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HPHT Rotating Jet Wash Tool

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Device Overview

The HPHT Rotating Jet Wash Tool is designed for use in high pressure downhole power washing operations. The design provides controlled rotation of a spinning nozzle head that is easily configured to optimize jetting performance and coverage for a range of power washing and debris removal applications.

The HPHT Rotating Jet Wash Tool is designed for use on coiled tubing or jointed tubing with clean fluids. The tool is corrosion resistant and suitable for use with commonly used acid treatment solutions.

The HPHT Rotating Jet Wash Tool assembly and shaft seals offer high pressure integrity and controlled rotational function at temperatures up to 400° F. Tool operation in higher temperatures up to 500° F can be managed with the device by dressing the tool with the optional high temperature O-ring seal kit and adhering to operating guidelines.

Three port nozzle and five port nozzle head options are available and are easily changed on the job site without disassembly of the rotating swivel assembly. The variety of nozzle head configurations provide means for optimizing jetting direction, jet pattern and hydraulic jetting power. The user may select radial or downward jetting trajectory or combinations of both. A range of replaceable wear resistant carbide jet orifice sizes are provided to further optimize tool performance and jetting hydraulics.



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Applications:

- Suitable for well intervention with either coiled tubing or conventional jointed tubing conveyance.
- Standard HPHT jetting and cleanout operations.
- Corrosion resistant material design suitable for mildly corrosive well environments.
- Suitable for use with nitrified fluids and mild acids.
- Ideal for scale and hard fill removal.
- Geothermal applications up to 500° F when assembled with the high temperature seal kit.

Features:

- Controlled rotation speed for improved jetting performance and washing characteristics.
- Reliable 360° tool rotation to ensure coverage.
- Constructed of wear and corrosion resistant materials for exceptional endurance.
- Pressure compensated bearing assembly for reliable operation at elevated temperatures.
- Multiple nozzle head and nozzle size options.
- Easily field dressed and maintained.

Operation

The Serva Oil Tools HPHT Rotating Jet Wash Tools are hydraulically powered self-rotating jet wash nozzle assemblies with a viscous fluid centrifugal braking mechanism which regulates nozzle head rotation speed.

The HPHT Rotating Jet Wash Tool is configurable for optimization of jetting forces that are directed to provide rotational thrust and jet impact force at the wash target(s) of interest. Jet nozzle head configurations are available in either 3 port or 5 port designs with variance in port exit angle. Each tool is shipped with a pre-configured nozzle head and jet nozzle orifice selection optimized for rotation, radial coverage, and downward penetration. The standard configuration is suitable for most jet washing applications however further optimization for scale removal, fill removal, hard fill penetration, or enhanced radial jet stream reach is possible by varying the nozzle number, direction of jet spray, number of jets, and rotation speed. Additional jet performance may be obtained through fluid selection and nozzle differential pressure optimization. Filtered fluids are recommended to avoid nozzle bridging issues. Particle size is an important consideration when filtering fluids, particle diameter should not exceed 1/3 of the selected nozzle orifice diameter as a rule of thumb. Solid content within the fluid is vitally important to control to avoid bridging off the nozzles and key to preventing abrasive wear on either the tool or the tubulars being jetted. Limit entrained solids to less than 0.1% by volume and filter it out entirely where possible.

Tool function and jetting performance depend upon proper sizing of jet nozzles. Select the number and size of jet nozzles according to the desired total flow rate with a maximum operating pressure differential at the tool face of 1600 psi for 1-11/16" or 3000 psi for larger tool diameters. The tool uses a relatively low viscosity synthetic oil to control rotation speed to maintain stable rotation speed between 60 and 140 rpm at temperatures up to 400° F while operating in the recommended pressure differential range between 1000 psi and 1600 psi.

Rotational speed of up to 260 rpm can be expected in some configurations that provide higher rotational torque. Much higher speeds may be realized if the bearing chamber is not adequately oil filled or when filled with a lower viscosity fluid. Operating at temperatures above 400° F is possible when the tool is dressed in the optional high temperature tool body O-ring seals, there is no need to swap shaft seals which are suitable to 500° F. Tool performance may be compromised at temperatures above 500° F and swivel assembly failure can occur where elevated temperature is coupled with high pressure differential (>1600 psi for 1.688" tool and >3000 psi for larger tool diameters) at the tool. In general, slower rotation speeds (50 – 100 rpm) are desired for hard fill penetration while higher rotation speed (100 – 260 rpm) is desired for power jet washing completion tubulars, loose fill removal,

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or comprehensive radial coverage during fluid placement applications. Trip speed is also a factor in ensuring coverage and/or contact time, evaluate trip speed accordingly when relevant to the operation.

