FAX CONTROL SHEET

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COMMENTS: **Part 21 Initial Notification and Preliminary Report - Cutler-Hammer A200 NEMA Size 1 Starters**

Equipment Identification: Starter, Non-Reversing, Size 1, 600VAC, 3 Pole, W/125VDC coil, Westinghouse/Cutler-Hammer P/N A200M1CS, Type B Thermal Overloads, Ambient Compensated, Manual Reset Only

In March 2002, Spectrum Technologies provided 20 Class 1E safety related Cutler-Hammer A200 NEMA Size 1 starters to Rochester Gas & Electric Company - Ginna Station. We had purchased the starters as commercial grade items from Cutler-Hammer, and dedicated them per EPRI NP5652, method 1, Special Tests and Inspections. This dedication successfully verified the following critical characteristics:

- Markings
- Dimensions and Configuration
- Electrical Functional Attributes, Including:
  - Insulation Resistance
  - Current Carrying Capacity
  - Minimum Pickup and Drop Out Voltage
  - Time Current Characteristics of Overload Relay

Ginna Station advised us that they had installed one of these starters in the circuit for their Boric Acid Storage Tank (BAST) Heaters. Approximately eight (8) weeks later they received MCB Alarm B-31 for low A BAST temperature. Investigation found an open coil on the starter and replaced the starter. The failed starter was sent to the Ginna Materials Laboratory for analysis. This analysis indicates that a manufacturing defect caused the failure.

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The Ginna Materials Laboratory examined the starter using a low power binocular microscope for signs of defects, overheating , or cracks. Resistance measurements between the two coils in the starter were taken and they were then subjected to X-ray radiography. Subsequent to this, the coils were disassembled and sectioned to reveal the defect. The failed coil wire was also examined using scanning electron microscopy for signs of overheating or melting.

It was determined that the failure is the result of a manufacturing defect in the epoxy surrounding the coil. The open circuit was caused when the epoxy cracked at the defect and broke a wire running through the epoxy. This wire connected the two coils and this failure caused the open circuit. The defect in the epoxy was caused by the tape surrounding the coils. A piece of the tape protruded into the area between the coils where the epoxy is poured. This created a weak area which resulted in the failure during service.

Figure 1 (attached) shows the starter as received and the coil after removal from the starter. No other defects were seen in the starter assembly except for in the failed coil.

Figure 2 (attached) shows: (A) an optical photograph of the coil before disassembly and sectioning, (B) a radiograph which identifies the crack location, and (C) an enlargement of the radiograph showing where the wire failed.

Figure 3 (attached) shows: (A) an optical photograph of the coil with one plastic cover removed. (B) the coil cross section. The coil was constructed by inserting the copper wire (wrapped in yellow tape) into the housing. Epoxy was then poured into the housing and hardened in stages. (C) shows the epoxy surface with the crack. Some of the copper wire and yellow tape has been removed to show the crack.. Figure 3C shows the epoxy surface with the crack.

The epoxy also separates the two coils except for the copper wire running between them. The yellow areas seen in Figures 4A and 4C are where the yellow tape is sticking out into the epoxy. Figure 4A shows the cracked epoxy surface. The yellow are on the surface is where the tape protrudes into the epoxy. Figure 4B shows the surface of the fracture where the copper wire broke. Figure 4C is a scanning electron microscope photograph of the fracture surface showing the yellow tape. This is the area where the fracture originated. Figure 4D shows an optical photograph of the fracture origin. The fracture surface appears brittle and lines radiating away from the origin can be seen.

No signs of overheating, tackiness or discoloration are visible.

It is likely that the epoxy did not crack until the part was placed in service. Since the epoxy between the two coils was 90% penetrated by the tape, any normal vibration or heat cycling may have been enough to cause the crack.

Ginna plans to examine any additional pre-mature failures for presence of cracks. They are also radiographing selected starters from the same lot for the presence of defects and will take additional actions based upon their findings or based upon the manufacturer's recommendations.

