

“Unusual Interventions”



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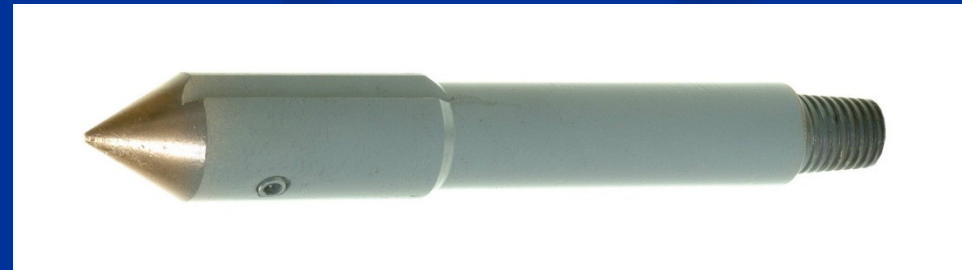
Outline

- Introduction
- The use of “Unusual Intervention” methods to resolve complex well bore scenarios.
 - Abrasive Cutting
 - Abrasive Perforating
 - Abrasive Slotting
- Case Histories
- BHA Design used to execute these operations
- Abrasive Job Requirements & Procedures

Abrasive Cutting



- Special Port Positioning for directing an abrasive fluid jet stream into the ID of the pipe to be severed.
- Abrasive fluids combined with a down hole motor create a complete cut of the tubular.
- The abrasive fluids penetrate and sever the tubing where the jet stream makes contact.
- Results in a clean cut without any flaring of the tubular.



Abrasive Cutting

**This presentation of new
high velocity sand cutting**

Abrasive Cutting Case Histories

- Coiled Tubing stuck in hole
 - Cut at surface, rigged in 1-1/2" CT
 - Abrasively Cut 2-3/8" CT down hole – removed string from well.
- Fish Hanging String w/ Internal Capillary Lines
 - Utilize a modified Flat Catch Overshot – capable of cutting CT
 - 2" CT has been tested in OKC, currently working on a test of 1-1/2" CT with 2 x 3/8" internal capillary lines.

Abrasive Cutting Case Histories

- Cut Hanging String
 - Currently designing an Abrasive Cutting assembly to cut a 1-1/2" CT hanging string 10-12" below tubing hanger
- Cut 4-1/2" Non-Magnetic Drill Collar
 - Passed thru 50.8mm ID Jar
 - Utilizing 1-1/2" CT w/ 1.95" Cutting Head
 - Complete the cut in 60min.

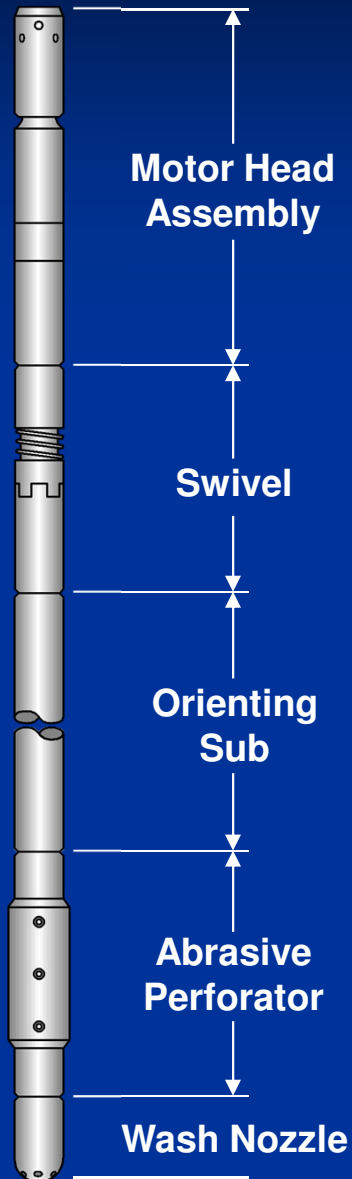


Abrasive Perforating



- The Abrasive Perforating System, allows multiple perforations to be made in the same trip in the hole.
- Custom tool designs available (ie: phasing, length, nozzle size)
- Alternative to conventional methods:
 - Tubing Conveyed Perforating (TCP)
 - Wireline deployed perforating
 - Mechanical Tubing Cutters
 - Chemical & Explosive Tubing Cutters
- Successful in perforating drill collars, drill pipe and multiple casing strings in a single trip.

