BLACKHAWK TECHNOLOGY COMPANY

Top-Head Drive Piston Pumps

Pump Any Fluid

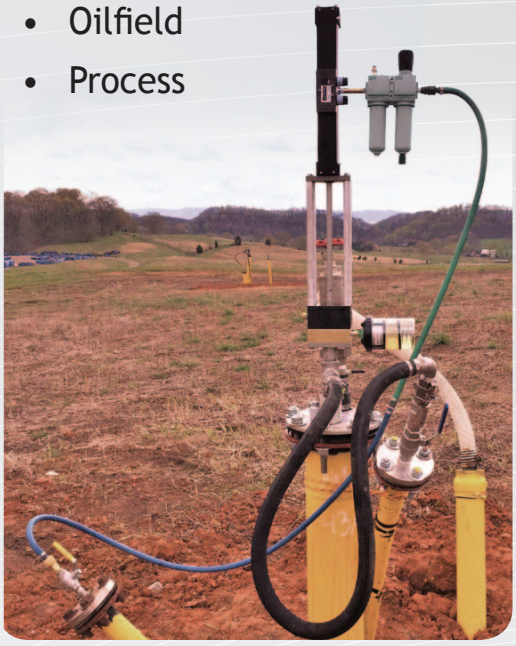
- Remediation
- Leachate
- Compliance
- Landfill Gas
- Chem Aggressive
- Hot-Corrosive
- Offshore
- Oilfield
- Process

Electric

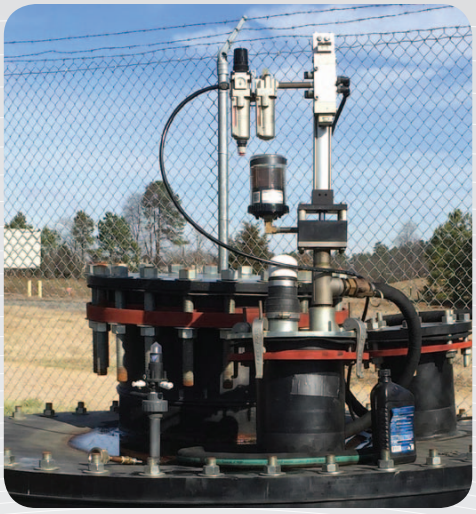
Offshore Pneumatic

Solar

Heavy-duty Pneumatic



Hi-temp Pneumatic



Economical Pneumatic

Electric Oil Field

New Technologies in Fluid Management

BLACKHAWK TECHNOLOGY COMPANY

800.469.4887

blackhawkco.com

Why Blackhawk?

Blackhawk is the originator and No.1 producer of top-head-drive, positive-displacement piston pumps for low-flow applications. Electric, solar and pneumatic models are in service worldwide.

Ruggedness & Reliability

- All-weather drivers
- Toughest downhole components
- Depths to 800 feet / 240 meters
- Operator-set controls & meters

Cost Effectiveness

- Low maintenance, longer intervals
- Quick servicing
- Simple installation
- Refurbishment program; lease program

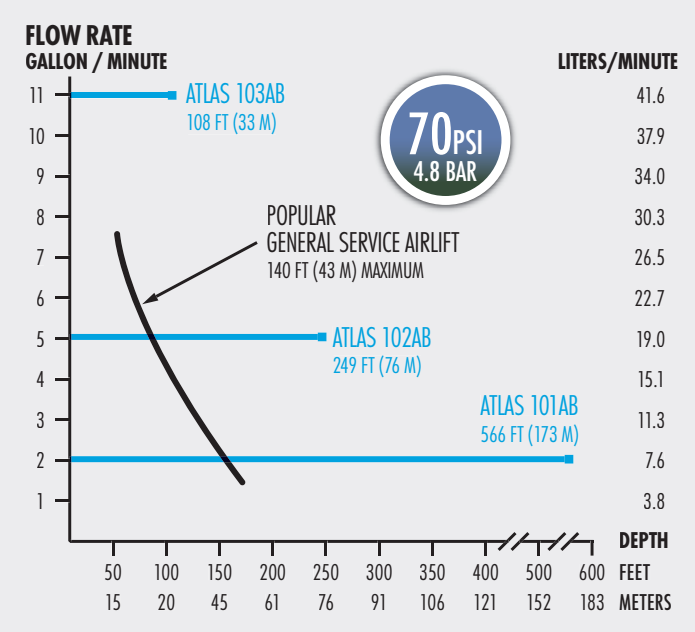
Adaptability

- Pump at any angle to horizontal
- Choose materials of construction
- Customize component configurations
- Fits well casings from 2 to 8 inches

