ECONOMICAL CASING HEAD GAS GATHERING SYSTEM

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BEAM GAS COMPRESSOR SYSTEM (BGC) DESIGN AND OPERATION.

The Beam Gas Compressors utilized in these illustrations use the energy from the normal pumping action of the pump jack already on location.

The size of the BGC was configured to compress the daily gas production from the lease at the operator's desired casing pressure within the pumping unit's normal operating run time. (See Figure #1)

The BGC's were installed on a centrally located Pumping unit in the field. The casings of the adjoining wells are joined together and a trunk line carrying the gas from the adjacent wells is plumbed to the casing of the well where the BGC is installed. (See Figure #2)

As the walking beam movement pumps the well, the Beam Gas Compressor draws gas from the gathering system by pulling the gas from the casing through check valves and discharges it into the flow line down stream from the pumping tee. The gas rejoins the tubing production and flows to the separator and on to the gas sales line.

A separate gas line (at the option of the operator) will allow the compressed gas to be directed to field compression, the separator or to the gas meter.
(See Figure #2)

BGC FEATURES

- The BGC utilizes a clamping system to mount the BGC to the walking beam and the pumping unit skid.
- The BGC is Double Acting and compresses gas in both the up and down motion of the pumping unit. The counter balance of the pumping unit is not affected.
- The BGC^{M} is manufactured to operate in all corrosive environments as well as wet and high BTU gases and has been installed on virtually every style-pumping unit.
- The Pump Jack is the prime mover for the BGC and allows the kinetic energy stored in the motion of the weights and rods to compress the gas.
- The BGC can be moved to other wells
- Pumpers and lease operators like the low day-to-day maintenance and reliability.

PRODUCTIVITY INDEX

Each formation is different in its response to back pressure or a reduction of back pressure. The producing formations that have good porosity and a good productivity index (PI) will give the best results when the back pressure is reduced. The productivity index is defined as the amount of increased fluid the well will give up for each pound of draw-down achieved at the formation.

In other words, if a well has a "PI" of one, then for each pound of pressure relieved from the face of the formation the well will give up one barrel of fluid. So when looking for an increase in production, we look at wells that have a

high PI. For example, a well with a PI of 0.5 and a wellhead back pressure of 50 PSI will increase 25 barrels a day when the wellhead pressure is reduced to 0 PSI.

GENERAL INFORMATION

When a well is drilled and placed in production, it normally has a good bottom hole pressure and will often flow, provided the bottom hole pressure is high enough to overcome the surface back pressure and fluid gradient. As the well continues to produce, and the bottom hole pressure declines, the surface pressure becomes a factor, and the well will ultimately be placed on some type of artificial lift – the most common of which is the rod pump.

As the well continues to produce, the bottom hole pressure continues to decline until the surface back pressure required to operate the lease equipment and pass produced gas through the sales meter becomes a greater percentage of the depleted bottom hole pressure. This is when the operator should consider a back pressure relief tool such as the Beam Gas Compressor

PERMIAN BASIN WELL TEST PROGRAM

PPEI offers a test program in the Permian Basin to allow an operator to determine the economical benefit of relieving back pressure on his wells.

We found that testing allows the opportunity to validate the candidate wells ability to be economically feasible. An actual test takes all the guess work out of the project.

The Test Program minimizes the risk of having operators expend dollars on projects that did not offer the ROI expected.

The Test Program works to the advantage of both parties and prevents mistakes by operators with a 30 day actual operation without back pressure for a test fee. The test fee helps cover the cost of the installation.

PPEI installs the Beam Gas Compressor..
PPEI furnishes plumbing suction and discharge.

Operator furnishes lubrication and day to day operation.
Operator shares production data with PPEI.

CASE STUDIES

Low Bottom Hole Pressure BGC Gathering System

Case #1, Rim Southwest: The Beam Gas Compressor was installed on the Navajo Tribal 33-43 in San Juan County close to Aneth, UT. The Navajo Tribal 34-33 and the Navajo Tribal 34-42 casing were tied together and a trunk line was run to the casing of the 33-43. This field has a low bottom hole pressure. The wells are being produced from in the Desert Creek formation. This BGC gathering system was installed in July 2003.
(See Chart Case #1)

Gas Interference (Gas Locking)

