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Compressor Gathers Low-Pressure Gas

By Charlie McCoy

MIDLAND, TX.–When a well is drilled and placed on production, it normally has sufficient bottom-hole pressure to flow naturally for a while, provided the bottom-hole pressure is high enough to overcome the surface backpressure and the fluid gradient. As the well continues to produce and natural reservoir drive decreases, however, bottom-hole pressure declines and the well must eventually be placed on some type of artificial lift, with rod pump systems the most common.

As bottom-hole pressure declines to the point where the surface backpressure required to operate the lease equipment and pass produced gas through the sales meter becomes a greater percentage of the depleted bottom-hole pressure, the operator should consider a backpressure relief tool. One of the newest advancements for relieving backpressure is beam gas compressor technology, which uses the energy from the normal pumping action of the pumpjack already on location.

The pumpjack acts as the prime mover for the beam compressor, with the kinetic energy stored in the motion of the weights and rods compressing the gas. As the walking beam movement pumps the well, the beam compressor draws gas from the gathering system by pulling the gas from the casing through check valves and discharges it into the flowline downstream from the pumping tee. The gas rejoins the tubing production and flows to the separator, and then on to the gas sales line. Alternatively, by installing a separate gas line, the operator can direct the compressed gas to field compression, a separator or to a gas meter.

When configured as a low-cost, multiple-well casinghead gathering system, the size of the beam compressor is designed to compress the daily gas production from the lease at the desired casing pressure within the pumping unit's normal operating run time. The compressor is typically installed on a centrally located pumping unit, with the casing of the adjoining wells tied together, and a trunk line is plumbed to the casing of the well with the compressor unit to carry the gas from the adjacent wells.

Beam compressors can be used with virtually any style of pumping unit. They utilize a clamping system to mount the units to the walking beam and pumping unit skid. The compressors are double-acting, meaning they compress gas in both the up and down motions of the pumping unit without affecting the counterbalance of the pumping unit. The technology is designed to operate in corrosive environments as well as with wet and high-Btu gases.

Productivity Index

Each formation is different in its response to backpressure or a reduction in backpressure. Producing formations that have good porosity and a good produc-

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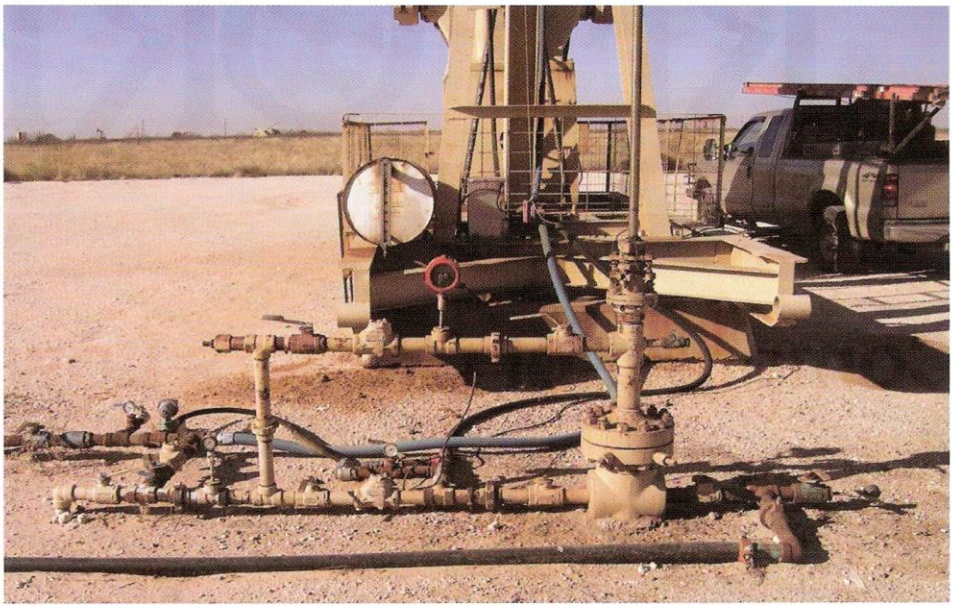
tivity index (the amount of increased fluid the well will produce for each pound of drawdown achieved at the formation) will yield the best results when the backpressure is reduced.

In other words, if a well has a productivity index of one, then for each pound of pressure relieved from the face of the formation, the well should give up one barrel of fluid. So when looking for an increase in production, operators should consider wells that have a high productivity index. A well with a productivity index of 0.5 and 50 psi of wellhead backpressure should increase production by 25 barrels a day when the wellhead pressure is reduced to 0 psi.

In fact, before abandoning marginal, low-pressure wells that are producing against separator surface pressures, operators should test the wells to determine the potential benefits of installing a beam compressor to produce candidate wells without backpressure on the formation. Some wells may continue to profitably produce for years once backpressure is eliminated.

One of the first applications of a beam compressor was in a low bottom-hole pressure field in San Juan County near Aneth, Ut. A beam compressor was installed on the Navajo Tribal No. 33-43 well as a casinghead gathering system. The casing from the 34-33 well and another well (the Navajo Tribal 34-42) were tied together and a trunk line was run to the casing of the 33-43 well. The wells produce from the Desert Creek formation. The beam compressor increased daily production by 14 barrels of oil and 26 Mcf of natural gas. Assuming conservative average prices of $95.00 a barrel for oil and $6.75 an Mcf for gas, the net revenue increase in the first year was more than $500,000.

