Multiphase Compression for Wellheads and Vapor Recovery
The Hydraulic Beam Gas Compressor®
Manufactured by Permian Production Equipment, Inc.—Midland, Texas

The MOST reliable compression system
Available

“The Real McCoy”

Hydraulic.beamgascompressor.com
How oil is produced
its just as easy as ...
...
Shooting at some food….and up thru the ground comes a bubbling crude… Oil that is…..Texas Tea
People have been relieving back pressure for years
Some on purpose by venting

Others not so much on purpose by a blow out…
Agenda:

• Historical Development
• Description/Advantages
• Applications
• Total Cost of Service Economics
• Summary & Pricing
The invention of the Beam Gas Compressor began with just a trip to the oil fields of Monahans, Texas, where Charlie McCoy couldn’t believe his eyes. Gas was flowing from the casing of a well between two sand domes, and lying on the ground in the middle of it were dead quail. The operator’s engineer accompanying Mr. McCoy said the well had a problem producing because of gas locking (gas interference) in the down hole pump.
“I watched that pumping unit run and thought, ‘How can we use the pumping unit as energy to take the gas and pressure off the well casing and not kill the quail?’” said Mr McCoy. His response was design of the Beam Gas Compressor®, which he tried out on the well, and soon the operator was buying his design. That was about 1982. Today, Mr. McCoy sells the Beam Gas Compressor throughout the United States, Europe, and Latin America, as well as the Middle East. Since then, over 5600 units sold world wide.
By utilizing the Prime Mover of the pumping unit we can now move oil and gas pressure.
Simple to install and operate
Double acting allows for gas compression and pressure reduction as the pumping unit goes up and down.
Without Beam Gas Compressor

High casing pressure entrains the gas in the fluid column and limit the coalescence of the bubbles in the gas separator. (High PIP)
Reduction in casing pressure reduces the PIP and increases the gas separation efficiency (Clegg, 1989). Better pump performance.
As pressure in the casing drops it causes the gas to expand as shown below and coalesce. With the gas bubbles expand as pressure drops so does its velocity as shown on the table to the left.
On most horizontal wells the gas carries mist or fluid to the surface in the casing, Causing problems for most skid compressors.
With the HyBGC ability to handle fluid and gas we can now lower the casing pressure and dramatically lower the PIP to increase production.
Hydraulic Beam Gas Compressor

- Utilizing Hydraulic pump and motor as the prime mover the Beam Gas Compressor could now be freestanding.
  
In 2013, the company looked at VRU applications and did further development.

- It turned out to be very robust and simple….something the VRU world needs.
Vapor Recovery is **NOT** Standard Compression

Three critical factors:

- **Very wet, very high BTU gas** – negatively affects oil systems
- **Large flow variations** including zero flow and frequent complete shut down – very hard on compressors
- **Reduced attention to small compression** – if its too complex and the production volumes are low, the operator uses up too much time and it sits out of service.

While screw, rotary vane and scroll compressors are commonly used in the design of VRU's, they can have serious shortcomings that degrade their usefulness such as complexity, high maintenance costs and downtime, resulting in decreased production and profit potential.
HYBGC does not need a suction scrubber, back pressure regulator, gas/oil separator or VFD.
The HyBGC Concept

Heart of the Unit

Advantages

- No lube in compression process to foul
- Can take liquids - Liquids are pushed through without damaging compressor
- Gas cooling takes place in compressor due to slow compression (10 cycles/min)
- Very simple
- No issues with multiple starts and stops
- No toxic gas emissions – Seal is between hydraulic cylinder and gas
In the upstroke, the directional control valve sends the pressurized fluid in to the lower portion of the drive cylinder, thereby pushing the drive piston up and raising the piston in the gas chamber and causing compression in the top portion and suction in the bottom. When the sensor senses the piston at the top of stroke, the fluid flow is reversed.
As the hydraulic fluid enters the top of the drive cylinder, the pressure forces the piston down thusly forcing the lower piston in the gas chamber down and compressing the gas that was sucked in during the upstroke while at the same time sucking in gas on the top side of the piston.
It has no need for a scrubber as it can also pump fluid thru the system to the flow line
Fluid Drive System consisting of:

- Heat Exchanger
- Fluid Temperature Transmitters
- Oil Filter
- Directional Valve
- Hydraulic Hoses
- Pressure Transmitters for Oil level Oil Filter System
- Tank for fluid
- Visual tank level and temperature
- Motor and Pump
- Ball valve
- Skid

