

Diagnosing and Troubleshooting Successive Fission Chamber Failures

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Washington State University Reactor: Background

- TRIGA® conversion (original MTR)
- 1 MW steady state with pulsing capability
- HEU/LEU mixed core until 2008
- Fuel conversion to 30/20 in central region and 8.5/20 outer region in October 2008
- Fission chamber replacement prior to this episode was in 2005

Symptoms and immediate actions

- 10 % power reading on NLW-1000, other power level indications reading normal for shutdown
- Verified all control elements were fully inserted
- Re-calibrated the NLW-1000 using resistors and pA source
- The PA-1000 and NLW-1000 were ruled out as the source of the problem by injecting pulses into the PA and verifying the NLW-1000 readout.

Diagnosis

- A power supply was put in line with a DVM to measure current.
- With changing voltage in the HP supply, we observed a leakage current in the DVM, indicating a resistance between the +/- wires of about 130 μA at 300 V.
- Possibility of a bad MHV wire (or the connector, or the insulator inside the detector cap)

The Fix

- OSU Reactor donated a fission chamber.
- GA sent detector cabling and insulation materials.
- Local shop fabricated detector can and performed chamber closure welds.
- Detector came with poly insulator that was replaced with teflon insulator milled in house.



Test Data: WL-8073

Table 1. Detector as received, with poly insulator around detector center wire

		Detector	Detector+cable
DVM	resistance (Ω)	2.47E+08	N/A
	capacitance (pF)	230	N/A
electrometer HPS +	voltage 1 (V)	200	200
	voltage 2 (V)	800	800
	current 1 (A)	1.49E-07	1.49E-07
	current 2 (A)	1.50E-07	1.50E-07
	resistance (Ω)	6.00E+11	6.00E+11

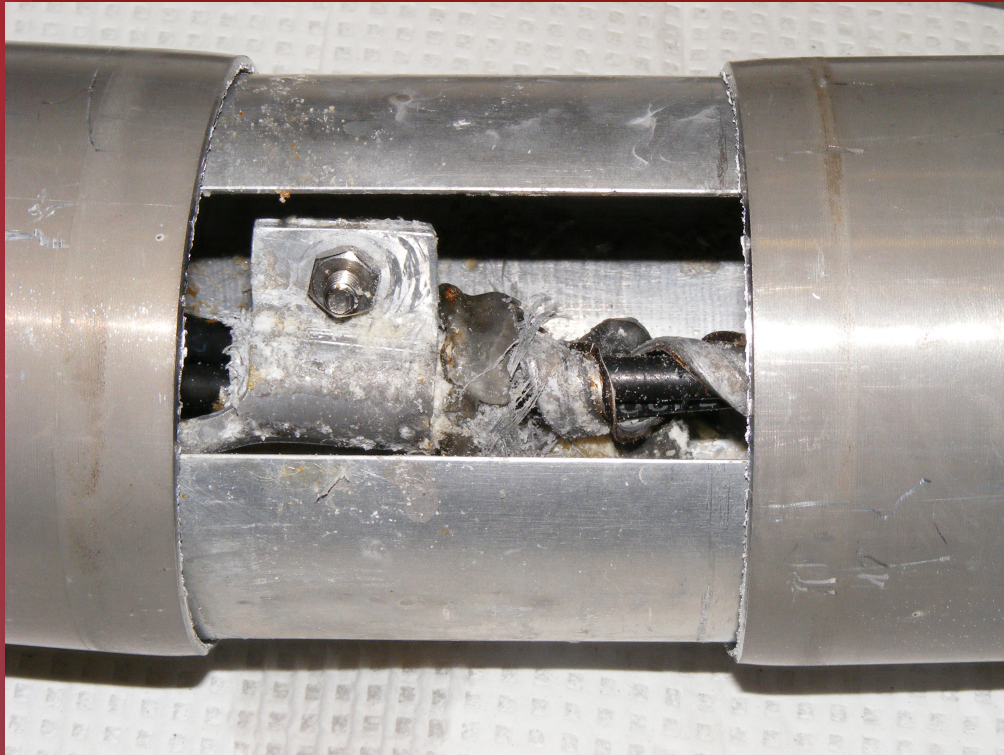


Test Data: WL-8073

Table 2. Detector with Teflon insulator around detector center wire, detector housing pre and post closure weld.

		Pre-weld		Post Weld
		Detector	Detector+cable	Detector+cable
DVM	resistance (Ω)	2.50E+08	2.50E+08	2.50E+08
	capacitance (pF)	237	1000	1001
electrometer HPS +	voltage 1 (V)	200	200	200
	voltage 2 (V)	800	800	800
	current 1 (A)	1.46E-07	1.40E-07	1.49E-07
	current 2 (A)	1.47E-07	1.41E-07	1.50E-07
	resistance (Ω)	6.00E+11	6.00E+11	6.00E+11

- Pulled the failed fission chamber out of the core and cut the housing open using a dye blade pipe cutter.



Prevention is key

- Because our pre-amplifier is in the pool room on the bridge, any change in humidity can be problematic
- Possible relocation of pre-amp to the reactor console
- The “noise” problems previously experienced in the NLW-1000 have not been observed since new detector install

Special Thanks to:

- Oregon State University Reactor
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- The University Texas at Austin Reactor