



PRODUCTION

WellPilot® Flow Control Technology

Optimizing production and extending pump life under dynamic conditions



Weatherford®

In continually changing conditions, can your PCP go with the flow?

When you use a progressing cavity pump (PCP) to enhance recovery, changes in well conditions can do worse than hinder production—they can wreak havoc on the pump. So for steady and reliable performance, it's essential that you properly monitor and regulate the pump speed. Pump too fast, and you risk outpacing well inflow, which can lead to pump off and consequential pump failure. On the other hand, if you pump more slowly to avoid pump off, you can reduce production to levels far below the well's potential. WellPilot® flow control technology (FCT) eliminates the guesswork and optimizes PCP performance.

Introducing the next generation of automated pump control.

Used in conjunction with a variable-speed controller, the Weatherford WellPilot FCT continuously fine-tunes pump speed to achieve optimal production and protect the system against flow losses. It's a versatile, affordable, and effective solution. And it's only from Weatherford.

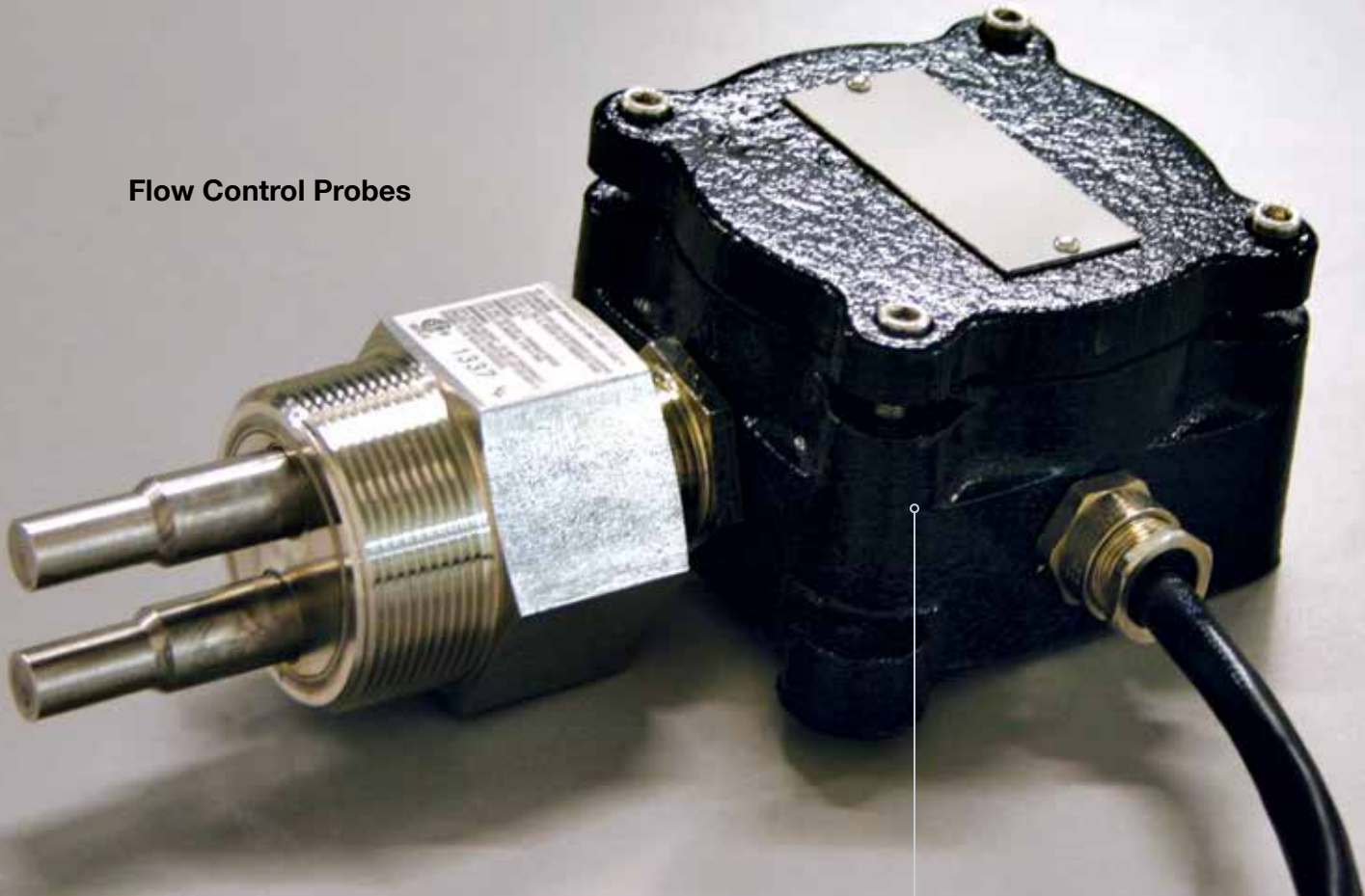
Exclusive technology gives you the power to fine-tune your PCP.

