

General Information (PAR)

Event # 45875

<b>Rep Org:</b> ENGINE SYSTEMS, INC.	<b>Notification Date / Time:</b> 04/26/2010 17:15 (EDT)		
<b>Supplier:</b> ENGINE SYSTEMS, INC.	<b>Event Date / Time:</b> 03/23/2010 (EDT)		
	<b>Last Modification:</b> 04/01/2011		
<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> JOHN ROGGE	R1DO	
<b>HQ Ops Officer:</b> BILL HUFFMAN	DAVID AYRES	R2DO	
<b>Emergency Class:</b> NON EMERGENCY	DAVID HILLS	R3DO	
<b>10 CFR Section:</b>	JEFF CLARK	R4DO	
21.21	UNSPECIFIED PARAGRAPH	PART 21 COORDINATOR	NRR

## EMD JACKET WATER PUMP WITH INCORRECT IMPELLER ORIENTATION

The following is a summary of a report received from Engine Systems, Inc. via facsimile:

"Engine Systems Inc. (ESI) began a 10CFR21 evaluation on 03/23/10 following a corrective action request from Entergy - Grand Gulf. The request was written as the result of Grand Gulf having an EMD jacket water pump with an incorrect impeller. Specifically, the impeller installed in the pump was for rotation opposite of the pump housing. The evaluation was concluded on 04/26/10 and was determined to be a reportable defect as defined by 10CFR21.

"EMD diesel engines utilized for emergency diesel generator sets use two engine jacket water centrifugal pumps (one for each bank) to circulate fluid throughout the engine for cooling. Each pump is mounted on the front of the engine and rotates in the opposite direction of the engine crankshaft. For single engine generator set applications (i.e. left hand rotation engine, viewed from the rear of the engine), the pumps used on each bank contain identical components; the only difference is the position of the impeller housing in relation to the pump shaft housing. When viewed from the front of the engine, these water pumps rotate counterclockwise (see Figure 1 below).

"For tandem generator set applications, one engine is left hand rotation and the other is right hand rotation. For each engine, the pumps used on each bank contain identical components and the only difference is the position of the impeller housing in relation to the pump shaft housing. However, for a right hand rotation engine the water pumps rotate clockwise when viewed from the front of the engine

In summary, because these pumps use impellers that rotate in both clockwise and counter-clockwise directions, it is possible that an impeller could be installed with a design rotation opposite that required for the associated pump housing.

JEI9  
NRR

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"A review has been performed to evaluate the impact on past supply of EMD water pumps. Historically, ESI has supplied a quantity of over 280 water pumps under 17 different EMD part numbers dating back to 1988. The pump returned by the customer [Grand Gulf] was supplied in January 1997. After reviewing the history of dedication activities performed on the water pumps it was found that dedication reports for EMD water pumps have always contained an inspection requirement to verify the correct operational rotation; however reports written prior to 2000 did not include a clear visual depiction of what the correct operational rotation is. It appears that this was an isolated incident where the inspector made an error when performing the inspection. Since April 2000, all EMD water pumps shipped were inspected to a dedication report that included a clear visual depiction of proper impeller geometry. This one incident is the only known instance of an EMD water pump with the incorrect impeller.

"ESI recommends that as a precaution, all customers with an EMD water pump in stock which was supplied by ESI prior to April 2000 should perform a visual inspection to ensure the correct impeller is installed. A pump which has been installed on the diesel engine is considered acceptable based on successful operation of the diesel engine. The impeller inspection is easily performed, without disassembly, by looking into the inlet port of the pump to confirm the orientation of the impeller matches the pump housing. A listing of the various part numbers supplied prior to April 2000 is included in Table [below].

