UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

March 7, 2018

Mr. Jeffery McConkey
Quality Assurance Manager
Flow Control Operations
Flowserve Corporation
5114 Woodall Road
Lynchburg, VA 24502

SUBJECT: FLOWSERVE – LIMITORQUE CORPORATION'S NUCLEAR REGULATORY COMMISSION INSPECTION REPORT NO. 99900100/2018-201, AND NOTICE OF NONCONFORMANCE

Dear Mr. McConkey:

On January 22-26, 2018, the U.S. Nuclear Regulatory Commission (NRC) staff conducted an inspection at Flowserve Corporation's Limitorque division (hereafter referred to as Flowserve) in Lynchburg, VA. The purpose of this limited-scope routine inspection was to assess Flowserve's compliance with provisions of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 21, "Reporting of Defects and Noncompliance," and selected portions of Appendix B, "Quality Assurance Program Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities."

This technically-focused inspection specifically evaluated Flowserve's implementation of the quality activities associated with the design, fabrication, and testing of the Limitorque motor-operated valve actuators and replacement valve parts for the U.S. nuclear industry. The enclosed report presents the results of the inspection. This NRC inspection report does not constitute NRC endorsement of Flowserve's overall quality assurance (QA) program.

During this inspection, the NRC inspection team found the implementation of your QA program did not meet certain regulatory requirements imposed on you by your customers or NRC licensees. Specifically, the NRC inspection team determined that Flowserve was not fully implementing its QA program in the areas of design control, inspection, control of quality assurance records, and control of purchase material, equipment, and services. The specific findings and references to the pertinent requirements are identified in the enclosures to this letter. In response to the enclosed notice of nonconformance (NON), Flowserve should document the results of the extent of condition review for these findings and determine if there are any effects on other safety-related components.

In addition to the U.S. nuclear operating fleet, Flowserve also supplied actuators to Vogtle Electric Generating Plant, Units 3 and 4 which are currently under construction. These motor actuators are associated with multiple Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) from Appendix C of the Combined License for Plant Vogtle, Units 3 and 4. While the identified nonconformances raise concerns regarding aspects of the processes used at Flowserve to verify the quality of commercial grade parts used in the manufacture of the

actuators, the NRC has not, to date, identified any specific parts that are defective. Consequently, at this time, we do not believe any of the three nonconformances are material to the associated ITAACs.

Please provide a written statement or explanation within 30 days of this letter in accordance with the instructions specified in the enclosed NON. We will consider extending the response time if you show good cause for us to do so.

In accordance with 10 CFR 2.390, "Public Inspections, Exemptions, Requests for Withholding," of the NRC's "Rules of Practice," the NRC will make available electronically for public inspection a copy of this letter, its enclosure, and your response through the NRC Public Document Room or from the NRC's Agencywide Documents Access and Management System, which is accessible at http://www.nrc.gov/reading-rm/adams.html. To the extent possible, your response, should not include any personal privacy, proprietary, or Safeguards Information so that it can be made available to the public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request that such material be withheld from public disclosure, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim (e.g., explain why the disclosure of information would create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If Safeguards Information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21, "Protection of Safeguards Information: Performance Requirements."

Sincerely,

/RA/

Terry W. Jackson, Chief
Quality Assurance Vendor Inspection Branch-1
Division of Construction Inspection
and Operational Programs
Office of New Reactors

Docket No.: 99900100

Enclosures:
1. Notice of Nonconformance
2. Inspection Report No. 99900100/2018-201
   and Attachment

SUBJECT: FLOWSERVE – LIMITORQUE CORPORATION'S NUCLEAR REGULATORY COMMISSION INSPECTION REPORT NO. 99900100/2018-201, AND NOTICE OF NONCONFORMANCE

Dated: March 7, 2018

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OFFICIAL RECORD COPY

NOTICE OF NONCONFORMANCE

Flowserve Corporation
5114 Woodall Road
Lynchburg, VA 24502

Docket No. 99900100

Based on the results of a U.S. Nuclear Regulatory Commission (NRC) inspection conducted at Flowserve Corporation's Limitorque (hereafter referred to as Flowserve) facility in Lynchburg, VA, from January 22 through 26, 2018, Flowserve did not conduct certain activities in accordance with NRC requirements that were contractually imposed upon them by NRC licensees:

A. Criterion III of Appendix B to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Design Control," states in part that, "Measures shall also be established for the selection and review for suitability of application of materials, parts, equipment, and processes that are essential to the safety-related functions for the structures, systems and components."

   Criterion VII, "Control of Purchased Material, Equipment, and Services," of Appendix B to 10 CFR Part 50, states, in part, that "Measures shall be established to assure that purchased material, equipment, and services, whether purchased directly or through contractors and subcontractors, conform to the procurement documents. These measures shall include provisions, as appropriate, for source evaluation and selection, objective evidence of quality furnished by the contractor or subcontractor, inspection at the contractor or subcontractor source, and examination of products upon delivery."

   Contrary to the above, as of January 26, 2018, Flowserve failed to ensure the suitability of materials, parts, equipment, and processes that are essential to the safety-related functions of the safety-related electric actuators. Specifically, as part of its commercial grade dedication process:

   1. Flowserve failed to verify the validity of the Certificates of Compliance provided by a commercial sub-supplier, by performing a commercial-grade survey, source surveillance, independent testing, or other acceptable methods, as necessary for ensuring the proper material composition (hardness and tensile strength) of motor shafts used in DC motors and supplied by Flowserve as either part of safety-related actuators or sold as replacement parts.

   2. Flowserve failed to identify motor torque as a critical characteristic and failed to verify the motor output torque conformed to the associated speed-torque curves for DC motors procured from a commercial supplier and then supplied by Flowserve as a safety-related replacement part.

   This issue has been identified as Nonconformance 99900100/2018-201-01.

B. Criterion XVII, "Quality Assurance Records," of Appendix B states, in part, that "Sufficient records shall be maintained to furnish evidence of activities affecting quality. Records shall be identifiable and retrievable."

Flowserve Procedure QAP 16.1, "Handling and Storing Quality Records", Revision 24, required receipt inspection records to be maintained in hardcopy format for a period of three (3) years. Contrary to the above, as of January 26, 2018, Flowserve failed to maintain sufficient records to furnish evidence of activities affecting quality. Specifically, Flowserve was unable to provide documented evidence (inspection records) covering a period of more than two (2) years between January 2016 and January 2018 that showed that commercial-dedicated fasteners procured from Industrial Products Company were inspected, and critical characteristics for the items were verified, as required by Flowserve Inspection Plans 10.19, 10.14, 10.16, and 10.15.

