



**ENGINE SYSTEMS, INC.**

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October 26, 2017

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

Subject: 10CFR21 Reporting of Defects and Non-Compliance -  
Engine Systems, Inc. Report No. 10CFR21-0118, Rev. 0

Speed Switch  
PNs ESI50267C, ESI50267E, ESI50267H, and ESI50267K

Dear Sir:

The enclosed report addresses a reportable notification on a speed switch,  
PNs ESI50267C, ESI50267E, ESI50267H, and ESI50267K.

A copy of the report has been mailed to our affected nuclear customers.

Please sign below, acknowledging receipt of this report, and return a copy to the  
attention of Document Control at the address above (or, fax to number 252/446-1134)  
within 10 working days after receipt.

Yours very truly,

ENGINE SYSTEMS, INC.

Susan Woolard  
Document Control

FE19  
NRR

Please let us know if ANY of your mailing information changes - name of recipient, name  
of company/facility, address, etc. Mark the changes on this acknowledgment form and  
send to us by mail or FAX to the number above.

93.

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DATE: \_\_\_\_\_



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**Report No. 10CFR21-0118**

Rev. 0: 10/26/17

**10CFR21 REPORTING OF DEFECTS  
AND NON-COMPLIANCE**

COMPONENT: Speed Switch  
P/Ns ESI50267C, ESI50267E, ESI50267H, and ESI50267K

SYSTEM: Emergency Diesel Generator

CONCLUSION: Reportable in Accordance With 10CFR21

Prepared By:   
Engineering Manager

Date: 10/26/17

Reviewed By:   
Quality Manager

Date: 10-26-17

REV	DATE	PAGE	DESCRIPTION
0	10/26/17		Initial issue.

**Component:**

Speed switch P/Ns ESI50267C, ESI50267E, ESI50267H, and ESI50267K.

**Summary:**

Engine Systems Inc. (ESI) began a 10CFR21 evaluation on September 12, 2017 upon notification of a potential issue with speed switch P/N ESI50267K supplied to Hope Creek Nuclear Generating Station. The speed switch had reportedly failed in service which resulted in a failure to start of the emergency diesel generator. An analysis performed by Exelon PowerLabs determined the failure was due to a shorted capacitor that is installed on the speed switch's relay output contacts to ground. The evaluation was concluded on October 25, 2017 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 to function properly could adversely affect the safety-related operation of the emergency diesel generator set.

**Discussion:**

The speed switch supplied to Hope Creek is P/N ESI50267K which corresponds to Dynalco P/N SST2400A-416. ESI assigns a unique part number to represent specific customer setpoints and qualification requirements. All of the ESI50267x series part numbers are of the same Dynalco P/N SST2400A-416 design (except P/N ESI50267B).

This speed switch design is fully EMC compliant in accordance with EPRI TR-102323, rev.3. In order to meet the EMC requirements, some design modifications were made during the EMC qualification. One of these modifications was the addition of eight (8) capacitors, C1 through C8, installed from Normally Open-to-Ground and Common-to-Ground for the speed switch's relay output contacts (the switch has four relays). See Photo 1 below and Figure 1 on the following page showing location of capacitors. The modifications utilized for EMC compliance were incorporated into the speed switch design by the OEM and offered as a unique part number SST2400A-416.

