



Resonant Undular Complex PILOT-1

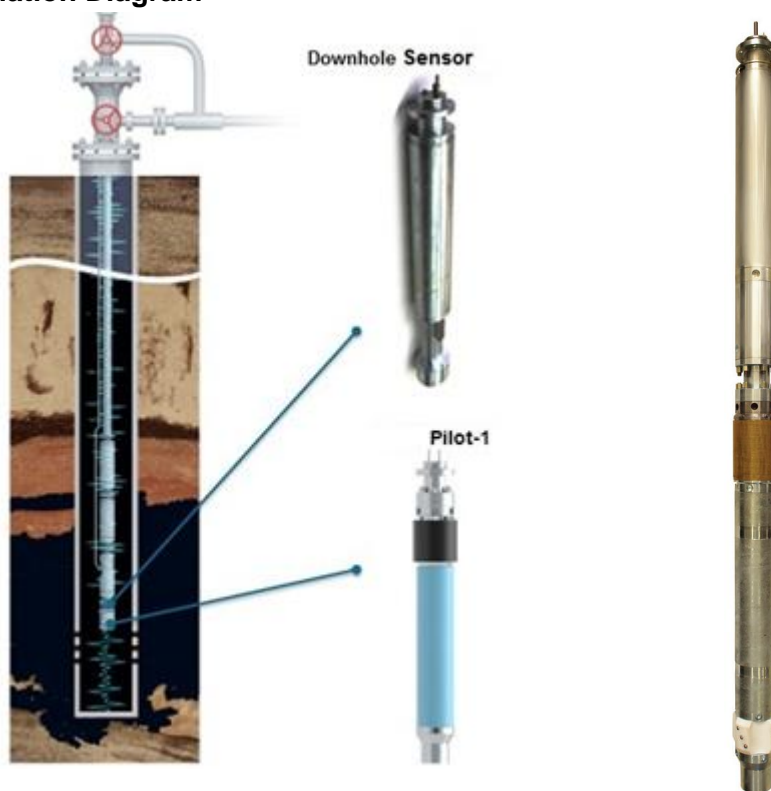
Main functions

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 the oil well.

Advantages

- Scaling reduction from bottom to wellhead
- Flow increase by on average of 20%
- Mean time between failures increased by a factor of more than 2 times
- Protection of electrical submersible pump unit over the whole run life
- Easy shipping and storage.

PILOT-1 Installation Diagram



PILOT-1 effect

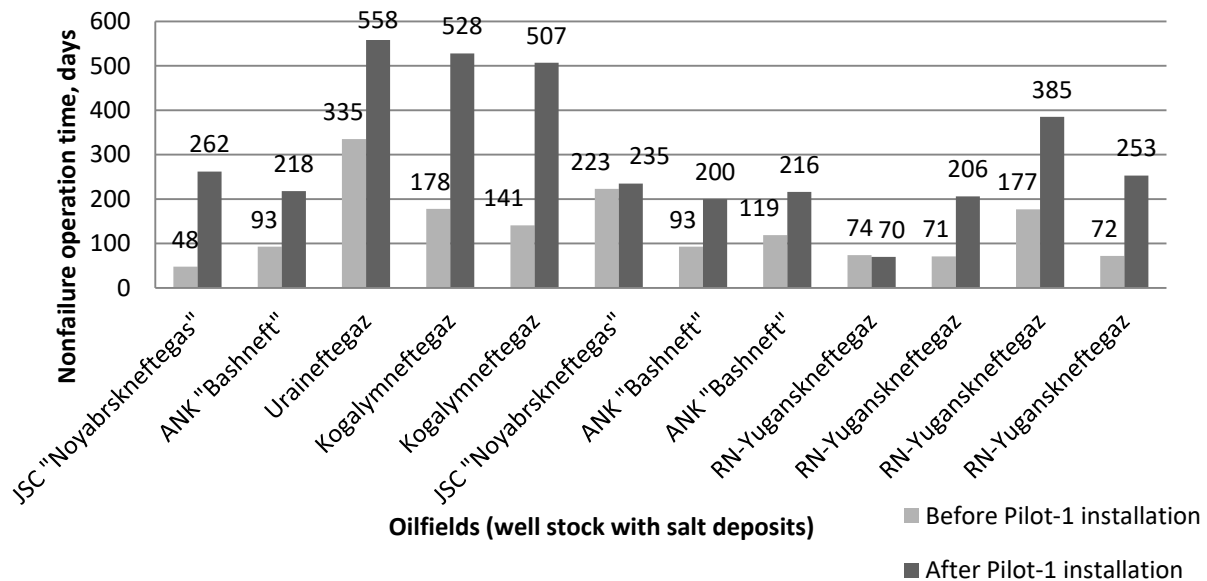
Before the installation of RUC "Pilot-1" in oil well



