ROCKY MOUNTAIN OILFIELD TESTING CENTER

PROJECT TEST RESULTS

DOWNHOLE DYNAMOTER

Sandia National Laboratories

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Sandia Lab Downhole Dynamometer
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Michael R. Tyler
Project Manager

Abstract

This test involved the use of Downhole Dynamometer Tools (DDT) that were developed by Albert Engineering and the Sandia National Laboratory.

The five (5) Downhole Dynamometers (DDT) were installed in the rod string of well 13-A-21 at predetermined intervals. The DDT tools are equipped with strain gauges and programmable clocks. The tools were place in the well and removed after the data had been gathered. The data gathering is pre-programmed to occur when pumped-off conditions are obtained in the well. This information then reflects the true conditions found downhole in a well in a pumped-off state.

Operators can design their downhole equipment to reduce and eliminate premature failure of downhole and surface equipment. When using beam pumping units as the method of artificial lift they can reduce lifting cost and increase production by having longer run times.

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TECHNICAL DESCRIPTION:

This test involved the use of Downhole Dynamometer Tools (DDT) that were developed by Albert Engineering and the Sandia National Laboratory.

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PROBLEM:

The industry used the information gathered from dynamometer data generated by surface equipment. The surface data could not accurately interpret the conditions found downhole in a rod string. The information was gathered at the surface from a strain gauge attached to the polish rod. The conditions downhole are hostile and dynamic. Finding a method to collect the data downhole where problems occur was required.

SOLUTION:

The DDT tools are equipped with strain gauges and programmable clocks. The tools are installed in the well and removed after the data has been gathered. The data gathering is pre-programmed to occur when pumped-off conditions are obtained in the well. This information then reflects the true conditions found downhole in a well in a pumped-off state. This data has been unavailable until now.

OPERATION:

The Albert Engineering/Sandia National Laboratories (AE/SNL) Downhole Dynamometer Tool (DDT) was field tested by the Rocky Mountain Oilfield Testing Center (RMOTC).

The five (5) DDT's were installed on well (13-A-21) at the Naval Petroleum Reserve 3 (NPR-3) in Natrona County, Wyoming. The selected well was an active producing well producing from the Second Wall Creek formation. The well was equipped with the following:

Casing Record: 5.5" 15.5# TO 2818'	
Tubing Record	2.875" to 2734', seating nipple at 2710', tubing anchor at 2647'
Pumping Rods:	0.75 straight string, 1.25" polish rod, full size couplings, Grade (C)
Perforations:	2703' to 2719', 4 shots per foot
Downhole Pump:	API 25-25-150-RWA-101-4-4
Pumping Unit:	Lufkin LC228D21386, CW rotation, weights in long hole
Motor:	Marathon OPDR 20HP, 1170 RPM
Tubing Pressure	~60 psi
Production:	~4 bopd, ~130 bwpd, 0 mcfpd
Fluid Properties:	38° API gravity oil, water specific gravity 1.
Pumping Speed	~11 spm
Stroke Length:	~86"
Fluid Level:	Measured at 8:40 and 10:52 on Day 2 to be 0' above pump

A Delta-X Dynamometer (version 2.12) was used a week before the test to confirm that maximum loads were within the AE/SNL tool specifications.

The well was produced until a pumped-off condition was obtained. The rods and pump were pulled and then returned to the well with the DDT's installed at the designated intervals. The well was returned to production until a pumped-off condition was obtained. The DDT's were programmed to collect data during this phase of operation. Surface dynamometer measurements with standing valve checks and fluid levels were obtained. Then the well was shut down and the rods, pump and DDT's were removed from the well. The DDT's were then returned to AE/SNL where the data was downloaded and interpreted.

BENEFITS:

1. Operators can design their downhole equipment to reduce and eliminate premature failure of downhole and surface equipment.
2. Operators using beam pumping units as the method of artificial lift can reduce lifting cost and increase production by having longer run times.

TEST RESULTS:

The data and graphs generated from this test are available from AE/SNL.

TECHNICAL OBSERVATIONS:

1. The DDT's were easy to install and remove.
2. The internal clocks must be set at the laboratory.
3. One DDT failed to gather information.

SUMMARY

The Downhole Dynamometer Tool test was successful. They were dependable and easy to install. The DDT can be used on any well equipped with a rod string and downhole pump. The data gathered can be used to learn conditions in specific wells.

Operators can design their downhole equipment to reduce and eliminate premature failure of downhole and surface equipment. When using beam pumping units as the method of artificial lift, they can reduce lifting cost and increase production by having longer run times.

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