Communication Interference Testing: The Low Cost, No Risk Approach

Interference testing, also known as a communication test, is a multiple well test that is used by operators to determine intra-field connectivity. Sometimes performed as a pulse test, an interference test is the concept of introducing a transient in one well, the active well, and monitoring the pressure on an adjacent well, known as the observation well. The active well is typically a producer or injector while the observation well is shut-in during the testing period. The transient introduced to the active well can be made by a variety of methods, but conceptually is made by changing the state of the well from producing to shut-in or the reverse. Also, a pressure pulse can be sent through the reservoir by pump-in or fracture stimulation. With pressure gauges on both the active and the observation well(s), a change in pressure response in the observation well is anticipated. In most cases, the main objective is to simply see whether or not there is communication between the two wells. Additionally, this technique is used to determine inter-well reservoir properties such as formation permeability and hydraulic diffusivity. In larger fields, multiple well’s inter-connectivities are being determined; thus more than one observation well can be monitored for each active well allowing strategic testing and efficient use of down time.

In the last several years hydraulic fracturing has taken strides with multi-well “simul-fracs” and horizontal, multi-stage fracturing. Many operators have seen or are concerned that an adjacent producer to a well to be fractured will be “knocked offline” by communication between the two wellbores during the fracture stimulation. In these cases, the fracture fluid is intruding on an adjacent well and “waters out” this adjacent producer artificially. An interference test can be used during the fracture job on candidate wells to see if and when each stage of the fracture is in communication with a neighboring producing well. For this interference test, the introduced transient is the pressure resulting from each fracture stage. These studies will allow operators to better understand the well spacing needed for future drills, the impact of interference and develop a pressure versus distance calculation based on the resultant transient. With this data a more efficient fracture schedule can be put in place for the field.

Recently, an operator came to Halliburton with plans for pressure mapping their old oilfield for EOR. This is a typical testing procedure performed initially with water injection to be followed with CO2. While in secondary recovery, the injection wells can act as the active wells, while the producers will be the observation well. There were 3 test plans that the operator was considering:

1. Have a field-wide shut in, restart injection on a chosen “active” injector and observe the pressure response of the shut in adjacent wells.
2. Shut in only the adjacent wells to the online injector and then shut down the injection well.
3. Pulsing the injector at a higher rate and pressure while the observation wells are shut in.

These plans all produce the transient needed to obtain critical interwell properties and can be performed with only the aid of the SPIDR® gauges and existing equipment. With the help of Halliburton’s engineers, the operator chose plan #2 where they could gather both the communication data as well as individual falloff data for the injector that is the active well in the test. With the data accumulated, the operator was able to determine the interwell permeabilities and prepared a cost-efficient CO2 injection program.

Since the pressure change detected on the observation well can be very small (0.01-0.05 psi) over the distance the transient travels from the active well, a high resolution digital pressure gauge must be used. Conventionally, a downhole gauge run on slickline or wireline has been used for these types of tests. Interference tests require only the detection of a pressure response in the observation well due to the active well’s induced transient, thus a high quality surface gauge with high resolution and sample rate
can be used in place of the cost and risk intensive downhole gauge. The SPIDR® gauge is the highest quality surface pressure gauge in the oilfield. No other gauge has higher resolution, faster sampling or better thermal compensation than the SPIDR® gauge. The SPIDR® gauge records pressure at 0.01 psi resolution with its dual-quartz transducer. A dual-quartz transducer is a 2 crystal transducer, one to measure pressure and the other to thermally compensate the pressure crystal as ambient temperatures change. This, along with the “out-of-line” connection of the SPIDR® gauge to the wellhead, allows the SPIDR® to accurately record wellhead pressure with minimal to no response due to changes in the surrounding temperature. The SPIDR® gauge can sample and store its high accuracy, high frequency pressure data for over 2 months without any disconnected data downloads, memory card swaps or any other data retrieval method that will cause a pressure acquisition interruption.

There are many variations to the interference test. With each test, the common thread is the need for accurate pressure vs. time data acquisition. The SPIDR® gauge offers a low cost, no risk approach to performing all the variations of interference testing. Whether looking to calculate interwell reservoir properties throughout a field or looking for the presence of communication between two wells, the SPIDR® gauge allows detection of the smallest pressure change possible without wireline trucks or well intervention. The extended memory and high resolution of the SPIDR® gauge allows interference testing in tight reservoirs and shales. The SPIDR® gauge can be downloaded real-time without data collection interruption with the aid of a laptop so the most efficient test can be performed. If you have further questions about interference testing, the SPIDR® gauge capabilities, or would like to inquire about Halliburton’s free test planning, please give us a call or contact us via email.

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