ENGINE SYSTEMS, INC.
175 Freight Road
Rocky Mount, NC 27804
Telephone: 252/977-2720
Fax: 252/446-1134

May 13, 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. 10CFR21-0101, Rev. 0

Magnetrol Level Switch, ESI P/N 8277780-ESI
Magnetrol Type A10

Dear Sir:

Enclosed is our evaluation report (10CFR21-0101) of a deviation with a Magnetrol level switch at the Monticello Nuclear Plant. Our evaluation determined that this deviation is not a defect as defined by 10CFR Part 21.

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

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.

RECEIVED: _____

93

DATE: _____

IE19
NRR

ENGINE SYSTEMS, INC.
175 Freight Road, Rocky Mount, NC 27804
Telephone: 252/977-2720
Fax: 252/446-1134

Report No. 10CFR21-0101
Rev. 0: 05/12/11

10CFR21 REPORTING OF DEFECTS AND NON-COMPLIANCE

COMPONENT: Magnetrol level switch
ESI P/N: 8277780-ESI
Magnetrol type A10

SYSTEM: Emergency Diesel Generator – fuel oil system

CONCLUSION: Not-reportable in accordance with 10CFR21

Prepared By: _____ Date: 5/12/11
Engineering Manager

Reviewed By: _____ Date: 5-12-11
Quality Assurance Manager

REV	DATE	PAGE	DESCRIPTION
0	05/12/11		Initial issue.

COMPONENT:

Magnetrol level switch
ESI P/N: 8277780-ESI
Magnetrol type A10

PURPOSE:

This report is a follow-up to an interim report (10CFR21-0101-INT) issued by Engine Systems, Inc. (ESI) on 04/15/11 which identified a deviation with a Magnetrol level switch. The interim report was issued because ESI was not able to complete the evaluation within the 60 day requirement of 10CFR21.

SUMMARY:

Evaluation of the level switch failure at Monticello was completed on 5/12/11 and it has been determined that the deviation is not a reportable defect as by defined by 10CFR21. Based on the data collected by ESI and through evaluation by and discussion with Magnetrol (manufacturer of the level switch), it is ESI's conclusion that the level switch was delivered to the customer in working order and that it must have been damaged subsequent to ESI's involvement. Furthermore, within the fuel oil system in which the level switch is installed, there is an inherent redundancy whereby the high/low level alarm switch will actuate to turn on or turn off a secondary fuel transfer pump in the event this level switch (or its associated fuel transfer pump) does not function properly. Therefore, ESI does not consider this as a reportable defect.

DISCUSSION:

ESI began an evaluation of a level switch, S/N 626780-01-001, on February 16, 2011. Monticello Nuclear Plant returned the level switch for failure evaluation. The reported condition was that the switch mechanism would not actuate throughout the entire level range. This level switch was originally supplied by ESI in July 2008.

Analysis by customer

Prior to returning the switch to ESI, Monticello Nuclear Plant utilized the services of a Magnetrol Field Service Technician (Mark Leven) for an on-site evaluation. The results of that evaluation are shown in Figure 1 below:

SN/ 626780-01-001

The switch mechanism would not pull in when lifting up on the spring all the way through the motion to the stop.

I tried to adjust the jam nuts but could not get the switch to pull in, even though I was certain the attraction sleeve was in position with the magnet.

I removed the attraction sleeve and slid it up and down through the e-tube with the switch (see video) the magnet would not pull in. I had another yellow dot switch mechanism (a 089-7401-156) and it worked fine under this test.

Conclusion

I can only conclude that the magnet on the switch has been weakened. I cannot find any physical signs of damage to explain this but the test is conclusive.

I recommend complete diagnosis at our facility after which, we will provide a report and completely rebuild this unit.

