



Coiled Tubing Multi Stage Frac System



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The KW coiled tubing Frac System delivers unprecedented flexibility for multistage completions. There is no practical limit to the number or spacing of stages. It also isolates and stimulates multiple stages in a single trip on coiled tubing and is typically used in Cased hole. This Hydraulic Jet Frac System works in both horizontal and vertical wellbores. Tool string depth is correlated to desired perforation depth by using a mechanical casing coupling locator. Starting with the lowest stage, the Packer is set to isolate the zone from wellbore below the packer. Then the abrasive slurry is pumped down the coiled tubing string to the Hydraulic Jet Unit. The high-velocity jets cut through the casing and cement and into the formation. After perforating, a leading-edge fluid such as acid can be circulated or injected down the coiled tubing/casing annulus. Then the frac is also pumped down the annulus. If screenout occurs, excess sand can be quickly reverse circulated out. Finally, a pull on the coiled tubing unsets the packer, which is then moved up to the next perforation point, where the sequence is repeated.



Features and Benefits:

- Simple design and most efficient
- Unlimited stages and spacing
- Precise frac location
- Water and chemical reservation
- Unrestricted, production-ready wellbore after frac.

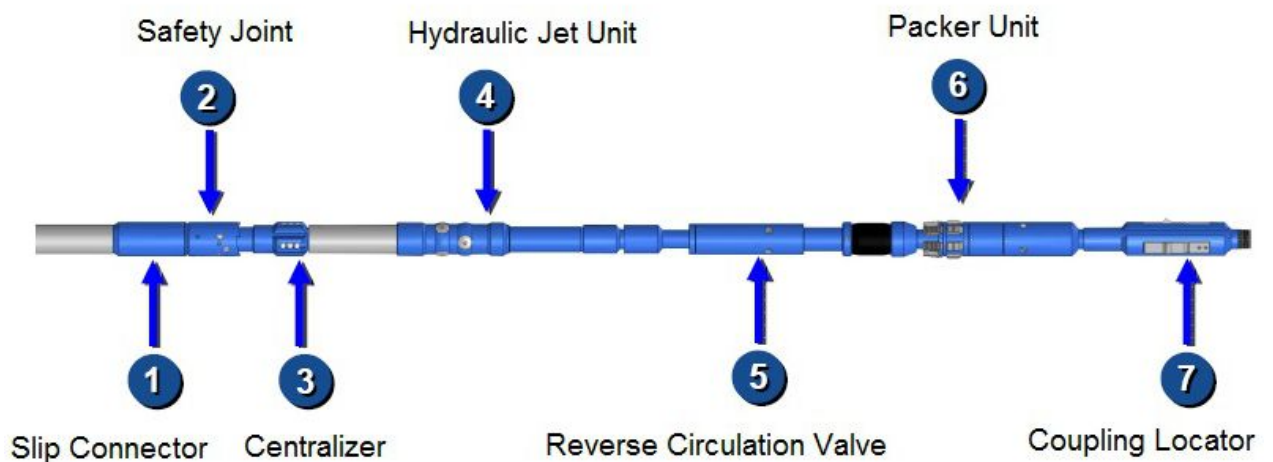


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- When annular fracturing, the coiled tubing serves as a deadleg for monitoring actual pressure at the frac point to assist in adjusting pad size, sand concentration and ramp, fluid viscosity and pump pressure in real time
- When screenout occurs, excess sand can be quickly reverse-circulated out without tripping out of the hole
- Equalizing valve allows movement without flowing the well
- Hydraulic disconnect unit enables emergency release
- Less hydraulic horsepower needed
- 5 minutes between Fracs. The simple operation of the Multistage Unlimited system cuts the time between fracs to as little as 5 minutes.
- Less equipment, less exhaust, smaller footprint. Environmentally friendly fracturing

The components



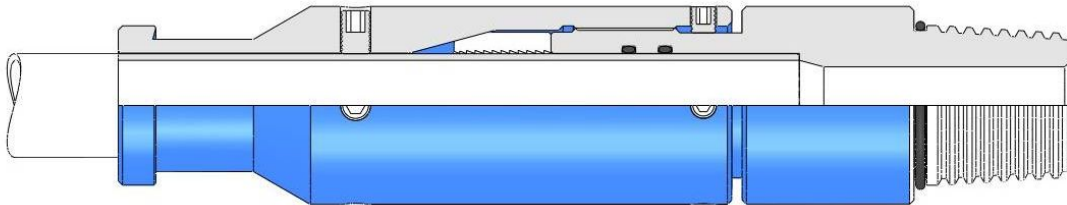


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Introduction of the components:

1. Slip Connector



Working Principle

Outside slip connector meshes the coiled tubing external through the slip. Its top end connects with the coiled tubing, the bottom end connects with the working string. This connector using a series of slip meshes the coiled tubing by the carving into effect, so that the larger tensile force, the tighter meshing, then more reliable anchoring.

