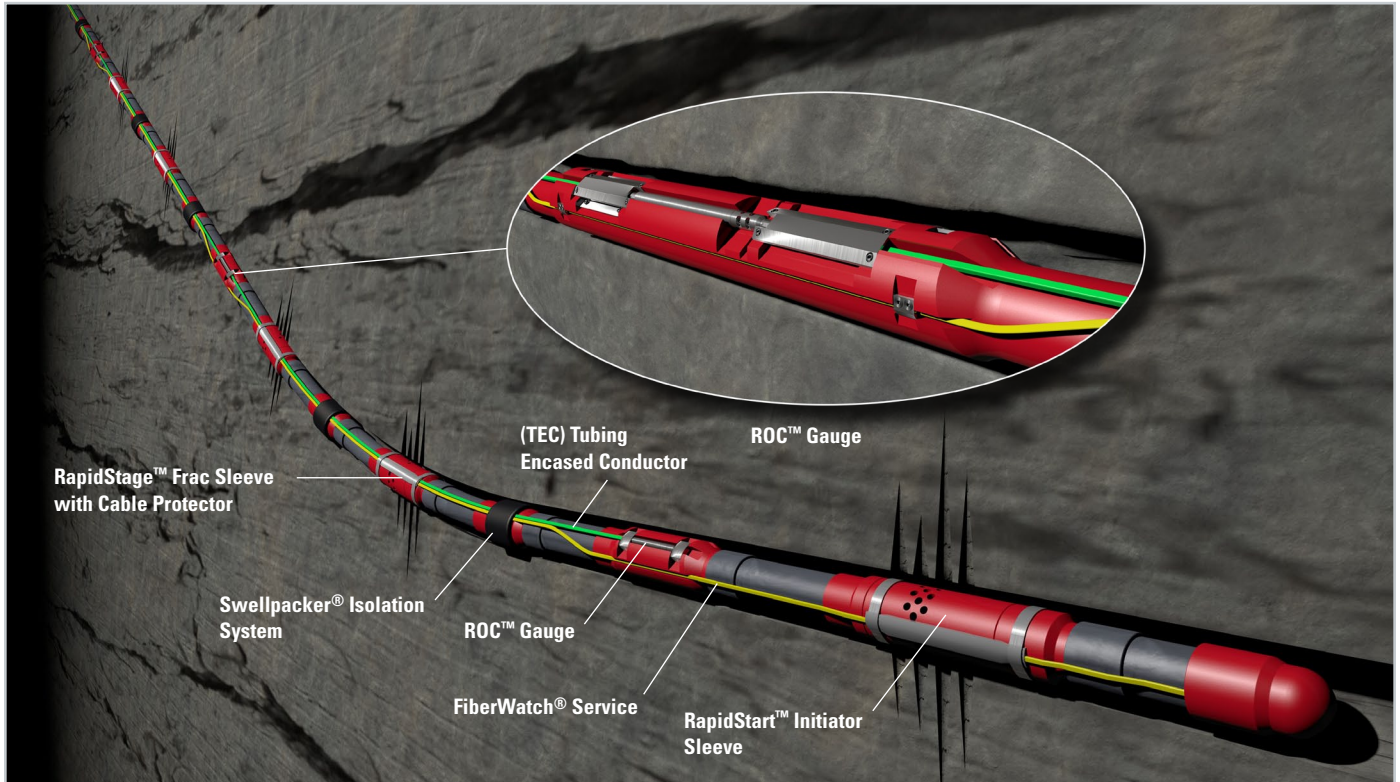


Permanent Downhole Monitoring

Single- or multi-zone monitoring during stimulation and production operations



Integrating permanent downhole gauges in an openhole horizontal completion with fiber optics.

Incorporating permanent downhole gauges provides data used to optimize production and improve reservoir drainage. Engineers can better understand fracturing stimulation performance and can evaluate, design, plan, and implement critical changes to their operations.

