Improving Reliability of Dunbar D10Y 3.75” WRSV Seals

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Overview

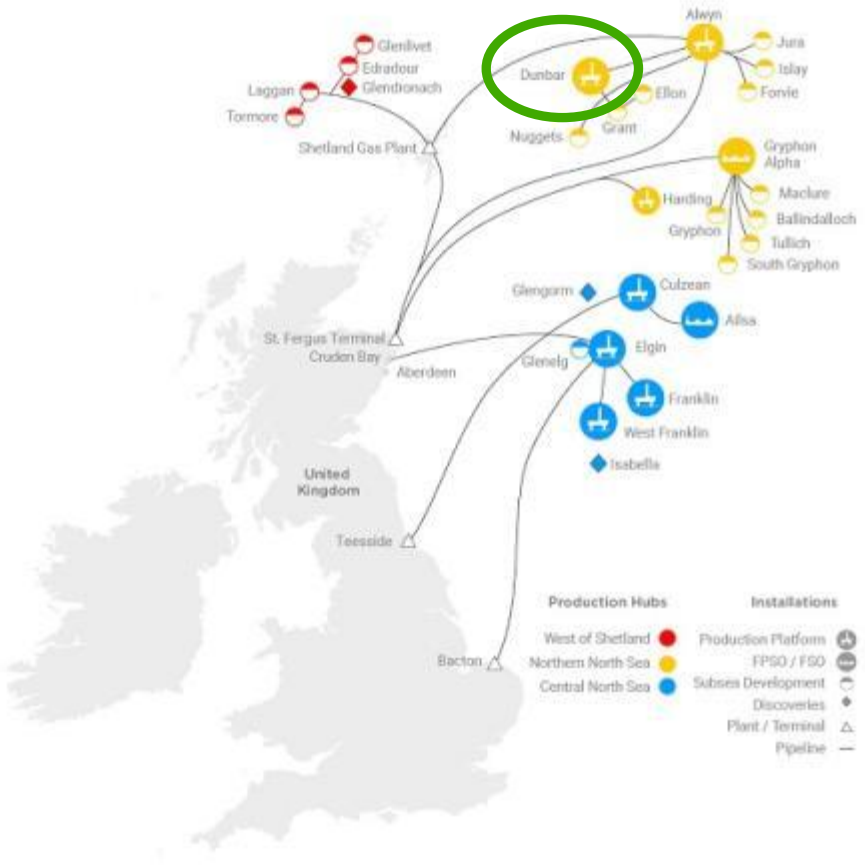
- Well History & WRSV Challenge
- Analysis of WRSV Service History
- Selection & Qualification of Oilenco REACT Seal Stack
- Results Realized
- Conclusion

Well History & Challenge

- Well History
  - D10Y is a 28-years producer on Dunbar platform
  - Its 4 ½” STV SideGuard DHSV which failed inflow test in 2015
  - WRSV has been used to operate the well since 2015
  - WRSV performance was hitch free initially & its reliability deteriorated over time

- Requirement/Challenge
  - Reliable and available WRSV for well operation
  - Lost production

- Options to Resolve Challenge
  - Intervention with WRSV
  - Workover → Not favoured by legacy asset economics



Analysis of WRSV Service History

- WRSV Failure Overview
  - 2015 – 2016: WRSV w/Crimp seals → 3-failures
  - 2016 – 2022: WRSV on Swellable Seals → 6-failures

- Reliability Assessment
  - Total installation count – 16
  - Successful – 6
  - Failures – 10
  - Reliability ~ 10% @ 85% confidence

- Other facts
  - WRSV passes inflow tests after installation
  - Downhole camera did not indicate any clear damage to sealbore
  - Mild scoring on recovered assemblies alludes to potential damage in the Side Guard DHSV cavity

