

General Information or Other (PAR)

Event # 45459

<b>Rep Org:</b> ENGINE SYSTEMS, INC	<b>Notification Date / Time:</b> 10/23/2009 16:32 (EST)
<b>Supplier:</b> ENGINE SYSTEMS, INC	<b>Event Date / Time:</b> 08/24/2009 (EDT)
	<b>Last Modification:</b> 12/01/2009
<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> PAUL STEPANTSCHENK	<b>Notifications:</b> NEIL OKEEFE R4DO
<b>HQ Ops Officer:</b> BILL HUFFMAN	J.THORP (e-mail) NRR
<b>Emergency Class:</b> NON EMERGENCY	O.TABATABAI (e-mail) NRO
<b>10 CFR Section:</b>	
21.21 UNSPECIFIED PARAGRAPH	

#### INTERIM REPORT ON THERMOSTATIC VALVE FAILURE ON PALO VERDE EDG

"This interim report is being issued because Engine Systems, Inc. (ESI) is not able to complete an evaluation of an identified deviation within the 60 day requirement of 10CFR21.21. The evaluation is expected to be completed no later than November 30, 2009.

"ESI began an evaluation of a thermostatic valve element failure on August 24, 2009. Palo Verde Nuclear Plant notified ESI of the failure as a result of a failure analysis they were performing on a thermostatic valve that had been removed from the lube oil system of their 2A-EDG. The element was in service since April 2008 and Palo Verde verified operation of the element prior to installation.

"The Palo Verde failure analysis determined that one of two elements within the valve was defective. The element failure was attributed to wax leakage past the diaphragm seal on one of two power pills within the element. Evidence of mechanical binding of the piston is believed to have caused the wax leakage. If the piston was jammed, the expanding wax could have over pressurized the diaphragm seal leading to wax leakage. The failure analysis noted the following to support piston binding:

- The piston was initially difficult to remove from its guide tube.
- A gouge was observed on the piston surface.
- The rubber plug within the power pill exhibited brass machining chip debris.

"ESI has been coordinating with Palo Verde and the manufacturer (AMOT) to complete our evaluation and to determine if this is a generic issue or if it is an isolated incident.

"To date, no other similar failures with AMOT thermostatic valves have been reported to ESI."

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Palo Verde has Cooper Bessemer KSV-20T diesel engines that use one 6" thermostatic valve in the engine jacket water system and one in the engine lube oil system to regulate system temperatures during engine operation. The thermostatic valve is an AMOT model 6HAS. The AMOT thermostatic valve element (P/N 9760X) is the defective part. ESI did not provide any information on other nuclear power plants that have EDGs that utilize this model thermostatic valve.

\*\*\* UPDATE RECEIVED VIA EMAIL FROM PAUL STEPANTSCHENKO TO DONG PARK AT 1642 EST ON 12/01/09 \*\*\*

"This report is a follow-up to an interim report (1 OCFR21-0098-INT) issued by Engine Systems, Inc. (ESI) on 10/23/09 which identified a deviation with an Amot thermostatic valve element. The interim report was issued because ESI was not able to complete the evaluation within the 60 day requirement of 10CFR21. The evaluation was completed on 11/30/09 and the deviation was determined be a reportable defect as by defined by 10CFR21.

"The Exelon analysis also reports that similar brass machining debris was observed on the plugs from the other three power pills to varying degrees. None of the stems of these pills displayed evidence of gouging or binding.

"To date, no other similar failures with Amot thermostatic valves have been reported to ESI.

"ESI has contacted the valve manufacturer (Amot) to discuss these findings. A copy of the Palo Verde failure analysis and eleven (11) element assemblies from ESI inventory were sent to Amot for evaluation. The following elements were sent to Amot for evaluation:

"- Qty. 8: PIN 9760 X-170' (CES PIN 2-05V-419-107)

"- Qty. 3: PIN 9760 X-160' (CES PIN 2-05V-419-109)

"Both part number elements are the same except for the temperature setting ("-170" indicates HOoF nominal and "-160" indicates 160°F nominal).

"Upon completion of their evaluation, Amot has reported the following:

"- Fine shavings/powder of brass was observed in some of the element pills.

"- None of the pill stems had any evidence of gouging.

"- The pills used in the 9760X elements are made by converting another part number pill. This conversion consists of removing the stem from the pill and performing some machining. Amot believes the brass debris may have entered the pill as a result of this conversion process.

"- Amot has not made any changes to this conversion process in recent history and has not had reports of similar problems with these elements.

"- Machining debris, while undesirable, was evident in other pills which did not exhibit any operability issues; therefore this is not believed to be the cause of the pill failure.

"- The primary cause of the failure is believed to be the gouge found in the pill stem. The gouge could have occurred during the conversion process as the stem is removed and handled at that time.

"- As a precaution, Amot has made changes to their conversion process for this pill. The drilling fixture was modified to eliminate the possibility of chips entering the pill during the machining operation. This change was made effective 10/22/09.

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"A listing of users with the thermostatic valves that contain the Amot 9760X element is provided in the table below.

