

Well Testing 101

Build-Up Testing:

- EASY TO PERFORM
- EASY ANALYSIS
- POSSIBLE PHASE AND CROSSFLOW PROBLEMS
- DELAYED/DEFERRED PRODUCTION



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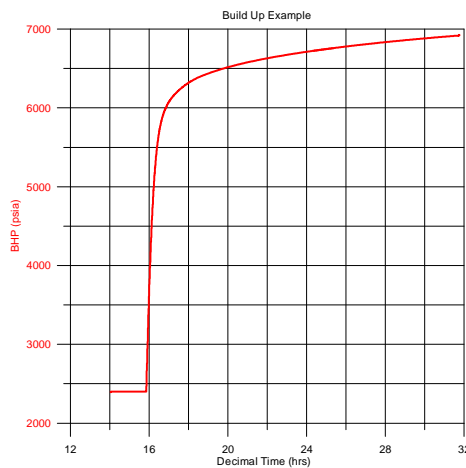
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Types of Well Tests: Build-Ups and Drawdowns

In this newsletter, build-up and drawdown testing will be discussed. In the next issue, various types of multi-rate tests will be addressed, as well as which type of test should be performed to meet a given objective.

The most commonly prescribed test for a completion/reservoir evaluation is a Pressure Build-Up (PBU) or Shut-In test.



Build-ups are done for two primary reasons:

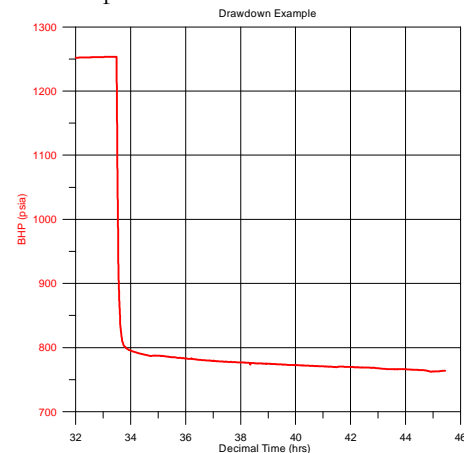
- 1) The math is simple for a zero rate and data tends to be smoother than a flowing test, which makes it easier for derivative type-curve matching.
- 2) It is quite easy to execute the procedure: hook up a gauge; shut-in the well.

Unfortunately, build-ups are subject to more phase re-segregation and cross flow problems than flowing tests. This can sometimes result in data trends that are not easy to analyze under shut-in conditions. Another problem with

build-ups is that they require the well to be shut-in, which means delayed/deferred production and interrupted cash flow.

Management approval to run a build-up test is most easily obtained when the well is going to be shut-in anyway due to pipeline or facilities maintenance, slack demand or rig moves. If the well is going to be shut-in anyway, record the pressures and try to learn something about the reservoir.

Drawdown (DD) testing is the opposite of a build-up.



In a drawdown, the well is produced on a *fixed* choke setting until the test objectives have been reached. A drawdown is usually initiated from a “cold-start” – a shut-in well, but it may also be conducted by doubling (or more) the current rate. In order for drawdown data to be valid, there must be critical flow across the choke (roughly a 2.2:1 ratio of upstream to downstream pressure). At these conditions, there will be an adiabatic shockwave across

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Drawdown Testing:

- CONSTANT CHOKE, NOT CONSTANT RATE
- SIMULTANEOUSLY TEST AND PRODUCE
- NOT WELL SUITED FOR TYPE-CURVE ANALYSIS



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Build-Ups and Drawdowns, continued from page 1...

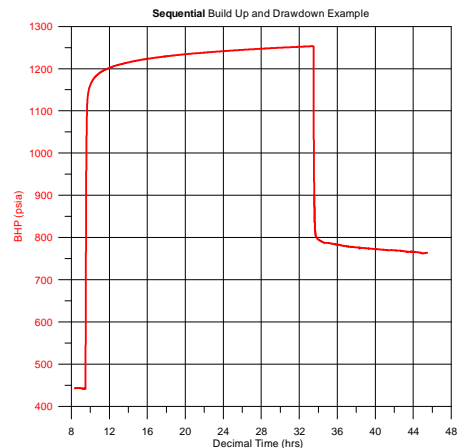
the choke which will isolate the well from facilities or other downstream disturbances. The best practice for a drawdown is to do a **constant-choke** test, not necessarily a **constant rate** test! Quite often a well will decline in both rate and pressure on a fixed choke setting. This is a natural decay and it can be accounted for in the analysis. Therefore, there is no need to “bump” the choke to maintain a constant rate. Remember, drawdown analysis is based on the rate of pressure decline. If the choke is adjusted, the rate of pressure decline will be adjusted too, making the well test interpretation less reliable.

An important advantage of running a constant-choke drawdown test (versus a PBU) is that the well is tested AND produced at the same time. This means that management sees cash flow, reservoir engineering finds the reservoir size, and production engineering evaluates the completion. Another benefit of a DD over a PBU is that in a drawdown, it is easier to differentiate whether a boundary/reservoir limit contacted during the test is a fault, strat-out or gas/liquid contact (edge, not bottom/top). Also on the plus side, drawdown testing evaluates the well/reservoir at PRODUCTION conditions. If there is multi-phase flow in the reservoir or if the rock is highly compressive and/or geo-pressured, there can be significant differences between a build-up response and a drawdown response, in which case the drawdown will likely be more valid. A final advantage of drawdown testing is that it mitigates or eliminates the effects of phase re-segregation and crossflow between layers, as long as the rate is high

enough to ensure that there is not any accumulation of oil and/or water in the well bore.

A possible problem with drawdown data is that it may be noisy and therefore take longer to analyze than a build-up. This is especially the case for derivative type-curve analysis. However, if MDH (Semi-log) analysis is used, accurate and timely results can be obtained.

Quite often, build-ups and drawdowns are done in succession, especially if the build-up is a “planned” shut-in.



This provides two snapshots of the well/reservoir behavior. If the analyses of the PBU and DD are the same, then there is greater confidence in the results. If there are differences, the effect of relative permeability, moving liquid levels, crossflow and/or rock and fluid properties may be examined to determine the cause of the discrepancy.