

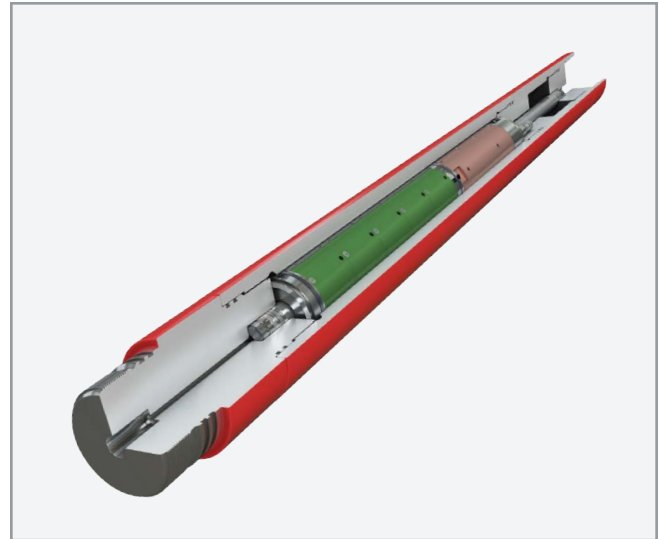
Shock Sensing Sub Tool

Shock Sensing Sub Tool Application

By capturing actual dynamic reservoir response at multiple points throughout the perforation interval, and during and after the perforating event, the Shock Sensing Sub tool provides “quick look data” that will be utilized to enhance future designs and exploitation of your asset.

Today, operators and service providers recognize wells are pushing the limits of design. The acknowledged importance of predicting events during the perforating process has pushed the industry to look at ways to gather dynamic information at zones of interest during the perforation event. While perforation cleanup and flow efficiency knowledge have always been desired, now other factors are being modeled and optimized. These include shock loading, dynamic and static underbalance, dynamic trip data, “fast response” reservoir data, characteristics, and analysis.

Operators and service companies recognize a new level of capability is necessary to truly understand and model the perforating event. To this end, Halliburton has developed Shock Sensing Sub technology to gather data at any desired location within the perforation string. Understanding the stress-strain relationships yields a more accurate characterization of downhole events. This is accomplished with the Shock Sensing Sub tool’s unique ability to be placed directly in the perforating gun string at multiple points, rather than only above or below the perforated interval like the industry-standard fast gauges. This placement enables verification of what is happening at a specific point in the perforated interval, rather than having to assume/correlate at points within the perforated interval. The Shock Sensing Sub technology enables direct measurement and analysis across non-homogeneous intervals with varying reservoir and wellbore parameters. The more accurate and location-specific measurement enables Halliburton and our clients to accurately predict and even eliminate downhole issues caused by shock loads and dynamic pressure events, as well as enhance perforating design at multiple points within an interval or intervals to optimize well productivity. Gathered data can also be utilized to accurately test at specific modeled conditions in our Advanced Perforating Flow Lab (APFL) to verify our model’s predictions prior to deployment.



Shock Sensing Sub

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 non-homogeneous intervals with varying reservoir and wellbore parameters
- Captures stress and strain, which yields a more accurate characterization of 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

Features

- Can be combined with APFL to verify the shock loading model's predictions prior to deployment
- Can be placed directly in the perforating gun string at multiple points
- Enables direct measurement and analysis across non-homogeneous intervals with varying reservoir and wellbore parameters
- Displays full job history

Technical Specifications	
Diameter	4 5/8 in.
Pressure rating	20,000 psi
Tensile rating	377,000 lb
Connections	Standard gun threads (pin x box)
Sensors	
Strain gauges	3 axial, 3 hoop, 1 torsion
Pressure	Dynamic pressure, 100 ksi
Accelerometers	Triaxial, 60 kg
Temperature	Resistance temperature detector
Environmental	
Temperature rating	302°F (150°C)
Logging	
Event sampling rate	100 kHz
Event duration	1 sec
Event records	10
Run duration	5 days

Technical Specifications	
Diameter	6 1/2 in.
Pressure rating	30,000 psi
Tensile rating	686,584 lb
Connections	Standard gun threads (pin x box)
Sensors	
Strain gauges	3 axial, 3 hoop, 1 torsion
Pressure	Dynamic pressure, 100 ksi
Accelerometers	Triaxial, 60 kg
Temperature	Resistance temperature detector
Environmental	
Temperature rating	302°F (150°C)
Logging	
Event sampling rate	100 kHz
Event duration	1 sec
Event records	10
Run duration	5 days



For more case studies or additional information, please contact your local Halliburton Business Development Representative.

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