

*Limitorque Actuation Systems*

U.S. Nuclear Regulatory Commission
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LIMDOC-2023-002
May 19, 2023

**Subject: Notification of Deviation Pursuant to 10 CFR 21.21
Regarding Limitorque Actuator Motor Pinion Installation**

10 CFR21.21 Report Details

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

Tyler Thompson
Director, Plant Manager
Flowserve, Limitorque 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 assembly containing the defect is an Limitorque model SBD-3 valve actuator manufactured in 2022 on Flowserve order number 188775.

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

Flowserve Corporation, Limitorque 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 nature of the defect is the motor pinion gear being inadequately secured to the electric motor shaft of the valve actuator potentially resulting in the pinion gear to move out of proper position on the motor shaft during operation. The cause of the defect was improper installation of the motor pinion. The root cause of this issue was attributed to human error. Installing the motor pinion on the motor requires manually drilling a shallow depth "spot" on the shaft prior to installing a set screw. The set screw prevents axial movement of the pinion on the shaft during operation. Inspection



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revealed that during installation of the motor pinion, the spot drill depth was too shallow for proper engagement of the set screw.

A safety related function of the valve actuator is to reposition the valve in electric motor operation mode when required. The function of the motor pinion is to transmit torque from the electric motor to the actuator drive train. Axial movement of the motor pinion on the shaft could result in a reduced tooth contact with the mating worm shaft gear, interference with other components causing binding and premature wear or, the pinion becoming detached from the motor shaft. 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 identified the assembly deviation during inspection of the subject actuators on April 13, 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.*

Flowserve's investigation revealed a quantity of three Limitorque model SBD-3 actuators (serial #s L1281311, L1281313, & L1281314) manufactured on Limitorque Order # 188775 in April 2022 with the described assembly defect were supplied to Bruce Power Nuclear Generation Station in Ontario, Canada. The affected actuators are currently located at the Flowserve facility in Lynchburg VA.

- (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.*

Containment actions related to this issue consist of the following. The total quantity of ten SBD-3 actuators manufactured for Trillium Flow Technologies in 2022 were returned from Bruce Power to Flowserve for inspection.

Corrective actions to prevent recurrence include the following. Flowserve assembly technicians will be retrained on the instruction procedures for motor pinion installation. QC assembly inspection requirements for nuclear qualified SMB/SB/SBD actuators will be enhanced to include visual verification of motor pinion set screw and lockwire appearance after installation. These corrective actions will be completed on or before July 31, 2023.



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- (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. Motor pinion installation guidance has been previously transmitted to the plants in Limitorque Maintenance Updates 13-01 and 89-1.

- (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 Assurance Manager, Flowserve – Lynchburg
cshaffer@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