Well Design: Lower Cost with Improved Integrity, Higher Production & Recovery

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Welltec®
Flex-Well® components
Illustrating a Cased Hole side track, with a TAML level 4 junction

1. WAB® ZI (Welltec Annular Barrier) – for zonal isolation
2. WAB® WI (Welltec Annular Barrier) – for well integrity
3. WAB® LH (Welltec Annular Barrier) – for liner hanger
4. WFV™ (Welltec Flow Valve) – for flow control
5. WDM™ (Welltec Data Monitoring)
6. WDR™ (Welltec Data Receiver)
7. WSC (Welltec Sand Control)

• Single skin, full bore, cementless liner with Ø optimized to meet injection / production requirements.
• No limitation on the number of zones in the main bore or the laterals with full open, close, variable choke valves and wireless p/t data monitoring
• Standardize completion hardware in the main bore and the lateral
Well Integrity & Zonal Isolation

- Well Annular Barrier - ISO 14310 Qualified metal expandable well barrier, compliments or substitute for cement (tomorrows session)
  - Delivers B (or C) Annulus protection
    - Positioned within the open hole below the 9 5/8” casing OR
    - Positioned within the 13 3/8” casing above top of cement
  - Position above and below future side track depth
  - Utilize to assist future well abandonment

- Deploy on the production liner to provide high sealing capability in all downhole well environments.
- Fullbore, rotational and drill in capabilities
- Multiple packers expanded quickly under surface control
- High pressure (12,500 psi) and high temperature (300 DegC) capabilities within enlarged (washed out) hole conditions
Lower Completion - Flexible Design

- Low cost components
- Fast, low risk liner deployment with full circulation and rotation capability
- Built in flexibility delivering
  - Stimulation / Frac
  - Production (ICD / Limited entry)
  - Water management (multiple choke)
  - Deploy within multi laterals
- Full bore, robust sliding sleeves
- Fully adjustable over the life of the well (open / closed, limited entry or variable choke)
- Combinable with screens / gravel pack
- No limitation on the number of valves in the main bore or lateral

![Diagram of lower completion with flexible design features]

- Sand screen (Wire wrapped/premium)
- Shroud
- Choked inflow ports
- Stimulation ports
- Dual sleeve valve
Lowering CAPEX – Data Monitoring

- Barrier Verification, ECD measurement or Early Stimulation / Production data
- Fast download with wireless transmission to w/l tool
- Delivers low cost completion
- 24/7 battery operated, wireless annular pressure and temperature gauges
- Up to two years monitoring (rechargeable capability 2017)
Cost & Risk Savings

- Increased initial production rate due to increased ID
- Shorter time to first hydrocarbons
- Normal well construction time
- Reduced well construction time
- Increased accumulated cash flow
- Oil production value curve in double skin, completed wells with control lines
- Oil production value curve with Flex-Well®
- Accumulated cash flow in double skin, completed wells with control lines
- Accumulated cash flow with Flex-Well®

Across the reservoir
- Reduce risk of not reaching TD (rotate and circulate)
- Remove inner wash down string
- Remove inner string (IW)
- Remove cementing operations
- Slim the liner to meet prod needs
- Optimize open hole Ø for drilling
- Maintain full bore liner

Improved Recovery
- Improved hole cleaning
- Full control of Zonal stimulation
- Zonal re stimulation over l0W
- Water (gas) management
- Zonal shut off

Shallow of the reservoir
- Remove B & C SAP costs
- Simplify cement operation
- Simplify side tracks
- Reduce abandonment costs
Deepwater Pre Salt

- Pre Salt deployment of a cementless single skin liner
- ZI is required for high pressure acid stimulation
- Failure of achieving zonal isolation impacts total recoverable ‘s
- Operator experienced challenges of achieving zonal isolation using cement
- A 9 5/8” liner was installed in a 12 ¾” OH, TVD approx. 20,000’
- Quantity four 958WAB5:5 open hole annular packers were deployed
  - One WAB set within the 13 3/8” casing to back up the liner hanger
  - Three WAB’s installed to provide Barriers between reservoirs
  - Four data Monitoring (P) gauges installed to record annular pressure
- Liner deployed, circulating and rotating to TD
- The hole was cleaned, dart dropped and the annular barriers expanded
  - Fast and under surface control
- TCP guns run, lower zine stimulated, up to 5,000 psi Delta P
  - Pressure gauges verifying sealing of the annular packers
  - Process repeated
- Liner top packer failed, annular packer within the 13 3/8” providing sealing
COMPLETION TECHNOLOGY ARCHITECTURE
HOW TO TRANSFORM THE INDUSTRY

FLEX-WELL®
Fast track and build wells which produce more, drain larger areas and won’t require interventions for years to come. The higher production and drainage per well enables you to reduce the number of platforms or pad sites required, significantly reducing overall CAPEX.

The Flex-Well® completion design provides all these benefits while simultaneously offering an approach that results in fewer people required, less complex operations and smaller amounts of equipment deployed for shorter amounts of time.

Simply put, higher recovery in a safer, more sustainable way.

Secondary Production
Optimizes production over the life of the well for maximum recovery

Primary Production
Higher initial production rates generate better returns on invested capital

Development
Reduce overall CAPEX and fast track production while drilling and completing wells faster and safer

Deposition
Mitigates the uncertainty due to reservoir characterization

Abandonment
Cost-effective approach built in from the start