



HydroPull™ Extended Reach



Motor Gas Separator (MGS™)



HydroPull™ SC Tool (Stimulation and Cleanout)



Water Bypass AV Sub (WBS)



High Pressure Rotary Jet (JetRotor™)



Job Planning Software



Engineering Services



Custom Tool Development

U.S. Patents
8,528,649 & 8,939,217

Tempress HydroPull™ SC Tool

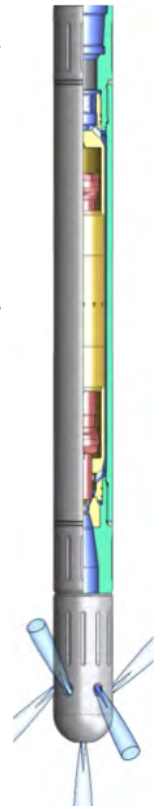
The HydroPull™ SC Stimulation & Cleanout tool momentarily interrupts the return flow in the completion annulus to create intense water-hammer pressure pulses that vacuum the wellbore, pulling fines and debris from behind completions and out of the formation. This tool incorporates a carbide hammer bit or bullnose with multiple jets that dislodge fill and scale. Pulsation of the return flow moves sand and debris in the horizontal and inclined sections of the well. The tool also pulls tubing into extreme reach horizontal wells at 20 ft/min (6 m/min) or more.

When the well is allowed to circulate flow, the tool generates alternating suction and pressurized pulses over a large area of the completion. The induced flow flushes debris out from behind complex screened completions and pulls fines out of the near wellbore formation.

When the well is shut-in, the valve causes the flow of acid or other stimulation fluid to pulsate. These pulses penetrate over 100 feet into the formation and can be detected at up to 10,000 ft. Case histories have demonstrated increased production from acid and solvent squeeze treatments. **The tool is fully tunable for various impact levels and custom applications.**

Applications

- Coiled and Jointed tubing
- Sand and fill cleanout
- Scale cleanout
- Cement milling
- Acidizing
- Sand screen flushing
- Perforation cleaning
- Depleted well service



| Feature | Benefit |
|----------------------------------|---|
| Pulling Force | <ul style="list-style-type: none"> • Pulls tubing into long tortuous wells • Eliminates the need for friction-reducing beads and chemicals • Routine entry of over 11,000 ft horizontals |
| Flow Pulsation | <ul style="list-style-type: none"> • One-trip cleanout and stimulation • Eliminates need for a motor and mill • Better sand and cuttings transport at low flow • Fewer short trips • Most powerful pulse pressure available |
| Low Pressure Differential | <ul style="list-style-type: none"> • Effective on various coil sizes or high-pressure wells • Maximizes flow |
| Intense suction pressure | <ul style="list-style-type: none"> • Removes debris from perforations and behind sand screens |
| Nitrogen Compatibility | <ul style="list-style-type: none"> • Effective on commingled fluid for depleted well service |
| High Reliability | <ul style="list-style-type: none"> • Multiday extreme-reach jobs without tripping • Over 99% downhole success rate |



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Specifications – HydroPull™ SC Tool

| Tools | 1.69-in. Standard Flow | 2.12-in. Std Flow | 2.12-in. High Flow |
|---|--|---|--|
| Design flow rate | 0.9-1.8 bpm (140-290 lpm) | 1.0-2.0 bpm (160-320 lpm) | 1.2-2.4 bpm (190-380 lpm) |
| Max intermittent (jarring) flow rate | 2.3 bpm (370 lpm) | 2.6 bpm (410 lpm) | 3.1 bpm (490 lpm) |
| Average pressure differential[◇] | 230-800 psid (1.6-5.5 MPa) | 220-640 psid (1.5-4.4 MPa) | 200-600 psid (1.4-4.1 MPa) |
| Max traction (impact) force at design flow | 1,900 lbf (860 daN) | 1,900 lbf (860 daN) | 1,500 lbf (670 daN) |
| Pulse cycle rate | 7-14 Hz | 7-14 Hz | 6-13 Hz |
| Pulse pressure | 1,000-2,300 psi [△] (6.9-15.9 MPa) | 650-1,350 psi [□] (4.5-9.3 MPa) | 500-1,600 psi [□] (3.4-11.0 MPa) |

