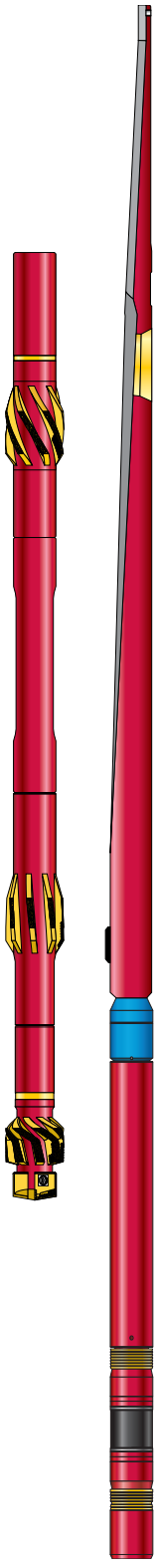
Shallow-Angle QuickCut™ Casing Exit System

PakLatch™ Permanent Seal-Bore Packer



Weatherford's shallow-angle *QuickCut* casing exit system with *PakLatch* permanent seal-bore packer is a high-performance, permanent, big-bore packer anchor that is set separately and independently of the whipstock assembly. Providing a permanent, known datum point for re-entry, multiple laterals, or re-entry and multiple laterals cut from the same target, as well as production flow-through ability, this system is the foundation for multilateral applications.

A survey tool is run downhole to determine the orientation of the packer. An orienting latch assembly is made up to the bottom of the concave, having been adjusted to the required direction from the information provided by the wireline survey. The shallow-angle *QuickCut* milling and whipstock assembly are run in the hole and latched into a matching profile inside the casing packer. After the assembly is latched into the packer, the whipstock face is automatically oriented to the required direction.

Applications

- Level 2 multilateral wells
- Extended-reach wells to minimize doglegs
- Wells requiring exits to accommodate long rotary-steerable drilling systems
- Wells running complex completion strings and expandables
- Exits through multiple strings of casing

Features, Advantages and Benefits

- The packer can be set by a wireline or hydraulically activated pipe, providing flexibility in the field.
- The assembly enables multiple sidetracks from one parent wellbore location, promoting operational flexibility.
- High-torque packer assembly can withstand mill-loading thrust and rotational torque, ensuring the tools stay in place during the milling operation.

Shallow-Angle QuickCut™ Casing Exit System

PakLatch™ Permanent Seal-Bore Packer

Features, Advantages and Benefits (continued)

- The packer anchor enables 360° whipstock orientation (adjustable in 4° increments), enhancing the ability to reach target, reducing the drill time to reach target and ultimately saving operational time and costs.
- The assembly provides re-entry access to the laterals, enabling future remediation.
- The unique lug technology protects the whipstock during cutout and accurately directs the mill into the casing wall, enabling more accurate drilling windows.
- The shallow-angle *QuickCut* milling assembly consistently generates a smooth transition from the parent bore into the lateral section by utilizing a full-gauge three-mill design.
- The large packer ID and accessories enable lower zonal production, providing isolation from below.
- The assembly provides a straight overpull to release the whipstock anchor from the packer, simplifying operations.
- Designed for hostile environments, the *PakLatch* packer can withstand hydrogen sulfide, high pressures, and high temperatures as required by ISO 14310, V3.
- The system can be can be retrieved through multiple methods, promoting operational flexibility.
- The 2° single-angle concave creates a smooth transition from the parent bore into the lateral section, reducing operational time and costs.

Shallow-Angle QuickCut™ Casing Exit System

PakLatch™ Permanent Seal-Bore Packer

Specifications

Milling Assemblies

Casing		Concave OD (in./*mm*)	Lead Mill			Secondary Mill		Flex Mandrel Connection Box × Pin	Steering Mill	
OD (in./*mm*)	Weight (lb/ft, *kg/m*)		OD (in./*mm*)	Pilot OD (in./*mm*)	Box Connection	OD (in./*mm*)	Connection Box × Pin		OD (in./*mm*)	Connection Box × Pin
7 *177.8*	23.0 SD *34.2 SD*	5-1/2 *139.7*	6-1/4 *158.8*	5 *127.0*	3-1/2 Reg	6-1/4 *158.8*	3-1/2 Reg	Flex mandrel is incorporated in secondary mill	6-1/4 *158.8*	3-1/2 IF × 3-1/2 Reg
	23.0 *34.2*		6-1/8 *155.6*			6-1/8 *155.6*			6-1/8 *155.6*	
	26.0 *38.7*									
	29.0 SD *43.2*									
	29.0* *43.2*		6* *152.4*	4-1/2 *114.3*		6* *152.4*			6* *152.4*	
	32.0* *47.6*		5-7/8* *149.2*			5-7/8* *149.2*			5-7/8* *149.2*	
	32.0 SD* *47.6 SD*		6* *152.4*			6* *152.4*			6* *152.4*	
	35.0* *52.1*		5-7/8* *149.2*			5-7/8* *149.2*			5-7/8* *149.2*	
9-5/8 *244.5*	40.0 *59.5*	8 *203.2*	8-5/8 *219.1*	7 *177.8*	4-1/2 Reg	8-5/8 *219.1*	4-1/2 IF × 4-1/2 Reg	4-1/2 IF	8-5/8 *219.1*	4-1/2 IF
	43.5* *64.7*		8-1/2* *215.9*	6-3/8* *161.9*		8-1/2* *215.9*			8-1/2* *215.9*	
	47.0* *69.9*									
	53.5* *79.6*									

