

## Plug and Sidetrack Procedure

**Well:** Harris 38N-18HZ  
**County:** Weld Co., Colorado  
**TD MD:** 7,575' (7,148' TVD)  
**Rig:** Xtreme 22

**CEMENTING PROGRAM:** - Halliburton Cementing – Dispatch - 303.655.4700  
- Engineering (on call) – 303.655.4818

**320 sacks, 53.5 bbl, (0.94 cf/sx) Class G Cement + .75% bwoc FR + 0.25% bwoc Retarder**  
(volumes include 20% excess)

|                        |             |
|------------------------|-------------|
| Slurry Weight, ppg:    | 17.5        |
| Slurry Yield, cf/sx:   | <b>0.94</b> |
| Mix Water, gps:        | <b>3.31</b> |
| Thickening time (70Bc) | <b>2:58</b> |

### ON SITE PREPARATION (PRIOR TO SETTING PLUG)

1. Check that all the necessary equipment is on location and is in good condition.
2. Review procedure and conduct pre job safety meeting.

### PLUG AND SIDETRACK PROCEDURE:

1. TIH 4" DP and 700ft of 2-7/8" tubing to 5290ft (100' above fish). Strap while TIH.
2. Circulate hole while cement trucks are pressure testing their lines
3. Pump 34bbls of 13.5 ppg Tuned Spacer III spacer – confirm calculations for balanced plug with Halliburton representative.
4. Mix and pump 320 sacks (53.5 bbls) of 17.5 ppg Class G Cement (see above for additives, 0.94 cf/sk, 3.31gps mix water). Get wet and dry samples while pumping.
5. Displace with 6.2 bbls 13.5ppg Tuned Spacer III spacer and 48bbls mud. Top of plug is estimated at 5110 ft once pipe is pulled out.
6. **SLOWLY** pull DP out of cement to +/- 4,800ft (+/- 300ft above top of cement).
7. Reverse out DP volume twice until no cement returns are observed.
8. Circulate conventional way at maximum rate for at least two bottoms up.
9. TOH and make up curve BHA with Sperry 2.36 degree motor and Smith Sdi611 bit.
10. TIH and stay inside surface casing while WOC.
11. WOC approximately 12hrs and TIH to 5,000ft. Time it so we are at that depth right at the 12hrs wait time.
12. Slowly TIH to tag top of plug.
13. Dress plug 100ft and begin kick off. If unable to kickoff within 100ft please inform Superintendent..
14. Once kicked off follow current directional plan until update is sent out.

| PLUG CEMENT PROGRAM               |  |                              |                     |                       |       |        |     |        |
|-----------------------------------|--|------------------------------|---------------------|-----------------------|-------|--------|-----|--------|
| Slurry                            | Density<br>ppg   | Yield<br>Ft <sup>3</sup> /sk | Mix Fluid<br>Gal/sk | Top /<br>Bottom<br>MD | Fill  | Volume |     |        |
|                                   |  |                              |                     |                       |       | Bbls   | SX  | Excess |
| <b>Spacer</b><br>Tuned Spacer III | 13.5   |                              |                     |                       |       | 33.8   |     |        |
| <b>Plug</b><br>Class G Cement     | 17.5   | 0.94                         | 3.31                | 5,830ft –<br>5,230ft  | 600ft | 53.5   | 320 | 20%    |
| <b>Spacer</b><br>Tuned Spacer III | 13.5   |                              |                     |                       |       | 6.2    |     |        |
| <b>Remarks</b>                    | Run balanced plug equations and make sure APC representative numbers match the Halliburton representative numbers. |                              |                     |                       |       |        |     |        |

| Volumes and Pump Times                  |               |             |             |                  |
|---|---------------|-------------|-------------|------------------|
| Slurry                                  | Volume<br>bbl | Rate<br>bpm | Time<br>min | Comments         |
| Tuned SpacerIII                         | 33.8          | 4           | 8.45        | Spacer           |
| Cement                                  | 53.5          | 4           | 13.4        | 225sx, 17.5ppg   |
| Displacement w/<br>water and <b>Mud</b> | 49.8          | 4           | 12.45       | Monitor returns. |
| Safety Factor                           | --            | --          | 30          |                  |
| Total                                   |               |             | 64.3        |                  |

