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August 20, 2025

U.S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555-0001

Attention: Document Control Desk
Subject: Notification of Potential Defect - 10CFR Part 21
Product: Regulating Transformer Model 85-IS0150-14

AMETEK Solidstate Controls Inc. is submitting the following Final Report of a Potential Defect discovered on 10/29/2024 in accordance with the requirements of 10CFR Part 21. This is associated with the interim report originally submitted on 12/28/2024 (Log No. 2024-37-00 / Accession No. ML24365A117).

Please contact me if you require any further information.

Sincerely,

Zachary Rumora

Zach Rumora
Quality Manager
Ametek Solidstate Controls

COMPONENT DESCRIPTION:
The AMETEK SCI model numbers listed are for regulating transformers that are intended to take in AC power and output AC power at 120V ± 2% with low harmonic distortion. The specifications for each model is below:

- 85-IS0075-12
  - Input: 460VAC ± 10%
  - Input Current: 24A Max
  - Input Phase: Single Phase
  - Input Frequency: 60Hz ± 0.5%
  - Output Voltage: 120VAC ± 2%
  - Output Phase: Single Phase
  - Output Frequency: 60Hz
- 85-IS0150-14
  - Input: 460VAC ± 10%
  - Input Current: 44A Max
  - Input Phase: Single Phase
  - Input Frequency: 60Hz ± 0.5%
  - Output Voltage: 120VAC ± 2%
  - Output Phase: Single Phase
  - Output Frequency: 60Hz

Note: Model 85-IS0075-12 which was listed on the original interim report was found to be functioning as expected during testing and did not present a failure mode. Therefore, that model has been removed from Appendix A of this updated notification listing the affected sites.

PROBLEM YOU COULD SEE:
During operation the transformer inside of these systems may experience a breakdown in which electricity is able to short from coil-to-ground or from coil-to-coil, typically via the transformer core. This will present thermally as a rapid increase in temperature readings obtained from thermal probes or IR guns, and/or visibly through charring of the coils, magnetic shunts, or core as shown below.

EFFECT ON SYSTEM PERFORMANCE:
Once short circuiting of the coils occurs the system is no longer able to provide regulated output power and needs to be shutdown to prevent further damage to the rest of the unit.

CAUSE:
The following units were returned to AMETEK SCI and investigated: 96000101-0415 and S88434-0414 – model 85-IS0150-14; 96000101-0915 – model 85-IS0075-12. The details and results of this investigation are detailed below for each unit as well as the key materials used in their construction.

85-IS0150-14 Investigation
Dielectric testing was performed on this unit and a short was found from taps 1 and 2 of the secondary coil to ground. Due to this and the condition of the transformer as received, no functional testing could be performed. A destructive teardown was then performed to identify the source of the failure within the transformer.

The apparent source of the failure in system 96000101-0415 was a short-circuit between the secondary coil of the transformer and the magnetic shunts and center leg of the transformer core. A teardown showed evidence that the short started on the top left of the secondary coil, entered and traveled through the left magnetic shunt, then exited the right side of the shunt into the center leg of the core. From there the short circuit entered the right magnetic shunt and exited through the bottom of the shunt back to the secondary coil on the right side of the transformer. Evidence of this path is shown in the photos in appendix B with the small pin holes (photos 1 and 2) demonstrating the suspected arc point, the welding points showing the travel between the shunt and core (3,4), the blowout showing the exit point into the right shunt (5,6), and finally the blow out showing the return of the current from the shunt to the secondary coil (also 6).

These results were confirmed through the evaluation of unit S88434-0414. The Evaluation of this unit found continuity between leads 1 and 2 of the resonant transform coil and leads 5 and 6 of the secondary coil. This continuity should not exist unless a short circuit path is present between the resonance and secondary coils. Further investigation found the apparent electrical path to be from the secondary coil through the magnetic shunt and into the resonant coil. Thus confirming the failure mode identified in unit 96000101-0415.

