



Date: 7/21/2020

To: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555
Fax Number (301)816-5151

10CFR Part 21 Formal Notification: P21-06032020, Rev. 1

Subject: Failures of Size 1 and 2 Freedom Series Auxiliary Contacts

Pursuant to 10CFR 21.21 (d)(3)(ii), Paragon Energy Solutions is providing formal notification of the identification of a defect.

The following information is required per 10CFR 21.21 (d) (4).

(i) Name and address of the individual or individuals informing the Commission.

Tracy Bolt,
Chief Nuclear Officer
Paragon Energy Solutions
7410 Pebble Drive
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(ii) Identification of the facility, activity, or the basic component supplied for such facility or such activity within the United States which fails to comply or contains a defect.

DUKE Harris Nuclear Plant

(iii) Identification of the firm constructing or supplying the basic component which fails to comply or contains a defect.

Paragon / NLI
7410 Pebble Dr. Fort Worth, Texas 76118

(iv) Nature of defect or failure to comply and the safety hazard which is created or could be created by such defect or failure to comply.

DUKE Harris Nuclear Plant (HNP) has identified instances where Size 1 and 2 Eaton Freedom Series starters have failed to function as expected in assemblies that were originally supplied by NLI. The auxiliary contacts have degraded prematurely and have failed to change state when the starter was energized which has affected indication and other controlling actions within the circuit.

The premature degradation of the auxiliary contacts with the old model NLI special coil, p/n: 057018-COIL-1/2 coupled with the old model control power transformer (CPT), has occurred on size 1 & 2 contactors that were continuously energized with significant run time after approximately 3-5 years of service time. HNP has provided information that to manage the known degradation, the auxiliary contacts should be replaced at an increased frequency until new auxiliary contacts are installed along with the new design NLI special coil, p/n: 057018-COIL-1/2-M.

Based on information provided by HNP; if HNP personnel had not identified the degraded auxiliary contacts (failure mechanism and new expected service time), this deviation could have resulted in a loss of safety function since these auxiliary contacts and old style coils are installed on numerous safety-related air handlers and pumps. Depending on whether the left-side aux contact block or right-side contact block is degraded, determines the impact on safety function of a specific component. Both the left and right-side aux contact blocks are susceptible to premature degradation. Note that some of the impacted air handlers have redundant air handlers in the respective equipment areas that may provide cooling to maintain the safety function. However, there are numerous components that support a safety function on a single train which may be lost if an aux contact failure were to occur.

The identified starters have been installed for 3-5 years, operating in a continuous duty application.

(v) The date on which the information of such defect or failure to comply was obtained.

June 1, 2020

- (vi) **In the case of a basic component which contains a defect or fails to comply, the number and location of these components in use at, supplied for being supplied for, or may be supplied for, manufactured or being manufactured for one or more facilities or activities subject to the regulations in this part.**

Location of the units installed:

DUKE Harris
 DUKE Oconee
 NextEra Turkey Point
 Energy Northwest Columbia
 Dominion North Anna

The part numbers of the affected starters are as follows

Eaton Part numbers	Comments	Eaton Part number designators
AN16DN0AB	When the NLI special coil was first introduced the part number of the starter was not changed. The description of the item included a statement such as: "With NLI Special Coil Part Number 057018-COIL-1/2"	AN16 = Non Reversing Starter
AN16DN0AB-T16		CN15 = Non Reversing Contactor
AN16GN0AB		CN55 = Reversing Contactor
AN16GN0AB-T16		T16 = with ring tongue terminals
CN15DN3AB		
CN15DN3AB-T16		DN = Size 1
CN15GN3AB		GN = Size 2
CN55DN3AB	For process improvement, NLI utilized an NLI part number to distinguish the NLI version with the special coil from the stock version from Eaton. The part number varied by project.	
CN55GN3AB		
CN55GNY1A		
NLI Part Number designations	Suffix	
NLI-AN16DN0AB-MOD	"MOD" = Contains the Original NLI Coil P/N: 057018-COIL-1/2	
AN16GN0AB-T16 SPECIAL	"Special" = Original NLI Coil P/N: 057018-COIL-1/2	
AN700DN022A-T16 SPECIAL		
CN55GN3AB-T16-SPECIAL	"M" = New NLI Coil P/N: 057018-COIL-1/2-M (Not affected by this Notification)	
NLI Coil Part number		
057018-COIL-1/2 = Original Coil for Size 1 and Size 2		
057018-COIL-1/2-M = New Coil for Size 1 and Size 2		

The number of units at each facility is not known as the issue is only related to the units in a continuous duty application.

The nature of the defect is the pre-mature aging of the component within the auxiliary contact mechanism that is adjacent to the operating coil. The starter coil is potentially being subjected to voltages of a nature that elevates the temperature within the starter adjacent to the auxiliary contacts.

