



HydroPull™ Extended Reach

•

Motor Gas Separator (MGS™)

•

HydroPull™ SC Tool  
(Stimulation and Cleanout)

•

Water Bypass AV Sub (WBS)

•

High Pressure Rotary Jet  
(JetRotor™)

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Engineering Services

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Custom Tool Development

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

## Tempress HydroPull™ SC Tool

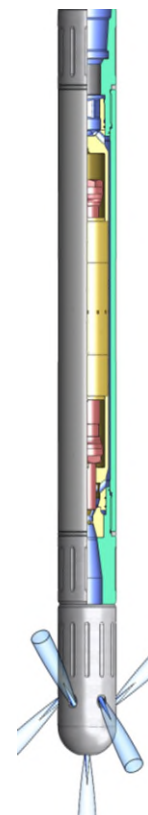
The HydroPull™ SC Stimulation & Cleanout tool momentarily interrupts the return flow in the completion annulus to create intense water-hammer pressure pulses that vacuum the wellbore, pulling fines and debris from behind completions and out of the formation. This tool incorporates a carbide hammer bit 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
<b>Pulling force</b>	Pulls tubing into long tortuous wells Eliminates the need for friction-reducing beads and chemicals <b><i>Routine entry of over 11,000 ft horizontals</i></b>
<b>Flow pulsation</b>	One-trip cleanout and stimulation Eliminates need for a motor and mill Better sand and cuttings transport at low flow Fewer short trips <b><i>Most powerful pulse pressure available</i></b>
<b>Low pressure differential</b>	Effective on various coil sizes or high-pressure wells Maximizes flow
<b>Intense suction pressure</b>	Removes debris from perforations and behind sand screens
<b>Nitrogen compatibility</b>	Effective on commingled fluid for depleted well service
<b>High reliability</b>	Multiday extreme-reach jobs without tripping <b><i>Over 99% downhole success rate</i></b>



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## Specifications – HydroPull™ SC Tool

Tools	1.69-in. Standard Flow	2.12-in. Std Flow 2.38-in. Std Flow	2.12-in. High 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 <sup>◇</sup>	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 <sup>□</sup> (6.9-15.9 MPa)	650-1,350 psi <sup>□</sup> (4.5-9.3 MPa)	500-1,600 psi <sup>□</sup> (3.4-11.0 MPa)

<sup>◇</sup>Based on 1.50-in. coil, 0.156-in. wall

<sup>□</sup>Based on 1.75-in. coil, 0.156-in. wall

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 <sup>◇</sup>	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 (1400 daN)	3,900 lbf (1700 daN)	4,400 lbf (2000 daN)
Pulse cycle rate	2 – 6 Hz		
Pulse pressure <sup>▲</sup>	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)

<sup>◇</sup> Add pressure differential from Hammer Bit or Bullnose for total differential pressure through HydroPull SC Stimulation and Cleanout Tool. See nozzle charts below.

<sup>▲</sup> Based on 2.38-in. coil, 0.156-in. wall



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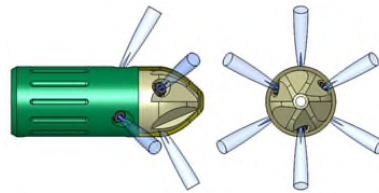
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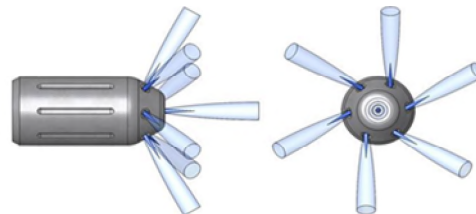
## Carbide Hammer Bit

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.



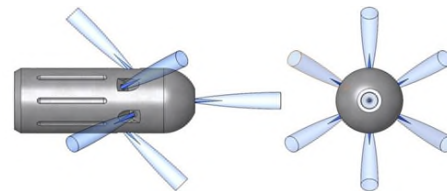
## Forward Firing Nozzle Bullnose

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.





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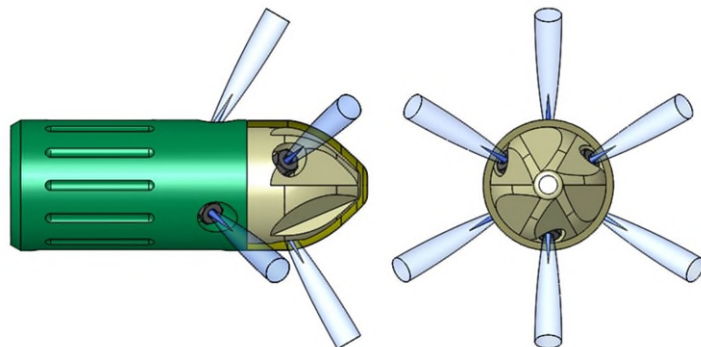
Custom Tool Development

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

Nozzles on 1.69-in. OD Tools		Low Flow	Medium Flow	High Flow	Max Flow
Average Hammer Bit pressure <sup>†</sup> 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 <sup>2</sup>	.053 in <sup>2</sup>	.074 in <sup>2</sup>	.099 in <sup>2</sup>
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 <sup>†</sup> 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 <sup>2</sup>	.074 in <sup>2</sup>	.099 in <sup>2</sup>	.141 in <sup>2</sup>
Nozzle Sizes	Qty	6	6	6	6
	Dia.	.106 in.	.125 in.	.145 in.	.173 in.

