ADVANCED FLOW CONTROL TECHNOLOGY

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INWELL FLOW SURVEILLANCE AND CONTROL: NEW FRONTIERS

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Limitations of Passive ICDs:
1) Cannot be adjusted downhole
2) Cannot shut off water
3) Cannot float screen to TD

OTC 21910
Selection Methodology for Passive, Active and Hybrid ICD
Saudi Aramco
Advanced Flow Control Valve Development Objective

- Leverage field proven technologies
- Full Bore and in all liner sizes (2-7/8” to 9-5/8”)
- Unlimited number of stages / zones with selective activation
- One design with multiple configurations
- Stimulation, closed and ICD positions
- Integrate with any sand control media
- Field Adjustable ICDs
- Robust shifting tool with fail-safe opening
Applications

- On/Off In-Flow Control Device with or without Sand Control
- Multiple position ICD settings
- Float/Circulate Liner to TD
- Set Hydraulic Packers with pressure
- Squeeze/Circulate acid, solvent, etc.
- Steam and Water Injection
- Stimulation (fracturing and acidizing)
  - Cemented and Open Hole
  - Multi-stage Stimulation
Same Valve Different Configuration

Can use 2 or more valves in series for more combinations.
Advanced Flow Control Technology

- Sleeve is made from 17-4 Stainless Steel coated with titanium nitride
- Extremely short throw < 2” from one position to other
- No profile on the sleeve – cylindrical design
- Teflon impregnated coated inner bore – Increases hardness, prevents build-up and corrosion
Advanced FCV Shifting Tool Design

- Extremely short profile (< 2ft)
- Fully hydraulic, no spring loaded keys.
- Fail Safe => Shifting tool only releases if the valve changes position or if the work string is de-pressured
- No restriction on number of valves to be shifted selectively
- Erosion Resistance
- Large Concentric contact area between the sleeve and shifting tool keys
- Coil Tubing/ Jointed Pipe deployed; Wireline Tractor as alternative for ERD wells
- Compatible with standard Accessories – Jet Cleaner, Bump & Accelerator, Fluid Loss Control Flapper, Frac Valve

Features and Benefits
- The hammer designed for pressures exceeding 10000psi, is designed for use in both annular and tubing hydraulic fracturing.
Cemented Multi-Stage Stimulation System

• Coil Tubing Based System
• BHA is left in the hole during fracturing operations
• Isolation is created by opening a single valve while all others are shut

Benefits:
• Very little water loss to formation
• Under-displacement not a risk
• Unlimited Stages
• Re-Stimulation with same BHA
• Reliable Water shutoff further down the road
• Full-Bore Completion
• BHA with Shifting Tool is left in the hole during fracturing operations
• Or use of graduated ball seat/ball drop for intervention less system
• Seats are milled post fracturing to provide full bore ID
• Isolation is created by opening a single valve while all others are shut
• Integration with screens for proppant flow back control
• Integration with On/off ICD for flow management
Case History – 1
Uncemented Multi-stage Frac with Sand Control

Drivers:

1. Able to Frac individual zones
2. Produce each zone selectively or commingled
3. Different ICD settings based on Simulation design
Case History – 2
In-Flow Control, along with Tracer Subs
Annular Isolation btw. Existing Pre-drilled Liner and Open Hole

Single Compartment of size 2 7/8" Liner

Service Bottom Hole Assembly (BHA for size 2 7/8" Liner)
Advanced- FCV with any Sand Control Media

Active FCV with 3-D Mesh Media:

Active FCV with Flush Mounted Premium Mesh:

Active FCV with Wire Wrap Media:

Active FCV with 3-D Sintered Mesh
Summary

- Premium Port is a versatile multi-position valve designed from field proven technologies
- Unlimited number of valves can be installed in a wellbore with selective opening
- Combines Multi-stage stimulation with Sand Control and Flow Control (Producers and Injectors)
- Run in conjunction with Tracer Sub to optimize valve adjustment
- Option to float screen to TD, circulate breaker and set OH packers
- Full Bore
- Available in wide range of Liners
Thank You! Questions?

- Sand Screens
- ICD Ports
- Stimulation Ports