Safety

- All service outside well, sump or pipe
- No worker contact with liquid
- No power in well
- Explosion-proof option

Steady Flows - No Pump Curve



Easy to install; onsite assistance (Shown: Apollo Solar)

Pump controls customizable to application (Shown: Anchor Electric)

Accessories for general or special service (Shown: Edge Pneumatic)

Three Pump-Driver Technologies

Electric

Blackhawk's Anchor Electric Piston Pump® is a broad-duty model driven by a ball-screw actuator utilizing incoming single or 3-phase 120v, 240v or 480v AC current with an explosion-proof option.

Designed for depths to 800 ft/240 m and flows to 6.7 gpm/25.3 lpm, applications include:

- Hydrocarbon remediation
- Sinking-product recovery
- Chemical
- Landfill leachate
- Condensate sump
- Oilfield -- Rhino MiniJack

Solar

The economical Apollo Solar Piston Pump™ is driven by a linear-rod motor powered by one or more solar panels, successfully operating in latitudes as northerly as Toronto, even in winter.

Designed for depths to 400 ft/122 m and flows to 2.7 gpm/10.2 lpm, applications include:

- Landfill gas dewatering
- Remote, closed sites
- Groundwater remediation
- Landfill leachate
- Process

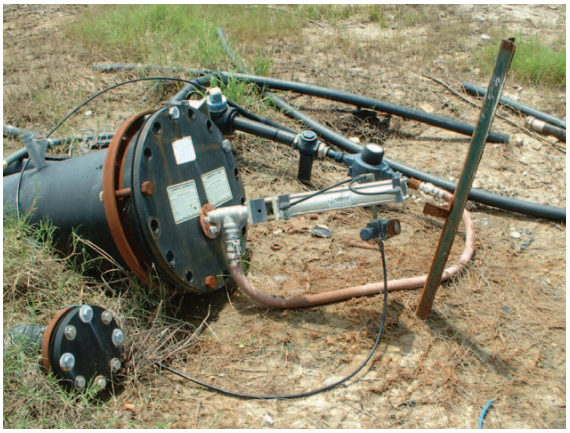
Pneumatic

Blackhawk's three models of land-based pneumatics offer many choices for force and application requirements using closed-system, above-grade drivers — no compressed air enters the well.

Designed for depths 800 ft/240 m and flows to 11 gpm/41.6 lpm, applications include:

- Chemically agressive, hot
- Sinking-product recovery
- Floating product remediation
- Landfill leachate and methane
- Deep, angled wells
- Crusty, bio-reactive, foamy
- Process
- Everyday pumping

Atlas Pneumatic



V-2 Pneumatic

Edge Pneumatic

Land-Based Models

Offshore Model

Neptune Pneumatic

The Neptune Offshore Pneumatic Caisson Sump Piston Pump™ is a high-performance pump jack designed to remove hot, viscous, oily liquids from aggressive saltwater environments.

The lightweight Neptune driver is mounted over the caisson and built of high-grade stainless steel for greater efficiency and superior wear resistance. It draws product from operator-set depth at adjustable flow rates.

Designed for depths to 800 ft/240 m and flows to 11.5 gpm/43.5 lpm, advantages include:

- Unaffected by chemical composition
- Fits into enclosed vault
- All weather
- No pneumatic air in sump
- Safe, easy access above sump
- Reduced bio buildup, encrustation
- Shutdown does not damage driver
- Clean air discharge

Rhino MiniJack™ Oilfield Piston Pump

Blackhawk's innovative Rhino MiniJack™ Piston Oil Pump miniaturizes the century-old oilfield pump jack to recover oil economically from low-flow stripper wells, bringing up more oil and less water through micropumping.

At less than half the price of a pump jack, the 125-pound Rhino MiniJack's top-head-drive motor is mounted at surface grade on a standard wellhead. Power is direct from grade through the sucker-rod assembly. The quiet, low-profile MiniJack reliably recovers up to 15 bbl/day at 1,500 feet. Operating costs and maintenance requirements are low, and the pump operates in extreme environments.

The MiniJack can be tuned to the yield of formation, not overpumping, to reduce water intake, gas lock and emulsification. It can be made explosion proof, meeting Class 2, Div. 1 requirements.