After the installation of RUC "Pilot-1" in oil well



Increase of Mean time between failures after Pilot-1 installation



Technical specification

No.	Parameter	Value
1	Characteristics of the reservoir fluid	
1.1	Reservoir fluid	Liquid-gas mixture consisting of oil, formation water, oilwell gas and mechanical admixture.
1.2	Liquid density, kg/m ³	700 - 1400
1.3	PH value of formation water	PH 4.0 - 8.5
1.4	Max water ratio in produced fluid, %	100
1.5	Maximum hydrostatic pressure at the point of downhole unit setup	Up to 30 MPa
1.6	Maximum length of the cable	3000 m
1.7	Maximum temperature of reservoir fluid, degrees C	120
2	System components	<ul style="list-style-type: none"> - Downhole electromagnetic unit - Downhole monitoring system with optional motor cross-over
3	Functional characteristics	
3.1		Prevention of scale formation on the outer and inner surfaces of downhole equipment (ESP, tubing, etc.) by the action of electromagnetic field that affects the emerging crystalline formations (inorganic salts) in the produced fluid. Action occurs along the entire wellbore - from the bottom hole to the wellhead.
3.2	Measured parameters	<p>The list of monitored parameters and monitoring specifications depend on the model of the downhole monitoring system used. Parameters of the downhole electromagnetic unit monitored by the system:</p> <ol style="list-style-type: none"> 1) Radiator current (A): 0...0,5 A 2) Radiator supply voltage (V): 0...100 V <p>Parameters monitoring error: +/- 2%</p>



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No.	Parameter	Value
		Monitoring resolution: 0,01
		All the parameters are measured and transmitted with the help of the downhole monitoring system while the motor is in operation. The surface read-out unit of the DH monitoring system transmits data from the downhole sensor to the controller of the motor drive using MODBUS protocol. Measured parameters can be transmitted by GSM modem (optionally).
3.3	Data link	Digital
3.3.1	Data link between surface and downhole units	PILOT-1 downhole unit is connected to the motor through the downhole sensor of the DH monitoring system. Data transmission is done through the zero point of the stator winding of the motor - motor stator winding - power cable - high-voltage winding of the transformer.
3.4	Operating voltage of Motor	From 1000 V to 4000 V
3.5	Power supply of the downhole electromagnetic unit	Supply voltage of the downhole unit is 16 ... 70 V. The downhole unit is powered by an additional stator winding of the motor (AC power sine wave with a frequency of 30 ... 100 Hz). Modification of the motor is required to ensure the connection.
3.6	Surface read-out unit	The surface read-out unit is to be installed in the VFD. Supply voltage of the surface read-out unit is 220 V \pm 15% Optionally, a stand-alone panel can be supplied (with display and data logging).
3.7	Current consumption of downhole unit	Maximum AC current is not more than 2 A.
3.8	Frequency of electromagnetic radiation	Frequency of electromagnetic radiation of the downhole unit is between 50 ... 250 kHz.
3.9	Motor cross-over (adapter)	Designed based on motor drawing
3.10	Resistance to interference	The system provides reliable data transmission from the well, regardless of the operating conditions and the completeness of surface electrical equipment. It overcomes voltage interferences with higher harmonic components, as well as insulation resistance drop in cable and Motor (up to 30 kOhm).
3.11	Overall dimensions of downhole electromagnetic unit	The maximum diameter of the housing is 124 mm
3.12	Housing design	The housing of the downhole electromagnetic unit has an internal thread, 60 mm pipe tubing (GOST 633) for mounting and retention of accessories with a weight of 500 kg.
2.18	Functional tests	Equipment is verified by a simulator to determine which part of the system (surface or downhole) is faulty while control station is in operation. The simulator is supplied for every 5 sets of Pilot-1, but not less than 1 per set.
2.19	Repairability	During the warranty period the system will be repaired the supplier.
2.20	Coating of housing and other outdoor elements	The outer surfaces are coated with paint which is resistant to mechanical stress and corrosive environments.
3	Reliability and effectiveness of equipment	
3.1	In case of failure of the system	PILOT-1 failure does not lead to the failure of ESP unit.
3.2	Warranty period	24 months from the date of shipment, 12 months from the date of putting into operation.
3.3	Effectiveness of the scale prevention	During the lifetime (2 years) the system prevents the outer and inner surfaces of the submersible equipment (ESP, tubing etc.) from scaling.



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3.4	Lifetime	2 years
4	Operational safety	
4.1	Design	The design conforms to the safety requirements of oil and gas industry in Russia.
5	Delivery set and engineering support	
5.1	Documentation and delivery set	<ul style="list-style-type: none"> - System - Operational documents - Simulation unit - Spare parts and accessories
5.2	Engineering support	Training of customer personnel, adjustment of the system at the service base, connection of the system with Motor, periodic monitoring of operation mode, maintenance during the warranty period.

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