[△] Based on 1.50-in. coil, 0.156-in. wall

[□] Based on 1.75-in. coil, 0.156-in. wall

| Tools | 2.88-in. Standard Flow | 2.88-in. High Flow | 3.12-in. High Flow |
|---|-----------------------------------|-----------------------------------|-----------------------------------|
| Design flow rate | 1.9 – 3.8 bpm (300 – 600 lpm) | 2.3 – 4.5 bpm (360 – 710 lpm) | 2.5 – 5.0 bpm (400 – 790 lpm) |
| Max intermittent (jarring) flow rate | 4.5 bpm (710 lpm) | 5.5 bpm (870 lpm) | 6.0 bpm (950 lpm) |
| Average pressure differential[◇] | 100 – 550 psid (0.7 – 3.8 MPa) | 150 – 590 psid (1.0 – 4.1 MPa) | 150 – 560 psid (1.0 – 3.9 MPa) |
| Max traction (impact) force at design flow | 3,200 lbf (1,400 daN) | 3,900 lbf (1,700 daN) | 4,400 lbf (2,000 daN) |
| Pulse cycle rate | 2 – 6 Hz | | |
| Pulse pressure[▲] | 550-1,300 psi (3.8-9.0 MPa) | 600-1,550 psi (4.1-10.7 MPa) | 600-1,750 psi (4.1-12.1 MPa) |

[◇] Add pressure differential from Hammer Bit or Bullnose for total differential pressure through HydroPull SC Stimulation and Cleanout Tool. See nozzle charts below.

[▲] Based on 2.38-in. coil, 0.156-in. wall



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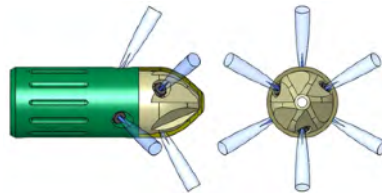


Custom Tool Development

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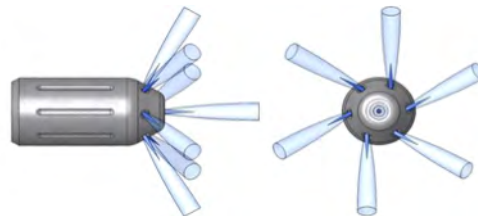
Carbide Hammer Bit

Carbide coated Hammer Bits have an aggressive coating of brazed carbide blocks on the front surfaces ideally suited for aggressive milling and hammering action. This configuration is recommended for applications where hard, consolidated materials may be encountered. The powerful forward movements caused by HydroPull water-hammer cycles create short stroke, hammer-milling action that breaks up scale. Forward firing nozzles at 60° from the tool axis further dislodge scale and clean the inside diameter of the tubing or casing. The nozzles have carbide inserts with good jet quality so the jets are effective at larger standoff (reach) and flow performance remains consistent throughout long jobs.



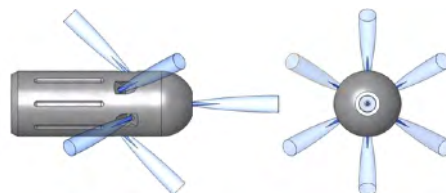
Forward Firing Nozzle Bullnose

The forward firing nozzle configuration has a center nozzle and several nozzles positioned at 60° from the tool axis that exit from the front surface of the tool near the outside diameter. This version is recommended for most sand fill cleanouts and stimulations.



Side Firing Nozzle Bullnose

The side firing nozzle configuration is preferred by some customers. It has a single forward nozzle and several forward and backward facing nozzles at 45° from the tool axis that exit at the outside diameter of the tool.





Specifications – Hammer Bit Only 1.69-in. to 2.38-in.

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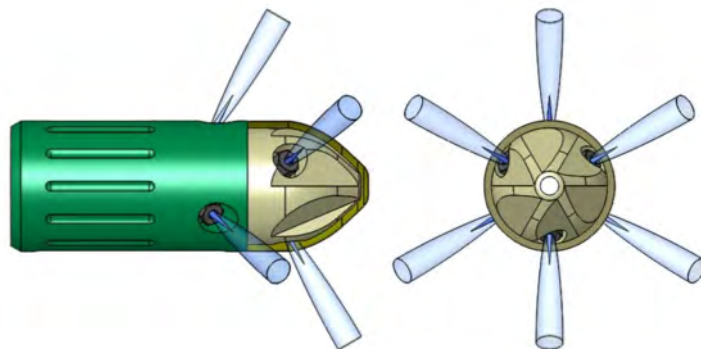
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| Nozzles on 1.69-in. OD Tools | | Low Flow | Medium Flow | High Flow | Max Flow |
|---|-------------|----------------------|----------------------|----------------------|----------------------|
| Average Hammer Bit pressure[†] at suggested flow rate | | 870 psi @ 1.0 bpm | 900 psi @ 1.4 bpm | 810 psi @ 1.8 bpm | 460 psi @ 1.8 bpm |
| Total nozzle flow area | | .038 in ² | .053 in ² | .074 in ² | .099 in ² |
| Nozzle Sizes | Qty. | 6 | 6 | 6 | 6 |
| | Dia. | .090 in. | .106 in. | .125 in. | .145 in. |

