Rock optimized shaped charges and Section IV testing

Introduction & Outline

- Test configuration & sandstone targets
- Test results (TTP & flow ratio)
- Analysis of results
- Summary (way forward)
Section IV Test Configuration

- 4 x sandstone rock types
- 3 x charge designs
- 26g DP (Conventional)
- 26g Reactive Liner
- 26g Hard Rock Optimized

- Overburden: 6000 psi
- Pore-Pressure: 2000 psi
- Wellbore: 3000 psi
- Casing Thickness: 1/2"
- Cement Thickness: 3/4"
- Cores Axially Flowed

SLAP-26
Sandstone Targets (7” x 30“)

Sander Schilf
UCS 6200psi
Porosity 19.4 – 20.6%
Perm. 120 – 150 mD

Carbon Tan
UCS 8900psi
Porosity 14.9 – 15.6%
Perm. 25 – 30 mD

Main
UCS 10150psi
Porosity 11.6 – 11.8%
Perm. 2 – 6 mD

Bunt
UCS 11312psi
Porosity 12.4 – 13.6%
Perm. 40 – 50 mD
Depth of Penetration

- **Sander Schilf**
  - 26g HRO
  - 26g Reactive Liner
  - 26g DP Conventional

- **Carbon Tan**
  - 26g HRO: 36.4“ (concrete*)
  - 26g RL: 32.1“ (API 19b)
  - 26g DP: 42.6“ (API 19b)

- **Main**

- **Bunt**

Penetration (")
26g Reactive Liner - 4 different rocks

- Sander Schilf: 10.9"
- Carbon Tan: 11.8"
- Main: 8.1"
- Bunt: 7.4"
Pre/Post Shot Permeability Ratio

Rock Type

- Sander Schilf
- Carbon Tan
- Main
- Bunt

![Bar Chart]

- **PR (Axial Flow)**

  - 0
  - 0.25
  - 0.5
  - 0.75
  - 1
  - 1.25
  - 1.5

Legend:
- 26g HRO
- 26g RL
- 26g DP

SLAP-26
Main Sandstone – 3 different charges

- Reactive Liner
- HRO
- DP

EHD: 0.37” – 0.41”
EHD: 0.35” – 0.38”
EHD: 0.28” – 0.30”
Fluorescent Dye Radial Flow

Sander Schilf Sandstone: (UCS 6200psi), 26g DP HMX/St

Fluorescent dye indicates path of fluid flow
Main Sandstone: (UCS 10150psi), 26g Reactive Liner HMX/St

Fluorescent dye indicates path of fluid flow
Bunt Sandstone: (UCS 11300psi), 26g DP HMX/St

Fluorescent dye indicates path of fluid flow

Tip Fracture
Main Sandstone: UCS 10150psi, 26g DP HMX/St

Fluorescent dye indicates path of fluid flow
Summary

- Sufficient and good penetration is desirable but highest DoP, especially in concrete targets, does not automatically mean best downhole performance.

- Best performance can be achieved by developing a charge specifically for the rock type (not always feasible – time/cost/availability of rock).

- Reactive Liner charges appear to be more suited to harder tighter sandstone rocks.

- Results indicate that sandstone rocks with medium-high porosity are more susceptible to skin effect and crushed zone than the harder rocks, particularly with OB perforating.

- Need to repeat more tests with other test configurations to confirm the effect of Overbalance and DUB on the results.
Thank you for your attention.