SPIRIT™ Downhole Production Tools

Mitigating the Effects of Gas and Solids on Rod Lift and ESP Systems
Gas and solids are two of the biggest issues in rod pumping and ESPs today; proven and advanced technologies are required to combat these issues and keep your pumps running.

Apergy offers a full line of downhole tools to separate gas and solids in the well, enabling increased system run life and enhanced production.

From ESPs moving 5,000+ bpd to stripper wells moving 10 bfpd, Apergy’s line of Downhole tools can meet all of your downhole separation needs.

The table below provides an overview of Apergy’s tools, and which tool to use for your most demanding applications.

### Applications
- Rod Lift wells from under 10 to 600+ bfpd
- ESPs moving under 200 to 5,200+ bpd
- Unconventional or conventional applications
- Applications with moderate-to-high GLRs
- Applications with moderate solids content

### Highlights
- 40k tools installed, mostly in the Permian Basin
- Consulting available to help with selection and install
- Made in USA

### Tool Overview Table*

<table>
<thead>
<tr>
<th></th>
<th>HYBRID-X / XR</th>
<th>GAS SEPARATOR</th>
<th>ROD LIFT DESANDER</th>
<th>POOR BOY</th>
<th>ESP DESANDER</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Production Capacity</strong></td>
<td>245 BPD</td>
<td>650 BPD</td>
<td>1,000 BPD</td>
<td>245 BPD</td>
<td>5,200 BPD</td>
</tr>
<tr>
<td><strong>GLR</strong></td>
<td>MODERATE - HIGH</td>
<td>MODERATE - HIGH</td>
<td>LOW</td>
<td>LOW - MODERATE</td>
<td>LOW</td>
</tr>
<tr>
<td><strong>Solids Content</strong></td>
<td>MODERATE - HIGH</td>
<td>N/A</td>
<td>MODERATE - HIGH</td>
<td>N/A</td>
<td>MODERATE - HIGH</td>
</tr>
<tr>
<td><strong>Install / Service</strong></td>
<td>ON TUBING</td>
<td>WITH PACKER, ON TUBING</td>
<td>ON TUBING</td>
<td>ON TUBING</td>
<td>WITH ESP ON TUBING</td>
</tr>
<tr>
<td><strong>Tool Length</strong></td>
<td>20’ – 30’</td>
<td>40’</td>
<td>10’</td>
<td>20’</td>
<td>7’</td>
</tr>
<tr>
<td><strong>Inner Tube</strong></td>
<td>20’ – 30’</td>
<td>40’</td>
<td>8’</td>
<td>16’</td>
<td>3.5’</td>
</tr>
<tr>
<td><strong>Corrosion</strong></td>
<td>CERAMIC COATING AVAILABLE</td>
<td></td>
<td></td>
<td></td>
<td>CERAMIC COATED</td>
</tr>
<tr>
<td><strong>Above / Below Perfs</strong></td>
<td>EITHER</td>
<td>ABOVE</td>
<td>EITHER</td>
<td>EITHER</td>
<td>EITHER</td>
</tr>
</tbody>
</table>

*5.5" casing example
HYBRID-X/XR™
GAS / SOLIDS SEPARATOR
Over 20,000 Units Installed Globally

Increase Production and Minimize Maintenance Costs

During production, naturally occurring gases and formation sand, salt, scale, corrosion and solid contaminants enter the wellbore and create pumping inefficiencies that severely diminish production and can contribute to increased maintenance costs and unnecessary failures. The patented SPIRIT Hybrid-XR™ Gas/Sands/Solids Separator is a simple, effective tool that uses cyclonic motion and internal baffling for superior downhole separation of gas, sands and solids.

Product Applications

The Hybrid-XR™ is designed to increase production output and decrease maintenance costs from lower volume wells.
- **All casing sizes** - varying tool sizes deployable for 4.5", 5.5", 7" casing
- **Moderate-to-high GLR applications** – additional 10’ gas separator added for high GLR applications
- **Unconventional applications** – prone to gas slugging, with moderate-to-high solids content
- **Conventional applications** – tool can be deployed above or below the perforations
- **Rod Pump Agnostic** – deployable with standard API and specialty pumps

Increased Production

Hybrid-XR™ agitates and breaks apart gas-fluid emulsions through a patented baffling action which breaks apart production emulsion.
- Liquid and sand gravitate to the spiral separator that extracts sand from the liquid
- Sand and solids are deposited in the mud joint
- Clean and gas-free production fluid fills the pump intake, resulting in greater pump efficiency and increased production

Decreased Maintenance and Service Costs

- Reduces excessive pump wear, sticking plungers, surface equipment damage, pump and flow line fouling
- Longer component life and system up-time
- The modular design makes it easy and less costly to transport, assemble, and run
- The tools can be disassembled to verify condition. Only damaged and worn elements can be replaced, as needed

Available Sizes*

<table>
<thead>
<tr>
<th>CASING SIZE</th>
<th>TOOL SIZE</th>
<th>PIN SIZE</th>
<th>PRODUCTION CAPACITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5&quot;</td>
<td>2.5&quot;</td>
<td>2.375&quot;</td>
<td>148 bpd</td>
</tr>
<tr>
<td>5.5&quot;</td>
<td>3.5&quot;</td>
<td>2.875&quot;</td>
<td>245 bpd</td>
</tr>
<tr>
<td>7&quot;</td>
<td>4.5&quot;</td>
<td>2.875&quot;</td>
<td>481 bpd</td>
</tr>
</tbody>
</table>

* Ceramic coating available for corrosive & heavy solids environments
* Divides into two 10’ sections for easy transportation
* Extended version available – extra 10’ gas separator
DOWNHOLE GAS SEPARATOR™

Over 15,000 units installed globally

The revolutionary patented SPIRIT Downhole Gas Separator™ puts an end to the efficiency-robbing gas interference in rod pumped oil wells. It is a simple, set-and-forget downhole tool that sits between the packer and rod pump. Using a patented internal baffling system, the tool agitates and breaks apart high GLR emulsions for more effective separation of gas and fluids. The gas exits the tool and is produced up the casing, while pure production fluid is fed from the tool to the pump.