| Nozzles on 2.12-in. & 2.38-in. OD Tools | | Low Flow | Medium Flow | High Flow | Max Flow |
|---|-------------|----------------------|----------------------|----------------------|----------------------|
| Average Hammer Bit pressure[†] at suggested flow rate | | 900 psi @ 1.4 bpm | 810 psi @ 1.8 bpm | 570 psi @ 2.0 bpm | 580 psi @ 2.4 bpm |
| Total nozzle flow area | | .053 in ² | .074 in ² | .099 in ² | .141 in ² |
| Nozzle Sizes | Qty. | 6 | 6 | 6 | 6 |
| | Dia. | .106 in. | .125 in. | .145 in. | .173 in. |

[†] Add pressure differential from HydroPull to Hammer Bit for total differential pressure through HydroPull SC Stimulation and Cleanout Tool. See HydroPull charts above.



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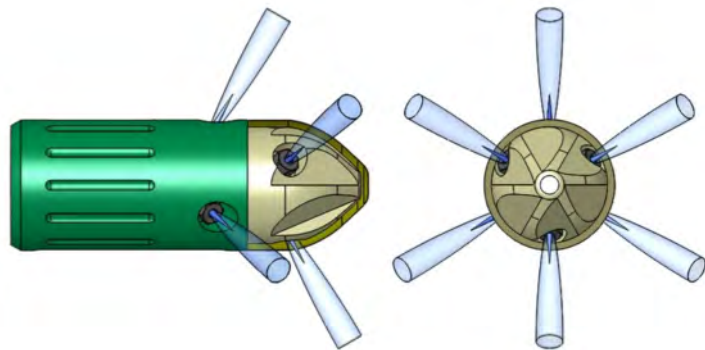
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Specifications – Forward Nozzle Bullnose Only 1.69-in. to 2.12-in. Outside Diameter

| Nozzles on 1.69-in. Tools | | Low Flow | Medium Flow | High Flow | |
|---|-------------------|----------------------|----------------------|----------------------|----------|
| Average Bullnose pressure[▲] at suggested flow rate | | 890 psi @ 1.2 bpm | 830 psi @ 1.7 bpm | 480 psi @ 1.8 bpm | |
| Total nozzle flow area | | .065 in ² | .096 in ² | .138 in ² | |
| Nozzle Sizes | Side Jets | Qty. | 6 | 6 | 6 |
| | | Dia. | .109 in. | .132 in. | .156 in. |
| | Front Jets | Qty. | 1 | 1 | 1 |
| | | Dia. | .109 in. | .132 in. | .156 in. |

| Nozzles on 2.12-in. Tools | | Low Flow | Medium Flow | High Flow | |
|---|-------------------|----------------------|----------------------|----------------------|----------|
| Average Bullnose pressure[▲] at suggested flow rate | | 810 psi @ 1.5 bpm | 600 psi @ 2.0 bpm | 510 psi @ 2.4 bpm | |
| Total nozzle flow area | | .086 in ² | .134 in ² | .172 in ² | |
| Nozzle Sizes | Side Jets | Qty. | 6 | 6 | 6 |
| | | Dia. | .125 in. | .156 in. | .177 in. |
| | Front Jets | Qty. | 1 | 1 | 1 |
| | | Dia. | .125 in. | .156 in. | .177 in. |

▲ Add pressure differential from HydroPull to Forward Nozzle Bullnose for total differential pressure through HydroPull SC Stimulation and Cleanout Tool. See HydroPull charts above.



