



**ENGINE SYSTEMS, INC.**

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Telephone: 252/977-2720  
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October 21, 2008

U.S. Nuclear Regulatory Commission  
Document Control Desk  
Mail Stop 03H8  
Washington, DC 20555

Subject: 10CFR21 Reporting of Defects and Non-Compliance -  
Engine Systems, Inc. Report No. 10CFR21-0095, Rev. 0

Ingersoll-Rand Series 89 Air Start Motors, P/N 8367694-ESI

Dear Sir:

The enclosed report addresses a reportable notification for Ingersoll-Rand series 89 air start motors, P/N 8367694-ESI.

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.**

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

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

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**Report No. 10CFR21-0095**

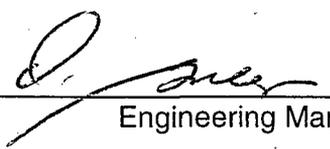
Rev. 0: 10/20/08

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

COMPONENT: Ingersoll-Rand series 89 air start motors  
P/N 8367694-ESI

SYSTEM: Emergency Diesel Generator – air starting system

CONCLUSION: Reportable in accordance with 10CFR21.

Prepared By:   
Engineering Manager

Date: 10/20/08

Reviewed By:   
Quality Assurance Manager

Date: 10/20/08

REV	DATE	PAGE	DESCRIPTION
0	10/20/08		Initial issue.