Case #2: Field: Means North of Odessa, TX: A Local operator with multiple leases throughout the Permian Basin. The Beam Gas Compressor was installed November, 2006 and replaced an electric skid mounted unit. The BGC was installed on a centrally located Pumping Unit with two additional wells tied into the casing of the BGC well. The BGC well is on a timer and the BGC was designed to compress the volume of produced gas the three wells make taking into account the PU run time. The BGC maintains the casing pressures at “0” PSIG to maximize hydrocarbon flow to the well bore. Note: These wells would not pump against line pressure due to gas interference and restricted flow of fluid to the bore due to surface back pressure .
(See Chart Case #2)

Operator Comment: At the time we installed the BGC gathering system we installed 4 other units on single wells. The BGC’ are set up on a 90 day PM program with PPEI and to date we have only had to replace a discharge hose on one of the units. The PM program checks out the units keeps the rod packing adjusted and assures each unit is performing as specified**.**

Note: This operator (legal did not want to release name) has installed additional units in two other fields and one of the installations was designed to compress a sister wells. At the time of this writing we have another project to do another BGC gathering system for two wells on a small lease.

High Sales Line Pressure

Case #3, Field: Texas University in the Sandhills Crane, TX: A Dallas, TX operator with multiple leases throughout Texas. The Beam Gas Compressor gathering system was installed May of 2005. The BGC was installed on a centrally located Pumping Unit with four (4) additional wells tied into the casing of the BGC well. This well is also on a POC so the BGC was designed to compress the volume of gas the five (5) wells make with the percentage of run time of the PU with the casing pressures at "0" PSIG. Note: These wells were producing into a long flow line that causes excessive back pressure at the wellheads. Since this installation the operator has installed another BGC gathering system and is in the process of looking at the third.
(See Chart Case #3)

High Fluctuating Line Pressure

Case #4, TDU 3-8, Pecos County, Texas, Tema Oil and Gas Company, Midland, TX.
This well is part of a field in a remote location of West Texas. It is producing from the Devonian formation with a low bottom hole pressure. The sales line pressure varies from a normal of 25 PSIG to a high of 40/45 PSIG. We noticed that when the line pressure went to the high side that we lost half of the production. The oil production would drop from 7 to 8 BOPD down to 3 to 4 BOPD and the gas from 50 MCFD down to 30 MCFD. We installed the BGC in May of this year and the production has increased to 11 or 12 BOPD and the gas from 50 MCFD to 60 MCFD. One thing we like about this system is that the well is producing at its maximum rate and it does it every day regardless of the sales line pressure variations. The lease operator says it is no problem to look after and maintain. The lubrication is the only routine for the pumper and it is done on a weekly basis.
(See Chart Case 4)

Two Staging the Beam Gas Compressor

Case #5, Pecos County, TX (Endeavor Energy). This installation is both a high-pressure installation as well as a low cost gathering system for multiple wells. Two BGC's were installed on the Herring #1 well. One compressor was installed between the Sampson post and the gearbox and the other between the Sampson post and the horse's head. Field gas is feed into a manifold and then into the casing of the Herring #1 (the casing acts as a scrubber) where the BGC'S are installed. The first BGC pulls the gas from the casing and compresses the gas to 60 PSIG and into the second BGC. The second BGC (a high pressure model) then compresses the gas into the high-pressure sales line. This installation takes advantage of not requiring an additional motor on location which results in energy savings for the lease as well as the simplicity of the BGC system. Because of this installation, Endeavor Energy has continues to utilize the Beam Gas Compressor on other application in other fields producing from other formations.

Cutting Compression Cost

Case #6: Halbower A,., Harper County, KS (McCoy Petro Corp designed by Abe's Oilfield Service, Spivey, KS) This operator elected to replace a C26 Gemini Gas Driven Compressor with the Beam Operated Beam Gas compressor in January 2007. An additional well was tied into the BGC for the small gathering system. The purpose was to reduce the operating cost of compression on this lease. With the Skid mounted compressor the operator had to by-pass gas to the Separator to move fluid. With the BGC they compressed gas to the separator eliminating the worry of by-passing gas and not moving fluid.
Comments: The BGC is Low maintenance and Pumper friendly. The operator calculated a savings of fuel gas and the operating cost of the Skid Mounted unit.

Typical Beam Gas Compressor Gathering System

Case #7: Aldrich A #4, Kingman County, KS (Mull Drilling designed by Abe's Oilfield Service, Spivey, KS). They tied in three (3) additional wells to the #4 casing with the Beam Gas Compressor in January 2002. Two (2") inch poly pipe was used to plumb to the tank Battery location and a line was laid from the TB to the #4. The suction of the BGC comes from the casing of the #4 and discharges back into the flow line of the #4. The Aldrich #4 runs on a timer and the BGC was designed to take this into account when designing for the total lease gas.