This issue has been identified as Nonconformance 99900100/2018-201-02.

C. Criterion X, "Inspection," of Appendix B to 10 CFR Part 50, states, in part, that "A program for inspection of activities affecting quality shall be established and executed by or for the organization performing the activity to verify conformance with the documented instructions, procedures, and drawings for accomplishing the activity. Examinations, measurements, or tests of material or products processed shall be performed for each work operation where necessary to assure quality.

Contrary to the above, as of January 26, 2018, the NRC inspection team identified four examples where the receipt inspection records lacked evidence that Flowserve had performed material testing on commercially-dedicated hardware and fasteners as necessary to confirm the suitability of the parts. In the following examples, the required testing data was either not filled in on the data forms or was marked N/A without explanation:

1. For stock order with Part Number HB8-1/2-13x28, dated March 23, 2015, and Part Number HB8-3/4-10x28, dated March 17, 2015, the receipt inspection datasheet failed to indicate that the hardness testing for the lot of hex head cap screws had been performed as required by the inspection plan.

2. For stock order with Part Number HC8-3/8-16x28, dated May 21, 2015, and Part Number HC8-3/4-10x36, dated August 4, 2015, the receipt inspection datasheet failed to indicate that the hardness testing for the lot of hex head cap screws had been performed as required by the inspection plan.

3. For Part Number CKI-49NE-164, dated August 5, 2015, receipt inspection records did not verify the manufacturer for these fasteners as required by procedure.

4. For stock order with Part Number 60-563-02691, dated August 3 2015, inspection records failed to show that hardness testing had been performed as required by procedure.

This issue has been identified as Nonconformance 99900100/2018-201-03.

Please provide a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, with a copy to the Chief, Quality Assurance Vendor Inspection Branch-1 Vendor Branch, Division of Construction Inspection and Operational Programs, Office of New Reactors, within 30 days of the date of the letter transmitting this Notice of Nonconformance. This reply should be clearly marked as a "Reply to

a Notice of Nonconformance" and should include for each noncompliance: (1) the reason for the noncompliance or, if contested, the basis for disputing the noncompliance; (2) the corrective steps that have been taken and the results achieved; (3) the corrective steps that will be taken to avoid further noncompliance; and (4) the date when the corrective action will be completed. Where good cause is shown, the NRC will consider extending the response time.

Because your response will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's Agencywide Documents Access and Management System, which is accessible from the NRC Web site at http://www.nrc.gov/reading-rm/adams.html, to the extent possible, it should not include any personal privacy, proprietary, or Safeguards Information (SGI) so that the NRC can make it available to the public without redaction. If personal privacy or proprietary information is necessary to provide an acceptable response, then please provide a bracketed copy of your response that identifies the information that should be protected and a redacted copy of your response that deletes such information. If you request that such material be withheld, you must specifically identify the portions of your response that you seek to have withheld and provide in detail the bases for your claim of withholding (e.g., explain why the disclosure of information would create an unwarranted invasion of personal privacy or provide the information required by 10 CFR 2.390(b) to support a request for withholding confidential commercial or financial information). If Safeguards Information is necessary to provide an acceptable response, please provide the level of protection described in 10 CFR 73.21, "Protection of Safeguards Information: Performance Requirements."

Dated this the 7th day of March 2018.

U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NEW REACTORS
DIVISION OF CONSTRUCTION INSPECTION AND OPERATIONAL PROGRAMS
VENDOR INSPECTION REPORT

Docket No.:	99900100
Report No.:	99900100/2018-201
Vendor:	Flowserve Corporation 5114 Woodall Road Lynchburg, VA 24502
Vendor Contact:	Mr. Jeffery McConkey, Quality Assurance Manager Flowserve Corporation 5114 Woodall Road Lynchburg, VA 24502 Email: jmcconkey@flowserve.com Phone: 1-434-845-9738
Nuclear Industry Activity:	Limitorque, a division of Flowserve Corporation, is a manufacturer of safety-related motor-operated valve actuators being supplied to the U.S. nuclear industry.
Inspection Dates:	January 22-26, 2018

Inspectors:		
	Jeffrey Jacobson	NRO/DCIP/QVIB-1 Team Leader
	Jermaine Heath	NRO/DCIP/QVIB-1
	Phil Natividad	NRO/DCIP/QVIB-1
	Khalid Mohamed Al Naqbi	FANR, United Arab Emirates, Observer

Approved by:	Terry W. Jackson, Chief Quality Assurance Vendor Inspection Branch-1 Division of Construction Inspection and Operational Programs Office of New Reactors

EXECUTIVE SUMMARY

Flowserve - Limitorque Corporation
99900100/2018-201

The U.S. Nuclear Regulatory Commission (NRC) staff conducted a vendor inspection at the Flowserve – Limitorque Corporation's (hereafter referred to as Flowserve) facility in Lynchburg, VA, to verify that it had implemented an adequate quality assurance (QA) program that complies with the requirements of Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities." In addition, the NRC inspection also verified that Flowserve implemented a program under 10 CFR Part 21, "Reporting of Defects and Noncompliance."

This technically-focused inspection specifically evaluated Flowserve's implementation of quality activities associated with the design, fabrication, and testing of safety-related motor-operated valve actuators and replacement parts being supplied to the U.S. nuclear industry. The inspection team focused its review on Flowserve's implementation of processes for commercial-grade dedication and supplier oversight, in-process inspections, design control, and corrective action/10 CFR Part 21.

In the area of commercial-grade dedication and supplier oversight, the NRC inspection team identified Nonconformance 99900100/2018-201-01 in association with Flowserve's failure to implement the regulatory requirements of Criterion III, "Design Control" and Criterion VII, "Control of Purchased Material, Equipment, and Services" of Appendix B to 10 CFR Part 50. Nonconformance 99900100/2018-201-01 cites Flowserve for failure to ensure the selection and review for suitability of application of materials, parts, equipment, and processes that are essential to the safety-related functions of the electric actuators. Specifically, Flowserve (1) failed to verify the validity of the Certificates of Compliance by commercial-grade survey, source surveillance, or other acceptable method, for material composition (hardness and tensile strength) of the motor shafts used in DC motors provided by a commercial supplier, and (2) failed to identify motor output torque as a critical characteristic and did not verify that the motor output torque conformed to the associated speed-torque curves for DC motors supplied to Flowserve from a commercial supplier.

