G. Pollock
 Senior Project Specialist


 30 July 10
 A.J. Vandermaar, P.Eng.
 Manager, High Voltage Laboratory

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APPENDIX 1

Oscillatory SWC Waveform Validity Tests
 (in accordance with IEEE Std C37.90.1-2002, Clause A.2)

Performed before the Oscillatory SWC Test

1. Measuring system feedthrough test

Generator Output voltage 2.50 kV
 Feed through voltage 0.8 V (pass ≤ 1%)

2. Open circuit voltage waveform test

Recorded waveforms – Figures 1 and 2.

3. Test Generator performance verification

| | | |
|------------------------------|----------------------------|-------------------------------------|
| Rise time of the first peak | <u>82</u> ns | (60 to 90 ns – 10% to 90%) |
| Peak voltage level (no load) | <u>2.55</u> kV | (2.25 to 2.5 kV when set to 2.5 kV) |
| Output impedance | <u>199.0</u> Ω | (160 to 240 Ω) |
| Waveform envelope decay | <u>4.5</u> μs | (4 to 6 μs to 50%) |
| Oscillation frequency | <u>0.926</u> MHz | (0.9 to 1.1 MHz) |
| Repetition rate | <u>8</u> bursts per period | (6-10 bursts per 16.7 mS) |
| Test duration | <u>2.18</u> s | (2 to 2.2 s) |

4. Test Pass X Test Fail _____

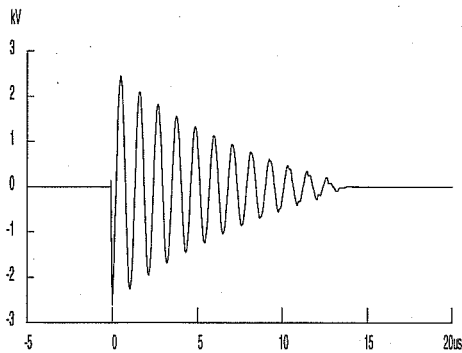


Figure 1

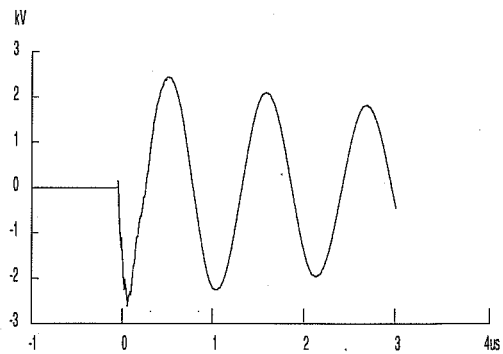


Figure 2

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APPENDIX 2

Oscillatory SWC Waveform Validity Tests
(in accordance with IEEE Std C37.90.1-2002, Clause A.2)

Performed after the Oscillatory SWC Test

1. Measuring system feedthrough test

Generator Output voltage 2.5 kV
 Feed through voltage 4.0 V (pass $\leq 1\%$)

2. Open circuit voltage waveform test

Recorded waveforms – Figures 1 and 2.

3. Test Generator performance verification

| | | |
|------------------------------|--|-------------------------------------|
| Rise time of the first peak | <u>82</u> ns | (60 to 90 ns – 10% to 90%) |
| Peak voltage level (no load) | <u>2.5</u> kV | (2.25 to 2.5 kV when set to 2.5 kV) |
| Output impedance | <u>208.4</u> Ω | (160 to 240 Ω) |
| Waveform envelope decay | <u>5.53</u> μ s | (4 to 6 μ s to 50%) |
| Oscillation frequency | <u>0.934</u> MHz | (0.9 to 1.1 MHz) |
| Repetition rate | <u>8</u> bursts per period (6-10 bursts per 16.7 mS) | |
| Test duration | <u>2.12</u> s | (2 to 2.2 s) |

4. Test Pass X Test Fail _____

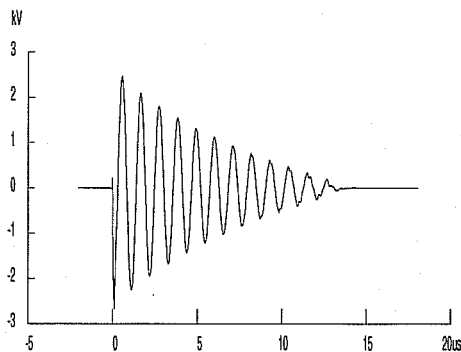


Figure 1

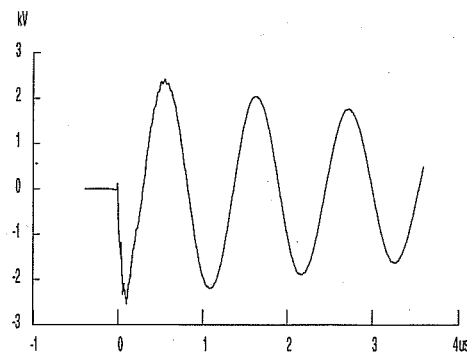


Figure 2


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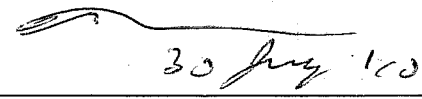
CONTROLLER FAST TRANSIENT SWC TEST REPORT