<sup>†</sup>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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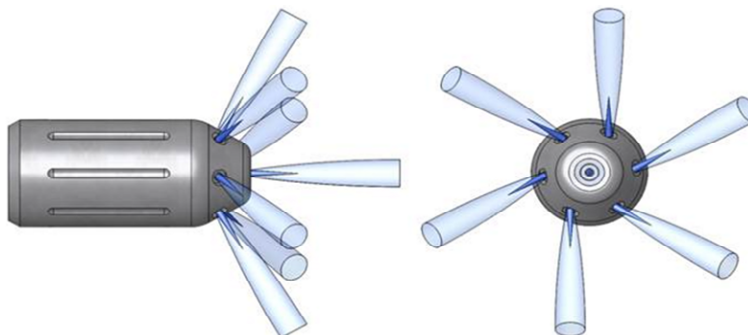
Custom Tool Development

## 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 <sup>2</sup>	.096 in <sup>2</sup>	.138 in <sup>2</sup>
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 <sup>2</sup>	.134 in <sup>2</sup>	.172 in <sup>2</sup>
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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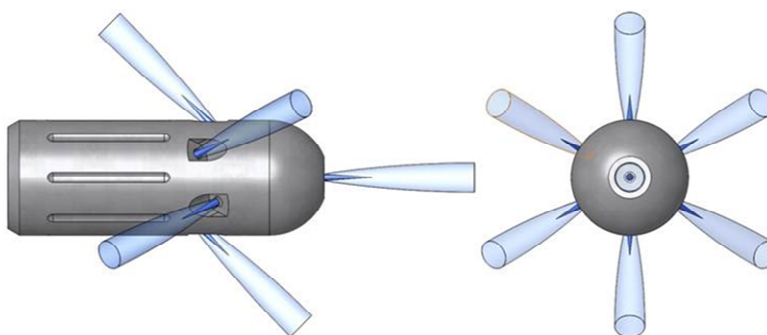
Custom Tool Development

## 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 <sup>△</sup> 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 <sup>2</sup>	.089 in <sup>2</sup>	.133 in <sup>2</sup>
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 <sup>△</sup> 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 <sup>2</sup>	.132 in <sup>2</sup>	.167 in <sup>2</sup>
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.

<sup>△</sup>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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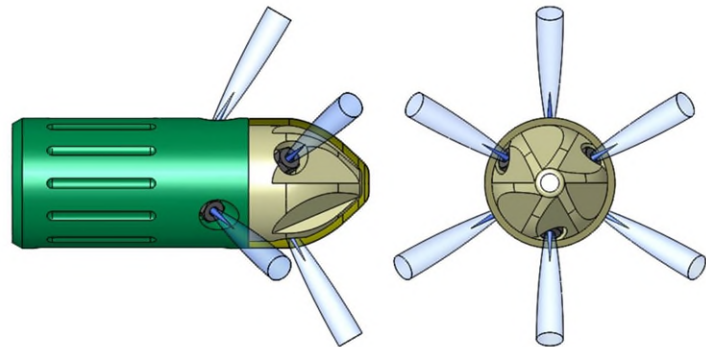
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## Specifications – Hammer Bit Only 2.88-in. Outside Diameter

Nozzles on 2.88-in. Tools		Low Flow	Medium Flow	High Flow
Average Hammer Bit pressure <sup>†</sup> 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 <sup>2</sup>	.132 in <sup>2</sup>	.188 in <sup>2</sup>
Nozzle sizes	Qty	8	8	8
	Dia.	.125 in.	.145 in.	.173 in.

<sup>†</sup>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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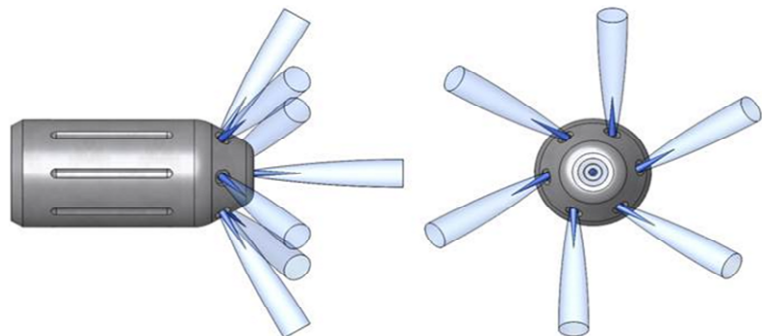
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## Specifications – Forward Nozzle Bullnose Only 2.88-in. to 3.50-in. Outside Diameter

Nozzles on 2.88" 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 <sup>2</sup>	.233 in <sup>2</sup>	.306 in <sup>2</sup>
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 <sup>2</sup>	.286 in <sup>2</sup>	.389 in <sup>2</sup>
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.