We have provided the above information, including all figures, to Cutler-Hammer for them to investigate/evaluate the situation. We have requested that they provide us with a formal report addressing what the cause of the condition is, whether it is unique or a common problem, what other components may be affected, and what will be done to prevent recurrence. We are expediting them for their response.

If you have any questions, please don't hesitate to call, fax, or e-mail us. If the quality of the faxed photographs is unacceptable, please provide an e-mail address and color copies will be provided.

Assuring you of our best intentions.

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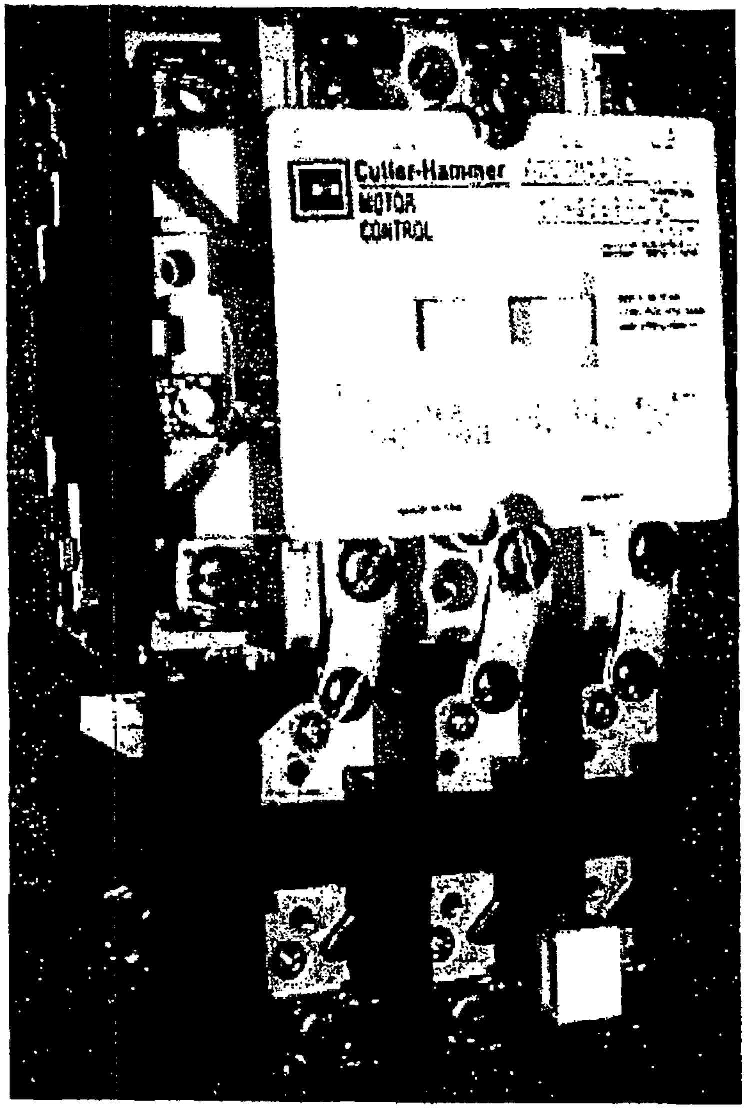
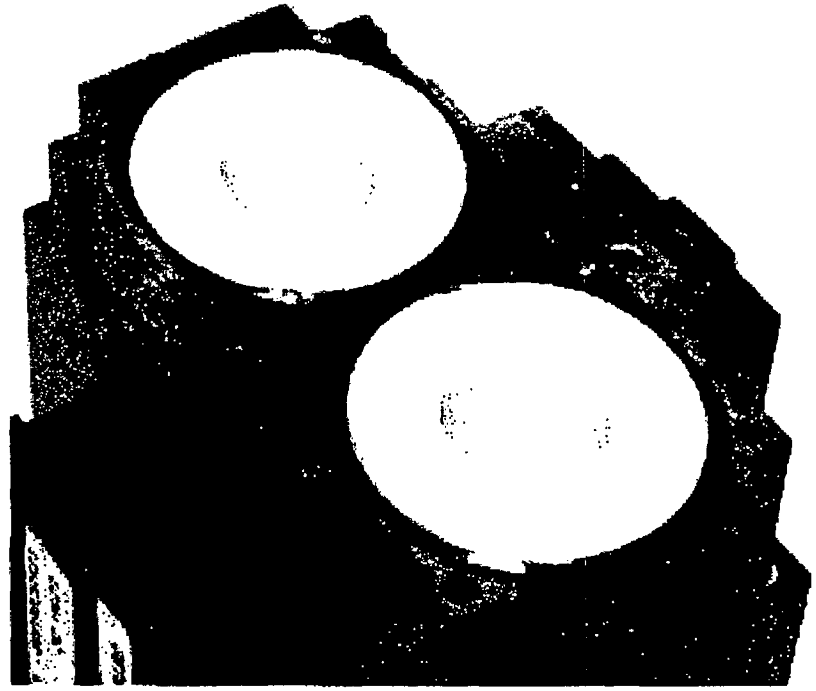
Figure 1 Contactor



