Part 21 (PAR) Event # 46924

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County:		**License #:**	
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NRC Notified by:	JEFF McCONKEY	**Notifications:**	RICHARD CONTE R1DO
HQ Ops Officer:	BILL HUFFMAN		JOSELITO CALLE R2DO
Emergency Class:	NON EMERGENCY		ROBERT DALEY R3DO
10 CFR Section:			BLAIR SPITZBERG R4DO
21.21	UNSPECIFIED PARAGRAPH		PT 21 GRP VIA E-MAIL

POSSIBLE DEFICIENCY IN ENVIRONMENTAL TESTING OF LIMITORQUE GEARED LIMIT SWITCH FOR INSIDE CONTAINMENT

The following is a summary of a Part 21 fax notification received from Flowserve-Limitorque Actuators:

This Part 21 evaluation is for Geared Limit Switch - Nylon Bearing Retainer Cage. Flowserve has provided the NRC an interim report that provides information concerning an evaluation that is being performed by Flowserve - Limitorque regarding a possible deficiency in previous EQ test programs which qualified Limitorque SMB-000 & 00 actuators to IEEE-382 requirements for inside containment service. An investigation to date has revealed that the non-metallic retainer cage material of the radial ball bearing may not have been properly considered when determining thermal aging requirements during EQ testing.

The safety related component affected is the geared limit switch (GLS) assembly on actuator type / size Limitorque SMB/SB/SBD-000 and SMB/SB/SBD-00 only qualified for inside containment to Limitorque EQ report number B0058 and B0212. The sub-component of the GLS under evaluation is a radial ball bearing (manufacturer's part # 1604-DC and 7304-DC) manufactured by Nice / RBC Bearing Corp / SKF which has been used in the cartridge assembly. This bearing provides partial support to the input pinion shaft of the GLS. This bearing was manufactured with a nylon (polyamide 6/6) retainer cage.

a) This bearing is used on the 2-train and 4-train geared limit switch cartridge assembly of the SMB/SB/SBD-00 and the 4-train GLS cartridge of the SMB/SB/SBD-000 only.
b) The GLS assembly used in SMB/SB/SBD-0, 1, 2, 3, 4 & 5 actuators use a slightly different cartridge construction that does not contain this bearing.

The functionality of the cartridge bearing in the GLS assembly may not have been properly validated in an accident

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environment test with the non-metallic nylon material properly thermally aged to "end of life" condition.

Limitorque is continuing the evaluation of this issue in an effort to finalize this position.

At this point of the evaluation, Limitorque does not feel that the safety related function of the subject actuators will be affected by the existence of the nylon bearing retainer cage in the GLS assembly. Limitorque will continue the evaluation of this issue and will submit a status update on or before July 15, 2011.

To date, the use of the nylon cage bearing in the GLS assembly has shown no negative affects on operability of the switch.

* * * UPDATE ON 7/15/11 AT 1500 EDT BY HUFFMAN * * *

The following information was received from Flowserve Limitorque Actuators via e-mail:

"As identified in the interim report above, the SMB-000 & 00 geared limit switch assembly contains a ball bearing which includes a nylon ball retainer cage. A review of previous EQ testing identified that the retainer cage material may not have been thermally aged to an end of life condition prior to High Energy Line Break / Main Steam Line Break exposure. The concern was that degradation of the retainer cage could result in loss of functionality of the limit switch assembly in safety related applications.

"This bearing is a subcomponent of the geared limit switch (GLS) assembly. The purpose of the bearing is the partial support of the input pinion shaft of the GLS cartridge. The input pinion shaft connects the GLS to the mechanical drive train of the actuator. This shaft is also supported by a bronze sleeve bushing in the cartridge. The purpose of the retainer cage in a radial ball bearing is to position the individual balls in the bearing assembly. As part of the evaluation, a sample bearing was installed in a GLS cartridge. Subsequently, the nylon ball retainer cage was intentionally removed from the bearing to simulate a worst case scenario of total degradation of the retainer cage. The removal of the ball retainer cage and the subsequent uncontrolled alignment of the individual balls inside the ball bearing race did not result in loss of GLS functionality. The input pinion shaft remained adequately supported by the sleeve bushing such that it is reasonable to conclude the GLS would perform its safety related function.

"To further evaluate the adequacy of the nylon retainer cage equipped bearing for the accident environment, a thermal screening test of an SMB-00 geared limit switch assembly containing the subject bearing was performed. This test consisted of continuous exposure to a 340°F ambient temperature while cycle testing the limit switch. The test was halted after 270 hours (11.25 days) and 1600 operational cycles without failure. Post test inspection showed that the nylon retainer cage remained intact and functional which indicates that the degradation of the bearing discussed above is highly unlikely. No loss of functionality of the limit switch occurred during the test indicating acceptability of the bearing for the application. This screening test is documented in report # STLO-1125 retained on file and available for audit at Flowserve - Limitorque

"Based upon the evaluation described above and the existing EQ test data, Limitorque has determined that this issue is not reportable under 10CFR21 guidelines. The investigation has shown that in the unlikely event of degradation of the bearing retainer cage, safety-related functionality of the geared limit switch assembly will not be affected. Environmental qualification of the SMB/SB/SBD-000 & 00 actuators by Limitorque EQ reports B0058 and B0212 remains valid."

R1DO (Dwyer), R2DO (Freeman), R3DO (Bloomer), and R4DO (Cain) notified. The Part 21 Group was informed via e-mail.

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