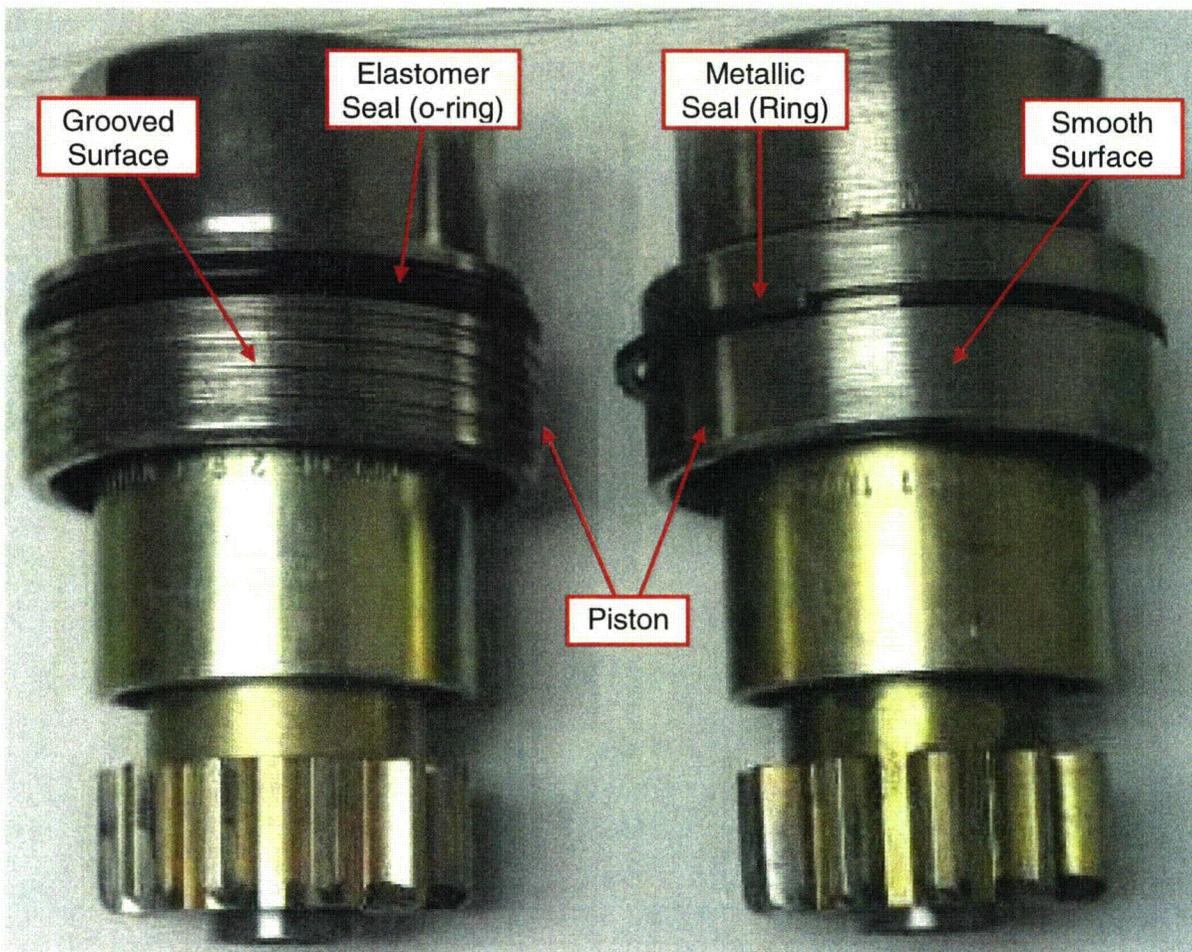
**COMPONENT:**

Diesel engine air start motor, part number 8367694-ESI (Ingersoll-Rand series 89)

**DISCUSSION:**

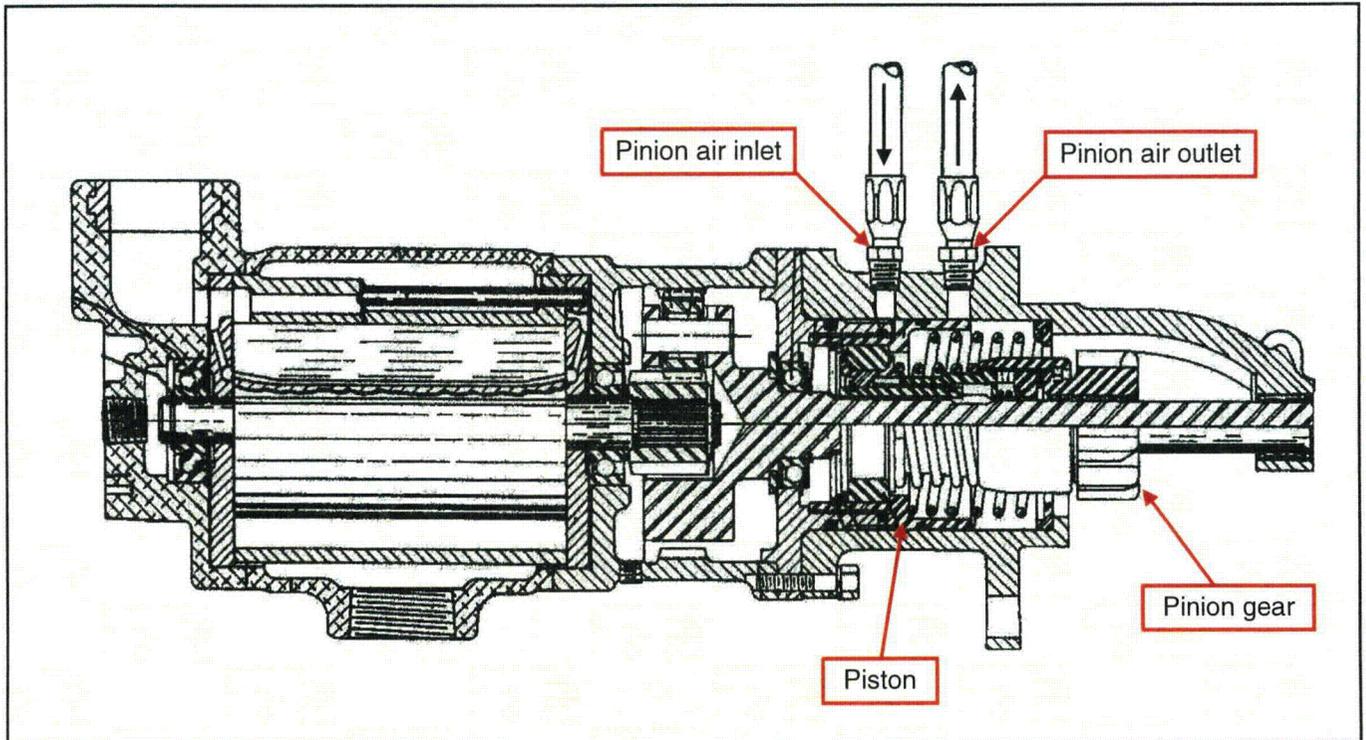
Engine Systems Inc. (ESI) began a 10CFR21 deviation evaluation on 9/10/08 after inspection of two (2) engine air starting motors (part number 8367694-ESI), returned from Nuclenor, revealed that the starters were incorrectly assembled. This evaluation was completed on 10/20/08. Nuclenor reported that the two (2) new air starters did not port air properly at the pinion engagement port. The motors were never installed on the engine and were being bench tested when the operability issue was observed. Both motors were returned to ESI for warranty evaluation.

