Validating the Performance of MOGAS' Delayed Coker Switch Valve

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APRIL 29 - MAY 3 2019

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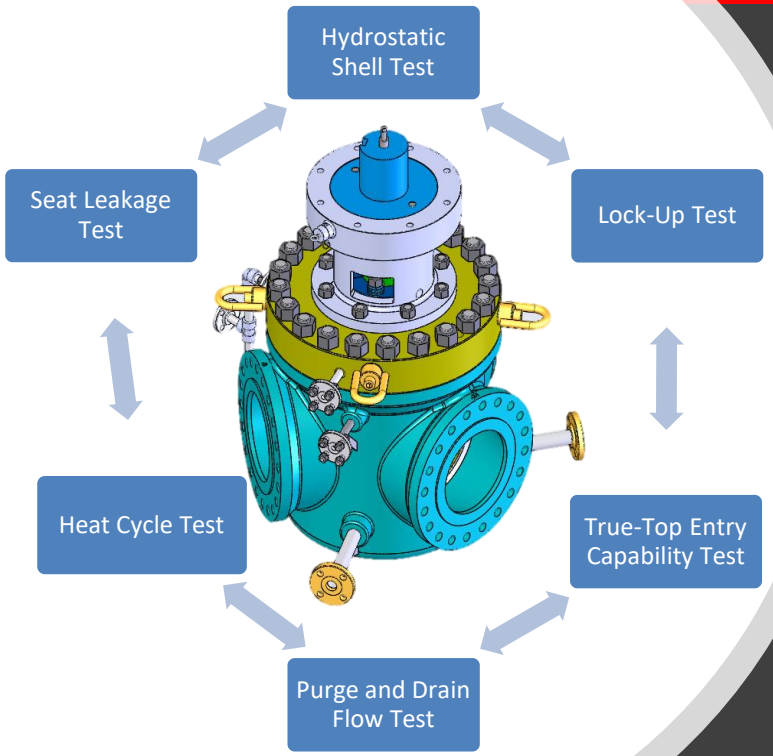
MAY, 2019

MOGAS®
SEVERE SERVICE BALL VALVES

INTRODUCTION

- Validating the performance of a valve in a severe service application is often times a challenge.

- In this study, MOGAS R&D set out to validate valve design features and concepts of the MOGAS delayed coker switch valve in 6 ways.



VALIDATION TESTS 6 WAYS

- Validate the integrity of the body design using standard hydrostatic shell test.
- Ensure smooth operation at high operating temperatures.
- Quantify the seat leakage class of the valve.
- Validate the operation of the new purging/draining technology.
- Simulate coking and validate operation of the valve in a coked up simulation.
- Validation of the true-top entry ability to remove internal parts in Clean and Coked up Valve

