Relieving Back Pressure May Boost Rod Pumping Wells

By Charlie McCoy

MIDLAND, TX – In the present State of the oil and gas economy, operators have been searching for ways to increase production and cash flow with no gamble, and with an AFE (expenditure) that gives their money back and a good return on their investment in the first year.

Operators are finding that one sure way to increase production and cash flow on producing wells is to relieve restricting back pressure on the producing formation on wells which respond to this technique. This restricting back pressure is caused by several things: a direct result of the gas sales line pressure. The pressure required to operate the separator: and the line friction from the separator back to the wellhead. Flow lines vary in length, and the longer the flow line and the terrain it follows places additional back pressure at the well head.

The final results of this back pressure translate all the way down to the face of the formation, and restrict its ability to give up oil and gas. Pressure requirements to operate an individual lease may vary, but the negative affect on production is the same – it is restricted!

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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 the production stream, 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 type of artificial lift is the rod pump. As the well continues to produce on rod pump, the bottom hole pressure continues to decline until the surface back pressure requires a greater percentage of the energy available from the formation to produce the well. This is when the operator should look at a tool to relieve this production restricting problem.

Beam Mounted Compressor

One sure way to remove the back pressure on a rod pumping well is with a beam mounted gas compressor (BGC). This tool mounts on the walking beam of the pumpjack, and incorporates a cylinder with a piston inside the casing through a check valve, and the discharge goes through a check valve back to the flow line, or to operate other lease equipment.

The energy source already on location (the pumpjack) is used to draw the pressure and gas from the well, and little additional energy is required. Most of the beam gas compressor types of casing pressure relief tools have been installed on low bottom hole pressure wells that are considered low producers, so most pumping units were on time cycles.

In the case of a pumping unit operating on a time cycle, the BGC is simply sized to compress the volume of gas the well makes, using the existing time cycle. In some cases, when the pressure is removed and the well gives up more fluid and gas, the time cycles have been extended. The by-pass line allows the casing to remain at the operators desired pressure.

Skid Mounted Compressor

Another method used to relieve back pressure is with a skid mounted compressor. Skid mounted compressors are excellent machines to remove back pressure where there is no pumping unit available to drive the BGC type compressor. Skid mounted compressors are used when the volumes of gas are larger than the pumping unit mounted systems can move.

While both the skid mounted and beam mounted gas compressors have their applications, the beam gas compressor installation is usually less costly to the operator, and with the addition of energy savings, the payout is much quicker.

In some applications, the operator is producing against a line pressure greater than 40-50 PSI. The beam gas compressor will take the casing down to 0 PSIG, and push gas directly into a line pressure of up to 125 PSI with one stage or one stroke of the piston. This equates to a compression ration of 10.

The skid mounted system would require a minimum of a two-stage system, which would increase the cost and extend the payout time for the operator. There are some cases where the BGC system is taking gas from the casing at 150 PSI and is discharging it into a 700 PSI flow line. Other operators are using them to boost gas from 50 PSI into a 400 PSI flow line. The application for both the skid mounted and the beam mounted compressor systems is determined by the well conditions and the pumping unit operation already on location.
Both the skid mounted and beam mounted systems will handle wet gas(most casinghead gas is heavily saturated with liquids), however the skid types require a liquid scrubber with an electric pump to discharge the liquids into the flow line or tank, where the beam mounted system does not.

Both systems can be protected form corrosive gas, however when a reciprocating type skid mounted unit is used, care must be taken to keep condensates and water away from the crank case. These components will reduce the lubricating properties of the crank case oil, thereby reducing the life of the system.

Gas Gathering Systems

In some cases where several wells are producing to the same tank battery, it is more economical to run gathering lines to the casing and draw the pressure down with one or two compression units. The skid mounted system is the most widely used for this practice.

However, where pumping units are available, the beam gas compressor systems have been used with great success. I know or one small field where one BGC is being used to keep 20 wells drawn to 0 PSIG on the casing, discharging into a 50 PSI flow line, It is very common to see two to five wells being placed on one beam gas compressor system.

When casing gathering systems are used for multiple well applications, care should be taken to assure that the wells in the back of the fields do not end with positive pressure because of line friction. As an example, I know of one field where thousands of dollars were spent to relieve back pressure with a skid mounted compressor, where the suction pressure at the compressor at the tank battery was 0 PSI and the wells at the back of the field still had as much as 20 PSI back pressure on the casing. These wells were tested by venting the 20 PSI still on the casings, and they showed as much as an additional 18 barrels of oil a day increase.

One major oil company overcame this type of situation by installing beam gas compressors throughout the field, and in effect had several small gas gathering systems. It was able to maintain 0 PSIG at each well by producing through a manifold to regulate the back pressure on each well, thereby maximizing production on each well.

Applications

There are numerous applications of casinghead gas compression on rod pumping wells. Among them:

To reduce back pressure on the formation to increase production on rod pumping wells;

To capture gas that is being vented to increase oil production and increase revenue (Small amounts of vented gas pushed into the sales line mean more cash flow and fewer problems with regulatory agencies);

To draw more gas from low producers to operate lease equipment like gas engines and heater treaters;

To eliminate ”gas lock” or gas interference in the down hole pump (drawing gas and reducing the casing pressure on the casing will cause more gas to break out of solution in the well bore where it will move up the casing to be removed by the compression, thereby giving a more efficient pumping action by the down-hole pumps).

To boost low pressure gas into the sales line (some wells have such a low bottom-hole pressure that the gas will not pass into the sales line without a little help; and

To keep a well on production when the gas sales line goes up because of downstream compressor problems, or because new wells are being put into production which are holding back older wells.

Most state regulatory agencies will issue temporary permits to vent test a well for a few days. While the vent test is being done, an operator may simply gauge the increased production and the economics are simple to compute. This system of testing takes all the gamble out of the project, since the operator will know for certain what the payout time will be.

If venting is not possible, and operator should then contact a manufacturer or distributor of a beam gas compressor (if a rod pumping well is involved) or a skid mounted unit to arrange for a test in his field.

I have seen well that were scheduled to be plugged and abandoned that were trying to produce against as little as 20 PSI line pressure that were able to maintain an additional two to three years of profitable life because of a reduction in restricting back pressure. The objective is to keep those wells producing at a higher profit for a longer time.

The average well producing in the united states today produces around 14 barrels a day, so no well is such a low producer that it should not be considered as a "suspect" for wellhead compression