| | | |
|---|--|------------------------------|
| Client: | G&W Electric Co., 3500 W. 127 th Street, Blue Island IL, 60406 | |
| Test Date: | July 23, 2010 | Project: 20114-27 (F) |
| Nameplate Data: | | |
| Three Phase Recloser Controller: | | |
| Manufacturer: | SEL | |
| Model: | 0651RR12BAA831123XX | |
| Serial No.: | 2010183448 | |
| Three Pole Switch: | | |
| Manufacturer: | G&W | |
| Catalog No.: | VIP388-ER-12-1-ST | |
| Impulse level (BIL): | 125 kV _{peak} Line-to-Ground; 125 kV _{peak} Line-to-Line | |
| Rated voltage: | 27 kV _{rms} | |
| Rated current: | 800 A _{rms} continuous/12.5 kA interrupting | |
| Serial No.: | 2010 0701 0013 | |
| Test Witnesses: | Blair Kerr, G&W Blue Island, IL; Alex Bradley, SEL, Pullman, WA | |
| Test Standard: | IEEE Std C37.60-2003, Clause 6.13.1: "Oscillatory and fast transients surge tests" | |
| Atmospheric Conditions: | Temperature | 20.1 °C |
| | Relative humidity | 47% |
| | Barometric pressure | 753.1 mmHg |
| Test Voltage: | 4.0 kV _{peak} | |
| Test Procedure: | Test surge was applied to the control cable in common mode using a capacitive clamp and transverse mode through 1.5 mH coils. Test surge was applied to ac power input in common mode and transverse mode using an external coupling filter. The AC power supplied to the controller was 120 Volts, 60 Hz. | |
| Test Results: | <p>A controller panel mounted GFCI receptacle failed during the EMI tests and was disabled. No other problems were observed.</p> <p>The controller and recloser operated normally following the Oscillatory SWC Test performed in accordance with the test procedures as per the above document. The controller complied with requirements of "IEEE C37.60-2003, Clause 6.13.1".</p> | |

Tested by:

Approved by:


 Robert G. Pollock
 Senior Project Specialist


 A.J. Vandermaar, P.Eng.
 Manager, High Voltage Laboratory

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APPENDIX 1

Fast Transient SWC Waveform Validity Tests
(in accordance with IEEE Std C37.90.1-2002, Clause A.2)

Performed before the Fast Transient SWC Test

1. Measuring system feedthrough test

Generator Output voltage 4 kV
 Feedthrough voltage 0.8 V (pass if $\leq 1\%$)

2. Open circuit voltage waveform test
 Recorded waveforms – Figures 1 and 2.

3. Test Generator performance verification

| | | |
|------------------------------|----------------------|----------------------------------|
| Rise time | <u>4.05</u> ns | (3.5 to 6.5 ns – 10% to 90%) |
| Peak voltage level (no load) | <u>4.0</u> kV | (3.6 to 4.4 kV when set to 4 kV) |
| Output impedance | <u>46.7</u> Ω | (40 to 60 Ω) |
| Impulse duration | <u>60</u> ns | (35 to 65 ns to 50% value) |
| Repetition rate | <u>2.50</u> kHz | (2 to 3 kHz) |
| Burst duration | <u>14.9</u> ms | (12 to 18 ms) |
| Burst period | <u>300</u> ms | (240 to 360 ms) |
| Test duration | <u>60.1</u> s | (≥ 60 s) |

4. Test Pass X Test Fail _____

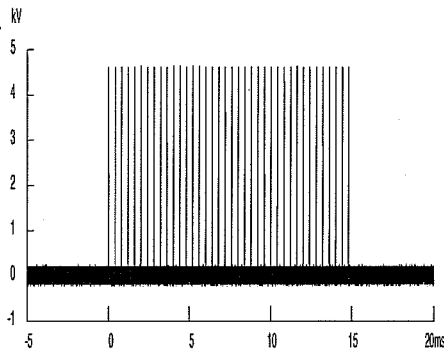


Figure 1

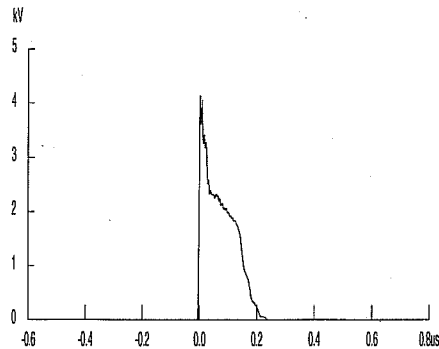


Figure 2

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APPENDIX 2

Fast Transient SWC Waveform Validity Tests
(in accordance with IEEE Std C37.90.1-2002, Clause A.2)

Performed after the Fast Transient SWC Test

1. Measuring system feedthrough test

Generator Output voltage 4 kV
 Feedthrough voltage 0.3 V (pass if $\leq 1\%$)