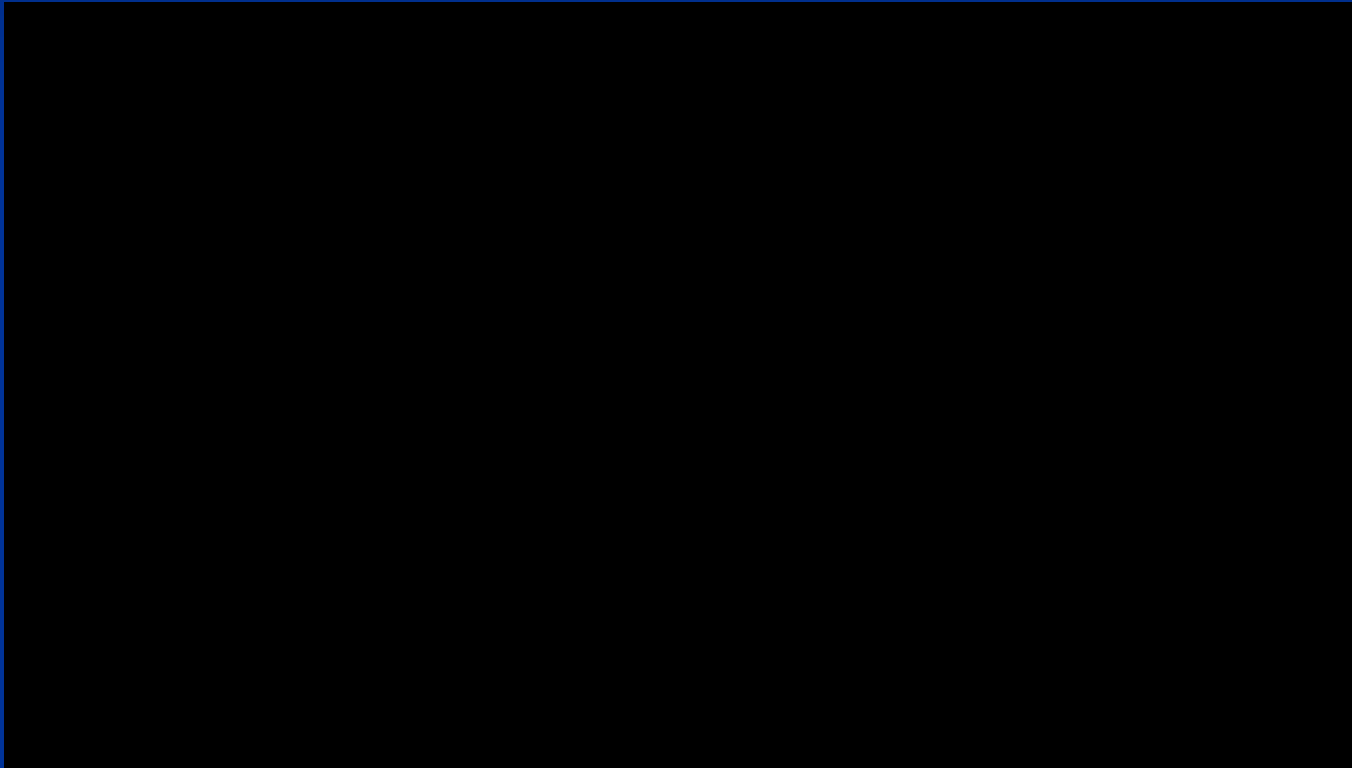
Abrasive Perforating



Abrasive Perforating



Abrasive Perforating

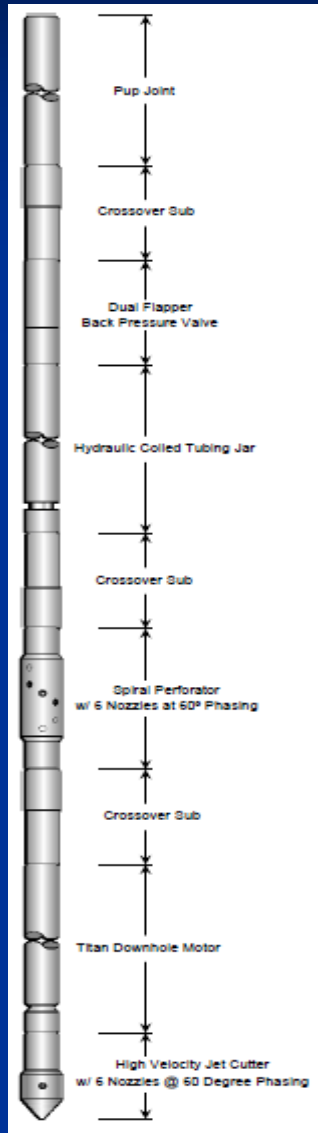


Abrasive Perforating Test

- Perforate thru 114.3mm Casing encased in shale rock and cement
- 27" + Penetration