In the area of in-process inspections, the inspection team identified Nonconformance 99900100/2018-201-02 in association with Flowserve's failure to implement the regulatory requirements of Criterion XVII, "Quality Assurance Records," of Appendix B to 10 CFR Part 50. Nonconformance 99900100/2018-201-02 cites Flowserve for failure to maintain sufficient records to furnish evidence of activities affecting quality. Specifically, Flowserve was unable to provide documented evidence (inspection records) covering more than two (2) years between January 2016 and January 2018 that showed commercially-dedicated items were inspected and critical characteristics for the items were verified.

Also, the NRC inspection team identified Nonconformance 99900100/2018-201-03 in association with Flowserve's failure to implement the regulatory requirements of Criterion X, "Inspection," of Appendix B to 10 CFR Part 50. Nonconformance 99900100/2018-201-03 cites Flowserve for its failure to ensure that material testing was performed on commercially-dedicated hardware and fasteners as required by procedure, as necessary to ensure the suitability of the parts.

In the area of design control, the inspection team identified that Flowserve was appropriately controlling the design of the safety-related valve actuators and was appropriately reviewing proposed changes to the design through the use of Engineering Design Documents (EDDs).

In the area of corrective action/10 CFR Part 21, the inspection team concluded that Flowserve is appropriately implementing its policies and procedures that govern corrective actions and Part 21 consistent with the regulatory requirements of Criterion XVI, “Corrective Action” of Appendix B to 10 CFR Part 50, and with 10 CFR Part 21.

Lastly, based upon the results of this inspection, the inspection team was able to close the following previously identified NRC findings:

NON 99900100/2011-201-04
NOV 99900100/2012-201-01
NON 99900100/2012-201-02
NON 99900100/2012-201-03
NON 99900100/2012-201-04
NON 99900100/2012-201-05.

REPORT DETAILS

1. Commercial-Grade Dedication and Supplier Oversight

   a. Inspection Scope

   The NRC inspection team reviewed Flowserve's policies and implementing procedures that govern the implementation of its commercial-grade dedication (CGD) program and supplier oversight to verify compliance with the requirements of Criterion III, "Design Control," Criterion IV, "Procurement Document Control," and Criterion VII, "Control of Purchased Material, Equipment, and Services," of Appendix B to 10 CFR Part 50.

   The NRC inspection team selected a sample of items and services that Flowserve procured from commercial suppliers and then dedicated for use in safety-related applications. Specifically, the NRC inspection team evaluated Flowserve's inspection plans and technical evaluations to verify the evaluations appropriately identified and verified the critical characteristics and technical attributes necessary to provide reasonable assurance the components being dedicated would perform their intended safety function. The NRC inspection team also evaluated the criteria for the selection of critical characteristics, the basis for the sampling plan (as applicable), and the selection and implementation of verification methods. The NRC inspection team also reviewed a sample of external audits and purchase orders (POs) issued to commercial suppliers to verify compliance with the applicable regulatory and technical requirements.

   b. Observations and Findings

   The NRC inspection team discovered an issue with Flowserve's identification of critical characteristics associated with DC motors that are procured by Flowserve from a commercial supplier and then dedicated for use in safety-related electric actuators or supplied as replacement components. The NRC inspection team reviewed Flowserve PO 239799 for a 250 VDC motor for the Limitorque SMB series actuator, dated November 13, 2015. Flowserve procured the DC motor from, a commercial supplier, and then dedicated the motor for use in safety-related electric actuators. Flowserve Inspection Plan (IP) 10.111, describes the dedication process for the DC motors.

   Flowserve Procedure QAP-10.4, "Procedure for Certificates of Compliance," Revision 6, establishes the requirements for testing and acceptance of AC and DC motors. Routine testing of the DC motors is performed by the commercial supplier. However, it was not clear how the specific parameters being verified relate to the safety function of the motors, nor how Flowserve was verifying the validity of the commercial supplier's data as part of its commercial grade dedication program. While the routine testing performed by the commercial supplier checks motor speed and current at one point, the inspectors noted that Flowserve had not generated a technical evaluation that identified specific critical characteristics related to motor output performance (including motor torque). Ensuring the motors conform to published speed/torque curves is necessary to ensure the motors can deliver the relied upon torque to operate the motor-operated valve actuators. In addition to the routine motor testing completed at the commercial supplier, the motor-operated valve actuator assemblies are subjected to a torque test at Flowserve which can be used to verify motor torque output performance. However, Flowserve also supplies stand-alone safety-related replacement motors and performs no additional testing to verify output torque for those motors.

In summary, the NRC inspection team determined that Flowserve had not identified nor verified an appropriate set of critical characteristics for the DC motors being supplied as replacement components. The NRC inspection team identified this issue as the first example of Nonconformance 99900100/2018-201-01 for Flowserve's failure to ensure the selection and review for suitability of application of materials, parts, equipment, and processes that are essential to the safety-related functions of the safety-related electric actuators, as required by Criterion III of Appendix to 10 CFR Part 50, "Design Control."

The NRC inspectors also identified an issue with Flowserve's acceptance, as part of its commercial grade dedication process, of unverified certificates of compliance (CoC) from a commercial sub-supplier who supplies motor shafts to the commercial supplier for safety-related DC motors. The NRC inspection team reviewed Audit #2018-01-E, commercial-grade survey of the commercial supplier, dated January 17, 2018. Flowserve Procedure IP 10.111 Revision 14, provides the method for dedicating the commercial supplier DC motors. The inspection plan required the testing of materials as listed on the purchase order as well as components identified in Quality Engineering Standard K-12028 Revision B. Table K-12028 of that standard identifies motor shaft material as a critical characteristic essential to motor function, the material be made from AISI 4140 steel, and the steel was to have a specific surface hardness and minimal tensile strength. These specifications apply to armature assemblies for Type LN and Type RH Design DC nuclear valve operators in accordance with Flowserve Quality Engineering Standard K-12057 Revision C, and K-11934 Revision F, respectively.

