BEAM GAS COMPRESSOR GOES HI TECH™

Charles D. McCoy and Mark W. Lancaster
Permian Production Equipment, Inc.

The Beam Gas Compressor ™ (BGC) is moving into the modern age of technology with satellite telemetry, variable speed or frequency drives and amp meters. This paper will document several different types of "modern" technology and how it is used in conjunction with the BGC to increase your production and minimize expense.

Satellite telemetry system uses the latest satellite and Internet technologies to bring data to your computer in near real time.

Partnering with AMCi Wireless we installed their Satellite Monitoring Unit (SMU) on a well approximately 45 miles east of Carlsbad, NM (Fig. 1). Our main purpose was to be able to determine if the ability to "see" the suction pressure, discharge pressure and temperature would enhance our ability to detect any maintenance problems in the down hole pump, rod string or our compressor prior to a major problem occurring (Fig. 5, 6 and 7).

Figure 2 shows you how the map would look with multiple units in a single field. In the middle you can see an alarm has been raised by the system indicating service would be needed. If this were the case a crew could be scheduled to visit the well and determine what the problem might be prior to an actual downtime event occurring.

In addition to this we could have other features added that would allow us to see the amount of gas flow thru the BGC on a daily and/or hourly basis transmitted to the production office or home office. This could save valuable time if leak or other occurrence had transpired allowing the facilities' team to fix a problem before it becomes severe.

The data is easily accessible on your own web page (Fig. 3) and you can create graphs and charts based on multiple variables and dates. The systems transducers easily "plug in" to pressure ports on the suction and discharge sides of the BGC with a "belt" adhering the temperature sensor to the cylinder. (Figure 4)

Figures 5, 6 and 7 show there is a dynamic relationship between the pressure on the backside of a well and its production. The temperature of the compressor is the exact opposite of the suction pressure. This would show that when the compressor is running the most and drawing down the pressure of the casing the temperature goes up in the compressor as it is discharging great amount of gas to the flowline.

The flow rate of the gas remains consistent as the pumping unit speeds up or slows down based on fluid production. This is represented in Figures 8, 9 or 10.

A variable-frequency or speed drive (VFD) is a system for controlling the rotational speed of an alternating current (AC) electric motor by controlling the frequency of the electrical power supplied to the motor (From Wikipedia)

With the VFDs controller monitoring the amount of fluid in the well bore and thus varying the amount of strokes per minute it was hoped to see a relationship between relieving bottom hole pressure and increase production. Figure 8 and 9 show the ways a typical VFD works; adjusting the stroke to the load of the pumping unit and the amount of the fluid in the well bore.

In addition to saving energy variable speed or frequency drives can also increase production by operating the pumping unit when there is fluid above the pump that a "normal" pump off controller may have allowed the fluid to continually build. This additional fluid would obviously place static fluid pressure onto the formation and keep fluid from naturally flowing thru the perforations to the well bore.

If the condition occurs where the standing or traveling valve is sticking or the pump is not as efficient due to other problems the VFD will speed up to allow for that and maintain production at the same rate. Then when this occurs the VFD can communicate with the Satellite system so that the Production team can then schedule maintenance on the pump. This will allow for the pump to remain in service for the longest possible time and increase the mean average between pump or rod failures.

Over pumping is also eliminated by a VFD/controller and minimizes fluid pound. When the unit senses the well no longer has fluid or load it slows down the pumping unit causing the BGC to move less gas and does not have as great a temperature. This is an interesting phenomenon and needs to be studied in greater detail.

Figure 11 shows a typical pumping unit in Europe with a Beam Gas Compressor,™ they increased from 50m³ to 70m³ fluid production which is about from 314bbl (fluid)per day to about 440 bbl fluid per day – they typically have between 10-20% water cut utilizing a Sam with VSD.