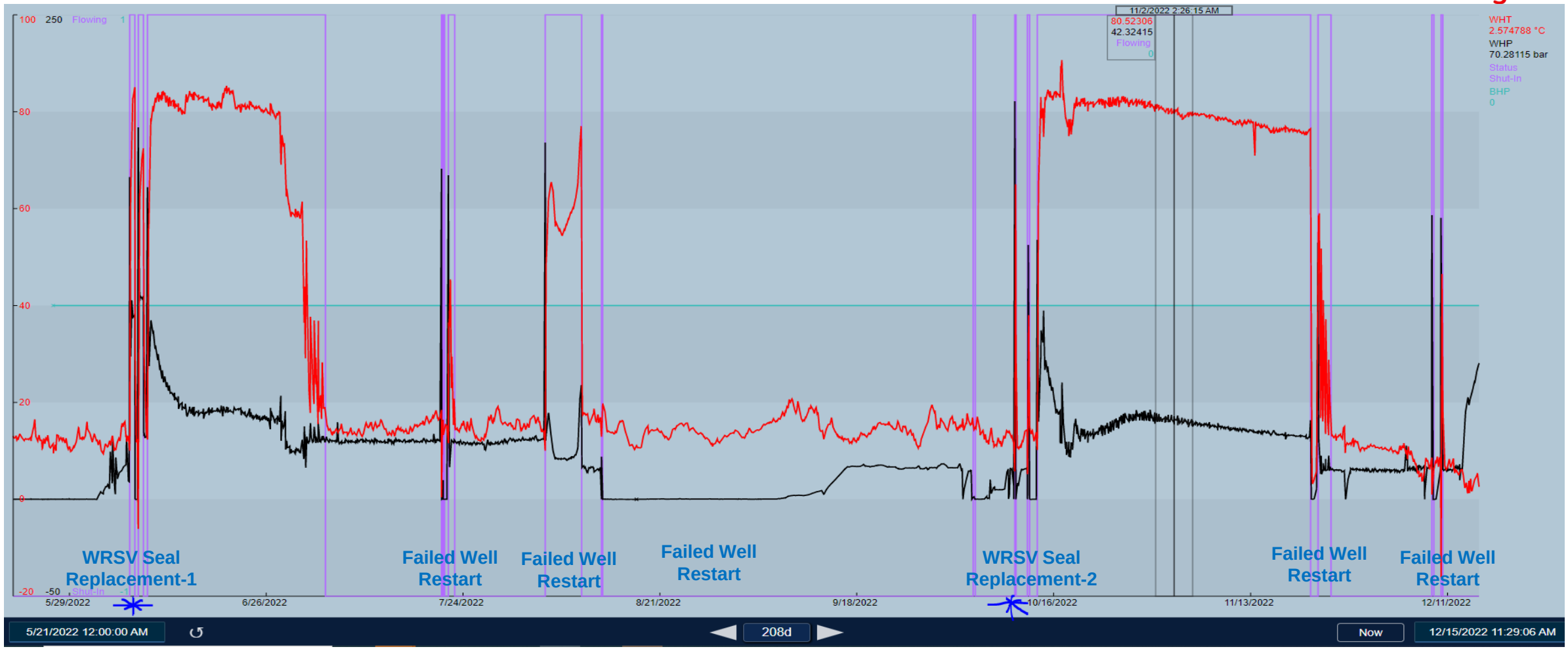
2021

Recovered WRSV with swellable seals

2022

Recovered WRSV with swellable seals

D10 Flowing & Shutin Wellhead Paremeters



Well Restart Issue after production shut-in

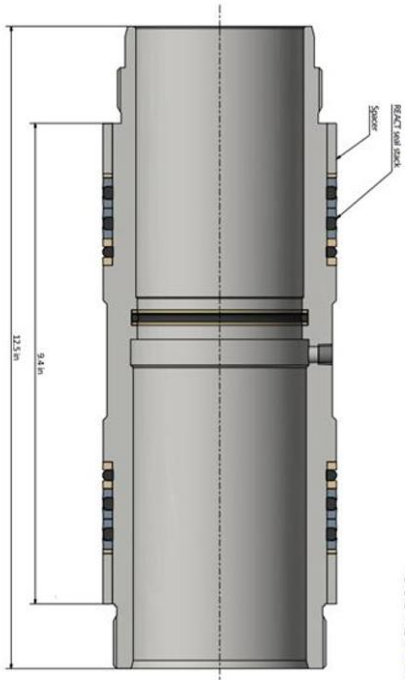
Deductions & Solutions Proposed

- Preliminary Deductions from WRSV Failures
  - Successful inflow test of flapper → No problem with WRSV flapper
  - Inability to control / operate WRSV via control line → Problem with WRSV body seals/sealbore
  - Some swellable seals having difficulty to retain control line integrity at installation → Seal configuration not fit-for-sealbore condition
  - Most recent swellable seal at installation but not retaining control line integrity after well shut-in → Loss of seal integrity (probably driven by pressure & temperature change)

- Possible Solutions
  - Controlled bleed off for control line pressure to minimize fatigue on WRSV seals → not feasible due to instrumentation layout
  - Reduce control line operating pressure → Little room to manoeuvre (350bars Control line pressure vs 180bars SIWHP)
  - More resilient seal stack which is validated to meet with well temperature cycle → Testing of Oilenco REACT seal stack
  - Energized Seal system for WRSV Sealing → Interwell IVC

