



Managing Surface Backpressure with the RamPump™



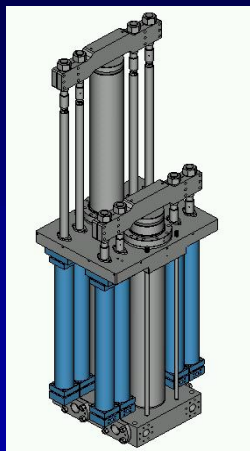
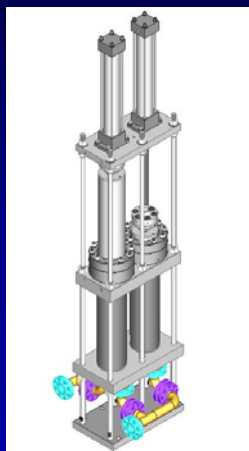
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Artificial Lift Systems





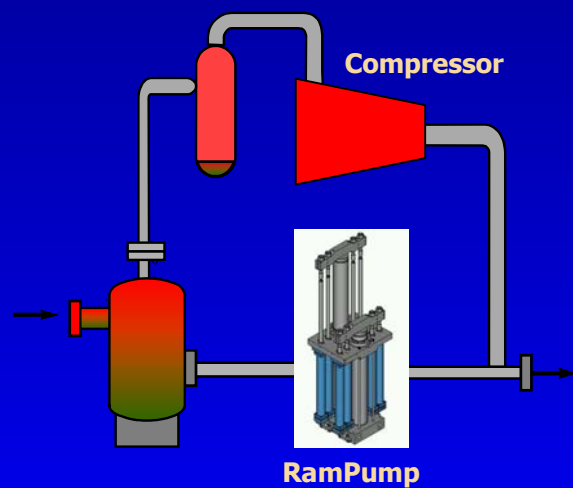
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Two Boosting Methods:



Ram Pump™ (patent pending)

The Ram Pump is a hydraulically driven piston pump powered by electric motor or a gas/diesel engine. Limited volume capacity to 150,000 BPDe. 7" and 12" configurations shown.



Dual Booster™ (patented)

The wellstream is divided into a free gas stream and a small, multiphase flow. A standard compressor is operated in parallel with the Ram Pump to boost the pressure of both flows prior to recombining. Unlimited total volume potential.

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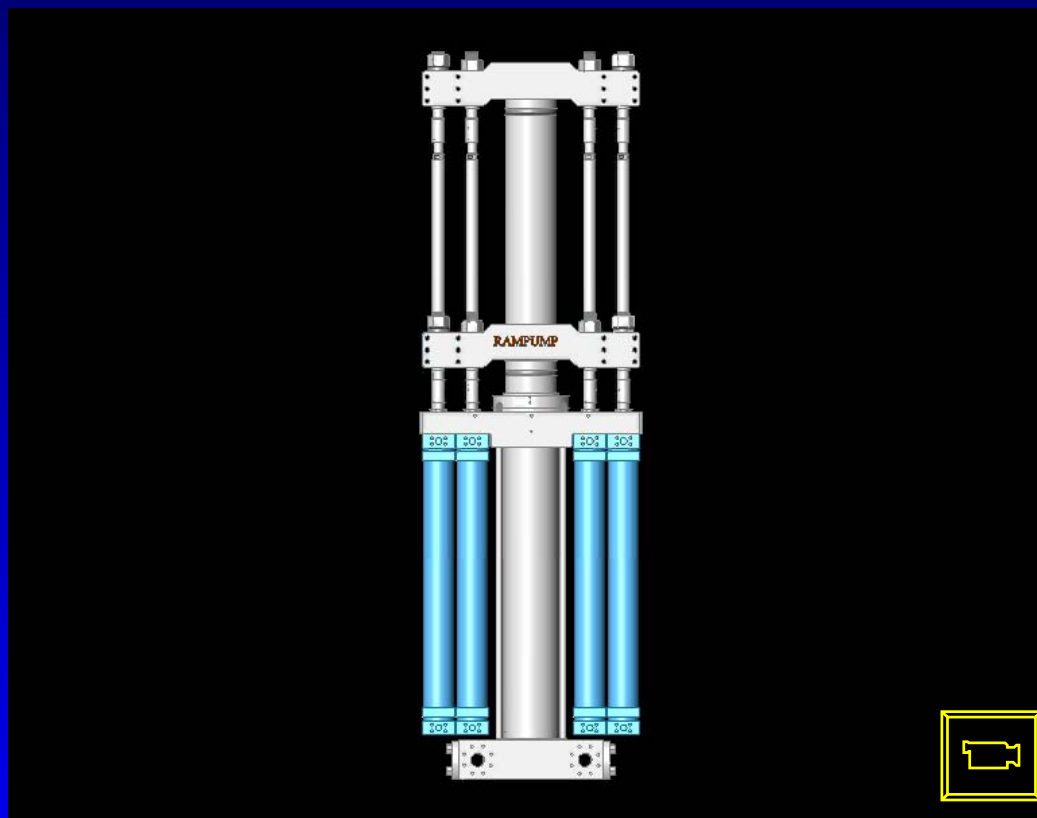


