The Lease Pumper's Handbook

CHAPTER 9

GAS LIFT

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Section A

INTRODUCTION TO GAS LIFT

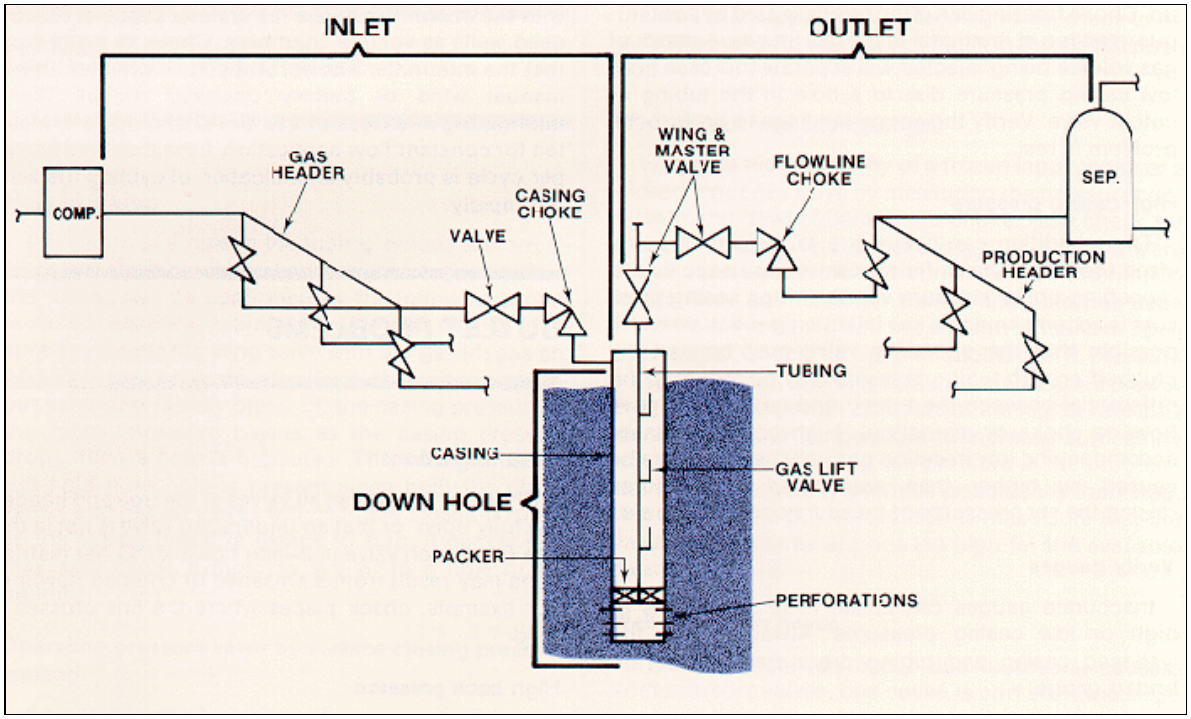

Figure 1. Diagram of a typical gas lift system.
(courtesy of McMurry-Macco Lift Systems)

A-1. The Use of Gas Lift.

Many wells flow naturally without artificial stimulation when the well is first drilled. As time passes and the reservoir gas pressure drops, oil production begins to slow down, and the number of barrels of oil produced daily begins to decline. When gas is introduced into the tubing below the level of liquid in the hole, the column of fluid in the tubing weighs less than the bottom hole pressure, and the well begins to flow again. Where gas is available, gas lift is used extensively in producing wells. This additional stimulation allows the wells to flow again. It is especially popular for wells that have marginal flow, providing a little boost in the daily production that can amount to several barrels.

In offshore production, where every square foot of platform costs thousands of dollars to construct and space is limited, gas lift is often used. Gas lift occupies very little space at the wellhead, and many directional

wells can be drilled close together and easily produced. This system is a common choice when lift stimulation is desired offshore.

In other situations, gas lift again becomes a favored option in order:

- To assist a flowing well by increasing production.
- To produce wells that will not flow without assistance.
- To unload a well that accumulates heads of water so that, after unloading, the well will then flow naturally.
- To produce high volumes of water to be used in waterflood.
- To remove solids by back flowing disposal wells.

This system is also utilized to stimulate wells with a low bottom hole pressure, and where water or oil may overload the system and kill the well. Gas is also used for many other purposes in different wells, such as chemical injection and water flood.

A-2. Advantages in Using Gas Lift.

