



ENGINE SYSTEMS, INC.

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January 23, 2006

U.S. Nuclear Regulator Commission
Document Control Desk
Mail Stop 0P1-17
Washington, DC 20555

Subject: 10CFR21 Reporting of Defects and Non-Compliance -
Engine Systems, Inc. Report No. 10CFR21-0091, Rev. 0

Woodward DRU Controls (Manufactured between November 2000
& November 2005) P/N: 9903-364, 9903-365, 9903-439 and 9903-470

Dear Sir:

The enclosed report addresses a reportable notification about Woodward digital
reference units (DRU's).

A copy of the report has also been sent to the NRC.

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

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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IE19



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175 Freight Road, Rocky Mount, NC 27804

Telephone: 252/977-2720

Fax: 252/446-1134

Report No. 10CFR21-0091

Rev. 0: 01/23/06

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

COMPONENT: Woodward DRU Controls (manufactured between Nov. 2000 & Nov. 2005)
P/N: 9903-364, 9903-365, 9903-439 and 9903-470

SYSTEM: Governor Control

CONCLUSION: Reportable in accordance with 10CFR21.

Prepared By: 
Engineering Manager

Date: 1/23/06

Reviewed By: 
Quality Assurance Manager

Date: 1/23/2006

REV	DATE	PAGE	DESCRIPTION
0	01/23/06		Initial issue.

COMPONENT:

Woodward DRU Controls (manufactured between Nov. 2000 & Nov. 2005)
P/N: 9903-364, 9903-365, 9903-439 and 9903-470

DISCUSSION:

Engine Systems Inc. (ESI) has concluded an investigation of a condition reported by Woodward about their Digital Reference Units (DRU's). DRU's provide a speed reference signal (via a proportional DC output voltage) to the electronic governor and are used to enable remote speed adjustment via raise/lower control switches.

A slight increase in the failure rate of a CMOS PDIP integrated circuit (IC) from a specific manufacturer has been noted by customer returned DRU's. The IC manufacturer has not identified a specific cause of the failure; however, a failure analysis completed by Woodward on some failed components identified the cause as internal aluminum conductor corrosion resulting from delaminating of the outer plastic package from the device lead frame. Woodward reports that alternative manufacturer's components have been used in these applications with no reported problems. Failure of the IC could result in the DRU not allowing speed raise/lower adjustment in the governor control system or it could result in a control shutdown (DRU output voltage to electronic governor goes to zero volts). DRU's shipped from Woodward between November 1, 2000 and November 22, 2005 containing the suspect IC's may be more susceptible to failure and have been identified by Woodward (see attached Woodward Service Bulletin 01363A). The bulletin identifies DRU's supplied by Woodward for commercial (8272 prefix), military (9900 prefix) and nuclear (9903 prefix) applications. Suspect DRU's that have been supplied by ESI for nuclear applications are identified on the next 2 pages.

This condition was originally reported by ESI in April 2004 (report 10CFR21-0088) following a DRU failure reported by Fairbanks Morse. At that time, the Fairbanks unit was the only reported failure in nuclear applications. The cause was attributed to a random contamination problem of an integrated circuit (IC) in DRU's manufactured by Woodward between November 2000 and January 2002. Three (3) additional IC failures within DRU's in nuclear service have now been reported. Three of the units failed during initial installation testing and one unit failed after approximately one year in service. All four (4) DRU failures occurred when the DRU was given a raise or lower signal.

