BACK PRESSURE RELIEF TESTING WITH THE BEAM GAS COMPRESSOR

Charlie McCoy
Permian Production Equipment, Inc.

THE 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 at the operator's desired casing pressure within the pumping unit's normal operating run time. As the walking beam movement pumps the well, the Beam Gas Compressor draws produced 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.

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™ 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.

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.

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

WELL TEST PROGRAM

PPEI has been working with Low Bottom Hole Pressure wells using the Beam Gas Compressor to relieve back pressure on almost every formation. We have worked hand in hand with operators to calculate the production increase we might see if we relieved the back pressure on candidate wells. We found that even with good data and input from field personnel we were not always successful in our selection of candidates. Some of the wells we selected did not show sufficient increases to justify the project. Testing allows the opportunity to validate the candidate wells ability to be economically feasible.

In order to minimize the risk of having operators expend dollars on projects that did not offer the ROI expected, we have offered a test before you rent or buy the BGC system.

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 is to help 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.

The following cases were the result of our test program. The Test Program has been most successful for both the Oil and Gas Operators and PPEI.

CASE STUDIES

Low Bottom Hole Pressure

Case #1, Germania 103, Midland County, Texas, Calvin Gene Turner, Faskin Oil & Ranch Ltd. Midland, TX. This area of the field has a low bottom hole pressure. The well is being produced from in the Grayburg formation and we installed a Beam Gas Compressor on this well in January of 2003. The well had a POC run time of approximately 12% with a casing pressure of 52 to 56 PSIG. With the BGC in operation, the run time on this well increased to 20 to 25% and the casing pressure was drawn down to "0" PSIG. The result was a 5 to 6 BOPD increase in total production from this well along with the associated gas.

Gas Interference (Gas Locking)

Case #2: Well: Forest Switzer Chisos Operating, Inc., Pecos County, TX
BGC Installed: 11/15/98
Operator Comment: Five months after the BGC^{TM} was installed, we tied in another well to the compressor. The BGC^{TM} is now compressing gas and pressure from two wells. Production has been allocated by test once a month after the second well was added and we are unable to provide accurate date on the Forest Switzer #1, however production is holding up on both wells. The Forest Switzer is utilizing a pump off controller and we noticed a 10% decrease in energy consumption after the installation of the BGC^{TM}. The field personnel report we have not experienced any problems in the operation of the unit after installing an automatic lubrication pump.

High Sales Line Pressure

Case #3, Well: Twyman #1 in Kingman County, Kansas, Dale May, Edmiston Oil Company. This application is a rod pumping gas well with a gas engine prime mover and is producing from the Mississippi formation at 4134 feet. The bottom hole pressure on this well is not sufficient to overcome the high sales line pressure (180 PSI) and we could not produce the full potential of this well. We installed the Beam Gas Compressor in 2001 at an AFE cost of $10,000. After installation of the BGC, Gas sales increased from 70 to 140 MCFD - an increase of 70 MCFD per day. The BGC system of compression was our choice for this application because it does not require an additional motor – the Pumping Unit is the prime mover of the BGC. This installation accomplished two objectives (1) if forced low pressure gas into the high sales line and (2) by relieving the back pressure on the formation, the formation was allowed to produce at its maximum rate based on the wells deliverability. At the time of the installation, gas prices were much lower than at present, however, we calculated the pay out was achieved within (3) three months. As a result of the success on this installation, we have evaluated other prospects and installed additional BGC Compression systems. As with most projects in the patch, some have shown good increases and

some not so good – but all have paid out. At the moment, we are considering other applications for this Beam Gas Compressor system. Not all the installations show this much improvement, however, the gas sales are consistent, even against sales line fluctuation.

Un-economical well (Scheduled for P & A)

Case #4: University 3764-101, Aghorn Operating, Inc., Andrews County, TX
BGC Installed: November, 1998
Operator Comment: This well was uneconomical to produce by the previous operator. The formation pressure is so low that the well will not produce against line pressure. With the installation of the BGC™ the well has been profitable even before the oil and gas prices made the upward swing. In two years of operation the only maintenance on the BGC™ has been to replace the piston seals. The well is still profitable and we are presently looking at another project for the BGC™.

Replacing Gas Fueled Skid Compressors

Case #5, Anasazie #1, Montezuma Creek, Utah (RIM Southwest Corporation) Ken Kundrik, Englewood, Colorado
The Beam Gas Compressor (BGC) was installed on the Anasazie #1 March 7, 2001. The BGC was used to replace a conventional gas fueled skid mounted compressor. The BGC reduced the casing pressure from 35 psig to < 0 psig. The Oil production increased from 55.14 BOPD in February to 70.58 BOPD in April. Metered Gas production also increased from 50 mcf/d in February to 63 mcf/d in April. The increased cash flows from the well amounted to $8530.66/month resulting in a unit payout of less than 2 months. As a result of this RIM Southwest Corporation has installed 9 additional units and is installing a 10th unit to be used by 3 wells. The units have been very reliable requiring only minor maintenance and upkeep in the past four years.