Mark Leven

Field Service / Tech Support

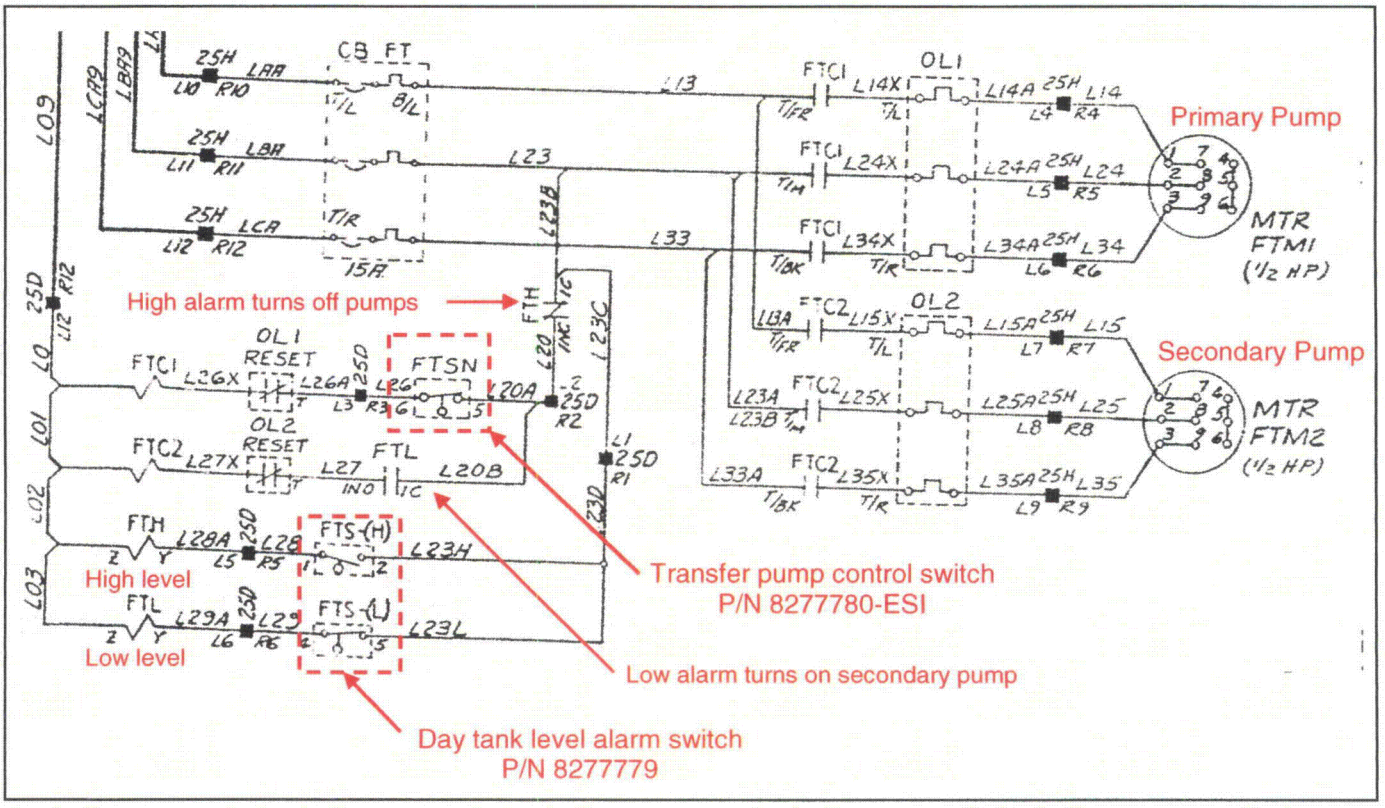
Magnetrol International

mleven@magnetrol.com, Phone 630-969-4000 X-1212 Cell 630-673-7677

Figure 1: Excerpt of Magnetrol Field Service Report

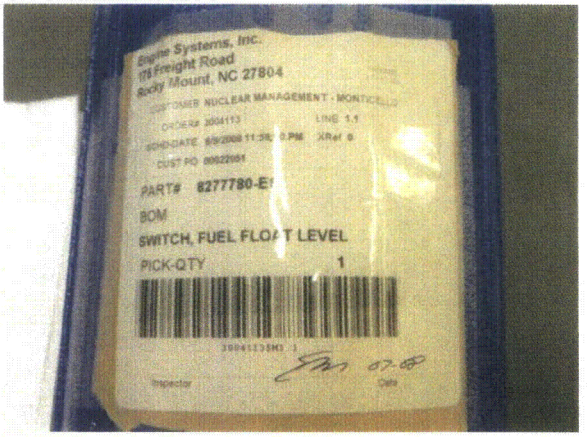
Analysis by ESI

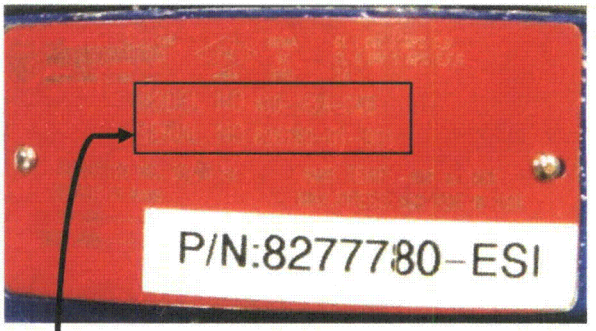
This part number level switch is used in the fuel oil day tank of some EMD 999 emergency diesel generators and controls the fuel transfer pump. The fuel transfer pump delivers fuel oil from the station's main fuel holding tank(s) to the engine's day tank. From the day tank, fuel oil is then delivered (by the engine driven fuel pump) to the engine's fuel manifold and to each cylinder's injector for atomization within the combustion chamber. Malfunctioning of this switch could prevent