The major benefits this operator found by using the SAM with BGC:

- Increase of production (as they measure surface card and calculate downhole card they know pump fillage and change of dynamic fluid level; and they pump as much as possible but still with 100% fillage)
- Reduce power costs: as they keep 100% fillage, they do not operate PU when they do not have 100% fillage (before when unit was on timer sometimes they were running with reduced fillage)
- Same production comes with lower run time, which increases life time of a well
- Work over can be planned as they take a down hole card with every stroke and they see trends (e.g. of a leaking standing valve or so); no work over when it is not necessary but before you have major problem as rod failure.

Over the past 50 years automation and electronics have increased the access to information. The key is taking that information and getting a return on investment.
For over 30 of those years the Beam Gas Compressor™ has been used to relieve back pressure on wells and thereby increasing production. The BGC has, over that time, a well deserved reputation of being "maintenance free" for years at a time. With telemetry we will be better able to increase that time by being able to monitor compressors and track their ability to keep the pressure off the backside of a well.

Amperature is a measure of the amount of electric charge passing a point per unit time. Around 6.241 × 10^{18} electrons, or one coulomb, passing a given point each second constitutes one ampere. In practice, its name is often shortened to ***amp***.

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In 2009 multiple wells having conventional gas powered as well as electric powered skid mounted compressors were replaced by BGC's due to the cost of operating. At the sites where we made the replacements the compressors were using an average of 20 mcfd to fuel there motors. This cost is about $29,200 per year per well of wasted energy and expense. In contrast the BGC's when installed showed incremental increases of horse power by the prime mover of the pumping unit and at subsequent significant lower operation costs.

Not to mention the cost of the other compressor for monthly rental in most cases exceeding $2,500 per month or $30,000 per year. In total this represents an increase of $60,000 per year to the up side of these wells.

ENERGY USED VS CREATED

For over 30 years the BGC has been installed on existing pumping units only to find that, in almost every case, the existing prime mover was sufficient to lift the rods and operate the BGC to compress the casing head gas into the flow line or sales line. In studies performed on several different pumping units with BGC's installed the energy requirements were measured to determine the amount of energy expended to operate the Pumping Unit when the BGC was and was not engaged.

As you can see by the table (Figure 14) the amount of additional energy is nominal and the wells generate over x amount of additional production when the BGC is engaged.

The Beam Gas Compressors operates basically by the walking beam movement that 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. This method of clamping prevents the need for welding on the PU.

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 do most of the work.

The BGC can be moved to other wells

Field service in minimal which reduces the time Pumpers and Lease Operators spend on 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 or pressure reduction 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 whole pressure continues to decline until the surface back pressure required operating the lease equipment and passing 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

CONCLUSION

In reality the oil field producers and operators of the world just want to sell their oil. Unfortunately producing formations do not behave in a way that easily allows fluid and gas to move to the surface and into flow lines.
So additional equipment and expense is necessary to take this valuable commodity to market.
These new fangled gadgets like satellite telemetry and VFD's provide quicker access to the information that is the most important to the operator.

How MUCH am I producing and can I economically increase the Production?
Are the questions?
Telemetry and technology like the Beam Gas Compressor™
give you the answers to those questions.