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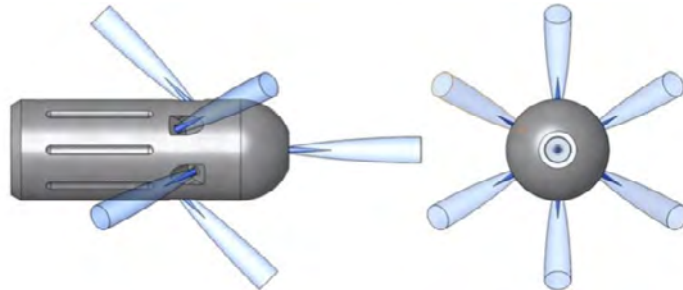
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Specifications – Side Firing Nozzle Bullnose Only 1.69-in. to 2.12-in. Outside Diameter

| Nozzles on 1.69-in. Tools | | Low Flow | Medium Flow | High Flow | |
|---|-------------------|----------------------|----------------------|----------------------|----------|
| Average Bullnose pressure^Δ at suggested flow rate | | 890 psi @ 1.2 bpm | 830 psi @ 1.7 bpm | 480 psi @ 1.8 bpm | |
| Total nozzle flow area | | .065 in ² | .089 in ² | .133 in ² | |
| Nozzle Sizes | Side Jets | Qty. | 6 | 6 | 6 |
| | | Dia. | .109 in. | .120 in. | .154 in. |
| | Front Jets | Qty. | 1 | 1 | 1 |
| | | Dia. | .109 in. | .163 in. | .163 in. |

| Nozzles on 2.12-in. Tools | | Low Flow | Medium Flow | High Flow | |
|---|-------------------|----------------------|----------------------|----------------------|----------|
| Average Bullnose pressure^Δ at suggested flow rate | | 810 psi @ 1.5 bpm | 600 psi @ 2.0 bpm | 510 psi @ 2.4 bpm | |
| Total nozzle flow area | | .086 in ² | .132 in ² | .167 in ² | |
| Nozzle Sizes | Side Jets | Qty. | 6 | 6 | 6 |
| | | Dia. | .125 in. | .150 in. | .173 in. |
| | Front Jets | Qty. | 1 | 1 | 1 |
| | | Dia. | .125 in. | .183 in. | .183 in. |

^Δ Add pressure differential from HydroPull to Side Firing Nozzle Bullnose for total differential pressure through HydroPull SC Stimulation and Cleanout Tool. See HydroPull charts above.





Specifications – Hammer Bit Only 2.88-in. Outside Diameter

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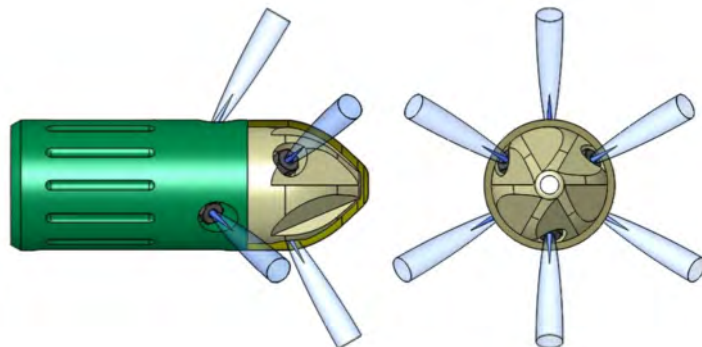
- Job Planning Software

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| Nozzles on 2.88-in. Tools | | Low Flow | Medium Flow | High Flow |
|---|-------------|----------------------|----------------------|----------------------|
| Average Hammer Bit pressure[†] at suggested flow rate | | 800 psi @ 2.4 bpm | 820 psi @ 3.2 bpm | 820 psi @ 3.8 bpm |
| Total nozzle flow area | | .098 in ² | .132 in ² | .188 in ² |
| Nozzle Sizes | Qty. | 8 | 8 | 8 |
| | Dia. | .125 in. | .145 in. | .173 in. |

[†] Add pressure differential from HydroPull to Hammer Bit for total differential pressure through HydroPull SC Stimulation and Cleanout Tool. See HydroPull charts above.



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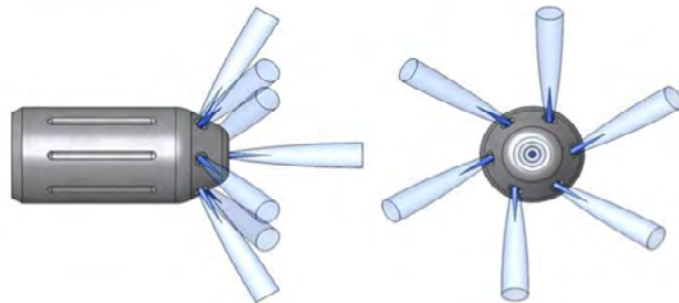
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Specifications – Forward Nozzle Bullnose Only 2.88-in. to 3.50-in. Outside Diameter

