Sand Control in Production Operations to Increase Production, Reliability, & Profits

“A Leader in Producing Productivity”
Sand, commonly found in most wells, can be problematic.

The changing landscape is being accelerated by increasingly deeper shale development. As these new plays become an increasing percentage of onshore oil and gas production, new demands in rod pumping are being created.
Multi-stage horizontal shale completions are growing.
Bakken Shale Example
Higher-Rate Rod Pumping

Configuration
SC2000 XPR
Completion with
API RHBM Bottom Holddown Pump Intake Protection, Gas Anchored.
General Principal

To protect the plunger and barrel of a rod pump, the sand and proppant fragments larger than the “fit” of the pump must be removed.

The most common and reliable API rod pump is a spray metal plunger in a nitrited, chrome, or nickel carbide plated barrel. The “fit” of the plunger barrel is typically .004 / .005” (100-125 microns)---approximately the width of a human hair.

Rod pumps are not designed or able to pump broken glass for long. Silica sand, proppant fragments, AND especially new, modern, high strength proppant fragments can rapidly cut into the precision ground, honed, and tolerated plunger and barrel surfaces leading to rapid pump failure.

For example, a nicarb-plated barrel only has plating .0015” thick. It is rapidly destroyed as the fragments of the high strength proppants (so valuable to deep shale development) carve through the plated surface into the softer base metal, leading to premature pump failure.
How are these proppant fragments (that look like broken glass under a microscope) generated?

- Pressure pumping (8000 PSI not uncommon)
- Proppant crushing by reservoir forces
- Velocity induced (impact) shattering forces
- A percentage of fines can be present from the manufacturing process.
Sand and proppant fragments are problematic. They are being found in production fluids more than ever before due to fracturing stimulation.
The sand production and pump failure relationship clearly illustrated.
Multi-stage shale fracking equates to higher production rates with subsequent increased risk of rod pumping failures. This results in greater downtime, loss of production, and higher pulling and pump repair costs.

Properly planned completions achieve increased production and lower production cost.

- Properly sized tubulars aid in velocity reductions.
- Sieve analysis helps to select proper screen size.
- Pump clearance is an issue; specialty pumps?
- Rod/Beam system matched to inflow of well helps to eliminate excessive sand production from 'surging'.
- Automated drives (VFD's) can match motor speed to widely varying well production.
Advanced “clean wellbore” completions allow confident rod pumping
Particles can easily pass through screens unless a determinate manufacturing process is employed.

Screen selection is critical for success.

Sometimes a practical photo is worth a thousand words; Stren 85 micron nominal, triangular wire wrap at 10 ga./(250 micron) 0.010 slot.
Stren SC2000 Series XPR is engineered in 2¾”, 2½”, 3½”, and all common API sizes for horizontal completions and rod pumping intake protection applications.
**SC2000™ Series XPR™ Pump Intake Protection Screens**

The SC2000 Series XPR completion unit for oil and gas wells provides a clean, sand-free wellbore and the lowest reservoir backpressure for increased production flow and rod-pump longevity. Many operators are not achieving full-production potential because of backpressure on the reservoir caused by sand infill and liquid loading. The XPR completion unit provides a single answer to both problems.

**Applications**
- Rod lifted gas and oil production and well workovers, solids infill control, and gas-well fluid-loading control.
- Cased hole, perforated-interval-interface, or new drill completions.

**Features, Advantages and Benefits**
- The XPR unit incorporates a high performance, matrix metal™ reservoir interface. This feature protects against sand infill and liquid loading to enhance production and extend pump life. It also prevents premature rod-pump failure caused by solids production, extending equipment life while preventing nonproductive time (NPT).
- Unique, rugged, corrosion resistant, matrix metal, stainless steel screen design with standard 100 micron control point results in lower pressure drops for longer service life and higher production flow.
- Heavy-duty CrossBar™ style shroud enhances flow vectoring attenuation of fluids, and flow distribution in perforated cased hole completions.
- The XPR unit provides cost-effective, easy installation and protects the rod pump from excessive wear – minimizing capital costs to replace failed rod pumps, as well as avoiding NPT.
- Integrated pumping sump increases rod-pump productivity.
- System design can accommodate oil or gas wells of any size.

