Hydropulsion

DOWNHOLE TOOLS

Hydropulse

Optimise the placement and penetration of injection fluids, using fluidic oscillating technology.

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Restore Well Performance, Unleash Production Potential

The Hydropulse leverages the combined power of Hydropulsion's downhole jetting expertise and proven fluidic oscillator technology. This innovative fusion tackles a wide range of wellbore challenges, including:

- Wellbore Cleanup: Effectively removes deposits like:
  - Formation fines
  - Scales (all types)
  - Paraffins and asphaltenes
  - Mud and cement damage
  - Emulsions
  - Drilling damage
- Formation Stimulation:
  - Primary stimulation for high permeability formations
  - Preparation for other stimulation treatments
- Wellbore Preparation:
  - Prepares wells for gravel packing or frac packing operations
  - Cleans out fill from open holes or casings
- Enhanced Injection:
  - Alters injection profiles for improved well performance
  - Enables precise placement of treatment chemicals

Hydropulse type fluidic oscillators have already been used successfully to treat thousands of wells globally.

Fluidic oscillator technologies have been applied in a wide variety of vertical and horizontal wells, both openhole and casedhole, including oil, gas, injection, geothermal, CO_2, water, disposal, monitoring, and solution mining. Any nonabrasive fluid suitable to downhole conditions can be used. to help remediate a number of problems:

Hydropulse offers a compelling set of benefits that streamline operations and enhance well performance:

- **Targeted Cleaning:** Removes formation damage throughout the wellbore, not just perforations, for a more complete cleanup.
- **Improved Well Connectivity:** Significantly reduces communication issues between perforations, optimizing well productivity.
- **Unrestricted Placement:** Unaffected by standoff limitations like jetting nozzles, enabling flexible deployment.
- **Enhanced Versatility:** Compatible with other downhole tools for comprehensive well intervention.
- **Boosted Chemical Effectiveness:** Breaks up formation damage, increasing the surface area for improved chemical treatment.

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What is Hydropulse fluidic oscillator technology?

The Hydropulse harnesses the power of fluidic oscillations, a technology based on the Coanda effect. This natural phenomenon describes how a fluid stream follows a curved surface. In the Hydropulse tool, a fluid stream enters the oscillator and, due to the Coanda effect, preferentially attaches to the outer wall of a curved passage. As it flows, it creates a low-pressure zone at a specific point. This pressure difference disrupts the main stream and diverts the flow to the opposite passage. This continuous switching creates rapid oscillations, resulting in powerful bursts of fluid.

Hydropulse's powerful bursts of fluid generate pulsating pressure waves that travel through the wellbore fluids and into the formation itself. These pressure waves act like a microscopic hammer, fracturing any type of near-wellbore damage. They work in two ways:

Dual Cleaning Action:
Hydropulse's pressure waves act like a powerful one-two punch to remove damage:
Compressive Force: Imagine a microscopic hammer. As the wave enters the perforation and contacts the rock face, it delivers a powerful compressive force, effectively shattering and breaking up any blockages like scale or debris.

This continuous cycle of pressure waves acts like a powerful cleaning mechanism, restoring and enhancing the permeability of the perforations and surrounding area.

Hydropulse fluidic oscillating technology sets itself apart with several key advantages:

- **Reliable Design:** No moving parts means less wear and tear, reducing downtime and maintenance costs.
- **Cavitation-Free Cleaning:** Unlike some methods, Hydropulse doesn't rely on cavitation, which can damage the wellbore itself.
- **Unrestricted Cleaning:** Pressure waves are unaffected by standoff distance, unlike jetting or velocity tools, allowing for effective cleaning regardless of tool placement.
- **Efficient Energy Transfer:** Kinetic energy travels through the wellbore fluid with minimal loss, delivering its full force upon contact with the formation.
- **Targeted Cleaning:** Energy is only expended when the wave hits the formation, maximizing effectiveness in removing near-wellbore damage.
- **360° Coverage:** Spherically expanding pressure waves ensure comprehensive cleaning throughout the entire wellbore as the tool moves through the interval.
- **Progressive Cleaning:** As damage is removed, the waves penetrate deeper, cleaning a larger area of the formation.

