



# **Industry Response to Flowserve Part 21 on Anchor Darling Double Disk Gate Valves and NRC Staff Next Steps**

Public Meeting  
February 15, 2018



## Overview

- Operating Experience has identified failures of Anchor/Darling (A/D) Double Disk Gate Valves (DDGVs)
- Significant progress has been made
  - Industry has developed guidance and is correcting the issue
  - All licensees have submitted information on the affected valves, including commitments for valve repairs
- The NRC staff and Industry continue to discuss the issue
- The NRC staff is preparing to inspect licensees' corrective actions
- The NRC staff continues to assess the need for a Generic Communication



## Background

- Failure of Anchor/Darling (A/D) Double Disk Gate Valve (DDGV) at Browns Ferry in 2013 revealed that threaded stem-to-wedge connection had not been properly torqued
- Flowserve Part 21 notification February 25, 2013
  - Recommended assessing wedge pin susceptibility to shear and rework the valve if needed
- BWROG developed guidance to address Part 21 to include:
  - Prioritization and Screening Criteria
  - Evaluation Methods
  - Inspection and Diagnostics
  - Repair Methods



## Background (cont.)

- NRC staff evaluated the Part 21 and determined the issue would be monitored with no generic communication
- Additional failures occurred at LaSalle Unit 2 and Columbia
- LaSalle event elevated to NRC special inspection
- Information Notice (June 2017)
- Flowserve updated Part 21 (July 2017)
- BWROG updated guidance to Rev. 4 (August 2017)
- NRC staff considered the need for generic communication due to larger population of failures and limited information readily available to the staff



## Progress to Date

- NRC staff held public meetings on guidance and licensee corrective actions
  - Staff requested clarification of guidance (October 2017)
  - NEI provided clarification (November 2017)
- All licensees submitted information (December 2017)
  - Valve population
  - Valve characteristics (susceptible, non susceptible, risk category)
  - Rework status
  - Commitments for future repairs



# **NRC Observations on BWROG Guidance**



# Summary

- Allowance to use engineering judgement for key assumptions that determine whether a valve is “susceptible”
  - Credit for thread friction
  - Maximum actuator torque
- Limited effectiveness of testing and diagnostics



# Engineering Judgement on Credit for Thread Friction

- Rev. 4 guidance implies that friction should only be used for borderline cases (small negative margin) and low levels of friction should be assumed
- Stem-to-Wedge thread friction has a wide range of possible values that could change over time and system conditions (.02 to .78 steel on steel)
- Staff questions crediting of stem-to-wedge thread friction to declare a valve “non susceptible.” Thread friction is acceptable for short term operability until the valve can be reworked to Flowserve Part 21 recommendations. A reasonable thread friction value to use for interim evaluations is 0.10<sup>1</sup>.

<sup>1</sup> Staff letter dated October 31, 2017





## **Engineering Judgement on Maximum Applied Torque**

- Rev. 4 guidance provides little direction on actuator torque
- Many plants are using as-tested values instead of full actuator capability
- Other licensees are using limiting value of the spring pack capability or maximum torque from the valve/actuator weak link analysis.
- Staff questions use of less-than-maximum actuator torque, which is stall torque and stall efficiency as appropriate, to bound potential over-torque events



## **Hidden Over-Torque Events and Reliance on Spring Pack**

- Licensees have experienced motor stall events caused by a sticky contactors, such as those in the motor control center
- Excessive force may be been applied in the early test years, such as when addressing GL 89-10
- Valve may have been subjected to a pressure locking event
- Test equipment in early test years was not as accurate as current test equipment (GL 89-10 Supplement 5)
- Spring pack does not limit torque on stem during over torque event, it prevents over travel of torque switch assembly



## **Diagnostics for Evaluating Stem-to-Wedge Connection**

- NRC SIT team for LaSalle Unit 2 MOV failure concluded that diagnostic testing and stem rotation checks are inconclusive in determining active stem-to-disc connection degradation<sup>1</sup>
- Diagnostics can be useful to help plan the schedule for rework
- Diagnostic testing and stem rotation checks will identify gross failure of the stem-to-wedge connection<sup>2</sup>