Cutler Hammer Motor Control



Motor Control Coil

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Figure 2 Coil Radiographs

Figure 2A

Optical Photograph of the coil- Top View

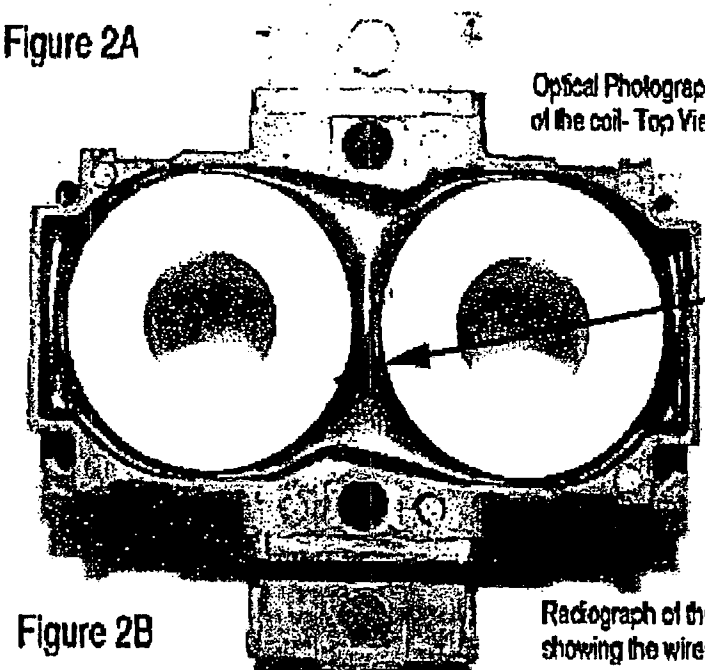
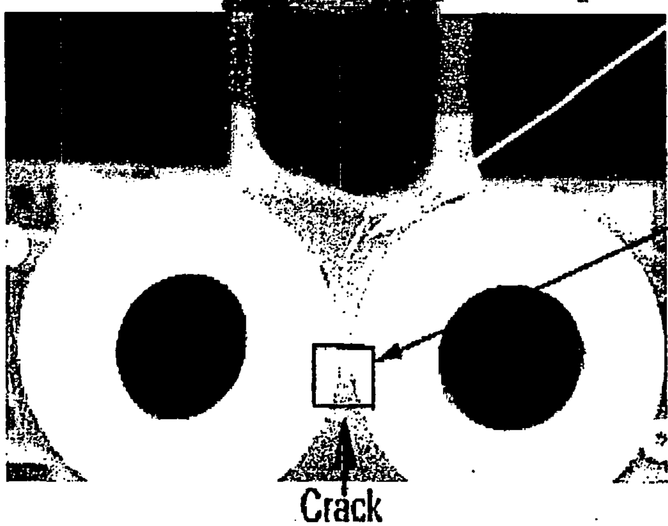