the primary fuel transfer pump from operating; however, a secondary fuel transfer pump is incorporated in the system. This secondary pump is controlled by the day tank level alarm switch; the pump turns on when the low level alarm is actuated and turns off when the high level alarm actuates. Therefore, a malfunction of the primary fuel transfer pump level control switch will not prevent the diesel generator from performing its safety related function.



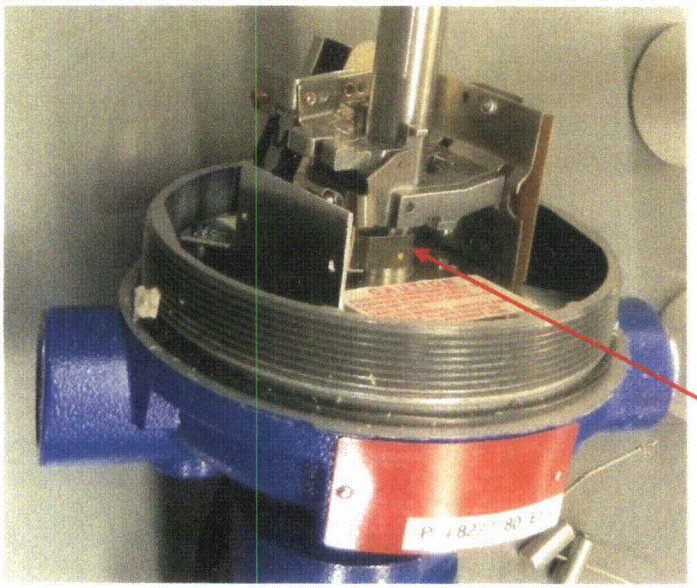
Fuel Transfer Pump Control Circuit

Upon receipt at ESI, the switch was inspected and tested. As-found visual inspection did not identify any obvious signs of damage or indicate a cause of failure. Overall condition appeared satisfactory. See photos below for a visual representation of the level switch:





Model No.: A10-1E2A-CKB
Serial No.: 626780-01-001

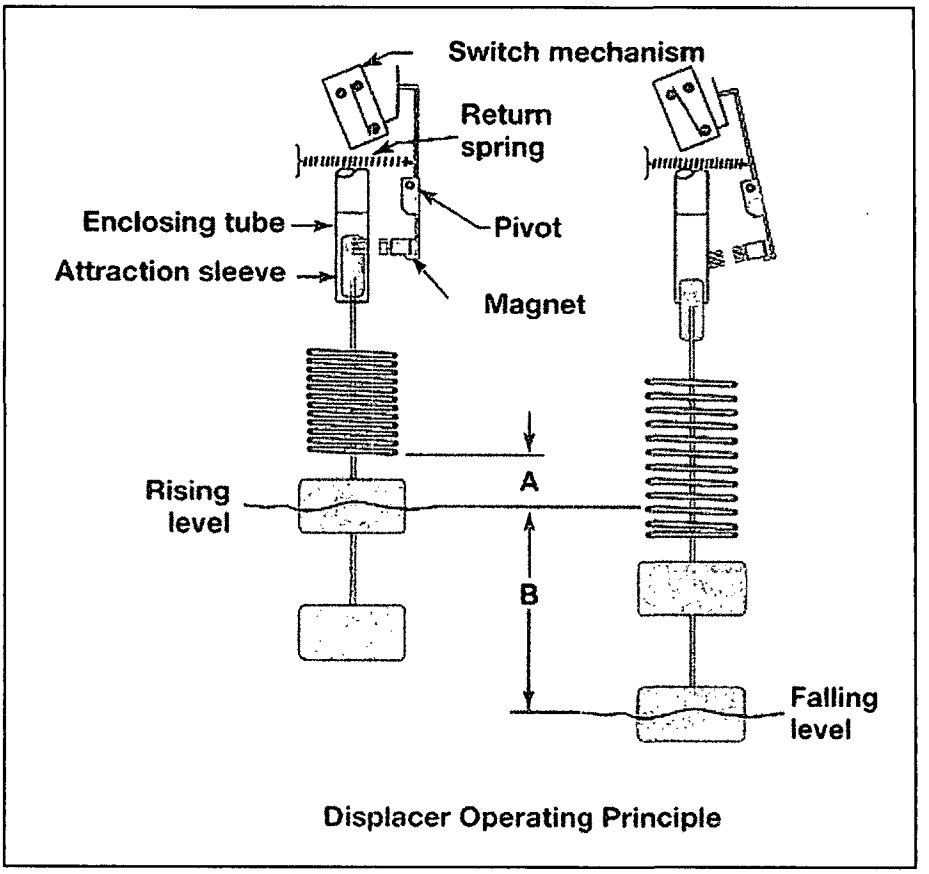


Switch mechanism
Housing (cover) removed

Magnet

Photos of Level Switch Returned by Monticello Nuclear Plant

ESI then attempted to functionally test the level switch by manually actuating the float cable by hand and noting proper movement of the switch mechanism. It was found that the switch mechanism would not pull-in as the cable and spring were raised. Operation of the switch is such that as the cable assembly rises (with rising fluid level), an attraction sleeve rises and moves into the path of a magnet on the switch mechanism. The pull of the magnet to the attraction sleeve causes the switch mechanism to change state. Conversely, as the cable assembly falls (with falling fluid level), the attraction sleeve falls and the magnet retracts causing the switch mechanism to change state.



Displacer Operating Principle

After noting this weak magnetic pull, ESI selected two similar Magnetrol level switches which had been used previously as seismic test specimens; one from 2006 and one from 2001. While they are different part number level switches, they both utilize the same magnet within the switch mechanism. Both of the units were found to still operate satisfactorily. The magnet in the customer's unit was then replaced with a magnet from each of the seismic specimens. In both instances, the customer's unit was operational (switch changed state). The magnet from the customer's unit was then placed into each of the seismic specimens. In both instances, the unit would not operate (switch would not change state). This series of testing provided further evidence that the magnet in the customer's unit was weak and was the cause of failure.

As part of this evaluation, ESI had been in contact with Magnetrol to discuss acceptance criteria for the magnetism of the magnet and possible reasons for reduced magnetism. At the conclusion of ESI's testing, the level switch was returned to Magnetrol for their in-house inspection and evaluation. Magnetrol summarized that:

> *"The magnet has experienced a weakening of the magnetic field, either due to impact or exposure to a magnetic field."*

Additionally, Magnetrol tested the magnet strength with a gauss meter and found the magnet measured below their internal acceptance criteria. Research indicates that the main reasons for magnets becoming demagnetized are:

- Heating, hammering, or jarring a magnet
- Placing the magnet in an alternating current field

Per correspondence with Magnetrol personnel, they indicated they check magnetism for each magnet to verify it meets their acceptance criteria. Also, several comments were made by Magnetrol to the fact that level switches with this style magnet have been installed for 50+ years and are still operational. It is Magnetrol's position that when the level switch left their facility, it was fully operational.

As part of ESI's dedication functional testing, 100% of the level switches are functional tested to ensure operation prior to shipment to the customer. This level switch was no exception. ESI utilized a fixture on which the level switch was mounted and the fluid level within the fixture was manipulated to verify the switch contacts actuated at the proper levels. This testing utilized fuel oil as the test medium and verified proper contact change of state through contact resistance measurement. At the conclusion of the testing, the housing was re-installed and the switch mechanism was therefore sealed and protected from any external elements. Based on the level of testing performed at Engine Systems Inc., ESI is confident that the switch was operational and the magnet performed as required.

ESI believes that weakening of the magnet must be due to an external force (impact to the magnet, exposure to a strong magnetic field, etc). To date, no other similar failures with Magnetrol level switches have occurred during functional testing at ESI or have been reported to ESI by others.

CONCLUSION:

Based on the data collected by ESI and through evaluation by and discussion with Magnetrol, it is ESI's conclusion that the level switch was somehow damaged subsequent to ESI's involvement. Furthermore, within the fuel oil system in which the level switch is installed there is an inherent redundancy whereby the high/low level alarm switch will actuate to turn on or turn off the secondary fuel transfer pump in the event this level switch (or its associated fuel transfer pump) does not function properly. Therefore, ESI does not consider this to be a reportable defect of the supplied level control switch, part number 8277780-ESI.