AFFECTED CUSTOMERS:

Part No.	Serial #	Latest ESI Ship Date	Original ESI SO#	Repair & Return ESI SO#	DOMESTIC CUSTOMER	Customer PO
9903-365	13576301	1/16/2004	111394		AMERICAN ELECTRIC POWER – D.C. COOK	190-0000031268
9903-365	13576302	10/11/2005	111394	8000473	AMERICAN ELECTRIC POWER – D.C. COOK	190-0000031268
9903-365	13577159	1/16/2004	111394		AMERICAN ELECTRIC POWER – D.C. COOK	190-0000031268
9903-365	13577160	10/9/2003	111394		AMERICAN ELECTRIC POWER – D.C. COOK	190-0000031268
9903-365	13577892	1/16/2004	111394	8000278	AMERICAN ELECTRIC POWER – D.C. COOK	190-0000031268
9903-365	13577893	1/16/2004	111394		AMERICAN ELECTRIC POWER – D.C. COOK	190-0000031268
9903-470	13149513	12/31/2001	94806		DOMINION NUCLEAR – MILLSTONE	03003390, REV.2
9903-470	13149514	12/31/2001	94806		DOMINION NUCLEAR – MILLSTONE	03003390, REV.2
9903-439	13186111	6/27/2002	92470	97802	DUKE ENERGY CORPORATION – MCGUIRE	NM6840 003
9903-439	13516650	6/17/2003	107763		DUKE ENERGY CORPORATION – MCGUIRE	NM12719
9903-470	13347822	11/30/2002	102165		ENTERGY OPERATIONS – FITZPATRICK	4500515542
9903-470	13347823	11/30/2002	102165		ENTERGY OPERATIONS – FITZPATRICK	4500515542
9903-470	13348461	11/30/2002	102165		ENTERGY OPERATIONS – FITZPATRICK	4500515542
9903-470	13348462	11/30/2002	102165		ENTERGY OPERATIONS – FITZPATRICK	4500515542
9903-470	13349177	11/30/2002	102165		ENTERGY OPERATIONS – FITZPATRICK	4500515542
9903-470	14212574	8/10/2005	3001597		ENTERGY OPERATIONS – RIVER BEND	10103424
9903-470	12382055	9/16/2004	80843	8000230	ENTERGY OPERATIONS – RIVER BEND	10069952 - AFW#2497
9903-470	12382056	9/16/2004	80843	8000230	ENTERGY OPERATIONS – RIVER BEND	10069952 - AFW#2497
9903-470	12382057	9/16/2004	80843	8000230	ENTERGY OPERATIONS – RIVER BEND	10069952 - AFW#2497
9903-365	13262045	9/16/2004	96239	8000237	EXELON – BRAIDWOOD	703 REL#11136
9903-365	14374699	8/22/2005	3001382		EXELON – BRAIDWOOD	703; Rel. 11202
9903-365	14374700	8/22/2005	3001382		EXELON – BRAIDWOOD	703; Rel. 11202
9903-365	14374701	8/22/2005	3001382		EXELON – BRAIDWOOD	703; Rel. 11202
9903-365	13175373	5/3/2002	93244		EXELON – BYRON	703; REL. 10704
9903-365	13319008	8/21/2002	101317		EXELON – BYRON	703; REL. 10809
9903-470	14071860	6/27/2005	3001371		EXELON / AMERGEN - OYSTER CREEK	80 015737
9903-439	13344808	10/28/2002	102350		FIRST ENERGY – DAVIS BESSE	7102012
9903-470	13490742	6/27/2003	111071		FIRST ENERGY – DAVIS BESSE	45101243
9903-470	13564432	7/23/2003	111071		FIRST ENERGY – DAVIS BESSE	45101243
9903-470	13443890	3/10/2003	105364		FLORIDA POWER & LIGHT – ST. LUCIE	00062193/ REV. 1
9903-470	13443891	3/10/2003	105364		FLORIDA POWER & LIGHT – ST. LUCIE	00062193/ REV. 1
9903-470	13443892	3/10/2003	105364		FLORIDA POWER & LIGHT – ST. LUCIE	00062193/ REV. 1
9903-470	13720683	5/27/2004	3000368		FLORIDA POWER & LIGHT – ST. LUCIE	00072539
9903-470	14209071	4/27/2005	3001086		FLORIDA POWER & LIGHT – TURKEY POINT	80356
9903-470	14209072	4/27/2005	3001086		FLORIDA POWER & LIGHT – TURKEY POINT	80356
9903-470	11514197	7/14/2003	92917	108898	NEBRASKA PUBLIC POWER DIST – COOPER STATION	4500028301-AFW 2353
9903-470	13149515	3/26/2003	106919		NEBRASKA PUBLIC POWER DIST – COOPER STATION	4500028501
9903-470	14081384	12/27/2004	3000733		NEBRASKA PUBLIC POWER DIST – COOPER STATION	4500042762
9903-470	14081385	12/27/2004	3000733		NEBRASKA PUBLIC POWER DIST – COOPER STATION	4500042762
9903-365	14177285	6/10/2005	8000316		PENNSYLVANIA POWER & LIGHT – SUSQUEHANNA	296924
9903-365	14177286	6/10/2005	8000316		PENNSYLVANIA POWER & LIGHT – SUSQUEHANNA	296924
9903-365	14177470	6/10/2005	8000316		PENNSYLVANIA POWER & LIGHT – SUSQUEHANNA	296924
9903-365	14177471	12/13/2005	8000316		PENNSYLVANIA POWER & LIGHT – SUSQUEHANNA	296924
9903-365	14177472	12/13/2005	8000316		PENNSYLVANIA POWER & LIGHT – SUSQUEHANNA	296924
9903-365	14177473	12/13/2005	8000316		PENNSYLVANIA POWER & LIGHT – SUSQUEHANNA	296924
9903-365	14177474	12/13/2005	8000316		PENNSYLVANIA POWER & LIGHT – SUSQUEHANNA	296924