ESI inspection determined that Ingersoll-Rand used the wrong pinion engagement piston during assembly of the air motors. A new style piston with an elastomer seal ring (used in I-R's series 88 air starters) was incorrectly installed in the drive housing instead of the required piston with a metallic seal ring (required for the series 89 motor).



**Series 88 Drive Pinion**  
***INCORRECT***

**Series 89 Drive Pinion**  
***CORRECT***



**AIR START MOTOR CROSS-SECTION**

Installation of the elastomer seal and piston within the series 89 starter could impact starting reliability of the diesel engine for the following reasons:

- (1) the elastomer seal is located further away from the drive gear on the piston; this requires increased travel of the piston to port air from the pinion outlet port. During abutment of the starter drive gear with the engine ring gear, air will not port from the starter to activate the main air start valve and thus engine cranking will not occur.
- (2) the elastomer seal can be cut by the pinion outlet port hole in the starter drive housing after a number of starter engagements. This could cause binding of the piston within the drive housing and or excessive air leakage past the seal. Both conditions could increase the time required for the pinion to engage with the engine flywheel and thus compromise the fast start capability of the engine.

ESI and Ingersoll-Rand (the starter manufacturer) have identified 20 air motors that were incorrectly assembled. These are identified as serial numbers SP071011063 thru SP080516043 having a date range of Oct. 11, 2007 thru May 16, 2008. I-R determined the root cause to be linked to one assembly technician that was pulling material from memory instead of using the part number specific pick list. Starter serial numbers include the year, month and day of manufacture. Serial number breakdown is as follows:

S/N SP080516039:    SP        08        05        16        039  
                         location\*    year        month        day        sequential number

\*SP: Southern Pines, NC plant

During evaluation of this issue, ESI contacted all customers that were shipped the incorrectly assembled starters. All starters have been inspected by ESI and confirmed that they were incorrectly assembled with pistons containing elastomer seals instead of the required metallic seals. None of the starters had been installed on the diesel engines and therefore they remained in customer inventory.

The last lot of starters supplied prior to the starters from Oct. 11, 2007 (071011) was assembled on June 18, 2007 (070618). ESI had two starters from the 070618 lot in inventory; these have been inspected and confirmed to be assembled correctly. Two other starters from a lot assembled on Jan. 22, 2007 were also inspected and confirmed to be assembled correctly. Based on this sampling of starters, it appears the assembly problem began with the Oct. 11, 2007 starters.

**AFFECTED USERS:**

A listing of nuclear safety related air start motors shipped with incorrectly assembled pinion pistons is shown below.

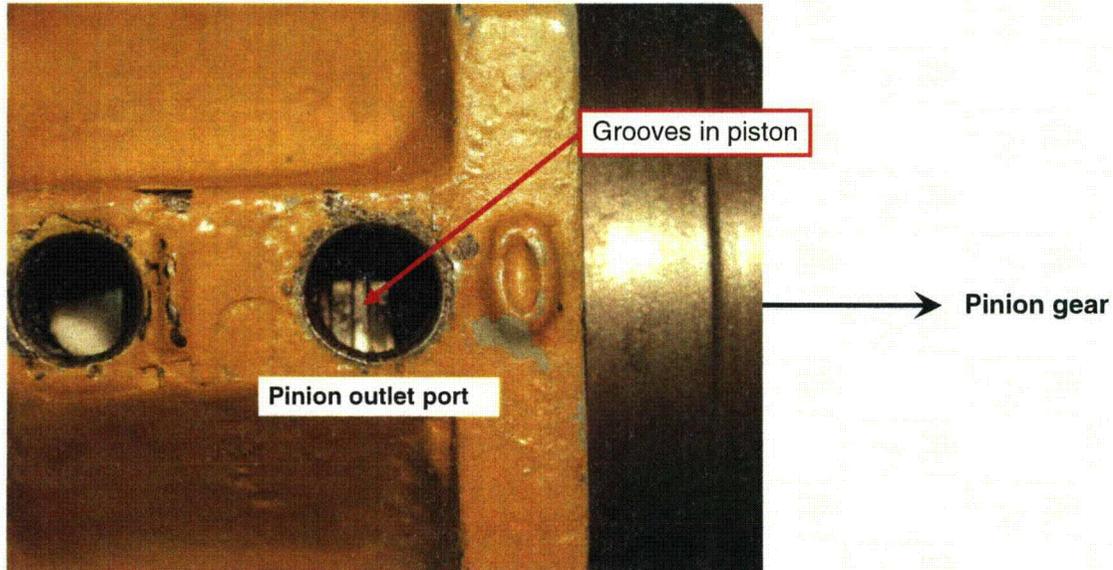
ESI S.O.	ESI C-of-C Date	Customer	Customer P.O.	Starter P/N	Starter S/N	ESI P.O.
3004530	5/29/2008	Davis-Besse	55108276	8367694-ESI	SP080516039 SP080516040 SP080516041 SP080516042	81229
3004427	6/05/2008	Millstone	45586442	8367694-ESI	SP080211016 SP080211023	83786
					SP080516043	81229
3004342	5/22/2008	Surry	45578190	8367694-ESI	SP080513004 SP080513005 SP080513007	85566
					SP080516038	81229
3004322	5/22/2008	Nuclenor	N2008/027	8367694-ESI	SP080211021	83786
					SP080513006	85566
3004033	2/19/2008	Beaver Valley	45253894	8367694-ESI	SP080211017 SP080211018 SP080211019 SP080211020	83786
3003748	11/20/07	Quad Cities	703; rel. 11581	8367694-ESI	SP071011063 SP071011064	82126
3003561	3/06/08	Clinton	703; rel. 11553	8367694-ESI	SP080211022	83786

