

Anchor Darling Double Disc Gate Valve Wedge Pin Failures

Greg Krueger (Exelon)
BWROG Vice Chairman

BWROG EOC & NRC Meeting
July 17, 2019



BWR Expertise – Proven Solutions

Topics to be Discussed



Double Disc Gate Valve Part 21

Initial Industry Survey

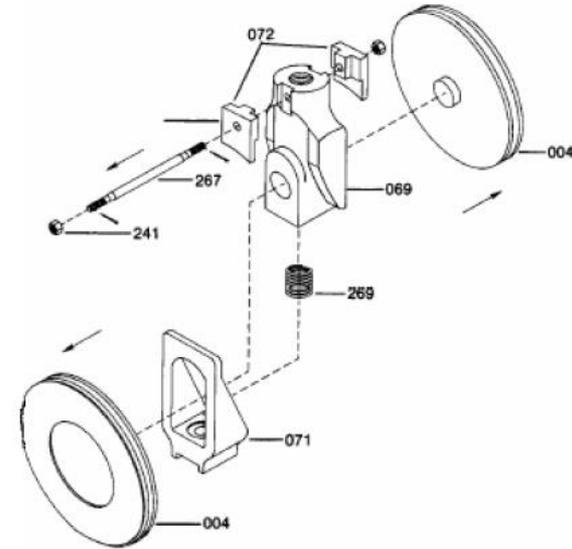
BWROG VTRG Document Revision

Follow-up Survey

A/D Double Disc Gate Valve P21



- On February 25, 2013, Flowserve issued a 10CFR Part 21 Notification concerning wedge pin failure of an Anchor Darling Double Disc Gate Valve at Browns Ferry Plant Unit 1. Disassembly and inspection revealed that the valve stem to wedge anti-rotation pin had broken in several locations and the disc retainer had fallen from the wedge assembly and was found between the valve discs. Flowserve in their 10CFR Part 21 Notification concluded that the root cause of the wedge pin failure was excessive load on the wedge pin. The stem operating torque exceeded the torque used to tighten the stem into the upper wedge before installation of the wedge pin, ultimately causing the wedge pin to shear. Flowserve states that this situation can potentially on any A/D DDGV with a threaded stem to upper wedge connection operated by an actuator that applies torque to the stem to produce the required valve operating force.
- On February 11, 2017, Exelon's LaSalle U2 experienced a stem-disc separation of their High Pressure Core Spray Pump Discharge Valve. It was concluded that the 12" MOV had failed during the refueling outage sometime between the local leak rate testing and the HPCS system fill and vent procedure. The subject MOV was identified as one of 22 LaSalle MOVs potentially susceptible to wedge pin failures. LaSalle had been monitoring this valve using the guidance provided under the original version of the BWROG VTRG guidance. The MOV was last diagnostically tested in 2015. Post failure analysis of the 2015 diagnostic test traces identified anomalies of the valve open pullout region that were not present in the 2011 and 2005 traces.



Double Disc Gate Valve Initial Survey



Double Disc Gate Valve Part 21 – Current Activities

- Industry survey of all US plants (joint effort with PWROG) to summarize results of internal inspections.
- 76 of 78 valves inspected had intact / undamaged wedge pins even though VTRG product guidance predicted substantial negative wedge-pin structural margin.
- Follow-up survey for valves with less than - 100% margin indicated a minimum coefficient friction of 0.100 between the threads of the upper wedge / stem was necessary to preclude wedge pin damage.

Inspections:		78
Wedge Pin Intact		
	Yes	76
	No	2
Stem/Wedge Joint Tightness		
	Loose	56
	Tight	22
Wedge Shouldered Against Stem		
	Yes	25
	No	53
Stem Collar Displaced / Damaged		
	Yes	5
	No	73
Wedge Thread Condition		
	Good	70
	Limited Damage	2
	Severe Wear	0
	Not Reported	6
Stem Thread Condition		
	Good	70
	Limited Damage	2
	Severe Wear	0
	Not Reported	6

BWROG Guidance Document Rev



TP16-1-112 R4 Issued August 2017 in response to P21 and other wedge-pin failures.

Revision 4 included:

- Evaluation of pressed on collar on possible susceptible population.
- Prioritized schedule for susceptible safety-related MOVs for periodic stem rotation checks.
- Evaluate existing stem rotation checks against recommended guidance.
- Review changes to configuration control recommendations to prevent recurrence.

Follow-up Survey



- Industry polled to collect inspection results for valves disassembled in 1st Quarter 2019.
- Responses included 20 additional disassembly results to date.
 - 18 had tight stem / upper wedge connections with no pin damage.
 - 2 had loose stem / upper wedge connections with no pin damage.
 - Analysis of thread friction on-going but indications are that a COF of 0.100 is bounding.
 - Currently waiting on additional responses before survey results finalized.

TP16-1-112, R4 Revision



- BWROG revising guidance document to incorporate lessons learned from survey.
 - Include upper wedge to stem thread friction results from survey.
 - Option to credit thread friction and classify an MOV as non-susceptible.
 - Low-risk MOVs (except 10-12" HPCI/HPCS applications) will be allowed to undergo periodic diagnostic tests (with stem rotation checks) in lieu of repair.
 - MOVs with Open or Open/Close safety function will have maximum test interval of 4 years.
 - MOVs with Close only will be limited to 8 years.
 - Brief discussion of alternate repair methods (e.g., installation of anti-rotation device).
- Draft in progress, targeted for 3Q/4Q 2019.

Anchor Darling Double Disc Gate Valve Wedge Pin Failures



QUESTIONS