

Rotaflex® Long-Stroke Pumping Unit

Provides efficient pumping in deep, troublesome, and high-volume wells

Applications

- High-volume and high-load wells
- Deviated and horizontal wells prone to sucker rod and tubing failure
- Heavy oil or high gas-to-liquid (GLR) wells
- Alternative to electric submersible pump (ESP) systems

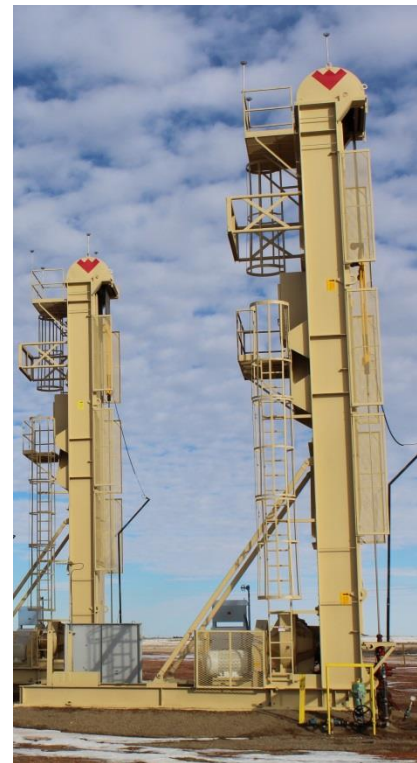
Features and Benefits

- Delivers up to a 366-in. (9.3-m) stroke with virtually no minimum speed.
- Reduces energy costs by 30 to 50% compared to ESP systems and 15 to 30% compared to conventional pumping units by means of an ultra-long stroke length and simple mechanical design.
- Requires fewer strokes per barrel of production, which increases equipment life span.
- Provides more efficient pump fillage, decreases stress loading, and reduces range-of-load on the sucker rod string.
- Installs quickly: Units arrives 90% pre-assembled and factory tested.
- Reduces gas-locking with increased pump compression ratios that are delivered by longer surface and downhole strokes.
- Reduces torque requirements and allows the use of a smaller prime mover and gear reducer through use of a short-radius torque arm.
- Includes a heavy-duty load belt that links the power train to the rod string, acts as a shock absorber, and reduces equipment stress.

Tool Description

The Weatherford Rotaflex long-stroke pumping unit delivers a long stroke—288-in. (7.3-m), 306-in. (7.8-m), or 366-in. (9.3-m)—with virtually no minimum speed for efficient pumping in deep, troublesome, and high-volume wells. The Rotaflex unit provides more complete pump fillage, lower dynamic loading, and an efficient design that reduces energy costs by 15 to 30% when compared to conventional pumping units. It requires fewer strokes per barrel produced and further reduces stress on equipment by operating at a constant polished-rod velocity.

Designed for use in a wide range of applications—including wells that previously required a costly ESP system—the Rotaflex unit offers safe and simple operation and maintenance. Optioned appropriately, the unit can roll away from the wellhead without the need for disassembly once the bridle and carrier bars are disconnected from the polished rod. When the workover is completed, the unit rolls back into place for reconnecting the carrier bar to the polished rod.



The Rotaflex unit requires fewer strokes per barrel produced when compared to standard pumping units, and it reduces stress on equipment by operating at a constant velocity.



Rotaflex® Long-Stroke Pumping Unit

Options

- Units available that meet Class 1, Division 2, intrinsically safe, and Canadian Standards Association (CSA) requirements
- Weatherford hydraulically powered Rotaflex rollback system for moving and repositioning the Rotaflex longstroke pumping unit when a workover is required. The system is available for new installations of Rotaflex long-stroke pumping units and can also be retrofitted to previously installed pumping units.
- Gas-engine extensions
- Wire-mesh safety fences
- LOWIS® well-management software
- WellPilot® variable-speed drive (VSD) for a variation of speed through the stroke cycle.

