Hydro-Helical™
Gas Separator

SUPERIOR SEPARATION EFFICIENCY
IN EXTREME GAS APPLICATIONS
Hydro-Helical™ Gas Separator

The Hydro-Helical™ gas separator sets a new industry standard for flow rate, performance, and reliability. The first new downhole dynamic gas separator design in decades, the Hydro-Helical gas separator achieves extreme separation efficiency at high flow rates up to 40% greater than conventional separators. This translates to more oil production in higher gas applications.

Hydro-Helical harnesses the kinetic energy of fluid using proprietary technologies designed for stability, efficiency, and reliability. This innovative new gas separator represents the latest in computational fluid dynamics design vetted on our fully instrumented, transparent two-phase test system.

INNOVATIVE IDEAS, RIGOROUS TESTING

Our two-phase test system uses transparent components that allow visual examination of flow conditions of both gas and liquid, internal and external to the gas separator. Multiple instrumentation, designed within the gas separator and throughout the system, collects pressure and flow data.

This empirical testing concept shows that the Hydro-Helical gas separator consistently outperforms conventional designs. In fact, studies indicate that performance of a single Hydro-Helical gas separator even exceeds conventional tandem gas separators.

The Hydro-Helical gas separator solves difficult problems that plague conventional systems including:

» Fluid remixing and inefficient separation due to regions of turbulent flow
» Ineffective fluid separation patterns due to high pressure differential across the separator
» Limited maximum flow rate and pump compatibility from ingestion of fluid through exit ports
» Flow losses, recirculation, and gas ingestion in tandem configurations
FEATURES & BENEFITS

Crossover technology enables maximum throughput efficiency of rotating fluids, optimum directional transfer of liquid to the pump, and increased erosion protection.

Proprietary Erosion Buster® protection design throughout reduces erosion and wear, and provides greater reliability.

Optimized intake provides maximum and streamlined intake of fluids.

Innovative fluid moving stages produce 20% greater flow rate than conventional separators and 33% greater flow rate in integral tandem configuration.

Anti-gas lock technology results in zero gas lock within the separator and thereby improved gas slug ride-through.

Superior thrust protection reduces erosion and wear on running surfaces between the impeller and diffuser.

Stationary helix vortex inducer creates greater than 95% separation efficiency, consistent separation of fluids at higher velocities and gas volume fractions, and eliminates erosion characteristics common in traditional paddle wheel vortex separators.
RESEARCH AND DEVELOPMENT

The Summit ESP Research and Technology Center brings together product engineers, R&D engineers, manufacturing, reliability, and quality teams focused on innovation and reliability. Our state-of-the-art facility is fundamental to continuous performance improvement in harsh environments. Test loops and wells allow system integration testing prior to field development and validate operation in extreme conditions.

TOP TIER TECHNOLOGY

Vortex Inducer
The stationary helix vortex inducer creates centrifugal separation without a spinning paddle wheel, enabling separation efficiency that increases with flow rate. The helix entry and exit angles, tapering cross-section and pitch minimize erosion and direct flow for significantly improved separation efficiency.

Intake, Crossover, and Exit Ports
Key components in the Hydro-Helical separation chamber minimize flow losses and reduce erosion. The intake, crossover, and exit ports are individually optimized, creating superior overall performance.

The enlarged intake creates flow paths that enable fluid moving stages to ingest large volumes of fluid with minimal deviation in flow direction. Precisely directed fluid-phase streams from the Hydro-Helical separation chamber into the crossover gyatory pathways minimize recirculation and erosion while reducing ingestion of fluid through the gas exit ports. The crossover also redirects the fluid at the pump’s intake to reduce pre-rotation for enhanced pump performance.

Fluid Moving Stages
Our proprietary stage design avoids pressure differentials that cause gas locking. Modular stages support adjustable flow rates and feature abrasion resistant bearings with proprietary thrust protection technology. This bearing system increases reliability through greater torsional rigidity and shaft support.
A. Vortex Inducer » Stationary helix vortex inducer creates greater than 95% separation efficiency.
B. Intake, Crossover and Exit Ports » Individually optimized, creating superior overall performance.
C. Fluid Moving Stages » proprietary stage design avoids pressure differentials that cause gas locking.

Erosion Buster® » proprietary design redirects fluid path inward and into the primary flow path, reducing erosion and wear on critical areas.
Gas Separator Comparison

<table>
<thead>
<tr>
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<th>Halliburton</th>
<th>Competitor A</th>
<th>Competitor B</th>
<th>Competitor C</th>
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</thead>
<tbody>
<tr>
<td>400 Single Flow Range (BPD)</td>
<td>Up to 10,000</td>
<td>Up to 8,000</td>
<td>Up to 6,000</td>
<td>180 - 3,000</td>
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<tr>
<td>400 Tandem Flow Range (BPD)</td>
<td>Up to 12,000</td>
<td>Up to 8,000</td>
<td>2,000 - 6,000</td>
<td>180 - 3,000</td>
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<tr>
<td>538 Single Flow Range (BPD)</td>
<td>Up to 20,000</td>
<td>Up to 15,000</td>
<td>2,000 - 15,000</td>
<td>1,050 - 9,600</td>
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<tr>
<td>538 Tandem Flow Range (BPD)</td>
<td>Up to 24,000</td>
<td>Up to 15,000</td>
<td>2,000 - 15,000</td>
<td>1,050 - 9,600</td>
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<tr>
<td>% Gas Handling</td>
<td>95% +</td>
<td>75%</td>
<td>80%</td>
<td>72% Max</td>
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<tr>
<td>AR Bearings</td>
<td>Up to 7</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Erosion Protection</td>
<td>+++</td>
<td>++</td>
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WELL MONITORING AND OPTIMIZATION

Our well applications engineers have access to a complete 360° view of every well’s operational information, downhole equipment, application design, and field service history. This allows the engineers to analyze and understand each well’s operational conditions and to identify when there is an issue.

UNPARALLELED SERVICE

Top performance requires great technology plus an unwavering commitment to customer service. We combine best-in-class product performance and service excellence to deliver a level of service that sets Halliburton apart. While many pump providers focus on product line management, Halliburton’s Artificial Lift team has a different approach. We focus on customers and their needs, first and foremost, and hold ourselves to the highest standard.
Sales of Halliburton products and services will be in accord solely with the terms and conditions contained in the contract between Halliburton and the customer that is applicable to the sale.

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