Peculiarity of New Concept Oilenco Seals on WRSV

New System

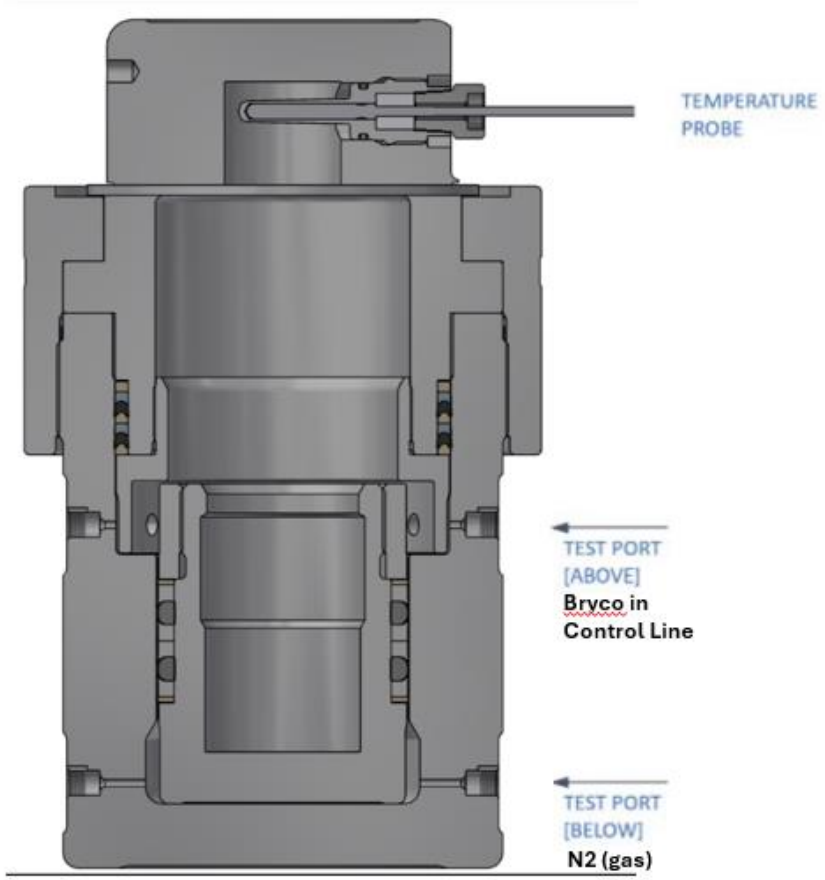


- Old System
- New System
  - Oilenco REACT seal stack

Old System

Qualification Test Program

Test Fixture



- Install REACT seal stack into test fixture
- Objective 1 - Simulate initial WRSV sealing after WRSV changeout
- Objective 2 - Check gas ingress into control line when well is shut-in
  - Test seals from below with N_2 gas up to 4.8kpsi differential & monitor from Bryco Control line: 3-times→ OK. Hold 4.8kpsi x 1hr → OK
- Objective 2 - Simulate well startup/production (hot)
  - Heat up to 100ºC in oven & 7.5kpsi control fluid in upper test port overnight
  - Test seals from below with N2 up to 4.8kpsi differential in 1kpsi increments & monitor from Bryco control line: 3-times
- Objective 3 - Simulate well shut-in & restart → Performed 3x
  - Apply 5kpsi N2 gas with 200psi Bryco
  - Cool and leave to stand overnight → Simulate closed flapper
  - 5kpsi N2 bled off and 5000psi Bryco applied above → simulate opening cold well
  - Increase temp to 100ºC and stable overnight → simulate production restart
  - Increase Bryco to 7500psi → Simulate hold open flapper
  - Bleed off 7.7kpsi Bryco and apply 5kpsi N2 below and cool fixture → simulate shut-in

N2 gas – Represents effluent

Bryco Micronic – Control line fluid

Ambient temperature test condition

100ºC test condition

Installation & Results

- WRSV was installed in June-2023 but there were challenges with the lock
  - Control line integrity held @ 350bars while WRSV was in the well

- WRSV assy recovered and replaced in Nov-2023
  - All the WRSV REACT seals were intact upon recovery
  - Control line integrity confirmed after installation
  - Successful WRSV leak test
  - Well put on production without issues

Recovered WRSV in Nov-2023

Year	Uptime (dates)	Uptime (days)	Downtime (days)
2021	1-Jan-21 to 17-May-21	75	290
2022	12-Jun-22 to 11-Aug-22 14-Oct-22 to 24-Nov-22	60 41	264
2023	24-Nov-23 to 31-Dec-23	37	328
2024	01-Jan-2024 till date	On production	

Abridged well up time analysis from 2021

Conclusions

- 3.75” WRSV was refurbished to accommodate New Oilenco REACT Seal Stack
- Performed rigorous validation testing of Oilenco REACT Seal Stack vis-à-vis D10 Operating Conditions.
- WRSV with Oilenco REACT Seal Stack was installed and recovered with seals intact
- WRSV is currently installed and well on production without WRSV issue(s)
- Investment into a rigorous testing Programme can be more effective than off-the-shelf solutions

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