INNO-CON® - INNO-MAT®
Metal Seated Liftplug Valves & Automation
a proven valve design with state of the art actuation options

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INTRODUCTION

• History of lift plug valves
• Advantages of the lift plug valve design
• Challenges and solutions of the lift plug valve design
• New developments and design updates
Lift Plug Valve Design utilized in the industry for over 100 years with several patent applications since 1914

Valve catalog of POLTE Valves in Magdeburg, Germany from 1931
Lift Plug Valves found application in
• coal fired steam systems,
• catalyst cracking units,
• rubber processing,
• delayed coker and
• other severe service hydrocarbons and chemical applications
Common Applied Valve Types

• Lift Plug Valves such as MIAM INNO-CON
• Metal Seated Ball Valves
• Gate Valves

INNO-SWITCH – MIAM Delayed Coker Switch Valve
ADVANTAGES of INNO-CON Lift Plug Valves

• Simple robust design with only 3 major parts (body, cover, plug)
• Protected seats when plug is in open or close position
• No friction operation as plug is lifted off seats specifically designed for high cycle service such as in delayed coking units
• Top entry design – in line maintenance/de-coking
• Shut off force from outside the valve, can be increased by increasing torque (tapered plug)
ADVANTAGES of INNO-CON Lift Plug Valves

• Lifting Design in conjunction with steam purging enables active cleaning of the seats at every operation
• Steam only consumed when plug is lifted off the seats (during opening/closing operation)
ADVANTAGES of INNO-CON Lift Plug Valves

CFD simulation of purging

- Valve size: NPS 16 / #300
- Plug lifted of the seat and partially turned
- 3 purge connections
- Steam with 3 bar differential pressure

With plug turned some area around plug exposed to process – cleaning imperative in severe services
ADVANTAGES of INNO-CON Lift Plug Valves

- Valve size: NPS 16 / #300
- Lifted plug position
- 3 purge connections
- Steam with 3 bar differential pressure

Detailed picture with lifted plug position
ADVANTAGES of INNO-CON Lift Plug Valves

Low Cost of Ownership

- Large Seating Area - Continuous seat integrity and sealing performance
- Steam only consumed when valve is operated
- Leakage Rate A as per ISO5208 (0 bubbles/drops)
- Torque Seated tapered plug, increased torque = higher shut off force
ADVANTAGES of INNO-CON Lift Plug Valves

Low Cost of Ownership

• Simple Robust Design with no special spare parts required
• Lifting Design – No metal on metal friction on seats when operated
• In-Line de-coking (disassembly in line)
• Limited required inventory for spare parts and spare valves
HISTORICAL CHALLENGES

Actuation

• Valve requires 2 movements:
  1. Lifting of Plug
  2. Turning of Plug

• Automation was a challenging task with screw gear heritage technology

• Mechanism to lift and turn the plug with one actuator
HISTORICAL CHALLENGES

Heritage Options: SCREW GEAR

• Movement based on threading and indexing balls
• Indexing balls must move in and out of a race to enable unit to make transition from up and down movement to 90° turn movement
• Forces from valve along with required tolerances in the mechanism often lead to lock up of the system and damages in the mechanism
• Does not allow for back and forth cycling
NEW DEVELOPMENTS

- Patented proven and reliable heavy duty lift and turn mechanism
- Optimum force transmission
- Smooth and fast operation
- Simple to automate
- Higher lifting than thrusting force to eliminate sticking plugs
- Standard range from 3-200tons of thrust output (other options on request)

INNO-MAT with Actuator on 12”
CI 600 INNO-CON Lift Plug Valve
NEW DEVELOPMENTS

Actuation: INNO-MAT®

Turnable Gear Cylinder with slope
- Guided in the body

„Static“ Body with limiter cut out

Slope in Gear Cylinder connected to limiter cut out in body through the axles

Turnable Stem Cylinder with Axles with bearings
- Guided in gear cylinder

Stem cylinder forced to move as desired (up, 90° turn, down)
NEW DEVELOPMENTS

Actuation: INNO-MAT®

Cycle Tested to 3600 cycles
Fire Safe and then cycle tested

INNO-MAT on MIAM INNO-CON Valves

Retrofits on off-brand valves
REFERENCES

Actuation: INNO-MAT® at Suncor, Edmonton Refinery, Canada
• Delayed Coker (Feed Line and Overhead Vapor Line)
• Valves in service are Lift Plug Type Valves with heritage Screw Gear Technology provided by the OEM of the installed valves

Operational Challenges:
• The majority of the issues with the OEM plug valve have been with the heritage design Screw Gear technology
• Lower reliability of actuation due to occurrences of lock up of screw gears
• High frequency of maintenance activities due to repair/change out of screw gears
Actuation: INNO-MAT® at Suncor, Edmonton Refinery, Canada
Installation of New INNO-MAT IM-30 on existing 10” feed line lift plug valves and IM-50 on existing 24” overhead vapor line valves in 2017 & 2018

Experience since Installation:
• Retrofitted valves with INNO-MAT have proven to be working as planned
• Higher reliability in operating these valves at much reduced maintenance requirements

It is planned to retrofit more INNO-MAT on further existing valves towards Q4/2019
REFERENCES

Valve & Actuation: INNO-CON® with INNO-MAT® at OMV Petrom, Petrobrazi Refinery, Romania

• Delayed Coker (Overhead Vapor Line)

• Replaced Valves in service were metal seated ball valves
Valve & Actuation: INNO-CON® with INNO-MAT® at OMV Petrom, Petrobrazi Refinery, Romania

• Installation of new INNO-CON with INNO-MAT and electric actuator in overhead vapor line valve in 2018

Experience since Installation:

• Very good reliability in operating these new valves with the INNO-MAT system
• No unscheduled maintenance activities thus far
REFERENCES

Valve & Actuation: INNO-SWITCH\textsuperscript{®} at OMV Petrom, Petrobrazi Refinery, Romania

- Delayed Coker (Switch Valve)

- Replaced Valves in service was Lift Plug Type Valve
REFERENCES

Valve & Actuation: INNO-SWITCH® at OMV Petrom, Petrobrazi Refinery, Romania

• Installation of new INNO-SWITCH and fully automated electric actuation system in 2018

Experience since Installation:

• Very good reliability in operating the new Switch Valve with the supplied automation system
REFERENCES

Valve & Actuation: INNO-CON® with INNO-MAT® at Rosneft, Novokuibyshevsk Refinery, Russia

• Delayed Coker (Feed Line and Overhead Vapor Line)
• Replaced Valves in service were Lift Plug Type Valves with heritage Screw Gear Technology

Operational Challenges:

• Valves were often not being able to be operated as the system would lock up in the screw gear
• Unscheduled downtime and loss in production due to low reliability of actuation due to occurrences of lock up of screw gears
• Unplanned cost for maintenance or replacement of parts
REFERENCES

Valve & Actuation: INNO-CON® with INNO-MAT® at Rosneft, Novokuibyshevsk Refinery, Russia

- Installation of new INNO-CON with INNO-MAT and electric actuator feed line and overhead vapor line valves in 2016 and 2017

Experience since Installation:

- Very good reliability in operating these new valves with the INNO-MAT system
- No unscheduled maintenance activities thus far
SUMMARY

INNO-CON with INNO-MAT®

- Proven Reliability with INNO-MAT automation
- Simple top entry 3 part build up (Body, Plug, Bonnet)
- Torque seated
- Non friction on seats when operated
- Low maintenance requirements
- Low steam consumption

Very Positive Value Proposition: Reliability / Safety / Low Cost
Proven by References Globally