Listing of Water Pump P/Ns Supplied Prior to April 2000

Part Number	Rotation	Bank	Type of Engine
40004235	LH	RIGHT	16 & 20-645E4 & E4B
40004234	LH	LEFT	16 & 20-645E4 & E4B
8347607	LH	LEFT	16 & 20-645E4 & E4B
8364236	RH	RIGHT	16 & 20-645E4 & E4B
8364237	RH	LEFT	16 & 20-645E4 & E4B
8269664	LH	RIGHT	12-645E4 & E4B
9336390	LH	LEFT	12-645E4 & E4B
8269638	LH	LEFT	12-645E4 & E4B
8324588	RH	RIGHT	12-645E4 & E4B
8324589	RH	LEFT	12-645E4 & E4B

NOTE: The ESI report did not provide an information on specific nuclear power plant licensees that may possess these components.

\*\*\* UPDATE RECEIVED VIA FAX FROM TOM HORNER TO DONG PARK AT 1614 EST ON 04/01/11 \*\*\*

Two sentences were added to address the safety hazard which is created or could be created by this defect.

"Installation of the incorrect impeller would result in considerable loss of engine cooling water flow. This would cause elevated engine cooling water temperature that could impact engine performance and/or load carrying capability with the possibility of eventual engine failure, thereby preventing the emergency diesel generator from performing its safety related function."

Notified R1DO (Powell), R2DO (Sykes), R3DO (Peterson), R4DO (Lantz), PART 21 GROUP via e-mail.

\*\*\*\*\*



**ENGINE SYSTEMS, INC.**

1220 S. Washington St., Rocky Mount, NC 27801  
P.O. Box 1928, Rocky Mount, NC 27802-1928

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

**TELEFAX**

**Date:** March 31, 2011

**Company:** NRC Operations Center

**Fax Number:** 301/816-5151

**Verification No.:** 301/816-5100

**Reference:** Report No. 10CFR21-0100, Rev. 1

**From:** Tom Horner

**Page:** 1 of 7

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Dear Sir:

Following this cover is a copy of our report 10CFR21-0100, Rev.1, for a 10CFR21 reportable notification on an EMD water pump, P/N 8324589. Under Summary, 2<sup>nd</sup> paragraph, the last two sentences were added to address the safety hazard which is created or could be created by this defect.

A copy of the revised report will be mailed to the NRC Document Control Desk and to all users with safety related EMD diesel engines.

Should you have questions, please let us know.

Sincerely,

ENGINE SYSTEMS, INC.

Tom Horner  
Quality Assurance Manager



**ENGINE SYSTEMS, INC.**

175 Freight Road, Rocky Mount, NC 27804

Telephone: 252/977-2720

Fax: 252/446-1134

**Report No. 10CFR21-0100**

Rev. 0: 04/26/10


Rev. 1: 03/30/11

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

COMPONENT: EMD water pumps

SYSTEM: EMD Emergency Diesel Generator – jacket water system

CONCLUSION: Reportable in accordance with 10CFR21.

Prepared By:   
Engineering Manager

Date: 3/30/11

Reviewed By:   
Quality Assurance Manager

Date: 3-30-11

Report No. 10CFR21-0100

Record of Revisions  
Page: 1 of 1

REV	DATE	PAGE	DESCRIPTION
0	04/26/10		Initial issue.
1	03/30/11	1	Under Summary, 2 <sup>nd</sup> paragraph, added the last 2 sentences to address the safety hazard which is created or could be created by this defect.

Report No. 10CFR21-0100  
Revision: 1  
Date: 03/30/11  
Page: 1 of 4

**COMPONENT:**

EMD water pump P/N 8324589

**SUMMARY:**

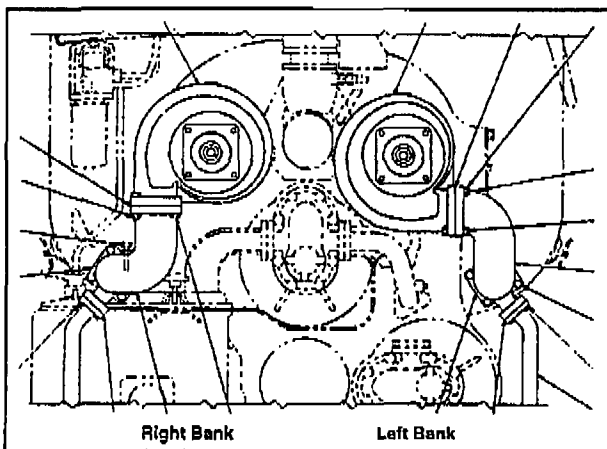
Engine Systems Inc. (ESI) began a 10CFR21 evaluation on 03/23/10 following a corrective action request from Entergy – Grand Gulf. The request was written as the result of Grand Gulf having an EMD jacket water pump (P/N 8324589, S/N 96M1464V) with an incorrect impeller. Specifically, the impeller installed in the pump was for rotation opposite of the pump housing. ESI supplied the jacket water pump to Grand Gulf in January 1997. ESI does not know if the pump has been in storage since that time or if any rework activities have been performed on the pump.