The inspectors observed that verification of the motor shaft materials is performed through a review of Certificates of Conformance (C of Cs) provided by the commercial sub-supplier (shaft manufacturer). However, the NRC inspection team identified that Flowserve had not taken any actions to evaluate the validity of the sub-suppliers C of Cs, either through a commercial-grade survey, source surveillance, or other means. The NRC inspection team identified this issue as the second example of Nonconformance 99900100/2018-201-01 for Flowserve's failure to establish appropriate measures for source evaluation or inspection at the contractor or subcontractors, as required by 10 CFR Part 50, Appendix B, Criterion VII, "Control of Purchased Material, Equipment, and Services."

c. Conclusions

The NRC inspection team issued Nonconformance 99900100/2018-201-01 in association with Flowserve's failure to implement the regulatory requirements of 10 CFR Part 50, Appendix B, Criterion III, "Design Control," and Criterion VII, "Control of Purchased Material, Equipment, and Services." Specifically, for DC motors sold as replacement parts, Flowserve failed to identify motor output torque as a critical characteristic and failed to verify the torque conformed to the associated speed-torque curves for the motor. Flowserve also failed to ensure the suitability of application of materials, parts, equipment, and processes that are essential to the safety-related functions of the electric actuators when Flowserve failed to verify the C of Cs for motor shafts provided by a commercial supplier.

2. In-Process Inspections

a. Inspection Scope

The NRC inspection team reviewed implementation of Flowserve's policies and procedures to verify compliance with the requirements of Criterion X, "Inspection," of Appendix B to 10 CFR Part 50. The NRC inspection team focused their review on the implementing procedures specific to the conduct of receipt inspections, specifically those receipt inspections being conducted as part of its commercial grade dedication program and being used by Flowserve to verify critical characteristics of commercially procured parts used in the assembly/manufacture of the motor actuators. The NRC inspection team reviewed a sample of receipt inspection records (e.g., receipt inspection reports, Certificates of Compliance, Certificates of Calibration, and Material Test Reports), to assess whether the requisite inspections were performed in accordance with procedures, were reviewed by Flowserve for compliance with the requirements of the POs, and contained the applicable technical and regulatory information. The NRC inspection team witnessed quality inspection personnel performing receipt inspections of materials acquired from its suppliers and used in safety-related applications.

The NRC inspection team discussed the inspection program with Flowserve's management and technical staff. The attachment to this inspection report lists the documents that the NRC inspection team reviewed.

b. Observations and Findings

The NRC inspection team reviewed inspection plans that govern the receipt inspection and verification of attributes associated with commercial grade fasteners and hardware. This hardware is used by Flowserve in the manufacture of the actuators and performs a safety function. During the inspection, and upon request by the NRC inspectors, Flowserve was unable to produce records documenting the receipt inspection and testing of the materials, as required by procedure. Flowserve disclosed during the inspection that receipt inspection records associated with materials procured from the commercial supplier were missing for the period between January 2016 and January 2018. These receipt inspection records are quality assurance records and are required to be maintained in hardcopy format for a period of three (3) years maintained by Flowserve's procedures for the handling of quality assurance records, Procedure QAP 16.1, "Handling and Storage of Quality Records," Revision 19.

Flowserve management was unable to provide an explanation as to the absence of the inspection records, and it was unclear at the conclusion of the inspection as to whether the records were just missing or whether or not the inspections had been performed. The NRC inspection team identified this issue as Nonconformance 99900100/2018-201-02 for Flowserve's failure to maintain records for receipt inspection of commercial fasteners procured and dedicated and used in Flowserve safety-related electric actuators. Upon identification of this issue Flowserve created Limitorque Corrective Action Request 18-1 and indicated to the inspection team that they would be performing a full root cause evaluation to determine the cause and extent of this issue.

In addition to the missing records noted above, the NRC inspection team also reviewed several receipt inspection records that were available (from 2015) for safety-related hardware and fasteners procured from the same commercial supplier. The NRC

inspection team identified four examples where the receipt inspection records lacked evidence that Flowserve had performed material testing on commercially-dedicated hardware and fasteners as required by procedure and as necessary to confirm the suitability of the hardware material. The required testing data was either not filled in on the data forms or was marked “N/A” without explanation.

In the first example, the inspection team identified that Procedure IP 10.19, “Hex Head Cap Screws Grade 5,” Revision 7, requires critical characteristics be verified by quality inspection for Grade 5 hex head cap screws. The inspection plan requires hardness testing for each lot of material received in accordance with a sampling plan developed from Society of Automotive Engineers (SAE) Standard J429, August 1983 edition. The NRC inspection team identified that for stock order with Part Number HB8-1/2-13x28, dated March 23, 2015, and Part Number HB8-3/4-10x28, dated March 17, 2015, the receipt inspection datasheet failed to indicate that hardness testing for the lot of hex head cap screws had been performed as required by the inspection plan.

In the second example, the NRC inspection team identified that Flowserve failed to perform material testing of socket head cap screws. Procedure IP 10.14, “Socket Head Cap Screws”, Revision 7, requires hardness testing of hex head cap screws used in safety-related applications per sampling plan developed from SAE Standard J429, August 1983 edition. The NRC staff identified that for stock order with Part Number HC8-3/8-16x28, dated May 21, 2015, and Part Number HC8-3/4-10x36, dated August 4, 2015, the receipt inspection datasheet failed to indicate that hardness testing for the lot of hex head cap screws had been performed as required by the inspection plan.

In the third example, the NRC inspection team identified the receipt inspection datasheet failed to indicate that the correct supplier of nylon insert (elastic) stop nuts had been verified. Inspection Plan 10.16, “Elastic Stop Nut,” Revision 5, identifies inspection attributes that are required to be verified for elastic stop nuts during receipt inspection. The plan requires visual inspection to verify the fasteners are manufactured by two specific suppliers. The NRC staff identified that for Part Number CKI-49NE-164, dated August 5, 2015, receipt inspection records did not verify the manufacturer for these fasteners as required by procedure.

In the fourth example, the NRC inspection team identified the receipt inspection datasheet failed to indicate that Flowserve had performed material testing of keys. Procedure IP 10.15, “Keys,” Revision 5, requires hardness testing for verification of hardness. The NRC staff identified that for stock order with Part Number 60-563-02691, dated August 3, 2015, inspection records failed to show that hardness testing had been performed as required by procedure. Ensuring the correct key material is used is critical as evidenced by actuator failures reported and discussed in NRC Information Notices 88-84 and 94-10.