Two Staging the Beam Gas Compressor

Case #6, 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.

Fluctuating Sales Line Pressure

Case #7, 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 relative 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.

OTHER

The Beam Gas Compressor is being utilized in steam floods as well as in CO_2 to draw gas and pressure from the casing to alleviate interference (gas-locking) in the down hole pump.

At present, according to the Texas Railroad Commission, there are over 17,000 wells in Texas that are being scheduled for P&A. A good number of these wells would be economical if produced without backpressure on the formation. This would result in a higher percentage of hydrocarbons being recovered from these existing well bores.

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, forcing production into the high-pressure sales line, to relieve gas interference in the down hole pump and one simply to increase production by reducing the back pressure on the formation. In each case the production increased which resulted 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 to operate the engine.

The cost of a BGC installation ranges from $8,000 to around 13,000.00 depending on the gas volume, line pressure and the pumping unit on location. Permian Production Equipment, Inc. suggest that, before you consider abandoning a marginal well producing against separator pressure, you take a look at what this well might do producing without back pressure. We have found that some wells will continue to produce at a profit for several more years.

ACKNOWLEDGMENT

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CASE STUDY DATA With PAYOUT BASED ON INCREASE
Oil: $45.00 Gas: $ 6.00

CASE (1)

Germania 103	Parameter	Before BGC	After BGC	Increase	Added Annual $'s
Midland Co	Casing PSIG	55	0		
Texas	Oil, BPD	11.10	18	6.90	$113,332.50
	Gas, MCFD	N/A	N/A		$00
				Total	**$113,332.50**

CASE (2)

Forest Switzer	Parameter	Before BGC	After BGC	Increase	Added Revenue
Pecos County	Casing PSIG	24	0		
TX	Oil, BPD	12.10	13.1	1	$ 1,395.00 mo.
	Gas, MCFD	34.5	69.6	35.10	$ 6,528.60 mo.
				Annual	**$ 95,083.20**

CASE (3)

Twyman #1	Parameter	Before BGC	After BGC	Increase	Added Revenue
Kingman Co	Casing PSIG	180	20		
Kansas	Oil, BPD	0	0	Water	$ mo.
	Gas, MCFD	70	140	70	$ 13,020.00 mo.
				Annual	**$ 156,240.00**

CASE (4)