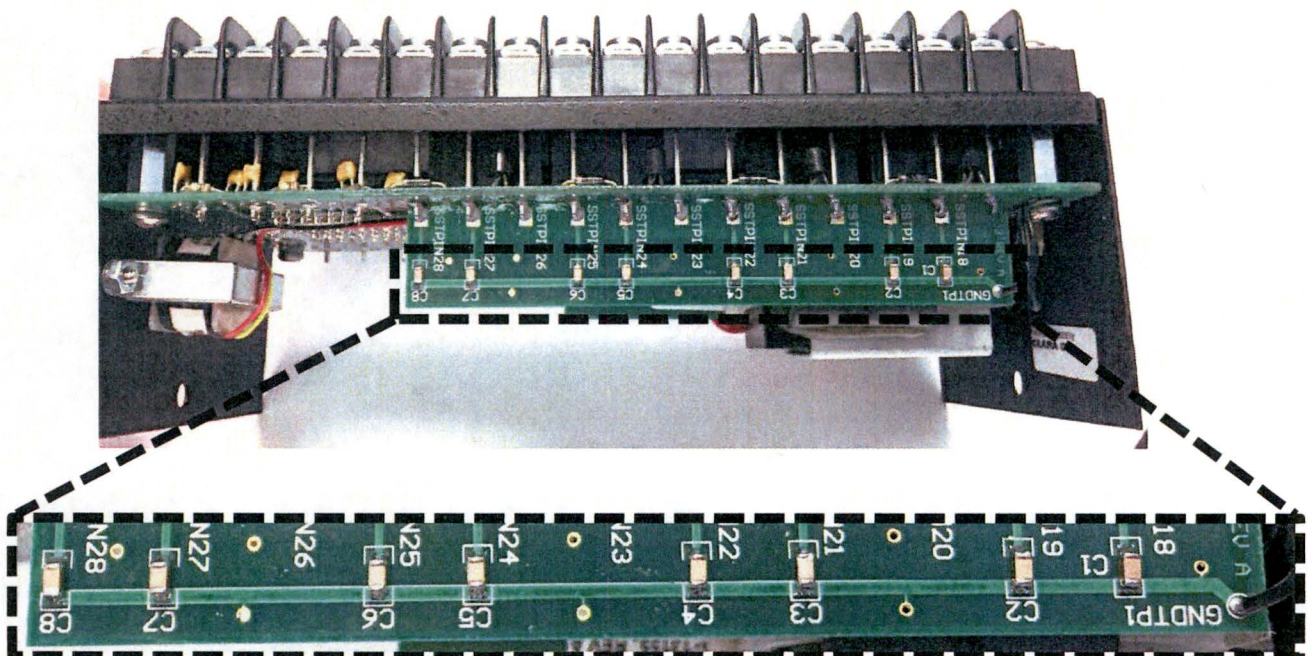


Photo 1: View Showing Capacitors C1 through C8

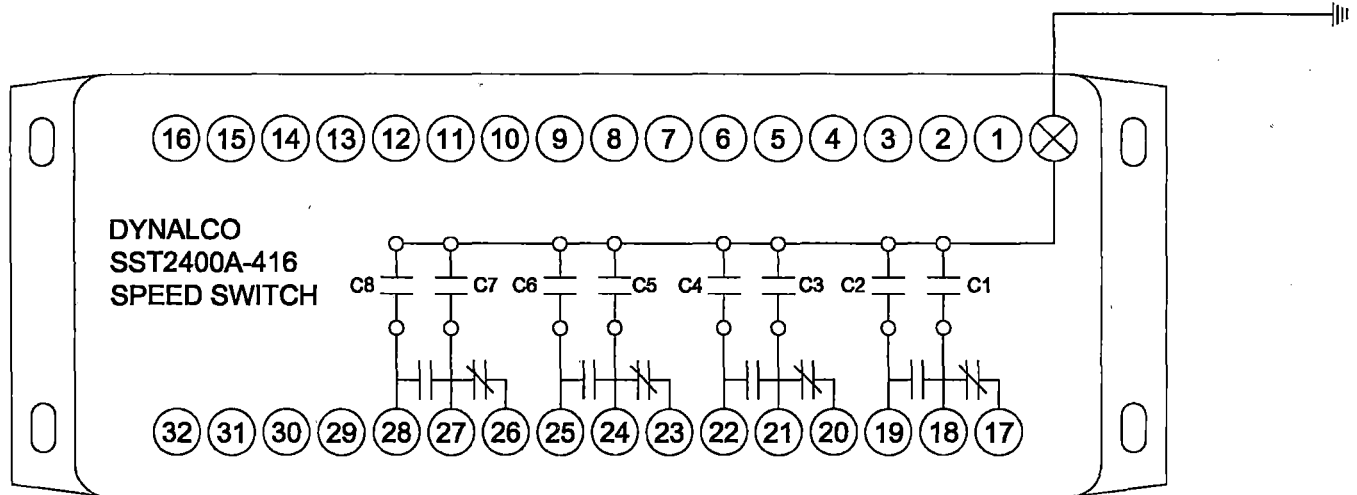


Figure 1: Schematic Representation of Capacitors Installed on Relay Output Contacts