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## Drill Pipe Performance Sheet

### Drill Pipe Configuration



|                          |      |        |
|--------------------------|------|--------|
| Pipe Body OD             | (in) | 4.000  |
| Pipe Body Wall Thickness | (in) | 0.330  |
| Pipe Body Grade          |      | S-135  |
| Drill Pipe Length        |      | Range3 |
| Connection               |      | XT39   |
| Tool Joint OD            | (in) | 4.875  |
| Tool Joint ID            | (in) | 2.688  |
| Pin Tong                 | (in) | 10     |
| Box Tong                 | (in) | 15     |

|                               |       |             |
|-------------------------------|-------|-------------|
| Nominal Weight Designation    |       | 14.00       |
| Drill Pipe Approximate Length | (ft)  | 43.8        |
| SmoothEdge Height             | (in)  | 3/32 Raised |
| Tool Joint SMYS               | (psi) | 120,000     |
| Upset Type                    |       | IU          |
| Max Upset OD (DTE)            | (in)  | 4.188       |

Note: Slip space shown includes centering ring

### Drill Pipe Performance



#### Performance of Drill Pipe with Pipe Body at 80 % Inspection Class

|                 | Applied Make-up Torque (ft-lbs) | Operational Torque (ft-lbs) | Max Tension (lbs) |
|-----------------|---------------------------------|-----------------------------|-------------------|
| Recommended MUT | 21,200                          | 18,300                      | 403,500           |
| Minimum MUT     | 17,700                          | 0                           | 403,500           |
|                 |                                 | 14,500                      | 361,700           |

#### Drill-Pipe Length Range3

|                                     | Best Estimates (without Coating) | Best Estimates (with Coating) | Nominal (least accurate) |
|-------------------------------------|----------------------------------|-------------------------------|--------------------------|
| Drill Pipe Adjusted Weight (lbs/ft) | 15.47                            |                               | 14.87                    |
| Fluid Displacement (gal/ft)         | 0.24                             |                               | 0.23                     |
| Fluid Displacement (Bbls/ft)        | 0.0056                           |                               | 0.0054                   |
| Fluid Capacity (gal/ft)             | 0.44                             | 0.43                          | 0.45                     |
| Fluid Capacity (Bbls/ft)            | 0.0104                           | 0.0103                        | 0.0106                   |
| Drift Size (in)                     | 2.563                            |                               |                          |

Note: Oil field barrel equals 42 US gallons

Note: Drill pipe assembly values are best estimates and may vary due to pipe body mill tolerance, internal plastic coating, and other factors

### Connection Performance



|                            | Applied Make-up Torque (ft-lbs) | Tension at Shoulder Separation (lbs) | Tension at Connection Yield (lbs) |
|----------------------------|---------------------------------|--------------------------------------|-----------------------------------|
| Recommended Make-up Torque | 21,200                          | Tensile Limited                      | 553,300                           |
| Minimum Make-up Torque     | 17,700                          | 647,200                              | 662,200                           |

  

|   | Tool Joint Dimensions |
|---|-----------------------|
| Recommended OD                              | (in) 4.926            |
| Minimum Tool Joint OD for API Premium Class | (in) 4.652            |
| Minimum Tool Joint OD for Connections       | (in) 4.652            |

Note: Recommended make-up torque is the maximum make-up torque that should be applied  
Note: To maximize connection operational tensile, a MUT (T4) of 18,100 (ft-lbs) should be applied

|  |         |
|--|---------|
| Tool Joint Torsional Strength (ft-lbs) | 35,300  |
| Tool Joint Tensile Strength (lbs)      | 662,200 |