<sup>1</sup> Staff inspection report dated August 31, 2017

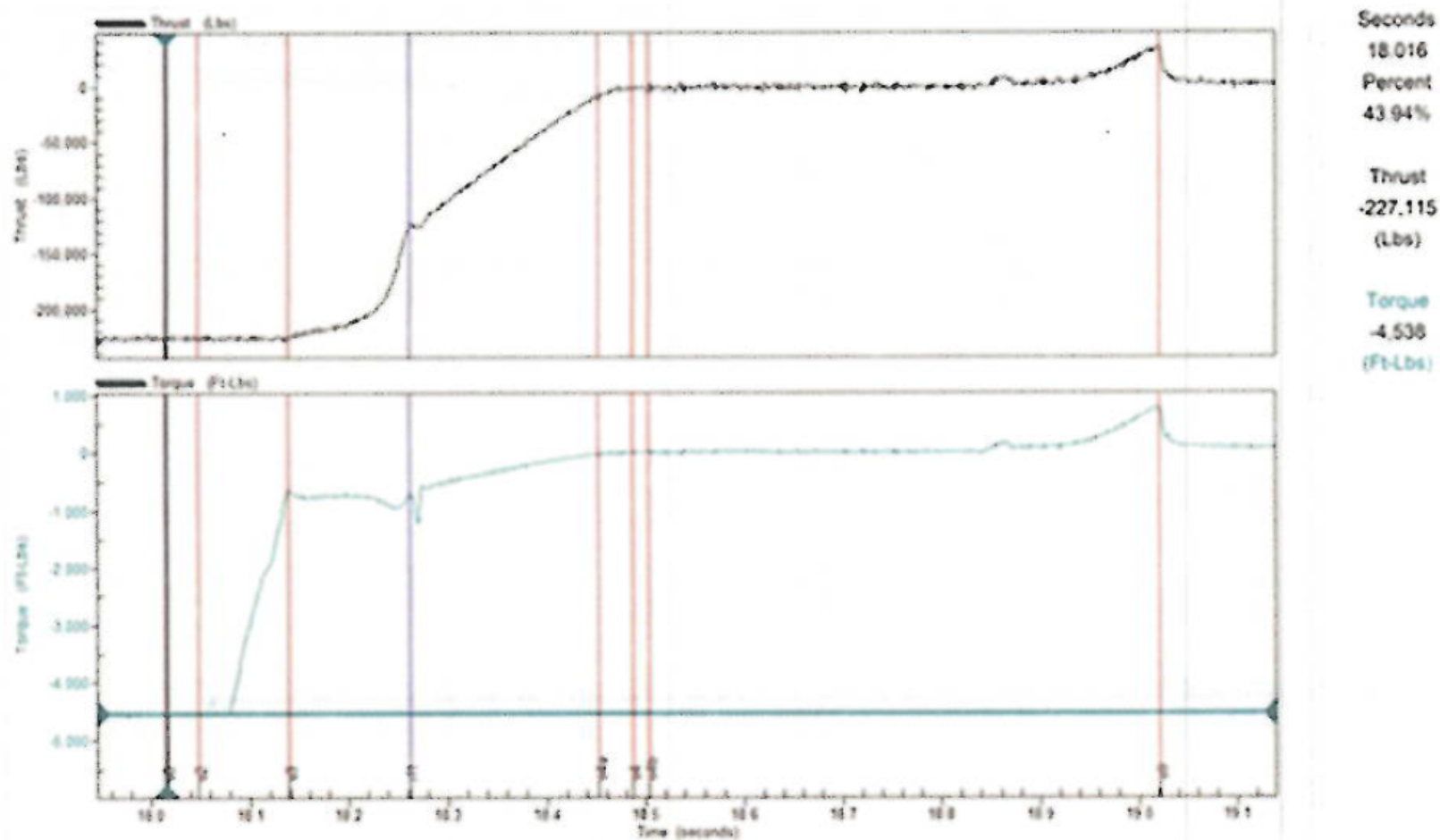
<sup>2</sup> Staff letter dated October 31, 2017



