

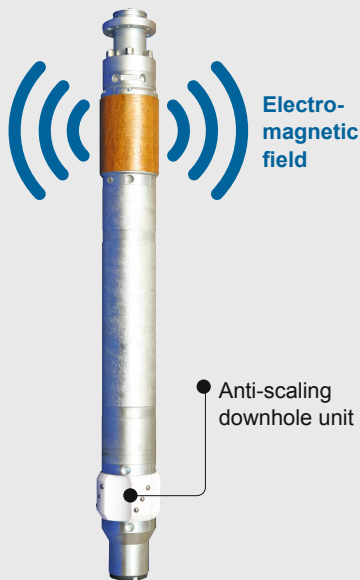
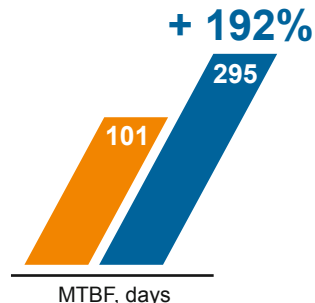
PILOT-1 Anti-Scaling System



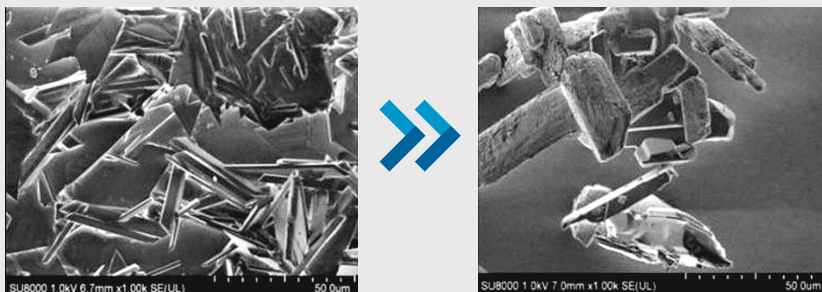
PILOT-1 is a patented system designed to reduce scaling on the outer and inner surfaces of downhole equipment and to achieve the highest efficiency of oil production.

Advantages

- Scaling reduction from bottom to wellhead
- Flow increase by on average of 20%
- MTBF increase by more than 2 times
- ESP protection over the whole run life



Electromagnetic field changes structure of salt crystals in fluid:



The emitter generates alternating electro-magnetic field which affects structure of salt crystals in fluid. As a result, salt is not deposited on metal surfaces of downhole equipment. The effect is observed along the whole length of the well.

The system prevents deposits of salts:

CaCO₃
Calcium carbonate

CaSO₄
Calcium sulfate

The effect is proved by laboratory and field tests



Without Pilot-1



With Pilot-1

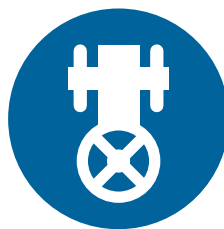
Implemented by



Schlumberger



Production since
2015



Over **500** units
in operation

Anti-scaling downhole unit



IN COLLABORATION WITH
PILOT
 group of companies

Anti-scale unit is connected through IRZ's downhole sensor (sensor is used to control and monitor the operation of Pilot-1) and is supplied along with the downhole sensor as an assembly unit. Sensor is connected to the bottom part of the Customers' motor with the help of a motor adapter (coupler) in a standard way to motor's Y-point.

The operation of anti-scaling downhole unit requires additional power and modification of a motor (extra winding in motor's stator).

Parameter	Value
Frequency of generated electromagnetic field (emitter)	50 .. 250 kHz ±10%
Supply voltage (powered by downhole sensor)	16..70 V @ 30 ..100 Hz
Maximum consumption current (emitter)	2.0 A
Overall dimensions	Ø 120 x 1865 mm
Weight	64 kg
Lifetime	2 years

Downhole sensor



The downhole sensor is designed to monitor the parameters of a well and motor, as well as to control and monitor the operation of the anti-scaling downhole unit of Pilot-1.