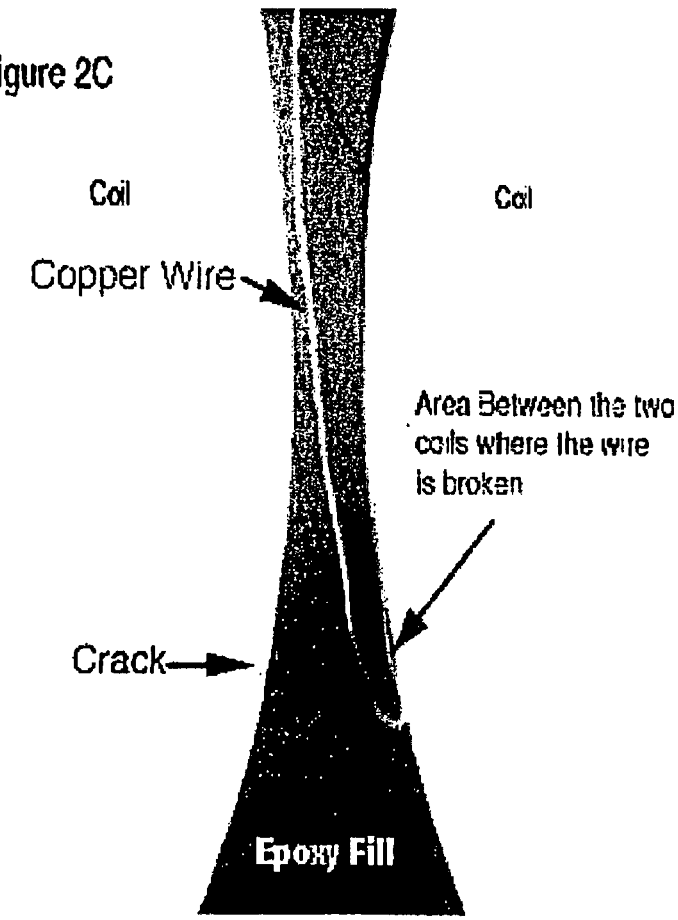
Figure 2B

Radiograph of the Coil- Top View showing the wires connecting each coil



Enlargement of Figure 2B Area between the two coils

Figure 2C



