NOV Anderreamer

New Technology Update

June-2026



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NOV Anderreamer

Product Review



Highlights:

- Expandable blade underreamer
- 25 years of global experience
- Over 10 million feet underreamed
- Known for reliable drilling performance
  - Stabilized main body
  - Durable cutter block design
  - Customization Options

Anderreamer Product Family:

- Hydraulic Anderreamer – Original Anderreamer
- FAST Anderreamer – Next-Gen Anderreamer
- FAST-R Underreamer – Flow-Control Anderreamer
  - FAST-RHE – Rathole Eliminator

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NOV Anderreamer

Applications

Reliable performance in any underreaming application

Underreaming While Drilling – Pilot Hole Underreaming – Rathole Elimination

Selectable Underreaming – Tandem Underreamers – Multi-Diameter Underreaming
Expandable Stabilization – Cement / Casing Reaming – Multi-Vendor Underreaming



Underreamer options for any position and configuration

Options for Ball Drop, Flow Cycling, or Both

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FAST-R Underreaming

Product Introduction

FAST-R is a flow-controlled Anderreamer

1. Simple Flow Cycling
2. Reliable Block Expansion
3. ReedHycalog™ PDC Technology

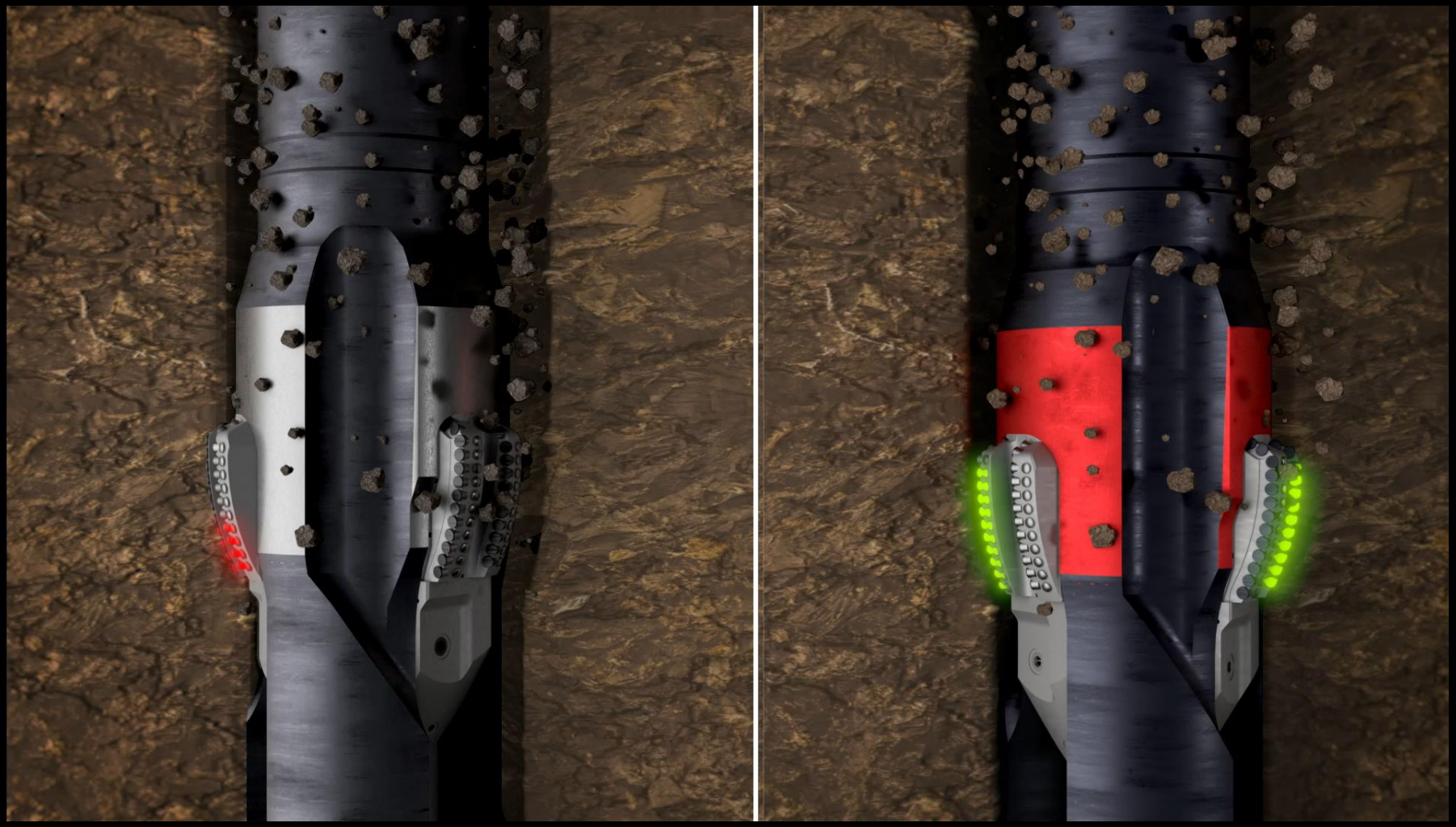
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FAST-R Underreaming

