«If only this flange had an isolation valve…»

Isolation without shut down

AOGV™
Add On Gate Valve

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Agenda

• Background – 30 years history
• AOGV
  • Main steps
  • Cases / Applications
  • Safe design – conformance to standards
  • Business Drivers
• Questions & Answers
Services

- Process Plant Services (on & offshore)
- Subsea Repair & Modification Solutions
- Pig Development, Refurbishment & Support Services
- Torque & Tension Technology & Services
- Calibration Services
- Application Engineering – Electronics Design & Communication
- Rental Tools

Products

- Pipe & Pipeline Isolation Tools
- Repair Clamps Subsea & Topsides
- Pigs & Accessories
- Pipeline Pig Tracking & Communication
- Pressure Testers & Equipment

from EPC contracts to sale of products and hire services for a fleet of products

Challenge Accepted
AOGV – Add On Gate Valve
Isolations without shutdowns

• Inserts an blind spade on a live flange couple
• Service provision
• 2-3 man specialist installation crew
• Field proven
• Increased up time by reducing:
  • Drainage
  • Venting
  • Purging
  • Flushing
  • Recommissioning
AOGV inserts blind flanges
AOGV – Dynamic seals on flange
AOGV – Pressure envelope

Challenge Accepted
AOGV – Flange compression
AOGV – Plugged bolt holes
AOGV – Flanges split, gasket removed
AOGV – Blind spade
AOGV – Blind spade – isolation complete
Insert a blind flange and remove the tubular
AOGV – valve maintenance at full production

- International operator
- 8” Class 1500
- Purpose: Valve maintenance
- 3 fields can remain in live production during operation
- Gas export system segregation
- Design pressure 150 Bar
- Increased uptime securing operator revenue stream
Valve repair - 8" 150 bar

- AOGV operated 2 times
- Flanges separated
- Gasket removed and isolation spade inserted
- Isolation confirmed
- Maintenance performed
- Process reversed and line recommissioned

Leak test 165 bar

Gasket removed from live 150 HC Gas system

Recommissioned system post AOGV operation

AOGV operation ongoing

Challenge Accepted
Live replacement of ESD Valve

- Replacing valves and pumps in live process plants
- Inserts and removes blinds in flanged connections
- Purge the isolated segments though the AOGV

**Step 1:**
Disconnect flange #1
Remove gasket
Insert double acting blind flange

**Step 2:**
Disconnect flange #2
Remove gasket
Insert double acting blind flange

**Step 3:**
Purge spool through the tool
Remove spool and valve

**Step 4:**
Install new valve with spool
Remove blind flanges
Reconnect flanges with new gaskets and flange bolts
Plant Operation back to normal
AOGV- Valve replacement

• Replacing isolation valves topsides
• 20” Gas pipeline riser
• Pipeline 100km
• Positive isolation
• New gasket in flange
Replace Butterfly valves online

Isolate on the pipe flanges

Pull out and replace the butterfly valve through the launcher
Live process segregation - 24"

- Scope: Isolate between flanges to enable intervention on a limited part of the process, liquid side in main process
- Save cost by reducing cleaning cost (75% reduction of cleaning volume) and time, and avoiding draining of production fluid.
- Operated 4 times in field on 2 separate flanges / locations
Slug catcher isolation - flashing sediments

- International operator
- 12" Class 300, 30 bar design
- Not possible to gas free during 21 day shut down
- AOGV Operated & Flanges separated
- Gasket removed, Isolation spade inserted, & isolation confirmed
- Maintenance performed
- Process reversed and line recommissioned

![Image of Slug catcher isolation setup]

- Flange to be isolated
- Removed gasket from live system
- AOGV isolation complete
Application of standards

- Relevant standards
  - Material selection
  - Allowable stress
  - Calculation rules
- The AOGV itself
- The AOGV / Flange interface
- The piping system
- Design vs Operation pressure

EN 13445-3

Unfired pressure vessels - Part 3: Design
Design verification – 150bar

- Standard – PED EN 13445
- Calculations – tool and interface
- FEM / FEA - Finite Element Analysis
- Notified Body – DnV GL
- CE Marked
Displacement vs stress