Nozzle head and nozzle size selection should consider both the intended application and the characteristics of the debris or material that will be addressed during the operation. For hard and tightly compacted fill, larger but fewer jets is desirable and jet direction focused downward. For soft fill, maximize circulating flow rate using the largest practical jet size and number of jets. For mineral build up on tubulars and formation walls, use smaller jets and focus direction outward. Choose the tool size that best serves the purpose intended, ensure the tool will drift to target depth and will have sufficient standoff to avoid abrasive jetting damage to both completion hardware and the tool string from abrasive solids during Jetstream splash back. Standoff and nozzle size selection is equally important to the regulation differential pressure at the tool as it is to jetting power on target. In practice, it is advised to choose a configuration that does not inhibit downhole flow rates significantly because of operating pressure limitation at the tool.

Serva Oil Tools provides the tools dressed with the standard three port nozzle head. Nozzles are pre-installed according to anticipated fluid flow rates for a given tool size. The standard nozzle head configuration is optimized based on jetting and rotational torque calculations which consider the typical industry length and size of coiled tubing used with a given tool string diameter. The standard tool setup will be acceptable for a wide range of operations jetting with straight fluids. Longer coiled tubing strings, hydraulic horsepower limitations, and treatment fluid properties including the use of nitrogen or high-density fluids and acid systems could all lead to a more demanding operating scenario. A variety of interchangeable and configurable multi-port nozzle heads and nozzle sizes are available enabling efficient use even in complex applications.

Commonly used inhibited acid treatment systems, nitrified fluids and foaming agents are suitable with the HPHT Rotating Jet Wash Tool. Use of CO₂ as a treatment fluid or constituent of pumped fluid systems is not recommended. As a rule of thumb, fluid treatment systems suitable for use with coiled tubing are compatible with the HPHT Rotating Jet Wash Tool. Be aware of limitations in the running tools above the RJWT as well as potential for rust and debris from the tubing or coiled tubing which may be dislodged and transported in high concentrations down to the nozzle. Jet nozzle plugging prevention measures including pickling and flushing of coiled tubing strings and treating lines prior to installing the jet tool is strongly advised. Use of a downhole filter is encouraged during any operation using acid treatment systems. Nitrified fluids typically require use of the smaller nozzle orifice sizes for efficient tool operation increasing possibility of debris bridging or plugging nozzles. Screening and filtering of fluids at surface is always advised.

Contact Serva Oil Tools for assistance in tool selection, tool setup, nozzle configuration and operating guidance for your application.

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HPHT Rotating Jet Wash Tool – Assembly Layout

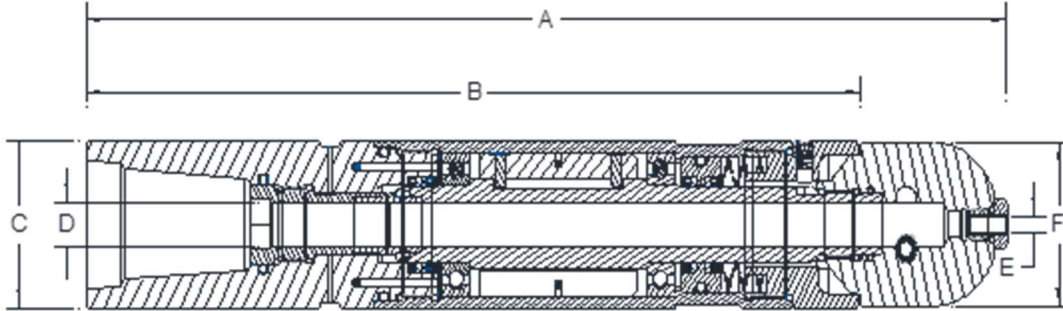


Figure 1) HPHT Rotating Jet Wash Tool physical characteristics illustration.

HPHT Rotating Jet Wash Tool - Tool Characteristics Quick Reference																
HPHT RJWT Size	Top Sub Thread	Tool Joint Make up Torque (ft.-lbs)	A Make up Length (in)	B Swivel w/o Jet Head Length (in)	C Tool Outside Diameter (in)	D Tool Internal Diameter (in)	E Jet Orifice Diameter (in)	E1 Jet Orifice Diameter (in)	E2 Jet Orifice Diameter (in)	E3 Jet Orifice Diameter (in)	F Std. 3 Port Nozzle Head O.D. (in)	F1 Std. 5 Port Nozzle Head O.D. (in)	F2 Radial 5 Port Nozzle Head O.D. (in)	Assembly Tensile Limit (Yield Point) lbs.	Max Differential Pressure Rating (psi)	Part Number
1 11/16	1" AMMT	380	11.7	10.0	1.688	0.380	0.156	0.125	0.094	0.063	1.650	1.650	1.650	20,000	1,600	2189168122
2 1/8	1.5" AMMT	600	13.9	11.9	2.125	0.380	0.156	0.125	0.094	0.063	2.050	2.090	2.090	35,000	3,500	2189212122
2 7/8	2.375" PAC	2000	16.1	13.6	2.875	0.688	0.250	0.219	0.188	0.156	2.810	2.810	2.810	70,000	3,500	2189287122

