

Part 21 (PAR)

Event # 51495

<b>Rep Org:</b> ENGINE SYSTEMS, INC.		<b>Notification Date / Time:</b> 10/23/2015 17:00 (EDT)	
<b>Supplier:</b> ENGINE SYSTEMS, INC.		<b>Event Date / Time:</b> 08/26/2015 00:00 (EDT)	
<b>Last Modification:</b> 10/23/2015			
<b>Region:</b> 1	<b>Docket #:</b>		
<b>City:</b> ROCKY MOUNT	<b>Agreement State:</b>	Yes	
<b>County:</b>	<b>License #:</b>		
<b>State:</b> NC			
<b>NRC Notified by:</b> TOM HORNER		<b>Notifications:</b> ALAN BLAMEY	R2DO
<b>HQ Ops Officer:</b> DONG HWA PARK		PART 21/50.55 REACTORS	EMAIL
<b>Emergency Class:</b> NON EMERGENCY			
<b>10 CFR Section:</b>			
21.21(d)(3)(i)		DEFECTS AND NONCOMPLIANCE	

PART 21 REPORT - SPEED SWITCH CAPACITOR FAILURE

The following is a summary of a submitted facsimile:

"Engine Systems Inc. (ESI) began a 10 CFR 21 evaluation on August 26, 2015 upon notification by Harris Nuclear Plant of a ground fault condition after installing two speed switches, P/N ESI50267B, supplied by ESI. Subsequent investigation revealed the condition was due to a failed capacitor installed across the relay output to ground within each speed switch. The evaluation was concluded on October 22, 2015 and it was determined that this issue is a reportable defect as defined by 10 CFR Part 21 . The speed switch output contacts are utilized in the engine's start circuitry and failure of the contacts to function properly could adversely affect the safety-related operation of the emergency diesel generator set.

"This issue only affects one part number (qty 6) supplied on one customer purchase order:

ESI Sales Order: 3013958

Part Number: ESI50267B

Customer: Duke Energy Progress - Harris Nuclear Plant

Customer P.O.: 00763117

ESI Serial Numbers: 3013598-1.1-1, 3013598-1.1-2, 3013598-1.1-3, 3013598-1.1-4, 3013598-1.1-5, 3013598-1.1-6

C of C Date: April 10, 2015

"Point of Contact: Tom Horner, Quality Assurance Manager, Engine Systems, Inc., phone (252) 977-2720"

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**ENGINE SYSTEMS, INC.**175 Freight Road  
Rocky Mount, NC 27804Telephone: 252/977-2720  
Fax: 252/446-1134**TELEFAX**

**Date:** October 23, 2015  
**Company:** NRC Operations Center  
**Fax Number:** 301/816-5151  
**Verification No.:** 301/816-5100  
**Reference:** Report No. 10CFR21-0113, Rev. 0  
**From:** Tom Horner  
**Page:** 1 of 5

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Dear Sir:

Following this cover is a copy of our report 10CFR21-0113, Rev. 0, for a 10CFR21 reportable notification on a speed switch capacitor failure, P/N ESI50267B for Progress Energy - Harris Nuclear Plant.

A copy of this report will be mailed to the NRC Document Control Desk and to our affected nuclear customer.

Should you have questions, please let us know.

Sincerely,

ENGINE SYSTEMS, INC.

A handwritten signature in black ink, appearing to read 'Tom Horner', is written over a horizontal line.

Tom Horner  
Quality Assurance Manager

**ENGINE SYSTEMS, INC.**

175 Freight Road, Rocky Mount, NC 27804

Telephone: 252/977-2720  
Fax: 252/446-1134Report No. 10CFR21-0113  
Rev. 0: 10/23/15**10CFR21 REPORTING OF DEFECTS  
AND NON-COMPLIANCE**COMPONENT: Speed Switch Capacitor Failure  
P/N ESI50267B

SYSTEM: Emergency Diesel Generator

CONCLUSION: Reportable in Accordance With 10CFR21

Prepared By:

Handwritten signature of Ju Lin in black ink.

Engineering Manager

Date:

10/23/15

Reviewed By:

Handwritten signature of the Quality Manager in black ink.

Quality Manager

Date:

10-23-15

Report No. 10CFR21-0113

Record of Revisions

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REV	DATE	PAGE	DESCRIPTION
0	10/23/15		Initial issue.

Report No. 10CFR21-0113

Revision: 0

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**Component:**

Capacitor installed in speed switch P/N ESI50267B.