Value

Save time and extend sections with FAST-R

Stabilized and load-balanced cutter blocks increase ROP and durability



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FAST-R Underreaming

Value

Save time and extend sections with FAST-R

Use on-demand cycling to help resolve hole cleaning and formation issues

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FAST-R Underreaming

Differentiation & Risk Mitigation

FAST-R is the most reliable flow control underreamer design

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FAST-R Underreaming

Enhanced Capabilities

Drill Out & Reaming Cement Sheath:

- 1 tool for reaming cement sheath then underreaming
  - Patented multi-diameter locking mechanism
  - Eliminate need for casing scraper
- Unique casing-friendly cutter blocks
- Tool won't expand beyond the cement reaming diameter until dropping the ball
  - Flow activation available if dropping a ball isn't possible

FAST-R Advantage:

- Flow control cycling between retracted and intermediate diameters
  - Cycle closed when near supplemental adapter

Partial Block Expansion



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FAST-R Underreaming

Enhanced Capabilities

Underreaming:

- Drop ball and / or flow activation to begin underreaming
- Pumps on: Cutter blocks expand
  - Low pressure to expand blocks
- Pumps off: Cutter blocks retract
  - Internal spring retracts the cutter blocks

FAST-R Advantage:

- Flow control cycling – simple downlink sequence
  - Pumps off / on 2x to cycle (time-based procedure)
  - Flow cycle closed to clear cuttings
  - Troubleshoot losses with blocks retracted

Activation & Full Block Expansion



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FAST-R Underreaming

Enhanced Capabilities

Underreaming:

- New cutter block designs for improved ROP and durability
- High opening force for challenging environments
- IQ cutter block sensors to monitor wear, vibrations, temperature, and cutter block position

FAST-R Advantage:

- No accidental cycles at connections
  - Unique design eliminates risk of accidental cycles
- **NEVER** get lost – quickly return to default setting (open) if unsure of position
- Clear signals to verify the tool's position

Reliable Reaming & Cycling



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FAST-R Underreaming

Enhanced Capabilities

Underreaming:

- Customizable and friendly operating pressures for problematic applications
- Options available for 2 or 3 reamers in one BHA
  - 2 reamers above MWD, 1 above MWD + 1 for rat hole elimination (below MWD), or 2 reamers above MWD + 1 for rat hole elimination

FAST-R Advantage:

- No flow range limitations
  - Intermediate and low flow rates will not damage the tool
- Independently control multiple tools
  - Flow cycle upper and lower tools as needed

Custom Configurations



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FAST-R Underreaming

Enhanced Capabilities

Circulating & Selectable Underreaming:

- Drop ball option to lock the tool closed for the remainder of the run
- After reaching TD, use high flow rates and high RPM with the cutter blocks retracted
  - Reamer bypass (open & closed) can be customized for RSS and drill bit requirements

FAST-R Advantage:

- Pump out while cutter blocks are retracted
  - Cycle back to open position if tight spots are encountered
- Updated lock closed mechanism can be used to deactivate tool
  - Ensures complete retraction while tripping out