"Site -	Thermostatic Valve -	System:
"Braidwood -	6HAS -	Lube
"Byron -	6HAS -	Lube
"Nine Mile Point -	6HAS-	Lube
"Oconee -	4HAS & 6HAS -	Water
"Palo Verde -	6HAS -	Lube & Water
"South Texas Project -	6HAS -	Lube & Water
"Susquehanna -	6HAS -	Lube & Water
"Waterford -	5HAS & 6HAS -	Lube & Water

"Corrective Action: The element failure at Palo Verde is considered to be an isolated incident related to a gouge in the pill stem. Thus, there is no recommended corrective action for users of the Amot 9760X element. The evaluation also indicated a weakness in Amot's manufacturing process for the element pill which introduced machining debris. While not believed to be the cause of the Palo Verde element failure, machining debris within the element pill is undesirable and increases the potential for failure in the future. Users with thermostatic valves containing Amot PIN 9760X elements should be aware of this issue so that they can monitor their systems for any indications of thermostat element problems.

Notified R1DO (Holody), R2DO (Guthrie), R3DO (Riemer), R4DO (Deese), NRR (Thorp) via e-mail, NRO (Tabatabai) via email.

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## ENGINE SYSTEMS, INC.

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### TELEFAX

**Date:** December 1, 2009  
**Company:** NRC Operations Center  
**Fax Number:** 301/816-5151  
**Verification No.:** 301/816-5100  
**Reference:** Report No. 10CFR21-0098, Rev. 0  
**From:** Paul Stepantschenko  
**Page:** 1 of 7

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Dear Sir:

Following this cover is a copy of our report 10CFR21-0098, Rev.0, for a 10CFR21 reportable notification about an Amot thermostatic valve element, P/N 9760X.

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

Should you have questions, please let us know.

Sincerely,

ENGINE SYSTEMS, INC.

Paul Stepantschenko  
Quality Assurance Manager



**ENGINE SYSTEMS, INC.**

175 Freight Road, Rocky Mount, NC 27804

Telephone: 252/977-2720  
Fax: 252/446-1134

**Report No. 10CFR21-0098**  
Rev. 0: 12/01/09

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

COMPONENT: Amot thermostatic valve element  
P/N: 9760X

SYSTEM: Emergency Diesel Generator -- lube oil & jacket water system

CONCLUSION: Reportable in accordance with 10CFR21

Prepared By: *D. [Signature]*  
Engineering Manager

Date: 12/1/09

Reviewed By: *[Signature]*  
Quality Assurance Manager

Date: 12/1/09

REV	DATE	PAGE	DESCRIPTION
0	12/01/09		Initial issue.

**COMPONENT:**

Amot thermostatic valve element  
Amot P/N: 9760X

**PURPOSE:**

This report is a follow-up to an interim report (10CFR21-0098-INT) issued by Engine Systems, Inc. (ESI) on 10/23/09 which identified a deviation with an Amot thermostatic valve element. The interim report was issued because ESI was not able to complete the evaluation within the 60 day requirement of 10CFR21. The evaluation was completed on 11/30/09 and the deviation was determined be a reportable defect as by defined by 10CFR21.

**SUMMARY:**

ESI began an evaluation of a thermostatic valve element failure on August 24, 2009. Palo Verde Nuclear Plant notified ESI of the failure as a result of a failure analysis they were performing on a thermostatic valve that had been removed from the lube oil system of their 2A-EDG. The element was in service since April 2008 and Palo Verde verified operation of the element prior to installation. The Palo Verde failure analysis report, performed by Exelon Power Labs, is a proprietary document and therefore a copy is not included in this notification.

The Palo Verde failure analysis determined that one of two elements within the valve was defective. The element failure was attributed to wax leakage past the diaphragm seal on one of two power pills within the element. Evidence of mechanical binding of the piston is believed to have caused the wax leakage. If the piston was jammed, the expanding wax could have over-pressurized the diaphragm seal leading to wax leakage. The failure analysis noted the following to support piston binding:

- The piston was initially difficult to remove from its guide tube.
- A gouge was observed on the piston surface.
- The rubber plug within the power pill exhibited brass machining chip debris.

The Exelon analysis also reports that similar brass machining debris was observed on the plugs from the other three power pills to varying degrees. None of the stems of these pills displayed evidence of gouging or binding.

To date, no other similar failures with Amot thermostatic valves have been reported to ESI.

ESI has contacted the valve manufacturer (Amot) to discuss these findings. A copy of the Palo Verde failure analysis and eleven (11) element assemblies from ESI inventory were sent to Amot for evaluation. The following elements were sent to Amot for evaluation:

- Qty. 8: P/N 9760X-170\* (CES P/N 2-05V-419-107)
- Qty. 3: P/N 9760X-160\* (CES P/N 2-05V-419-109)

\*Both part number elements are the same except for the temperature setting ("170" indicates 170°F nominal and "160" indicates 160°F nominal).

