

Octopoda™: A Quantum Leap in Intervention

Reduction of Annulus Pressure via Innovative Annulus Intervention

Petronas Offshore Malaysia: IADC/SPE-209882-MS & SPE-214576-MS



EXPRO



IADC/SPE-209882-MS

Making Wells Safer; Rectification of High Annulus Pressure via Diagnostic and New Technologies Through Annulus Intervention Method

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Octopoda™

Diagnose | Solve | Secure

EXPRO



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Agenda

Annulus Intervention

- Sabah: XK-2 & XK-3 SCP Challenges
- Sabah: XK-1 Annulus Intervention
 - SCP Challenge
 - Octopoda™ Selection Criteria
 - Planning Phase
 - Execution
 - Outcome



Neil Wilson

Global Product Champion
Octopoda Annulus Intervention
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Sabah Field Historical Challenge, Well XK-2 & XK-3 (2009)



Customer Challenge



Sustained Casing Pressure



Leaking cement

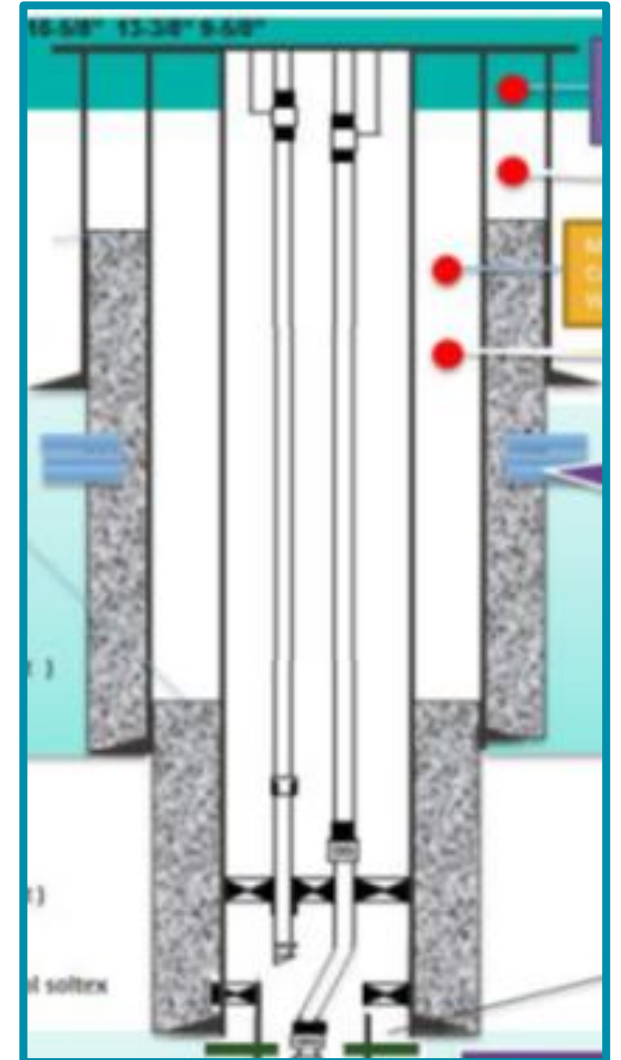
B & C Annulus Sustained Casing Pressure (500psi)

Shallow Gas Source Channelling Through Cement

Exceed Regulators Limits (300psi) & Wells Shut-in

Lube & Bleed With Heavy Brine Unsuccessful

Rig Workover & Recompletion Performed (2010)



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Petronas Offshore Malaysia, Well XK-1 (2020)



Customer Challenge

B Annulus (9 5/8" x 13 3/8") Sustained Casing Pressure (500psi)

Shallow Gas Source Channelling Through Cement



Sustained Casing Pressure

Exceed Regulators Limits (300psi) & Well Shut-in



Leaking cement

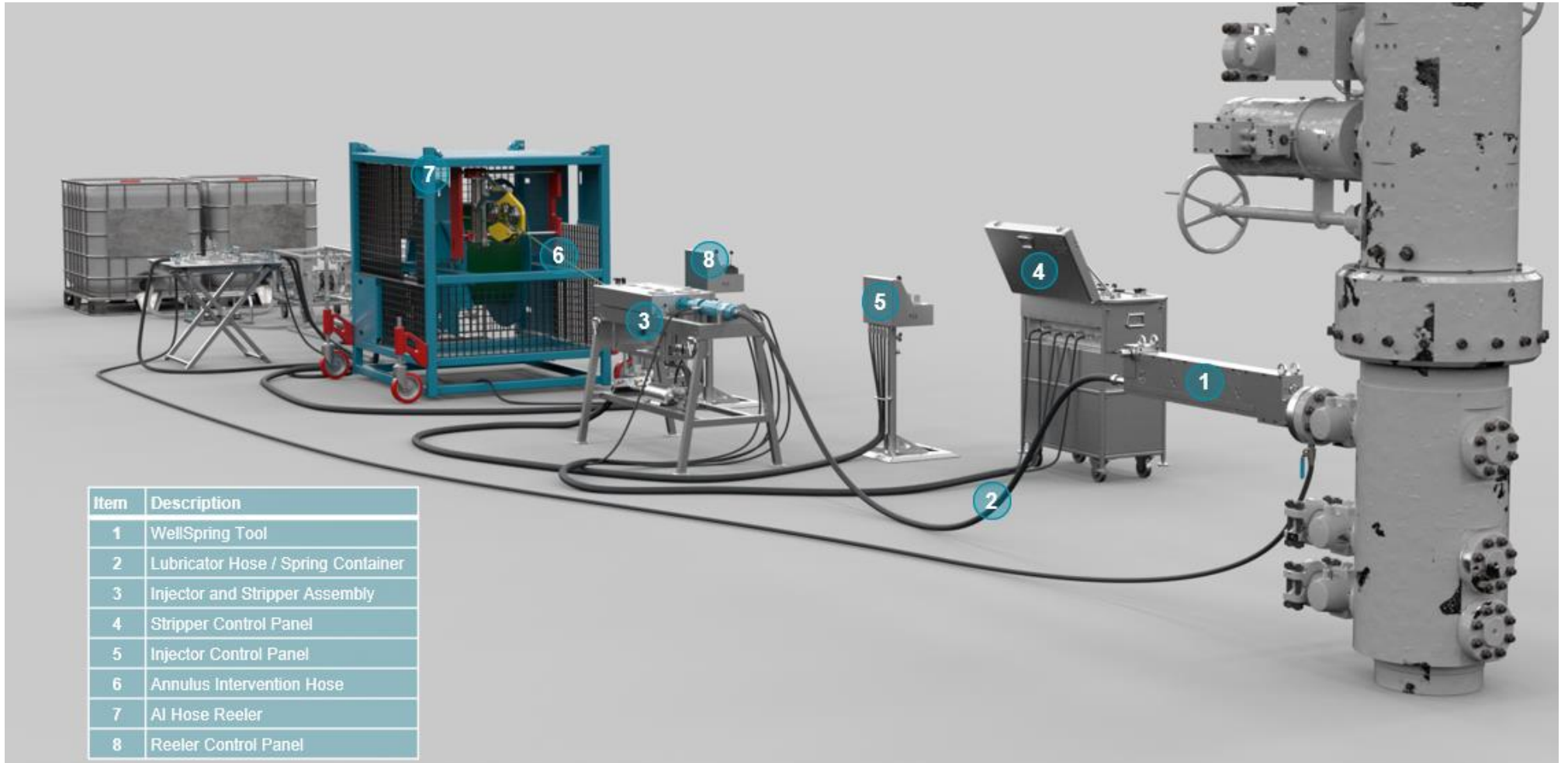
Petronas sought a cost-effective alternative to rig workover and a more efficient and reliable solution to lubricate & bleed