<u>Part No.</u>	<u>Serial #</u>	<u>Latest ESI Ship Date</u>	<u>Original ESI SO#</u>	<u>Repair & Return ESI SO#</u>	<u>DOMESTIC CUSTOMER</u>	<u>Customer PO</u>
9903-470	13709567	8/20/2004	8000005		SOUTHERN CALIFORNIA EDISON CO – SAN ONOFRE	6H2N3025
9903-470	13713930	6/16/2004	8000005		SOUTHERN CALIFORNIA EDISON CO – SAN ONOFRE	6H2N3025
9903-470	13713931	6/16/2004	8000005		SOUTHERN CALIFORNIA EDISON CO – SAN ONOFRE	6H2N3025
9903-470	13715637	6/16/2004	8000005		SOUTHERN CALIFORNIA EDISON CO – SAN ONOFRE	6H2N3025
9903-470	13715638	6/16/2004	8000005		SOUTHERN CALIFORNIA EDISON CO – SAN ONOFRE	6H2N3025
9903-470	13716888	6/16/2004	8000005		SOUTHERN CALIFORNIA EDISON CO – SAN ONOFRE	6H2N3025
9903-470	13716889	6/16/2004	8000005		SOUTHERN CALIFORNIA EDISON CO – SAN ONOFRE	6H2N3025
9903-470	13717949	8/20/2004	8000005		SOUTHERN CALIFORNIA EDISON CO – SAN ONOFRE	6H2N3025
9903-470	13717950	8/20/2004	8000005		SOUTHERN CALIFORNIA EDISON CO – SAN ONOFRE	6H2N3025
9903-470	13719247	8/20/2004	8000005		SOUTHERN CALIFORNIA EDISON CO – SAN ONOFRE	6H2N3025
9903-470	13719248	8/20/2004	8000005		SOUTHERN CALIFORNIA EDISON CO – SAN ONOFRE	6H2N3025
9903-470	13720684	8/20/2004	8000005		SOUTHERN CALIFORNIA EDISON CO – SAN ONOFRE	6H2N3025
9903-470	13861533	3/7/2005	3000571		SOUTHERN CALIFORNIA EDISON CO – SAN ONOFRE	6H2N3025
9903-470	14146651	4/28/2005	3000957		SOUTHERN CALIFORNIA EDISON CO – SAN ONOFRE	6H2N3025
9903-470	14146660	4/28/2005	3000957		SOUTHERN CALIFORNIA EDISON CO – SAN ONOFRE	6H2N3025
9903-470	14151877	4/28/2005	3000957		SOUTHERN CALIFORNIA EDISON CO – SAN ONOFRE	6H2N3025
9903-470	13564433	8/12/2003	112425		TENNESSEE VALLEY AUTHORITY – WATTS BAR	00001690/00251
					FOREIGN CUSTOMER	
9903-470	13149512	7/9/2002	96580		KOREA HYDRO & NUCLEAR POWER CO – KORI 2	NKR2-01M0142-010
9903-470	13253050	7/9/2002	96580		KOREA HYDRO & NUCLEAR POWER CO – KORI 2	NKR2-01M0142-010
9903-470	13263718	7/9/2002	96580		KOREA HYDRO & NUCLEAR POWER CO – KORI 2	NKR2-01M0142-010
9903-470	13789808	7/23/2004	8000124		KOREA HYDRO & NUCLEAR POWER CO – KORI 3 & 4	K040102011
9903-470	13789815	7/23/2004	8000124		KOREA HYDRO & NUCLEAR POWER CO – KORI 3 & 4	K040102011
9903-470	13789818	7/23/2004	8000124		KOREA HYDRO & NUCLEAR POWER CO – KORI 3 & 4	K040102011