Beam Gas Compressor consisting of:

- Hydraulic Cylinder
- Pressure Relief Valve
- Middle Head
- Manifold
- Gas Cylinder
- Trunnion Mount
Advantages over Screw Packages

- Elimination of frequent oil filter changes caused by oil to gas contact
- Significantly reduced possibility of oil loss caused by typical collapsed filter, failed backpressure valve, hydrate formation or cold weather startup
- No VFD required and yet better flexibility with wobble plate option (8:1 turndown)
- No inlet scrubber, gas/oil separator, liquid transfer pump with switches, dumps and seals to fail or freeze and motor to fail.
- Much higher allowable H2S levels (up to 25% experience today). No leak sources from compressor.
- Simple enough to be controlled by tank battery PLC vs its own PLC
- Simple for operators and mechanics to easily pick up the maintenance and operation. No specialized training.
- Gas cooling need reduced – Gas cools in cylinder & downstream pipe on small unit and a cooler is not required (Max of 10 cycles per minute). May not need cooler in bigger model.
### Discharge Pressure PSI

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#### 10 Horsepower HyBGC

#### 20 Horsepower HyBGC

#### 40 Horsepower HyBGC

#### 75 Horsepower HyBGC
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<td>Suction Pressure (desired) Gauge</td>
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Increase in Production
105 bopd or $1,916,250 per year
The 3 units were installed in winter of 2014 in New Mexico in high H2S service

Number of service calls mechanical 1
  Fan motor blade
Number of service calls automation 4
  3 PLC set points
  1 Transmitters
  Average 1.5 million cycles per year
Vapor Recovery Unit
16% H2S
High CO2/H2S Application in Texas Clampett - installed November 2015
- Number of cycles since installation 2,855,452
- Service calls:
  - 3 Cooling radiator leak
  - 2 Paraffinic crude in gas compressor not treated by chemical. Check valves sticking needed replacement
  - Automation 2 Set points changes
North Dakota – Installed December 2015 in High H2S service in cold weather environment.

Number of cycles since installation 2,325,452
Number of service calls 0
Steam system application installed in 2014 - average temperature of gas 275 degrees F
Portable unit for testing wells in Eastern Europe
What about the seal between the hydraulic and gas cylinders (is there a risk of blow by and gas contamination)?
Emissions are non existent
Hydraulic Cylinder
Wog 750 - 1400 psi

Gas Cylinder
Wog 50 - 400 psi

Different diameters of gas cylinders are used to attain higher discharge rates.

Seal design: zero failures in 3 years on 7 units.
Application Use Examples
• Relieve restricted back pressure on wells for increased production

• VRU service

• Gas supply to operate surface equipment such as separators, natural gas engines, etc.

• Small gathering system on high H2S applications

• Operation in extreme sour gas situations and also HIGH TEMPERATURE applications such as steam floods.
With the HyBGC ability to vary its stroke based on the volume of gas, you can have multiple wells hooked to one unit.
Progressive Cavity Pumps
Can benefit with a HyBGC by relieving the back pressure on the formation and allowing gas to flow up the casing instead of the tubing
Same can be said for ESP
Hydraulics a time tested concept has now come to wellhead and vapor compression
Summary of Advantages of HyBGC

- No process filters to contaminate and replace frequently (typically monthly or quarterly)
- No chance of oil contamination – Happens frequently with screw VRU’s in high H2S or very wet service
- Significantly reduced chance of oil loss – screw loses its oil if slugged by water or excessive hydrate formation. These can occur in intermittent service during startup or in poor gas quality service.
- No VFD required and yet better flexibility than VFD. 8:1 turndown with NO recycle- with wobble plate but costs more. Other way is to manually adjust oil bypass (typically done for lower flow models to save money)
- No inlet scrubber, gas/oil separator, liquid transfer pump with switches, dumps and seals to fail or freeze.
- No oil system heaters required because the compressor does not need oil and hydraulic system works down to X degrees.
- Gas cooler – Gas cools in cylinder downstream pipe on small unit and a cooler is not required (Max of 10 cycles per minute). May not need cooler in bigger model.
- Use and control of your own PLC and software
- Much lower operating costs.
THE GREEN MACHINE®
No emissions and environmentally friendly

Impervious to H2S
No Scrubber System needed

Hydraulic beamgascompressor®
Manufactured by Permian Production Equipment, Inc.

Vapor Recovery
Made Simple in the USA
Hydraulic.beamgascompressor.com
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