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Petronas Technology Selection Criteria



Rig-less Compact, Small Footprint & Quick Rig-Up



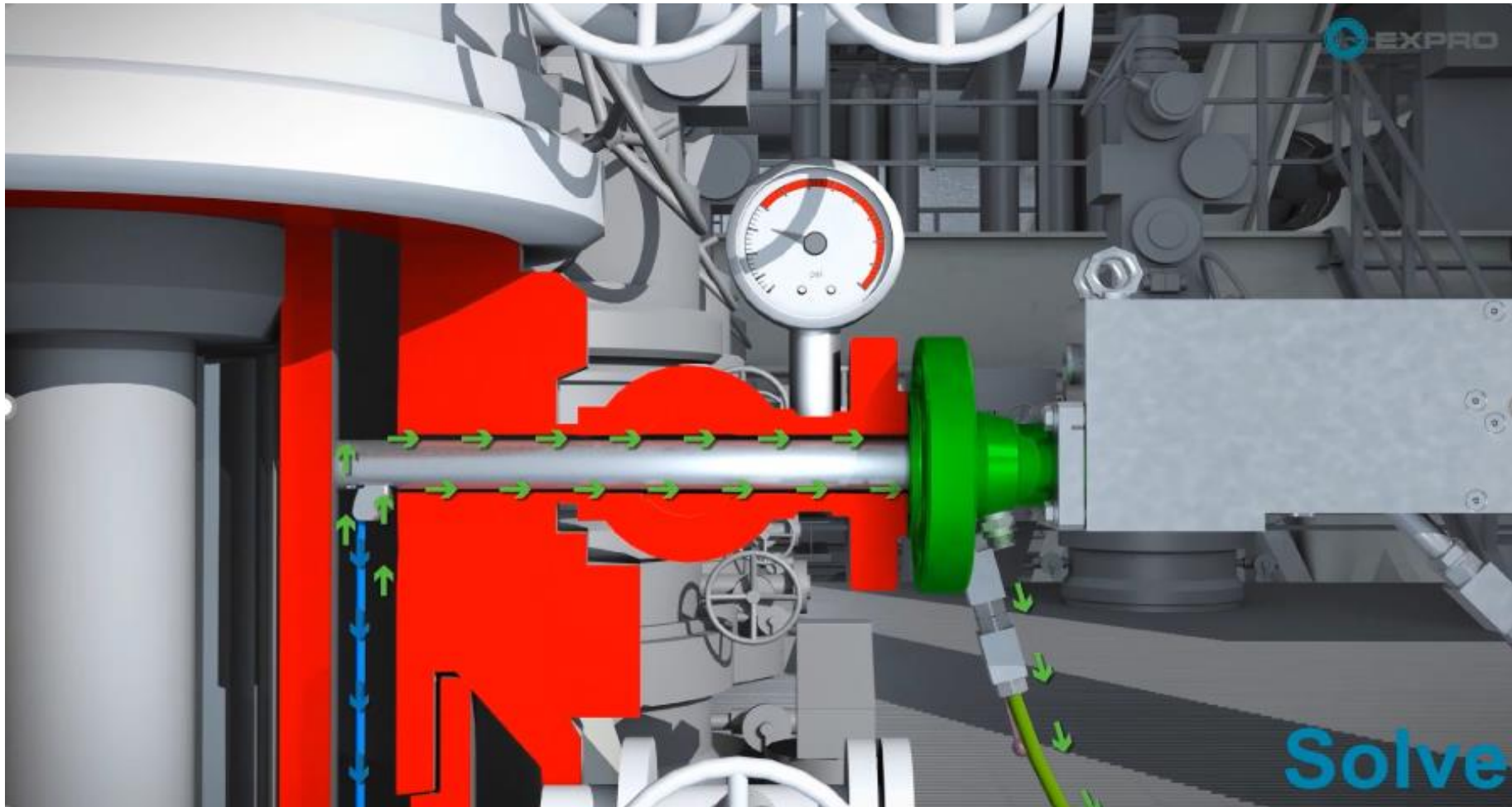
Item	Description
1	WellSpring Tool
2	Lubricator Hose / Spring Container
3	Injector and Stripper Assembly
4	Stripper Control Panel
5	Injector Control Panel
6	Annulus Intervention Hose
7	AI Hose Reeler
8	Reeler Control Panel

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Petronas Technology Selection Criteria

