# CONTROLLER SIMULATED SURGE ARRESTER OPERATION TEST REPORT

**Client:** Schweitzer Engineering Laboratories, 2350 NE Hopkins Court, Pullman, WA 99163-5003, USA  
**Test Date:** 7 & 8 November 2005  
**Project:** 16063-27  

## Nameplate Data:

- **Controller:** Schweitzer Engineering Laboratories, Pullman, Washington, USA  
- **Model No.:** 0081R2128Q11H3CXX  
- **Serial No.:** 20051226168  
- **Recloser:** Cooper Power Systems  
- **Type:** Nova 27  
- **Impulse level (BIL):** 125 kV  
- **Rated voltage:** 37 kV  
- **Rated current:** 630 A, continuous; 12.5 kA interrupting  
- **Serial No.:** 4925-BH

## Test Witness:

- Kenneth G. Workman, Schweitzer Engineering Laboratories  
- Francois Boulard, Hydro Quebec  
- Jacques Cote and Jean-Francois Briand, Grimsby

## Test Standard:


## Atmospheric Conditions:

- **Temperature:** 19.7 °C  
- **Relative humidity:** 36%  
- **Barometric pressure:** 755.8 mmHg

## Test Current:

- 7 kA

## Test Configurations (in accordance with the above standard):

- **A** - surges applied to the source bushing with the recloser open  
- **B** - surges applied to the source bushing with the recloser closed  
- **C** - surges applied to the load bushing with the recloser closed  
- **D** - surges applied to a properly rated transformer with the recloser open  
- **E** - surges applied to a properly rated transformer with the recloser closed

## Test Results:

The controller and recloser operated normally following the Simulated Surge Arrester Operation Test performed in accordance with the test procedures as per the above standard. The controller complied with the requirements of IEEE Std C37.60-2003, Clause 6.13.2.

## Remarks:

None

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**Prepared by:** Milan Vasek, P.Eng.  
**Approved by:** A.J. Vandermaar, P.Eng.

Senior Electrical Engineer  
Manager, High Voltage Laboratory

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CONTROLLER OSCILLATORY SWC TEST REPORT

Client: Schweitzer Engineering Laboratories, 2350 NE Hopkins Court, Pullman, WA 99163-5003, USA

Test Date: 9 November 2005  Project: 16065-27

Nameplate Data:
Controller: Schweitzer Engineering Laboratories, Pullman, Washington, USA
Manufacturer: 0301R01250011H0C0X
Model No.: 2005122186
Serial No.: 0

Recloser:
Manufacturer: Cooper Power Systems
Type: Nova 27
Impulse level (BIL): 125 kV
Rated voltage: 27 kV
Rated current: 630 A continuous, 12.5 kA interrupting
Serial No.: 4925-BH

Test Witness: Kenneth G. Workman, Schweitzer Engineering Laboratories


Test Voltage: 2.5 kV

Test Procedure: Test surge applied in common mode and transverse mode to wire pairs.

Test Results: The controller and recloser operated normally following the Oscillatory SWC Test performed in accordance with the test procedures. The controller compiled with requirements of IEEE C37.60-2003, Clause 6.13.1.

Remarks: The controller passed the test.

Tested by: Approved by:

Senior Project Specialist  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 2.5 kV
   Feedthrough voltage 2.1 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 84 ns (60 to 90 ns – 10% to 90%)
   Peak voltage level (no load) 2.5 kV (2.25 to 2.5 kV when set to 2.5 kV)
   Output impedance 199 Ω (160 to 240 Ω)
   Waveform envelope decay 4.94 µs (4 to 6 µs to 50%)
   Oscillation frequency 0.917 MHz (0.9 to 1.1 MHz)
   Repetition rate 6 bursts per period (6-10 bursts per 16.7 ms)
   Test duration 2.2 s (2 to 2.2 s)

4. Test Pass X Test Fail

![Figure 1](image1)

