

Industry-leading LFS-5 Shear Ram upgrades and conversions done on location...at sea or onshore

The NOV Low Force Shear Ram – Generation 5 (LFS-5) is the latest application of the NOV Low Force Shear technology with enhanced shearing performance on high-strength, heavy-weight drill pipe and landing strings. NOV began working on a solution to the challenges from the industry to shear heavier landing strings. The design philosophy included shearing and sealing “back-to-back” heavy-weight landing string and subsequent work string. This new design must also center off-center or edge of bore pipe. New requirements by the Bureau of Safety and Environmental Enforcement, 30 CFR Part 250 and API 16-A 4th Edition also influenced this radical new design.

LFS-5 Features

- Shear efficiencies improved by up to 40%
- Automatically centers pipe by sweeping the entire throughbore to accommodate off-center wire line
- Centers pipe with 10,000 lbs side pull
- Designed to shear and seal landing string and work string consecutively
- Passed API16 A qualification testing
- Rated ED (30°F to 250°F)
- Will retrofit to current LFS capable doors
- Improved seal design with increased cycle life

LFS-5 Shear Rams Generation 5 (LFS-5)

The LFS-5 design employs a self-centering geometry that sweeps the entire wellbore, ensuring that the drill pipe, casing, wireline or control lines are moved into the shearing surface of the ram.

Off-center shear tests were conducted with 10,000 lbs side load force to simulate a slack or buckled drill pipe. Wireline shear tests were conducted with slack wireline held against the extreme edge of the wellbore, without any tension to aid in the shearing process. The LFS-5 has sheared and sealed wireline, multiple strands of control tubing, drill pipe, landing strings and casing and in one simplified design the LFS-5 sweeps 100% of the wellbore to ensure that the pipe or wireline is sheared and not “trapped between the rams”.



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Shear Ram Upgrade Package Generation 5 (LFS-5)





Robust, ready and reliable

Superior strength, design and unmatched reliability

In testing the LFS5 was able to repeatedly shear and seal heavy weight landing string followed by today's tougher work strings. This extreme condition test demonstrates the superior performance and reliability of the design. Testing has proven the capability of this shear ram design with consecutive shearing of the following pipes all performed on the same set of shear rams:

- 5-7/8", 27 ppf, 0.440" wall, S-135 Drill Pipe
- 6-5/8", 57 ppf, 0.813" wall, UD-165 Landing String
- 6-5/8", 64 ppf, 1.16" wall, V-150 Landing String
- 10-3/4", 85 ppf, 0.837" wall, Q-125 Casing
- 14", 115 ppf, 0.820" wall, Q125 Casing

The ability to shear tougher, heavier landing strings can significantly reduce well costs by running fewer but longer casing strings resulting in less round trips.



Impact on the industry

Shear & Seal:

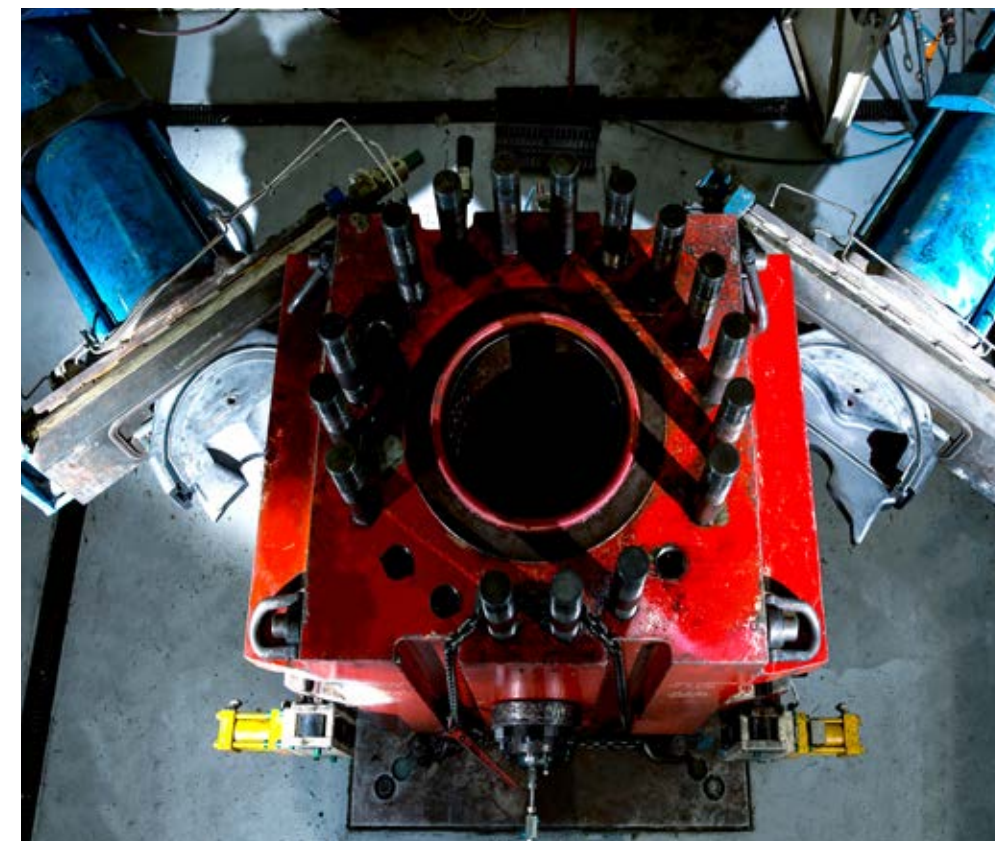
- 6 5/8", 50ppf, S-135 followed by 5 7/8", 27ppf, S-135
- 6 5/8", 57ppf, UD-165 followed by 5 7/8", 27ppf, S-135
- 6 5/8", 64ppf, V-150 followed by 5 7/8", 27ppf, S-135
- 7 1/16" x 5 1/2", VIT, CR-115 followed by 5 7/8", 27ppf, S-135
- THRA followed by 5 7/8" 27ppf, S-135
- 7 7/8", 54ppf, V-150 followed by 5 7/8", 27ppf, S-135
- 10 3/4", 104ppf, P-110 followed by 10 3/4", 104ppf, P-110
- 14", 115ppf, Q-125 followed by 14", 115ppf, Q-125

Shear & Seal Wireline:

- Schlumberger 7-48A SUS
- Rochester 7-H-490K
- Rochester 1-H-314K

*All with no tension on wireline

*All of the above shear and seal tests (and more) were performed using the same set of shear rams.



The LFS-5's ability to repeatedly shear and seal today's tougher, heavier pipe dramatically improves safety. Back-to-back shearing of landing and work strings and sealing full working pressure of 15,000 psi after each shear demonstrates robustness and dependability.

The ability to fully sweep the bore and mitigate the possibility of trapped or pinched pipe that can restrict the shearing operation is a key safety feature. From 14", 115ppf, Q-125 Casing to 3/16" Wireline, 30°F to 250°F test temperature range, the LFS-5 is a truly robust and reliable shear ram.

The ability to shear tougher, heavier landing strings can significantly reduce well costs by running fewer but longer casing strings resulting in less round trips. Reduced shear pressures means less subsea accumulator capacity resulting in significant cost and real estate savings.

Eliminating additional accumulators, one casing liner with tools, run time and cement costs could conservatively account for \$1M - \$1.5M in savings on a deep-water well cost.

Repeat shear capability translates to greater reliability and reduced downtime