



HydroPull™ Extended Reach



Motor Gas Separator (MGS™)



HydroPull™ SC Tool
(Stimulation and Cleanout)



Water Bypass AV Sub (WBS)



High Pressure Rotary Jet
(JetRotor™)



Engineering Services



Custom Tool Development

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

Tempress HydroPull™ Tool

The Tempress HydroPull tool is the most powerful friction-breaking tool on the market. This tool incorporates a cycling valve that momentarily interrupts the flow to create water-hammer pressure pulses inside coiled or jointed tubing used in horizontal well interventions. The water-hammer effect generates traction forces that pull the tubing into the well at 20 ft/min (6 m/min) or more. These periodic pulses also vibrate the tubing, which reduces friction drag and extends the lateral reach of the tubing by delaying the onset of helical buckling and lockup.

The HydroPull tool is typically run above a downhole motor for milling applications. The HydroPull tool continues to set and break all existing records for extended reach applications. **The tool is fully tunable for various impact levels and custom applications.**

Applications

- Fishing
- Coiled and Jointed tubing
- Composite bridge plug milling
- Ball seat milling
- Sand cleanout
- Valve shifting
- Extended-reach well service
- Acidizing
- Chemical placement
- Screen and perforation cleaning
- Scale removal
- Depleted well service



| Feature | Benefit |
|----------------------------------|---|
| Pulling Force | Pulls tubing into long tortuous wells Reduces plug milling time Eliminates the need for friction-reducing beads and chemicals Routine entry of over 11,000 ft horizontals |
| Flow Pulsation | Better hole cleaning Fewer short trips Mill 48+ plugs per day |
| Low pressure differential | Effective on various coil sizes or high-pressure wells |
| High reliability | Multiday extreme-reach jobs without tripping Over 99% downhole success rate Mill 70+ plugs in a single run |
| Polymer gel compatibility | Effective sweeps minimize short trips |
| Nitrogen compatibility | Effective on commingled fluid for depleted well service |



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Specifications

| Tools | 1.69-in. Standard Flow | 2.12-in. Std Flow | 2.12-in. High Flow |
|---|-------------------------------|-------------------------------|-------------------------------|
| | | 2.38-in. Std Flow | 2.38-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 lbr (860 daN) | 1,900 lbr (860 daN) | 1,500 lbr (670 daN) |
| Pulse cycle rate | 7-14 Hz | 7-14 Hz | 6-13 Hz |

| Tools | 2.88-in. Standard Flow | 2.88-in. High Flow | 3.12-in. Std/HF | 3.38-in. Std/HF | 3.50-in. Std/HF |
|---|-----------------------------------|-----------------------------------|-----------------------------------|----------------------------------|-----------------|
| | Design flow rate | 1.9 – 3.8 bpm (300 – 600 lpm) | 2.3 – 4.5 bpm (360 – 710 lpm) | 2.5 – 5.5 bpm (400 – 869 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 lbr (1400 daN) | 3,900 lbr (1700 daN) | 4,400 lbr (2000 daN) | | |
| Pulse cycle rate | 2 – 6 Hz | | | | |



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Case Histories

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

Contact Information:

Tempress Technologies Inc.
2200 Lind Avenue SW
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 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 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 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 tool is operated at the high end of its design flow rate range. Refer to the HydroPull 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 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.



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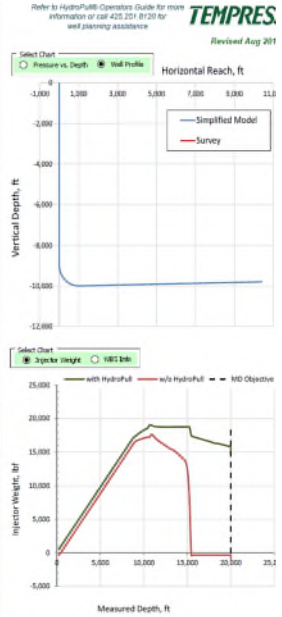
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Custom Tool Development