9903-470	13789819	1/28/2005	8000128		KOREA HYDRO & NUCLEAR POWER CO – KORI 3 & 4	K040102011
9903-470	14425565	10/12/2005		8000457	KOREA HYDRO & NUCLEAR POWER CO – KORI 3 & 4	K040102011 AFW 2601
9903-470	14071858	12/15/2004	3000714		KOREA HYDRO & NUCLEAR POWER CO – ULCHIN	U040353011
9903-470	14071859	12/15/2004	3000714		KOREA HYDRO & NUCLEAR POWER CO – ULCHIN	U040353011
9903-470	14073051	12/15/2004	3000714		KOREA HYDRO & NUCLEAR POWER CO – ULCHIN	U040353011
9903-470	14073052	12/15/2004	3000714		KOREA HYDRO & NUCLEAR POWER CO – ULCHIN	U040353011
9903-470	14073053	12/15/2004	3000714		KOREA HYDRO & NUCLEAR POWER CO – ULCHIN	U040353011
9903-470	14081386	12/15/2004	3000714		KOREA HYDRO & NUCLEAR POWER CO – ULCHIN	U040353011
9903-365	13383317	3/6/2003	104392		KOREA HYDRO & NUCLEAR POWER – WOLSONG	NWS1-02M0041-810
9903-365	13383318	3/6/2003	104392		KOREA HYDRO & NUCLEAR POWER – WOLSONG	NWS1-02M0041-810
9903-365	13384198	3/6/2003	104392		KOREA HYDRO & NUCLEAR POWER – WOLSONG	NWS1-02M0041-810
9903-365	13384199	3/6/2003	104392		KOREA HYDRO & NUCLEAR POWER – WOLSONG	NWS1-02M0041-810
9903-365	13467372	4/30/2003	108337		KOREA HYDRO & NUCLEAR POWER – WOLSONG	W030013011
9903-365	13467373	4/30/2003	108337		KOREA HYDRO & NUCLEAR POWER – WOLSONG	W030013011
9903-365	13468141	4/30/2003	108337		KOREA HYDRO & NUCLEAR POWER – WOLSONG	W030013011
9903-365	13468142	4/30/2003	108337		KOREA HYDRO & NUCLEAR POWER – WOLSONG	W030013011
9903-470	12382054	6/17/2004	102141	8000173	KOREA HYDRO & NUCLEAR POWER CO – YONGGWANG	NYG1-02M0086-010
9903-470	13351538	12/6/2002	102141		KOREA HYDRO & NUCLEAR POWER CO – YONGGWANG	NYG1-02M0086-010
9903-470	13351539	12/6/2002	102141		KOREA HYDRO & NUCLEAR POWER CO – YONGGWANG	NYG1-02M0086-010
9903-470	13352957	12/6/2002	102141		KOREA HYDRO & NUCLEAR POWER CO – YONGGWANG	NYG1-02M0086-010
9903-470	13352958	12/6/2002	102141		KOREA HYDRO & NUCLEAR POWER CO – YONGGWANG	NYG1-02M0086-010
9903-470	13603450	12/29/2003	115518		NUCLEAR POWER PLANT KRSKO+	8035 / 309 REV 1
9903-470	13684563	3/3/2004	115518		NUCLEAR POWER PLANT KRSKO+	8035 / 309 REV 1
9903-470	13684564	3/3/2004	115518		NUCLEAR POWER PLANT KRSKO+	8035 / 309 REV 1