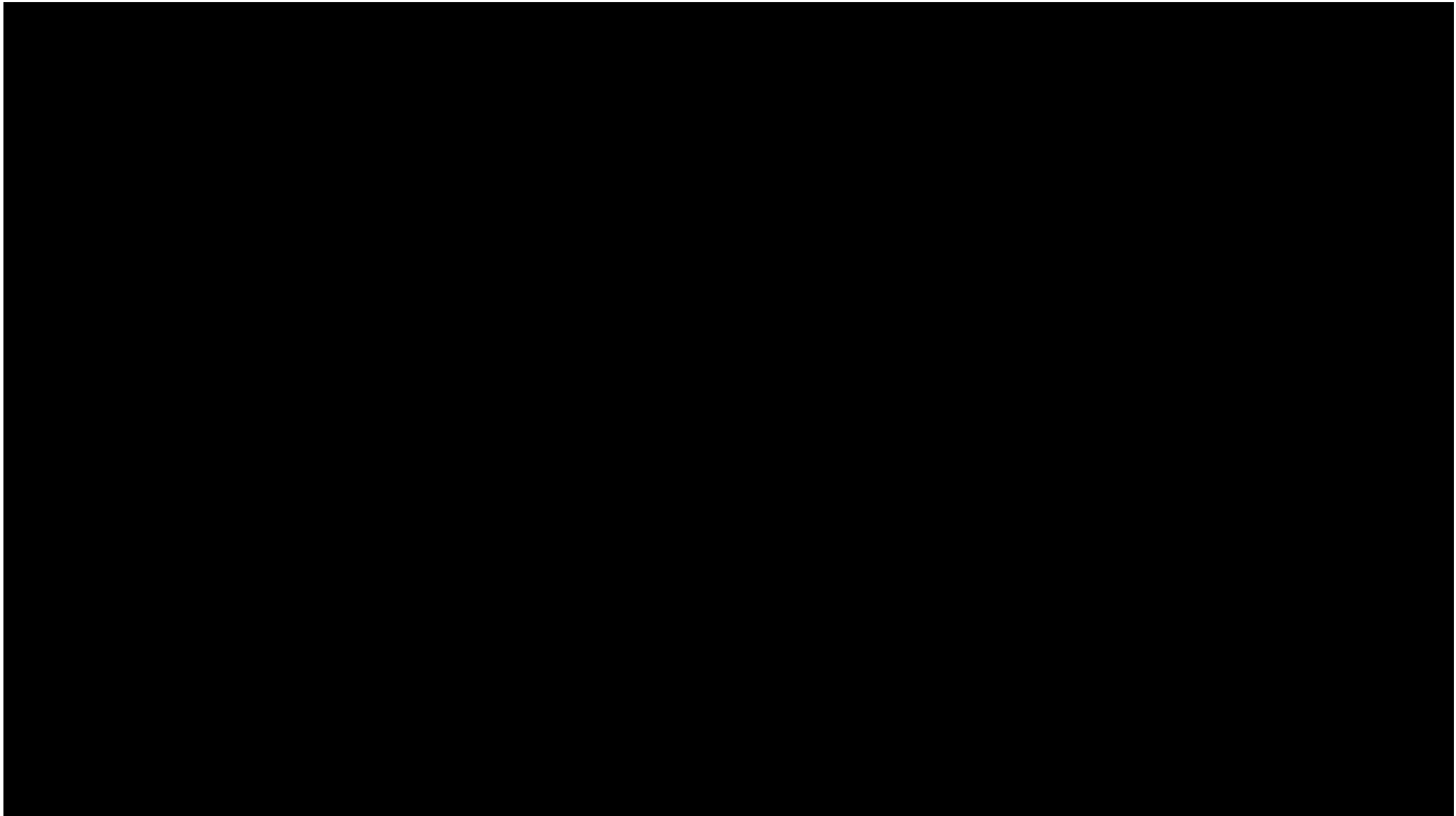


Hose Deployed Into Pressurised Annulus



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Animation

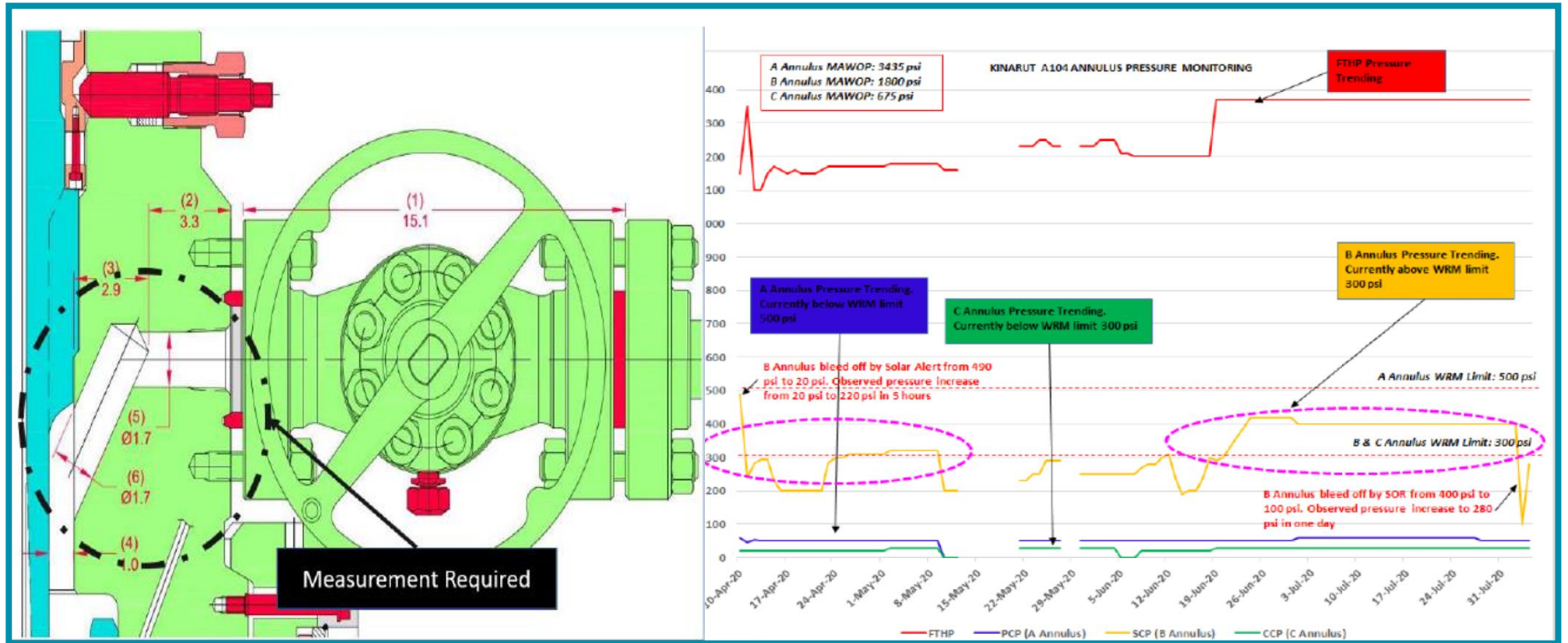


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Planning Phase: Initial Engineering



Evaluate Access & Integrity Status



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Planning Phase: Site Visit



Wellhead & Facilities Survey

The diagram illustrates the wellhead and its connection to the main deck. The wellhead is located on the Wellhead Deck and is connected to the Main Deck via a Well Spring Tool. The diagram shows a 3-Way Manifold (Sampling Point) and a 3" HP Hose connected to the Wellhead. A Return Line is shown on the Passive Side of the Wellhead, leading to a Return Fluid Management system. The Main Deck contains a Spring Controller, Cool Dräger, Motor, Pump, Main Pump, and Pump manifold. A 1000 liter IBC Tank is also shown, connected to the Main Deck. A Sea Water Supply / Return to Thermostat is also indicated.

Return Line to Sump Line

Well Spring Tool

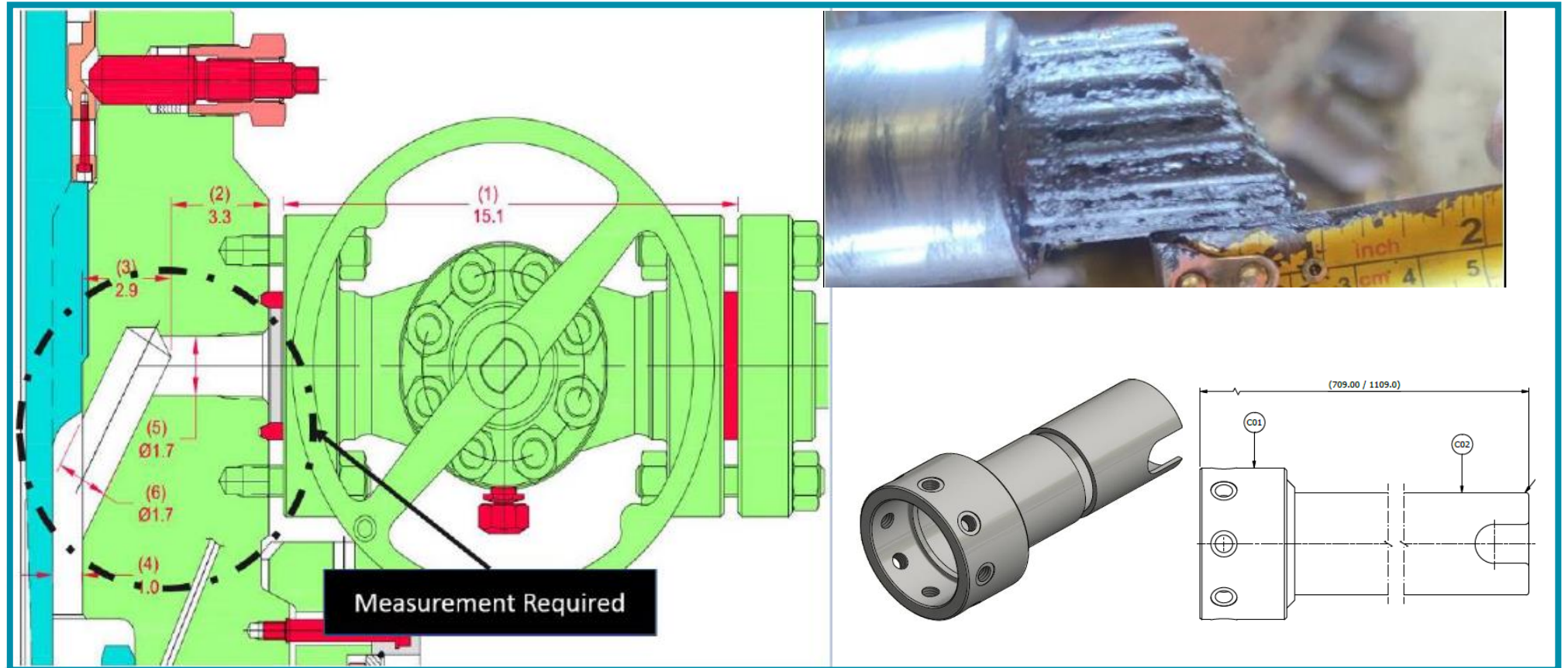
AI WELLSRING TOOL – Rig up on the Well Head Deck to Active Side. Return Line to Sump Line on the Passive Side of the Wellhead

