



**ENGINE SYSTEMS, INC.**

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August 1, 2011

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. 10CFR21-0102, Rev. 0

Air Start Motors with Friction-Clutch Inertia Drives

Dear Sir:

The enclosed report addresses a reportable notification on air start motors with friction-clutch inertia drives.

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

**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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**Report No. 10CFR21-0102**

Rev. 0: 08/01/11

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

COMPONENT: Air Start Motors with friction-clutch inertia drives

SYSTEM: Emergency Diesel Generator – starting air system

CONCLUSION: Reportable in accordance with 10CFR21

Prepared By:   
Engineering Manager

Date: 8/1/11

Reviewed By:   
Quality Assurance Manager

Date: 8-1-11

REV	DATE	PAGE	DESCRIPTION
0	08/01/11		Initial issue.

**COMPONENT:**

Air start motors with friction-clutch inertia drives (not pre-engagement type)

**SUMMARY:**

Engine Systems Inc. (ESI) began a 10CFR21 evaluation on 06/16/11 upon receipt of a failed air start motor from Exelon – Clinton. According to information provided by Clinton Nuclear Plant, they experienced a slow start of an EDG during one of their surveillance runs. Subsequent troubleshooting revealed that one of the air start motors had failed. Specifically, it was found that the starter drive had failed which prevented the air start motor from applying full starting torque to the engine. The inspections performed by Clinton indicated the failed motor had what appeared to be excessive preload applied to the springs of the drive clutch which led to spring roll and fragmentation. Clinton had also supplied six remaining air start motors from their inventory to ESI for evaluation of the drive clutch torque setting. The air starters are Pow-R-Quik type LS-60-RH1 and LS-60-LH1 (where RH and LH designate right hand and left hand rotation respectively).

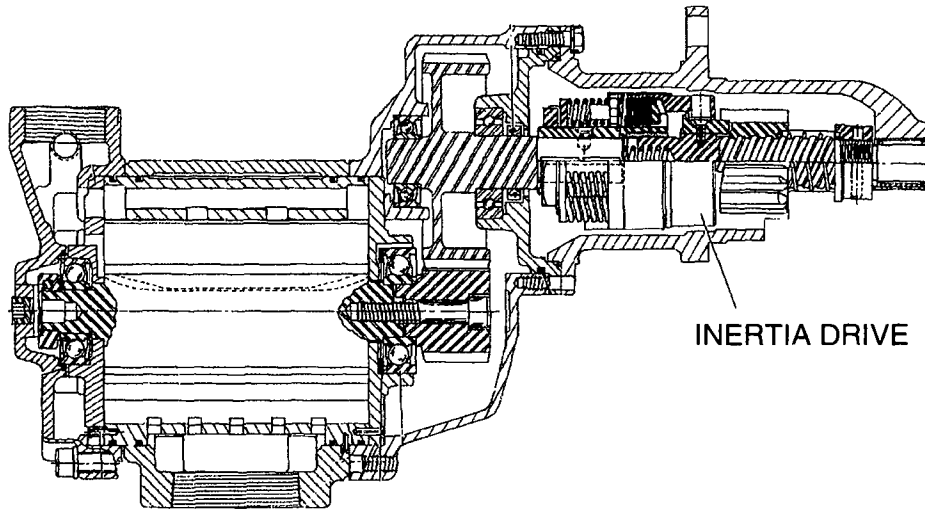
The evaluation was concluded on 08/01/11 and determined the air motor failure to be a reportable defect as defined by 10CFR21. The starter drive failure was attributed to excessive torque adjustment of the clutch assembly. This overstressed the clutch disc plates which lead to eventual failure of the friction-clutch inertia drive assembly. Failure of the clutch drive renders the air start motor inoperative. Depending upon the configuration of the engine’s starting system, an inoperative air start motor could cause excessive starting times or a start failure. Either scenario has the potential to prevent the emergency diesel generator from performing its safety related function.

**DISCUSSION:**

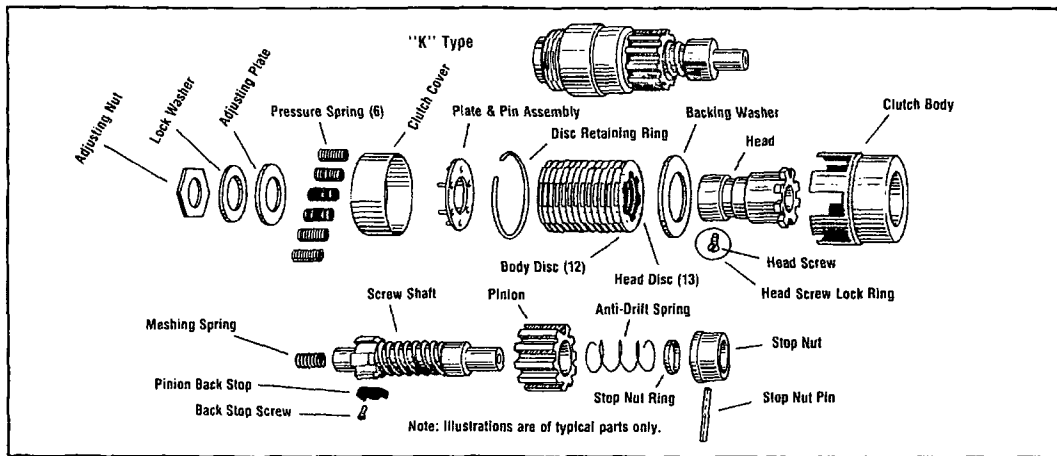
The friction-clutch inertia drive is utilized on air starting motors that do not incorporate the pre-engagement feature. In this case, air motor rotation begins before the drive pinion gear meshes with the engine ring gear. The clutch is designed to slip at a prescribed torque setting to absorb the initial torque inrush experienced by the air motor as the pinion and ring gears mesh. This drive assembly was originally manufactured by Facet and was their “K” Type friction clutch. Facet P/N A-3111 was used on clockwise rotation (RH) air starters and P/N A-3236 was used on counterclockwise rotation (LH) air starters. Facet has not supplied starter drives since 2003 and the clutch drives are now supplied by two (2) other manufacturers, ASC (Air Starter Components) and Sun Autoelektrik.