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What is the Ram Pump™ ?

The Ram Pump™ is a new duplex piston pump design that cycles under hydraulic power to transfer well fluids and gas. The plungers draw in well fluids (liquids and gas) past check valves into a fluid cylinder and then boost the pressure into the flowline.

**Operates
similar to:**



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Applications

- **Production gains by lowering the wellhead pressure**
- **Full wellstream pressure boosting - no separation.**
- **Wet gas compression**
- **Produced gas re-injection for gas lift**
- **Well kick-off**
- **Reduce remote site process equipment**
- **Reduce number of flow lines**
- **Eliminate need for vapor recovery system**

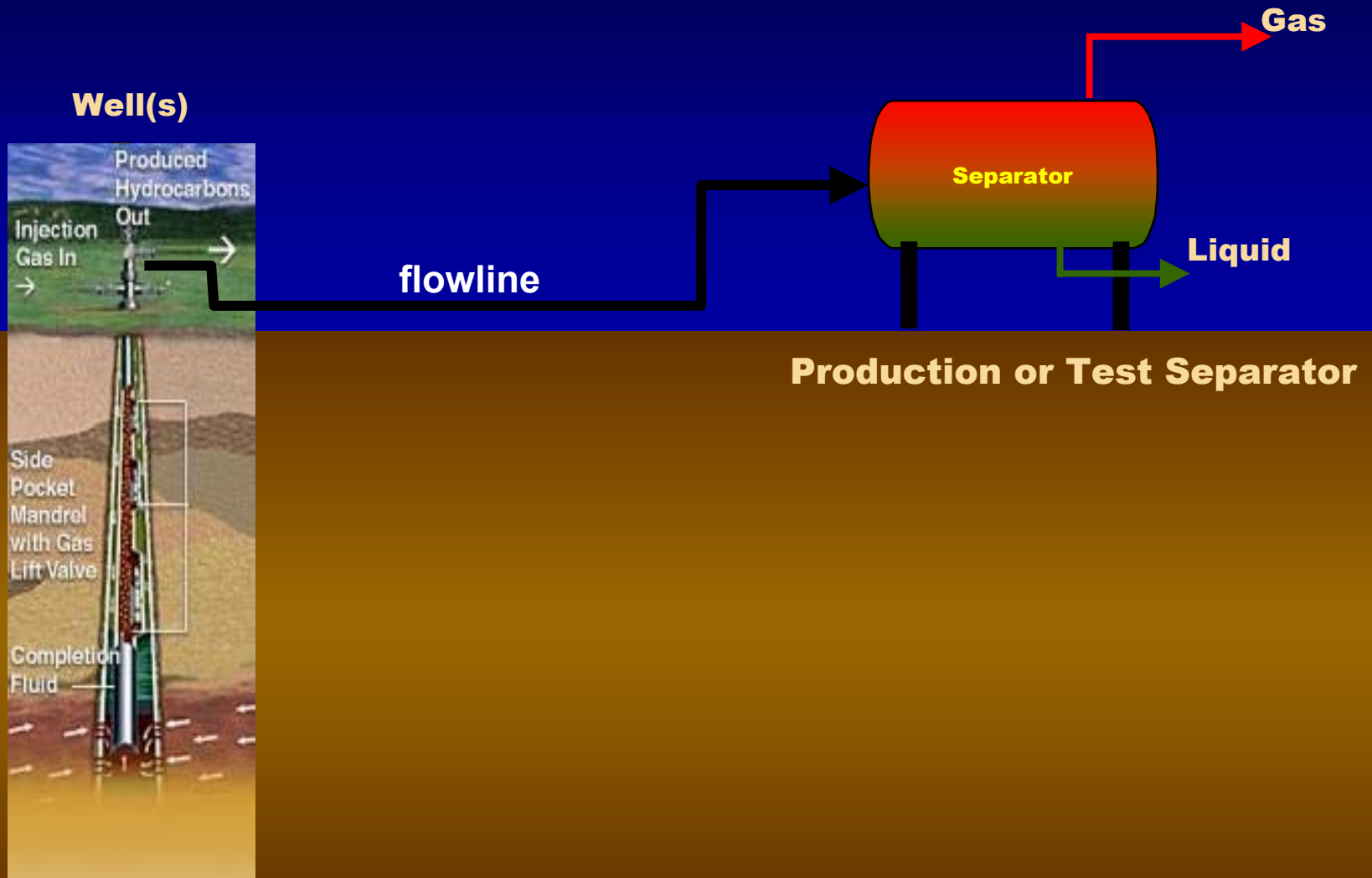


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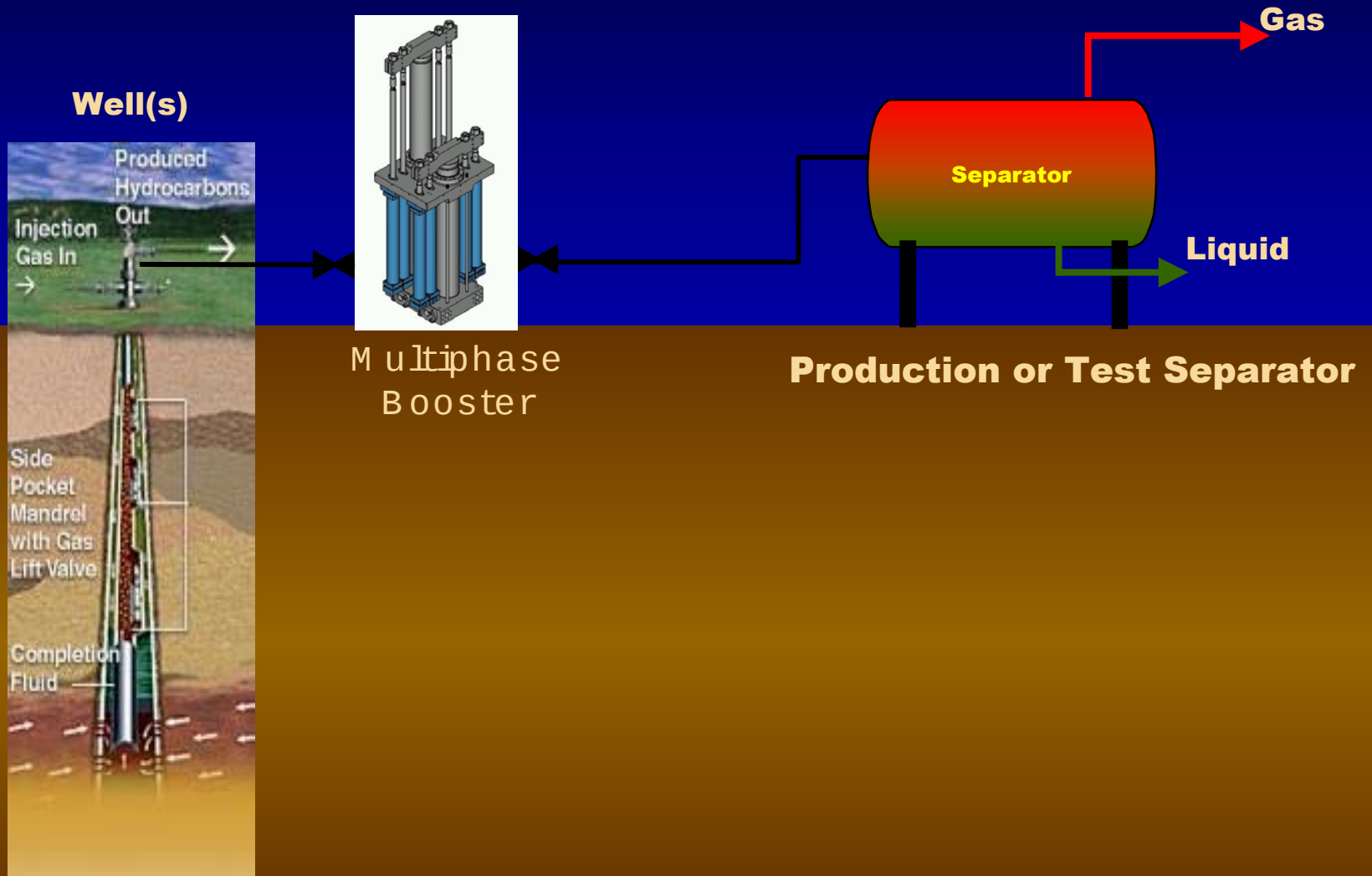
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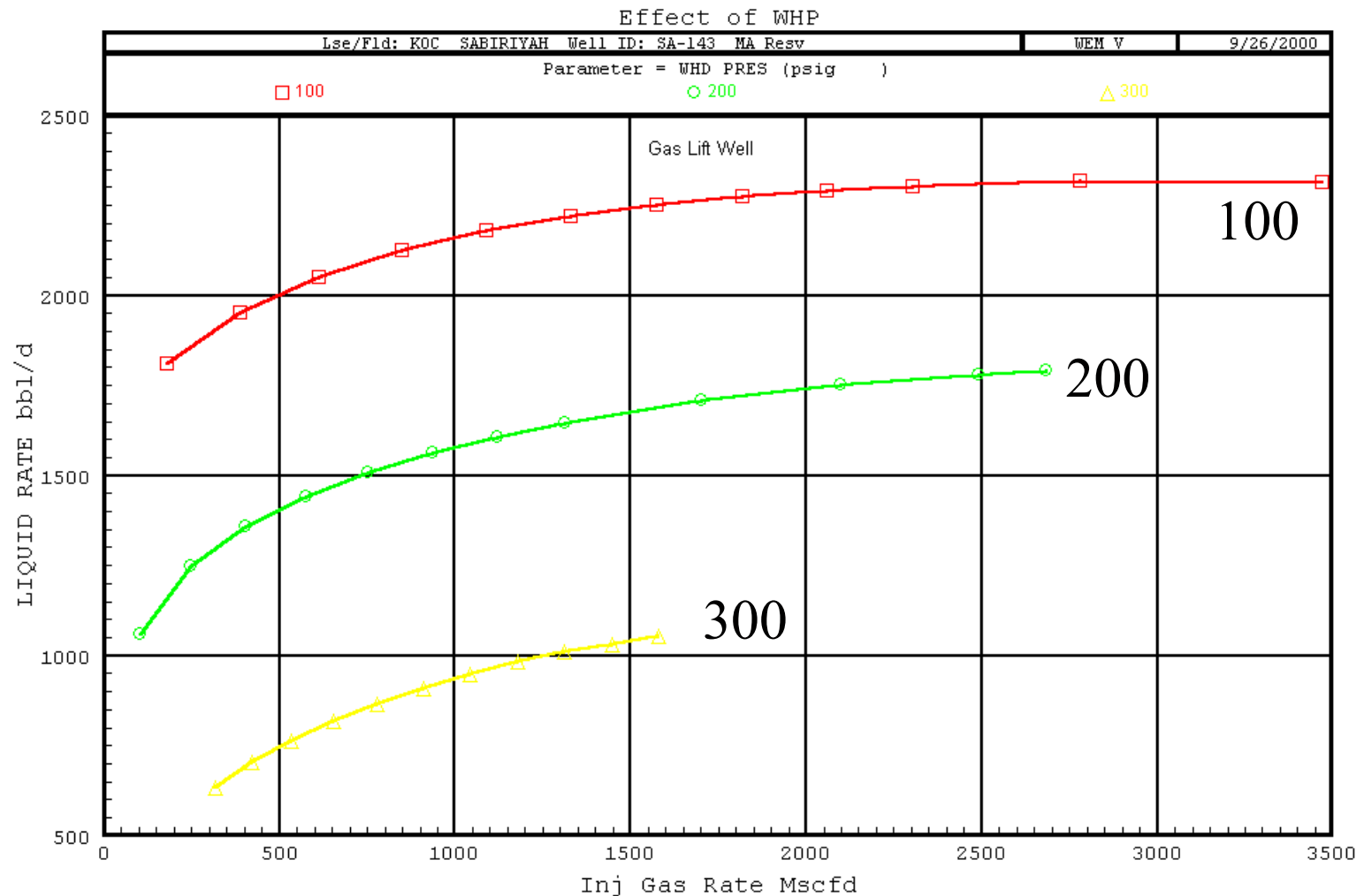
High Backpressure Can Limit Production