* radiographs courtesy of Ginna LIS group

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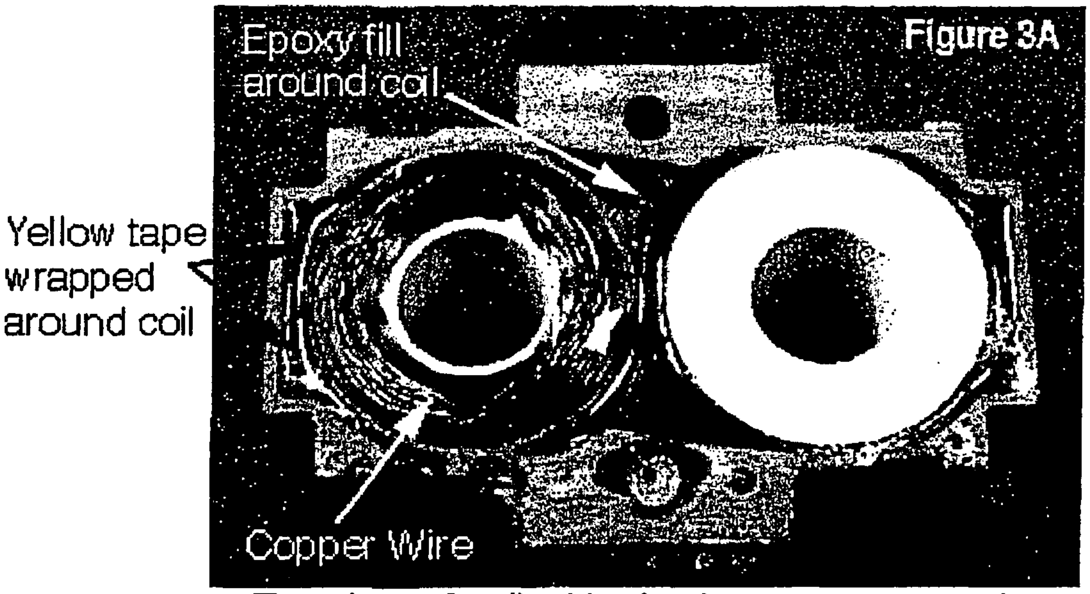
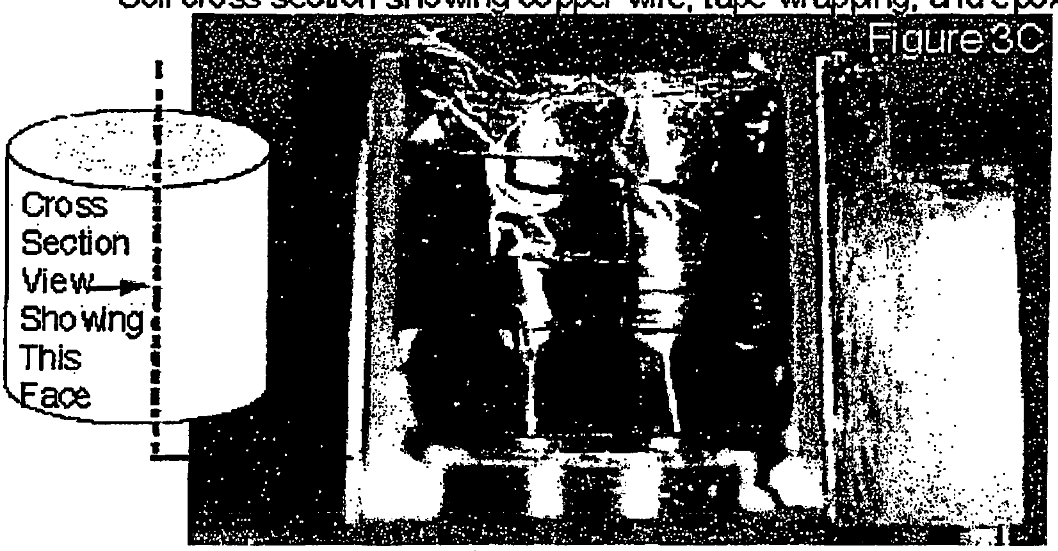
Figure 3 Coil Construction