*Heavyweight assemblies

Shallow-Angle QuickCut™ Casing Exit System
PakLatch™ Permanent Seal-Bore Packer

Specifications (continued)

Packers

Pressure and Temperature Ratings			
	Packer Size		
Ratings	**5-1/2 in.**	**7 in.**	**9-5/8 in.**
Pressure from above (psi, *kPa*)	5,000 *34,470*		
Pressure from below (psi, *kPa*)			
Minimum temperature (°F/°*C*)	150° *66°*		
Maximum temperature (°F/°C)	275° *135°*		

Axial Release Pressure[1]			
Packer size	**5-1/2 in.**	**7 in.**	**9-5/8 in.**
Nominal shear value (lbf/*daN*)	60,000 *26,689*		
Piston area (in.^{2}/*cm*^{2})	11.0 *71.0*	20.6 *132.9*	44.2 *285.2*
Pressure rating from below with standard shear ring[2] (psi, *kPa*)	5,435 *37,473*	3,049 *21,022*	1,357 *9,356*
Maximum shear value[3] (lbf/*daN*)	60,000 *26,689*	80,000 *35,590*	100,000 *44,482*

[1]Values represent axial release using a standard shear mechanism. Axial release can be increased or decreased by adjusting the thickness of the shear mechanism.
[2]Pressure from below, working against the piston area, determines the axial release. This value is determined by dividing the nominal shear value by the piston area. Example: 60,000 lb / 44.2 in.^{2} = 1,357 psi.
[3]Maximum shear value can only be achieved with a special-order shear ring.

Formula for Determining Overpull Required for Releasing the Tool		
Step	Formula	Example for Reservoir with Pressure of 1,000 psi (69 Bars)
1	Reservoir pressure from below × piston area = shear load resulting from pressure	1,000 psi x 44.2 in2 = 44,200 lbs *6,895 kPa x 0.01 x 285.2 cm2 = 19,664 daN*
2	Shear value – shear load resulting from pressure = overpull	60,000 lb – 44,200 lb = 15,800 lb overpull *26,689 daN – 19,664 daN = 7,025 daN*

Shallow-Angle QuickCut™ Casing Exit System

PakLatch™ Permanent Seal-Bore Packer

Specifications (continued)

Packers

Casing size (in./*mm*)	**5-1/2** ***139.7***	**7** ***177.8***	**9-5/8** ***244.5***
Casing weight (lb/ft, *kg/m*)	20 to 23 *29.8 to 34.2*	20 to 32 *29.8 to 47.6*	40.0 to 53.5 *59.5 to 79.6*
***PakLatch* packer**			
Maximum OD (in./*mm*)	4.440 *112.8*	5.870 *149.1*	8.250 *209.6*
Minimum ID (in./*mm*)	2.688 *68.30*	4.000 *102.4*	6.000 *153.2*
Maximum torque (ft-lb/*N•m*)	5,000 *6,779*	7,500 *10,169*	10,000 *13,558*
Maximum pressure differential (psi/*kPa*)*	5,000 at 275ºF *34,470 at 135°C*		
***QuickCut* whipstock**			
Mill range OD (in./*mm*)	4,500 to 4,625 *114.300 to 117.475*	5,875 to 6,250 *149.225 to 158.750*	8,375 to 8,625 *212.725 to 219.075*
Shear value (lbf/*daN*), mill from whipstock	14,000 *6,228*	28,000 to 43,000 *12,455 to 19,127*	40,000 to 59,000 *17,793 to 26,245*
***PakLatch* latch assembly**			
Stab-in force (lbf/*daN*), latch into packer	<5,000 <*2,224*		
Shear release nominal force (lbf/*daN*), unlatch from packer	60,000 *26,689*		
Pressure rating from below with standard shear ring (psi, *kPa*)	5,435 *37,473*	3,049 *21,022*	1,357 *9,356*
Maximum OD (in./*mm*)	4.43 *112.6*	5.87 *149.1*	8.24 *209.4*
Minimum ID (in./*mm*)	1.75 *44.4*	2.69 *68.3*	3.75 *95.2*
Re-entry guide			
Minimum ID (in./*mm*)	1.50 *38.1*	2.50 *63.5*	2.25 *57.2*
Maximum OD (in./*mm*)	3.45 *87.6*	4.65 *119.9*	6.50 *165.1*
Face angle	6°		
Running tool OD (in./*mm*)	4.50 *114.3*	5.75 *146.1*	8.13 *206.5*

*Or 80% of casing pressure rating if less than these values. Latch shear-ring value may reduce maximum pressure differential.

Shallow-Angle QuickCut™ Casing Exit System

PakLatch™ Permanent Seal-Bore Packer

Specifications (continued)

Permanent seal-bore packer

Releasable latch-type anchor