Controlling Backpressure



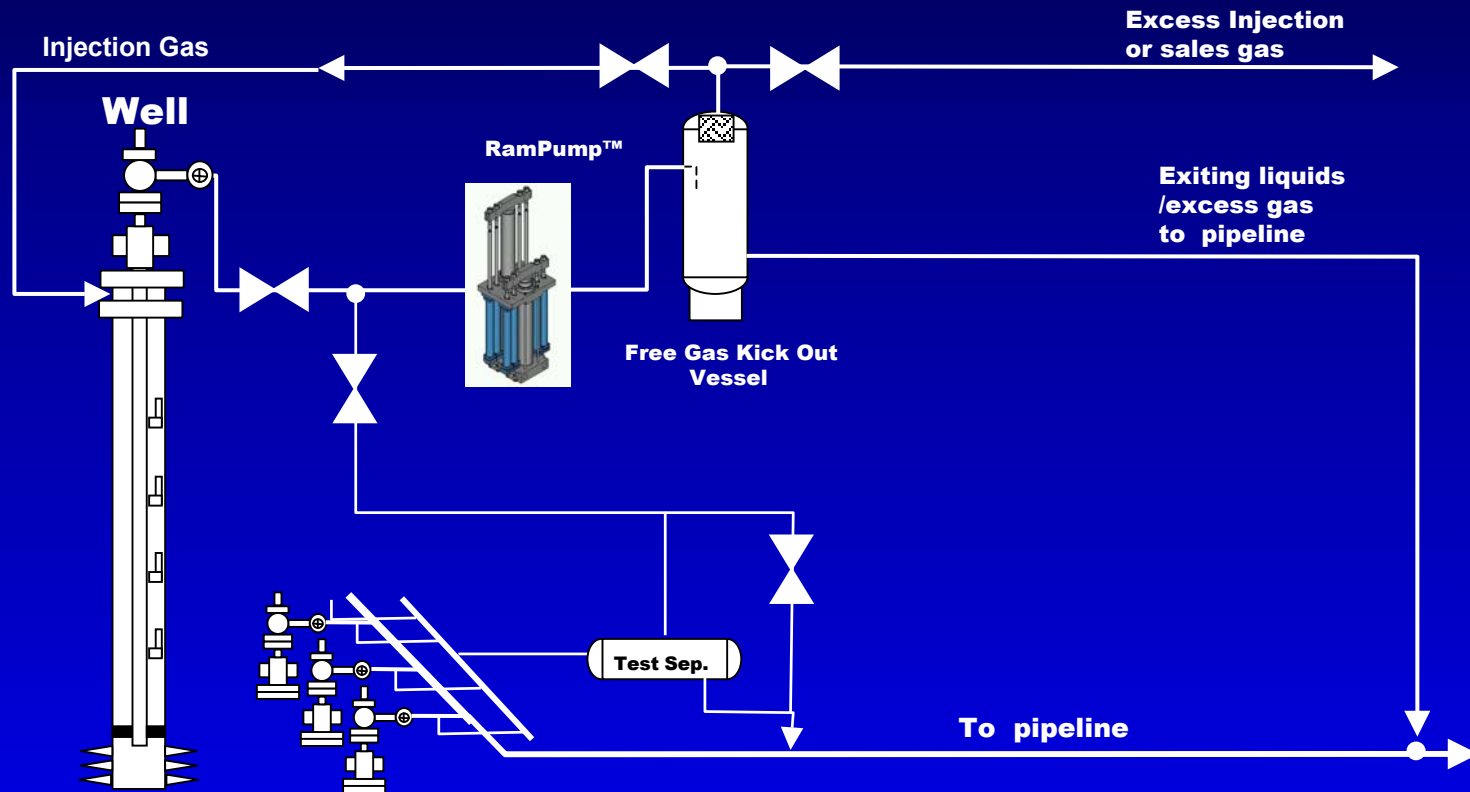
Effects on Well Productivity by controlling backpressure



Effect of WHP on a gas lift well's production rate



Well Stimulation / Gas Lift



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RamPump™ Success in GOM



Problems to Overcome:

- **Back Pressure of 230 psi on flowline**
- **Lift gas supplied from other platforms**
- **Wells loading up**

Eugene Island 257-D

Ram Pump



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Production Benefits

RAM PUMP									
WELL		OIL	WTR	GAS			GL		PROD SEP PRESSURE
D6D		68	185	75			230		210
D9D		218	1059	246			270		210
D10		41	68	111			570		210
D10D		68	782	70			230		210
TOTAL		395	2057	502			1300		
NOTE Ram Pump down for repairs									
Current well test with Ram Pump down for repairs									
WELL		OIL	WTR	GAS			GL		PROD SEP PRESSURE
D6D		83	244	81			243		80
D9D		386	900	283			301		75
D10		44	82	90			300		85
D10D		73	841	95			324		80
TOTAL		586	2067	549			1168		
NOTE Ram Pump running									
Current well test with Ram Pump running									
Note	Increase in oil production when Ram Pump is running of 191 barrels per. Day								