Cutter Block Retraction



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FAST-R Underreaming

Status Update

- **Large diameter tools available for use**
  - Over 80 offshore runs completed (Chevron, BP, HESS, and Shell)
  - Successful runs with Baker Echo, SLB Rhino XM, & WFT RipTide
    - Conducting evaluation and testing for wired FAST-R with Halliburton
  - 18.125”, 16.5”, 14.5”, and 12.25” commercially available
- **Smaller sizes in various stages of testing and development**
  - 8.5” x 9.875” trials have started
  - 10.625” x 12.25” & 6” x 7” designs have been released, and testing is in progress



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NOV Anderreamer

Product Development Update

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FAST-R Underreaming

Product Development Highlights

New Capabilities for the Proven FAST-R Platform

- **Flow Activation**
  - Reliable flow activation mechanism as an alternative to drop ball activation
- **Wired Options (IntelliServ)**
  - Configuration options for a passive tool (wire-thru) and real time control
- **Tandem FAST-R BHA's & Rathole Elimination**
  - Position the FAST-R between MWD and RSS
  - Independent control of two FAST-R tools in the same BHA



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FAST-R Underreaming

Rathole Elimination

FAST-R is a Universal RHE Solution

- New option to run two FAST-R tools in the same BHA
  - *1 in normal BHA position + 1 between MWD & RSS*
- Minor and simple update to existing FAST-R tools
  - *Default open vs closed, independently control / flow cycle either tool*
- Connect MWD and RSS with wire-thru or short hop options
  - *HAL: Wire-thru with hanger sub system*
  - *SLB: Short-hop system (reduced length FAST-R available)*



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FAST-R Underreaming

Rathole Elimination

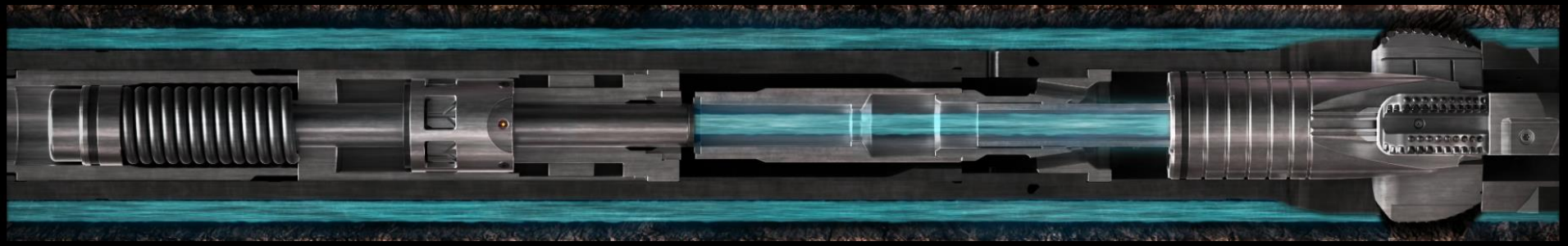
RHE Configuration Review: Tandem FAST-R BHA Setup

Upper FAST-R (Normal URR Position in BHA, 1 nozzle for SPP signal)



Default Open FAST-R: Flow Diverted to Cutter Block Expansion System (Cam)

Lower FAST-R (Between RSS and MWD, 2 nozzles for SPP signal)



Default Closed FAST-R: Flow Diverted Away From Cutter Block Expansion System

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FAST-R Underreaming

Rathole Elimination

FAST-R Operating Overview (Cycling Sequence)