Many advantages can be realized with gas lift. No gas is lost to the atmosphere in this production process, and the same gas can be utilized over and over. It is not uncommon for a gas lift well to produce as few as 40 barrels of fluid a day or more than 20,000 barrels by producing through the annulus rather than through the tubing. This makes gas lift a very flexible system. There are also other advantages to the gas lift system, such as:

- Initial equipment costs may be lower than other systems.
- It costs less to maintain the system.
- Equipment is easily installed and serviced.
- It allows intermittent operation for low production wells.
- The system adapts easily to wells producing sand that may damage other systems.
- Gas lift is well suited for deviated wells where rod wear will occur.

A-3. Setting Up a Gas Lift System.

Three major sets of components are necessary to set up a gas lift system:

- **Inlet.** A supply of dry, high-pressure gas.
- **Downhole.** Appropriate downhole well arrangements
- **Outlet.** An appropriate production handling facility.

Gas compression and distribution. The first step in installing a gas lift system is having a large, satisfactory supply of dry, high-pressure gas. If wet field gas is to be used, a scrubber must be installed to remove condensate and water and a compressor to step the gas pressure up high enough for lease distribution and injection. Drip pots may also have to be installed to remove fallout condensate and water that will separate under line pressure. The ideal situation is to pipe the wet or rich natural gas to a processing facility to remove all liquids. Then the dry or lean gas is piped back to the gas lift lease for compression and injection. A lease distribution system must supply the gas to each of the gas lift wells.

Control valve. Near to where the line from the compressor is connected to the wellhead, a valve is installed in the line to open or close the gas to the well. A second choke valve is installed next to the wellhead to regulate or throttle the gas that is being injected. This valve will be choked to

permit the pumper to inject the minimum amount of gas to obtain maximum production.

Packer. A packer is run just above the casing perforations to isolate the annular space above the casing and tubing perforations.

Tubing valves. As the tubing is run into the hole, several valves are installed in the tubing string at specific predetermined locations along the string. All of these valves are located below the fluid level in the tubing and are spaced several hundred feet apart. The pressure required to open each of these valves is pre-determined by the manufacturer by injecting nitrogen into each valve.

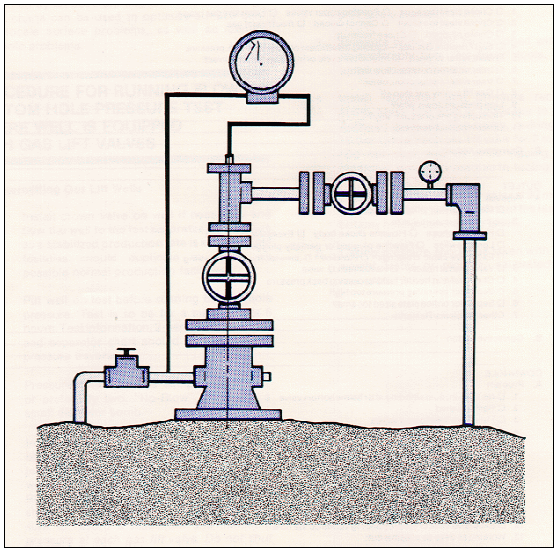

Figure 2. Diagram of a wellhead with a two-pin pressure recorder.
(courtesy of McMurry-Macco Lift Systems)

The wellhead and the two-pin recorder. A two-pin pressure recorder can be located on the wellhead to track the gas lift operation in the casing and in the tubing. It can record the pressures in the sequencing of the gas lift valves during the unloading sequence and allow the efficiency of the operation to be monitored.

The chart is used to calculate how much gas is being injected, and a choke is used to set the injection rate on the desired volume. Many problems can be detected by examining the charts—such as low production, cycles that are too long or short, freezing in the injection gas line, etc.

A-4. How Gas Lift Works.

The objective of **gas lift** is to **reduce the weight of the column of fluid in the tubing** so that the bottom hole pressure of the well is adequate to lift the column and to overcome the resistance of the tubing, pipes, and connections. With this reduced weight, natural flow may begin or production may increase. The well will continue to flow as long as fluid enters the well from the formation, and the weight of the column is maintained light enough to be lifted by the bottom hole pressure.

Sequences in unloading the well. As gas pressure is injected into the casing, the first or highest gas lift valve opens. As gas is injected into the column of liquid, the column becomes lighter and part of the liquid flows to the tank battery. After this first stage action, the second valve opens, and another *slug* or column of oil is lifted out.

After the second column has been lifted out of the tubing the third valve opens, and the procedure continues until the column of fluid in the tubing weighs less than the bottom hole pressure. At this point, the well will begin to flow.

A-5. Tank Battery Arrangements for Gas Lift.

When changing from a mechanical lift system to gas lift, changes may have to be made at the tank battery to be able to handle the increased production of natural gas, crude oil, and formation water. A comparison should be made on all three of these handling systems to be sure that the tank battery can handle the increase of fluids without overloading any of these systems.