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Damaged Control Line Solution to Maintain Functional Downhole Safety Valve and avoid Workover

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Agenda

- Scope of Work and Challenges
- Data Gathering & Engineering
- Damaged Control Line System
- Conclusion
- Questions & Answers (Stand 22)

Scope of Work

- **Single producer well drilled & completed in 1998**
- **Control Line for Downhole Safety Valve observed leak in 2008**
- **Sealing chemical and flow operated valves were attempted to keep the well online but unsuccessful due to Control Line Plugging & Well Integrity Policies.**
- **Retrofit the well with a downhole safety valve with capability for surface control of the Safety valve operation.**

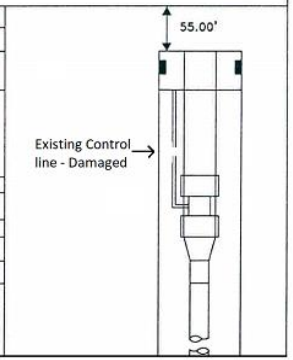
RIG: ABC | WELL:

SINGLE 3 1/2" COMPLETION HORIZONTAL

X-MAS TREE TYPE: SINGLE PRODUCER (4 1/16"x11"x5,000psi)

ACTUATOR TYPE:3 1/8" x 5000

DESCRITION	MIN. I D	MAX. O D.	LENG. FT.	DEPTH BRT
TUBING HANGER	3.93	10.81	1.26	56
TUBING 4 1/2" 12.6 LB/FT 9 JTS.	3.958	4.892	276.09	332
FLOW CPLG. 4 1/2" NEW VAM	3.958	4.892	6.01	338
3.81" NIPPLE 4 1/2" 12.6 LB/FT	3.812	5.937	2.38	341
FLOW CPLG. 4 1/2" NEW VAM	3.958	4.892	6.03	347
X-O 4 1/2" 12.6 LB/FT V. BOXx3 1/2" 9.2 LB/FT	3.958	4.892	1.75	349
X-O 3 1/2" VAM BOXx3 1/2" TDS PIN	2.992		1.60	350
3 1/2" TUBING 9.,2 LB/FT 200 JTS.	2.992		6220.89	6571



Typical Solutions

Commonly used solution - Workover

- **Recovery of old completion and installing replacement completion string requiring larger carbon footprint**
- **Extended timeline for mobilization of workover rig to the well location**

Commonly used solution – Ambient Valve

- **Lack of ESD contingency with flow operated valves**
- **Production loss due to wells shut down caused by (Nuisance Trips)**

Data Gathering for WDCL System Design

Well Production data

- Well parameters in flowing & shut-in conditions (Bottomhole pressure, Bottomhole Temperature, Wellhead Pressure, etc.)
- Production fluid rate & contents (water, oil and gas rate and specific gravities)
- H2S and CO2 content
- Chemicals injected into the well
- Any scale or corrosion related issues

Completion String Components & Well Head data

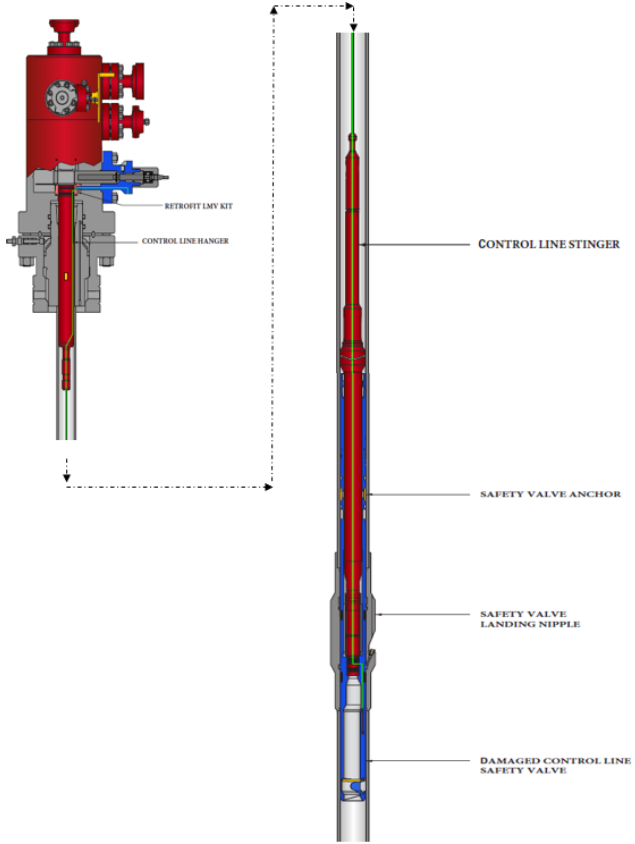
- Well Completion Schematic
- Dimensional details of Safety Valve Landing Nipple (SVLN).
- Dimensional details of Lower Master valve (LMV) and Back Pressure Valve (BPV) profile within tubing hanger
- Existing metallurgy and pressure rating of Wellhead and downhole Completion string components.