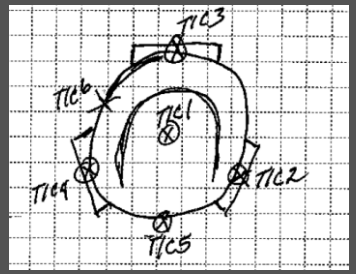
HYDROSTATIC SHELL& SEAT LEAKAGE TESTS

- Valve Passed Hydro Test No Leakage
- Valve reached class IV Shutoff

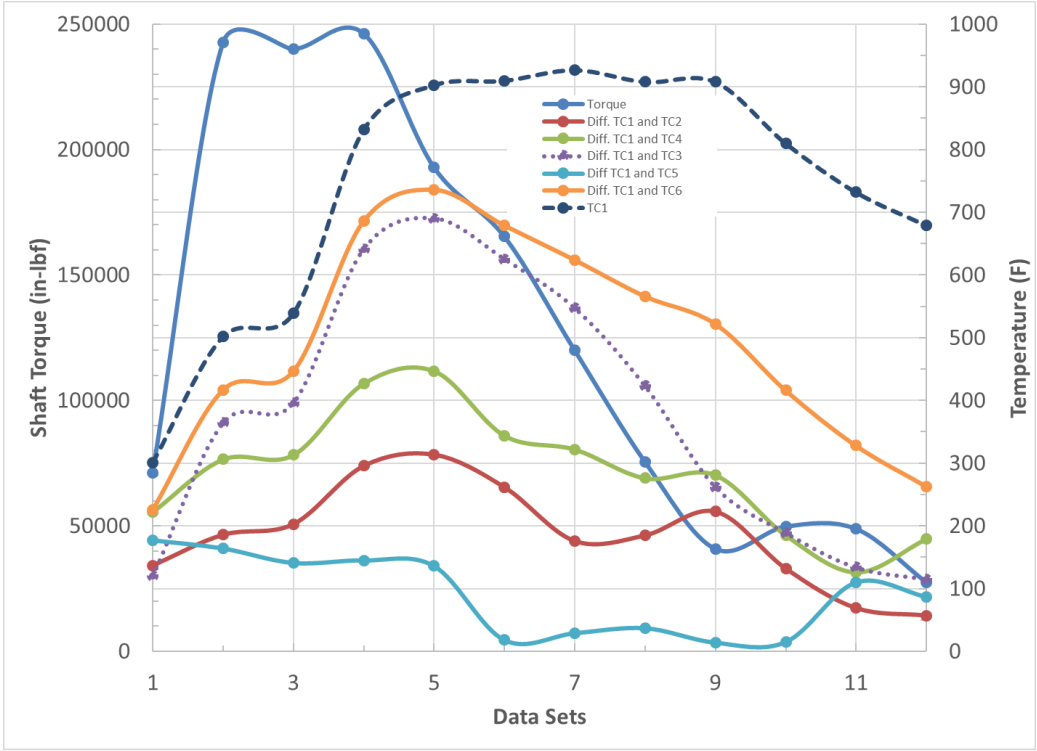
HEAT CYCLE TEST

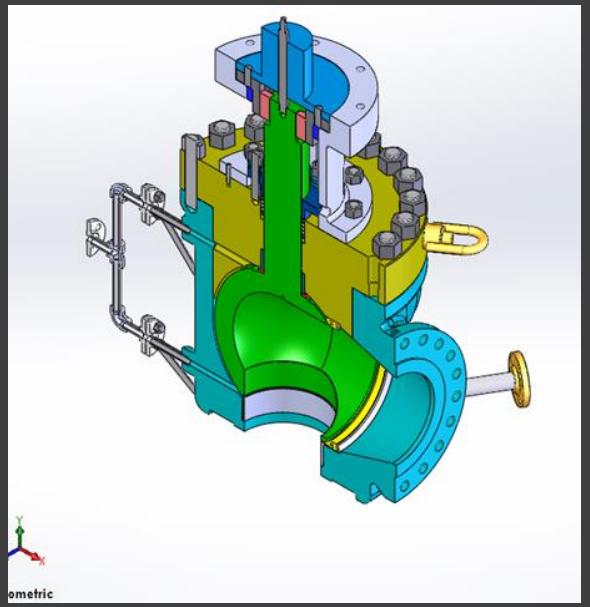
- Apply heat inside valve until temp reached 920ºF
- Stroke the valve while temperature is increasing & record torque.
- Simulates startup/warm up conditions