2. Open circuit voltage waveform test
 Recorded waveforms – Figures 1 and 2.

3. Test Generator performance verification

| | | |
|------------------------------|----------------------|----------------------------------|
| Rise time | <u>4.45</u> ns | (3.5 to 6.5 ns – 10% to 90%) |
| Peak voltage level (no load) | <u>4.2</u> kV | (3.6 to 4.4 kV when set to 4 kV) |
| Output impedance | <u>42.0</u> Ω | (40 to 60 Ω) |
| Impulse duration | <u>59</u> ns | (35 to 65 ns to 50% value) |
| Repetition rate | <u>2.50</u> kHz | (2 to 3 kHz) |
| Burst duration | <u>14.8</u> ms | (12 to 18 ms) |
| Burst period | <u>300</u> ms | (240 to 360 ms) |
| Test duration | <u>60.0</u> s | (≥ 60 s) |

4. Test Pass X Test Fail _____

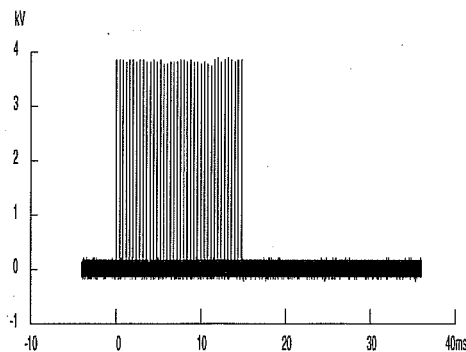


Figure 1

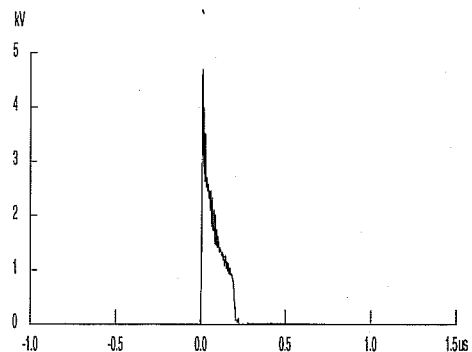


Figure 2

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RECLOSER CONTROLLER SIMULATED SURGE ARRESTER OPERATION TEST REPORT

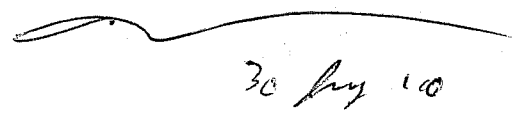
| | | |
|--|---|------------------------------|
| Client: G&W Electric Co., 3500 W. 127 th Street, Blue Island IL, 60406 | | |
| Test Date: July 20-21, 2010 | | Project: 20114-27 (A) |
| Nameplate Data: | | |
| Three Phase Recloser Controller: | | |
| Manufacturer: | SEL | |
| Model: | 0651RR12BAA831123XX | |
| Serial No.: | 2010183448 | |
| Three Pole Switch: | | |
| Manufacturer: | G&W | |
| Catalog No.: | VIP388-ER-12-1-ST | |
| Impulse level (BIL): | 125 kV _{peak} Line-to-Ground; 125 kV _{peak} Line-to-Line | |
| Rated voltage: | 27 kV _{rms} | |
| Rated current: | 800 A _{rms} continuous/12.5 kA interrupting | |
| Serial No.: | 2010 0701 0018 | |
| Test Witnesses: | Blair Kerr, G&W Blue Island, IL; Alex Bradley, SEL, Pullman, WA | |
| Test Standard: | IEEE Std C37.60-2003, Clause 6.13.2: "Simulated Surge Arrester Operation Test" | |
| Atmospheric Conditions: | <u>July 20/10</u> | <u>July 21/10</u> |
| Temperature | 21.1 °C | 22.2 °C |
| Relative humidity | 55 % | 57 % |
| Barometric pressure | 755.9 mmHg | 755.0 mmHg |
| Nominal Test Voltage and Current: | 100 kV (125 kV * 0.8), 7 kA _{peak} | |
| Test Configurations Tested (in accordance with the above standard): | | |
| <p>A - 15 surges of positive polarity and 15 surges of negative polarity were applied to the source bushings with the switch open.</p> <p>B - 15 surges of positive polarity and 15 surges of negative polarity were applied to the source bushings with the switch closed.</p> <p>C - 15 surges of positive polarity and 15 surges of negative polarity were applied to the load bushings with the switch closed.</p> <p>D - 15 surges of positive polarity and 15 surges of negative polarity were applied to a properly rated transformer with the recloser closed.</p> <p>E - 15 surges of positive polarity and 15 surges of negative polarity were applied to a properly rated transformer with the recloser open.</p> | | |
| Test Results: | The controller and switch complied with the requirements of IEEE Std C37.60-2003, Clause 6.13.2, configurations A to E. | |
| Remarks: | None | |

Tested by:

Reviewed by:



R.G. Pollock,
Senior Projects Specialist



A.J. Vandermaar, P.Eng.
Manager, High Voltage Laboratory

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