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Planning Phase: Tailored Design



Survey Interpretation & Modified Outer Pipe

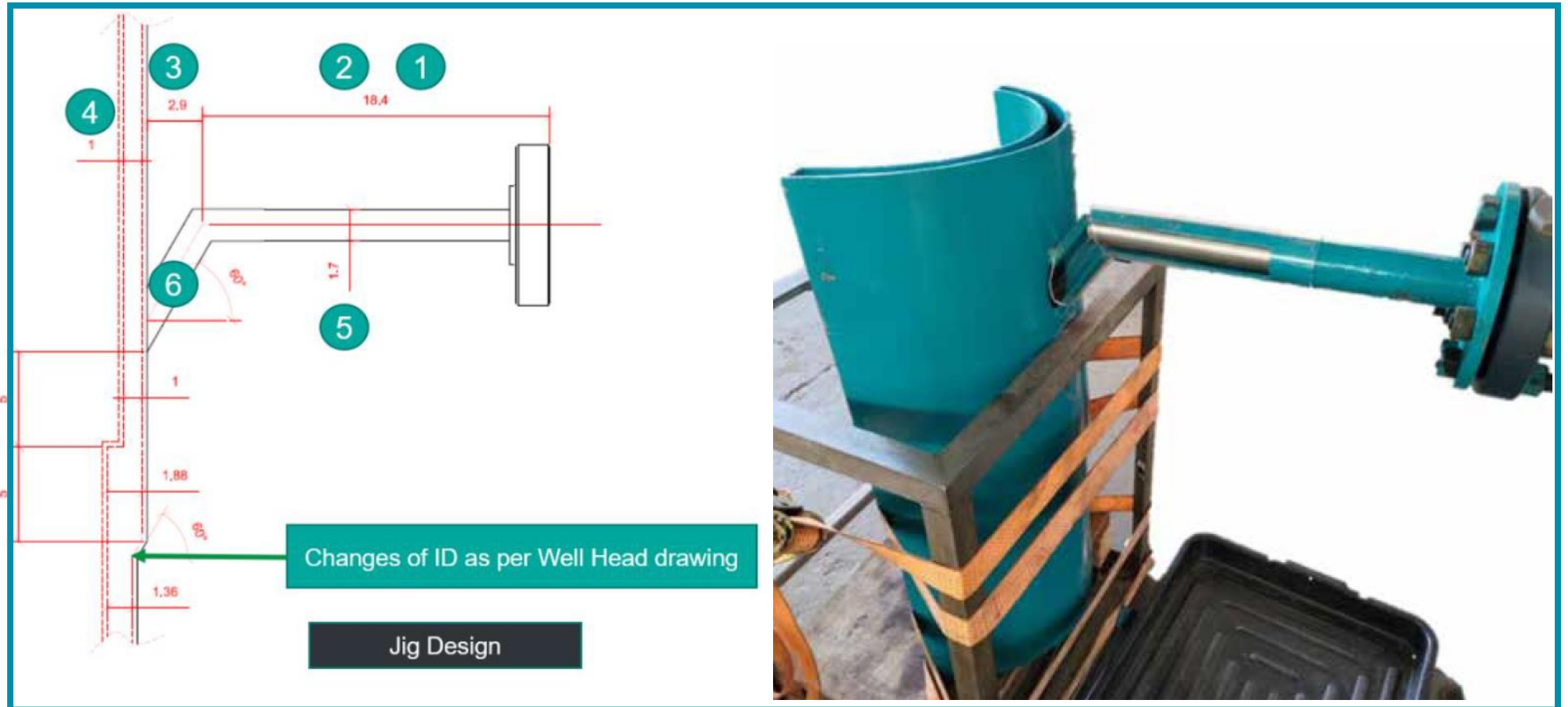


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Planning Phase: System Integration Test



Replicate Tool Access With Test-Jig



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Planning Phase: Technical Evaluation



Diagnosis & Detailed Job Design

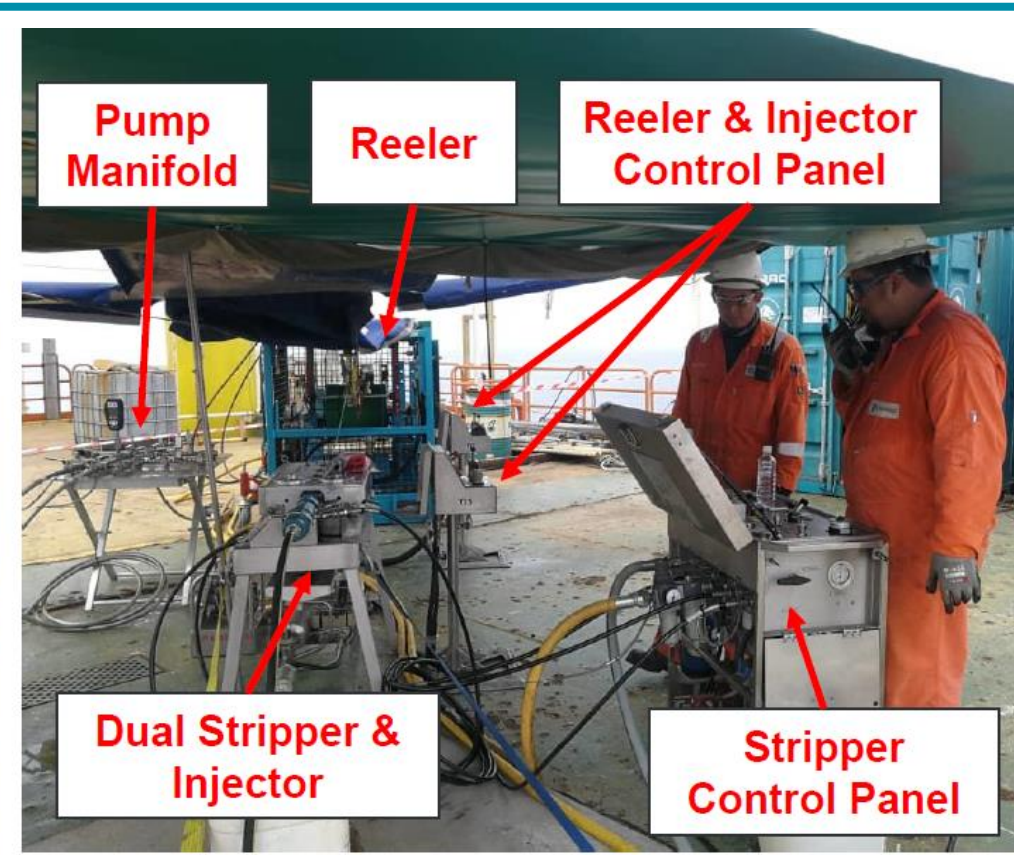


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Planning/Mobilization Phase



Execution Strategy & Equipment Mobilisation



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XK-1 Execution : Annulus Status & Fluid Selection