The failed speed switch at Hope Creek was sent to Exelon PowerLabs for analysis. It was determined that capacitor C4 (terminal 22 to ground) had degraded and exhibited a low-resistance path to ground. Capacitor C4 is rated for 200 VDC working voltage and has a withstand voltage of 500 VDC. Further investigation revealed that although the nominal system voltage is 120 VDC, the customer's external relay coils that are connected to the speed switch output contacts do not have transient suppression, such as with a flyback diode. In these cases, the voltage transient produced when de-energizing the relay's coil is large enough to damage the capacitors. Hope Creek recorded a voltage spike exceeding 1467 VDC.

For customers that have flyback diodes or a similar transient suppression device across the external relay coil, there is no issue. However for customers without such protection, the magnitude of the voltage transient may be sufficient to damage and degrade the capacitor to the point of a low resistance path to ground.

**Impact on Operability:**

If the resistance path to ground were sufficiently low, the ability of the relay output contacts to pick-up and/or drop-out associated components would be compromised. The speed switch relays are used in safety-related EDG start circuitry to control various electrical relays. Failure to properly control any of these components could adversely affect the safety-related operation of the emergency diesel generator.

**Root cause evaluation:**

The root cause of the failure is a deficiency in the design and selection of the EMC mitigating components. Consideration was not given for the impact of voltage transients imparted on the capacitors during coil de-energization. For customers without suppression from the inductive kick, the magnitude of voltage transients may be sufficient to damage and ultimately degrade the capacitors to the point of failure.

**Evaluation of previous shipments:**

This issue applies to all customers that were supplied the fully EMC compliant, 125 VDC speed switch by ESI. See table below:

ESI Sales Order	Part Number	Customer	Customer P.O.	Qty	C-of-C Date
3015066	ESI50267C <sup>1</sup>	Exelon - Nine Mile Pt.	00582889	3	9/22/2016
3016146	ESI50267C <sup>1</sup>	Exelon - Nine Mile Pt.	00587949	1	11/22/2016
3014884	ESI50267E <sup>2</sup>	Exelon - Quad Cities	00563670	2	8/31/2016
3015316	ESI50267E <sup>2</sup>	Exelon - Quad Cities	703; Rel. 12702	2	9/15/2016
3015745	ESI50267E <sup>2</sup>	Exelon - Dresden	703; Rel. 12726	3	11/23/2016 (qty 1) 11/30/2016 (qty 2)
3015982	ESI50267H	FirstEnergy - Davis Besse	45500676	2	11/4/2016
3016506	ESI50267K <sup>3</sup>	PSEG - Hope Creek	4500959851	6	2/20/2017 (qy 5) 3/17/2017 (qty 1)

- Notes: (1) P/N ESI50267C was supplied as a component of speed sensing panel assembly ESI51155B.  
(2) P/N ESI50267E was supplied as a component of speed sensing panel assembly ESI51155A.  
(3) The failed speed switch, S/N 3016506-1.1-3, was from this batch of six (6) supplied to Hope Creek.

**Corrective Action:**

- (1) For those customers that have transient suppression across the associated relay (i.e. VSR or ESR relays at the Exelon plants), there is no negative impact. The speed switch will operate properly in this system.
- (2) For those customers that do not have transient suppression across the associated relay (i.e. CRR, ASR, LSR, and HSR at Hope Creek), this speed switch design is not appropriate for their system. Any speed switch(es) that are installed should be removed from service.
- (3) ESI is currently evaluating options for re-designing the speed switch while maintaining the EMC compliance desired by many customers. This evaluation is underway and is expected to be complete within 60 days.