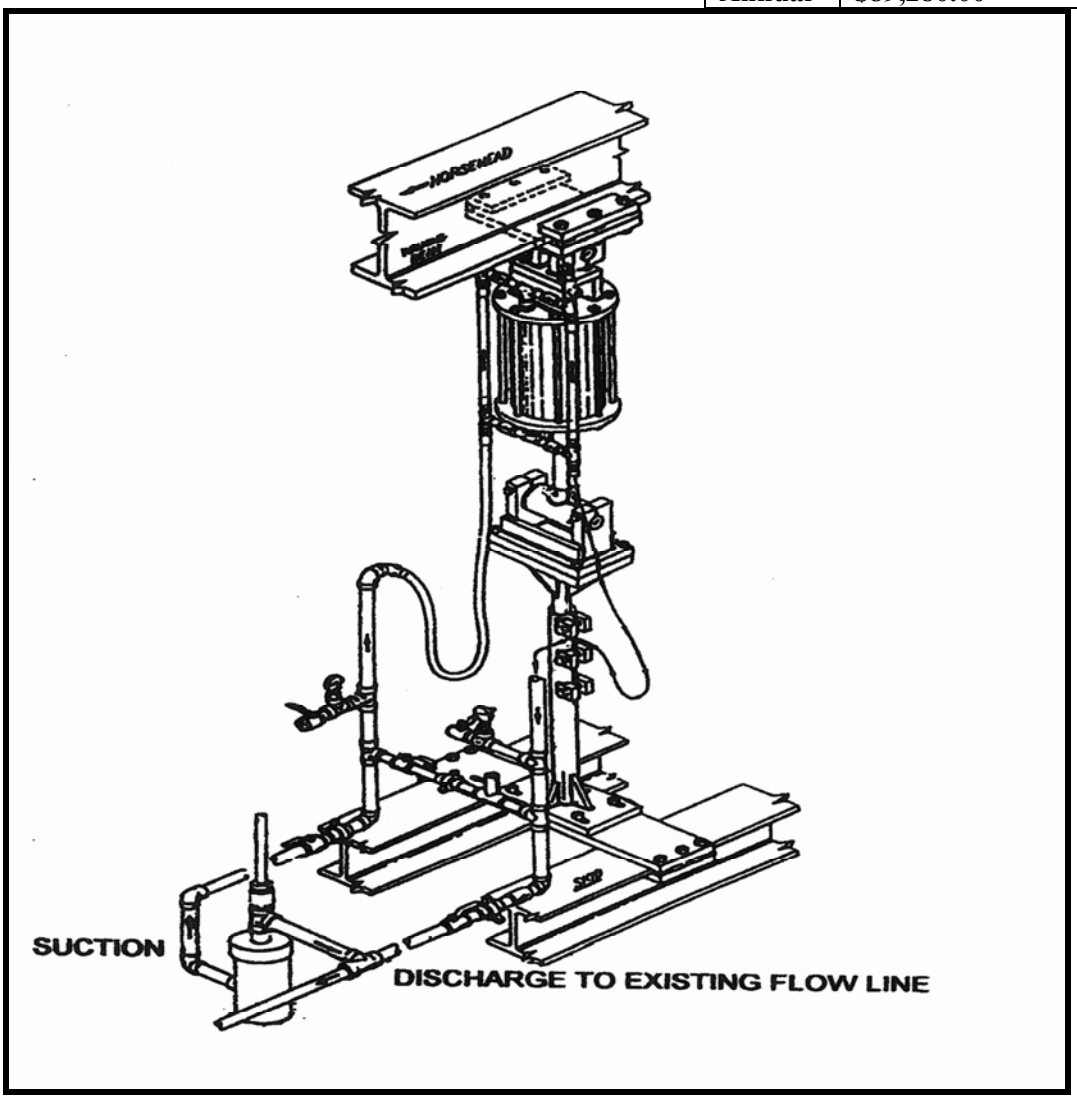
University 101	Parameter	Before BGC	After BGC	Increase	Added Revenue
Andrews Co.	Casing PSIG	15	<0		
TX	Oil, BPD	2.27	12.7	7.9	$ 11,020.50 mo.
	Gas, MCFD	0	7.3	7.3	$ 1,357.80 mo.
				Annual	**$ 148,755.60**

CASE (5)

Anasazie #1	Parameter	Before BGC	After BGC	Increase	Added Revenue
Montezuma	Casing PSIG	35	<0		
Creek	Oil, BPD	55.14	70.58	15.44	$ 21,538.00 mo.
Utah	Gas, MCFD	50	63	13	$ 2,413.00 mo.
				Annual	**$ 287,412.00**

CASE (7)

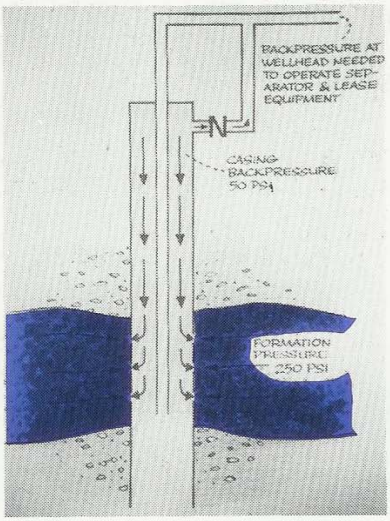
TDU 8-3	Parameter	Before BGC	After BGC	Increase	Added Revenue
Pecos County	Casing PSIG	25/45	0		
Texas	Oil, BPD	7.5	11.5	4.00	$5,580.00 mo.
	Gas, MCFD	50A	60	10	$ 1,860.00 mo
				Annual	**$89,280.00**



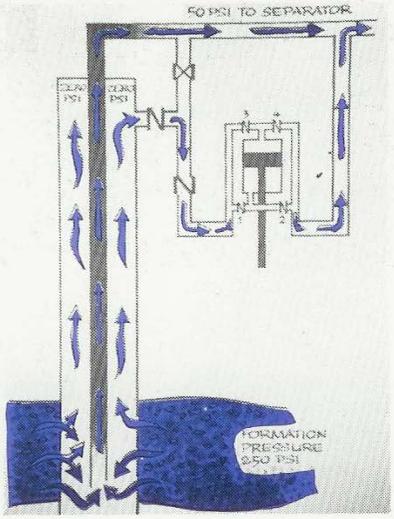
Typical BGC Installation

Before the BGC

Restricting Back pressure holds back the flow of Hydrocarbons into the well bore.



After the BGC



Back pressure is relieved from the face of the formation allowing more hydrocarbons to flow into the well bore.