The WellPilot FCT has no moving parts. Based on the principle of thermal cooling, our proprietary system uses two stainless-steel probes to determine changes in flow rate. One probe generates heat and detects heat absorption, while the other is unheated and acts as a high-precision thermometer. The probes alternate roles periodically, switching between heated and unheated functions, to deter scale and paraffin buildup.

To determine flow rates, the heated probe detects how much heat is being absorbed by the passing fluid. The higher the flow, the more heat is absorbed, which creates a greater cooling effect. The unheated probe helps fine-tune the flow detection by reading the fluid's ambient, in-motion temperature. Using a patented Weatherford algorithm, the controller continually analyzes changes in temperature readings from the probes. Based on this information, it automatically signals the variable-speed drive to adjust pump speed in relation to the production capabilities of the well.

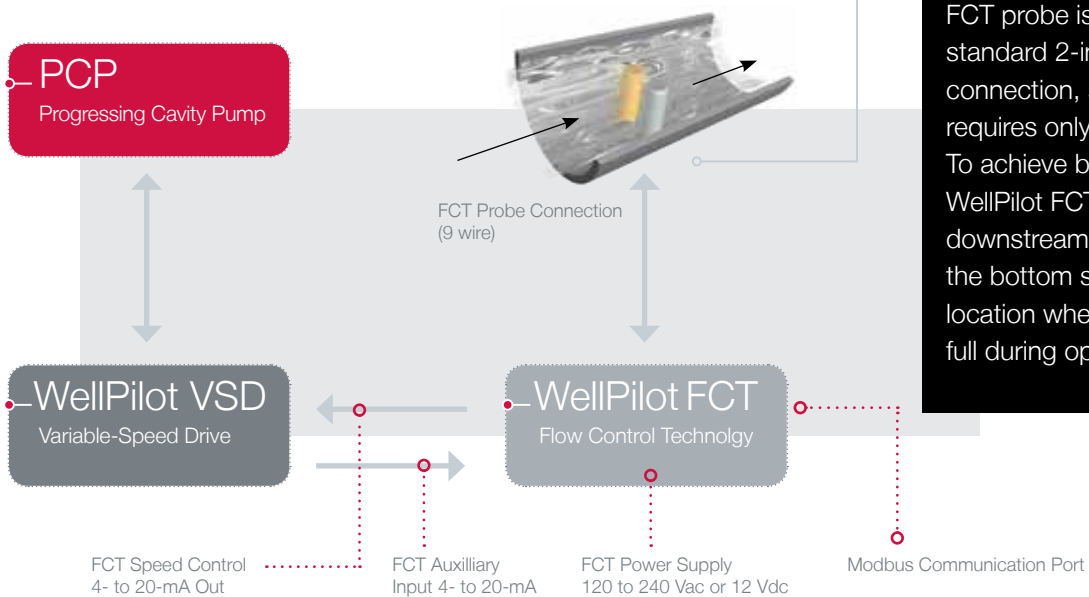
Plus, because gas absorbs heat at a much lower rate than oil or water, the WellPilot FCT can easily identify gas in the flow line and make automatic adjustments to avoid a pumpoff condition. This provides the kind of added assurance that you just can't get from conventional flow-measurement devices.

Flow Control Probes



Quick and easy installation. Long-lasting benefits.

FCT/PCP Control Interface



The easy-to-install WellPilot FCT probe is fitted into a standard 2-in. threaded connection, so plumbing requires only a pipe wrench. To achieve best results, the WellPilot FCT unit is installed downstream of the wellhead, on the bottom side of the pipe, in a location where the pipe will be full during operation.

Precise, auto-adjusting flow control to maximize your production.

The WellPilot FCT is an autocalibrating instrument. Once installed and powered on, it begins controlling the well immediately. The objective is to always operate the pump at the lowest speed required to deliver maximum production from a well. To find this speed, the WellPilot FCT follows a patented process called “climb and double-back.” This process achieves optimal control and reliability for your PCP.



Climb and double-back process optimizes pump speed and flow rate.

To help get fluid to the surface faster, you can configure the WellPilot FCT to start at a higher speed when it is powered on or reset—and then to maintain that speed for a predetermined amount of time. After that time has elapsed, or once fluid has been detected at the surface, the system automatically begins to build a progressive pump speed/measured temperature table, starting at your preset minimum speed. This table is visible on the FCT controller display.

If an increase in pump speed causes the flow rate to decline, or if the flow rate remains unchanged as a result of a speed increase, WellPilot FCT automatically compensates. It doubles back, searching through its progressive table of climbing speeds and corresponding flow rates, comparing the current flow rate to those observed at lower speeds. It then starts the climbing process again, selecting the lowest recorded speed that resulted in a flow rate at or above the current production rate of the well. In this way, the controller uses temperature values to determine the control action that will best optimize the well.