Specifications

Parameters	Model			
	900	1100	1150	1155
Reducer torque	320,000 in./lb (36.16 kN/m)	320,000 in./lb (36.16 kN/m)	320,000 in./lb (36.16 kN/m)	500,000 in./lb (46.49 kN/m)
Stroke length	288 in. (7.31 m)	306 in. (7.77 m)	366 in. (9.3 m)	366 in. (9.3 m)
Maximum polished-rod load	36,000 lb (16,329 kg)	50,000 lb (22,679 kg)	50,000 lb (22,679 kg)	50,000 lb (22,679 kg)
Sprocket diameter	33.547 in. (0.86 m)	33.547 in. (0.86 m)	33.547 in. (0.86 m)	36.720 in. (0.94 m)
Maximum strokes/min (SPM) ^A	4.50	4.30	3.64	3.75
Race track overall SPM	5.6	5.4	4.6	4.7
Peak straight-way SPM	6.24	5.96	5.05	5.20
Minimum SPM ^B	No absolute minimum for short-term operation			
Counterweight assembly	9,400 lb (4,263 kg)	9,800 lb (4,445 kg)	9,800 lb (4,445 kg)	9,800 lb (4,445 kg)
Counterweight	21,980 lb (9,969 kg)	30,200 lb (13,698 kg)	30,200 lb (13,698 kg)	30,200 lb (13,698 kg)
Total counterweight	31,380 lb (14,233 kg)	40,000 lb (18,143 kg)	40,000 lb (18,143 kg)	40,000 lb (18,143 kg)
Load belt width	42 in. (1.06 m)	50 in. (1.27 m)	50 in. (1.27 m)	50 in. (1.27 m)
Load belt length	32.5 ft (9.91 m)	33.83 ft (10.3 m)	33.83 ft (10.3 m)	33.83 ft (10.3 m)
Load belt tensile strength	10,000 per-inch width (PIW)			
Installed dimensions ^C	21.6 × 10.3 × 40.5 ft (6.6 × 3.1 × 12.3 m)	23.6 × 11.3 × 44.3 ft (7.2 × 3.4 × 13.5 m)	23.6 × 11.3 × 49.3 (7.2 × 3.4 × 13.5 m)	23.6 × 12.3 × 49.3 (7.2 × 3.4 × 13.5 m)
Shipping dimensions	40.5 × 7.4 × 9.2 ft (12.3 × 2.3 × 2.8 m)	44.3 × 8.3 × 10.2 ft (13.5 × 2.5 × 3.1 m)	49.3 × 8.3 × 10.2 ft (15.0 × 2.5 × 3.1 m)	49.3 × 8.5 × 10.2 ft (15.0 × 2.6 × 3.1 m)
Shipping weight	42,900 lb (19,459 kg)	52,300 lb (23,722 kg)	53,880 lb (24,439 kg)	59,900 lb (27,170 kg)
Base weight	29,000 lb (13,154 kg)			
Base size	24 × 8.5 ft (7.3 × 2.6 m)			
Working ambient temperature ^D	32 to +140°F (0°C to +59°C)			
Automatic braking system	Yes			

^ARefer to section 10.3 of the operating manual (Rotaflex Racetrack Parameters) for details on operating in "Race Track Mode" with a VSD.

^BAt SPMs less than 0.8 SPM, the oiling system may not adequately lubricate the chain. SPMs of less than 0.5 SPM are not recommended when paired with a WellPilot VSD or similar system.

^CThese dimensions exclude the front platform, motor guard, and any other field attachments. The length is measured at the base.

^DThis is the standard unit rating and applicable when the correct fluids have been added to the appropriate components.