Parameter	Value	Note
Consumption current	less than 50 mA	
Overall dimensions	Ø 103 x 802 mm	
Weight	less 24 kg	
Housing material	Carbon steel with anti-corrosion coating	Optional: 13Cr stainless steel
Sealing	Rubber O-rings	
Connections:		
– with motor bottom	6-bolt flange	Standard coupler is for 456 or 540 motor series, customizable
– with motor Y-point	Connector	Requires assembly of the mated connector part to the Y-point cable
– with motor temperature measuring facility	Motor oil pin	Optional: thermocouple K-type (standard) or J-type

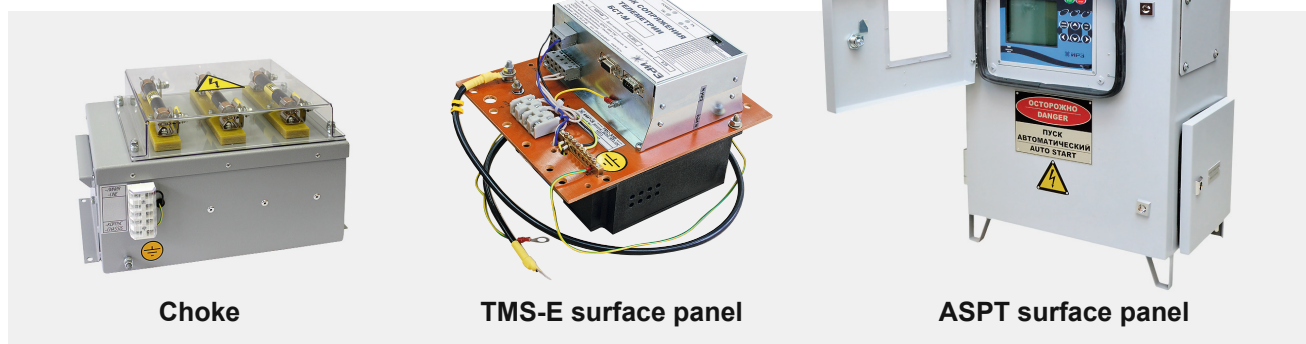
Monitored parameters	Value		
	Range	Resolution	Accuracy
Intake temperature	0-150 °C	0.01 °C	±1%
Motor oil / winding temperature	0-250 °C	0.01 °C	±2%
Intake pressure	5700 psi	0.1 psi	±0.5% FS (±0.25 - upon request)
Vibration (X, Y, Z)	0-5g	0.01g	±5%
Emitter current (anti-scaling downhole unit)	0-0.5 A	0.01	±2%
Emitter voltage (anti-scaling downhole unit)	0-100 V	0.01	±2%
Data link	Digital		



Operational limits

Parameter	Value
Reservoir fluid	Liquid-gas mixture consisting of oil, formation water, oilwell gas and mechanical admixture
Fluid density	700-1400 kg/m ³
Associated water hydrogen index	PH 4.0 - 8.5
Maximum concentration of aggressive components	H ₂ S – 0.01 g/l (0.001%) CO ₂ – 0.15 g/l Cl – 20 g/l HCO ₃ – 1 g/l Ca ₂ ⁺ – 2 g/l
Maximum mass concentration of solids (hardness not greater than 7 points according to Mohs' scale)	500 mg/l
Water cut	max 100%
GOR	max 80%
Maximum temperature of reservoir fluid	120 °C (248 °F)
Maximum hydrostatical pressure at the point of downhole unit setup	30 MPa (4703 psi)
Minimum ESP intake pressure relative to tubing annulus	+ 15 atm (+ 220 psi)
Maximum vibration	5g (50 m/s ²)
Weight of additional equipment to hang up below the anti-scaling unit	less than 1000 kg
Maximum depth	6000 m
Maximum diameter of the housing	124 mm
Motor operating voltage	1000 - 4000 V
Max. constant voltage at measurement of insulation resistance (including motor high-voltage bench testing)	500 V
Maximum voltage on step-up transformer tap to restart ESP in case it is stuck with change of rotation vs. nominal design voltage	as per nominal ESP technical conditions
Maximum number of restarts with rotation change in case of stuck ESP	as per nominal ESP technical conditions

Surface equipment



Contacts

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