



U.S. Nuclear Regulatory Commission
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11555 Rockville Pike
Rockville, MD 20852

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LIMDOC-2023-003
November 17, 2023

Subject: **Final Report of a Defect Associated with a SMB-1 Geared Limit Switch Assembly Pursuant to 10 CFR 21.21(a)(2)**

Reference: NRC Accession No. ML23276A641

The final Part 21 report is a follow-up to Flowserve's interim notification dated 9-28-23 pertaining to actuator geared limit switch assemblies contained in SMB-1 actuators supplied to Bopp & Reuther Valves for use in safety related applications at Bruce Power Nuclear Generating Station. Flowserve's investigation has concluded that the deviation evaluated constitutes a reportable defect affecting the three actuators identified below.

10 CFR21.21 Report Details

(i) *Name and address of the individual or individuals informing the Commission.*

Tyler Thompson
Director, Plant Manager
Flowserve, Limatorque Actuation Systems
Lynchburg VA, 24502

(ii) *Identification of the facility, the activity, or the basic component supplied for such facility or such activity within the United States which fails to comply or contains a defect.*

The basic component containing the defect is a SMB-1 Geared Limit Switch Assembly identified as Limatorque part number 10168.

(iii) *Identification of the firm constructing the facility or supplying the basic component which fails to comply or contains a defect.*

Flowserve Corporation, Limatorque Actuation Systems
Lynchburg VA, 24502

- (iv) *Nature of the defect or failure to comply and the safety hazard which is created or could be created by such defect or failure to comply.*

The defect was the result of improper assembly of the Geared Limit Switch (GLS) assembly. The root cause of the defect was attributed to misidentification of a subcomponent of the GLS resulting in a SMB-2 drive pinion being incorrectly installed on a SMB-1 GLS. The use of the incorrect input pinion results in an improper engagement of the limit switch to the actuator mechanical drive train which could result in a loss of function of the GLS.

A safety related function of the SMB/SB/SBD actuator is to reposition the valve electrically. Loss of function of the geared limit switch assembly could potentially impact this safety function. Therefore, the deviation described above constitutes a reportable defect.

- (v) *The date on which the information of such defect or failure to comply was obtained.*

Flowserve's date of discovery of a deviation was July 31, 2023.

- (v) *In the case of a basic component which contains a defect or fails to comply, the number and location of these components in use at, supplied for, being supplied for, or may be supplied for, manufactured, or being manufactured for one or more facilities or activities subject to the regulations in this part.*

A quantity of three SMB-1 actuators containing the defect were manufactured on Flowserve sales order # 175377.001 and shipped to Bopp & Reuther Valves in Mannheim, Germany on 2-4-2020. The actuators are identified as serial # L1226986, L1226987, and L1226988. Bopp & Reuther Valves subsequently shipped the actuators to Bruce Power Nuclear Generating Station in Ontario, Canada.

- (vii) *The corrective action which has been, is being, or will be taken; the name of the individual or organization responsible for the action; and the length of time that has been or will be taken to complete the action.*

Immediate corrective actions related to this issue consist of the following. The GLS assemblies supplied with the identified actuators were reworked by Bruce Power by replacing the improper SMB-2 drive pinion with the correct SMB-1 pinion. At Flowserve, all SMB geared limit switch assemblies in stock in Lynchburg were placed on temporary quality hold for enhanced inspection. No GLS assemblies were found to contain the defect.



Corrective actions to prevent recurrence include revisions to the machining drawings of the six different GLS drive pinions used in the SMB actuator product family to add a stamping of the SMB actuator size to the drive pinion for use as a visual identifier. This was completed on August 08, 2023.

The existing Flowserve internal inspection procedure for geared limit switch assemblies is being enhanced to add a visual verification of the proper drive pinion on the assembled GLS using the newly implemented stamped identifier. Revisions to the inspection procedure will be completed on or before 11-28-2023. Quality Control Manager Chris Shaffer has responsibility for ensuring assembly and quality control personnel are trained in the revised procedure on or before November 30, 2023.

- (viii) *Any advice related to the defect or failure to comply about the facility, activity, or basic component that has been, is being, or will be given to purchasers or licensees.*

There is no action required by the nuclear plants in response to this Part 21 notification.

- (ix) *In the case of an early site permit, the entities to whom an early site permit was transferred.*

N/A

Questions concerning this notification can be directed to:

Chris Shaffer, Quality Manager, Flowserve Corporation, Lynchburg VA Operations

C.Shaffer@flowserve.com

A handwritten signature in black ink that reads "Tyler Thompson". The signature is written in a cursive, flowing style.

Tyler Thompson
Director, Plant Manager
Flowserve. Limitorque Actuation Systems
Email: TyThompson@flowserve.com