CONCLUSION

The cases in this writing are applications conceived by the operators. While each installation shows an increase in production due to the reduction in back pressure on the formation, they were installed for a different reason: (1) To reduce compression cost in the case of the fuel gas driven compressor, (2) Forcing production into the high-pressure sales line, (3) To relieve gas interference in the down hole pump and to simply increase production by reducing the back pressure on the formation. In each case the production increased resulting in increased cash flow for these wells. In the case where the skid mounted compressors were replaced, the operating cost of compression was lowered by not having the additional prime mover to maintain and the savings related to the fuel gas and electric energy cost to operate the motors.

The cost of a BGC Turn Key installation ranges from $12,000.00 to around 18,000.00 depending on the gas volume, line pressure and the pumping unit on location. Permian Production Equipment, Inc. suggest that, before you consider abandoning marginal wells producing against separator pressure, you test the well to determine the benefit of producing without back pressure on the formation. We have found that some wells will continue to produce at a profit for several more years.

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CASE STUDY DATA WITH PAYOUT BASED ON INCREASE

Oil: $95.00 Gas: $ 6.75

CASE (1)

Rim Southwest	Parameter	Increase	Price	Added Annual $'s
Navajo Tribal 34-33	Casing PSIG	"0"		
Aneth, UT	Oil, BPD	14	95.00	$485,450.00
	Gas, MCFD	26	6.75	64,057.50
		Total Revenue Increase		$549,507.50
		Beam Gas Compressor Installation	16,936.31	
		Installing Lines and Other Cost	18,940.00	
		Total AFE Cost		(34,940.00)
		Net Revenue Increase First Year (ROI)		+ $514,567.50

CASE (2)

Independent Operator	Parameter	Increase	Price	Added Annual $'s
Means Field	Casing PSIG	0 to 60		
Andrews, TX	Oil, BPD	37	95.00	$1,282,975.00
	Gas, MCFD	20	6.75	49,275.00
		Total Revenue Increase		$1,332,250.00
		Beam Gas Compressor Installation	$17,870.89	
		Installing Lines and Other Cost	6,500.00	
		Total AFE Cost		(24,370.89)
		Net Revenue Increase First Year (ROI)		+ $1,307,879.11

CASE (3)

Independent	Parameter	Increase	Price	Added Annual $'s
Texas University	Casing PSIG	-0 to 65		
Crane, TX	Oil, BPD	24	95.00	$835.200.00
	Gas, MCFD	60	6.75	147,825.00
		Total Revenue Increase		$983,025.00
		Beam Gas Compressor Annual Rent	$8,400.00	
		Installing Lines and Other Cost	8,200.00	
		Total AFE Cost		(16,600.00)
		Net Revenue Increase First Year (ROI)		+ $996,425.00

CASE (4)

Tema Oil & Gas Co.	Parameter	Increase	Price	Added Annual $'s
TDU 3-8	Casing PSIG	0 to 50		
Pecos County	Oil, BPD	5	95.00	173,375.00
	Gas, MCFD	12	6.75	29,565.00
		Total Revenue Increase		202,940.00
		Beam Gas Compressor Installation	11,925.00	
		Installing Lines and Other Cost	3,200.00	
		Total AFE Cost		(15,125.00)
		Net Revenue Increase First Year (ROI)		+ $187,815.00

CASE (5) No Data

CASE (6)

Halbower A	Parameter	Increase	Price	Added Annual $'s
McCoy Petro Corp	Casing PSIG	25 to 180		
Harper County, KS	Oil, BPD	0	95.00	$.00
	Gas, MCFD	12	6.75	29,565.00
		Total Revenue Increase		29,565.00
		Beam Gas Compressor Installation	12,714.32	
		Installing Lines and Other Cost	3,000.00	
		Total AFE Cost		(15,714.32)
		Net Revenue Increase First Year (ROI)		+ $13,850.68

CASE (7)

Aldrich A #4	Parameter	Increase	Price	Added Annual $'s
Mull Drilling	Casing PSIG	0 to 35		
Kingman County, KS	Oil, BPD	10	95.00	$346,750.00
	Gas, MCFD	20	6.75	49,275.00
		Total Revenue Increase		396,025.00
		Beam Gas Compressor Installation	13,150.00	
		Installing Lines and Other Cost	15,000.00	
		Total AFE Cost		(28,150.00)
		Net Revenue Increase First Year (ROI)		+ 367,875.00

Figure 1 - Beam Gas Compressor Installation

Figure 2 - Gathering Manifold