“Secure your revenue stream!”

AOGV™
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• Feedback from Customers
• Companies which has approved and used the Technology
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40 Years experience

- 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
AOGV Main Steps installation
Flanged live system
Install Dynamic seals on flange
Pressure envelope

- Class pressure
- Telescopic aspect
  Dynamic seal slides inside the AOGV
- Seals are static wrt flange
Flanges compression

- Hydraulic operation
- End cap
- Big piston – flange face
Ready to operate

- Plug flange holes
- Verify barrier pressure envelope
- Split flanges
- Remove gasket
- Insert spade

- Option: Remove isolated flange (Pipe / valve / pump)
- Reverse process to reinstall pipe / valve / pump
AOGV™ Animation

https://www.youtube.com/watch?v=fwZnAxF9KW0&t=79s
AOGV™
25+ successful isolations
Slug catcher - flashing sediments

- International Operator, UK sector
- 12” Class 300#
- Purpose: Isolate Slug Cather
- Not possible to gas free during a 21 days shut down
- Presented at OE19
Valve replacement – instrument air and flare

- Operator NCS
- 2in class 150
- 2in Valve replacement – instrument air and flare
- Purpose: Replace passing valves
- Operation pressure 9 bar
- AOGV installed and operated on 4 locations to facilitate 4 valve changeouts
Isolation of Butane line

- International Operator, UK
- 18” Class 300#
- 50 bar Design pressure
- Purpose: Isolation of Butane line for changing out Metering system.
Live process segregation

• International Operator NCS
• 24in Class 300#
• Purpose: Isolate between flanges to enable intervention on a limited part of the process, liquid side in main process
• Operated 9 times in field
• IK / ENI present OTC 2018
Live replacement of ESD Valve

• Operator NSC
• 4" Class 150#
• Purpose: Replacing ESD valve in live process plant
• Rest of process can remain in live
• Inserted 2 blinds and replaced valve and spool.
Valve Maintenance

• International Operator NCS
• 8” Class 1500#
• 150 bar Operation pressure
• Purpose: Isolate to facilitate maintenance on valve
• Gas export line
Replace Butterfly valves online on FPSO

- International operator NSC
- 16" Butterfly AOGV
- Purpose: Change out passing valves, by isolating between slop tank and HC header.
- Isolate on flanges, Pull out and replace the butterfly valve through the launcher
- Operated in field 7 times
Ongoing deliveries
Isolation of Pipeline

- Supermajor
- 20" AOGV - class 900# Australia
- Purpose: To replace Last Valve Out (LVO)
- Design pressure: 110 bar
- Operation early 2021
Cryogenic AOGV

- Supermajor
- 3" AOGV (Italy), LNG
- Purpose: Modify liquid line to pumps
- SS304 – Graphite seals
- Design temperature: -170Deg. C
- Test medium: Liquid Nitrogen (7bar - 170C)
- Operation 2021
Isolate Flare line

- International Operator, NCS
- 1" AOGV - class 150#
- Purpose: Isolate the line to allow a valve to be replaced without a shutdown
- Design pressure: 19,6 bar
- Operation late 2020
Isolate to facilitate flare connection

- International Operator, NCS
- 8in class 150# AOGV
- Purpose: Isolate to facilitate Flare connection.
- Operation pressure: 5 bar
- Operation October 2020
Isolate for Valve replacement

- International Operator, UK
- 10” and 2” class 300# AOGV
- Purpose: Isolate to facilitate valve replacement. Passing valve.
- Design temperature: 200 dgr C
- Design pressure: 22,5 bar
- Operation October 2020
Pressure Equipment Directive (PED)

- Harmonized standards (EN..)
- Material selection
- Allowable stress
- Calculation rules
- The AOGV itself
- The AOGV / Flange interface
- The piping system
- Design vs Operation pressure
- Pipe stresses
Design verification

• Standard – PED EN 13445
• Calculations – tool and interface
• FEM / FEA - Finite Element Analysis
• Notified Body – DnV GL
• CE Marked
Business drivers

• Move scope out of TAR (Turnaround)
  - Increased production through simplified isolation
• Isolate individual process trains, 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
Site execution

- 3 - 6 days: Rigging and preparation, interface meetings, installation of AOGV (system in operation)

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

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

- ½ - 1 day: Retract spade, insert gasket, recommission system

- 2 - 3 days: Disassemble tool, pack and demob (system in operation)
Wide range of applications

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<th>Flare isolation</th>
<th>Replacement of passing Isolation valve</th>
<th>Heat exchanger isolation</th>
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<tr>
<td>Cryogenic -163 deg C, LNG</td>
<td>24” – Class 1500# Design Pressure 80 Bar To facility pigging operations or valve changeout</td>
<td>6 – Class 150# Design pressure 3,5 Bar For changing out heat exchangers</td>
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“It is about time that someone did this”

Very Well Done!!

It has been a great pleasure to work with the clever and professional IK Team throughout this critical job. I will be looking forward to working with all of you in many future jobs.

“I do not think you understand how big this idea is”

Feedback from Operators on the AOGV
AOGV™ now qualified and used for:

- Eni
- Equinor
- bp
- Vår Energi
- Shell
- AkerBP
- ExxonMobil
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