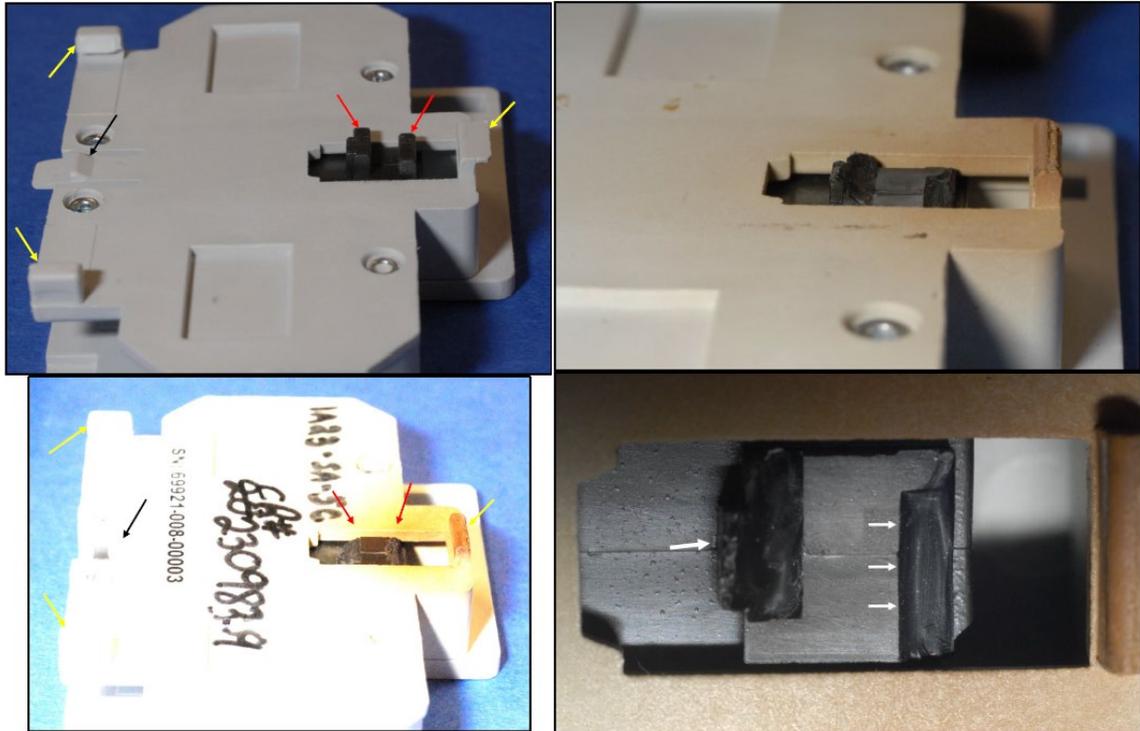
The specific units at HNP that have experienced the damage have been identified and the run times vary from 5 years cycling on and off on 2 week intervals, to 3 years operating in a continuous running application.

Continuous duty application is based on a run time that allows for the unit to reach thermal equilibrium.

(vii) The corrective action which has been, is being, or will be taken; the name of the individual or organization responsible for the action; and the length of time that has been or will be taken to complete the action.

The root cause of the degraded component is due to the increased voltage and the overall temperature of the starter coil at the elevated voltage. This elevated voltage and temperature has degraded the mechanism of the auxiliary contact operator to a point to which it has become separated from the parent component. See example figures below.





Paragon/NLI has investigated the root cause of this issue. The root cause of this issue (elevated voltage) is the same as previous notifications that have been reported. Paragon/NLI has developed the proposed solution below in (viii). In addition, Paragon/NLI has developed a new version of the special coil, (P/N: 057018-COIL-1/2-M) that operates at a lower temperature than the original special coil that is currently in use at HNP. When the new version of the special coil is subjected to the same voltages, the temperature is lower.

(viii) Any advice related to the defect or failure to comply about the facility, activity, or basic component that has been, is being, or will be given to purchasers or licensees.

The current configuration of the size 1 and size 2 motor control center cubicles at HNP that were supplied by NLI, includes a control transformer that has a nominal 4:1 turns ratio (the CPT has an actual turns ratio of ~3.7:1). What this “actual” turns ration does is boosts the secondary voltage of the CPT. Effectively, with no load at 480VAC input, the output on the control circuit will be approximately 129VAC instead of 120VAC. However, at 508 VAC input (HNP nominal bus voltage), the no load voltage would be approximately 137 VAC. This exceeds the rated control circuit voltage of 132VAC. During normal operation it is expected that there is a load on the control circuit since the control transformer is providing power to the starter, relays lights and other components that are connected to the control circuit of the MCC cubicle. This load varies with each cubicle based on the specific application and the number of accessories that are being energized. This loading will cause the control voltage at the coil terminals to droop, however it has been noted in some instances that, even with this

droop, the rated control voltage of 132VAC is still being exceeded. This additional voltage applied along with the original special coil generates the additional heat that is causing the premature degradation/aging of the auxiliary contact component.

It is recommended that the starters and coils be replaced in the applications where the units are being operated in a continuous duty application. It is also recommended that the control transformer be replaced with a true 4:1 ratio transformer. Paragon/NLI has developed a true 4:1 ratio transformer that will provide additional mitigation of this potential over-voltage condition. Replacing the transformer with a true 4:1 ratio, reduces the control voltage that is being applied to the control circuit in a manner that will not prevent the unit from providing a sufficient voltage during a degraded voltage condition, and also will not subject the components to a voltage above the ratings when the supply voltage is operated above the nominal 480 VAC bus voltage.

Paragon has no other recommendations, as the accelerated aging of the components and the expected life based on the additional heat the units have been subjected to is unknown.



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