Abrasive Perforating Case Histories



■ Casing Leaks

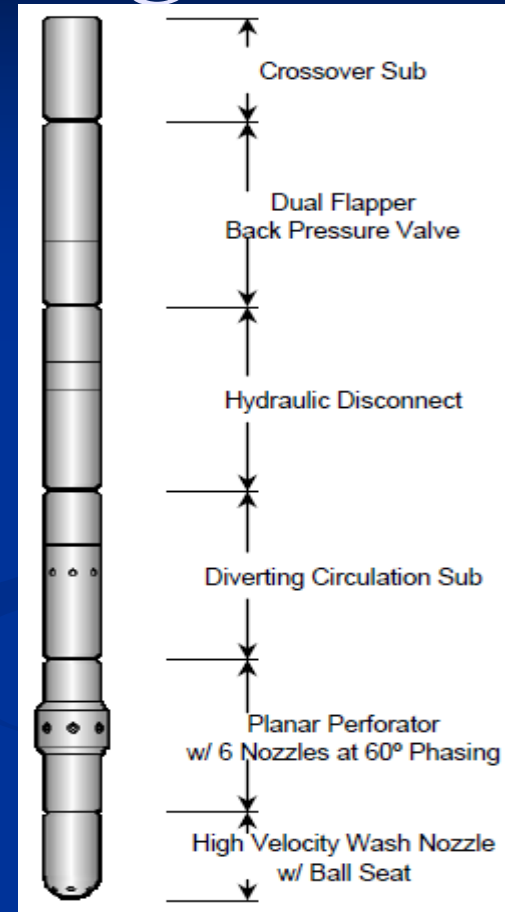
- Multiple wells with casing leaks that need to be squeezed off
- Dual horizontal cuts with a motor followed by perforating multiple setting between the cuts, utilizing a piston perforator.
- Entire procedure completed in a single trip

Abrasive Slotting

- The Abrasive Slotting Assembly utilizes a planar perforator
 - The # of jets can be altered, allowing a variety in phasing.
- Slotting can be completed in multiple stages and various lengths, simply by adjusting your work string in the hole.
- The planar perforator can be combined in a BHA with a cutting head to form “Coupon” cut-outs within the tubular of interest
 - Beneficial for damaged casing, testing purposes

Abrasive Slotting

Planar Perforator

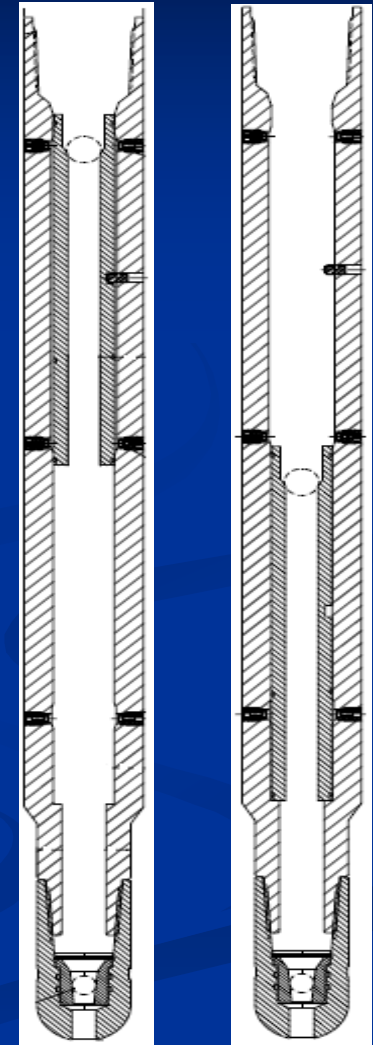
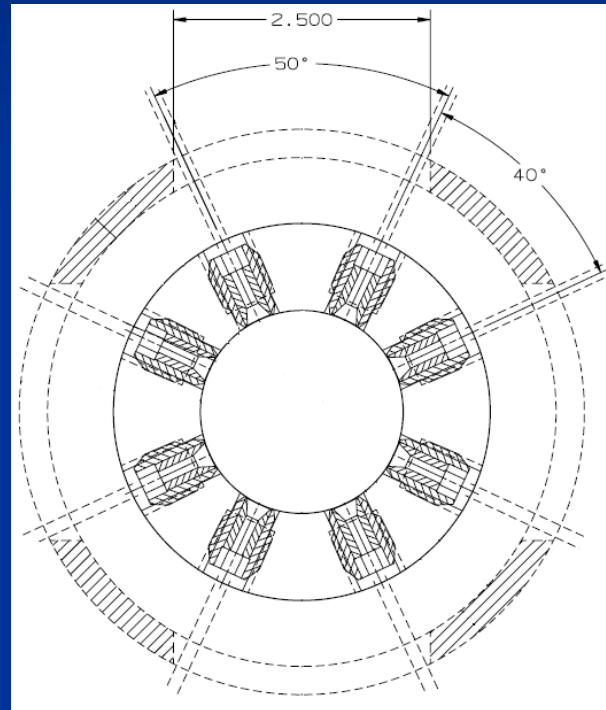