The NRC inspection staff identified the above four examples as Nonconformance 99900100/2018-201-03 for Flowserve's failure to ensure that inspections required by procedure to verify critical characteristics associated with fasteners used in safety-related applications had been performed.

c. Conclusions

The NRC inspection team issued Nonconformance 99900100/2018-201-02 in association with Flowserve's failure to implement the regulatory requirements of Criterion XVII, "Quality Assurance Records," of Appendix B to 10 CFR Part 50. Nonconformance 99900100/2018-201-02 cites Flowserve for failure to maintain sufficient records to furnish evidence of activities affecting quality. Specifically, Flowserve was unable to provide documented evidence (inspection records) covering more than two years between January 2016 and January 2018 that showed that commercial-dedicated fasteners procured from a commercial supplier were inspected and critical characteristics for the items were verified.

The NRC inspection team issued Nonconformance 99900100/2018-201-03 in association with Flowserve's failure to implement the regulatory requirements of Criterion X, "Inspection," of Appendix B to 10 CFR Part 50. Nonconformance 99900100/2018-201-03 cites Flowserve for failure to ensure that inspections designated to verify the suitability of the fasteners used in safety-related electric actuators had been performed as required by the inspection plan or procedure.

3. Design Control

a. Inspection Scope

The inspectors reviewed several Engineering Design Documents (EDDs) as described in Flowserve Procedure EDP 5.1, "Procedure for Engineering Design Documents," Revision 3, dated April 7, 2005. These EDDs are used by Flowserve to substantiate design changes to the Limitorque actuators. The inspectors focused their review on those design changes that could impact the seismic or environmental qualification of the Limitorque actuators.

Brown vs Black Fibrite

The inspectors reviewed EDD 080, "Evaluation of Black Fibrite 5064 as a Substitute for Brown (Natural) Fibrite type 5064 in Nuclear Safety Applications," Revision A, dated June 12, 2003. This EDD was written to substantiate a change in the Fibrite material used to manufacture certain piece parts contained in both the limit and torque switches used in the Limitorque actuators, including those certified as being environmentally qualified. The brown Fibrite used in portions of the limit and torque switches was originally qualified as part of testing conducted in accordance with Limitorque Report B0114, "Aging Analysis Report Limitorque Actuators," Revision 1, dated January 24, 1984, and Limitorque Qualification Report B0212, "Qualification Type Test Report for Limitorque Valve Actuators With Type LR Motor," dated April 12, 1985. At the time the EDD was written, Flowserve chose to address the qualification of the new material by analysis and did not perform any actual environmental testing on the new material.

The EDD included a comparison of material properties (provided by the Fibrite manufacturer) between the brown and the black Fibrite. The comparison showed that the newer black Fibrite generally exhibited superior mechanical and physical properties. Of particular interest were the properties of water absorption, tensile strength, and flexural strength which were all stated as being significantly better for the black material. Flowserve also received information from the manufacture of the Fibrite (Georgia Pacific) that explained the physical differences between the two materials (primarily that the older brown material contained an additional compound that was added to increase the cure speed during the molding process. However, once cured, the two materials were expected to end up with a similar crosslinked structure. In addition, Flowserve commissioned an outside laboratory (Bodycote-Taussig) to perform a material Fourier Transform Infrared Spectroscopy (FTIR) analysis of the two materials. The laboratory concluded that FTIR trace for the black Fibrite was consistent with that of the brown material.

Based upon the information contained in the EDD, Flowserve issued Limitorque Technical Update 01-01 to the nuclear industry on March 5, 2001, which indicated that the new black material was suitable for use as an alternate to the brown material for all nuclear applications.

C Style SMB000 Torque Switch

The inspectors reviewed Limitorque Technical Update 14-01, dated August 25, 2014, which provided an engineering analysis for a new type of “C style” torque switch, as an alternate replacement part for the “cam style” torque switches currently in use in the operating fleet. Originally, Limitorque actuators were provided with one of two types of torque switches. SMB000 actuators were provided with cam style torque switches and all other size actuators were provided with C style torque switches. The SMB000 C style torque switch is a scaled down version developed to mimic the C style torque switches currently in use in the larger SMB type actuators. The materials used in the manufacture of the SMB000 actuators are essentially identical to those used in the larger actuators.

The inspectors reviewed Limitorque Report B0373, “Limitorque Environmental Qualification Report for SMB-000 “C-Style” Torque Switch,” dated August 22, 2014, which summarized the qualification methodology. The inspectors identified that Flowserve had contracted with AREVA engineering to perform the actual evaluation. The inspectors reviewed the AREVA Report, No. 51-9212494-001, “Equipment Qualification – Flowserve Limitorque, SMB/SB-000 “C Style” Torque Switch,” Revision 1, dated July 11, 2014, paying particular attention to the portions of the report associated with the seismic qualification of the switch.

Limit Switch Intermittent Gear Change

The inspectors reviewed EDD-105, “SMB/SB/SBD Geared Limit Switch Intermittent Gear Material Change,” dated November 13, 2007. The evaluation was associated with a change in the materials used in one of the limit switch gears from brass to stainless steel. The analysis included a comparison of the relevant properties between the two materials.

b. Observations and Findings

Brown vs Black Fibrite

Based upon the information reviewed, the inspectors concluded that the Flowserve EDD provided reasonable assurance that the newer black Fibrite material would perform in a similar (or better) way as the brown Fibrite material that was subjected to environmental qualification testing during original qualification of the Limitorque actuators. Of significance was the fact that, while not available at the time the EDD was performed, the inspectors identified the black Fibrite material was recently tested as part of the qualification program for AP1000 Limitorque actuators and no problems were identified with the material during the qualification testing. The inspectors reviewed Westinghouse APP-PV95-VPC-001, "AP1000 Limitorque Valve Actuator Equipment Qualification Radiation and Thermal Aging Calculation," Revision 0, dated October 30, 2009, which established the thermal aging requirements for the AP1000 actuators. The actuator components (including the black Fibrite limit and torque switches) were aged for a period to simulate 60 years of operating life plus accidents and transients, with the normal environment being 120 degrees Fahrenheit. In calculating the thermal aging times, Westinghouse utilized a more conservative activation energy than what had been used previously as part of the Flowserve/Limitorque qualification testing program. The activation energy used by Westinghouse was based upon the Fibrite property of 50 percent retention of flexural strength as opposed to the Limitorque derived activation energy which was based upon thermogravimetric analysis. No findings were identified associated with this review.