The suspected cause of this short circuit is the design of the magnetic shunt. The combination of enameled magnet wire without Nomex wrapping, no Glastic side shims, and 5-mil Nomex, allowed for the electrical path described above to be possible. It is unclear when each of the connections in the short circuit may have happened (coil-to-shunts and shunts-to-core) however it can be concluded that the circuit was completed at some point on or before August 13th, 2024, triggering the inciting event when load was applied to the secondary coil.

It is theorized that over time as the transformer experienced constant vibrations from normal operation the insulating Nomex on the shunts may have become partially damaged allowing for the short circuit path to initially develop, however, this cannot be known for certain.

This same failure mode is highly unlikely with the 7.5kVA design as it utilizes Nomex wrapped magnet wire in the construction of the coils. Therefore, the possibility of a short is extremely unlikely due to this additional insulation layer. The testing of the returned 7.5kVA unit is further described below.

85-IS0075-12 Investigation
Further testing of unit 96000101-0915 (model 85-IS0075-12) did not yield a failure mode similar to the one reported except through extraordinarily unusual condition. The unit was run in typical ambient conditions (~20°C) both loaded and unloaded and reached a peak hot spot

temperature of 172°C. After partially blocking the unit vents and repeating the testing the unit had a peak temperature of 179°C. Next, the unit's vents were fully blocked and the ambient temperature for the enclosure was increased to approximately 50°C, and testing was repeated. During this test the highest peak temperature was observed, as the harmonic coil reached 201°C after 8 hours. After completion of this testing the transformer was found to still be operating within expected ranges, however, the extreme conditions and insufficient airflow caused 6 of 8 capacitors in the unit to fail as they had exceeded their rated temperature. Finally, after replacing the capacitors the unit was once again retested in typical conditions. The unit operated nominally with the exception of the transformer being noticeably louder. All dielectric testing was performed and no shorts were found.

The results of the testing unit 96000101-0915 leads to the conclusion that except in certain extreme conditions the 85-IS0075-12 model is expected to continue to operate within its design parameters and that the darkening originally noted is a symptom of increased temperature, but not a sign of impending failure.

Review of Other Materials

A review of the materials used in the equipment returned nominal results. These results are summarized below:

Capacitors:

The capacitors were reviewed and determined to be appropriate for the design. The 70°C rated temperature is determined to be sufficient. The failures noted above during the testing of the 7.5kVA unit returned only occurred under extreme conditions outside of what the unit should be installed in. However, if any capacitors were to fail it would lead to a decrease in output voltage from the system.

Wire Harnesses:

Wire harnesses were reviewed and found to be nominal; no abnormalities were noted.

Transformer Materials:

Records of resin samples taken were reviewed and found to be nominal. The resin design was reviewed and confirmed to be rated for a 220-degree insulation system

10-mil Nomex paper is used in a majority of the design of both models and is sufficient to maintain the 220-degree insulation system. Additionally, the 7.5kVA system uses Nomex wrapped enameled wire which also maintains a 220-degree insulation system. The 15kVA system uses enameled magnet wire without Nomex wrapping. Due to this the 15kVA design has a 200-degree rated insulation system. Therefore the 40-year life will be maintained with a maximum coil hotspot temperature of 180°C or lower. The upper magnetic shunts of both model designs are wrapped in 5-mil Nomex paper. Although thinner than the rest of the design, this thickness still maintains the 220-degree insulation system.

ACTION REQUIRED:
It is recommended that units currently in service are monitored for excessive coil temperature (>180°C or >355°F) that may indicate potential arcing or blockage of a unit's ventilation. Units found to have temperatures above this threshold should be considered for removal from service. These actions can be done in accordance with each site's normal monitoring schedule. The following is also recommended to be added to the standard PM schedule if not already performed:

1. Resistance test of the transformer to ensure no dielectric degradation of the transformer has occurred. This should be performed on the following: coil-to-coil and coil-to-core.

Appendix A lists the currently known population of 85-IS0150-14 model regulating transformer equipment distributed as safety related.

AMETEK SOLIDSTATE CONTROLS CORRECTIVE ACTION:
To prevent similar failures of the transformer used in model 85-IS0150-14, a design change is being implemented to enhance the insulation system. The enameled copper wire currently used for the secondary and resonance coils will be changed to nomex wrapped copper wire. This change adds an additional insulation layer to the transformer significantly reducing the change that a short circuit path can form. There will be a slight increase in the coil dimension, however, this change does not affect the overall fitment of the transformer inside the unit. This design change is expected to be released by August 31st, 2025.