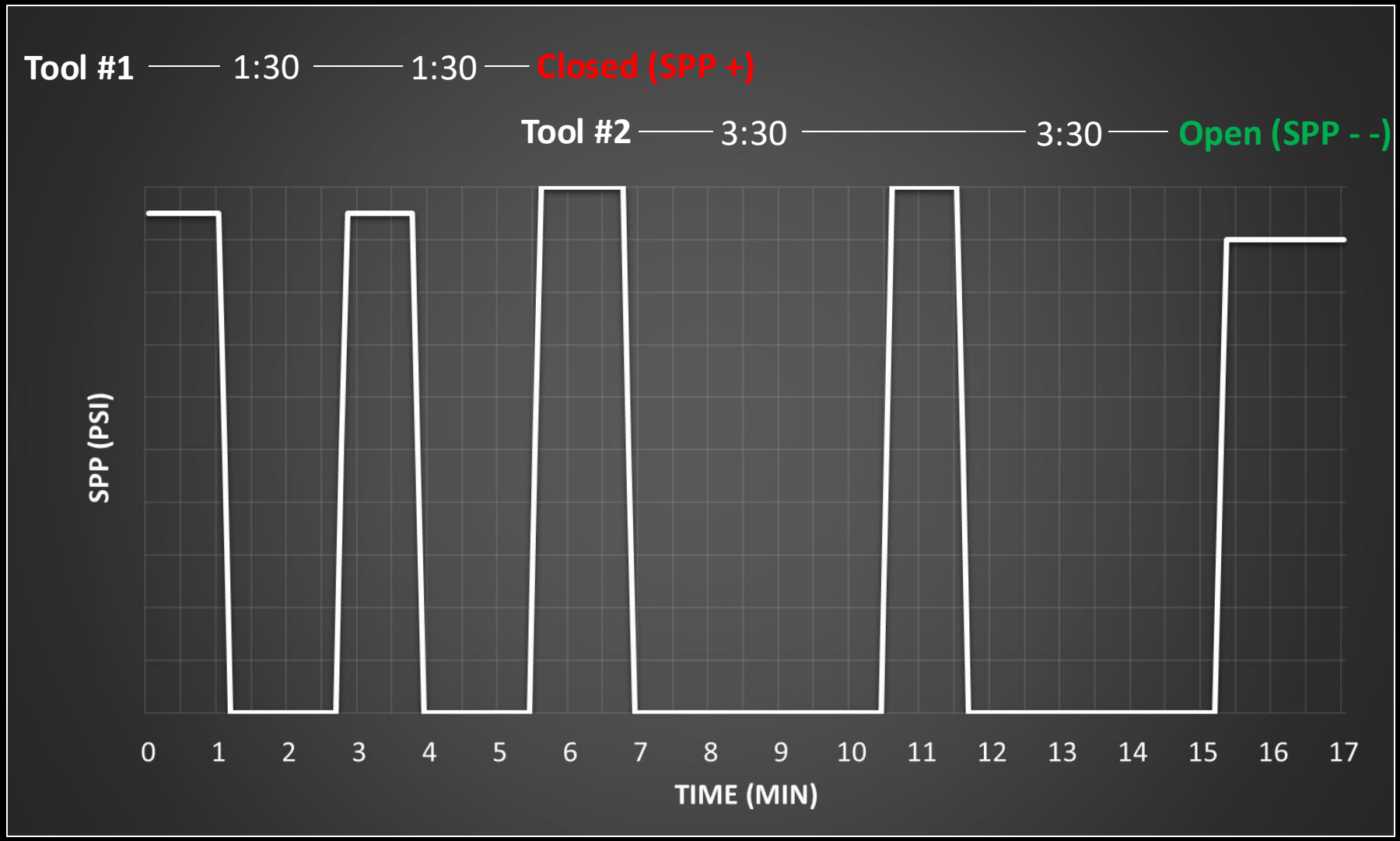


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FAST-R Underreaming

Rathole Elimination

FAST-R and FAST-RHE Cycling Sequence – Option 1 (Independent Cycling)