CONCLUSION:

The suspect DRU's listed under Affected Customers could experience an increase in IC failures. These reported IC failures occurred when the DRU was issued a raise or lower signal. Therefore, in-service, suspect DRU's that have successfully completed surveillance testing are not susceptible to this failure mode while energized in standby, since raise and/or lower signals are normally not issued during emergency mode operation. DRU failure can be detected by observing a sudden load shift and/or loss of load adjustability when synchronized with the utility or by a sudden frequency shift and/or loss of speed adjustability when running isolated from the utility.

CORRECTIVE ACTION:

1. Suspect DRU's that are currently not in service should have the IC's replaced as soon as possible. Contact ESI's Customer Service department with the part number and serial number of the DRU(s).
2. Suspect DRU's that are currently in service should be replaced at the earliest convenience with a non-suspect DRU or with a corrected DRU (item 1 above). The removed DRU can then have its IC's replaced and retained as a spare.

SERVICE BULLETIN
**Digital Reference Unit
CMOS PDIP Integrated Circuit—Corrosion Issue**

January 2006

01363A

Issue

Corrosion has been detected in some CMOS PDIP integrated circuits (IC) used in Digital Reference Unit (DRU) products. The corrosion of certain ICs on the circuit board can cause the DRU to function incorrectly.

Description

Woodward has identified DRUs that have been returned for repair due to internal corrosion of a CMOS PDIP integrated circuit from a specific manufacturer. Failure analysis recently completed on defective components confirmed that the cause of failure was due to internal aluminum conductor corrosion resulting from delamination of the outer plastic package from the device lead frame. Although the IC manufacturer has not identified a specific failure cause, customer returns indicate a slight increase in the failure rate that began with units shipped in November, 2000. Alternative manufacturer's components have been used in these applications with no reported problems.

The potential failure modes of affected units could result in the DRU not allowing speed control raise/ lower adjustment in the governor control system, or could result in a control shutdown.

Affected Units

Specific DRU controls with the following item numbers that shipped between 1 November 2000 and 22 November 2005, containing the suspect manufacturers/type components may be more susceptible to delamination.

9903-364	9900-486	5422-047	8272-682
9903-365	9900-517	5422-059	8272-683
9903-439	9900-519		8272-684
9903-470	9900-524		8272-685

Refer to tables below for specific serial numbers. Units that are currently within the standard warranty period (as of 1 January 2006) are identified with an asterisk (*) The affected date range was determined from actual field return and inventory transaction data.

Corrective Action

Woodward has removed the specific manufacturer as an approved vendor for the affected IC grade on all eight component part numbers that are used on the DRU.

Customer Action

If it is determined that a unit needs to be returned to Woodward, please select one of the following options:

- Contact your Woodward customer service representative for a return authorization number (RAN) and return the unit(s) to Woodward.
- If a return is not feasible, contact your Woodward customer service representative to discuss the availability of replacement/exchange unit(s).

Please refer to this service bulletin number when scheduling your return. Service bulletin actions will be performed at no charge for all controls that fall within the product warranty period at the time they are returned. Units outside of the standard warranty period can be quoted for replacement of the affected ICs.