**CORRECTIVE ACTION:**

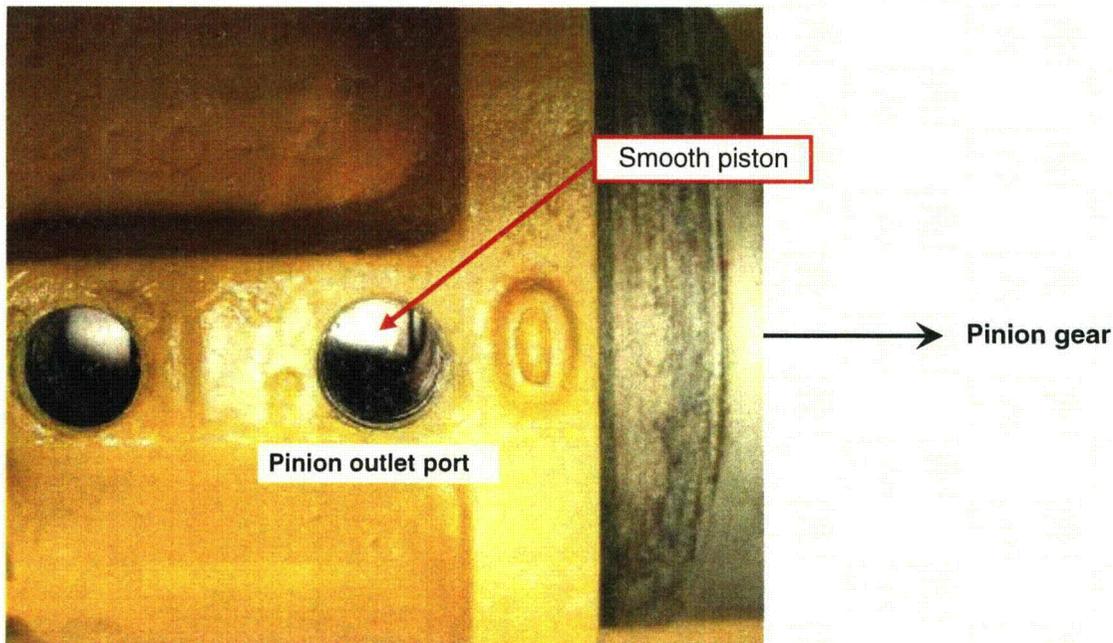
1. ESI has contacted all affected customers that were shipped the incorrectly assembled starters. All starters have been returned to ESI.
2. ESI has added verification of correct pinion piston and seal assembly to the critical characteristic inspection activity for future starter shipments.
3. If desired, users can inspect other starters in their inventory to verify correct assembly of the pinion piston and seal. An inspection procedure is provided on the following page.

**INSPECTION PROCEDURE (OPTIONAL):**

The pinion piston can be viewed through the pinion air outlet port to determine proper configuration. Refer to photos below.



***INCORRECT***



***CORRECT***