The evaluation was concluded on 04/26/10 and was determined to be a reportable defect as defined by 10CFR21. Installation of the incorrect impeller would result in considerable loss of engine cooling water flow. This would cause elevated engine cooling water temperature that could impact engine performance and/or load carrying capability with the possibility of eventual engine failure, thereby preventing the emergency diesel generator from performing its safety related function.

**DISCUSSION:**

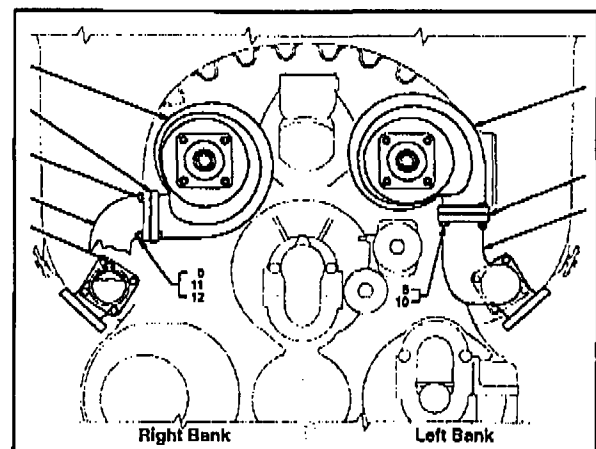
EMD diesel engines utilized for emergency diesel generator sets use two engine jacket water centrifugal pumps (one for each bank) to circulate fluid throughout the engine for cooling. Each pump is mounted on the front of the engine and rotates in the opposite direction of the engine crankshaft. For single engine generator set applications (i.e. left hand rotation engine, viewed from the rear of the engine), the pumps used on each bank contain identical components; the only difference is the position of the impeller housing in relation to the pump shaft housing. When viewed from the front of the engine, these water pumps rotate counterclockwise (see Figure 1 below).

For tandem generator set applications, one engine is left hand rotation and the other is right hand rotation. For each engine, the pumps used on each bank contain identical components and the only difference is the position of the impeller housing in relation to the pump shaft housing. However, for a right hand rotation engine the water pumps rotate clockwise when viewed from the front of the engine (see Figure 2 below).