The friction-clutch inertia drive is used within the following air start motors supplied by ESI.

<b>Starter Part Number</b>	<b>Starter Manufacturer</b>
SS810GB03R31	Ingersoll- Rand
SS810GB03R31-13B	Ingersoll- Rand
LS-60-LH1	Pow-R-Quik
LS-60-RH1	Pow-R-Quik
DS-60-LH1	Pow-R-Quik
DS-60-RH1	Pow-R-Quik



**TYPICAL AIR START MOTOR ASSEMBLY**



**EXPLODED VIEW OF FRICTION-CLUTCH INERTIA DRIVE**

Clutch torque testing was performed on the six (6) starters returned from Clinton's inventory. Results are listed below and indicate inconsistent clutch settings. The specified torque setting for the clutch drive is 275-300 ft-lbs. Of the six starters tested, only one was within specification.

Serial No.	Pow-R-Quik Part Number	Clutch Slip Torque (ft-lbs)	Drive Manufacturer
26959	LS-60-LH1	225	Facet
30170	LS-60-RH1	255	Sun Autoelektrik
30737	LS-60-LH1	250	Sun Autoelektrik
39102	LS-60-RH1	260	ASC
39104	LS-60-RH1	380	ASC
39107	LS-60-LH1	275	Sun Autoelektrik

**CLINTON STARTER DRIVE CLUTCH TORQUE SETTINGS**

**AFFECTED USERS:**

Based on the test data obtained from the six (6) Clinton starters, all previous shipments of air motors with the friction-clutch inertia drive are suspect for having inconsistent clutch drive torque settings. The table below lists ESI shipments of air start motors that contain friction-clutch inertia drives.

Customer	Part Number	Serial No.	ESI Sales Order	ESI Ship Date
Exelon-Clinton	DS-60-LH1	28836	3003073	4/4/07
Exelon-Clinton	DS-60-LH1	28837	3003073	4/4/07
Exelon-Clinton	DS-60-RH1	28840	3003073	4/4/07
Exelon-Clinton	LS-60-LH1	26959 <sup>(2)</sup>	3003773	9/18/08
Exelon-Clinton	LS-60-LH1	26960	3003773	9/18/08
Exelon-Clinton	LS-60-LH1	29635	3003773	9/18/08
Exelon-Clinton	LS-60-RH1	30170 <sup>(2)</sup>	3003773	9/18/08
Exelon-Clinton	LS-60-RH1	30173	3003773	9/18/08
Exelon-Clinton	LS-60-RH1	30176	3003773	9/18/08
Exelon-Clinton	LS-60-RH1	30177	3003773	9/18/08
Exelon-Clinton	LS-60-LH1	30737 <sup>(2)</sup>	3003773	9/18/08
Exelon-Clinton	LS-60-RH1	31590 <sup>(1)</sup>	3003773	9/18/08
Exelon-Clinton	LS-60-LH1	31596	3003773	9/18/08
Exelon-Clinton	LS-60-RH1	39101	3007171	6/30/10
Exelon-Clinton	LS-60-RH1	39102 <sup>(2)</sup>	3007171	6/30/10
Exelon-Clinton	LS-60-RH1	39104 <sup>(2)</sup>	3007171	6/30/10
Exelon-Clinton	LS-60-RH1	39105	3007171	6/30/10
Exelon-Clinton	LS-60-LH1	39106	3007171	6/30/10
Exelon-Clinton	LS-60-LH1	39107 <sup>(2)</sup>	3007171	6/30/10
Exelon-Clinton	LS-60-LH1	39109	3007171	6/30/10
Entergy-Indian Pt. 3	SS810GB03R31	SP101021110	3007732	10/26/10
Entergy-Indian Pt. 3	SS810GB03R31	SP101021111	3007732	10/26/10
Entergy-Indian Pt. 3	SS810GB03R31	SP101021112	3007732	10/26/10
PSE&G-Salem	SS810GB03R31-13B	SP030724044	110353	10/9/03

(1): This is the failed starter returned by Clinton  
(2): These are the six (6) starters returned by Clinton for torque testing.

**ESI SHIPMENTS OF SUSPECT AIR START MOTORS**

**CORRECTIVE ACTION:**

Users should return any of the suspect air start motors in their inventory to ESI for verification of the inertia drive clutch torque setting. These starters can then be used to replace currently installed starters once the torque setting is verified.

At the next available maintenance interval, users should return any installed starters to ESI for verification of the inertia drive clutch torque setting.

ESI will include clutch torque setting verification in the dedication process for all future shipments of air start motors with friction-clutch inertia drives.