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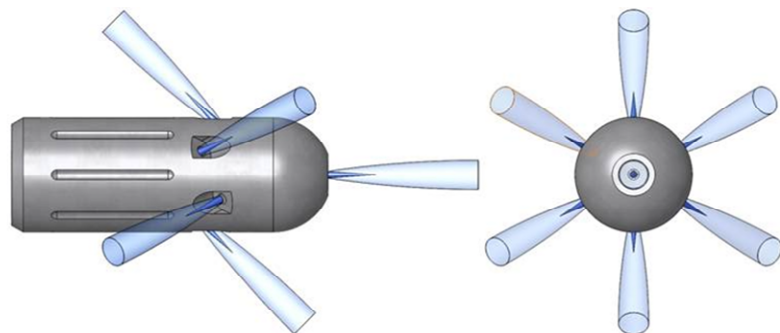
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## Specifications – Side Firing Nozzle Bullnose Only 2.88-in. Outside Diameter

Nozzles on 2.88-in. Tools			Low Flow	Medium Flow	High Flow
Average Bullnose pressure <sup>△</sup> 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 <sup>2</sup>	.233 in <sup>2</sup>	.306 in <sup>2</sup>
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.

<sup>△</sup>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.**  
2200 Lind Avenue SW  
Building A, Suite 108  
Renton, WA 98057  
Phone: 425.251.8120  
[www.tempresstech.com](http://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.



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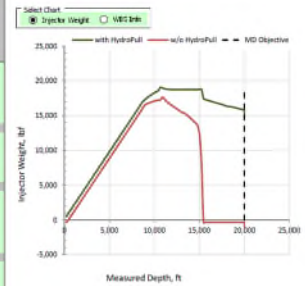
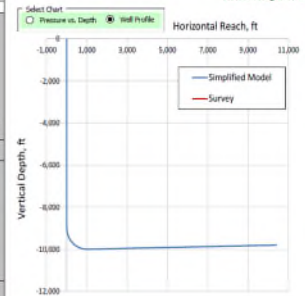
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## HydroPull Performance Software

HydroPull® Extended Reach Model- Simplified Well Profile		Enter All Blue Data	©Tempress OSES 2017
Performance Software is designed specifically for use with Tempress tools only.			
Well Designation & Data		Wellname	mm/dd/yr
Well Data	Select units	US Units	
	Kickoff point (TVD)	9.000	ft
	End of curvewarding point (TVD)	10.000	ft
	True depth (TVD)	9.900	ft
	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
Workstring (Separate Tab)	Static friction coefficient	0.24	21 for pipe-on-pipe friction reducer, with no JIC, 30 ft no coil dragline
	Coil OD	2.000	in
	Coil Wall Thickness	0.109	in
	Minimum flow ID in motorhead	0.76	in
	HydroPull® tool diameter	2.38	in
	HydroPull® Configuration (Flow, Impact Rating)	Standard Flow, High Impact	
	# of Nozzle Ports (jet, ballnose)	5	see Tempress Nozzle Sizes
	Port diameter	0.375	in
BHA	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
	Pump flow rate	3.00	gpm
	Minimum Weight on Bit	500	lbf
	Wellhead circulating pressure (cheeks)	100	psi gauge
	Fluid friction reducer effect	50%	% reduction
	Fluid density	8.34	ppg Spec. Gravity: 1.00
Operating Parameters	Est. fluid test to (-) or gained from (+) formation	0.00	ppm Default is 0
	Total BHA pressure drop	1300	psi differential
	Pump pressure (drilling/milling)	3450	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
Results	Minimum rupture disk rating	3717	psi
	Impact force at BHA	3166	lbf
	Fluid velocity in horizontal section	219	fpm OK
	Vertical cuttings transport rate (1-mm sand)	7.4%	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

Refer to HydroPull® Operations Guide for more information or call 425.251.8120 for well planning assistance.

TEMPRESS®  
Revised Aug 2017 DF



A proprietary software program is available for HydroPull SC Stimulation and Cleanout tool job planning. The software evaluates circulating pressures in the well, BHA pressure drop, and horizontal reach capabilities based on a set of input parameters. The program calculates pump pressure requirements, the transport of sand and cuttings in the horizontal and vertical sections of the well, 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.