| Nozzles on 2.88-in. Tools | | Low Flow | Medium Flow | High Flow | |
|---|-------------------|----------------------|----------------------|----------------------|----------|
| Average Bullnose pressure[▲] at suggested flow rate | | 860 psi @ 2.4 bpm | 630 psi @ 3.6 bpm | 520 psi @ 4.3 bpm | |
| Total nozzle flow area | | .134 in ² | .233 in ² | .306 in ² | |
| Nozzle Sizes | Side Jets | Qty. | 6 | 6 | 6 |
| | | Dia. | .156 in. | .206 in. | .236 in. |
| | Front Jets | Qty. | 1 | 1 | 1 |
| | | Dia. | .156 in. | .206 in. | .236 in. |

| Nozzles on 3.12-in., 3.38-in., 3.50-in. Tools | | Low Flow | Medium Flow | High Flow | |
|---|-------------------|----------------------|----------------------|----------------------|----------|
| Average Bullnose pressure[▲] at suggested flow rate | | 810 psi @ 3.4 bpm | 690 psi @ 4.6 bpm | 440 psi @ 5.0 bpm | |
| Total nozzle flow area | | .194 in ² | .286 in ² | .389 in ² | |
| Nozzle Sizes | Side Jets | Qty. | 6 | 6 | 6 |
| | | Dia. | .188 in. | .228 in. | .266 in. |
| | Front Jets | Qty. | 1 | 1 | 1 |
| | | Dia. | .188 in. | .228 in. | .266 in. |

▲ Add pressure differential from HydroPull to Forward Nozzle Bullnose for total differential pressure through HydroPull SC Stimulation and Cleanout Tool. See HydroPull charts above.





Specifications – Side Firing Nozzle Bullnose Only 2.88-in. Outside Diameter

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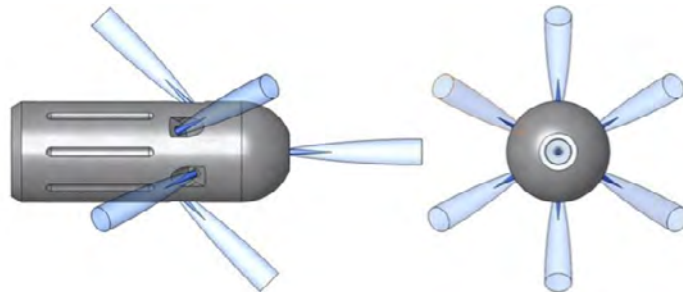
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| Nozzles on 2.88-in. Tools | | Low Flow | Medium Flow | High Flow | |
|---|-------------------|----------------------|----------------------|----------------------|----------|
| Average Bullnose pressure^Δ at suggested flow rate | | 860 psi @ 2.4 bpm | 630 psi @ 3.6 bpm | 520 psi @ 4.3 bpm | |
| Total nozzle flow area | | .134 in ² | .233 in ² | .306 in ² | |
| Nozzle Sizes | Side Jets | Qty. | 6 | 6 | 6 |
| | | Dia. | .156 in. | .206 in. | .236 in. |
| | Front Jets | Qty. | 1 | 1 | 1 |
| | | Dia. | .156 in. | .206 in. | .236 in. |

^Δ Add pressure differential from HydroPull to Side Firing Nozzle Bullnose for total differential pressure through HydroPull SC Stimulation and Cleanout Tool. See HydroPull charts above.



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Case Histories

The HydroPull SC tool is consistently setting or breaking existing records. Please contact us or visit our website for the most recent HydroPull SC Case Histories.

CONTACT INFORMATION:

Tempress Technologies Inc.

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Building A, Suite 108
Renton, WA 98057
Phone: 425.251.8120

www.tempresstech.com



Flow Rate Effect

The traction force is linearly proportional to the flow rate in the coil and is magnified by the impact configuration. Several HydroPull SC tool configurations are available for most applications including Standard Impact, Medium Impact, High Impact, and the Max Impact for the most demanding applications.

Two-Phase Flow

The HydroPull SC tool is designed to operate on two-phase flow. The presence of nitrogen dampens the pulse. The tool can also be run with a Tempress Motor Gas Separator (MGS™). The HydroPull SC tool may also be run downhole with straight gas, if required.

Coiled Tubing Connection

A high-quality coiled tubing connection is recommended when the HydroPull SC tool is operated at the high end of its design flow rate range. Refer to the HydroPull SC Operation Guide for pressure test and pull test recommendations.