Engineering Process

- Data is shared with Design and engineering team to analyse well data and design critical components of WDCL system
- Retrofit Gate valve components and Control Line Hanger are designed based on dimensional data of LMV and BPV.
- WDCL Safety Valve and its anchor are designed based on dimensional data of SVLN.
- Selection of metallurgy (13Cr) and elastomer (HNBR) are performed based on production fluid content.
- All designs are compliant and certified to applicable API certifications.

Damaged Control Line Solution (WDCL)

- Rigless solution to restore the well with fully surface controlled Sub surface Safety valve.
- Combination of retrofit surface and downhole components
- WDCL Safety Valve with Anchor system compatible with existing Safety Valve Landing nipple (SVLN).
- A new in-tubing Control line installed from Wellhead to WDCL Safety Valve.
- Lower Master Valve modified to provide penetration for in-tubing Control line communication to WDCL Safety Valve.
- API design qualification (API 14A and API 6A)



Conclusion

- **Installation of WDCL System enabled well with fully surface controlled subsurface Safety Valve.**
- **Well capable of producing at expected flow rates with no integrity issues to the well or WDCL system. Currently producing at 2000 bpd.**
- **All Xmas Tree valve remained operational at all times after the installation.**
- **No requirement of flow operated valves lacking ESD contingency.**
- **Well removed from the workover plan after intensive testing of the system.**

Weatherford®

REAL RESULTS

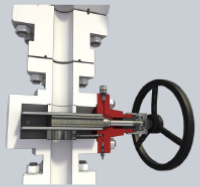
Renaissance™ WDCLP System Enables Shell UK to Avoid Costly Workover on North Sea Well for Savings of £5 Million

Objectives

- Restore the full functionality of a tubing-retrievable surface-controlled subsurface safety valve (SCSSV) in an offshore well where the safety-valve control line had become blocked, rendering the safety valve inoperable. The tubing-retrievable safety valve had severely damaged sealbores, making it impossible to set and seal a wireline-retrievable SCSSV.
- Avoid a major rig workover and the need for a hydraulic workover rig to pull 5 1/2-in. production tubing.
- Create a new wellhead penetration without changing the geometry and configuration of the Christmas tree. The flowlines could not be altered or raised.
- Introduce and install the technology quickly and efficiently.

Results

- Working closely with Shell UK and Cameron, Weatherford designed a Ren Gate™ conversion to the wellhead, providing a new wellhead penetration without altering the flowlines or raising the wellhead.
- Weatherford installed a 5 1/2-in. damaged control line packoff (WDCLP) system consisting of the following tools:
  - Retrievable sealbore production packer with type QN safety-valve landing nipple in the upper bore.
  - 3.81-in (96.8-mm) *Renaissance* WDCL safety valve.
  - Control-line stinger to transport the new control line to surface and a *Ren Gate* control-line hanger sealed in the wellhead penetration.
  - A 3.81-in. (96.8 mm) *Renaissance* WDCL damaged control-line replacement system consisting of a WDCL safety valve, control-line stinger to transport the new control line to the surface, and a *Ren Gate* control line hanger sealed in the *Ren Gate* wellhead penetration.



The *Ren Gate* conversion to the wellhead provided a new wellhead penetration without altering the flowlines or raising the wellhead.

Location
North Sea, UK sector

Rig
Gannet Platform

Well Name
GA-03

Products/Services
- *Renaissance* WDCLP system
- *Ren Gate* wellhead
- BlackCat™ retrievable sealbore production packer
- QN safety-valve landing nipple
- WDCL safety valve

OBJECTIVE - ACHIEVE

INCREASED UPTIME
REDUCED COSTS
ENHANCED PRODUCTION
REDUCED FIELD PRESENCE

THANK YOU

ICoTA + Audience