



**ENGINE SYSTEMS, INC.**

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June 9, 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. 10CFR21-0117, Rev. 0

Motor Operated Potentiometer Without Pre-Position Feature  
PNs: 72-07900-100-ESI, 2-04E-184-103-ESI, 2-00G-009-002-ESI

Dear Sir:

The enclosed report addresses a reportable notification on a motor operated potentiometer without pre-position feature, P/Ns: 72-07900-100-ESI, 2-04E-184-103-ESI, and 2-00G-009-002-ESI.

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

1E19  
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.

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RECEIVED: \_\_\_\_\_

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



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**Report No. 10CFR21-0117**

**Rev. 0: 06/09/17**

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

**COMPONENT:** Motor operated potentiometer without pre-position feature  
P/Ns: 72-07900-100-ESI  
2-04E-184-103-ESI  
2-00G-009-002-ESI

**SYSTEM:** Emergency Diesel Generator

**CONCLUSION:** Reportable in accordance with 10CFR21

Prepared By: *Ju Min*  
Engineering Manager

Date: 6/9/17

Reviewed By: *Thomas W. H.*  
Quality Assurance Manager

Date: 6-9-17

REV	DATE	PAGE	DESCRIPTION
0	06/09/17		Initial issue.

**Component:**

Motor operated potentiometer without pre-position feature.

**Summary:**

Engine Systems Inc. (ESI) began a 10CFR21 evaluation on April 12, 2017 following correspondence with Duke Energy - Catawba Nuclear Plant of a potential issue with a motor operated potentiometer (MOP) supplied by ESI. During bench testing, Duke was unable to adjust the cams of the MOP to operate the pre-position feature (also referred to as return-to-center). Further investigation revealed that the MOP supplied to Duke did not contain the desired cam arrangement.

The evaluation was concluded on June 8, 2017 and it was determined that this issue is a reportable defect as defined by 10CFR21. For installations that rely on the pre-position function to drive generator output voltage to a pre-determined setpoint in an emergency event, an incorrect cam arrangement on the motor operated potentiometer could negatively affect the emergency diesel generator set's output voltage. This may prevent the EDG from carrying its safety-related loads in an emergency event.

**Discussion:**

A motor operated potentiometer is commonly used in the voltage regulator system of emergency diesel generator sets to allow for local or remote adjustment of generator output voltage. The assembly supplied by ESI was a replacement for obsolete Portec/NEI part number 72-07900-100. ESI initiated a Supplier Deviation Notification (Part Number Change) to replace the obsolete part with one that would serve as a functional replacement using the same mounting footprint. To accomplish this, a Basler brand MOP was selected. The "-ESI" suffix was added to designate a modification to the Basler MOP by replacing the standard 2W, open-wound potentiometer with a 3W, precision-wound potentiometer identical to the one used in the original Portec units. The SDN indicated that the replacement MOP would have the pre-position feature. Note that the SDN would later be revised to include replacements for Cooper-Bessemer part numbers 2-04E-184-103 and 2-00G-009-002 which represented the same Portec part number 72-07900-100.

The Basler MOP selected by ESI for the assembly was model MOC2103. A review of Basler model MOC2103 indicates that it is not a return-to-center style device and instead contains a standard cam arrangement. Photos on the following page depict the differences between the two cam arrangement styles. ESI inadvertently selected the incorrect model for this application. Reviewing the qualification testing performed by ESI revealed that ESI's testing duplicated the original Portec test procedure (whereby one cam is set to close above setpoint and one cam is set to close below setpoint). However, the testing was shown to be inadequate to fully ensure the return-to-center functionality. Though the cams were properly set above and below setpoint, a further verification that the unit would return to center, even if sufficiently away from setpoint, was not performed. For installations that rely on the pre-position function, it is possible that the MOPs supplied by ESI would not return the potentiometer to setpoint. Since the MOP is used to set output voltage of the emergency diesel generator, the consequences of this issue are that the EDG may not maintain voltage within its required range to support its safety-related loads.