Deployment

Source:

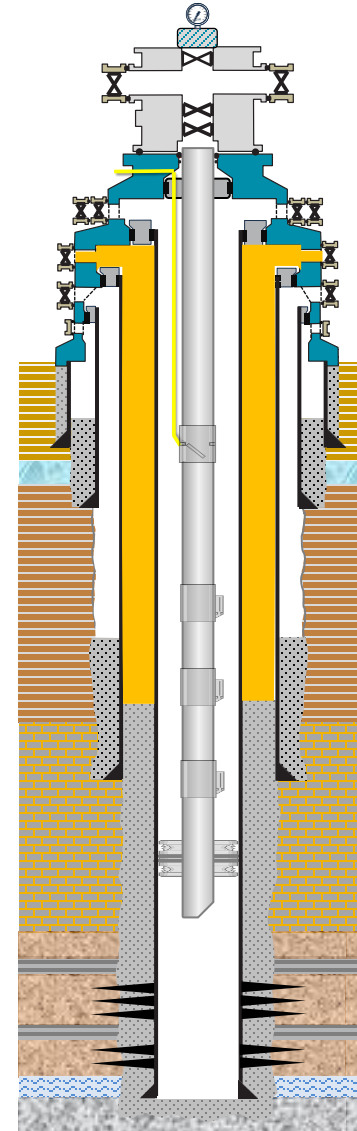
- Lower Kamunsu Sand
- 6879ft TVD, 1480psi

Annulus Content:

- 9.2ppg KCL WBM
- TOC = 3700ft TVD

Fluid Selection:

- 14.8ppg $\text{CaCl}_2/\text{CaBr}_2$
- Hydrostatic Overbalance
- Inhibition Package



B Annulus Pressure

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XK-1 Execution: Fluid Swap Sequence

Hose Deployment:

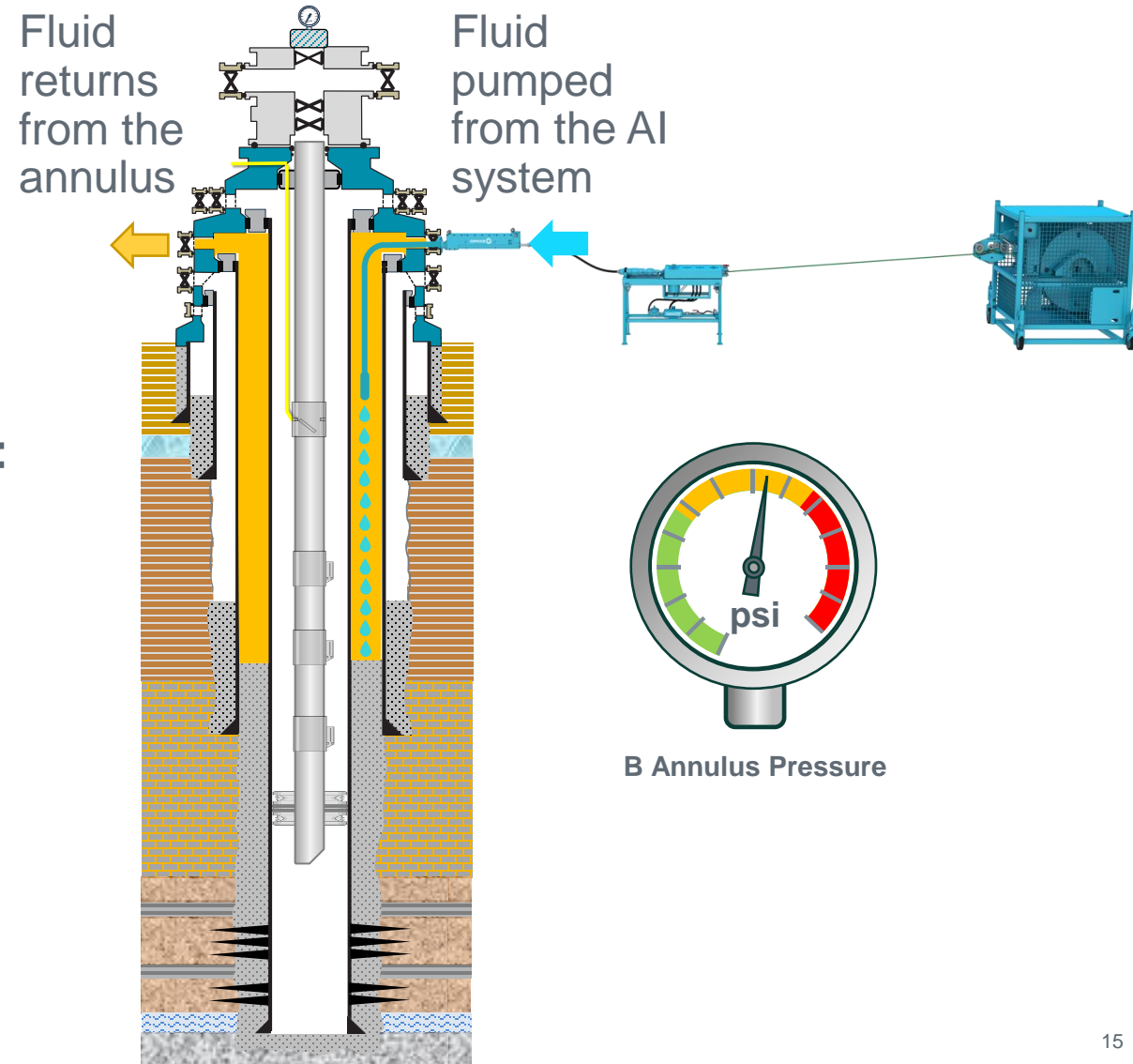
- Access Successful
- 75ft Achieved
- Circulation Path Created

Fluid Circulation:

- Brine Supplied in Totes
- Circulation Rate Dictated By:
 - Hose ID
 - Hose Length
 - Brine PV