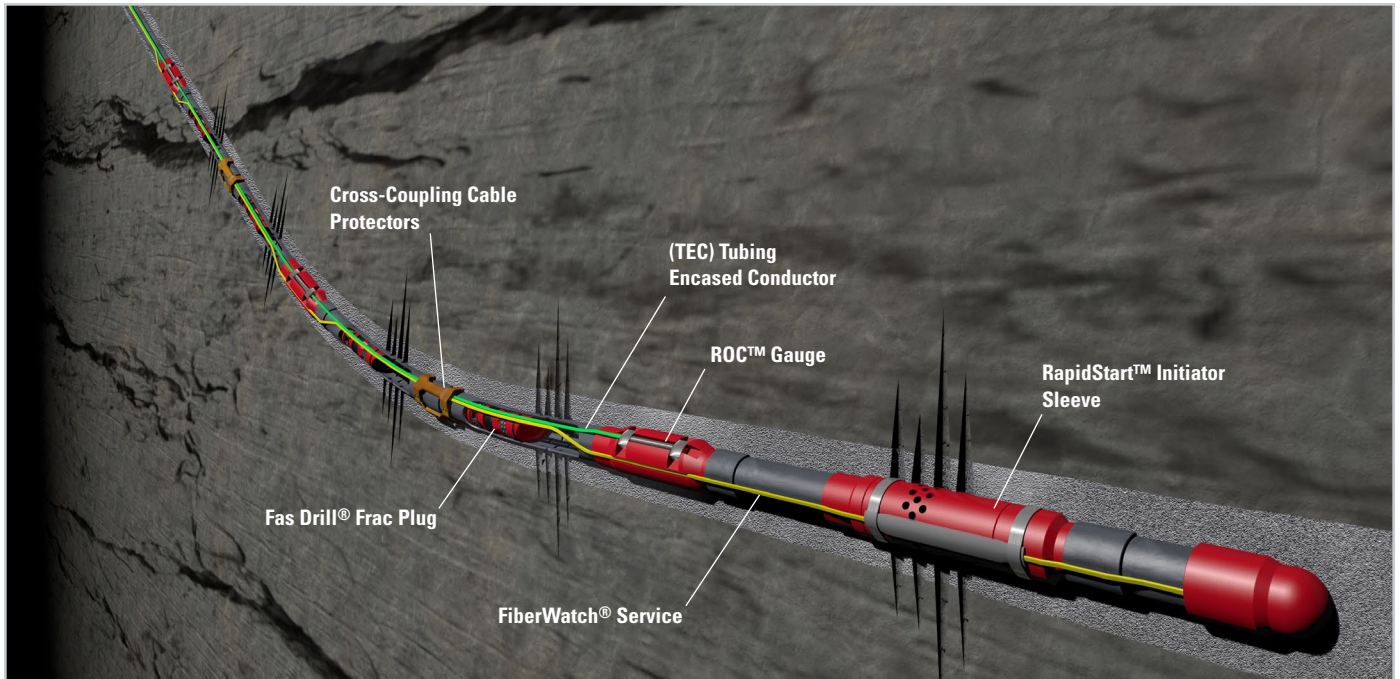
Downhole monitoring helps with reservoir management and well production through continuous real-time transmission of data back to surface.

Challenges in Fracture Operations

- ▶ Fracturing with the **calculated** value for downhole pressure has produced viable wells, but the wells are not optimized to full production potential
- ▶ Bottomhole net treating pressure values are determined using surface pressure and a friction loss calculation that is often inaccurate

Solutions with ROC Gauges

- ▶ Optimize the fracture design 'on the fly' using **actual** real-time bottomhole temperature and pressure data
- ▶ When used in conjunction with fiber optics, fracture placement and analysis is more accurate with ROC gauges



Integrating permanent downhole gauges in a cemented horizontal completion.

Other Applications of ROC™ Gauges

- ▶ Can be used in single- or multi-zone monitoring applications in conjunction with RapidSuite™ system technology and Plug-n-Perf methods, to detect slight changes in downhole pressure and temperature
- ▶ Avoid harmful depletion strategies
 - Excessive drawdown which could cause sand production or severe wellbore damage
 - Reservoir pressure dropping below bubble point
 - Excessive flow rates greater than the maximum allowable rate
- ▶ Identify opportunities for re-stimulating wells by understanding flow potential and provide production history matching to interpret completion effectiveness
- ▶ More accurately forecast performance of future wells and the reservoir
- ▶ Mitigate health, safety and environment impacts by
 - Monitoring wellbore integrity
 - Obtaining pressure and temperature data without well intervention
 - Optimizing fracture design to reduce water usage

For more information on how permanent downhole gauges can help optimize your fracturing operations, contact your local Halliburton representative or email completions@halliburton.com.

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