**Root cause evaluation:**

ESI selected the incorrect MOP to be used for this assembly. The original MOP used was an Portec/NEI P/N 72-07900-100 which became obsolete in the 1990s. ESI offered a replacement assembly (using the "-ESI" suffix) that included a Basler brand MOP, modified by replacing the factory supplied potentiometer to replicate the original Portec design. The original Portec MOP had the return-to-center feature and Basler offers some models with return-to-center and some without. ESI inadvertently selected the model without return-to-center.

As a secondary cause, ESI's functional testing did not adequately verify the MOPs ability to return to center. The test procedure has steps to set the cams and limit switches as would be performed for the return-to-center style; however, the testing did not ensure that the cams would return the potentiometer back to the center, regardless of starting position.

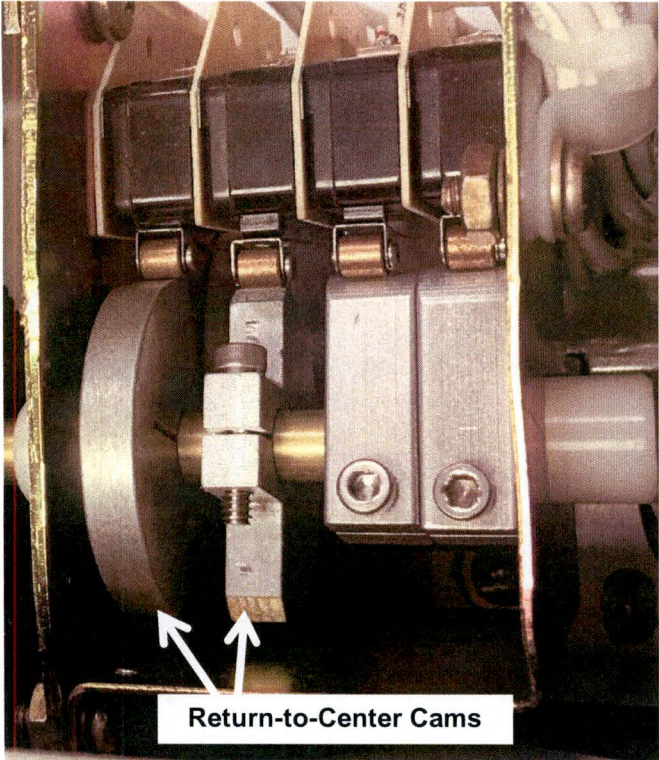


Photo 1: Desired Return-to-Center Cam Arrangement

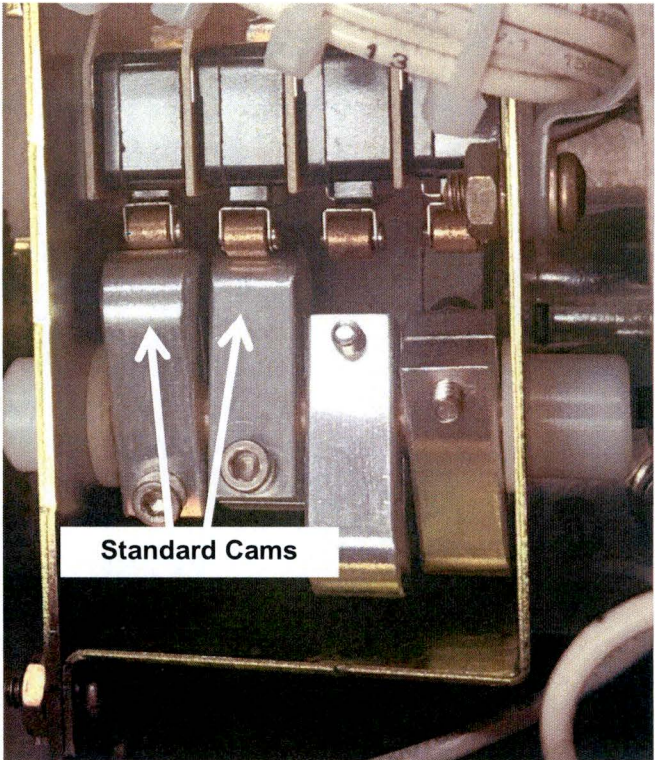
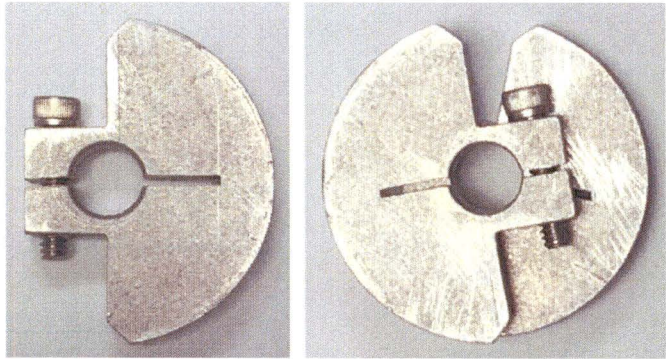


