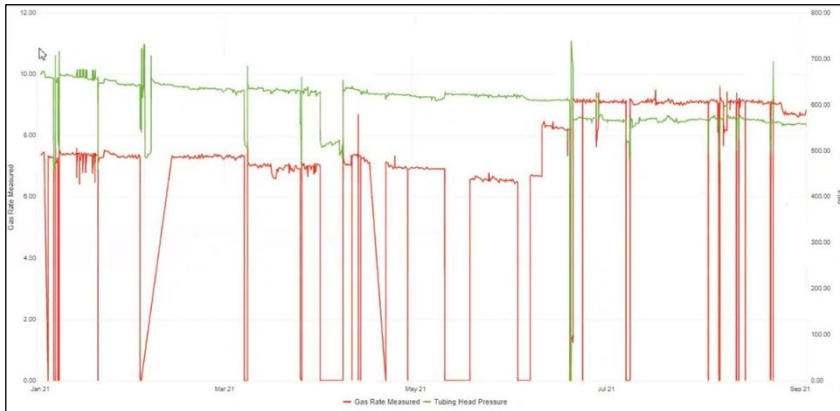


Velocity String Installation Via Coiled Tubing

Stabilized Gas Production on Liquid Loading Gas Well, Avoided Workover, Delivered Continual Production



Post velocity string installation, the well has not experienced production flow stop or a reduction in tubing head pressure but, due to the reduced inside diameter, the well now produces at a slightly lower but continuous flow rate of 6 MMScf/day.

Objectives

- Determine a solution to eliminate liquid loading in several gas wells. Liquid loading occurs when the accumulation of liquids in the tubing produces a hydrostatic column that is too heavy for the natural pressure to sufficiently carry the hydrocarbons to the surface. This causes a decline in production and can ultimately prevent production.
- Stabilize and optimize the flow and avoid periodic coiled tubing intervention.

Our Approach

- Weatherford experts used the WellFlo[®] design and analysis software to determine if the installation of a velocity string to overcome liquid loading issues could be performed without the need of a workover. A velocity string is a small-diameter tubing string run inside the production tubing of a well as a remedial treatment to resolve liquid loading. The velocity string works by reducing the flow area which increases the flow velocity and enables liquids to be effectively carried to the surface.
- Well production data, fluid properties, and reservoir details were collected, and a production modeling performed. The modeling indicated that a 2 3/8-in. string would provide consistent production rates and minimize interventions.

LOCATION
Middle East

WELL TYPE
Gas

HOLE SIZE
5-1/2 in. and 4-1/2 in. completion

CASING SIZE
9-5/8 in.

LINER SIZE
7 in.

BOTTOMHOLE TEMPERATURE
246°F (118°C)

BOTTOMHOLE PRESSURE
947 psi (6.5 MPa)

DEPTH
310 to 9,160 ft (94.4 to 2,791 m)

PRODUCTS/SERVICES

- WidePak[™] straddle packer
- WellFlo design and analysis software
- Coiled tubing hanger
- OptiSleeve[™] sliding sleeves
- Stinger assembly
- QN nipple
- QNB nipple
- Coiled tubing connector with QuickConnect[™] module
- Coiled tubing connect
- Pup joints
- Yo-yo valve



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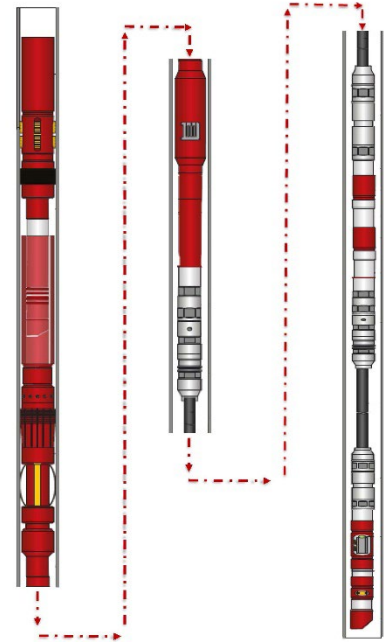
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Our Approach (continued)

- To overcome the reduced fluid capacity through the velocity string, a sliding sleeve door was installed to allow annular flow and enhance the overall production volume. The installation was performed by hanging the velocity tubing string with a thru-tubing hanger inside the production tubing without the need to kill the well, eliminating formation damage issues. The string was installed below the safety valve, so the functionality of the valve was maintained.
- Following the installation, the well flowed consistently with enough pressure to prevent flow reductions.

Value to Customer

- The cost-effective Weatherford solution was carried out using coiled tubing, eliminating the requirement of a rig or workover unit.
- All operations were conducted without killing the well which eliminated formation damage.
- The velocity string was installed below the existing safety valve, ensuring it remained fully operational.
- When compared to the conventional approach—which typically requires more than 50 field personnel for a workover rig operation and a duration of at least 20 days for replacing the well completion string—Weatherford's field workforce of 6 coiled-tubing crew members and 2 velocity string specialists completed the operation in 12 days.
- Prior to the velocity string installation, gas production rate fluctuated between 0 and 9 MMSCF/day. Liquid loading also stopped production more than 10 times in a span of 9 months. At times, it could take 7 days or more to mobilize a coiled tubing unit for lifting the well, leading to loss of production. After installation of the velocity string, the well has been producing continuously at around 6 MMSCF/d without production shutdown.
- The Weatherford solution provided accessibility for slickline and wireline for future operations, enabling the customer to successfully install and retrieve downhole gauges for a span of 2 weeks within the velocity string. In addition, the velocity string system can be easily and safely retrieved in the future.



Weatherford's velocity strings reduce the flow area and increase flow velocity in production gas wells to reduce the liquid-loading effect.