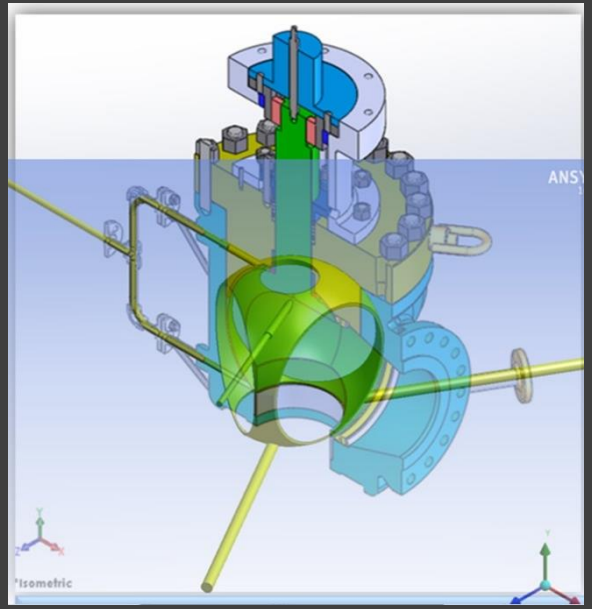
HEAT CYCLE TEST RESULTS

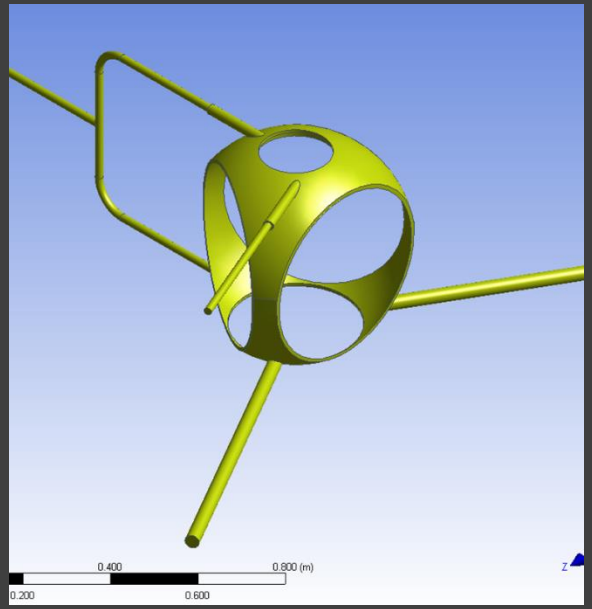


The results of the Heat Cycle test validated the thermal clearances and functionality of the valve at operating temp









SolidWorks Model Defeaturing

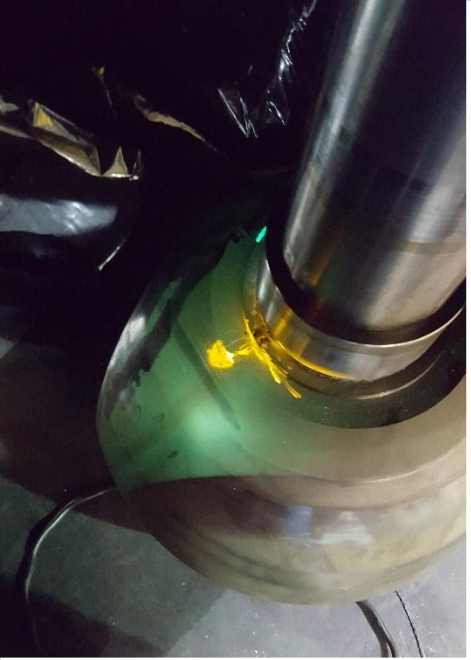
ANSYS Extracted Fluid volume

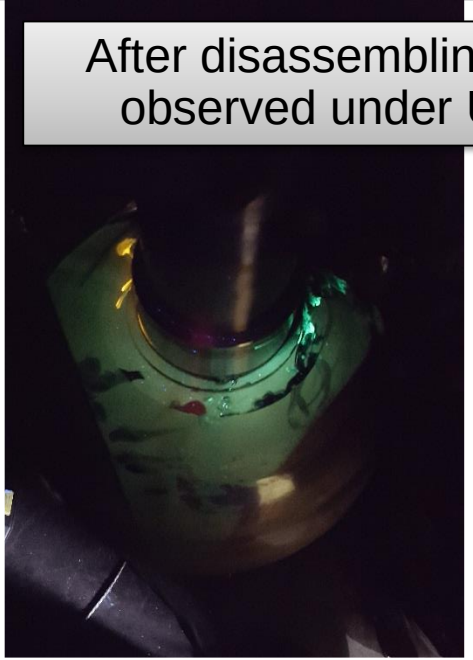
Final CFD Analysis Model

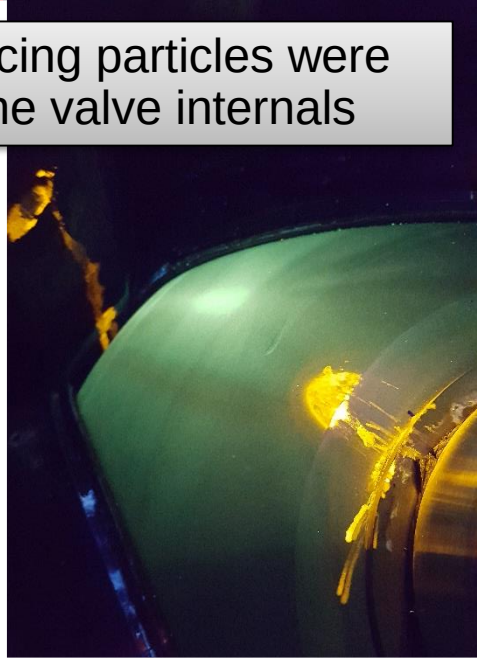
PURGE TESTING

- Fluorescent Microspheres (FM) polymer particles were used to trace the purge flow path and ensure full coverage to validate CFD findings.
- Different colored FM particles were injected into the purge ports using a 6-jet collision nebulizer.