Deployment



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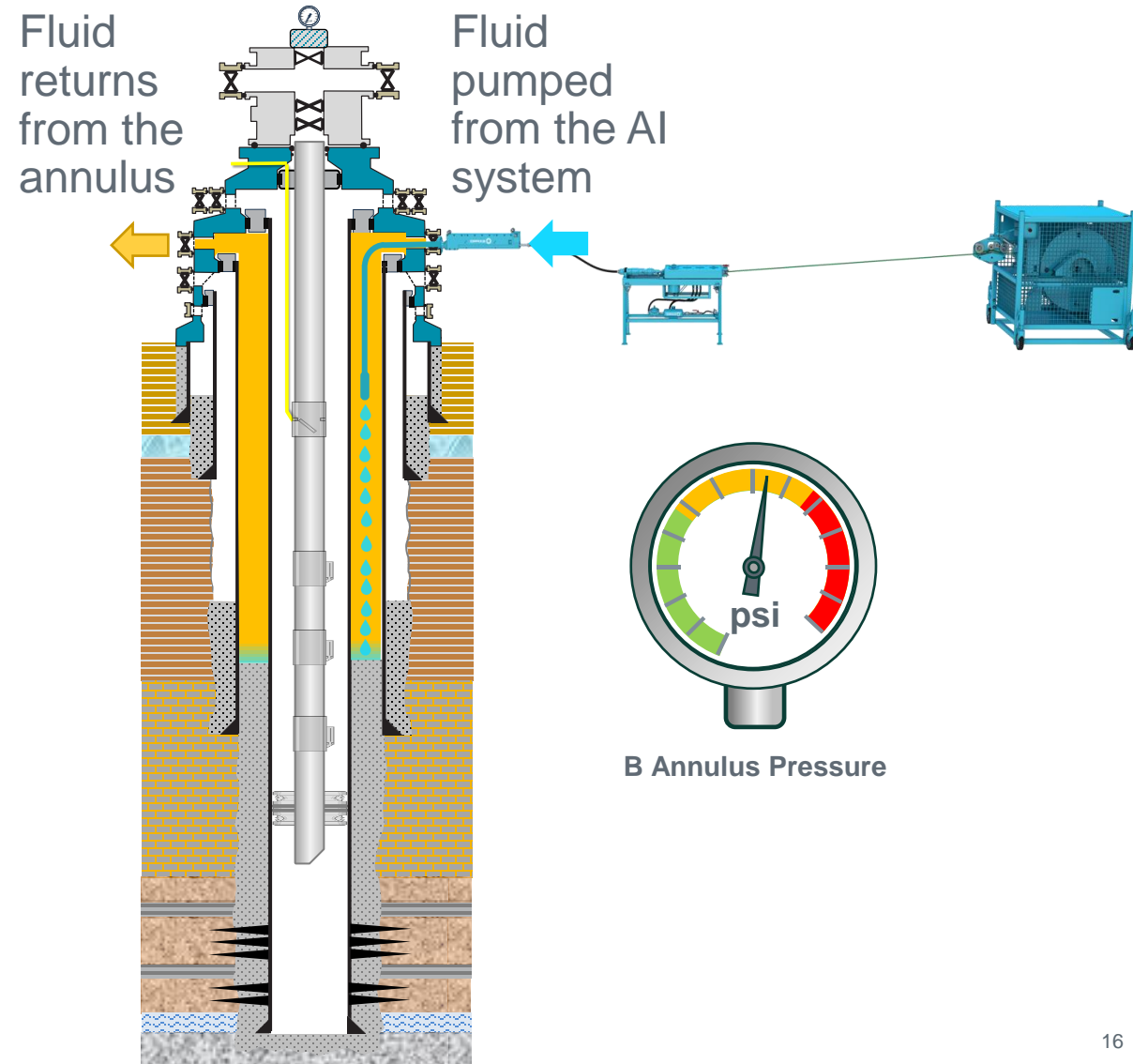
XK-1 Execution: Fluid Swap Sequence

Returns Handling:

- Via Passive Side
- In-line Choke
- Holding Tank
- Sampling Point



Deployment



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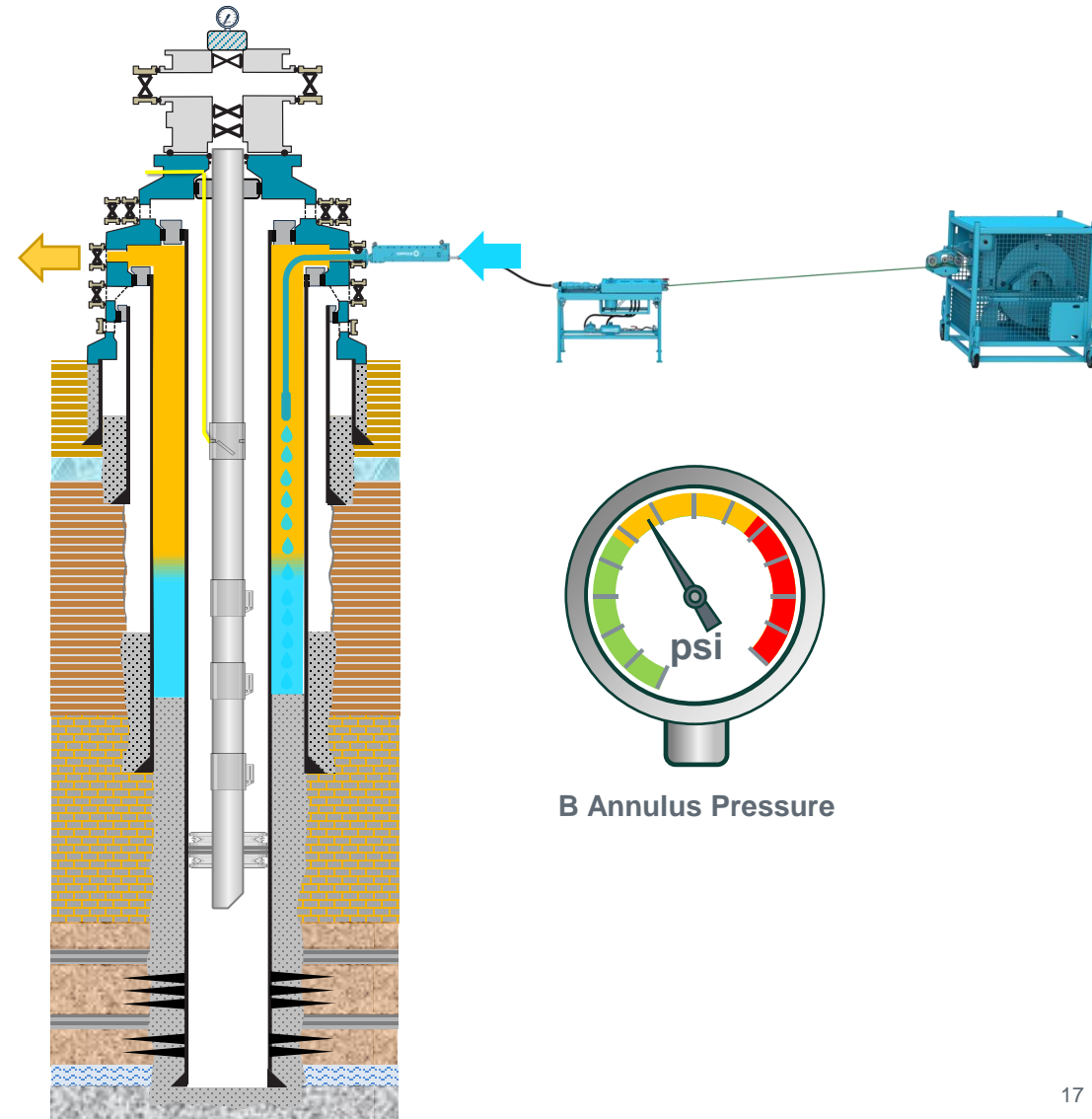
XK-1 Execution: Fluid Swap Sequence

Returns Monitoring:

- Density Checks
- Water/Oil Content
- Adjust Parameters



Deployment



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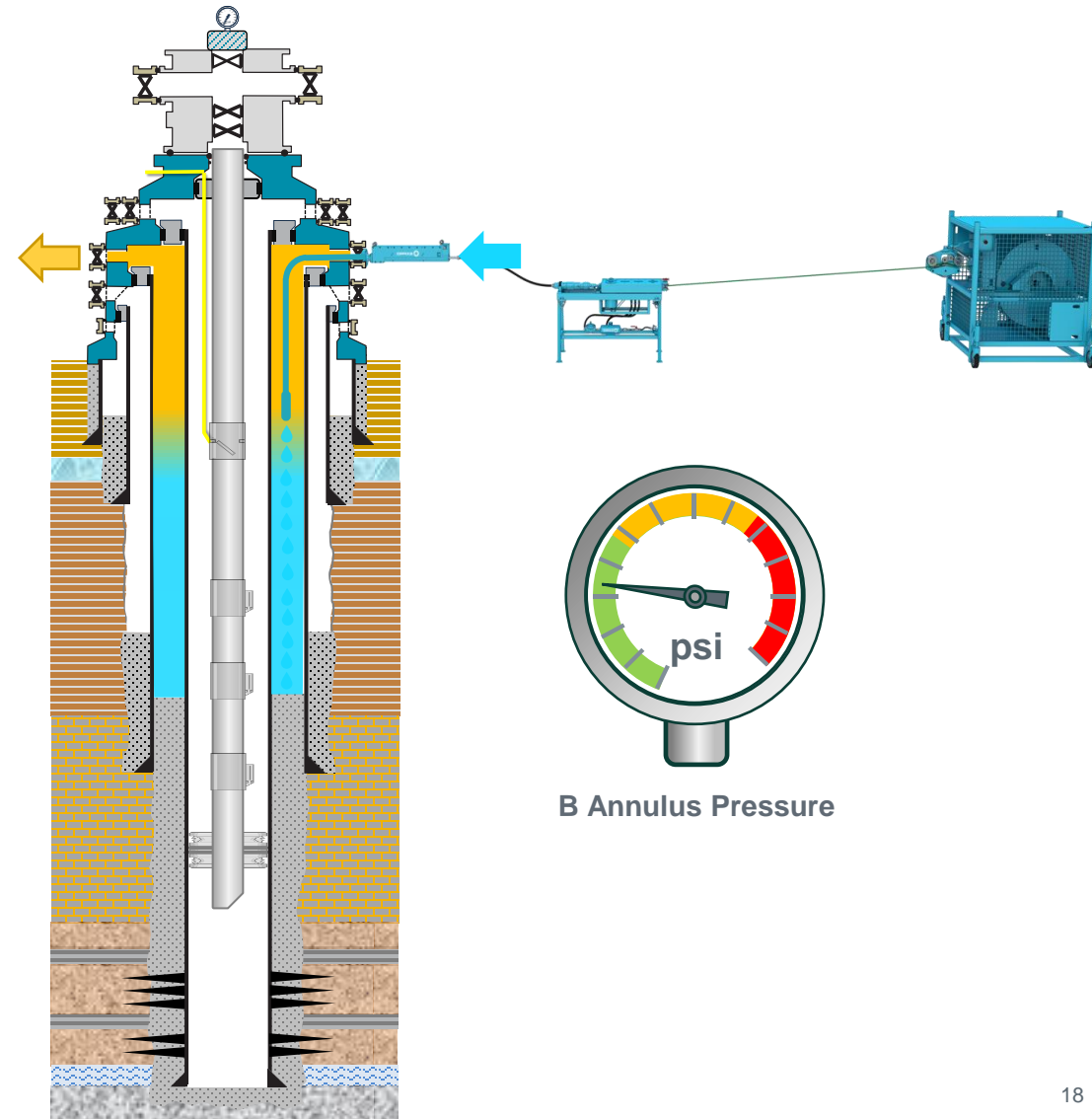
XK-1 Execution: Fluid Swap Sequence

Pressure Build-Up:

- Periodic Shut-Ins
- Allow Fluids Freefall/mix
- Monitor Job Progress



Deployment



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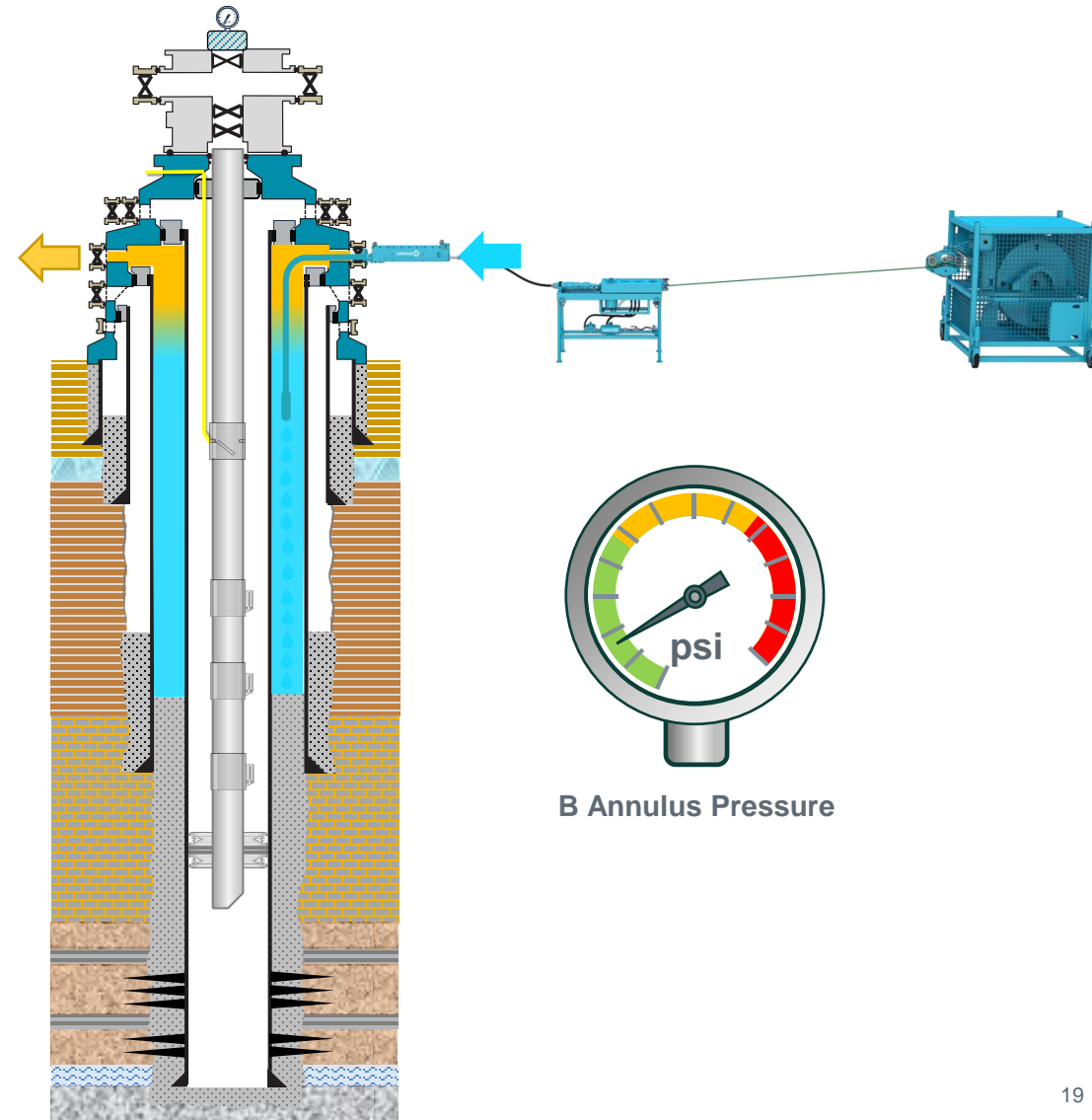
XK-1 Execution: Fluid Swap Sequence

Pressure Build-Up:

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Deployment



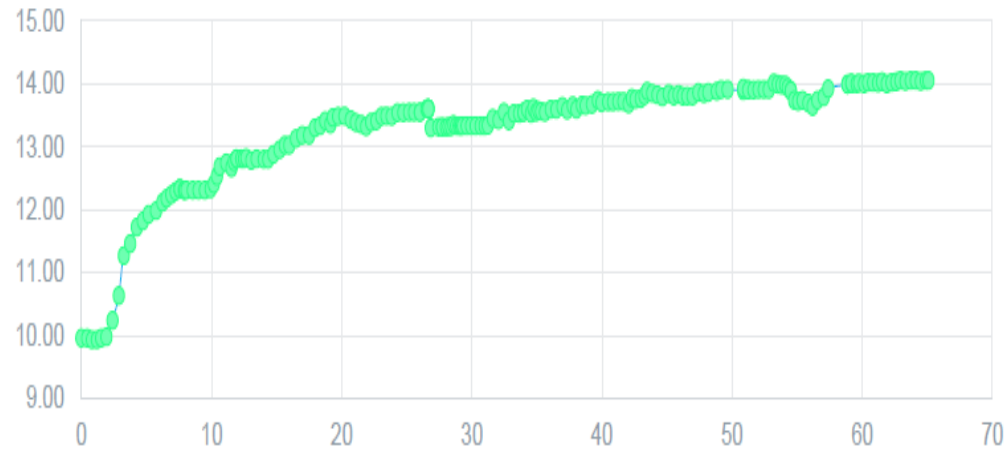
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XK-1 Execution: Fluid Swap Sequence

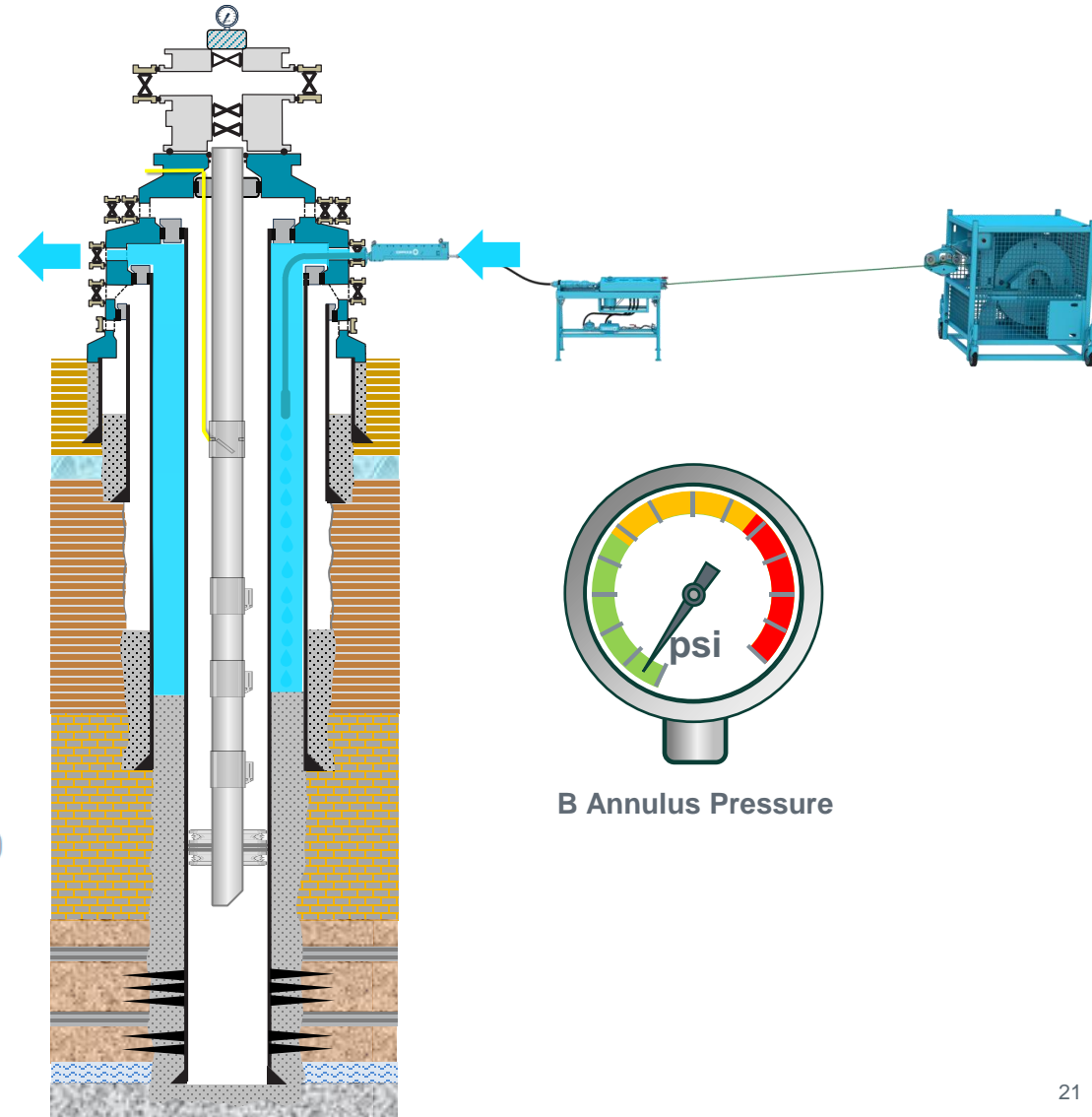
Brine Returns to Surface:

- Gradual Density Increase
- 14.1ppg Final Density

RETURN DENSITY (ppg) vs VOLUME PUMPED (bbl)



Deployment

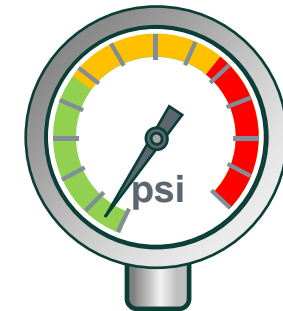
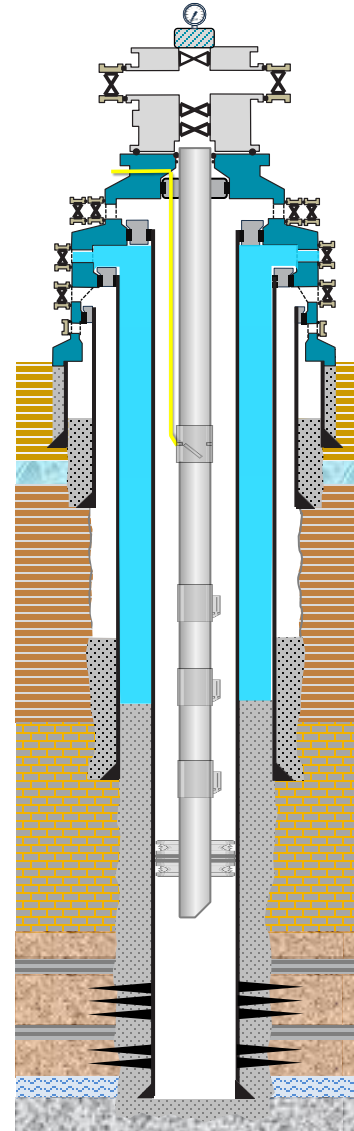


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XK-1 Execution: Fluid Swap Sequence

Objectives Achieved:

- 65bbls Brine Pumped
- 8 Pumping Days (12hr shifts)
- 21 Total Operational Days
- B annulus Pressure 160psi
- Well Brought Back Online



B Annulus Pressure



Bespoke solution



Well Integrity Remediation



Reduces operating costs



Increases asset value

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Value to Client

SCP Reduced to Below Regulator Limits in 3 Weeks and Wells Brought Back On-line



“
We, the Petronas Well Integrity team finally managed to rectify the sustained annulus pressure issue for this well after a series of past trials with other technologies and methods.”

Customer quote

Presentation end

Any questions?