In the Means Field north of Odessa, Tx., a Permian Basin operator installed a beam compressor to gather gas production with gas interference/gas locking problems. The compressor was installed on a centrally located pumping unit (replacing an electric skid-mounted unit) to gather the production from that well along with two additional wells (tied into the beam compressor well's casing). The wells are on a timer and the beam compressor was designed to compress the total volume of gas the three wells produced, taking pumping unit run time into account. The compressor maintains the casing pressures at 0 psi to maximize hydrocarbon flow into the well bores.



When configured as a low-cost gathering system for multiple wells, a beam compressor is usually installed on a central pumping unit, with the casing of the adjoining wells tied together and connected to the well equipped with the compressor.

By reducing the casing pressure from 60 to 0 psi, daily production was increased by 37 barrels of oil and 20 Mcf of gas, resulting in a net revenue increase of more than $1.3 million in the first year at an average oil price of $95.00 a barrel and gas price of $6.75 an Mcf.

Before installing the unit, the wells would not pump against line pressure because of gas interference and restricted fluid flow to the bore hole because of surface backpressure that was transferred down to the face of the formation. The operator also installed four other beam compressor gathering systems on single wells in the Means Field. To date, the only maintenance or repair issue has been replacing a discharge hose on one of the units. The operator has since installed additional units in two other fields, including one installation designed to compress a sister well.

High Sales Line Pressures

In the Texas University Field, a beam compressor gathering system was installed to remedy a problem with high sales line pressures. The compressor was installed on a centrally located pumping unit with four additional wells tied into the well's casing. The well is on a pump-off controller, so the compressor was designed to compress the volume of gas that all five wells made with the percentage of pumping unit run time with casing pressures at 0 psi. These wells were producing into a long flowline that caused excessive backpressure at the wellheads. Since this installation, the field operator has installed another beam compressor gathering system.

With casing pressure reduced from 65 to 0 psi (the beam compressor is capable of pulling a vacuum), the well produced an additional 24 barrels of oil and 60 Mcf of gas a day, for a net revenue increase of nearly $1 million in the first year at an average oil price of $95.00 a barrel and gas price of $6.75 an Mcf.

The TDU No. 3-8 well in a remote location in Pecos County, Tx., produces from the Devonian formation with a low bottom-hole pressure. The sales line pressure varies from a "normal" of 25 psi to a "high" of 40-45 psi. When the line pressure went to the high side, half the well's production was lost (dropping from seven to eight barrels of oil and 50 Mcf of gas a day to three to four barrels of oil and 30 Mcf of gas a day). After installing the beam compressor, daily production increased to 11-12 barrels of oil and 50 Mcf-60 Mcf of gas. The No. 3-8 well produces at its maximum rate regardless of sales line pressure variations, for an es-

timated net revenue increase in the first year of $188,000.

Two-Stage Application

Another Pecos County field is a two-stage application, serving as both a high-pressure installation as well as a low-cost gathering system for multiple wells. Two beam compressors were installed on the Herring No. 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 fed into a manifold and then into the casing of the Herring No. 1 well (the casing acts as a scrubber). The first compressor pulls the gas from the casing and compresses it to 60 psi, while the second compresses the gas for delivery into the high-pressure sales line. This installation takes advantage of not requiring an additional motor on location, resulting in energy savings as well as operational simplicity. Based on the success of this installation, the operator is now utilizing beam compressors in applications in other fields.

In Harper County, Ks., the operator elected to replace a conventional natural gas-fired compressor with the beam-operated compressor, tying an additional well into the compressor for the small gathering system. The primary purpose was to reduce compression costs on the lease. With the skid-mounted compressor, the operator had to bypass gas to the separator to move fluid. With the beam compressor, the gas is compressed to the separator, eliminating the worry of bypassing gas and not moving fluid.

On the Aldrich A No. 4 well in Kingman County, Ks., three additional wells were tied into the No. 4 well's casing. Small-diameter (2.0-inch) plastic poly pipe was used to plumb to the tank battery location and a line was laid from the battery to the No. 4 well. The beam compressor's suction comes from the casing of the No. 4 and discharges back into the well's flowline. The well runs on a timer, so the compressor was designed to gather total lease gas taking into account the pumping unit run times. The estimated net revenue increase in the first year for this application is $368,000.

While each of these beam compressor applications resulted in increased production by reducing backpressure on the formation, they were each installed for different reasons–reducing compression costs, forcing production into a high-pressure sales line, relieving gas interference in downhole pumps, etc. However, in each case the improved production performance resulted in increased cash flows.

Moreover, beam units provide low-cost compression by eliminating the need to have an additional prime mover on site to maintain, and the economic savings related to fuel gas and electric energy costs to operate the motor. ❐

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Charlie McCoy is president of Midland, Tx-based Permian Production Equipment Inc., which manufactures the patented beam compressor. He is a member of the board of directors of the Permian Basin Petroleum Association, a director of the Permian Basin International Oil Show, and a past director of the Independent Petroleum Association of America. McCoy received his education in mechanical engineering and business administration at Louisiana Tech University.