Product Applications

• Production rates with higher GLRs
• Horizontal completions prone to gas slugging
• Higher volume rod lift applications, up to 650 bfpd
• Above the perforation completions

Benefits of Enhanced Gas Separation

• Separates free and entrained gas from the production fluid - patented baffling within the tool breaks gas out of solution
• Eliminates gas locking
• Mitigates gas interference causing poor pump efficiency
• Improved pump efficiency enhances overall system performance - potentially allowing the pumping unit to run at slower SPM

How it Works

1. Fluids and gas enter through the bottom of the separator and travel up between the outer and inner tubing
2. Baffles on the inner tubing create turbulence that aids in breaking apart emulsions. Then liquid and gas move upward and out of the top portals.
3. The separated gas flows freely up the casing to the surface
4. Fluid drops down inside of the casing creating an artificial sump
5. Gas-free fluid then enters the pump intake tube and travels up the inner tube

Available Sizes*

<table>
<thead>
<tr>
<th>TOOL SIZE</th>
<th>CASING SIZE</th>
<th>PRODUCTION CAPACITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 3/8”</td>
<td>4.5”</td>
<td>350 bpd</td>
</tr>
<tr>
<td></td>
<td>5.5”</td>
<td>650 bpd</td>
</tr>
<tr>
<td></td>
<td>7”</td>
<td>1,230 bpd</td>
</tr>
<tr>
<td>2 7/8”</td>
<td>4.5”</td>
<td>260 bpd</td>
</tr>
<tr>
<td></td>
<td>5.5”</td>
<td>560 bpd</td>
</tr>
<tr>
<td></td>
<td>7”</td>
<td>1,140 bpd</td>
</tr>
</tbody>
</table>

Both sizes are 40’ in length

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SAND/SOLIDS SEPARATOR

Over 5,000 Units Installed Globally

Rod Pump Applications

- Conventional or unconventional production with high sand and solids content—either introduced or naturally occurring
- Rod Lift wells experiencing excessive pump wear, fouling pumps, or sticking plungers or valves
- Downhole pump agnostic - API or specialty pumps
- Tool works with most sand and solids sizes - contact our team when dealing with finer frac sands

Benefits of Enhanced Solids Separation

- Effectively separates larger solids from production fluid, sending solids into mud joints below the tool
- Reduces excessive pump wear, sticking plungers and valves, fouled pumps and other downhole damage
- Reduces surface tank capacity requirements, flow line fouling, and other surface equipment damage
- Can be run on bottom of a packer-style gas separator for enhanced gas and solids separation

How it Works

1. Solid-laden production fluids enter the separator intake slots.
2. The separator uses centrifugal force to separate solids from the production fluid. The tool is designed such that a smaller area enables higher centrifugal velocities resulting in better solids separation
3. Solids are directed downward into the mud joints Produced fluid travels upward, either into the pump intake or into the gas separation stage
4. The number of recommended mud joints is based on estimated or proven solids production from that well.

Available Sizes*

<table>
<thead>
<tr>
<th>Casing Size</th>
<th>Tool Size</th>
<th>Pin Size</th>
<th>Production Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.5”</td>
<td>2.5”</td>
<td>2.375”</td>
<td>0 - 1,000 bpd</td>
</tr>
<tr>
<td>5.5” or 7”</td>
<td>3.5”</td>
<td>2.875”</td>
<td></td>
</tr>
</tbody>
</table>

* Interchangeable cups for all casing weights
SPIRIT ESP DESANDER

The ESP desander is a downhole centrifugal sand separator designed to separate sand and solids from the produced fluid prior to entering the pump.

**ESP Applications**

- Low to higher volume ESP wells with moderate-to-high sand or solids content
- Conventional or unconventional well types, with tool set either above or below the perforations
- Tool works with most sand and solids sizes - contact our team when dealing with finer frac sands.

**Features and Benefits**

- 7’ tool with 3.5’ inner tube
- 5.5” and 7” packer assembly with interchangeable cups
- Redressable tool enhances economics on reruns - cups and inner tube can be replaced
- Sand is pushed into mud joints at the bottom of the tool. The number of mud joints varies pending on application.
- Ceramic coating increases tool hardness, allowing for longer runtime in solids-heavy environments. The coating also provides a slicker surface, to mitigate deposits from forming on the tool.
- No well preparation required - tool is installed with the ESP
- Extra heavy wall barrel (0.75” thick) enhances life in high solids environments
- Chemical injection packer assembly available for integration with CT line for efficient delivery below the packer

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**Key Features**

- Redressable
- Ceramic coating
- Extra heavy wall barrel
- Easy to transport, assemble and run

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**Available Sizes**

<table>
<thead>
<tr>
<th>CASING SIZE</th>
<th>TOOL SIZE</th>
<th>PIN SIZE</th>
<th>PRODUCTION CAPACITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.5” 7&quot;</td>
<td>5.5” 7&quot;</td>
<td>*</td>
<td>750 - 5,200 bpd</td>
</tr>
</tbody>
</table>

* Interchangeable cups for all casing weights