**Figure 1**

**Water Pumps for LH Rotation Engine**

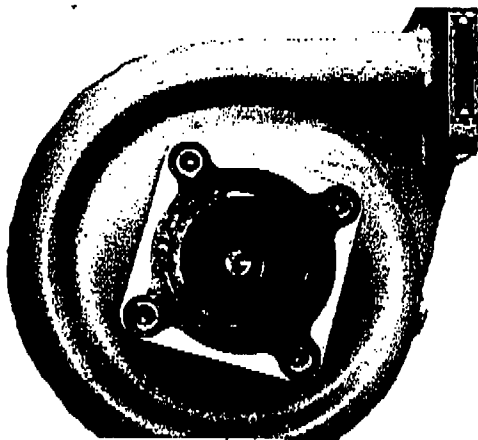


**Figure 2**

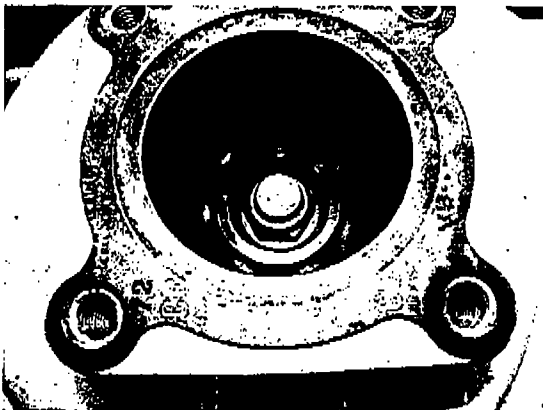
**Water Pumps for RH Rotation Engine**

It was reported by Grand Gulf that "while troubleshooting low Div III DJ jacket water pressure it was discovered that the wrong impeller was supplied in the P81C007A pump. The supplied impeller was intended to rotate in the opposite direction as the pump rotation. This appears to be the cause of low jacket water pressure in the A engine."

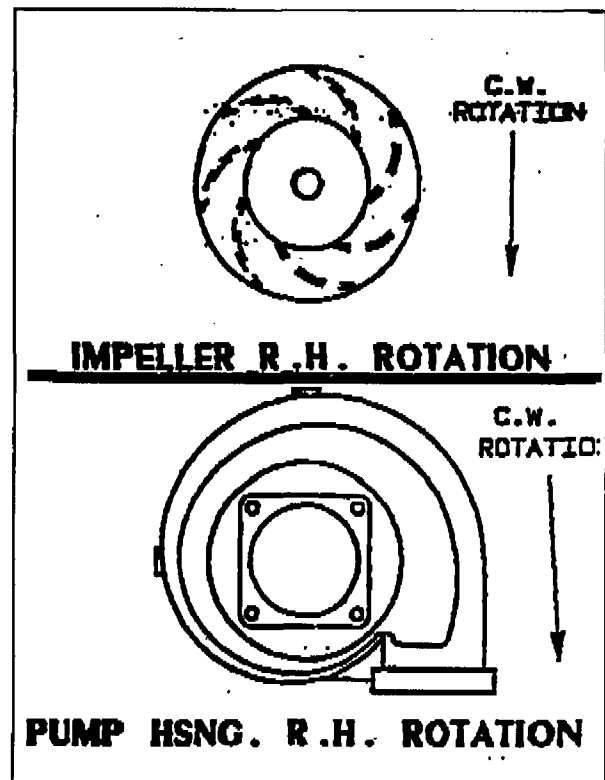
Subsequently, the water pump was returned to ESI for further inspection. It was apparent from a visual inspection that the incorrect impeller was installed for this pump. P/N 8324589 corresponds to a right hand rotation, left bank water pump for use on a 12-cylinder EMD 645E4 or E4B engine. As shown in Photos 1 and 2 below, the housing corresponds to a right hand rotation pump, but the impeller is for left hand rotation. Figure 3 shows the correct impeller for a right hand rotation pump.



**Photo 1:** Water Pump Returned by Customer (note impeller fin orientation)



**Photo 2:** Close-up of Water Pump (note impeller fin orientation)



**Figure 3:** Correct Housing and Fin Orientation for RH Rotation

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### **EVALUATION OF PREVIOUS SHIPMENTS:**

A review has been performed to evaluate the impact on past supply of EMD water pumps. Historically, ESI has supplied a quantity of over 280 water pumps under 17 different EMD part numbers dating back to 1988. The pump returned by the customer was supplied in January 1997. After reviewing the history of dedication activities performed on the water pumps it was found that dedication reports for EMD water pumps have always contained an inspection requirement to verify the correct operational rotation; however reports written prior to 2000 did not include a clear visual depiction of what the correct operational rotation is. It appears that this was an isolated incident where the inspector made an error when performing the inspection. Since April 2000, all EMD water pumps shipped were inspected to a dedication report that included a clear visual depiction of proper impeller geometry. This one incident is the only known instance of an EMD water pump with the incorrect impeller.

As noted above, ESI supplied this water pump in 1997. Since that time ESI is unaware if any rework or refurbishment activities have been performed on the pump but it was noted that paint had chipped off the heads of the capscrews, indicating that the screws had been removed at some time. There exists a possibility that the pump impeller may have been previously removed.