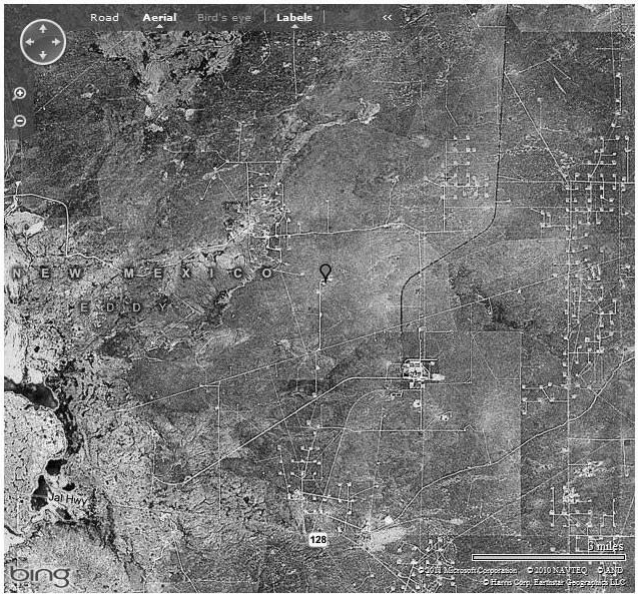


Figure 1

Figure 2

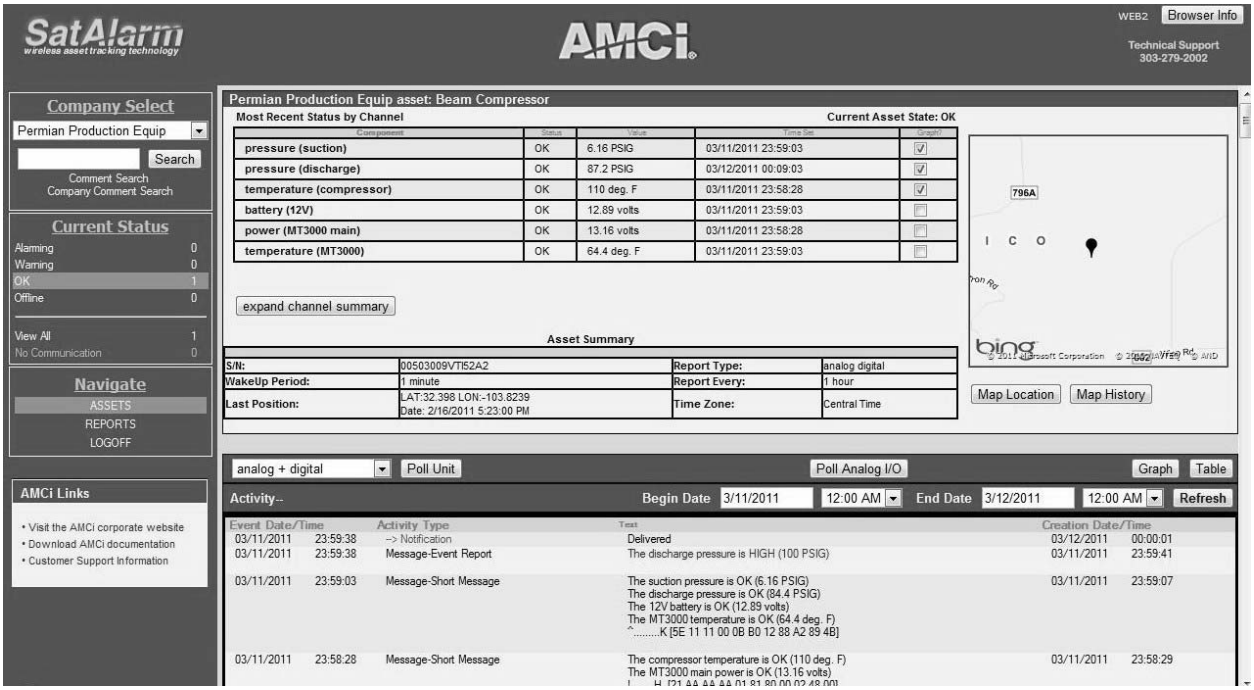
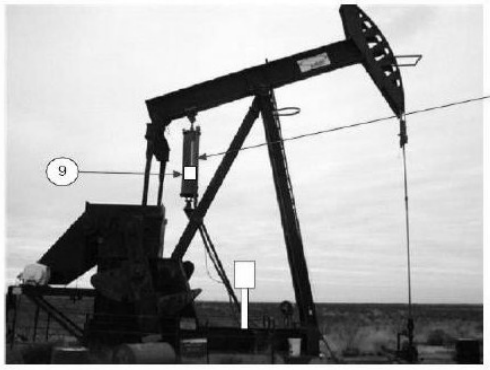
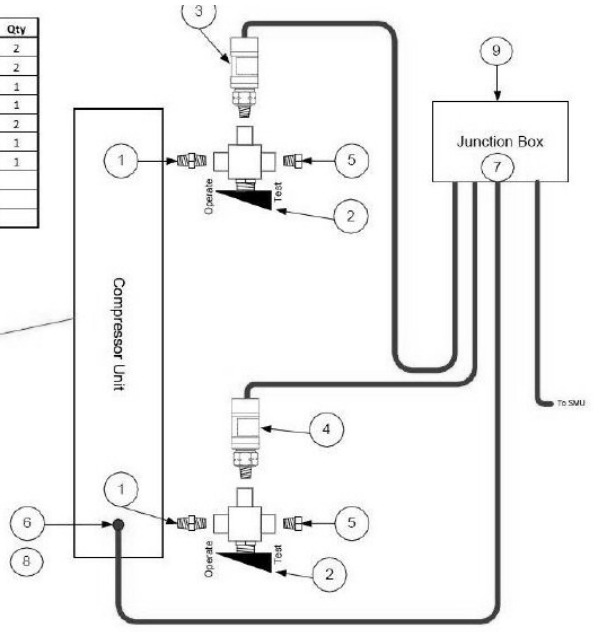