Additionally, an alternative regulating transformer design is available that can replace the existing design. The alternative model (85-IS0150-57) utilizes a 4-core transformer set. This design is a form/fit/function difference from the 85-IS0150-14 model and as such, underwent seismic qualification to verify that it meets the design requirements. The results of the qualification test are recorded in report Q1337.0 Rev. 1. The transformer designs used in the 85-IS0150-57 model are significantly different than those in the 85-IS0150-14 model and are not susceptible to the same failure mode as described in this report.

Appendix A

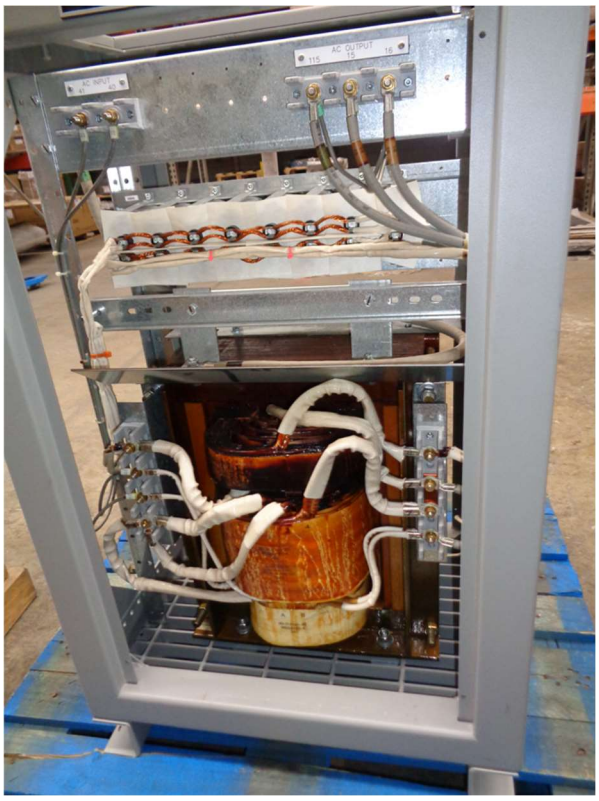
Affected Site	Site Purchase Order	AMETEK SCI Sales Order	Model	Quantity
Southern Nuclear Company – Vogtle	SNG31574-0144	96000101	85-IS0150-14	2
	SNG31574-0144	96000101	85-IS0150-14	4
	SNG31574-0200	96000136	85-IS0150-14	1
	SNG31574-0200	96000136	85-IS0150-14	2
	SNG31574-0226	96000144	85-IS0150-14	1
	SNG31574-0336	96000173	85-IS0150-14	1
	SNG31574-0414	96000190	85-IS0150-14	5

Appendix B

Units as received

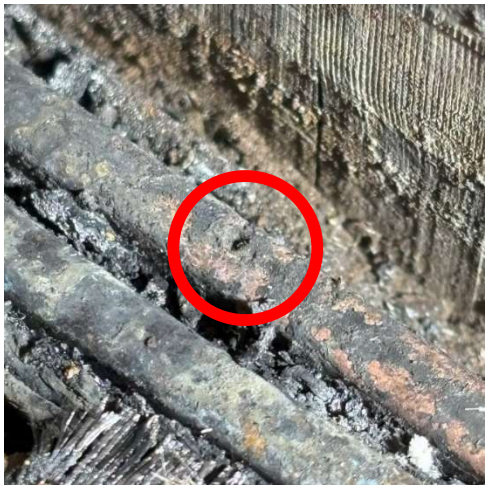
96000101-0415 – 85-IS0150-14

96000101-0915 – 85-IS0075-12



Appendix C

Short Circuit Path – Photo 1



Short Circuit Path – Photo 2

Short Circuit Path – Photo 3

Short Circuit Path – Photo 4

Short Circuit Path – Photo 5

Short Circuit Path – Photo 6