TECHNICAL SPECIFICATIONS

OD (Inches)	Length (Inches)	Connection	Flow Rate (BPM)	Part No.
1.688	8.25	1.00" AMMT	1 - 2	HP-ON-1688-01
		1500-2500 Psi 100-200 Hertz		
2.125	8.25	1.50" AMMT	2 - 3	HP-ON-2125-01
		1500-2500 Psi 100-200 Hertz		

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Frequently Asked Questions

Q. Is this tool a jet tool?

A. No! Jet tools depend on fluid impingement to clean. Unless the fluid jet hits the target with adequate force, it will not clean it. Jet tools are also limited by standoff from the surface of the nozzle OD to the ID of the tubular to be cleaned. This can be a major problem when working under a packer. The Hydropulse utilises a fluidic switch to create oscillating pressure waves within the wellbore fluid. These waves move through the wellbore fluid in a spherical fashion and release their energy when they contact the formation. The fluid exiting the Hydropulse is used to clean out in front of the tool and the pressure waves clean to the sides.

Q. What is a fluidic switch?

A. A fluidic switch is a device that diverts fluid flow non-mechanically. Flowing fluids tend to preferentially attach to a nearby surface and remain attached thereto until the fluid stream is disturbed. A stream splitter in the Hydropulse is designed to cause the fluid flow to adhere to and flow down one passageway, while also creating enough of a disturbance in the fluid to cause the flow to switch to the opposite passageway. As long as the flow rate through the Hydropulse is above the activation rate for that switch, the flow will cycle “on and off” between the two outlet ports. The Hydropulse uses a bi-stable design based in part on the Coanda effect which describes the tendency of a fluid stream to adhere to a nearby curved surface. The Hydropulse uses this “positive pulse” design to generate the pressure pulses/waves.

Q. What is the magnitude of the pressure waves created by the action of the Hydropulse?

A. Several approaches can be adopted to estimate the magnitude of the oscillating pressure waves. Our estimates of these pressure increases range from 1500 psi up to 2500 psi, the frequency of this range is from 100 – 200 hertz.
Increasing the pump rate does not necessarily increase the magnitude of the pressure wave as the relative velocities within the tubing and wellbore do not change. The effective power of these waves can be increased by an increase of hydrostatic pressure or back pressure on the tool.

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Q Is there any benefit from the acoustics' generated by the tool?

A. Yes. The beneficial effects of the acoustic energy generated by the Hydropulse are produced through,

a) the oscillating pressure waves that lead to physical disruption of the formation damage,
b) the fluid flows induced by acoustical streaming, and
c) the enhancement of chemical reactions through greater surface area contact.

Acoustic streaming is characterized by steady rotational flow occurring as a result of the interaction of acoustic waves with physical properties inhomogeneities in a fluid, such as smooth boundaries and solid particles. Fluid agitation caused by acoustic streaming is not as violent as that caused by cavitation, but streaming is very effective for liberating particles attached to surfaces. This phenomenon is believed to be the mechanism by which the Hydropulse can effectively increase the near-wellbore permeability of a borehole. During the clean-out and initial stimulation treatments of a wellbore, the oscillating pressure waves break up the filter cake and the crushed zone around the wellbore (perforations). The streaming flows remove the plugging fine particles from the pore throats of the rock thus restoring the natural permeability of the formation.

Studies have suggested the possibility that even the native particles and fines may be removed which increases the effective permeability of the near wellbore region. Experiments and field usage show that a significant increase in the flow capability of the near wellbore is possible using water only. The initial cleaning of the wellbore before acidizing will greatly enhance the acid job.

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