After disassembling the valve, the FM tracing particles were observed under UV light to fully cover the valve internals

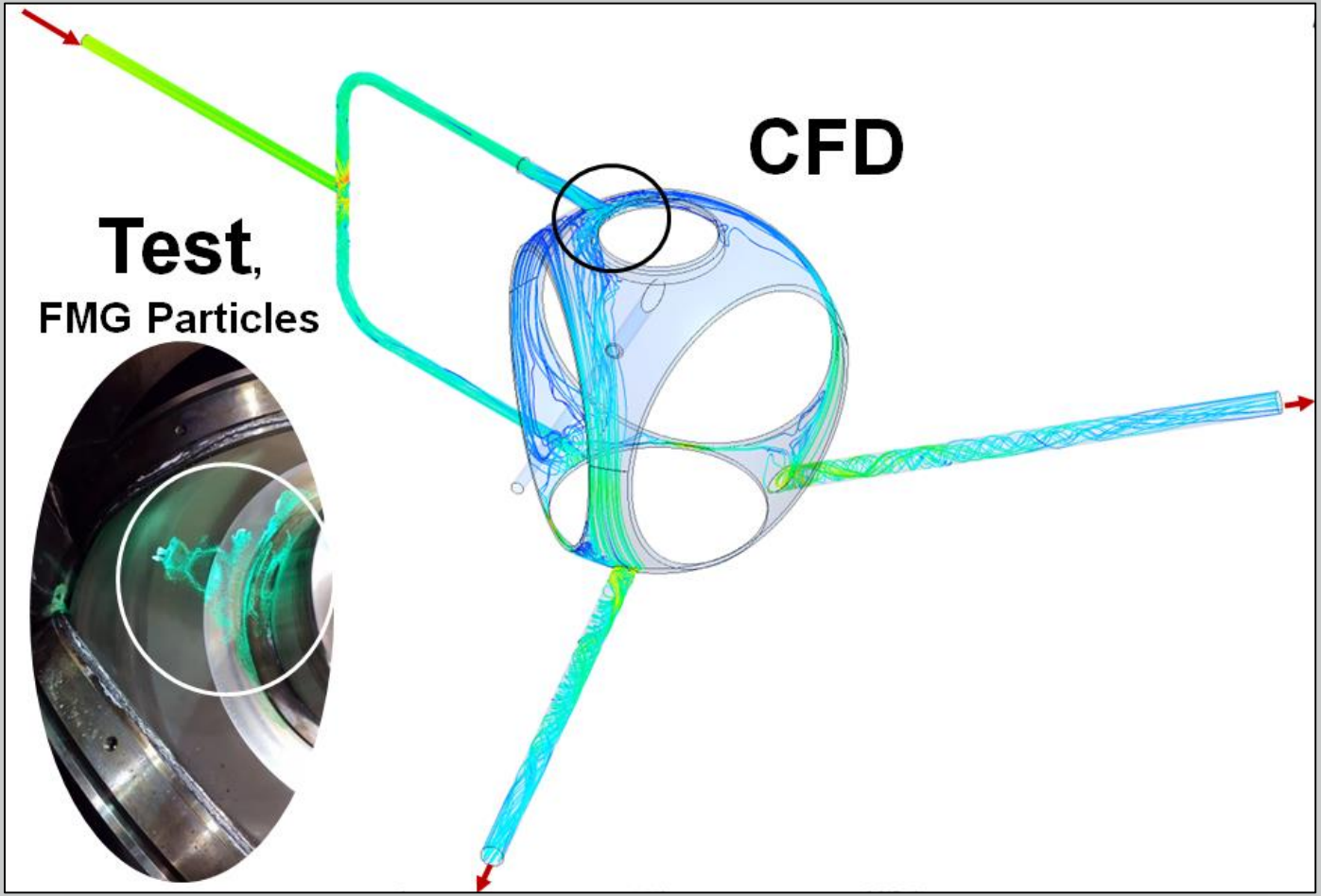




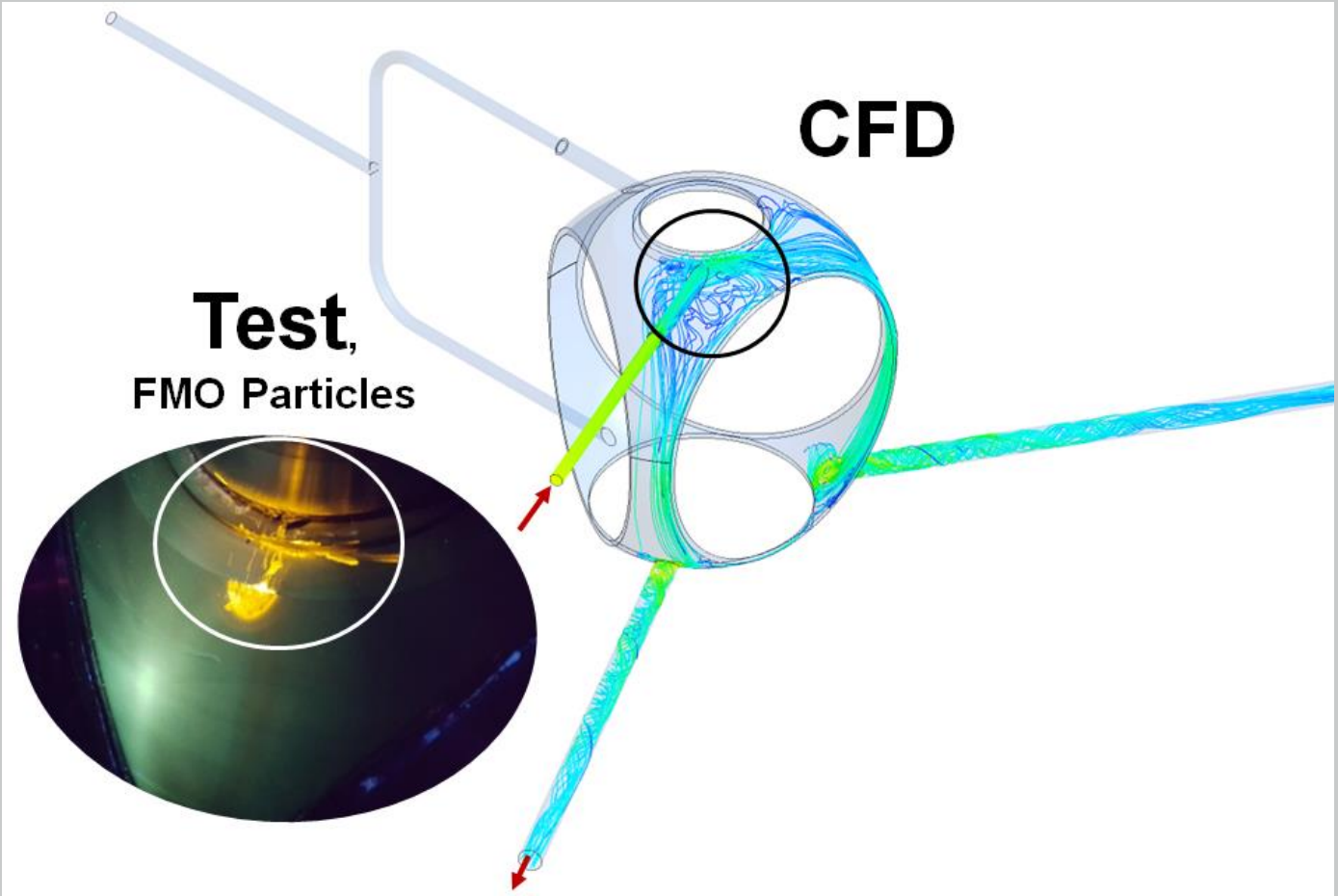


TEST PICTURES

FLOW COVERAGE FROM INLET PURGE A

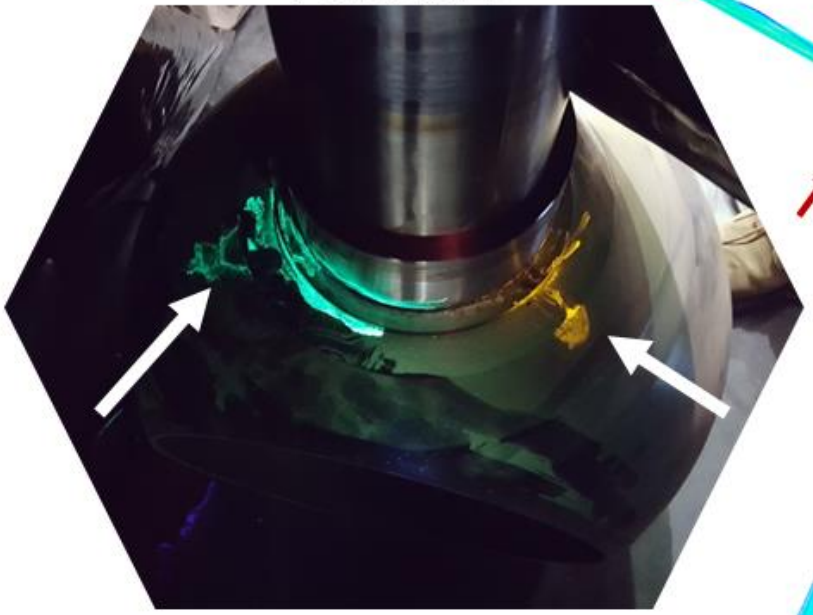


FLOW COVERAGE FROM INLET PURGE B



Test,

FMG & FMO Particles



CFD

FLOW COVERAGE FROM INLET COMBINED PURGE A & B

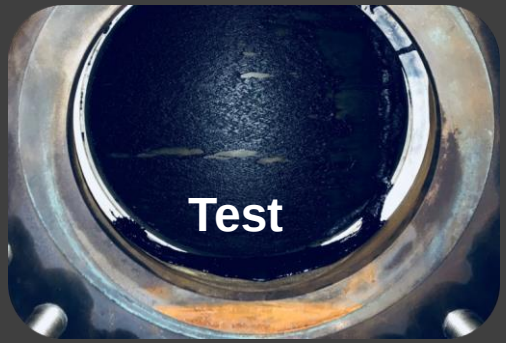
TRUE TOP ENTRY

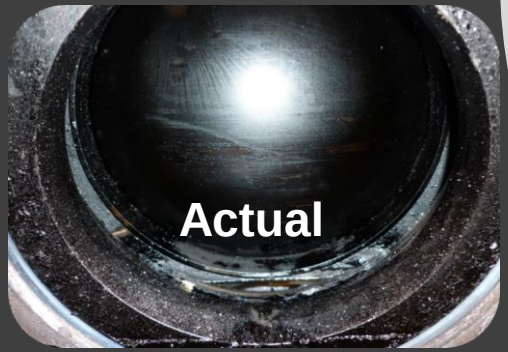
- At MOGAS Service shop the ability to remove internal parts was validated for
  - Clean Valve &
  - Coked up Valve

- After successful operation of the valve in the simulated coking test, the valve was taken apart to test the true-top entry feature.