Maximum overpull (Tensile) at the tool: 20,000 LBF Note: 20k for 1-11/16, 35k for 2-1/8, and 70k for 2.88 tools.
Maximum set down load (Compression) at the tool: 15,000 LBF Note: 15,000 LBF for 1-11/16 and 2-1/8 tools, 25,000 LBF for 2.88 tools.
Maximum Internal to External Differential Pressure: 1,600 PSI Note: 1,600 PSI for 1-11/16" tool and 3.500 PSI for 2-1/8" and 2-7/8" tools.
Max Tool Pressure Rating @ Zero Differential Pressure: 15,000 PSI
Maximum Temperature Rating: 400° F (500° F when assembled with the high temperature FFKM o-ring seal kit, available as a spares kit and order option.)

Note: E, E1, E2, & E3 are jet orifice options. E is installed in the standard 3 port nozzle head when shipped from Serva Oil Tools. Orifice size options are included as spares and are interchangeable. 0.141" jet orifice are available on request, useful in some applications where the radial 5 port nozzle head is deployed.
Note: F, F1, & F2 are configurable nozzle head options. F is the standard three port nozzle head and is installed when the tool assembly is shipped from Serva Oil Tools. F1 & F2 are available order options. F1 is a standard five port nozzle head option with 2 ports @ 90°, 2 ports @ 45°, and 1 down jet port. F2 is configured for radial jetting applications with 4 ports @ 90° and 1 down jet port.

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Table 1) Tool Specifications

Reference	1-11/16 RJWT	2-1/8 RJWT	2-7/8 RJWT
Top Connection type	1" AMMT	1-1/2" AMMT	2-3/8" PAC
Tool Length (in)	11.72	13.93"	16.14"
Make up length (in)	11.72	13.93"	16.14"
Maximum OD (in)	1.688	2.125"	2.875"
Minimum Bore ID (in)	0.380	0.380"	0.688"
Flow Range, bpm	Configurable (0.4 – 1.3)	Configurable to 2 bpm	Lo Flo 2-6 bpm, Hi Flo 3-8 bpm
Carbide Jet Orifice (in)	0.156 (selectable)	0.156 (selectable)	0.250 (selectable)
Standard Nozzle Head	3 Port (1 down, 2@90°)	3 Port (1 down, 2@90°)	3 Port (1 down, 2@90°)
Optional Nozzle Head	5 Port (1 down, 2@45°, 2@90°)	5 Port (1 down, 2@45°, 2@90°)	5 Port (1 down, 2@45°, 2@90°)
Optional Nozzle Head	5 Port (1 down, 4@90°)	5 Port (1 down, 4@90°)	5 Port (1 down, 4@90°)
Nozzle Head Diameter (in)	1.650	2.090	2.810
Torsional Limit, Top Sub (ft*lbF)	700	1500	4800
Compression Limit*, LBF	15,000	15,000	25,000
Tensile Limit, LBF	20,000	35,000	70,000
Max. Working Pressure, psi.	15,000	15,000	15,000
Max. Differential Pressure, psi	1,600	3,500	3,500
Temperature Rating, Deg. F	400	400	400
Rotation Speed, rpm	70 - 260	70 - 260	70 - 260
Bearing Chamber	Pressure Compensated	Pressure Compensated	Pressure Compensated
Bearing Lubricant	ISO 220 Gear Oil	ISO 220 Gear Oil	ISO 220 Gear Oil

Table 1 stated specifications are based on either measured or calculated values at 70° F. Stated values are considered accurate within 15% with applicable tool setup configurations. Damage or catastrophic failure of tool assembly components can occur where stated ratings are exceeded by the user.

Operating environment and conditions vary greatly, tool rating calculations do not consider many potential operating situations or combined loading stress relationships. Therefore, derating stated limits is essential by the user for safe operation and extended tool life. Consider the surface and downhole operating environment, operating temperature, well parameters and tool configuration when defining a safe operating envelope.

The HPHT Rotating Jet Wash Tool is constructed of chemical resistant metal alloys and elastomers. Most common water-based cleanout fluids, surfactants, foaming agents, inhibited acids and nitrified fluids are suitable. Use of strong acid concentrations, high ratio solvent solutions, and high solids content fluids are not recommended. Consult Serva Oil Tools for compatibility guidance anytime harsh substances are considered.

Serva Oil Tools Rotating Jet Wash Tool can be dressed to operate at temperatures up to 500° F by changing O-ring seals from Viton to FFKM. A high temperature seal kit is available from Serva Oil Tools for each tool size.

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