Shtokman subsea valves

Technical meeting with Russian valve manufacturers
Moscow 24th June 2010
Shotkman Artistic view Phase 1
Subsea export (TRB and PLEM’s)
Subsea infield production loop (3 off)
Essential Subsea Valve Key Points

• Reliable and robust design.
• Quality and ‘on schedule’ delivery.
• Low leakage.
• Low frequency of operation.
• Little maintenance.
• Life Cycle Cost (LCI) is considered to be more important than the purchase cost of the valves.
Background

- FEED phase decision to use Statoil subsea valve experience.
- Gas pipelines developed by Statoil.
History

- In the late eighties and early nineties Statoil had some serious problems with subsea valves. A systematically monitoring of the regularity were carried out. The reason for production losses and high Life Cycle Cost turned often out to be failure of valves, in particular failure of actuators.
- In 1997 Statoil established a new regime of specifications, which specified preferred technical solutions and more stringent requirements than the international standards.
- In order to ensure the best regularity for the Riser Bases (SIV), Statoil developed a Retrievable Actuator. In case of trouble with the open close facility, the actuator could easily be replaced without interrupting the production.
- A special ‘top work’ was developed with an interface that also could fit a torque tool and a high pressure cap.
Achievement

• By taking a direct approach to the industry Statoil took a leading role in specifying requirements in order to increase the quality and improve the robustness and regularity of subsea valves. In general this approach has made great improvements for the design of ‘high performance valves’.

• The ‘Statoil Standard’ is today followed by Oil Company’s world wide. The Statoil Standard has also been recognised by the valve industry itself as a major factor in order to bring quality forward.
Statoil References

• Since 1997 there has been more than 30 large subsea projects where ball valves made from the ‘new’ requirements has been installed.
• On these projects there are 165 ball valves with sizes from 6-42.
• 58 valves has been with retrievable actuators.
• No valves or actuators has so far failed!
Additional requirements adapted by SDAG

- Bare stem valves and direct operated valves. Avoid fixed gearboxes and actuators (retrievable).
- Taylor made valves regarding to size and pressure (a lot to gain on weight).
- For ball valves; metal to metal seal as primary seal on seat/ball stem/bonnet and body/bonnet.
- Top entry.
- Double piston effect (DPE) downstream side.
- Tungsten Carbide (TC) on seal areas.
- Finite element analysis (FEA) for all sizes and ratings, proved by full scale pressure testing with bending moment 2/3 of pipe yield.
- Extensive Quality Control QC of material and survey of each valve piece before assembling. QC hold points at sub suppliers.
- Demonstration of rate B with gas during Factory Acceptance Test (FAT). The valve performance have to be demonstrated at all pressure levels from 5 bars to 1,1 design pressure.
- Hydrostatic shell test to 1,5 design pressure.
- All seals tested one by one.
- Testing with hubs with blind flanges on transition/pup pieces, not in bench.
Subsea valve with interface for actuator, torque tool and high pressure caps
36” cl1500 Ball Valve
36” cl1500 Ball Valve

INTERFACE IN ACCORDANCE WITH APPENDIX 2
400 KN/m INTERFACE

BLIND FLANGE
2" Class 2500

Value Weight (Kgf)
High Pressure Ball Valve Interface
Subsea actuators
Actuator/valve assembly
Actuator retrieval tool (ART)
Subsea Torque Tool 80, 250, 400 (650) kNm
Skid installed in buoyancy
High Pressure Cap
High Pressure Cap

General
This document gives a brief operation procedure for the Hokus Engineering 200tm Protection Cap. The information is sufficient to install and operate the Protection Cap on a “need to know” basis. Further details are found in the Hokus Engineering AS user manual as indicated above, which is included in the delivery and enclosed in the transport box.

Pre-installation check:

P. 1: Insert the ROV handle into the clamp interface (horizontal or vertical) and rotate by hand in “O” direction until the clamps are fully open.

P. 2: Verify that the clamp mechanism is fully open as shown.

P. 3: Bail out the bleed-off plug and secure it to the Protection Cap or ROV tool box. Bleed-off plug to be reinverted solved.
Benefits:

- Less mechanical equipment subsea that can fail.
- Failure of a gearbox or an actuator will not cause production loss. (i.e. improved regularity)
- Torque tool or retrievable actuator intervention are easy, quick and can be carried out from most kind of vessels.
- Less equipment that require maintenance.
- High pressure caps gives the benefit of an extra stem leakage barrier. Production can keep running if a leakage occur. Allow planned intervention.
- The valves itself will be cheaper without gearboxes, however high pressure caps are needed.
- Pressure class can be optimised (for TRB a reduction of rating closer to max test pressure will exceed 100Tonns).
- By adapting to the Statoil barrier philosophy, allow less valves on the structures
Disadvantages:

- Require more ‘loose items’.
  - Caps
  - Actuator retrieval tool
  - Torque tool
- Cost of the a.m. ‘loose items’
- Keeping Tool Pool.
Conclusion

• For Shtokman the Statoil based Valve requirements will result in less valves, less actuators, smaller and lighter structures and foundations and easier installation, with less possibility to exceed the limitations of 280T/structure.

• During operation phase, lower ‘Life Cycle Cost’, higher regularity with less subsea interventions.
Response of invitation to pre-qualification 36” Valves

• Initial prequalification
  Deadline for reply was set to XX of September 2009.

• Second Open prequalification
  Deadline for reply was set to 06 of November 2009.

• Evaluation criteria
  The candidates have been evaluated with regards to the following main selection criteria:
  - Documented subsea experience (referenced list) with large bore high pressure valves
  - Qualified designs
  - Design features like metal to metal sealing and double piston effect
  - Russian Content

• The twelve candidates were located:
  5 Italy, 2 Russia, 2 Germany, 1 Italy/Rus, 1 Spain, 1 UK