Rhino Electric MiniJack, pumping a stripper oil well

Vector® Positive-Displacement Process Pumps

The versatile, durable Vector® Positive-Displacement Process Pump family provides advanced-technology fluid management for a range of process applications including abrasive, corrosive, salty, high or low pH, viscous, sludge, slurries and semi-solids, toxic, foamy and bio-reactive, potentially explosive.

Vectors are reciprocating-action piston pumps with a gentle, low-flow operation that reliably transfers virtually any liquid or semi-sold regardless of angle or environments. Vectors can pump against heads to 800 feet/244 meters at pressures to 50 psig/3.4 bar and temperatures to 300 F°/150C°. Flows to 11 gpm/41.6 lpm remain constant regardless of head or length of travel.

Highly customizable to meet individual application requirements, Vectors are offered in three size options and Blackhawk's three power sources -- electric, pneumatic and solar.

Piston Pump Downhole

Standard specifications for Blackhawk pumps include high-grade materials. If the application is not standard, we work with customers to make appropriate choices.

Well Seals

- 6, 8, 10 12 inches
- Gas seals - 6, 8 inches
- Zinc-coated steel flanged

Drive Rod

- High-strength fiberglass
- High-temperature Green
- Steel

Drive Piston

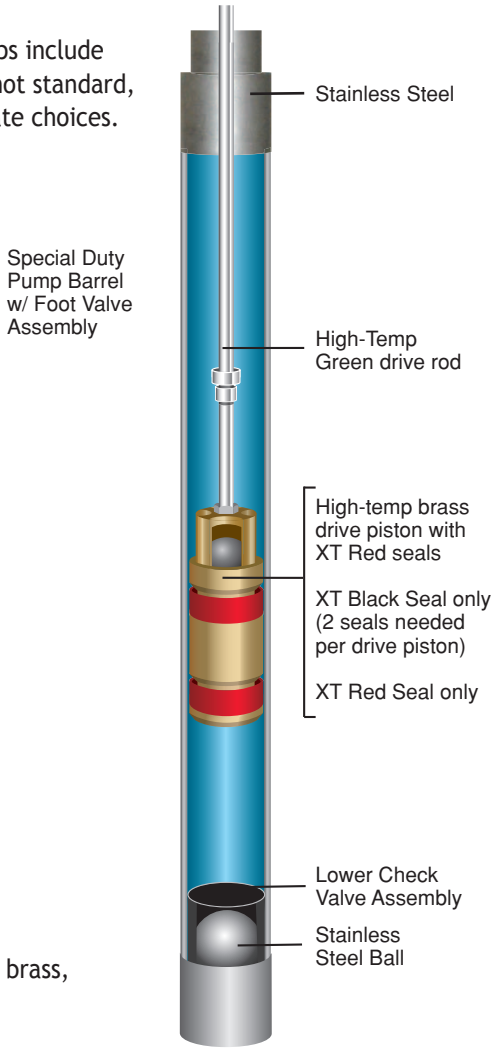
- Delrin
- Buna
- Brass
- PEEK

Seals

- Viton
- Buna
- XT-Black
- XT-Red

Process Pump

- Range of thermoplastics
- Chemically-resistant metals including brass, zinc, chrome
- High-strength, flexible fiberglass



Customize Materials of Construction

Blackhawk's rugged pump and stuffing box components are industry leading. Most can be customized for specific applications and environments with varied materials of construction.

Stuffing Box

Seal-plate blocks and cartridges, including the patented Hat Ring™ Pop-Out E-Z Swap, are available in more than 128 combinations of configurations and materials.

Seal Block Materials

- Molded polymers
- Die-cut metals including brass, stainless steel, Super Duplex stainless steel
- Several block depths, stackable