Top view of coil with plastic cover removed

Coil cross section showing copper wire, tape wrapping, and epoxy fill



Coil cross section with tape and copper removed to show crack

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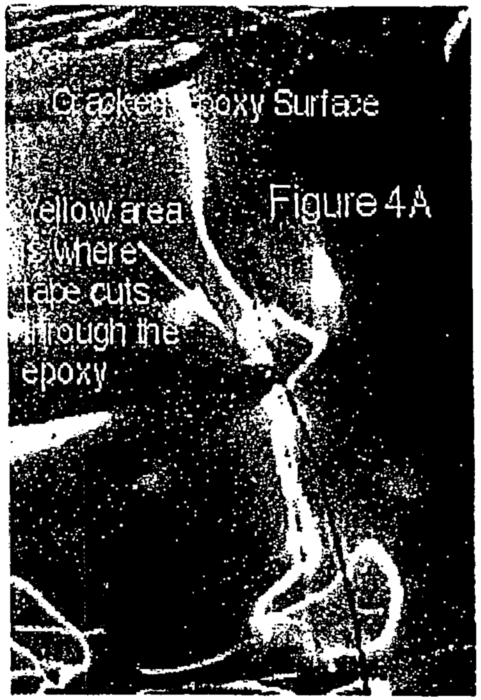
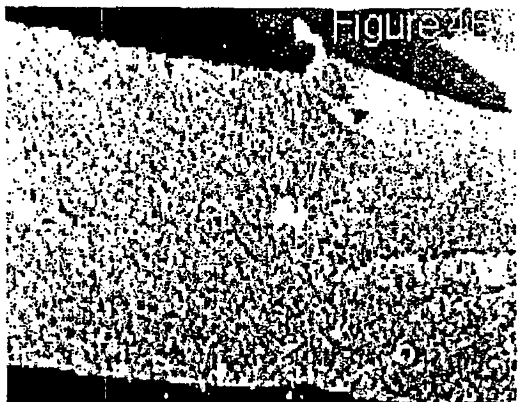
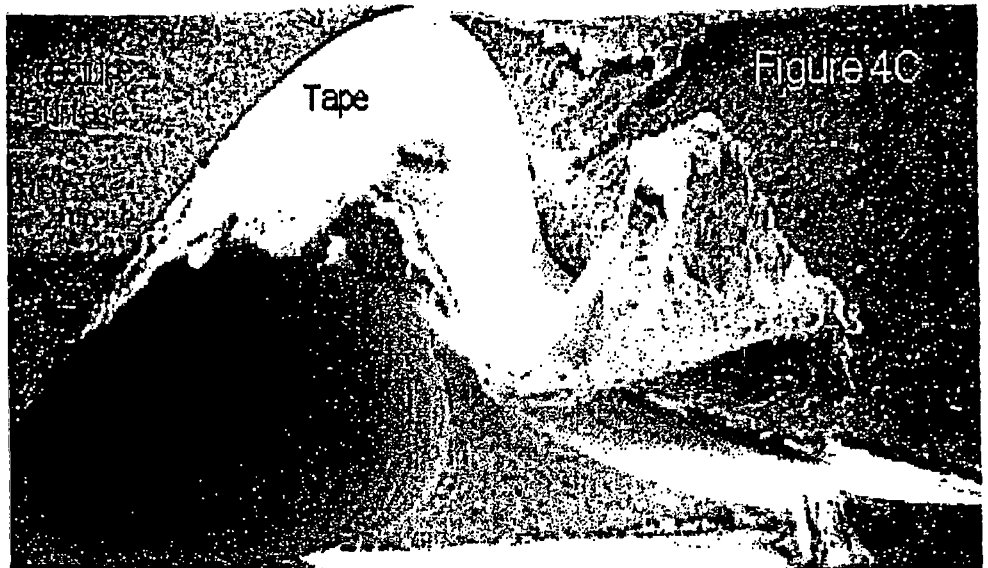
Figure 4 Coil Fracture Face

Cracked Epoxy

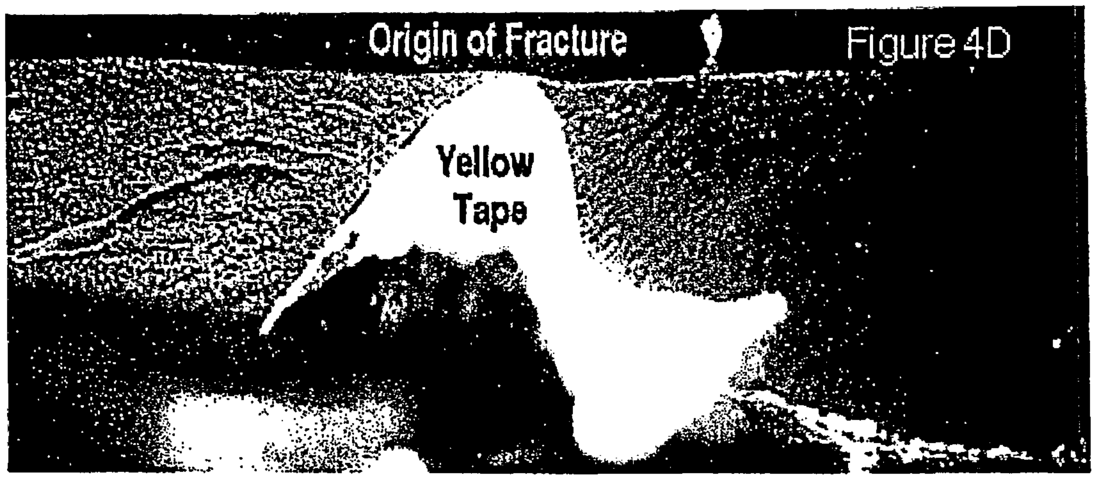




Fracture Surface with broken wire



SEM Photo of the tape defect Magnification ~25x



Fracture surface where the incursion of tape caused a weak area in the epoxy

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