Upon completion of their evaluation, Amot has reported the following:

- Fine shavings/powder of brass was observed in some of the element pills.
- None of the pill stems had any evidence of gouging.
- The pills used in the 9760X elements are made by converting another part number pill. This conversion consists of removing the stem from the pill and performing some machining. Amot believes the brass debris may have entered the pill as a result of this conversion process.
- Amot has not made any changes to this conversion process in recent history and has not had reports of similar problems with these elements.
- Machining debris, while undesirable, was evident in other pills which did not exhibit any operability issues; therefore this is not believed to be the cause of the pill failure.
- The primary cause of the failure is believed to be the gouge found in the pill stem. The gouge could have occurred during the conversion process as the stem is removed and handled at that time.
- As a precaution, Amot has made changes to their conversion process for this pill. The drilling fixture was modified to eliminate the possibility of chips entering the pill during the machining operation. This change was made effective 10/22/09.

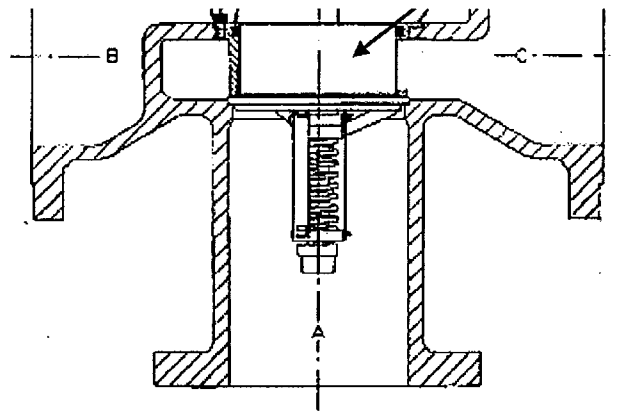
### **DISCUSSION:**

The Amot type 9760X elements are used in the Amot type "H" thermostatic valve. These valves are used in some Cooper-Bessemer KSV diesel engine jacket water and/or lube oil systems to maintain proper system temperatures during engine operation. A very limited number of EMD diesel engines also use the type "H" valve in the jacket water system.

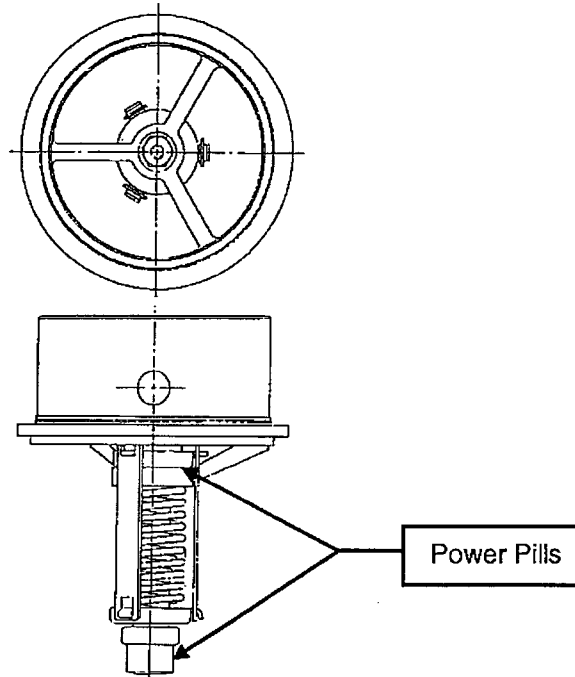
Each valve uses 2 thermostatic elements, Amot type 9760X (item 2 in Figure 1). The element being investigated for the Palo Verde application has a nominal temperature setting of 160°F and therefore the element part number is 9760X-160.

The 9760X element contains two power pills (Figure 2). The power pills contain a temperature sensitive wax that expands with increasing temperature and provides the motive force to lift the element off of its seat.





**FIGURE 1: AMOT THERMOSTATIC VALVE**



**FIGURE 2: VALVE ELEMENT 9760X**

**AFFECTED USERS:**

A listing of users with the thermostatic valves that contain the Amot 9760X element is provided in the table below.

***LISTING OF DIESEL ENGINES WITH 9760X ELEMENTS***

Site	Diesel Engine			Thermostatic Valve	Systems
	Mfg	Model	Cyl		
Braidwood/Byron	C-B	KSV	20	6HAS	Lube
Nine Mile Point	C-B	KSV	16	6HAS	Lube
Oconee	EMD	645	12 & 16	4HAS & 6HAS	Water
Palo Verde	C-B	KSV	20	6HAS	Lube & Water
South Texas Project	C-B	KSV	20	6HAS	Lube & Water
Susquehanna	C-B	KSV	20	6HAS	Lube & Water
Waterford	C-B	KSV	16	5HAS & 6HAS	Lube & Water
Laguna Verde - Mexico	EMD	645	16	6HAS	Water

**CORRECTIVE ACTION:**

The element failure at Palo Verde is considered to be an isolated incident related to a gouge in the pill stem. Thus, there is no recommended corrective action for users of the Amot 9760X element.

The evaluation also indicated a weakness in Amot's manufacturing process for the element pill which introduced machining debris. While not believed to be the cause of the Palo Verde element failure, machining debris within the element pill is undesirable and increases the potential for failure in the future. Users with thermostatic valves containing Amot P/N 9760X elements should be aware of this issue so that they can monitor their systems for any indications of thermostat element problems.