C Style SMB000 Torque Switch

The inspectors verified that the AREVA report addressed relevant aspects of the SMB000 torque switch, including both seismic and environmental qualification. Qualification of the new switches was based upon a similarity analysis to the previously qualified larger size C style switches as well the older cam style SMB000 switches. No findings were identified associated with this review.

Geared Limit Switch Intermittent Gear Change

The inspectors identified that Flowserve had performed an appropriate evaluation associated with the change material from brass to stainless steel for one gear internal to the limit switch. No findings were identified associated with this review.

c. Conclusions

The inspectors concluded that for the EDDs reviewed, the EDDs appropriately addressed the safety-related aspects of the changes, including impact on environmental and seismic qualification as applicable.

4. Corrective Action and 10 CFR Part 21

a. Inspection Scope

Flowserve maintains multiple methods for documenting conditions adverse to quality, including: Discrepant Material Reports (DMRs) for the most common nonconformances

during the manufacturing process; Customer Complaints (CCs); and internal Limitorque Corrective Action Requests (LCARs). Audit Deficiency Notices (ADNs) are specifically generated for each finding from internal/external audits and inspections. The NRC inspection team reviewed ADNs and their closure documentation for the previously open NRC findings (NON 2011-04, NOV 2012-01, and NONs 2012-02 through 2012-05). NRC inspectors also reviewed a sampling of DMRs, ADNs, CCs, and LCARs from the past three years in addition to those specific to the 2011-2012 NRC NOV and NONs for closure. The attachment to this report lists the documents reviewed by the NRC inspection team.

In conjunction with closing the prior 2011 and 2012 NRC NOV findings regarding 10 CFR Part 21, the NRC inspection team noted that Flowserve has not made any Part 21 notifications in the last three years. NRC inspectors reviewed a sampling of technical evaluations of potential Part 21s that were determined by Flowserve not to be defects. The attachment to this report lists the documents reviewed by the NRC inspection team.

b. Observations and Findings

The NRC inspectors noted that Flowserve documents a relatively large number of nonconformances (DMRs) throughout the individual steps of the manufacturing process, which is not unusual for a diverse and robust manufacturing process. The LCARs reviewed from the last three years appeared to show an appropriately low threshold for initiation. LCARs are a corrective action for more significant issues, and include a section for cause analysis and actions to prevent recurrence as required by 10 CFR Part 50, Appendix B Criterion XVI. The NRC inspectors noted that CCs, LCARs, and ADNs all have a similar format in their electronic document system and that no CCs were initiated in the last two years. The inspectors reviewed a sample of CCs from 2015 and verified in Flowserve's electronic database that no CCs remained in an open status, including the six examples previously identified in NON 99900100/2012-201-02.

The NRC inspectors noted that each CC, LCAR, or ADN includes an appropriate linkage to 10 CFR Part 21 for evaluation of each identified condition for reportability as a potential defect. The NRC inspectors concluded that the sampled non-reportable Part 21 evaluations provided adequate technical justifications. The evaluations reviewed showed timely completion within 60 days of discovery as required by Part 21.

Closure of Nonconformance 99900100/2011-201-04

The NRC issued Nonconformance 99900100/2011-201-04 during the 2011 inspection and cited Flowserve for failure to develop guidance for when software reviews are to be performed and for failure to independently verify changes to the "Configurator" software used in the design and assembly of safety-related Limitorque actuators.

By letter dated August 12, 2011 (ML11229A768), Flowserve provided a response to the NON. Flowserve conducted a historical review for configurator changes that could affect nuclear product and also modified Quality Assurance Procedure 5.1, "Procedure for Issuance of Internal Engineering Documents Processing Engineering Change Orders," Revision 8, dated March 30, 2016, to require additional verification of configurator outputs. The NRC inspection team concluded that Flowserve's corrective actions in

response to the nonconformance were adequate and therefore Nonconformance 99900100/2011-201-04 is closed.

Closure of Notice of Violation 99900100/2012-201-01

The NRC issued Violation 99900100/2012-201-01 in its 2012 inspection and identified that Flowserve failed to implement the regulatory requirements in 10 CFR 21.21, including a procedure to identify when a deviation is discovered, reviewed, evaluated, and approved; and evaluation of deviations in Evaluation Reports 11-69 and 11-72 within 60 days of discovery.

During the current inspection, the NRC inspection team verified the responses Flowserve provided to the NRC dated November 21, 2012, and January 17, 2013, which the NRC acknowledged on January 30, 2013, to ensure all actions were completed associated with this nonconformance. The NRC inspection team did not identify any further issues and closed Nonconformance 99900100/2012-01.

Closure of Notice of Nonconformance 99900100/2012-201-02

The NRC issued Nonconformance 99900100/2012-201-02 in the 2012 inspection and identified that Flowserve failed to take corrective actions to resolve multiple inadequacies. These inadequacies included the nonconformance initially identified by the NRC in 2011 and held open in 2012 as NON 99900100/2011-201-04 as noted above, as well as the 2012 finding NON 99900100/2012-201-04 below, and six uncompleted CCs.

During the current inspection, the NRC inspection team verified the responses Flowserve provided to the NRC, dated November 21, 2012, and January 17, 2013, which the NRC acknowledged on January 30, 2013, to ensure all actions were completed associated with this nonconformance. The NRC inspection team did not identify any further issues and closed Nonconformance 99900100/2012-02.

Closure of Nonconformance 99900100/2012-201-03

The NRC issued Nonconformance 99900100/2012-201-03 during the 2012 inspection and cited Flowserve for failure to verify the adequacy of certain design features associated with Grade 5 Hex Head Cap Screws that were procured from commercial suppliers and dedicated by Flowserve. Specifically, the material characteristics of the cap screws were tested on a limited basis from the shipment received from the distributor without establishing a basis for lot sampling. Flowserve failed to verify the source of the screws or traceability from the original manufacturer.

By letters dated November 21, 2012 (ML12334A025) and January 17, 2013 (ML13022A540), Flowserve provided responses to the NON. Flowserve administered training to receiving inspectors on the sampling plan requirements of QCI 10.7, “Sample Plan for CGID & Inspection,” Revision 5, dated October 15, 2015. Flowserve took immediate corrective actions to obtain and verify Mill Test reports for the lot of fasteners in question. Additionally, Flowserve developed a commercial grade survey checklist and performed a commercial grade survey of the supplier. The NRC inspection team concluded that Flowserve’s corrective actions in response to the nonconformance were adequate and therefore Nonconformance 99900100/2012-201-03 is closed.