Rotaflex® Rollback System

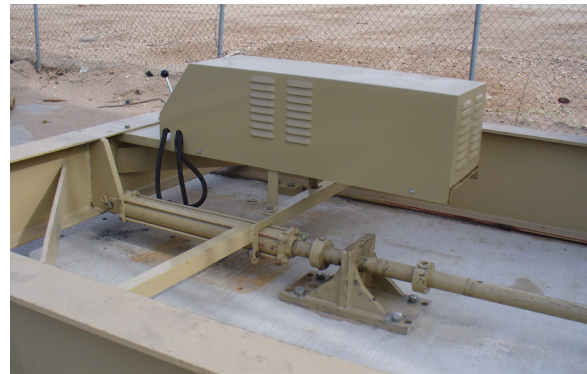
Weatherford's *Rotaflex* rollback system is a self-contained, hydraulically powered system that moves and repositions the *Rotaflex* long-stroke pumping unit before and after workover operations.

Use of the rollback system is safer, easier, and more economical than commonly used methods. The system allows one operator and an assistant to move a *Rotaflex* pumping unit the specified distance of 10 ft (3 m) in less than twenty minutes, whereas other current methods require a two- or three-person crew with additional equipment.

The rollback system operator must maintain positive (touch) control of a single lever for the pumping unit to move. The system can move the pumping unit in 20-in. (0.5-m) increments up to the maximum of 10 ft.

Applications

- Workovers of wells in which new *Rotaflex* pumping units will be installed (available as optional equipment)
- Workovers of wells in which models 900, 1100, and 1150 *Rotaflex* pumping units are already installed (can be retrofitted for all models)



Self-contained rollback system installed in *Rotaflex* infrastructure.



Operations stop when lever is released to ensure crew safety.



Alignment marking ensures proper positioning when the *Rotaflex* unit is moved to the operating or rolled-back position.



Rotaflex® Rollback System

Features, Advantages and Benefits

- The self-contained rollback system eliminates the need to transport additional equipment and personnel to the site to move and reposition the *Rotaflex* pumping unit, thereby eliminating nonproductive travel time and costs.
- The rollback system hydraulic mechanism moves the *Rotaflex* pumping unit in less time and with fewer personnel than manual methods.
- The system features a lever that requires positive control by the operator for the *Rotaflex* pumping unit to move. This feature allows a single operator to always be in control of the pumping unit, enhancing operational safety.
- Compatibility with all *Rotaflex* pumping unit models facilitates retrofitting of the rollback system to previously installed pumping units.

Related Products

- *Rotaflex* long-stroke pumping units



Weatherford®

REAL RESULTS

Custom-Designed Rod Pump with Rotaflex® Pumping Unit to Convert Well from Producer to Steam Injector

Objectives

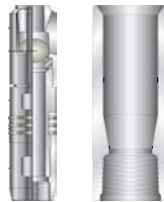
- Convert an onshore well from producer to steam injector without the need for a workover rig.
- Provide an alternative artificial-lift method to produce or inject wells in ultra-heavy oil fields to enhance recovery during steam injection and production phases.

Results

- Weatherford deployed a heavy-oil designed downhole rod pump (Model 30-275-THM-30-2-2-2) with a modified bottom-seating nipple along with a *Rotaflex* long-stroke pumping unit.
- The downhole seat nipple was modified to allow for a wireline to pass, eliminating the need to pull the completion string. This enabled a wireline tool to be run-in in preparation for steam injection.
- Wellhead temperature and flow was increased from 93.2°F (34°C) at 100 bbl/d before conversion to steaming to 356°F (180°C) at 1,000 bbl/d after the conversion.

Value to Client

- Weatherford's rod pump and *Rotaflex* unit were combined to effectively reduce operating costs by converting the well from producer to steam injector without the use of a workover rig.
- The *Rotaflex* unit's unique downhole pump and modified bottom-seating nipple enabled production in both cold and hot oil regimes and provided the operator with a wide range of production rates (100 to 1,000 bbl/d) without altering the well completion.



The illustration shows a Weatherford heavy-oil pump and a modified nipple ready to accept a wireline tool without pulling production tubing.



The well is pumping 1,013 bbl/d of extra-heavy oil using Weatherford's *Rotaflex* pumping unit.

