



# Cable 1175 Air Brake Failure: Broken Wire Sensor Investigation

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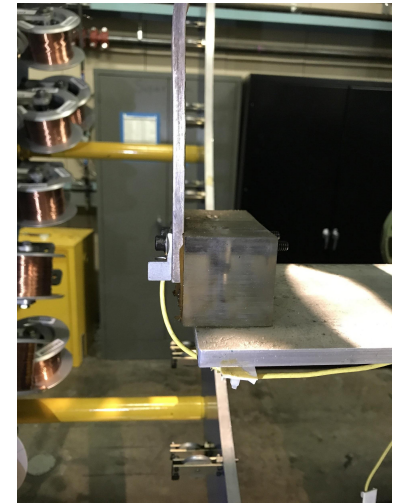
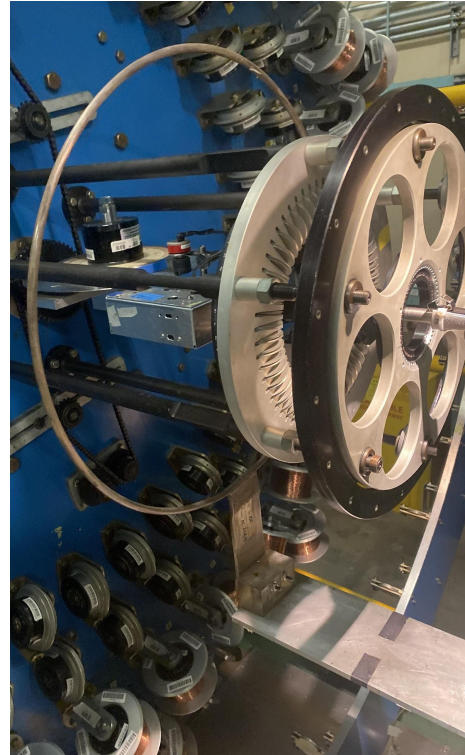


# Overview

- ~335 m into the production run for AUP cable 1175, the air brake for the cable bay fired and stopped the run
  - Sudden stop created a crossover at the 335<sup>th</sup> m and subsequent cable collapse (~.25 m long)
  - Cable does not meet the minimum unit length specified by AUP
  - No broken wires (strands) found on machine, even though the primary system that could trigger this type of stop is the machine's broken wire sensor

# Broken Wire Sensor - Overview

- If a wire hits the ring loop, the brake will fire if the sensor is on
  - Will also engage the brake if another foreign object contacts the ring or another bar contact on the floor
  - Can be turned off



# Broken Wire Sensor - Inspection Scope

- ❑ Identify electrical control mechanism for air brake system
  - ❑ Physical inspection (as-built)
  - ❑ Find documents in LBNL Document Control Center
- ❑ Assess all electrical components and wiring harness for evidence of damage
  - ❑ Check electrical connections for good contact
  - ❑ Check integrity of insulation and cover bald spots in wiring
- ❑ Verify that operator controls work normally to control the air brake
- ❑ Re-verify that excess shock, lubricant, etc. do not trigger air brake

# Broken Wire Sensor - Inspection Results

- ✓ Identify electrical control mechanism for air brake system
  - ✓ Physical inspection (as-built)
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- ✓ Assess all electrical components and wiring harness for evidence of damage
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# Electrical Inspection Results

- **No evidence of thermal or electrical** damage to any wiring components
- **No shorts or poor connections** found
  - All connections checked and re-tightened by QEW
- Main sensor wire had one exposed pigtail, but not in a location that is likely to cause a fault
  - “That pigtail had a small exposed tip of copper that could short against the box depending upon vibrations, etc. and spectacular bad luck. I don’t think this is what caused the fault, but I none-the-less covered the end with some electrical tape”
- Main sensor ring’s *insulation block is ok*
  - Cleaned to remove any excess oil

# Additional Lines of Inquiry (Low to High Risk)

1. *Double check the pneumatic pressure at the time of failure*
  - a. Immediate action
2. *Air cylinder and gas spring inspection*
  - a. 1-3 month time horizon
  - b. System removal/reinstallation required
3. *Motor drive removal and inspection*
  - a. Long term monitoring
  - b. System removal/reinstallation required
  - c. Schematic not present in DCC
  - d. Calibration procedure for the motor drive not present in DCC
  - e. QEW able to inspect surface level panel components, but not the drive circuit/power capacitor bank

# Conclusion

- It is *electrically safe* to operate the machine with the broken wire sensor off
- Brake controls and broken wire sensor are working normally as of the morning of July 23rd
  - Machine seems to be operating normally with sensor turned off
- Root cause not identified at this time

LBNL Cabling Team will *continue cable fabrication with the sensor turned off* and pursue additional lines of inquiry, as necessary



# Control Mechanism Identification

- Solenoid valve (air cylinder control) triggered by sensing/timing relay module
  - Lathe body, lathe platform connected to ground
  - Ring sensor and floor sensor are energized at 12 V
  - Shorting to ground will disengage lathe clutch and fire the air brake
- No other instrumentation in control panel box (module + one secondary relay)
- *No documentation or schematic found for sensing circuit*