### **AFFECTED USERS:**

Based on the above review of previous EMD water pump shipments, it appears that this was an isolated incident. However, there exists the potential that an incorrect impeller was installed in an EMD water pump supplied by ESI prior to April 2000. Therefore, this notification is applicable to all users with safety related EMD diesel engines.

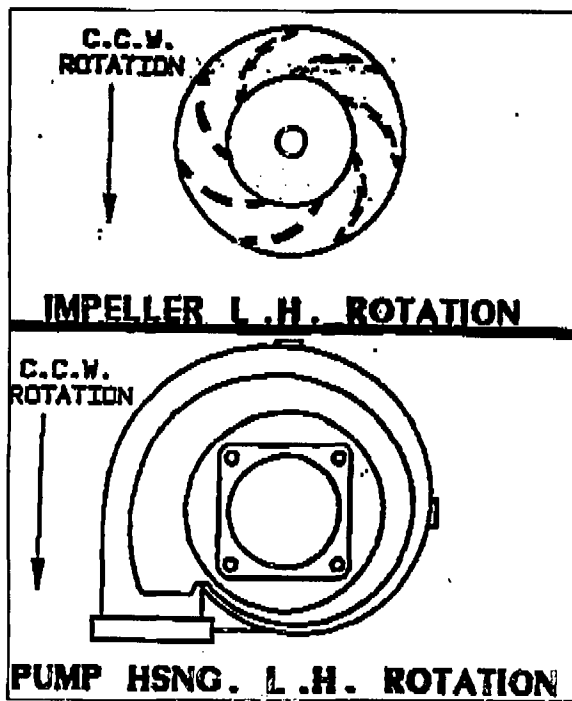
### **CORRECTIVE ACTION:**

ESI recommends that as a precaution, all customers with an EMD water pump in stock which was supplied by ESI prior to April 2000 should perform a visual inspection to ensure the correct impeller is installed. A pump which has been installed on the diesel engine is considered acceptable based on successful operation of the diesel engine. The impeller inspection is easily performed, without disassembly, by looking into the inlet port of the pump to confirm the orientation of the impeller matches the pump housing. A listing of the various part numbers supplied prior to April 2000 is included in Table 1. Figures 4 and 5 contain visual guidance to ensure the impeller corresponds to the installed pump housing.

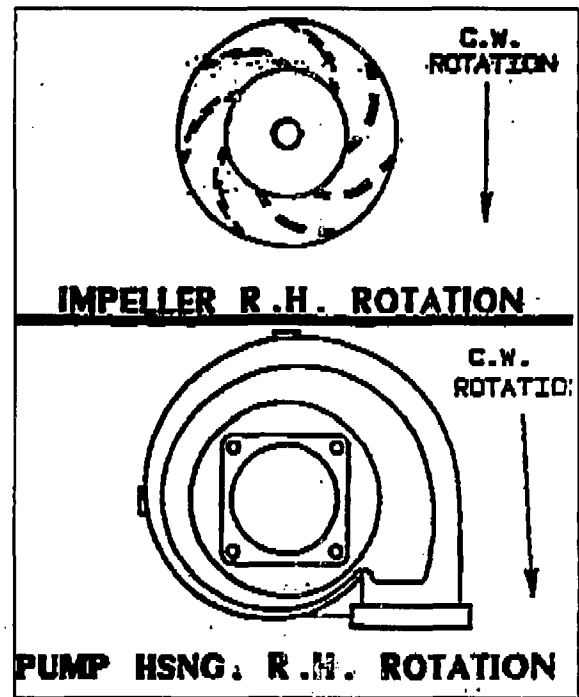


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8324588	RH	RIGHT	12-645E4 & E4B
8324589	RH	LEFT	12-645E4 & E4B

**Table 1: Listing of Water Pump P/Ns Supplied Prior to April 2000**



**Figure 4: Correct Housing and Fin Orientation for LH Rotation**



**Figure 5: Correct Housing and Fin Orientation for RH Rotation**