Photo 2: As-Supplied Standard Cam Arrangement



Photos 3&4: Return-to-Center Cam Profile & Arrangement

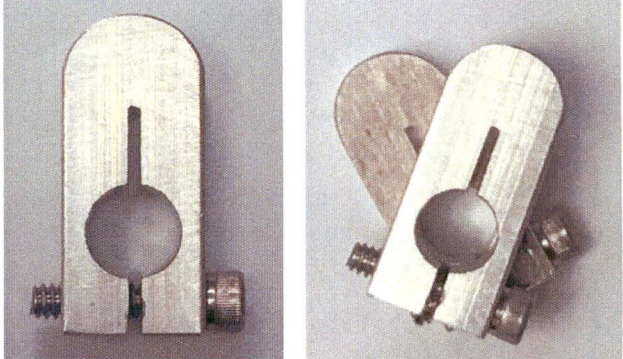


Photo 5&6: Standard Cam Profile & Arrangement

**Evaluation of previous shipments:**

ESI has supplied the replacement MOP from 2009 to 2016 on five (5) separate safety-related orders. A review of each order indicates that the incorrect MOP was selected for the assembly.

**Affected Customers:**

ESI has supplied motor operated potentiometers with the incorrect cam arrangement to the following customers.

Part Number	Customer	Customer PO	Qty	ESI Serial Number	MOP Serial Number	C-of-C Date
72-07900-100-ESI	Duke Energy - Catawba	196046	6	3013905-1.1-1 thru 6	H01931980 H01995582 H01995584 H01995585 H01995586 H01995587	5/30/2015
	Dremel/CFE - Laguna Verde	14-011/700427979	1	3011566-3.1-1	H01798043	2/13/2015
2-04E-184-103-ESI	APS - Palo Verde	500530279	3	3005695-1.1-1 thru 3	H00958610 H00961219 333861	7/31/2009
	APS - Palo Verde	500555659	3	3008341-1.1-1 thru 3	H01151813 H01161548 H01161550	2/2/2012
2-00G-009-002-ESI	South Texas Project	200410	2	3015607-1.1-1 thru 2	H02027435 H02027436	8/19/2016
<b>Total Quantity</b>			<b>15</b>			

**Table 1: Affected Users**

**Corrective Action:**

- Customers that have installed the motor operated potentiometer must evaluate the impact on their specific system. It may be acceptable to continue to use the MOP if other provisions are in place to ensure the EDG voltage is within an acceptable range for safety-related operation. Credit may also be taken for site acceptance testing following installation of the MOP. If the MOP is deemed acceptable for the application, no further action is necessary.
- For those customers that have determined the MOP is unacceptable for their application and/or would simply rather ensure they have the correct MOP, it may be returned to ESI for warranty replacement. Once a warranty order and Return Goods Authorization (RGA) is issued, supply of safety-related replacement MOP(s) is expected to be complete within 90 days.
- To prevent recurrence of this issue, ESI is implementing a revision to the procurement process for this assembly to update the part number of the MOP utilized. In addition, the dedication inspection and testing activities are being revised to ensure testing properly validates the return-to-center feature. This action is currently underway and will be completed prior to any future shipments.