# **Example of Diagnostic Test Inability to Conclusively Determine Degradation of Stem-to-Wedge Connection**

## LaSalle Unit 2 Anomaly 2015 - Example used in BWROG Guide as Active Stem-to- Wedge Connection Degradation

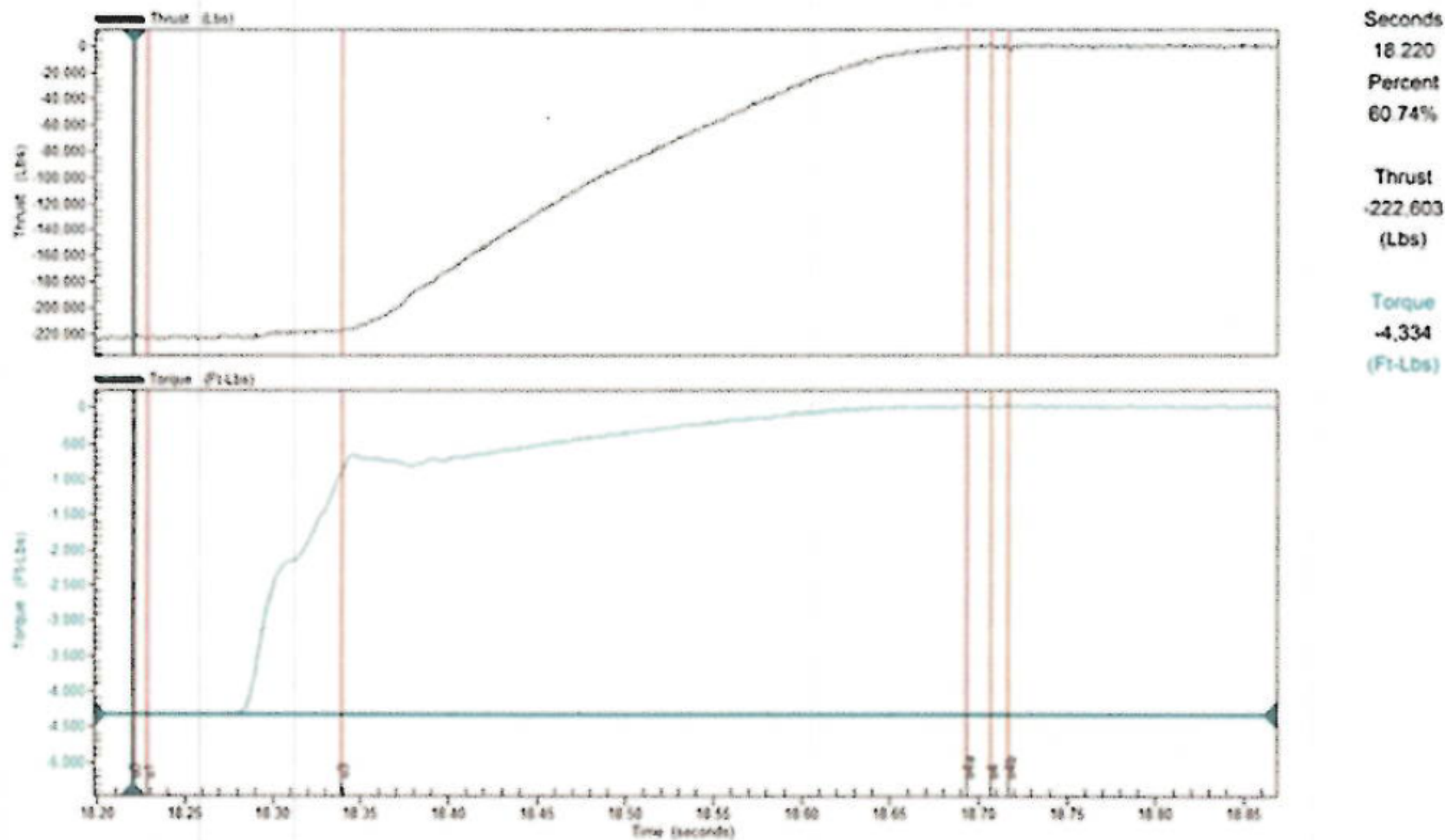
**2E22-F004 - As-Left**  
02/05/2015 05:40:14 File 150361004