System Selection: Dual Booster with RamPump™



Problems Solved:

- ✓ **Separator pressure lowered from 230 psig to 50 psig.**
- ✓ **Over 700 BLPD (over 180 BOPD) increase.**
- ✓ **Injection gas requirement dropped and gas production increased to where the platform produced a surplus.**
- ✓ **Ram Pump™ eliminated gas locking and sand erosion noted in earlier conventional triplex pumps**
- ✓ **99% mechanical availability**
- ✓ **No increase in emissions**

Operating since April/2000



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Pump Selection



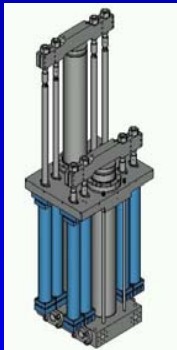
- ♦ Pumps are sized based on the total volume to be pumped – gas & liquid
- ♦ Gas must be converted to a BPD equivalent *
- ♦ Gas and liquids are then additive to obtain total BPD equivalent

* Based on actual conditions - not typical 6 to 1 ratio used by accounting

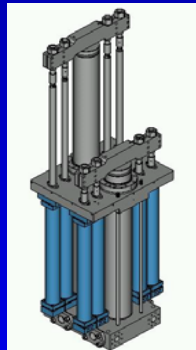
7x24



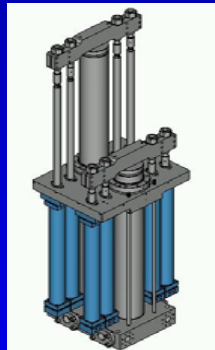
10x60



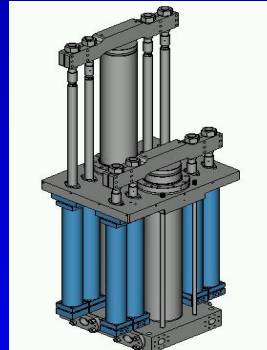
12x60



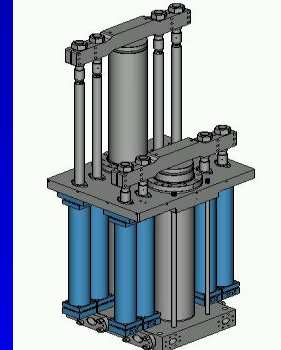
16x60



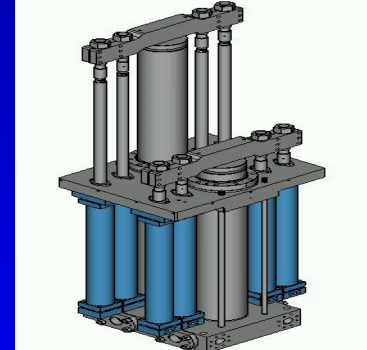
20x60



24x60



32x60



2,500 BPD

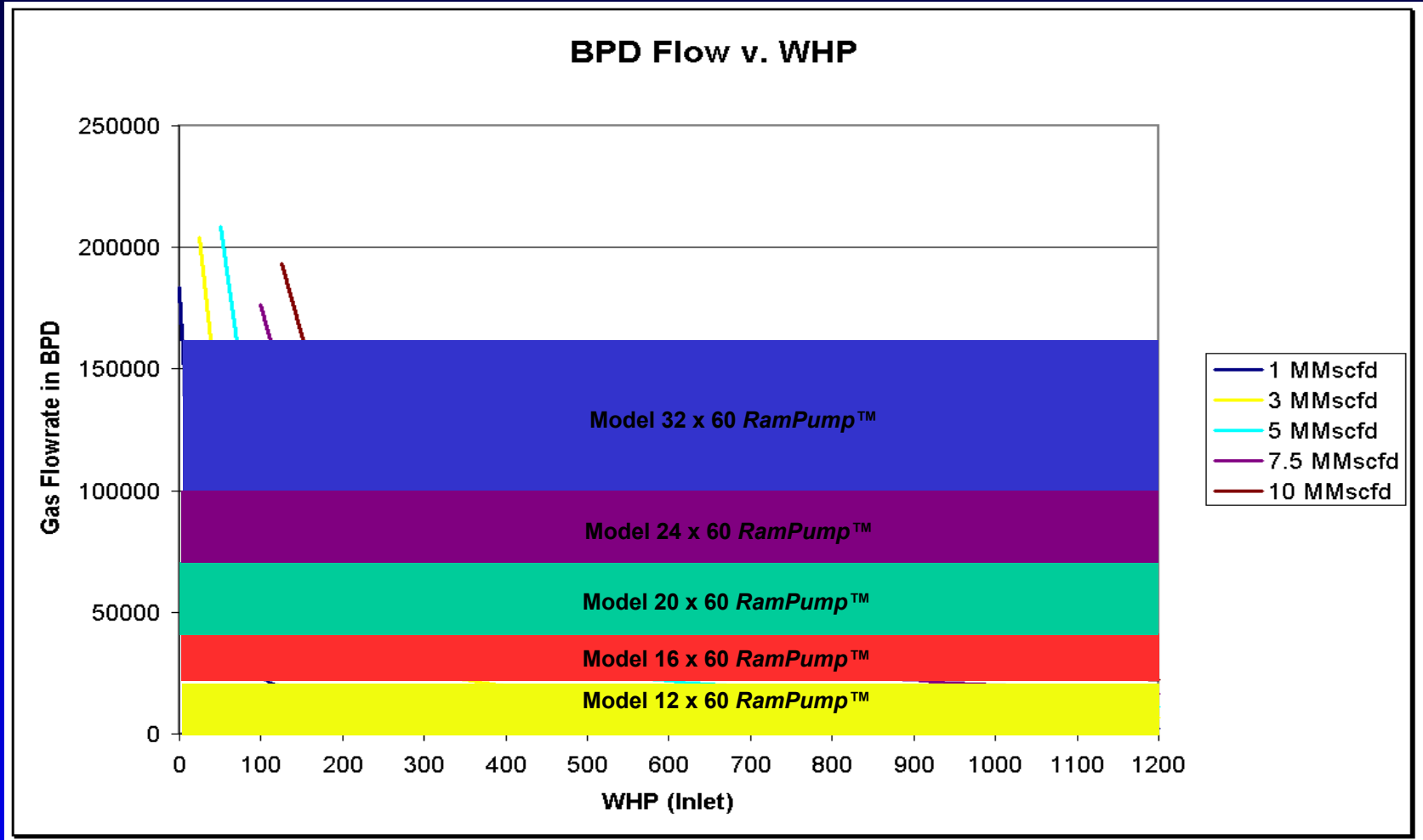
150,000 BPD

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Pump Selection Range at various gas rates



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Money Saving Features



- **SEALS:**
- NO mechanical seals!
- Sealant is INJECTIBLE -- while operating.
- Seals are LONG LIFE!
- No Seal Plan is needed to cool or lubricate seals.
- Every RamPump has 100% Seal Back Up -- Included.
- Can handle solids in the flow -- has built in labyrinth seal protection.