**Summary:**

Engine Systems Inc. (ESI) began a 10CFR21 evaluation on August 26, 2015 upon notification by Harris Nuclear Plant of a ground fault condition after installing two speed switches, P/N ESI50267B, supplied by ESI. Subsequent investigation revealed the condition was due to a failed capacitor installed across the relay output to ground within each speed switch. The evaluation was concluded on October 22, 2015 and it was determined that this issue is a reportable defect as defined by 10CFR Part 21. The speed switch output contacts are utilized in the engine's start circuitry and failure of the contacts to function properly could adversely affect the safety-related operation of the emergency diesel generator set.

**Discussion:**

The speed switch, P/N ESI50267B, is a later design switch that operates at nominal 125 VDC and is also EMI/RFI compliant per EPRI TR-102323, rev.3. Previous design speed switches operated at 24 VDC and required a separate 125/24 VDC power supply for applications using 125 VDC supply voltage. During the course of EMI/RFI qualification for the 125 VDC unit, it was determined that some modifications to the manufacturer's design were required to meet the susceptibility requirements of RS103. One of these modifications was the installation of eight (8) capacitors across the relay output contacts to ground. In cooperation with the speed switch manufacturer, capacitors were selected for EMI/RFI compliance and testing was completed to verify conformance to EPRI TR-102323, rev.3.

ESI continued with all remaining qualification activities and supplied the speed switches as dedicated, safety-related items to Harris Nuclear Plant. Following installation of two of the speed switches, Harris reported a ground fault condition in the DC voltage system. Troubleshooting determined that the normally open contact of relay 2 on both speed switches had an internal short to ground. The speed switches were returned to ESI and on September 8, 2015 a joint failure analysis was performed with Harris and ESI representatives. Troubleshooting confirmed a low resistance to ground and determined the failed component to be a capacitor that was installed across the relay 2 output contact to ground on both speed switches.

**Impact on Operability:**

If the resistance path to ground were sufficiently low, the ability of the relay output contacts to pick-up associated components would be compromised. In the case of Harris plant, the speed switch relays are used in the safety-related EDG start circuitry to energize electrically operated solenoid valves and relays. Failure to actuate any of these components could adversely affect the safety-related operation of the emergency diesel generator.

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**Root cause evaluation:**

During selection of the components required for the switch to meet EMI/RFI compliance, capacitors were selected that had a voltage rating less than the system voltage of the intended application. The capacitors selected had 100 VDC rating whereas the system voltage is 125 VDC nominal, with voltages as high as 140 VDC. Failure analysis performed on the capacitors determined the failure was due to an Electrical Over Stress (EOS) event; whereby high voltage caused the electric charge to concentrate near the edge of the inner electrode print pattern which generated a stress failure at that location. Continued application of current at the shorted location generated heat and lead to crack propagation, as visibly noted on the failed capacitors.

**Evaluation of previous shipments:**

This issue only affects one part number (qty 6) supplied on one customer purchase order:

ESI Sales Order	Part Number	Customer	Customer P.O.	ESI Serial Numbers <sup>(1)</sup>	C-of-C Date	Qty
3013958	ESI50267B	Duke Energy Progress - Harris Nuclear Plant	00763117	3013598-1.1-1 3013598-1.1-2 3013598-1.1-3 3013598-1.1-4 3013598-1.1-5 3013598-1.1-6	April 10, 2015	6

Note (1): All six of the speed switches supplied to Harris have been returned to ESI under warranty. Serial numbers 3013598-1.1-5 and 3013598-1.1-6 were the failed assemblies. The remaining four speed switches were inspected and tested by ESI and no abnormal conditions were noted.

**Corrective Action:**

No action is required by the customer. All six affected speed switches have been returned to ESI under warranty.

To prevent reoccurrence the following actions are being implemented by ESI:

- For the specific Harris application to which P/N ESI50267B was supplied, the customer only requires compliance to the Electrically-Fast Transient/Burst testing (EFT) portion of EPRI TR-102323, rev.3. Therefore, the modifications that were performed to the speed switch to meet the entire EPRI TR-102323, rev.3 requirements will be removed. The only modifier remaining will be the metal oxide varistors (MOVs) that are installed for surge protection. This has been denoted internally via a manufacturer's part number change; however ESI will supply the speed switch under existing part number ESI50267B since this is an application specific part number that has only been supplied one time and all affected switches have been reworked. This action has been completed.
- For all other applications requiring full compliance with EPRI TR-102323, rev.3, the capacitors installed across the relay outputs to ground will be upsized from 100 VDC to 200 VDC rating; thereby encompassing the system operating voltage upper limit. This action is being completed by the manufacturer and will be incorporated on all speed switches of this style going forward.