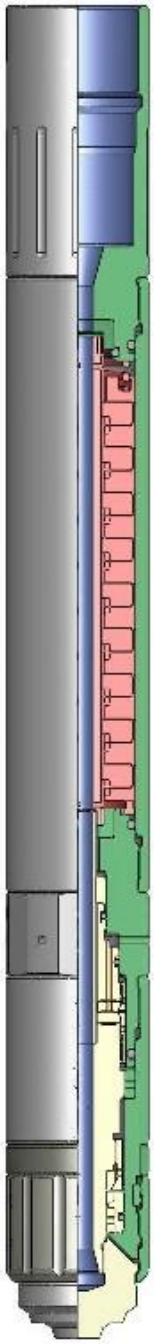
High-Pressure Rotary Jetting Tool



Patents Pending

High-pressure rotary jetting offers the ability to remove mineral scale safely and quickly and to stimulate well completions with ***no risk of damage to production tubing or downhole equipment*.**

The Tempress™ JetRotor™ tool is compatible with a broad range of fluids making it applicable in almost all coiled tubing well service jobs. The design is highly compact, which greatly simplifies transport, BHA setup and job execution. The tool is available in several sizes:
1.69 in. (43 mm), 2.06 in. (52 mm) and 2.12 in. (54 mm).

High-Pressure, High-Power, High-Quality Jets

The JetRotor™ tool operates at the highest power and pressure levels available in the industry. The patented open-flow seal design virtually eliminates power losses due to leakage and friction. This seal design ensures that maximum hydraulic power is delivered to the jets.

- Greater range and effectiveness than conventional wash nozzles.
- Flow conditioners in nozzle heads ensure a coherent jet.
- Field-changeable nozzle heads & nozzles for specific applications.

Hydrokinetic Speed Governor

Tempress™ has conducted extensive testing on the effects of rotary speed on jet effectiveness. JetRotor™ tools incorporate a patented hydrokinetic speed governor that provides the optimum rotation rate with maximum jet effectiveness. The high rotation rates (3000 to 4000 rpm) achieved by the tool allow efficient cleaning at coil feed rates of over 30 ft/min (10 m/min).

- High coil feed rates.
- No special fluids or procedures required to set up speed governor.
- Tools can be rerun on multiple jobs without redress.

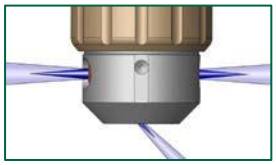
High-Temp, Corrosion-Resistant Alloy Construction

The JetRotor™ tools are fully acid capable and are routinely run in the most severe high-temperature (400°F/200°C) sour gas environments.

- Can run on energized fluids including nitrogen and carbon dioxide.
- Dry gas can be used to complete the job.
- High-concentration HCl is commonly pumped for well stimulation.
- Bleach, solvents, polymers and surfactants can also be jetted to enhance the well service.

Nozzle Head Configurations

Stimulation and Screen Cleaning



Two large radial jets, one small forward jet.

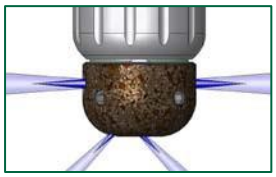
- Removes drilling damage from openhole completions.
- Cleans screens and perforations.
- Acid blasts for uniform acid delivery during acid squeeze.
- Multistage foam diversion acid squeeze.

Milling

Hydraulic energy is focused forward. The core region of the jets provides 100% coverage of the front of the tool to mill through bridged material.

- Removes soft mineral scale, barite sag, paraffin, hard-packed sand and other well obstructions.
- A high-pressure (HP) milling tool is available for hard scales.

Mechanical-Assist (MA) Cap



The replaceable MA cap is covered with tungsten carbide chips that remove hard mineral scales. The synergy of high-pressure jetting and mechanical milling allows penetration through harder scales than possible with jets alone.

Specifications

Tool length [in. (mm)]		16.0 in. (406 mm)			15.0 in. (381 mm)		21.0 (533)
Nozzle head style		**Stimulation**	**Milling**	**HP Milling**	**Milling**	**HP Milling**	**MA**
Typical coil sizes [in. (mm)]		1.25, 1.5 (32, 38)	1.25, 1.5 (32, 38)	1.25 HP (32 HP)	1.5, 1.75 (38, 44)	1.25 HP (32 HP)	1.75, 2 (44, 51)
Fluid compatibility		Water, nitrogen, polymer gels, solvents, bleach, brine, surfactants					
Acid jetting capable		28% acid	28% acid	1% acid	---	---	28% acid
Maximum temperature		400°F (200°C)					
Design pressure (DP)		3000 psi	3000 psi	5000 psi	3000 psi	5000 psi	3000 psi
		20 MPa	20 MPa	35 MPa	20 MPa	35 MPa	20 MPa
Max. pressure (DP)		5000 psi	5000 psi	8500 psi	10000 psi	10000 psi	5000 psi
		35 MPa	35 MPa	60 MPa	70 MPa	70 MPa	35 MPa
Fluid flow rates (water) (varies depending on nozzle configuration)	bpm	0.6–1.5	0.7–1.1	0.6	0.8–1.2	0.9–1.0	1.5–2.0
	gpm	25–45	30–45	25	35–50	40–45	65–85
	lpm	95–240	115–165	95	125–190	145–165	240–320