### Elevator Shoulder Information



|                            | SmoothEdge Height 3/32 Raised | Nominal Tool Joint OD | Worn to Bevel Diameter | Worn to Min TJ OD for API Premium Class |
|----------------------------|-------------------------------|-----------------------|------------------------|---|
| Box OD (in)                | 5.062                         | 4.875                 | 4.786                  | 4.652                                   |
| Elevator Capacity (lbs)    | 631,200                       | 470,100               | 395,700                | 286,300                                 |
| Assumed Elevator Bore (in) | 4.281                         |                       |                        |   |

Note: Elevator capacity based on assumed Elevator Bore, no wear factor and contact stress of 110,100psi  
Note: A raised elevator OD increases elevator capacity without affecting make-up torque

### Pipe Body Slip Crushing Capacity



|                                 | Nominal | 80 % Inspection Class | API Premium Class |
|---------------------------------|---------|-----------------------|-------------------|
| Slip Crushing Capacity (ft-lbs) | 454,400 | 358,500               | 358,500           |
| Assumed Slip Length (in)        | 23      |                       |                   |
| Transverse Load Factor (K)      | 2.6     |                       |                   |

Note: Slip Crushing: Slip crushing load is calculated with the Spri-Rainold equation from "Why Does Drill Pipe Fail in the Slip Area" World Oil, 1958 for the slip length and transverse load factor shown and is for reference only. Slip crushing is dependent on the slip design and condition, coefficient of friction, loading conditions, time in slip, drill pipe OD and wall variation and other factors. Consult with the slip manufacturer for additional information.

### Pipe Body Performance



|  | Nominal | 80 % Inspection Class | API Premium Class |
|--|---------|-----------------------|-------------------|
| Pipe Tensile Strength (lbs)                          | 513,600 | 403,500               | 403,500           |
| Pipe Torsional Strength (ft-lbs)                     | 41,900  | 32,800                | 32,800            |
| TJ/Pipe Body Torsional Ratio                         | 0.84    | 1.08                  | 1.08              |
| 80% Pipe Torsional Strength (ft-lbs)                 | 33,500  | 26,200                | 26,200            |
| Burst (psi)  | 19,491  | 17,820                | 17,820            |
| Collapse (psi)                                       | 20,141  | 13,836                | 13,836            |
| Pipe OD (in)   | 4.000   | 3.868                 | 3.868             |
| Wall Thickness (in)                                  | 0.330   | 0.264                 | 0.264             |
| Nominal Pipe ID (in)                                 | 3.340   | 3.340                 | 3.340             |
| Cross Sectional Area of Pipe Body (in <sup>2</sup> ) | 3.805   | 2.989                 | 2.989             |
| Cross Sectional Area of OD (in <sup>2</sup> )        | 12.566  | 11.751                | 11.751            |
| Cross Sectional Area of ID (in <sup>2</sup> )        | 8.762   | 8.762                 | 8.762             |
| Section Modulus (in <sup>3</sup> )                   | 3.229   | 2.523                 | 2.523             |
| Polar Section Modulus (in <sup>3</sup> )             | 6.458   | 5.046                 | 5.046             |

Note: Nominal Burst calculated at 87.5% RBW per API.

Note: The technical information contained herein, including the product performance sheet and other attached documents, is for reference only and should not be construed as a recommendation. The user is fully responsible for the accuracy and suitability of use of the technical information. NOV Grant Prideco cannot assume responsibility for the results obtained through the use of the material. No expressed or implied warranty is intended. Drill pipe assembly properties are calculated based on uniform OD and wall thickness. No safety factor is applied. The information provided for various inspection classes and for various wear conditions (remaining body wall) is for information only and does not represent or imply acceptable operating limits. It is the responsibility of the customer and the end user to determine the appropriate performance ratings, acceptable use of the product, maintain safe operational practices, and to apply a prudent safety factor suitable for the application. For API connections that have different pin and box ID's, tool joint ID's refer to the pin ID. Per Chapter B, Section 4 VII of the IADC drilling manual, it is recommended that drilling torque should not exceed 80% of MUT.

Customer Connection

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