![Figure 2](image2)

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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

4. Measuring system feedthrough test
   Generator Output voltage 2.5 kV
   Feedthrough voltage 0 V (pass ≤ 1%)

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

6. Test Generator performance verification
   Rise time of the first peak 68 ns (60 to 90 ns – 10% to 90%)
   Peak voltage level (no load) 2.5 kV (2.25 to 2.5 kV when set to 2.5 kW)
   Output impedance 194.7 Ω (160 to 240 Ω)
   Waveform envelope decay 6.0 μs (4 to 6 μs to 50%)
   Oscillation frequency 0.91 MHz (0.9 to 1.1 MHz)
   Repetition rate 8 bursts per period (6-10 bursts per 16.7 ms)
   Test duration 2.2 s (2 to 2.2 s)

5. Test Pass X Test Fail

![Figure 1](image1)

![Figure 2](image2)

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# CONTROLLER FAST TRANSIENT SWC TEST REPORT

| Client: | Schweitzer Engineering Laboratories, 2350 NE Hopkins Court, Pullman, WA 99163-5603, USA |
| Test Date: | 9 November 2005 |
| Project: | 16553-27 |

## Nameplate Data:
- **Controller:** Schweitzer Engineering Laboratories, Pullman, Washington, USA
- **Model No.:** 0351R129Q11HXXDXX
- **Serial No.:** 2005122166
- **Manufacturer:** Cooper Power Systems
- **Type:** Nova 27
- **Impulse level (BIL):** 125 kVpeak
- **Rated voltage:** 27 kVrms
- **Rated current:** ISO Amax Continuous: 12.5 kA interrupting
- **Serial No.:** 4925-SH

## Test Witness:
- Kenneth G. Workman, Schweitzer Engineering Laboratories
- François Soulard, Hydro Québec
- Jacques Côté and Jean-François Briand, Grimard

## Test Standard:

## Test Voltage:
4.0 kVpeak

## Test Procedure:
Test surge applied in common mode and transverse mode to wire pairs.

## Test Results:
The controller and recloser operated normally following the Fast Transient SWC Test performed in accordance with the test procedures. The controller complied with the requirements of IEEE C37.80-2003, Clause 6.13.1.

## Remarks:
The controller passed the test.

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## Tested by:
Robert G. Pollock  
Senior Project Specialist

## Approved by:
A.J. Vanlennmaat, 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 0.22 V (pass if ≤ 1%)

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

3. Test Generator performance verification
   Rise time 3.6 ns (3.5 to 6.5 ns – 10% to 90%)
   Peak voltage level (no load) 4.3 kV (3.6 to 4.4 kV when set to 4 kV)
   Output impedance 44.3 Ω (40 to 60 Ω)
   Impulse duration 65 ns (35 to 65 ns to 50% value)
   Repetition rate 2.5 kHz (2 to 3 kHz)
   Burst duration 14 ms (12 to 18 ms)
   Burst period 300 ms (240 to 360 ms)
   Test duration 60 s (> 60 s)

4. Test Pass X Test Fail

![Figure 1](image1)
![Figure 2](image2)

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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

5. Measuring system feedthrough test
   Generator Output voltage 4 kV
   Feedthrough voltage 0.1 V (pass if ≤ 1%)

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

7. Test Generator performance verification
   Rise time 4 ms (3.5 to 6.5 ms – 10% to 90%)
   Peak voltage level (no load) 4.4 kV (3.6 to 4.4 kV when set to 4 kV)
   Output impedance 45.0 Ω (40 to 66 Ω)
   Impulse duration 52 ms (35 to 65 ms to 50% value)
   Repetition rate 2.5 kHz (2 to 3 kHz)
   Burst duration 15.0 ms (12 to 18 ms)
   Burst period 301 ms (240 to 360 ms)
   Test duration 60.0 s (> 60 s)

8. Test Pass X Test Fail

Figure 1

Figure 2

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