HydroPull™ Performance Software

| HydroPull™ Extended Reach Model- Simplified Well Profile | | Enter All Blue Data | | ©Tempress OSES 2017 | | |
|---|---|---|---------------------------|------------------------|--|--|
| Well Description & Data | | Wellname | | mvs009r | | |
| Well Data | Select units | ft/Units | | | | |
| | Kickoff point (TVD) | 9,800 | ft | | | |
| | End of curvabending point (TVD) | 10,800 | ft | | | |
| | Toe depth (TVD) | 9,800 | ft | 1.2 deg toe-up | | |
| | Measured Depth (MD) Objective | 20,000 | ft | | | |
| | ID of casing in vertical and curve | 4.67 | in | | | |
| | Lateral ID (cased or open hole) | 4.67 | in | | | |
| Average dog leg severity in horizontal | 1 | °/100 ft | | | | |
| Static friction coefficient | 0.24 | .21 for pipe-on-pipe friction reducer, with no FR .30 if no coil straightener | | .24 | | |
| Working (Separate Tab) | Coil OD | 2.880 | in | Deployed For Reference | | |
| | Coil Wall Thickness | 0.109 | in | | | |
| | Minimum flow ID in motorhead | 0.70 | in | | | |
| BHA | HydroPull™ tool diameter | 2.58 | in | | | |
| | HydroPull™ Configuration (Flow - Impact Rating) | Standard Flow, High Impact | | | | |
| | # of Nozzle Ports (all subnozzles) | 6 | use Tempress Nozzle Sizes | | | |
| | Port diameter | 0.375 | in | | | |
| | Tempress® Water Bypass Sub | No | | | | |
| | No-load motor pressure (see Motor Data Tab) | 50 | psid | 0 if no motor | | |
| | On-off bottom motor pressure differential | 750 | psid | 0 if no motor | | |
| Operating Parameters | Pump flow rate | 3.00 | gpm | | | |
| | Minimum Weight on Bit | 500 | lb | | | |
| | Wellhead circulating pressure (c/dikes) | 100 | psi | gauge | | |
| | Fluid friction reducer effect | 60% | % reduction | | | |
| | Fluid density | 8.34 | ppg | Spec Gravity= 1.00 | | |
| | Est. fluid lost to () or gained from () formation | 0.00 | bbbl | Differential is 0 | | |
| Results | Total BHA pressure drop | 1300 | psi | differential | | |
| | Pump pressure (drilling/milling) | 3490 | psi | | | |
| | Bottomhole circulating pressure (BHCP) | 4359 | psi | | | |
| | Wellhead snubbing force | 360 | lbf | | | |
| | Hydraulic Liftoff force | 175 | lbf | | | |
| | Water hammer pulse in annulus | 187 | psi | differential | | |
| | Water hammer pulse in work string | 1036 | psi | | | |
| | Minimum rupture disk rating | 3747 | psi | | | |
| | Impact force at BHA | 3166 | lbf | | | |
| | Fluid velocity in horizontal section | 219 | fpm | OK | | |
| Vertical outflow transport ratio (1-mm 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 | ft | | | | |
| MD with HydroPull® | 21998 | ft | | | | |
| Reach increase due to HydroPull® | 6752 | ft | | | | |



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.



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Competitor Analysis – Friction Breaking Tool

| | The Tempress HydroPull™ Tool | Fluidic Flow Modulation Tool | Rotary Valve Pulse Tool with Rotor/Stator |
|--|------------------------------|------------------------------|---|
| Most powerful friction-breaking tool on the market | ✓ | | |
| Lowest pressure differential on the market | ✓ | | |
| Minimal or no elastomeric components | ✓ | ✓ | |
| Compatible with high BHT >400 °F | ✓ | | |
| Highly effective in extreme, extended reach laterals | ✓ | | |
| Relatively short length | ✓ | ✓ | |
| Most reliable friction breaking tool on the market | ✓ | | |
| Nitrogen compatible | ✓ | ✓ | |
| High chemical compatibility | ✓ | ✓ | |
| No moving parts | | ✓ | |
| Wide operating range | ✓ | ✓ | ✓ |
| Fully tunable for various impact levels | ✓ | | |
| Pulls the tubing in the well at >20 ft/min | ✓ | | |
| Enhances the MWD signal | ✓ | | |