Reclosable CT Fracturing Sleeve

Precise multistage stimulation with flexibility for water and gas shutoff

APPLICATIONS
- Cemented multistage stimulation with single-entry fracture placement
- Openhole multistage stimulation, deployed with openhole packers
- Gas or water shutoff

BENEFITS
- Simplifies multistage stimulation operations
- Enables subsequent zonal shutoff

FEATURES
- Reclosable sleeve that is opened and closed with CT tension
- Ratings up to 15,000 psi [103 MPa]
- Premium coatings and scraping mechanisms that are proven in harsh thermal environments
- Large flow port area that ensures access to fracture planes
- Full bore access, enabling cementing and reentry for subsequent stimulation or workovers
- Reliable shifting tool technology with positive indication of sleeve actuation
- Fail-safe opening and closing, releasing only upon 100% sleeve shift (open or closed) or if the operator stops pumping
- Short sleeve length to facilitate handling and installation

Selective stimulation and reentry

The reclosable CT fracturing sleeve enables selective single-point multistage stimulation and adds flexibility for rigless zonal shutoff later in the life of the well.

The sleeve is a two-position, fullbore, reclosable fracturing sleeve designed for the most common high-pressure and high-rate fractures. The inner sleeve is run in a pinned configuration and sheared when desired, providing positive indication that the specified port has opened before fracturing.

The sleeve can be opened, closed, or reopened, allowing operators to tailor production over the life of the well using the CT fracturing sleeve shifting tool. This has been accomplished through premium manufactured sealing technology, incorporating coatings and associated inner bore scraping mechanisms that have been proven in the harshest thermal environments. In addition, the sleeve utilizes an adjustable detent locking system that locks the sheared sleeve to prevent accidental manipulation and provides operators with reliable weight indicators to mark when the sleeve has shifted.

Positive sleeve actuation

The shifting tool engineered to actuate the sleeve is compact (2.5 ft [0.8 m]) and designed to self-centralize. The tool is rated to 10,000-psi [69-MPa] differential pressure. Individual hydraulically controlled keys ensure maximum performance during actuation. Each key is engineered to withstand as much as 37,000 lbf [16,450 daN] of overpull without damage to the tool.

The shifting tool has been engineered as a fracture-in-place solution with no requirements for isolation or related service tools, even after hundreds of stages are fractured. The fully compartmentalized and hydraulically balanced design with multiple layers of solids control ensures that no solids will interfere with the tool’s operation.

Fail-safe operation

The shifting tool works with the sleeve’s adjustable detent lock mechanism to provide a reliable surface indication when a sleeve has shifted: a clear change on the weight indicator along with release of the shifting tool. The shifting tool is designed to release only when fully actuated (100% open or 100% closed) or after hydraulic pressure is released from the tool (when the operator stops pumping through the tool).
Reclosable CT Fracturing Sleeve

4.5-in. Reclosable CT Fracturing Sleeve

Sleeve Specifications

Max. OD 5.5 in [139.7 mm]
Min. ID in casing weight of
- 11.6 lbm/ft [17.3 kg/m]: 3.96 in [100.6 mm]
- 13.5 lbm/ft [20.1 kg/m]: 3.90 in [99.1 mm]
- 15.1 lbm/ft [22.5 kg/m]: 3.80 in [96.5 mm]
Sleeve weight 79.1 lbm [35.8 kg]
Total length 28.5 in [723.9 mm]
Up position/lower position Stimulation/closed
Fracture port area 10.70 in² [69.03 cm²]

Casing Specifications

Size 4.5 in [114.3 mm]
Weight 11.6–15.1 lbm/ft [17.3–22.5 kg/m]

Sleeve Operating Data

Tensile 260,000 lbf [115,650 daN]
Max. pressure 15,000 psi [103 MPa]
Temperature rating 285 degF [141 degC]
Up shifting weight 3,000–5,000 lbf [1,334–2,224 daN]
Down shifting weight 3,000–5,000 lbf [1,334–2,224 daN]
Torque 12,000 ft.lbf [16,270 N.m]

5.5-in. Reclosable CT Fracturing Sleeve

Sleeve Specifications

Max. OD 7.0 in [177.8 mm]
Min. ID in casing weight of
- 17.0 lbm/ft [25.2 kg/m]: 4.87 in [123.7 mm]
- 20.0 lbm/ft [29.7 kg/m]: 4.75 in [120.7 mm]
- 23.0 lbm/ft [34.2 kg/m]: 4.65 in [118.1 mm]
Sleeve weight 155 lbm [70.3 kg]
Total length 36.20 in [919.48 mm]
Up position/lower position Stimulation/closed
Fracture port area 11.94 in² [77.03 cm²]

Casing Specifications

Size 5.5 in [139.7 mm]
Weight 17.0–23.0 lbm/ft [25.3–34.2 kg/m]

Sleeve Operating Data

Tensile 600,000 lbf [266,893 daN]
Max. pressure 15,000 psi [103 MPa]
Temperature rating 285 degF [141 degC]
Up shifting weight 3,000–5,000 lbf [1,334–2,224 daN]
Down shifting weight 3,000–5,000 lbf [1,334–2,224 daN]
Torque 18,000 ft.lbf [24,404 N.m]

Stage 1. Pumping through the shifting tool results in a hydraulic differential that extends three sets of paired keys (six keys in all). The keys extend uniformly as the CT string is pulled upward toward the sleeve to be shifted.

Stage 2. The leading keys of each pair deflect over the inner sleeve to pass freely. As the CT string continues to pull, the rear keys latch onto the sleeve, creating tension that eventually exceeds the shear pin setting. The sleeve has been designed to enable shifting with even a single key, adding redundancy for maximum quality.

Stage 3. When the sleeve is fully actuated (100% open), the leading keys reach a kickoff profile in the upper sleeve cavity, retracting all of the keys and releasing the sleeve.

Stage 4. The CT string loses tension to indicate the sleeve has shifted and the tool can be pulled through the sleeve cavity. (If a sleeve is partly shifted, the keys will retract only after the operator stops pumping and releases the hydraulic differential pressure.)

4.5 in-Shifting Tool Specifications

Tool Specifications

Gauge ring max. OD
- for 11.6–13.5 lbm/ft [17.3 kg/m]: 3.75 in [95.3 mm]
- for 15.1 lbm/ft [22.5 kg/m]: 3.65 in [92.7 mm]
Min. ID 0.75 in [19.05 mm]
Length 24.2 in [614.68 mm]
Top connection (PAC) 2.375 in [63 mm]
Bottom connection (PAC) 2.375 in [63 mm]

Tool Operating Data

Tensile (on keys) 37,000 lbf [16,450 daN]
Working pressure 3,000 psi [20.65 MPa]

5.5 in-Shifting Tool Specifications

Tool Specifications

Gauge ring max. OD
- for 17–23 lbm/ft [25.2–34.2 kg/m]: 4.44 in [112.78 mm]
Min. ID 1.0 in [25.4 mm]
Length 26.0 in [660.4 mm]
Top connection (PAC) 2.375 in [63 mm]
Bottom connection (PAC) 2.375 in [63 mm]

Tool Operating Data

Tensile (on keys) 45,000 lbf [20,000 daN]
Working pressure 3,000 psi [20.65 MPa]