Figure 3

Item#	Part #	Description	Manufacturer	Qty
1	[redacted]	Fitting, Hex Nipple, Close, 1/4" mnpt x 1/4" mnpt, SS	[redacted]	2
2		Valve, Ball, 3-way, 1/4" fnpt x 1/4" fnpt		2
3		Transmitter, 4-20 mA, 0-15 psig, Suction		1
4		Transmitter, 4-20 mA, 0-150 psig, Discharge		1
5		Plug, 1/4" MNPT, SS		2
6		RTD, Surface Mount, 100 ohm Pt, SS, w 40" lead wire		1
7		RTD Transmitter, 4-20 mA		1
8		Clamp for RTD assembly		
9		Junction box, N x N x N		
10				





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DATE: 02/10/11 TIME: 5:00.00 PM PG: 1 OF 1 PGS

COMPANY: PPE CREATOR: Fred Wenzel

Figure 4

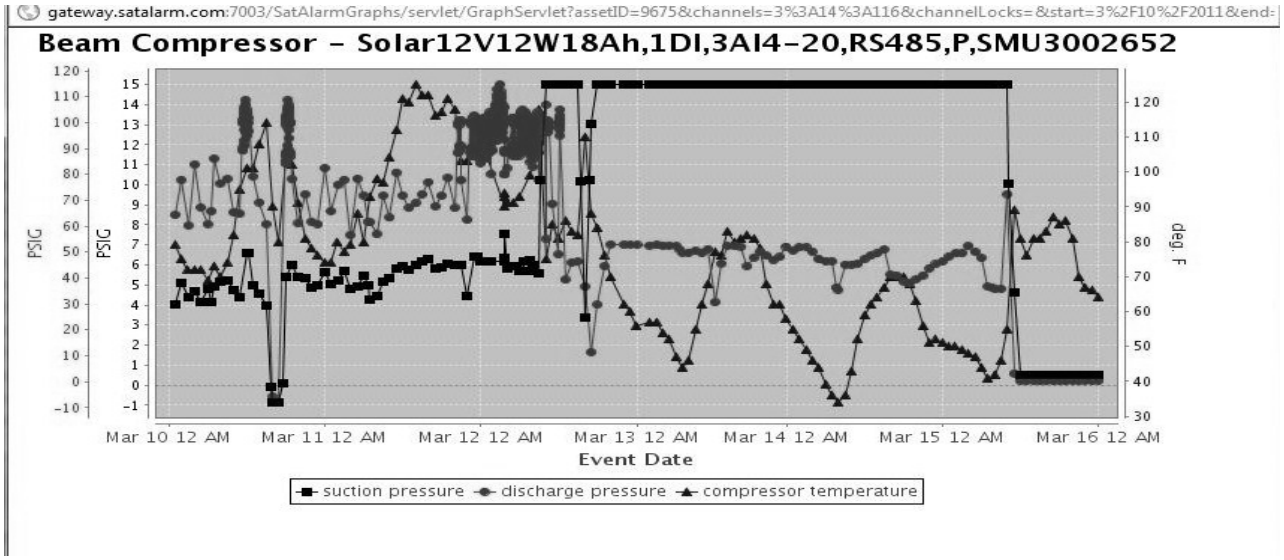


Figure 5

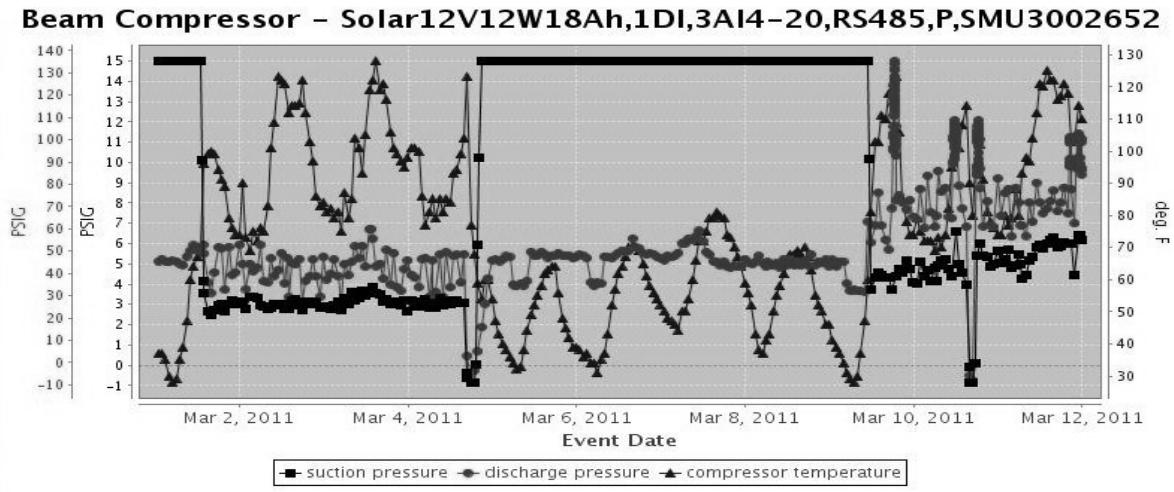


Figure 6

