Mitigating the Problems in Select-Fire Perforating Operations

SLAP-16-21
AGENDA/INTRODUCTION

Mitigating the Problems in Select-Fire Perforating Operations

- Reported Failures
- Objectives of the System
- Safety Benefits
- Service Quality Solutions
- Operational Benefits
- System Overview
- Conclusion
- Questions
Reported Failures

CIPS 2014 Poster Session “Solutions for Consistent Service Quality in Perforating Services”

- 18 month period 750+ Reported Select Fire Issues/problems
- 38% Pinched or nicked lead wire
- 22% Seal failure
- 18% Lack of operational confirmation
Objectives of the System

- Added level of safety to prevent surface detonations
- Eliminate service quality failures in select fire perforating
- Ease of use for operational efficiency
- Reduce footprint for extended laterals with increased perf clusters
- Advanced technology for today’s perforating market
Safety Benefits

- Added level of safety
  - Electrically unarmed
  - Protection up to 500V

- RF SAFE

- API RP 67 Compliant

- Third Party Tested
Safety Benefits

- Shorter tool string
  - 4-6” per gun connection

- Lighter tool string
  - 18# lighter per gun connection

- Reduced pinch points

- No exposed detonating cord
Service Quality Solutions

- Failure - Pinched or nicked lead wire
  - Solution - Eliminate wires

- Failure - Seal Failure
  - Solution - Eliminate ports and tandem subs

- Failure - Lack of operational confirmation
  - Utilize proven intelligent electronic select-fire system
Operational Benefits

- Box by pin gun
- No subs
- No required auxiliary hardware clean up (throw away gun)
- No wires
- Charge tube is the conductor
- Reduced loading time
- No charge clips or pull over tabs on charge tube
Operational Benefits

- Allows for closer shot to shot between two guns (TCP and P/A operations)
- Allows added perforated clusters in horizontal operations
- Compatible with SDP, GH, BH or Consistent Hole shape charges

<table>
<thead>
<tr>
<th>Gun Diameter</th>
<th>2.75 in. [70 mm]</th>
<th>3.125 in. [79 mm]</th>
<th>3.375 in. [86 mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shot Density</td>
<td>Up to 6 SPF</td>
<td></td>
<td></td>
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<tr>
<td>Phasing</td>
<td>60</td>
<td></td>
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<tr>
<td>Temperature (°F/°C)</td>
<td>350 [177]</td>
<td></td>
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<tr>
<td>Pressure (psi/MPa)</td>
<td>20,000 [138]</td>
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<tr>
<td>Overall Length (ft/m)</td>
<td>Up to 21 [6.4]</td>
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</tbody>
</table>
System Overview

- Insulated shape charges and charge tube
- End to end ballistic transfer
System Overview

- Pin to pin contact no wires required
- Pressure bulkhead, detonator, and intelligent electronic switch in one package
System Overview

- One piece plug shoot and firing head to reduce length and electrical connections
- Uniformed outside diameter quick connection with reduced length
System Overview

- Allows more guns to be run with reduced tool string length
- Guns can be easily downloaded as the job scope changes
Conclusion

- System mitigates 78% of reported failures and problems in select fire perforating.

- Creates RF Safe, API RP 67 compliant, and proven operating gun system for the user.

- Advanced technology in the current market situation.
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