Seal Plate Cartridges

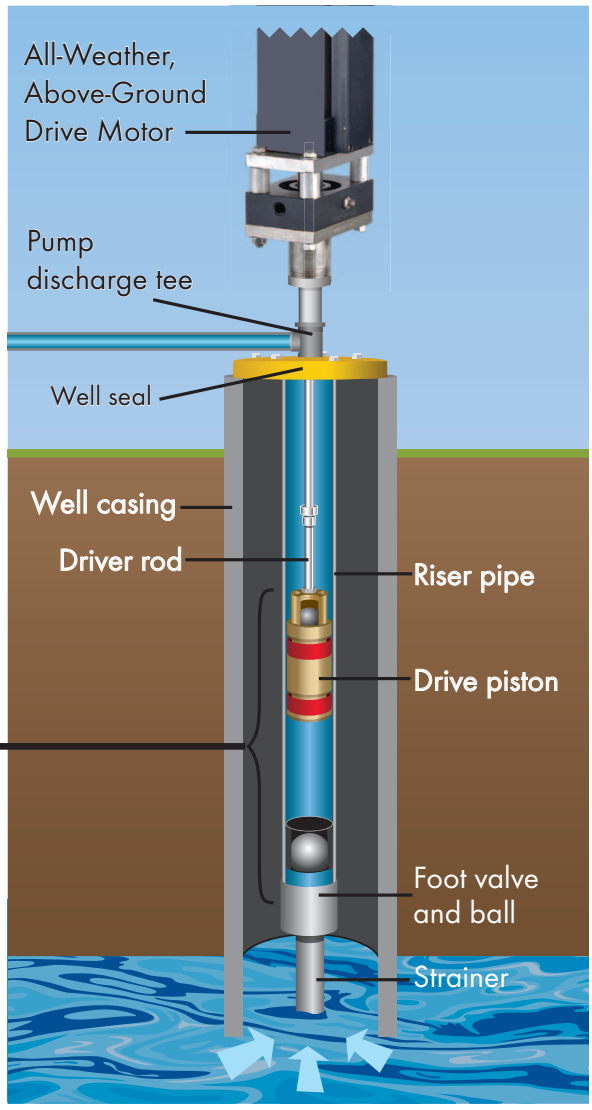
- Hat Ring™ and V-Stack ribbed designs
- Buna, Viton, brass, specialty polymers
- Factory seal-replacement program

Seal plate with pop-out cartridges

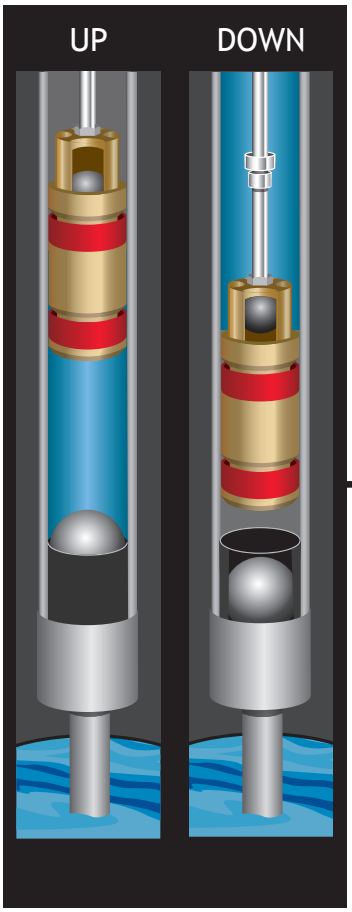
Piston Pump Technology

Above, outside the well or sump

The drive motor is powered by electricity, solar panel or compressed air. The drive rod moves back and forth, creating a suction that pulls fluid into the pump.



Inside the piston pump



On the upstroke

1. As the motor pulls the drive rod, the piston creates suction in the pump barrel.
2. Fluid is pulled through a strainer and into the pump barrel. A standing check ball opens to allow fluid to pass into the drive-piston pump-barrel chamber.
3. The check ball in the piston opens to pass the fluid to the next stage.

On the downstroke

4. The check ball in the pump barrel closes to prevent fluid from returning.
5. The check ball in the piston is pushed open by the force of the trapped fluid, allowing the fluid to move up the pump barrel cylinder and into a discharge pipe.

On the next upstroke

6. The check ball at the top of the piston closes, and another round of fluid from the pump enters the chamber to displace the liquid that has been released.
7. When the check ball in the pump barrel opens, the drive piston ball closes. The piston check ball opens again on the downstroke, and the pump-barrel ball closes.

See www.blackhawkco.com/how-reciprocating-piston-pumps-work for animation.