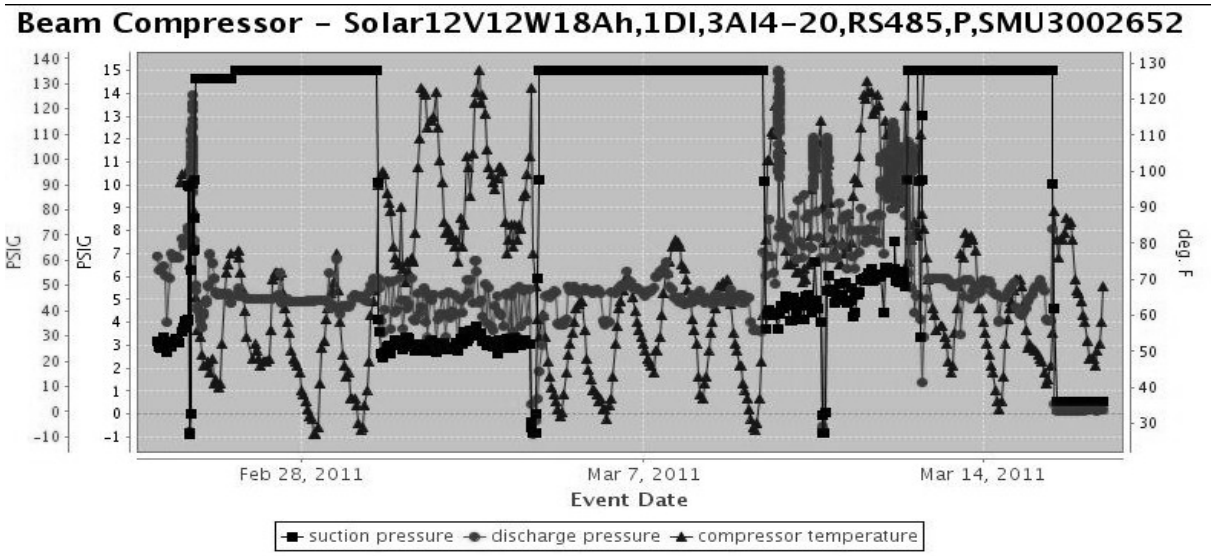


Figure 7

PUMPING UNIT MODEL.....:	640C	GAS SWEET/SOUR...:	SWEET
STROKES PER MINUTE.....:	8.25	PISTON SQ INCHES.:	113.1
TIME CYCLE IN % (.00).....:	100%	* STROKE IN FT.....:	4.5833
PUMPING UNIT STROKE HOLE.....:	S124	* PSIA (ATMOS.+ GA):	13.5
CASING (BGC) SUCTION PSIG.....:	0	* COMPRESSION RATIOS	8.41
DISCHARGE PRESSURE GUAGE.....:	100		
MCFD EXPECTED PLUS ANY FUEL GAS:	73	* BGC DAILY VOLUME.:	72.17

Figure 8 -When the pumping unit is running to remove fluid off the pump

PUMPING UNIT MODEL.....:	640C	GAS SWEET/SOUR...:	SWEET
STROKES PER MINUTE.....:	7	PISTON SQ INCHES.:	113.1
TIME CYCLE IN % (.00).....:	100%	* STROKE IN FT.....:	4.5833