Location

Latin America

Well Type

Onshore producer/steam injector

Casing Size

7 in., 26 lb/ft

Tubing Size and Type

3 1/2-in., 20.62-lb/ft thermal

Casing Size and Type

13 3/8-in., 68 lb/ft, L-80 BTC with torque rings

Pump Depth (Average)

2,624 ft (800 m) total vertical depth (TVD)

API Gravity

8.6°

Oil Viscosity

113°F (45°C), 8,445 cP

Products/Services

- *Rotaflex* long-stroke pumping unit
- Model 30-275-THM-30-2-2-2 rod pump

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REAL RESULTS

Rotaflex® Long-Stroke Pumping Unit Achieves Run Life Almost Three Times Historical Average

Objectives

- Extend the run life while maintaining the same production level in a well plagued with valve malfunctions due to the rod pump working on a deviated zone. The average run life for the well was 178 days.

Results

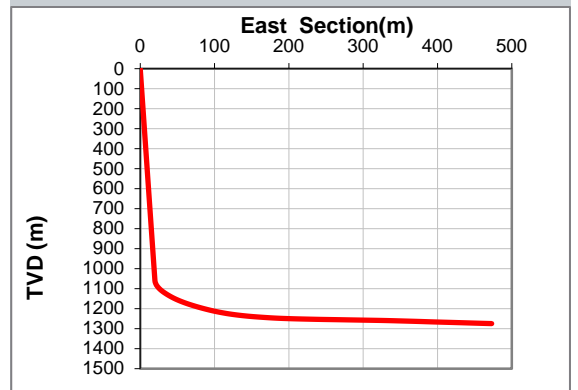
- Weatherford installed a Rotaflex 900 long-stroke pumping unit to reduce the pumping speed, friction loads, and mechanical wear of the sucker-rod string and rod pump. To further reduce friction loads allocated in the deviated zone, a 2 7/8-in. tubing with Policore® 2-in. internal diameter (ID) internal coating was used.
- To achieve the target production of 250 BFPD (39.75 m³/d) with minimum friction, Weatherford personnel installed a special tubing pump that consisted of the following:
 - Special standing and traveling valve cage for deviated wells
 - Plunger, spray metal, 4-ft with a 0.003 in. clearance
 - Connector, on-off AT-90
 - Special upper connector to 2 7/8-in. - 8RD pipe
- The pump was positioned at 4,180 ft (1274 m) total vertical depth (TVD) and 5,325 ft (1623 m) total measured depth (TMD).

Value to Client

- The installation of Weatherford's Rotaflex unit achieved a run life of 519 days, a 213-day increase over the previous rod pump and 341 days more than the well's average run life at the same production level of 250 BFPD.
- Due to the extended run life, the client saved US\$150,000 in pulling savings, three pulls less than the run life average of 178 days.



Weatherford's unique-designed Rotaflex long stroke pumping units feature a stroke length of up to 25.5 ft (7.8 m) and an innovative 100%-mechanical reversing-mechanism design.



The table above illustrates the deviation survey for this well.

Extraction Date	Installation Date	Run Life (days)
January 14, 2012	August 13, 2010	519
August 13, 2010	October 11, 2009	306
October 11, 2009	September 14, 2009	27
September 14, 2009	December 20, 2008	268
December 20, 2008	July 11, 2008	162
July 11, 2008	March 11, 2008	122
March 11, 2008	September 7, 2007	186

The table shows the run life history of the well. The average run life for the well is 178 days.