Closure of Nonconformance 99900100/2012-201-04

The NRC issued Nonconformance 99900100/2012-201-04 during the 2012 inspection and cited Flowserve for failure to ensure that individuals performing quality inspections for commercial-grade dedication do not perform assembly work. Specifically, the quality control inspector performing the inspection of three four-train geared limit switches disassembled one limit switch when it did not pass one of its critical characteristic checks, performed work to correct the problem, reassembled, did not document, and retested the switch.

By letters dated November 21, 2012 (ML12334A025), and January 17, 2013 (ML13022A540), Flowserve provided responses to the NON. Immediate corrective actions included re-inspection of the affected four-train limit switches. Flowserve also issued a corrective action to the supplier of the rotor component to address the deficiency that resulted in failure of the critical characteristic check. Additionally, Flowserve conducted retraining for all inspection personnel on the conduct of rework and also 10 CFR Part 21 requirements.

The NRC inspection team concluded that Flowserve's corrective actions in response to the nonconformance were adequate and therefore Nonconformance 99900100/2012-201-04 is closed.

Closure of Notice of Nonconformance 99900100/2012-201-05

The NRC issued Nonconformance 99900100/2012-201-05 in the 2012 inspection and identified that Flowserve failed to provide evidence that two test personnel had been trained on the diagnostic testing equipment and to document up-to-date training.

During the current inspection, the NRC inspection team verified the responses Flowserve provided to the NRC dated November 21, 2012, and January 17, 2013, which the NRC acknowledged on January 30, 2013, to ensure all actions were completed associated with this nonconformance. Three personnel were documented as trained in the ADN closure package, and currently in 2018, only one person continues to perform the associated testing. The NRC inspector observed a portion of this torque testing during the week of the current inspection and also reviewed the up-to-date training record for this individual. The NRC inspection team did not identify any further issues and closed Nonconformance 99900100/2012-05.

c. Conclusions

The NRC inspectors concluded that Flowserve is implementing its policies and procedures that govern corrective actions and Part 21 consistent with the regulatory requirements of Criterion XVI, "Corrective Action" of Appendix B to 10 CFR Part 50, and with 10 CFR Part 21.

Attachment

1. Entrance and Exit Meetings

   On January 22, 2018, the NRC inspection team discussed the scope of the inspection with Wade Shephard, General Manager, Flow Control Operations, and other members of Flowserve's management and technical staff. On January 26, 2018, the NRC inspection team presented the inspection results and observations during an exit meeting with Wade Shephard, General Manager, Flow Control Operations, and other members of Flowserve's management and technical staff. The attachment to this report lists the attendees of the entrance and exit meetings, as well as those individuals whom the NRC inspection team interviewed.

2. Entrance/Exit Meeting Attendees/Persons Interviewed

Name	Title	Affiliation	Entrance	Exit	Interviewed
Andrew Washington	Test Technician	Flowserve			X
Kyle Ramsey	Engineer	Flowserve	X	X	X
Wade Shephard	General Manager	Flowserve	X	X	
Jeff McConkey	Quality Manager	Flowserve	X	X	X
David Breeding	Engineer	Flowserve	X	X	X
Steven Campbell	Planning Manager	Flowserve	X		
Amy Wingfield	Order Management Supervisor	Flowserve	X	X	
Mike Semones	Supply Chain Manager	Flowserve	X		
James Puryear	Manufacturing Manager	Flowserve	X	X	
Chris Shaffer	Quality Supervisor	Flowserve	X	X	X
Kenneth Woodall	Manufacturing Manager	Flowserve	X	X	
Dan Martin	Order Management	Flowserve	X	X	
Jeffrey Jacobson	Team Leader	NRC	X	X	
Phil Natividad	Inspector	NRC	X	X	
Jermaine Heath	Inspector	NRC	X	X	
Khalid Mohamed Al Naqbi	Observer	Federal Authority for Nuclear Regulation – United Arab Emirates	X	X	

3. Inspection Procedures Used

Inspection Procedure (IP) 36100, “Inspection of 10 CFR Part 21 and Programs for Reporting Defects and Noncompliance,” dated February 13, 2012

IP 43002, “Routine Inspections of Nuclear Vendors,” dated January 27, 2017

IP 43004, “Inspection of Commercial-Grade Dedication Programs,” dated January 27, 2017

4. List of Items Opened, Closed, and Discussed

Item Number	Status	Type	Description
99900100/2011-201-04	Closed	NON	Criterion III
99900100/2012-201-01	Closed	NOV	10 CFR Part 21
99900100/2012-201-02	Closed	NON	Criterion XVI
99900100/2012-201-03	Closed	NON	Criterion III
99900100/2012-201-04	Closed	NON	Criterion X
99900100/2012-201-05	Closed	NON	Criterion II & XVII
99900100/2018-201-01	Open	NON	Criterion III & VII
99900100/2018-201-02	Open	NON	Criterion XVII
99900100/2018-201-03	Open	NON	Criterion X

5. Applicable ITAAC

These motor actuators are associated with multiple Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) from Appendix C of the Combined License for Vogtle, Units 3 and 4. While the identified nonconformances raise concerns regarding aspects of the processes used at Flowserve to verify the quality of commercial grade parts used in the manufacture of the actuators, we have not, to date, identified any specific parts that are defective. Furthermore, a review of operating experience has not determined any recently reported problems with the associated hardware or DC motors. Consequently, at this time, we do not believe any of the three nonconformances are material to the associated ITAACs. Therefore, these nonconformances do not constitute ITAAC findings as per NRC Inspection Manual Chapter 2506, “Construction Reactor Oversight Process General Guidance and Basis Document,” dated February 20, 2017.