PUMPING UNIT STROKE HOLE.....:	S124	* PSIA (ATMOS.+ GA):	16.25
CASING (BGC) SUCTION PSIG.....:	2.75	* COMPRESSION RATIOS	6.98
DISCHARGE PRESSURE GUAGE.....:	100		
MCFD EXPECTED PLUS ANY FUEL GAS:	73	* BGC DAILY VOLUME.:	73.71

Figure 9 - Pumping unit slowing down and casing pressure going up

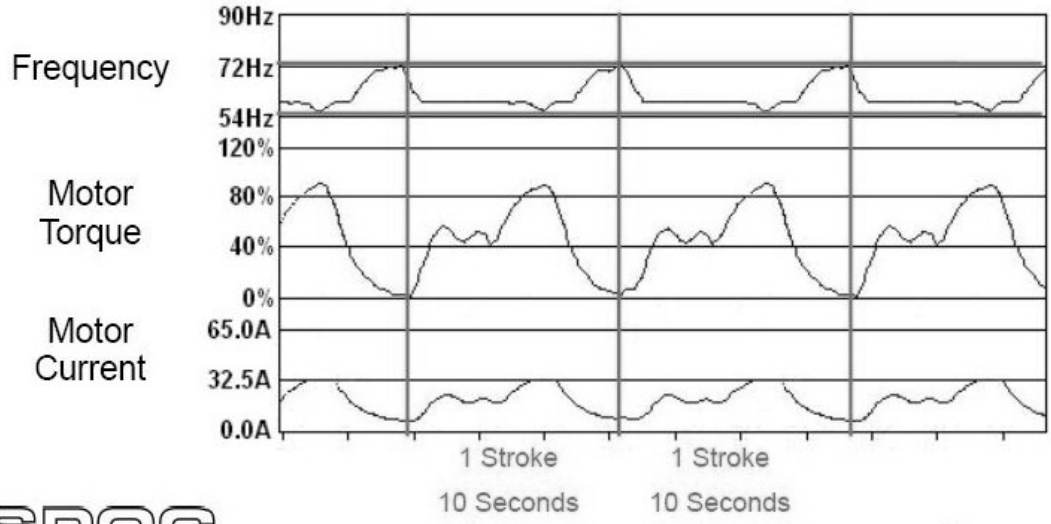
PUMPING UNIT MODEL.....:	640C	GAS SWEET/SOUR...:	SWEET
STROKES PER MINUTE.....:	4	PISTON SQ INCHES.:	113.1
TIME CYCLE IN % (.00).....:	100%	* STROKE IN FT.....:	4.5833
PUMPING UNIT STROKE HOLE.....:	S124	* PSIA (ATMOS.+ GA):	28.5
CASING (BGC) SUCTION PSIG.....:	15	* COMPRESSION RATIOS	3.98
DISCHARGE PRESSURE GUAGE.....:	100		
MCFD EXPECTED PLUS ANY FUEL GAS:	73	* BGC DAILY VOLUME.:	73.87