- The valve was successfully disassembled an all the internal parts were removed easily to allow for cleaning and reassembly.

LOCK UP TEST RESULTS



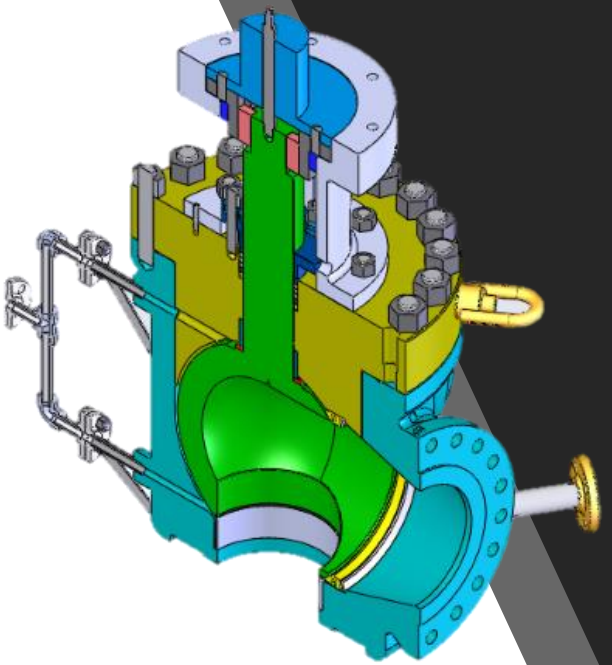


- A hot rubberized tar material with similar properties to coke was poured into the MOGAS valve

LOCK- UP TEST

- Valve was left for 2 days then stroked manually.
- Valve was left for 1 more week then strokes using a motor
- The results of the lock-up test indicated that the valve would most likely continue to function during steam purge loss and that the valve internals can be removed through the top after a coking incident

CONCLUSIONS



- The results of the heat cycle test validate the thermal clearances built into the valve to ensure proper. operation at warm up normal and upset conditions.
- The lock up test results validated the MOGAS valve design of reducing coke build up area in order to continue operating during or after steam purge loss.
- Hydrostatic shell testing verified no leakage of the pressure boundary and the seat leak test validated class IV shutoff (per FC 70-2).
- The purge testing validated the results of the CFD and ensured that the body cavity was being fully covered.
- The true-top entry design of the MOGAS valve was validated following the lock-up test.

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