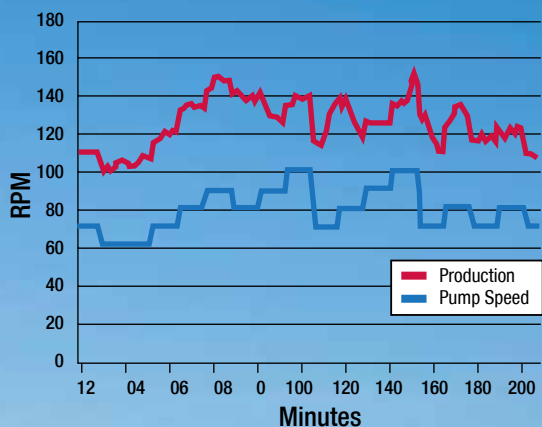
Climb and Double-Back Table

Example of Typical Operation

Climb	Pump RPM	Temperature	
	100	73°F (23°C)	
	119	72°F (22°C)	
	↓	↓	
	↓	↓	
	400	64°F (18°C)	
			Double-Back

The table above shows an example of how the WellPilot FCT tracks changes in pump speed against changes in the measured temperature. A lower temperature reading indicates a higher cooling effect at the heated probe, which means an increased flow rate.

Typical WellPilot FCT Control



The example above illustrates how the WellPilot FCT adjusts pump speed in response to changes in production flow rate. The system automatically determines the lowest speed necessary to maintain the maximum available flow rate.

Calibrates Automatically

The WellPilot FCT calibrates itself automatically to well performance and controls the pump at the lowest speed required to capture maximum available production. As well conditions change, it responds quickly by adjusting speed to the optimum value to minimize shutdowns and maximize production. Continuous flow at a constant rate reduces sanding problems—and it also decreases the need for paraffin removal, reduces cold oil start-up problems, and reduces the need for other downhole workover operations. For optimum control, the build table is automatically reset and rebuilt according to your preset intervals.

Optimizes Production

Traditional PCP systems make no allowances for changes in fluid production, but WellPilot FCT automatically adjusts pump speed to accommodate production changes. This helps maintain minimum fluid level and continuous flow through the pump—to maximize production and minimize the possibility of damage to the pumping system.

Compatible With Modbus TCP/IP/RTU

For remote communication, the WellPilot FCT contains both Modbus RTU and Modbus TCP/IP interfaces.

Fights Scale Buildup

Both WellPilot FCT probes contain heating coils; however, only one is turned on at a time. Periodically, the roles of the two probes are reversed, so that the ambient probe assumes the role of heated probe and vice versa. This minimizes the buildup of wax and other residue on the surface of the probes—issues that, with conventional metering systems, can cause inaccurate flow measurements and require frequent cleaning and recalibration.

Provides Complete Pump Protection

When integrated with the WellPilot VSD, the WellPilot FCT delivers a complete set of available safety options to protect the pump in response to well-related problems such as sanding, well pump off, gas slugs, and other problems. The pump can be stopped for conditions such as production loss and over-torque. Pump restart can be restricted to an operator (manual restart only) or fully automatic (based on a preset timer).

Advantages

Features

- Integrated WellPilot VSD for PCP (optional)
- Multiple parameter views on single screen
- Historical data
 - Torque, speed, and flow-rate graphs
 - Data logger (internal and external points)
 - Alarms and faults
 - VSD information (Modbus connection required)
- Menu-driven setup screens
- Flowmeter input (4 to 20 mA)
- Control for hydraulically driven PCPs (optional hardware required)

Minimum and Maximum Flow Rates Using Thermal Probe

The WellPilot FCT offers a wide range of operations, with a maximum fluid temperature of 302°F (150°C).

Approximate fluid rates

Flowline Size (sch40) ID	1 in.	1 1/2 in.	2 in.	2 1/2 in.	3 in.
Minimum flow rate at 1 cm/sec – full pipe only	3 BPD (0.5 m³/d)	7 BPD (1.1 m³/d)	12 BPD (1.9 m³/d)	22 BPD (3.6 m³/d)	26 BPD (4.1 m³/d)
Maximum flow rate at 75 cm/sec – full pipe only	230 BPD (36 m³/d)	530 BPD (85 m³/d)	880 BPD (140 m³/d)	1,260 BPD (200 m³/d)	1,950 BPD (310 m³/d)

Specifications

Power.....	120 to 240 Vac or 12 Vdc input
Probe dimensions, 2-in. thread, hexagonal base	2.50 × 1.50 in. (6.35 × 3.81 cm)
Probe (tip) length above thread.....	1.57 in. (4.00 cm)
NEMA 4.....	Double-panel steel enclosure
Enclosure dimensions.....	17.72 × 11.81 × 5.91 in. (45 × 30 × 15 cm)
Display	Enhanced graphical display with backlight and heater; integrated keypad
Environmental operating range	-40 to 185°F (-40 to 85°C)
Input signal.....	4 to 20 mA
Output (speed) signal.....	4 to 20 mA
Modbus TCP/IP/RTU compatible	Yes
Modbus scanning for external devices.....	Yes
Inlet fuse protection	Yes



For more information on how Weatherford FCT technology reduces lifting costs and helps to maximize gas production in your wells, please contact your authorized Weatherford representative or visit us online at **weatherford.com**.



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