Figure 10 - VFD has slowed unit down and suction pressure hits highest number
Discharge rate is erratic do to flowline fowling.

Figure 11

SPOC Automation's IronHorse Drive

Weight heavy or rod heavy, its all the same to the IronHorse Drive, it just changes where in the stroke the drive performs which type of motor control.



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Pump Control Technology for the Oil & Gas Industry

Figure 12

SPOC Automation's IronHorse Drive

The IronHorse Drive monitors and adjusts the motor performance to control every portion of the stroke.

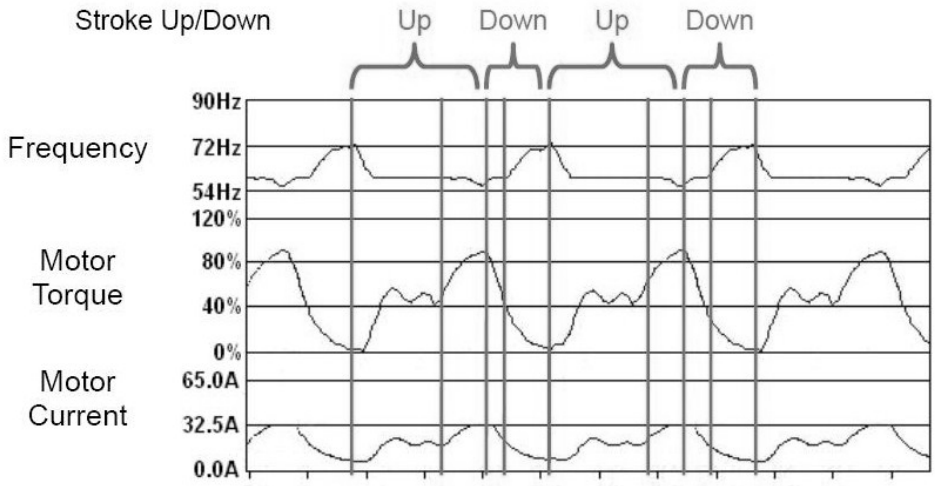

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Figure 13

Beam Gas Compressor - Power Measurements

Well Name			upstroke (amps)	downstroke (amps)	Motorsize (kW)	Pumping Unit Type	Gasflow (MCFD)
							
StU 213	with BGC	L1	29.80	56.60	50-62	640	47
		L2	29.70	56.60			
		L3	30.40	59.40			
	without BGC	L1	29.40	54.40			X
		L2	29.40	54.70			
		L3	30.40	57.20			
							
Stbg 21	with BGC	L1	32.60	31.10	9-15-18,5	320	11.3
		L2	32.70	30.60			
		L3	32.90	31.30			
	without BGC	L1	30.30	30.10			X
		L2	30.10	30.30			
		L3	30.50	30.40			
							
StU 37	with BGC	L1	24.20	20.70	9-15-20	228	13.24
		L2	24.30	21.90			
		L3	24.20	20.90			
	without BGC	L1	23.00	20.00			X
		L2	23.00	20.40			
		L3	23.00	20.10			
							
Be Süd 2	with BGC	L1	47.30	54.40	30.0	320	11.93
		L2	47.20	54.00			
		L3	47.30	55.10			
	without BGC	L1	44.20	53.20			X
		L2	43.80	52.80			
		L3	43.20	52.80			

Figure 14

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