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Money Savers -- Continued



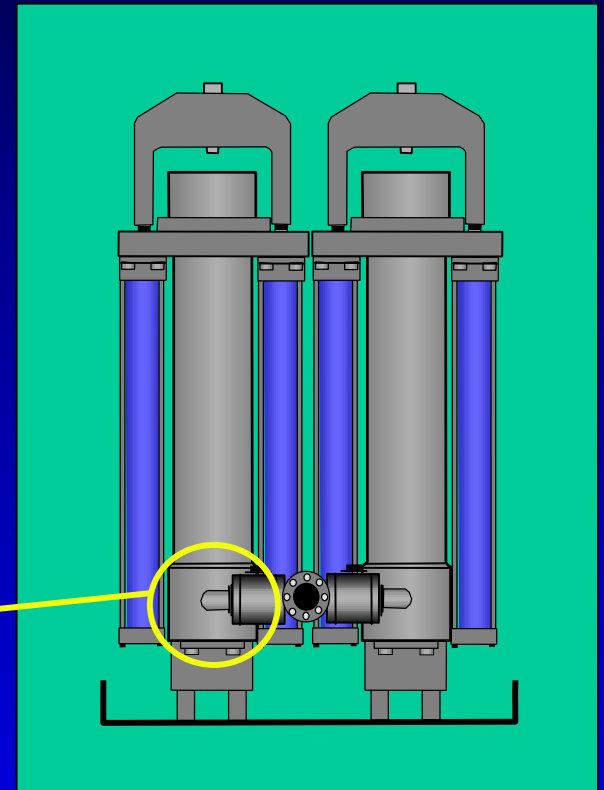
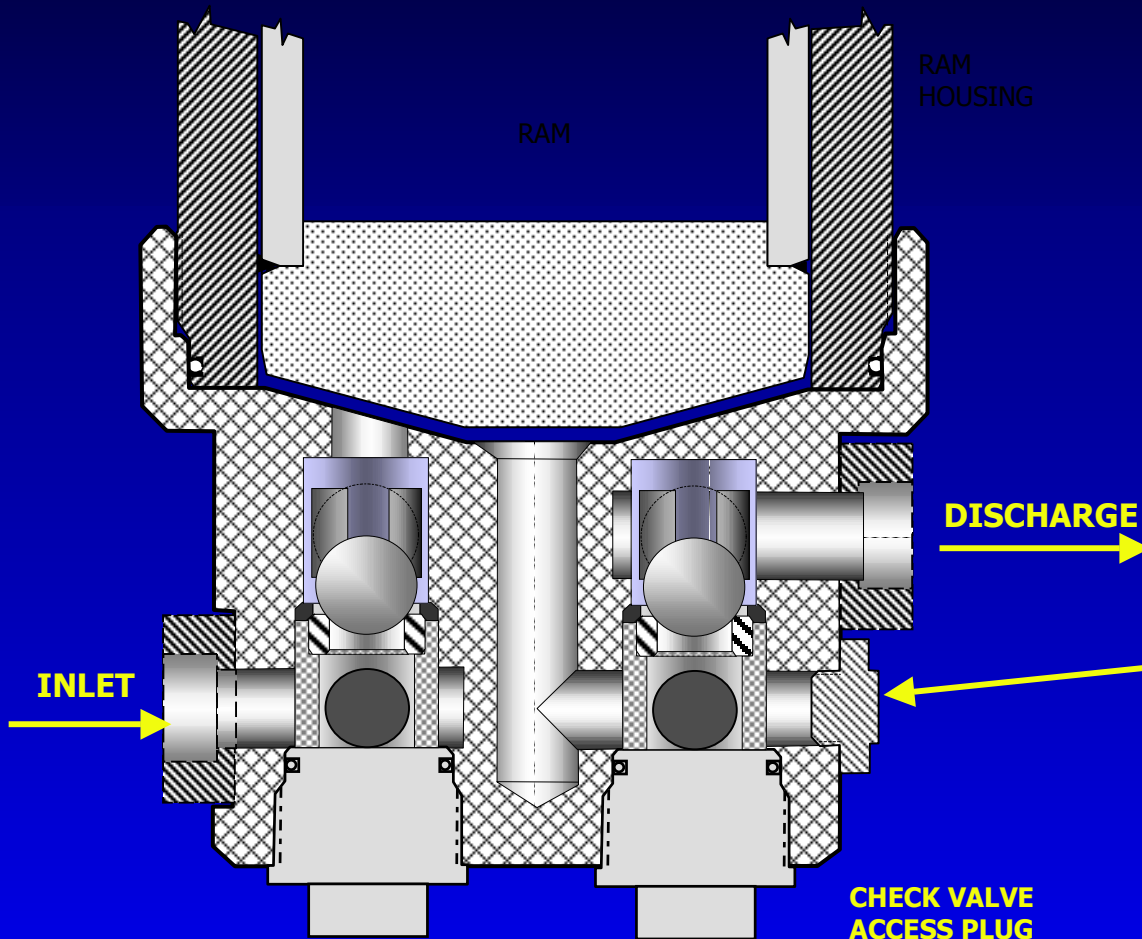
- **FIELD OPERATIONS**
- No need for flow splitter when running pumps in parallel.
- Infinite Speed Control -- standard on every unit.
- No VFD or PLC required for control.
- No recirculation loop required.
- Automatic stall out -- with automatic return to pumping.
- Can handle H₂S and CO₂.
- Pressure Integrity -- Both the mechanical system and the seals are rated at the same proof pressure. No de-rating while operating.

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RamPump Check Valve (Typ.)



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Money Savers, Continued



- **MAINTENANCE**

- The RamPump is designed to be field maintained -- no need to take it to the shop.
- No special alignment required to reinstall seals.
- Average field mechanic can trouble shoot and can operate.
- Rugged, “Oil Field” Design, modular.
- Most components commercially available.
- Parts box provided for maintenance convenience.