Blackhawk Pump Specifications

Model	Power	Gal./ liters per min.	Gal./ liters per day	Lift weight in feet/ meters	Min pipe size: in/cm
Anchor	Electric	6.7 / 25.3	9,648 / 36,432	813 / 248	2 / 4.8
Apollo	Solar	2.7 / 10.2	3,888 / 14,172	400 / 122	2 / 4.8
Atlas	Pneumatic	11.5 / 43.5	16,560 / 62,686	813 / 248	2 / 4.8
Edge	Pneumatic	5.0 / 18.9	120 / 454	281 / 86	2 / 4.8
Neptune	Pneumatic	11.0 / 41.6	15,800 / 59,900	100 / 30	8 / 20
Rhino Oil	Electric	—	15 bbl /day	1,500 ft	2-3/8; 2-7/8 in
V-2	Pneumatic	7.6 / 28.7	10,944 / 41,328	555 / 169	2 / 4.8

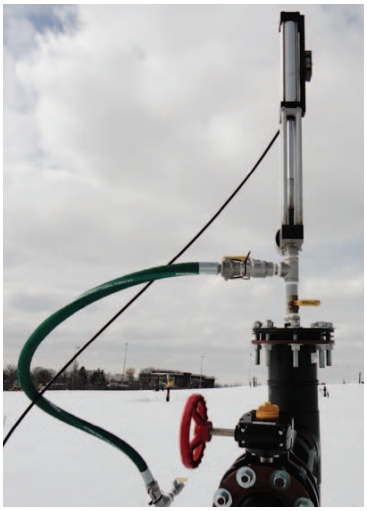
BLACKHAWK TECHNOLOGY COMPANY®

What Is a Piston Pump?

Windmill pumps and oilfield pump jacks use reciprocating-piston, positive displacement technologies. Blackhawk has miniaturized pump jacks for a broad range of applications.

Apollo Solar

Anchor Electric



Atlas Pneumatic

Edge Pneumatic

Piston Pump Advantages

- Pumps any fluid, many semi-solids
- Pumps at any angle, even horizontal
- Pumps to bottom of tank, well, caisson
- Indifferent to + or - pressure
- Can run dry without harm
- Controlled, metered flow
- Safer for workers
- No air or power contacts fluids
- Motor outside well or sump
- Can pump viscous, hot, foamy
- Does not shear fluids
- Operates in extreme environments

All power & maintenance are cleanly outside the well, sump or pipe.

Anchor Electric

Apollo Solar/Electric

Edge Pneumatic

General Applications and Common Power Options

Application	Power
Chemical remediation	Electric, pneumatic
Sinking-product remediation	Electric, pneumatic
Landfill methane dewatering	Solar, pneumatic
Floating-product remediation	Pneumatic, solar, electric–with skimmer
Landfill leachate	Pneumatic, electric
Hot, viscous fluid	Heavy-duty pneumatic HTCR, electric
Remote sites	Solar
Offshore rig sump	Special-duty pneumatic
Oilfield stripper wells, gas	Explosion-proof electric, solar, pneumatic
Process industries	Modified electric, pneumatic
Compliance	Pneumatic, solar, electric
Other low-flow applications	All drivers customizable to special needs

Atlas Pneumatic

V2 HTCR Pneumatic

Neptune Pneumatic

Accessories

Cycle Counter

Counts each full stroke; mounted on driver motor

Cylinder Oiler

Conditions pneumatic air entering drive motor

Filter Regulator

Filters air contaminants; regulates incoming pressure

Floating-Product Recovery Tool

Automated attachment skims surface LNAPL

Flow Meter

Counts gallons of liquid flowing from discharge tee

Liquid Level Control

Uses pressure transducers to turn pump on and off

Pitless Adaptor

Forms 90° elbow connecting riser to underground discharge

Power Supply Converter

Converts incoming 120, 240 or 480v AC to 24v DC

Programmable Pneumatic Timer

Turns pump on and off at operator-set schedule

Programmable Logic Control

Manages run times, dwell, remote, more

Pressure Relief Valve

Controls/limits built-up pressure from clogs, failures

Rod Oiler

Injects tiny, pre-set oil amounts into seal plate to lube drive rod

Solar Charge Controller

Modulates panel variances to feed steady 24v DC

Solar On-Off Timer

Converts flip-switch toggle into programmable timer

Speed Control

Sets operator-directed speeds from 4 to 21 strokes per minute

Stuffing Box Seal Kit

Seals in Buna, Viton & brass; quick pop-out cartridges

Well Seals

Zinc-coated steel; 6, 8, 10 & 12 in.; gas recovery 6 & 8 in.

Since 1990, Blackhawk Technology Company has provided innovative, dependable piston pumps for challenging low-flow operations on six continents.

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