**Options**
- On/off tool/torque safety joint.

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“**If you let sand get into your pump you’ve got a fight on your hands.**”

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The Series XPR screen design is unique with rugged, corrosion resistant, matrix metal stainless steel construction. The unit’s standard 100 micron control point provides for lower pressure drops, higher production flow, and longer service life.
**Stren SC2000 Series XPR Capacity Ratings**

**SC2000™ Series XPR™ Example**

*Capacity Ratings for General Applications*

 Capacities to thousands of BFP and more by threading units end-to-end to reach capacity required. Contact the Applications Engineering Dept. of Stren for well configuration and support assistance.

<table>
<thead>
<tr>
<th>Product Description</th>
<th>Oil Well Production Completions</th>
<th>Gas Well De-watering Completions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Completion Series Stren XPR2012 CrossBar™, 2-3/8” 6.7 # JIS top, 3rd EU connections, 100 micron control point and CrossBar™ high performance shroud. Max OD = 3.20” x 15 ft OAL with 1.5 ft bore pipe handling ends.</td>
<td>50 BPD, Based on average conditions, conventional +/- 30 API gravity</td>
<td>200 BFP, Gas Well Post-Frac Applications</td>
</tr>
<tr>
<td>Completion Series Stren XPR2512 CrossBar™, 2-7/8” 6.4 # JIS top, 3rd EU box connections, 100 micron control point and CrossBar™ high performance shroud. Max OD = 3.70” x 15 ft OAL with 1.5 ft bore pipe handling ends.</td>
<td>200 BPD, Based on average conditions, conventional +/- 30 API gravity</td>
<td>250 BFP, Gas Well Post-Frac Applications</td>
</tr>
<tr>
<td>Completion Series Stren XPR3012 CrossBar™, 3-1/2” 9.2 # JIS top, 3rd EU box connections, 100 micron control point and CrossBar™ high performance shroud. Max OD = 4.35” x 15 ft OAL with 1.5 ft bore pipe handling ends.</td>
<td>400 BPD, Based on average conditions, conventional +/- 30 API gravity</td>
<td>300 BFP, Gas Well Post-Frac Applications</td>
</tr>
</tbody>
</table>
**Stren SC2000 XPR Completion Unit**

The SC2000 Series XPR completion unit for oil and gas wells provides a clean, sand-free wellbore and the lowest reservoir backpressure for increased production flow and rod-pump longevity. Many operators are not achieving full-production potential because of backpressure on the reservoir caused by sand infill and liquid loading. The XPR completion unit provides a single answer to both problems.

**Applications**
- Rod lifted gas and oil production and well workovers, solids infill control, and gas well fluid-loading control
- Cased hole, perforated-interval-interface, or new drill completions

**Features, Advantages and Benefits**
- The XPR unit incorporates a high performance, matrix metal™ reservoir interface. This feature protects against sand infill and liquid loading to enhance production and extend pump life. It also prevents premature rod-pump failure caused by solids production, extending equipment life while preventing nonproductive time (NPT).
- Unique, rugged, corrosion resistant, matrix metal, stainless steel screen design with standard 100 micron control point results in lower pressure drops for longer service life and higher production flow.
- Heavy-duty CrossBar™ style shroud enhances flow vectoring attenuation of fluids, and flow distribution in perforated cased hole completions.
- The XPR unit provides cost-effective, easy installation and protects the rod pump from excessive wear – minimizing capital costs to replace failed rod pumps, as well as avoiding NPT.
- Integrated pumping sump increases rod-pump-productivity.
- System design can accommodate oil or gas wells of any size.

**Options**
- On/off tool/torque safety joint

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The Series XPR screen design is unique with rugged, corrosion resistant, matrix metal stainless steel construction. The unit’s standard 100 micron control point provides for lower pressure drops, higher production flow, and longer service life.
The above wedge wire type screen did not and cannot protect the pump. The slot opening at .010” (10 gauge) is too large. It let’s into the pump the very size range of sand and proppant fragments most damaging to the plunger and barrel. Narrowing the slot typically reduces the available open area to an unacceptable level.
Stren SC2000 – This sand screen combines sintered metal mesh layers and metal fiber composite matrix for accurate pore sizing, yielding rugged, accurate sand particle control and flow erosion resistance. Robust and crush resistant, the SC2000 (Fig. 2.39) screens have body diameters typically only 0.25 in. (0.64 cm) larger than tubing upset diameter.