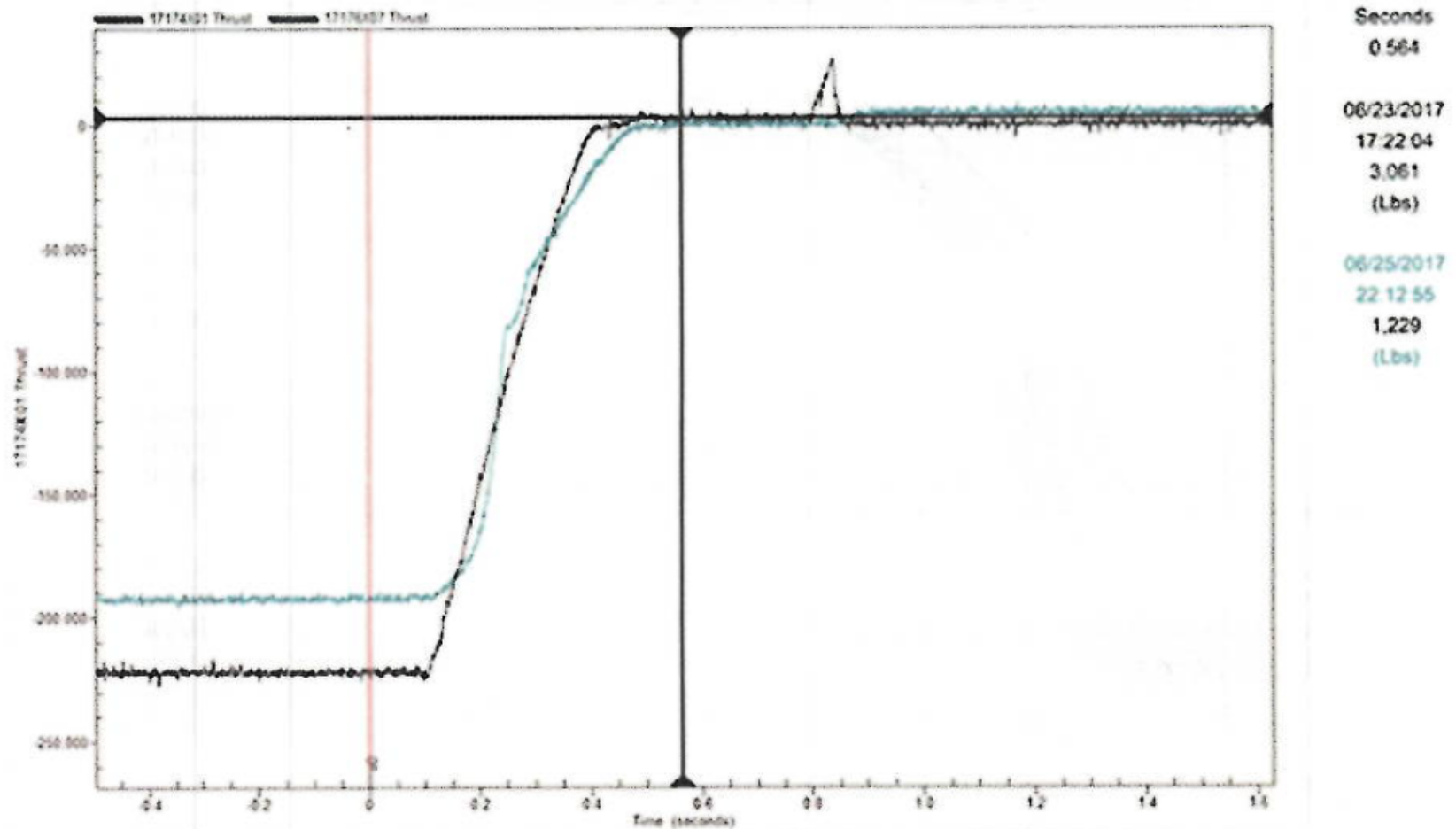
# LaSalle Unit 2 As Left Thrust/Torque Trace After Rework