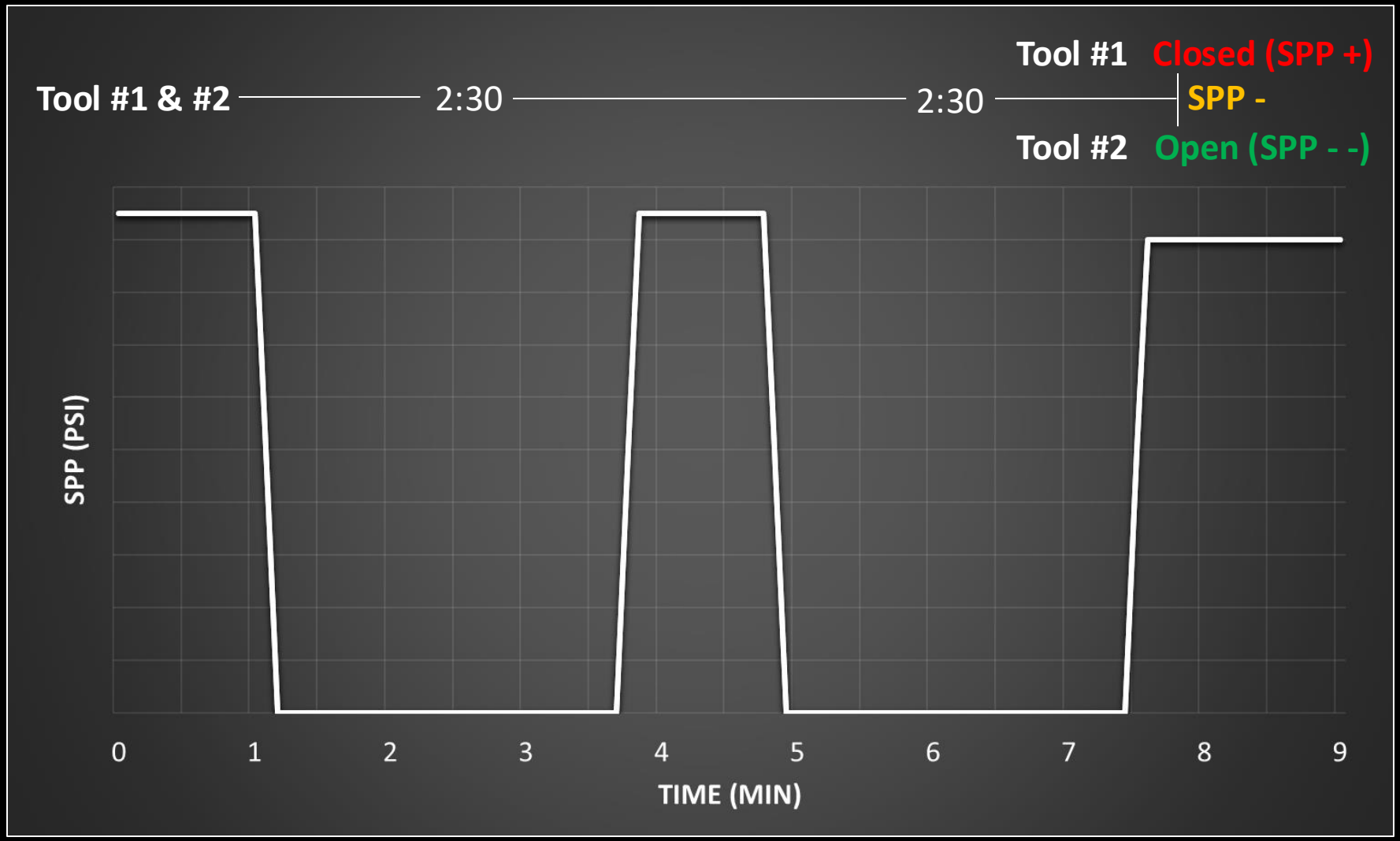


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FAST-R Underreaming

Rathole Elimination

FAST-R and FAST-RHE Cycling Sequence – Option 2 (Synchronized Cycling)



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FAST-R Underreaming

RHE Job Planning

- **Initiate discussions with DD company**
  - Review options to run the FAST-R in the RHE position (dormant or active)
  - Discuss MWD & RSS connection options, address concerns, and FAST-R advantages
- **Operational planning**
  - Information sharing sessions (training) where necessary
  - Operating procedure review (including troubleshooting)
  - Tandem FAST-R Demonstration (virtual / Teams option available)
- **Review job timing**
  - Confirm availability for sizes required (12.25” & 14.5” available first)
  - Assess manufacturing lead times for new parts and unique configurations



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