Parent Item	Serial Number
5422-047	13248424
5422-059	13049814
8272-682	12376944
8272-682	12376945
8272-682	12376946
8272-682	12387999
8272-682	12388000
8272-682	12388001
8272-682	12388002
8272-682	12404127
8272-682	12404128
8272-682	12404129
8272-682	12404130
8272-682	12404386
8272-682	12404387
8272-682	12405817
8272-682	12405818
8272-682	13016075
8272-682	13017714
8272-682	13017715
8272-682	13022073
8272-682	13022074
8272-682	13022075
8272-682	13022076
8272-682	13022077
8272-682	13023706
8272-682	13025071
8272-682	13025072
8272-682	13046435
8272-682	13046436
8272-682	13046437
8272-682	13046438
8272-682	13061950
8272-682	13063072
8272-682	13067610
8272-682	13073421
8272-682	13074204
8272-682	13081916
8272-682	13081917
8272-682	13092871
8272-682	13092872
8272-682	13102898
8272-682	13102899
8272-682	13104150
8272-682	13104151
8272-682	13106729
8272-682	13107148
8272-682	13107149
8272-682	13108663
8272-682	13110231
8272-682	13112097
8272-682	13113952
8272-682	13115070
8272-682	13115071
8272-682	13146972

8272-682	13146974
8272-682	13147940
8272-682	13147941
8272-682	13149674
8272-682	13150078
8272-682	13150079
8272-682	13152934
8272-682	13179256
8272-682	13179257
8272-682	13179258
8272-682	13190573
8272-682	13192039
8272-682	13192940
8272-682	13193629
8272-682	13193630
8272-682	13195491
8272-682	13196796
8272-682	13197975
8272-682	13200352
8272-682	13207221
8272-682	13207741
8272-682	13227661
8272-682	13228868
8272-682	13234756
8272-682	13236766
8272-682	13236767
8272-682	13237755
8272-682	13246607
8272-682	13259342
8272-682	13268966
8272-682	13270962
8272-682	13272212
8272-682	13306023
8272-682	13309056
8272-682	13310998
8272-682	13312469
8272-682	13315405
8272-682	13322143
8272-682	13324398
8272-682	13333103
8272-682	13333104
8272-682	13333807
8272-682	13334306
8272-682	13334307
8272-682	13344260
8272-682	13348445
8272-682	13357514
8272-682	13358275
8272-682	13370076
8272-682	13391521
8272-682	13393136
8272-682	13394666
8272-682	13395538
8272-682	13396420
8272-682	13396421
8272-682	13399323
8272-682	13399324

8272-682	13409633
8272-682	13460535
8272-682	13462311
8272-682	13465497
8272-682	13472131
8272-682	13477583
8272-682	13482423
8272-682	13482424
8272-682	13485000
8272-682	13485002
8272-682	13486659
8272-682	13488277
8272-682	13490722
8272-682	13492120
8272-682	13493455
8272-682	13494997
8272-682	13495948
8272-682	13496746
8272-682	13513994
8272-682	13514974
8272-682	13523515
8272-682	13532991
8272-682	13534050
8272-682	13534792
8272-682	13552620
8272-682	13560027
8272-682	13563676
8272-682	13563678
8272-682	13563679
8272-682	13569088
8272-682	13569089
8272-682	13570137
8272-682	13570138
8272-682	13578510
8272-682	13578511
8272-682	13592746
8272-682	13594624
8272-682	13594625
8272-682	13603922
8272-682	13617947
8272-682	13617948
8272-682	13619809
8272-682	13619810
8272-682	13653381
8272-682	13660810
8272-682	13660811
8272-682	13666891
8272-682	13666892
8272-682	13667601
8272-682	13691730
8272-682	13691731
8272-682	13710472
8272-682	13710473
8272-682	13740427 *
8272-682	13749950 *
8272-682	13749951
8272-682	13752839

8272-682	13752840 *
8272-682	13752841
8272-682	13752842 *
8272-682	13753388
8272-682	13753389
8272-682	13754550
8272-682	13754551
8272-682	13856137 *
8272-682	13856138 *
8272-682	13861547 *
8272-682	13892906 *
8272-682	13892907 *
8272-682	13903010 *
8272-682	13905060 *
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