

Slow Surge™ Perforating Design Analysis with HPET™ Halliburton Perforating Evaluation Tool

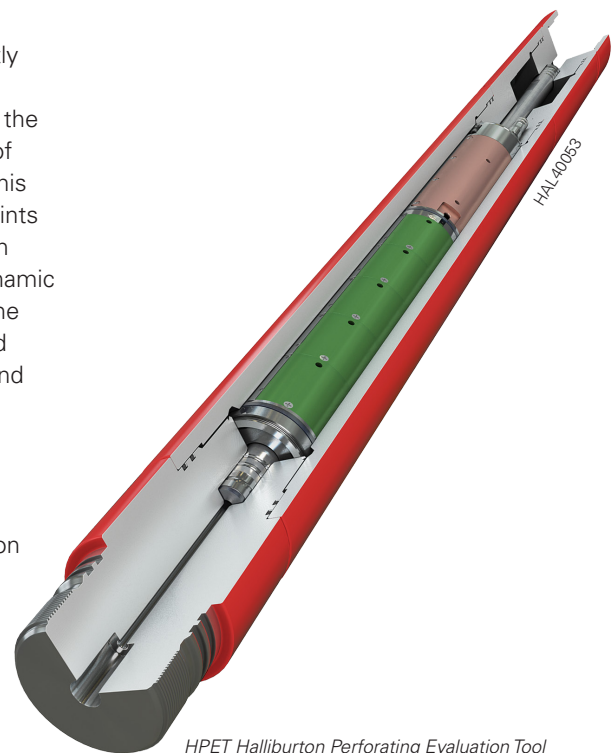
PERFORATING ASSEMBLIES AND PROCEDURES DESIGNED TO OPTIMIZE SLOW SURGE ACHIEVING ENHANCED WELL PRODUCTIVITY

CLEAN PERFORATION TUNNELS OPTIMIZE PRODUCTION

The Halliburton Slow Surge™ process is an examination and prejob planning system used to engineer static underbalance flow post-perforation, significantly increasing the productivity index. Underbalance has been proven to provide improved cleanup of the perforation tunnels created by jet perforators. Before the implementation of the Slow Surge perforating design analysis, the efficiency of removing the crush zone in the perforating tunnel has been hard to quantify. This is because of the inability to capture the required pressure drop at multiple points across the Slow Surge string. With the development of the HPET™ Halliburton Perforating Evaluation Tool, this is no longer a concern. By capturing actual dynamic pressure response at multiple points throughout the Slow Surge string after the perforating event, the HPET tool provides “quick look data” that will be utilized in the prejob Slow Surge process design analysis to enhance future designs and exploitation of your asset.

HPET TOOL BENEFITS

- » Can be placed anywhere in the perforating assembly
- » More data available for job verification, post-job analysis, and model validation
 - 12 active channels for high-speed recording
 - Each channel provides 100,000 data samples:
 - Tool string acceleration
 - Mechanical strain/stress in the tool string
 - Dynamic wellbore pressure
 - Static pressure/temperature
- » Provides high-resolution characterization across nonhomogeneous intervals with varying reservoir and wellbore parameters
- » Provides high-resolution characterization post-perforation for Slow Surge characterization
- » Captures stress and strain, which yields a more accurate characterization of the downhole events
- » Enables life-of-well, time-lapsed reservoir monitoring capabilities for proactive asset management
- » Operates in deviated or horizontal wells for dynamic string shock loading response



HPET Halliburton Perforating Evaluation Tool

The Halliburton Slow Surge™ perforating design analysis is physics driven and relies on measurable or estimated actual input parameters – no curve fitting or back-of-the-envelope calculations.

To fully represent wellbore behavior, the Slow Surge perforating design analysis takes into account a wide variety of factors:

- » Thermodynamic mixing and multiple compressible fluid types/phases
- » Multiple diameter effects in the well, including:
 - Surface pressurization, pumping, and fluids flowback
 - Flow into and breakdown of perforation tunnels
 - Subsequent transient return flow from perforations

SLOW SURGE PERFORATING DESIGN ANALYSIS BENEFITS

The Slow Surge perforating design analysis is ideal for predicting:

- » Wellbore drawdown at specific location within the perforated intervals
- » Pressure drop across different string profiles
- » Fluid injection/production
- » Tunnel cleanup, enhancing shot effectiveness
- » Accuracy—Physics-based solution with documented validation

The Slow Surge perforating design analysis is based on a proprietary analysis developed from API Section IV perforation flow laboratory studies.

- » Time-marching finite-difference modeling
- » High-speed pressure measurements
- » Empirical field data



Understanding and prediction of dynamic and static pressure behavior become paramount when perforation damage cleanup and tunnel integrity are necessary.

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For more information, contact your local Halliburton representative or visit us on the web at www.halliburton.com

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