6. Documents Reviewed

Purchase Order

- PO 219442 for 1020/1026 DOM Tubing Stock, dated September 15, 2017
- PO 2208813 for 60-40-10 ductile casting iron, dated January 23, 2018
- PO 1015001346 for 250 VDC motor, Model SMB-000, dated January 16, 2015
- PO 162287 for SMB-3 electric actuator, dated March 16, 2017
- PO 153600 for 4TR geared limit switch, SMB-000, dated November 25, 2015
- PO 239799 for 250 VDC motor for Limitorque SMB series actuator, dated November 13, 2015
- PO 156502, GEARED LIMIT SWITCH ROTOR, dated May 24, 2016
- PO 153321, MOTOR 10#, 250VDC, AP1000, dated June 28, 2016
- PO 162353, SB-00 ELEC ACTUATOR, dated October 20, 2017

Procedures

- IP 10.19, Hex Head Cap Screws Grade 5, Revision 7, dated April 4, 2016
- IP 10.14, Socket Head Cap Screws, Revision 7, dated April 4, 2016
- IP 10.16, "Elastic Stop Nut," Revision 5
- IP 10.15, "Keys," Revision 5
- IP 10.38, 2-Train and 4-Train Geared Limit Switch Assemblies, Revision 9, dated April 12, 2016
- IP 10.111, Peerless-Winsmith Critical Component Material Testing, Revision 14, dated April 12, 2016
- QAP 10.4, Procedure for Certificate of Compliance, Inspection Plan for AC/DC Motors, Revision 6, dated May 12, 2015
- QAP 5.1, Procedure for Issuance of Internal Engineering Documents Processing
- SAE J429, "Mechanical and Material Requirements for Externally Threaded Fasteners, dated August 1983
- QAP 16.1, "Handling and Storing Quality Records", Rev 19, dated November 26, 2013
- Engineering Change Order, Revision 8, dated March 30, 2016
- QCP 10.10, Commercial Grade Dedication, Revision 12, dated April 24, 2014
- Engineering Instruction Procedure (EIP) 444, Center of Gravity Calculator, Revision 1, dated January 4, 2016
- Engineering Inspection Procedure EIP-459, "SMB/SB Torque Limit Test for CAP1000/1400," Revision 0, dated September 2017
- EIP-444, "Center of Gravity Calculator," Revision 1
- QAP 13.2, "Reporting Defects for Safety Related Equipment", Revision dated January 31, 2013
- QAP 17.1, "Audit Procedure," Revision 26, dated January 4, 2018
- EDP 5.1, "Procedure for Engineering Design Documents," Revision 3, dated April 7, 2005
- QCI 10.7, Sample Plan for CGID & Inspection, Revision 5, dated October 15, 2015

M&TE

- Calibration of hardness tester, ID# R574-00-0064, dated July 5, 2017
- Calibration of hardness tester, ID # 81135602, dated July 5, 2017
- Calibration of magnetic particle tester, Serial Number 11R101, dated January 12, 2018

Commercial Grade Surveys

- Audit #2018-01-E for Supplier of DC motors, dated January 17, 2018
- Audit #2016-04-E for Supplier of MOV Long Life Grease, dated October 2, 2016
- Audit # 2016-01-E for supplier of commercial hardware and fasteners, dated February 23, 2016

Corrective Action

- ADN 2012-04-E-3, dated October 29, 2012
- ADN 2012-04-E-4, dated October 29, 2012
- ADN 2012-E-1, "NRC Inspection"
- ADN 2012-E-2, "NRC Inspection"
- ADN 2012-E-3, "NRC Inspection"
- ADN 2012-E-4, "NRC Inspection"
- SCAR 267, Excess molding material on part number 60-701-0067-1, dated September 12, 2012
- Discrepant Material Report (DMR) 36311
- Customer Complaint (CC) 15-439
- Customer Complaint CC 15-455 and associated Part 21 Evaluation File #86
- Part 21 Evaluation File #87
- Limitorque Corrective Action Request LCAR 16-03
- Audit Deficiency Notice (ADN) 2011-04, "NRC Inspection"
- ADN 2012-05, "NRC Inspection"
- Annual Audit Number 2017-01-I, dated January 17-19, 2017
- Annual Audit Number 2015-04-I, dated December 14-18, 2015
- Limitorque Corrective Action Request 18-2, Commercial Grade Dedication of Ohio Electric DC Motors, dated January 25, 2018
- Limitorque Corrective Action Request 18-1, Missing Inspection Records for the Inspection of IPC Hardware and Fasteners, dated January 25, 2018

Qualification Reports

- Limitorque Report B0114, "Aging Analysis Report Limitorque Actuators," Revision 1, dated January 24, 1984
- Limitorque Qualification Report B0212, "Qualification Type Test Report for Limitorque Valve Actuators With Type LR Motor," dated April 12, 1985
- Westinghouse APP-PV95-VPC-001, "AP1000 Limitorque Valve Actuator Equipment Qualification Radiation and Thermal Aging Calculation," Revision 0, dated October 30, 2009
- Limitorque Report B0373, "Limitorque Environmental Qualification Report for SMB-000 "C-Style" Torque Switch," dated August 22, 2014

- AREVA report, No. 51-9212494-001, “Equipment Qualification – Flowserve Limitorque, SMB/SB-000 “C Style” Torque Switch,” Revision 1, dated July 11, 2014

Other

- Test certificate T717847 for Mobil 28 Grease, dated October 16, 2017
- Test certificate T718963 for MOV Long Life, dated November 2, 2017
- Purchase Req. to vendor #183109 for material testing of item #485 (grease), dated October 6, 2017
- Purchase Req. to vendor #183109 for material testing of item #535 (grease), dated October 24, 2017
- DC Motor Test record 147278 for customer order 207436, dated September 18, 2015
- Product spec sheet 06-4000576-005 for Safety-Related Flowserve/Limitorque DC Motors, Revision 5
- Flowserve training records on Nuclear safety culture, dated October 20, 2014
- Flowserve training records on 10 CFR Part 21, dated October 21, 2013
- Quality Engineering Standard (QES) K-12057, “Peerless-Winsmith/Flowserve-Limitorque Materials of Construction for DC Nuclear Valve Operator – Type LN Design,” Revision C, dated April 1, 2015
- QES K-11934, “Peerless-Winsmith/Flowserve-Limitorque Materials of Construction for DC Nuclear Valve Operator – Type RH Design,” Revision F, dated April 1, 2015
- QES K-12028, “Peerless-Winsmith/Limitorque Critical Characteristic Selection Justification for All Nuclear Motor Applications,” Revision B, dated February 20, 2013.
- Receipt Inspection Record for Belleville spring, P/N 60-600-0073-1, Revision C, dated November 29, 2017
- EDD 080, “Evaluation of Black Fibrite 5064 as a Substitute for Brown (Natural) Fibrite type 5064 in Nuclear Safety Applications,” Revision A, dated June 12, 2003
- EDD-105, “SMB/SB/SBD Geared Limit Switch Intermittent Gear Material Change,” dated November 13, 2007
- Limitorque Technical Update 14-01, dated August 25, 2014