From: Zachary Rumora
To: Hoc, HOO X
Cc: Ethan Salsbury
Subject: [External_Sender] AMETEK Solidstate Controls Follow-up Part 21 Notification
Date: Friday, May 17, 2024 1:05:08 PM
Attachments: Final 10CFR Part 21 Notification.pdf

Hello,

AMETEK Solidstate Controls is submitting the attached follow-up report/notification of a potential defect in compliance with 10CFR21. This follow-up is intended to close the initial report assigned Event/Accession number ML24043A086. Please confirm receipt and feel free to contact me with any additional questions.

Best,

Zach Rumora
Quality and EHS Manager

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May 17, 2024

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: Oil Filled Capacitors in Aluminum Case Part Number 07-020139-10

AMETEK Solidstate Controls Inc. is submitting the following notification of a Potential Defect discovered on December 13th, 2023, in accordance with the requirements of 10CFR Part 21.

This final notification is to follow-up and close the deviation discovered and reported on interim report ML24043A086.

Please contact me if you require any further information.

Sincerely,

Zachary Rumora

Zach Rumora
Quality Manager
Ametek Solidstate Controls

COMPONENT DESCRIPTION:

The information in this section has not been changed from the original interim report (ML24043A086):

This component (07-020139-10) is a 13µF AC oil filled capacitor rated for use at 1000V, 50/60Hz, and 90°C case temperature (50°C environmental temperature).

PROBLEM YOU COULD SEE:

The information in this section has not been changed from the original interim report (ML24043A086):

During operation inside of a piece of equipment (e.g. an inverter) oil may be visible on, around, or dripping from the capacitor or its mounting bracket or tray. If present, the effect of this failure mode will depend on the extent of the leaking experienced. Given sufficient time, enough oil will leak from the capacitor that it will short internally and fail open. “Sufficient time” may be greater than the recommended 10-year preventative maintenance cycle for this part number or it may be less.

EFFECT ON SYSTEM PERFORMANCE:

The information in this section has not been changed from the original interim report (ML24043A086):

These capacitors are typically used in parallel as part of a larger capacitor bank in most equipment. The failure mode that may present in the equipment as a result of one or more capacitors failing is a decrease in output voltage that is directly related to the number of capacitors in the bank that fail. In all cases this would be less than a 3 volt decrease in output voltage.

CAUSE:

At this time there has been no way of recreating the potential defect described above to obtain a root cause. There is no evidence of a broad defect with the general design, manufacture, or use of this capacitor. Ametek SCI identified the below hypothesized causes of failure. Each of these potential failures were then tested by Ametek SCI and/or the capacitor manufacturer to attempt to replicate the failure mode originally discovered; all were unsuccessful. The details of the potential causes of failure and the associated testing are detailed below. There have also been no reports from any end-users of a similar failure modes since issuance of the interim report even with increased vigilance during maintenance activities.

<u>Hypothesized causes of failure:</u>

1. Incorrect method used to install capacitors into capacitor tray assembly or discrepant materials in assembly
    a. Over torquing of capacitor mounting bracket
    b. Capacitors misaligned with mounting holes creating additional mechanical stress to capacitor lid
    c. Capacitors mounted too closely together causing some capacitors to press against others creating additional mechanical stress to capacitor lid and body
2. Defect or modification of capacitor construction methods or materials by manufacturer
3. Damage occurred during shipping that is not able to be identified during visual inspection or electrical testing

<u>Analysis/Testing of hypotheses:</u>

1. Incorrect method used to install capacitors into capacitor tray assembly or discrepant materials in assembly
    a. Over-torqued the capacitor mounting brackets by as much as 3 times the specified torque value
    b. Capacitors were intentionally mounted incorrectly in a capacitor tray assembly in such a way that they were physically contacting each other. This tested for potential added mechanical pressure created by incorrect assembly method.
2. Defect or modification of capacitor construction methods or materials by manufacturer
    a. Suspect capacitors were physically deconstructed to identify potential sources of failure and defects
    b. Fluid leak testing performed at rated and above rated temperature (90°C and 95°C, respectively). Multiple test runs were performed for 7-20 hours.
    c. Reviewed engineering changes, manufacturing processes, and shipping methods with the manufacturer. No changes have been identified.
3. Damage occurred during shipping that is not able to be identified during visual inspection or electrical testing
    a. Manufacturer tested capacitor samples using ISTA test procedure 1G to replicate various shipping forces

Corrective actions are in place (see Corrective Action section) to mitigate the risk of this failure mode and provide reasonable assurance of capacitor performance. This issue will continue to be monitored in accordance with the Ametek Solidstate Controls Quality Program.

ACTION REQUIRED:
Systems should continue to be monitored regularly in accordance with the operation manual associated with each piece of equipment in which these capacitors are installed. It is not apparent that there is a credible risk to capacitors supplied by Ametek SCI currently installed or in-stock with the end-users. However, in the interest of taking the most conservative approach, Ametek SCI suggests that capacitors supplied to end-users on the orders listed in Appendix A are screened for leaking at 90°C for >50 hours. If the end-user has the capability to perform this screening this is recommended, however, Ametek SCI can assist if necessary. Please contact your Ametek SCI parts administrator for assistance. To ensure quick resolution, it is advised that any requested returns are delivered within the next 6 months.

It is recommended that field replacements of these capacitors are done using the 12in·lbs ± 1in·lbs torquing guidelines discussed in the corrective action section. This, however, is considered an enhancement of workmanship practices and not a requirement. For reference this level of torque has been identified to be about “hand-tight” though this is a subjective reference.

AMETEK SOLIDSTATE CONTROLS CORRECTIVE ACTION:
The following actions have been implemented:
1. Ametek SCI has implemented additional testing to screen for the potential leaking of capacitors. The testing consists of mounting the capacitors upside down in a heat chamber and then baking them at 90°C for a minimum of 50 hours. The capacitors are not required to be powered during this testing. This test method provides reasonable assurance that the construction of the capacitors (seals, terminals, etc.) will not fail (i.e. leak) in their intended application without causing damage to their construction. This testing is done as part of the receipt inspection process prior to further testing activities that are part of the commercial grade dedication process.

2. A torque specification of 12in·lbs ± 1in·lbs has been implemented for internal manufacturing and is the recommended torque for field installation. Although over torquing was not shown to have caused the failure mode originally observed, it was determined to be an easily implemented enhancement to further ensure minimal mechanical stress is applied to these capacitors.

APPENDIX A

Client	Client PO Number	Ametek Order Number	Quantity
Duke Energy - Oconee	03173127	46004806	13
TVA - Watts Bar	7555114	46004792	8
Georgia Power - Vogtle 1 and 2	SNG10322052	46004762	25
TVA - Browns Ferry	7499172	46004673	5
STP Nuclear Operating Company	278124	46004662	50
Dominion - Surry	4500855869	46004619	7 (part of assembly number 80-902367-90)
Duke Energy - Catawba	03163283	46004580	122
KHNP - Shin Kori 3 and 4	A220171021	46004359	254