Location
Argentina

Well Type
Onshore, horizontal oil

Pump Depths

- 4,180 ft (1274 m) TVD
- 5,325 ft (1623 m) TMD

Products/Services
Rotaflex 900 long-stroke pump unit

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REAL RESULTS

Rotaflex® Long-Stroke Pumping Unit Increased Oil Production by 126% in High Water-Cut Areas

Objectives

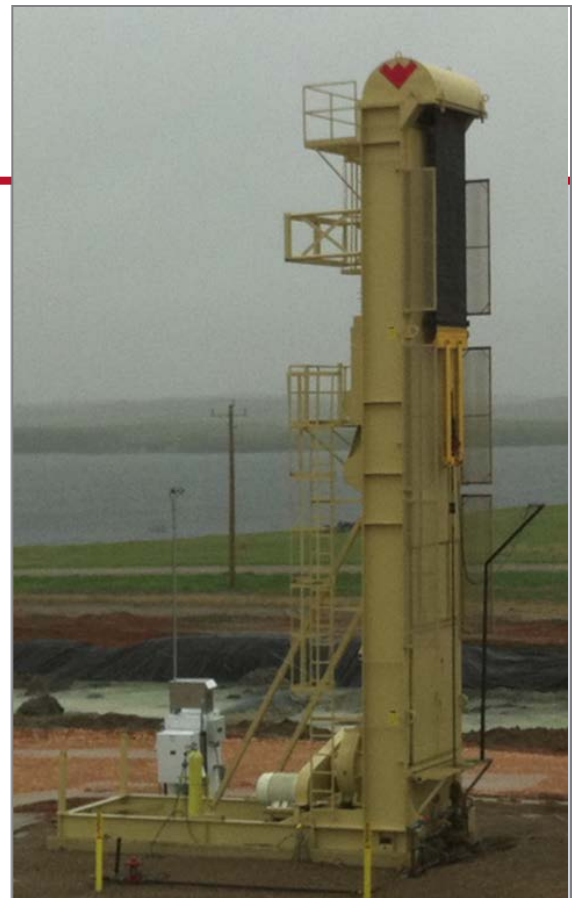
- Identify and design optimal rod lift for area with high water cut of from 27% to 68%.
- Conventional-geometry pumping units are the standard for the area.

Our Approach

- Weatherford first installed conventional pumping units with taper rod strings, guided K sinker bars, and an AJAX single-cylinder gas-engine prime mover for 7 wells. These wells were evaluated over time with the use of dynamometer analysis and inflow performance relationships. The average oil recovery per well was 43,699 bbl after 6 months, 72,404 bbl after 12 months, and 93,220 bbl after 18 months. A total of 10 rod lift failures occurred with an average of 0.391 failures per well each year.
- When co-op electricity and natural gas generators later became available, Weatherford installed Rotaflex® long-stroke pumping units with 100-hp electric prime movers with variable-speed drives (VSDs) and rod-pump controllers for 27 wells. The average oil recovery per well was 59,163 bbl after 6 months, 97,670 bbl after 12 months, and 127,950 bbl after 18 months. A total of 9 rod lift failures occurred with an average of 0.125 failures per well each year.
- Analysis of the two tested forms of rod lift proved that the Rotaflex long-stroke pumping unit provided higher oil recovery than the conventional pumping units: 35.4% more after 6 months, 34.9% after 12 months, and 37.3% more after 18 months.
- Compared to the average oil recovery of other wells in the area using the conventional-geometry pumping units, the wells equipped with the Rotaflex units produced 126% more oil and 68% more fluid over 2 years.

Value to Client

- The use of Weatherford Rotaflex long-stroke pumping units increased run times, reduced workover expenses, and increased oil production. The optimal rod lift design allowed the client to continue production in these high water cut areas that otherwise would have been uneconomical.
- With the success of the first 32 wells, the client plans to expand the use of the Rotaflex units to 271 additional wells in the area.



The Rotaflex long-stroke pumping unit increased oil production in historically costly, high water-cut environments.

Location
North Dakota

Well Type
Onshore oil

Number of Wells
34

Water-Cut Range
27% to 68%

True Vertical Depth
7,800 to 8,800 ft (2,377 to 2,682 m)

Products/Services

- Conventional pumping units
- Rotaflex long-stroke pumping units
- Prime movers
- VSDs and rod pump controllers

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