Abrasive Slotting Case Histories

- Uranium Mine flooded with water
 - Relief wells were drilled and cement squeeze performed
 - Subsequent water influx still present – drill 4 wells and install down hole pumps to remove excess water
 - Abrasively Slot casing to accommodate extra volume of water required to operate pumps.
- Parted Casing in steam injection well
 - Perform 6 – 48” Vertical cuts between upper and lower radial cuts.
 - Create “coupons” that will fall in and be fished out later.
 - Modified an Abrasive Cutting Head to accommodate the High Tech Rare Earth Magnet – resulting in the “coupons” being retrieved on the same trip.

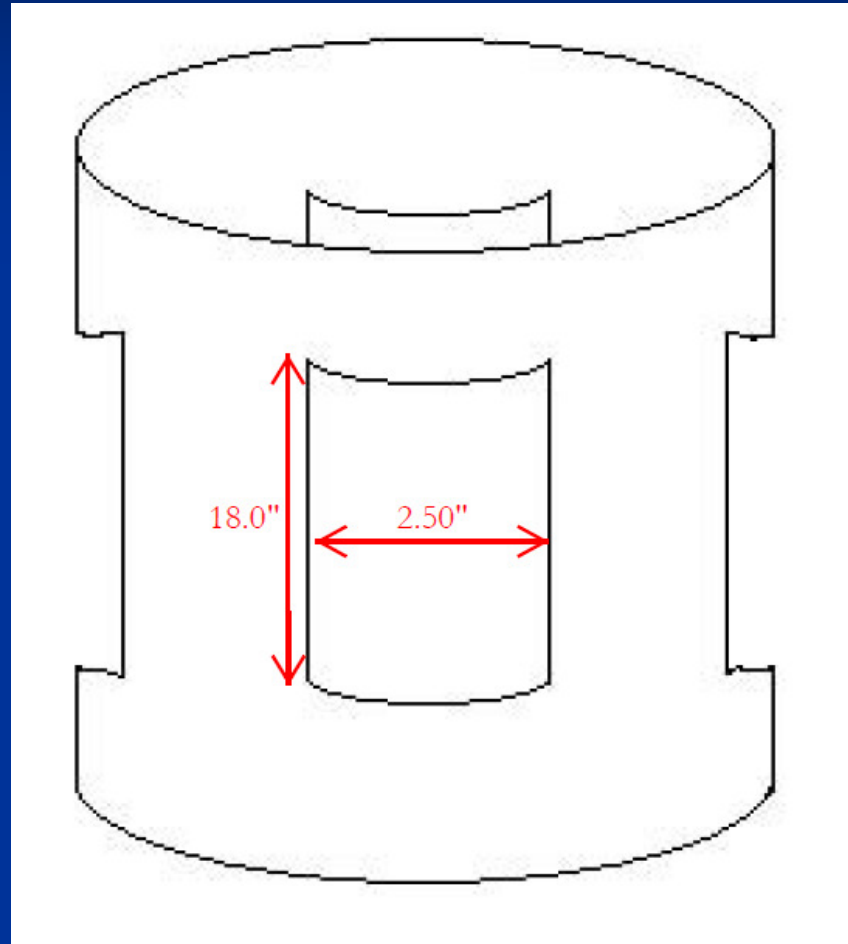
Abrasive Slotting Case Histories

- Multilateral Jetting w/ Slotted Windows
 - Generate 8 x 18" vertical slots
 - Shift piston & Reposition tool string
 - Perform 4 horizontal cuts (upper and lower) between the slotting
 - Create 4 x 2.50" 'windows' w/ casing between
 - Maintaining casing integrity
 - Install a whip stock through the window
 - 31.75mm CT out to high pressure jet the formation



Abrasive Slotting

- Resulting in:
 - 4 windows
 - 2.5" Wide
 - Casing Integrity Intact
 - Whipstock Capable



Abrasive Requirements & Procedure

- Coiled Tubing or Threaded Pipe
- Fluid Pump
 - Minimum Pump Rate 80L/min per nozzle
- 100 Mesh Sand Slurry
 - Mixed 100kg/m³ – 120kg/m³

- ID / Weight of tubular will determine cutting time
- # Nozzles per cutting tool – increase flow rate
- Continue pumping sand slurry until cut is complete.

*** Each job scenario is different, we use the above as guidelines***

Questions?