- Pipe flexibility – displacement
- Pipe spade (20mm – 75mm)
- Pipe supports – allow flexing
- Stress analysis - displacement
- Site survey
Site execution

- **3 – 6 days**  Arrival of equipment and personnel on site, rigging and preparation, interface meetings, installation of AOGV

- **1 day**  Split flanges, remove gasket, insert spade and verify isolation

- **X days**  Perform maintenance work / purpose of isolation (Operator / incumbent contractor)

- **1 day**  Retract spade, insert gasket, recommission system

- **2-3 days**  Disassemble tool, pack and demob
Business drivers

• Move scope out of TAR
  - Increased production through simplified isolation

• Isolate individual process train, valves or heat exchangers

• Increased up time by reducing drainage, venting, purging & flushing

• Strategy change for shut down and maintenance work

• Longer shut down intervals

Partnership review
Wide range of applications

- Slug catcher isolation
  - Cryogenic -163 deg C
  - 3"
  - 20 Bar

- Blind flange replacement
  - 8"
  - 10 Bar

- Control valve isolation
  - Gas export
  - 8"
  - 150 Bar

- Slug catcher isolation
  - 12"
  - 30 Bar

- Heat exchanger isolation
  - 24"
  - 16 Bar

Challenge Accepted
AOGV – Isolation without shut down

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AOGV – Summary

The purpose of the tool is to enable safe isolations and to reduce extent and duration of production shutdowns, adding value of 2-20 MUSD per application. The principle design was developed within the Company addressing shortcomings of traditional isolation methods. The tool is field proven on a platform on the NCS.

Plants have large volumes which require substantial preparation and start up activities in relation to performing maintenance operations. The isolation tool can shorten shut down periods significantly thereby reducing cost.

Typical applications may include replacement of valves and piping, isolate heat exchangers for chemical cleaning or replacing leaking flange gasket with new gaskets and bolts. The live isolation tool can turn the original spectacle blinds on live systems, replace elements connected to piping systems, floating hulls, connections to high volume tanks.

The tool can be installed on a pair of flanges at the maintenance location and significantly reduces the need for drainage, venting purging and flushing.

A field proven tool for live process isolation has been demonstrates as a safe and cost saving technology. The technology is patented and is significantly different from existing methods of line stopping. There is a wide range of application areas in Facilities and Production Operations and the new tool will increase plant uptime.
Repair Clamps SubSea & Topside

- Design, manufacturing and delivery (EPCI) of specialized clamp solutions, subsea and topside
- Temporary or permanent pipeline repair clamps
- Sealing and / or structural repair clamps
- Hot tap clamps for tie-ins or plugging / stoppling
- Patch clamps for local repairs
- Split clamps for grout / epoxy / sealant injection
- Competency Based Emergency Repair, fast-track delivery of repair solutions for leaking pipelines
SubSea Repair & Modification Solutions

- Design, manufacturing and delivery (EPCI) of specialized solutions.
- Modification and repair of pipelines, structures and subsea production systems
- Supply of custom designed equipment and systems
- A variety of ROV and diver assisted custom made tools
- Competency Based Emergency Repair (fast track)
- SubSea MMO
Pipe & Pipeline Isolation Tools

• Hydraulic and mechanical high and low Pressure Plugs for topside and subsea use
• AOGV™ - Ad On Gate Valve (Patented)
  – Isolation without shutdown
• Twin Tyre Flexible Isolation Plug
  – To provide positive isolation before hot work.
• ABIS and Mini ABIS - Air Bag Isolation System,
  when welding on hydrocarbon filled systems.
• Valkyrie – Specialised Back-Gas shield weld purging system.
• High Friction Pig - Used to provide a low pressure,
  high seal isolation.
• SkadiPlug™ - Remote operated plug system using ice plugs.
36 Years

- Special pipe clamps subsea and top side
- Sealing on flange circumference
- Mechanical plugs
- Calculations – EN (PED) / ASME
- Barrier philosophy – verification steps
- Handling of mechanical loads in piping system
- Dynamic seals – Rods / Bolts
- Bolting technology