Last Chance Screen



Clean fluid with no sand should be run. A last chance screen is included with each tool to prevent gravel and other debris from blocking the tool and to minimize the chance for premature failure of other bottomhole assembly components. The screen openings are 0.06 in. (1600 microns) to 0.16 in. (3900 microns) depending on tool size and job requirements.

HydroPull SC Operation Guide

An operation guide is included with the HydroPull tool that provides operating instructions and job reporting requirements. These guides are also located within our Client Login site on our website.



HydroPull™ Performance Software

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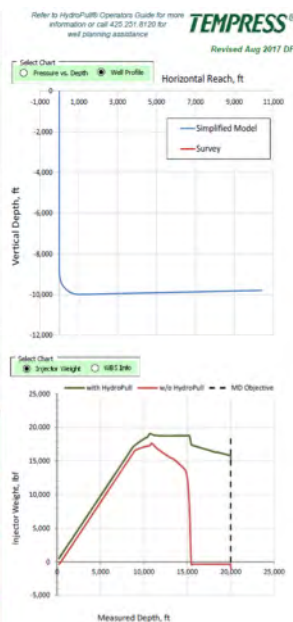
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| HydroPull™ Extended Reach Model-Simplified Well Profile | | Enter All Blue Data | ©Tempress OSES 2017 |
|---|---|----------------------------|--|
| Well Designation & Date | | Wellname | mm/dd/yy |
| Well Data | Select units | US Units | |
| | Kickoff point (TVD) | 9,000 | R |
| | End of curve/landing point (TVD) | 10,000 | R |
| | Toe depth (TVD) | 9,800 | R |
| | Measured Depth (MD) Objective | 20,000 | R |
| | ID of casing in vertical and curve | 4.67 | in |
| | Lateral ID (casing or open hole) | 4.67 | in |
| | Average dog leg severity in horizontal | 3 | 1/100 ft |
| Working (Separate Tab) | Static friction coefficient | 0.24 | .24 for pipe-on-pipe friction reducer, with no FR, .30 if no coil straightener |
| | Coil OD | 2,000 | in |
| BHA | Coil Wall Thickness | 0.199 | in |
| | Minimum flow ID in motorhead | 0.70 | in |
| | HydroPull™ tool diameter | 2.89 | in |
| | HydroPull™ Configuration (Flow - Impact Rating) | Standard Flow, High Impact | |
| | # of Nozzle Ports (jet, bullnose) | 8 | see Tempress Nozzle Sizes |
| | Port diameter | 0.375 | in |
| | Tempress® Water Bypass Sub | No | |
| | No-load motor pressure (see Motor Data Tab) | 60 | psid |
| On-off bottom motor pressure differential | 750 | psid | |
| Operating Parameters | Pump flow rate | 3.00 | gpm |
| | Minimum Weight on Bit | 500 | lbf |
| | Wellhead circulating pressure (lbf/in²) | 100 | psig |
| | Fluid friction reducer effect | 50% | % reduction |
| | Fluid density | 8.34 | ppg |
| | Est. fluid lost to () or gained from () formation | 0.00 | gpm |
| | Total BHA pressure drop | 1,900 | psi |
| | Pump pressure (drilling/milling) | 3490 | psi |
| Results | Bottomhole circulating pressure (BHCP) | 4359 | psi |
| | Wellhead snubbing force | 360 | lbf |
| | Hydraulic Lift-off force | 175 | lbf |
| | Water hammer pulse in annulus | 187 | psi |
| | Water hammer pulse in work string | 1236 | psi |
| | Minimum rupture disk rating | 3747 | psi |
| | Impact force at BHA | 3166 | lbf |
| | Fluid velocity in horizontal section | 219 | fpm |
| Vertical cuttings transport ratio (1-min sand) | 74% | OK | |
| Water Flow to Motor | 3.0 | gpm | |
| Water Bypass (if WBS selected) | - | gpm | |
| On-Off Bottom Motor Flow Variation w/WBS | - | | |
| Maximum coil feed rate at toe of well | 17 | ft/min | |
| Coil lockup MD without HydroPull™ | 15246 | R | |
| MD with HydroPull™ | 21998 | R | |
| Reach increase due to HydroPull™ | 6752 | R | |



A proprietary software program is available for HydroPull tool job planning. The software evaluates circulating pressures in the well and horizontal reach capabilities based on a set of input parameters. The program also calculates pump pressure requirements, the transport of sand and cuttings in the horizontal and vertical sections of the well, predicted lockup, and the rate at which the tool will pull tubing into the well. This software is located within our Client Login site on our website.