In addition, Stren’s new SC2000 XPR CrossBar screen (Fig. 2.40) has particular utility in controlling solids infill into the wellbore. It is a component of the SC2000 Series XPR (see Chapter 5) completion unit that is designed to increase rod pumping productivity. Somewhat unique to this screen is its heavy-duty “cross bar” style shroud that, according to the manufacturer, enhances flow vectoring attenuation of fluids and flow distribution.
Bakken higher capacity XPR3012-30-100M30, 3½” assembly configured for rod pumping intake protection and enhanced gas separation to increase pumping efficiency.
An alternative to TBG deployment is installation on a liner hanger or packer for ESP or long, horizontal completions. Special configurations assist in cost effective retrievals.
Stren CNC precision machining centers facilitate cost effective consistently accurate production components.
For insert pump retrievable configuration (sucker rod retrievable pump intake production)

Field Proven PumpGard™ Rod Pump Intake Protection
Improves Pumping Productivity

An Example of Success
A major operator was experiencing repeated pump failure due to sand cut and gas lock. The existence of abrasive conditions from both sand and formation abrasives caused two problems: First, the need to set the pump 150 ft above the perforations in an attempt to reduce abrasive action and second, pump failure was occurring every 37 days. PumpGard was installed and 310 days later no service had been required. Additionally, the pump was lowered in closer proximity to the perforations resulting in increased production.

Bring it on line... keep it on line... is the bottom line.

PUMPGARD™

<table>
<thead>
<tr>
<th>MODEL</th>
<th>PGXPR20</th>
<th>PGXPR25</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump Type</td>
<td>Insert Rod Pump</td>
<td>Insert Rod Pump</td>
</tr>
<tr>
<td>API Pump Size</td>
<td>2-⅜” Insert (API 20)</td>
<td>2-⅜” Insert (API 25)</td>
</tr>
<tr>
<td>Rod string retrievable</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Capacity:</td>
<td>Use 1 ft per 10-15 BFPD</td>
<td>Use 1 ft per 10-15 BFPD</td>
</tr>
<tr>
<td>Dimensions</td>
<td>Max. OD = 1.75” x 102” OAL</td>
<td>Max. OD = 2.06” x 103” OAL</td>
</tr>
<tr>
<td>Micron Ratings</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Pressure:</td>
<td>To 3000 PSI</td>
<td>To 3000 PSI</td>
</tr>
<tr>
<td>Temperature</td>
<td>To 400° F</td>
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<tr>
<td>Pump End Connection</td>
<td>1” NPT</td>
<td>1-¼” NPT</td>
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</tbody>
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For Higher Capacity
Thread Multiple Units Together End-to-End

Typical Description:
PumpGard™ Model PGXPR for protecting API insert pumps;
PGXPR2(x)08-100M24; 1.0” (or 1.25”) NPT API standardized pin up gas anchor dip tube base connection to 2-⅜” (or 2-⅜”) insert pump, with 316 stainless steel matrix core #M24-125, 100 micron control point and CrossBar™ high productivity reservoir interface shroud.

Optional: Factory install PAB20-100 over-pressure control relief valve and 6” strainer nipple.

Stren, Inc. – Houston Mfg Plant
15045 Woodham Drive
Houston, TX 77073
PH: 281-915-3000
sales@stren.net
www.stren.net
Oil & Gas Producers Completion Configuration

For 4½” 11.6# CSG with 2³/₈” EUE TBG
Stren SC2000 Series XPR2020 CrossBar™ Completion
Details matter: Customer preferred transport packaging can reduce labor and rig cost; especially in remote/international development. (This is for Caspian/Kazakhstan directionally drilled well set for example.)
We look forward to the opportunity to be of service in increasing production and productivity in your operations.