**2E22-F004 - As-Left**

03/03/2017 02:58:52 File 17062X07

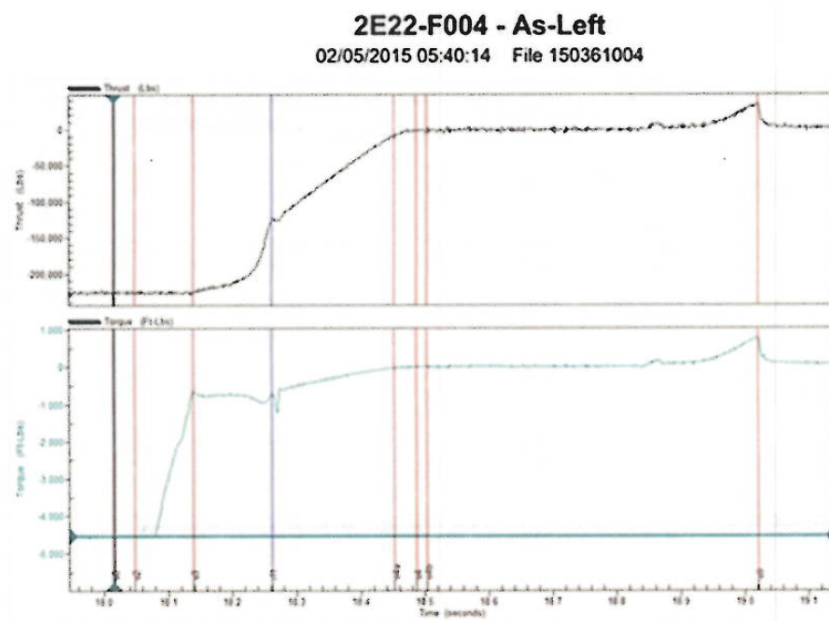


## Recent MOV Rework As-Found-Left Thrust Trace

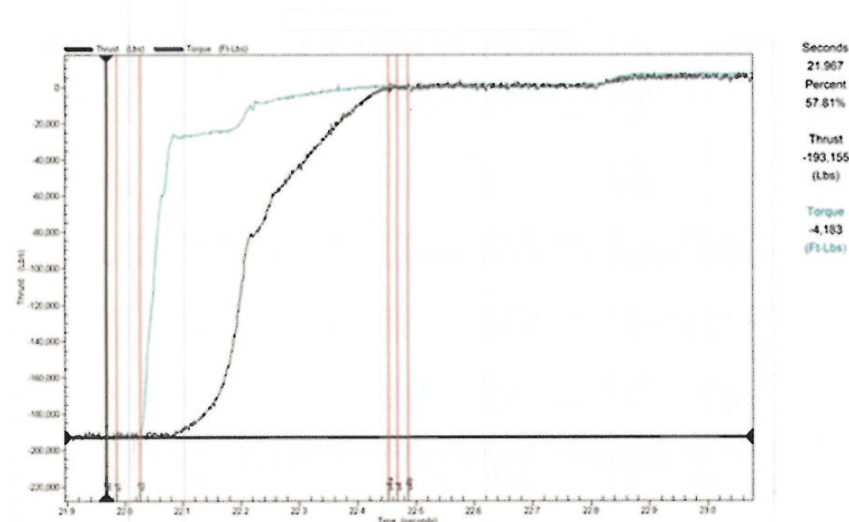


## LaSalle Unit 2 Anomaly Compared to Recent MOV Post Rework Trace

### Unit 2 Anomaly



### Recent MOV Post Rework As Left Torque & Thrust Trace







## **Summary of A/D DDGV Population from Licensee Submittals**

- 584 – Total # of valves reported
- 119 – Total # of valves repaired
- 425 – Total # of valves not repaired
- 40 – Total # of valves N/A (T-Head design, not always reported)
- 106 – Total # of high risk valves
- 163 – Total # of medium risk valves
- 305 – Total # of low risk valves
- 182 – Total # of valves that use thread friction  $> 0.10$
- 59 – Total # of valves that use thread friction  $\leq 0.10$
- 38 – Total # of valves that are non-safety
- 225 – Total # of valves that require further NRC review



## **A/D DDGVs Requiring Further Review**

- 113 – Total # of valves considered not susceptible using thread friction  $> 0.10$  with no plans to repair
- 51 – Total # of valves considered not susceptible using thread friction  $\leq 0.10$  with no plans to repair
- 39 – # of High Risk valves using thread friction with no plans to repair
- 14 - # of High Risk valves with no plans to repair and provided data not clear
- 13 - # of valves that have been repaired and using thread friction to justify final repair
- 35 - # of non-safety related valves. Need to verify failure does not affect other systems.



## NRC Inspection Plans

- NRC staff is developing an inspection sample
- NRC draft Temporary Instruction is in internal review
- Focus of inspection:
  - Verify licensee properly identified valves population
  - Evaluate thrust for impact on valve integrity
  - Evaluate torque/shear pin to determine whether valve is susceptible
  - Evaluate history of over torque events and plans for identifying future over torque events if licensee does not use maximum torque
  - Review risk categorization
  - Evaluate planned corrective actions



## NRC Next Steps

- Public Meeting (April 2018)
- Finalize TI (May 2018)
- TI inspections (2018 into 2019)
- Continue to assess need for generic communication



# QUESTIONS?

## Future Questions

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