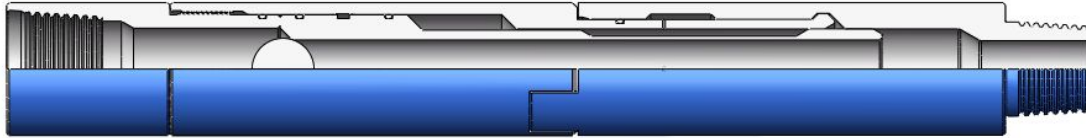
OD (in)	ID (in)	Thread
2	2.75	1"AMMT
2.25		
2.625	0.875	1.5"AMMT
2.75	1	



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2. Safety Joint



Working Principle

Safety joint is a safe device during the working. When abnormal phenomena happen, throw a ball from the tubing and pressurize from the tubing, the ball can fall on the joint, and push the piston in the tool downward, then the tool's upper part will be separate with the lower part, at this time, the upper part and the tubing can be removed from the well safely.

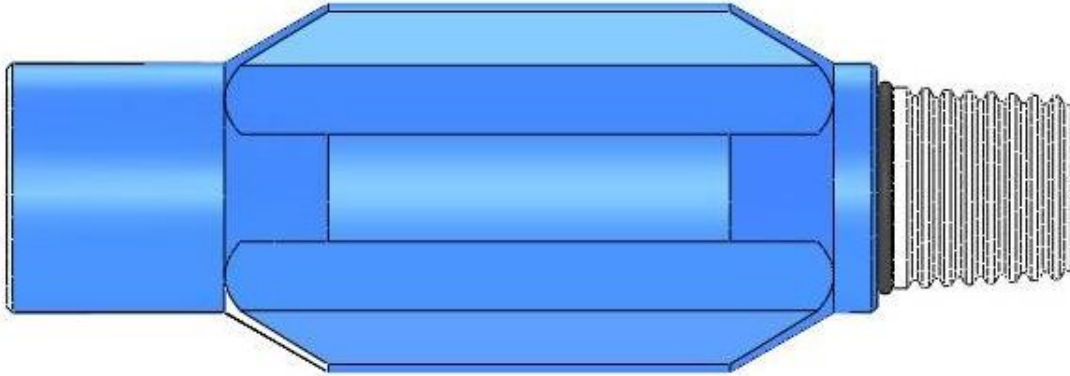
OD	ID	Length	Thread
2.25"	0.47"	23.25"	1 1/2" AMMT
2.50"	0.47"	23.69"	1 1/2" AMMT
2.88"	0.59"	26.75"	2 3/8" PAC
3.13"	0.69"	29.75"	2 3/8" PAC
3.50"	1.25"	29.75"	2 7/8" PAC



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3. Centralizer



Working Principle

Rolling ball type centralizer guides and centralize the tool in the wellbore, which make the tool centered. It has simple and compact structure. The free rotatable balls reduce the friction between the tool and the well wall, which reduce the resistance when well-logging, and it can protect the casing.

Recommended centralizers outer diameter

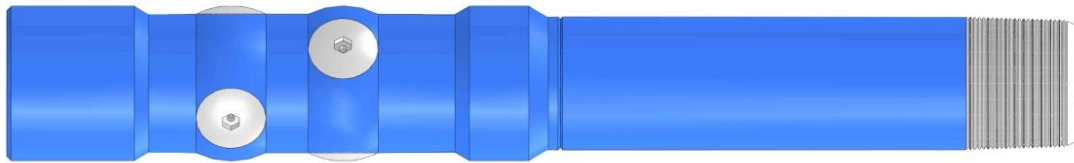
Pipe Type	Size(in)	Centralizer OD
Casing	$< 9 \frac{5}{8}$	ID-3.18
	$\geq 9 \frac{5}{8} \sim \leq 13 \frac{3}{8}$	ID-3.97
	$> 13 \frac{3}{8}$	ID-4.76
Tubing	$\leq 2 \frac{7}{8}$	ID-2.38
	$> 2 \frac{7}{8} \sim \leq 8 \frac{3}{8}$	ID-3.18
	$> 8 \frac{3}{8} \sim < 10 \frac{3}{4}$	ID-3.97



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4. Hydraulic Jet Unit



Working Principle

Hydraulic jet unit is made of high hardness body and wear resisting nozzle. The number of nozzles and nozzle diameter is adjustable according to the actual situation. After the hydraulic jet unit perforating tool which connects with the string goes down to the predetermined position, the hydraulic pump in the ground pressurizes and injects the liquid, the liquid in the throttling effect of the nozzle results in high-speed, high-pressure fluid to penetrate the casing, formation, achieving the project purpose.

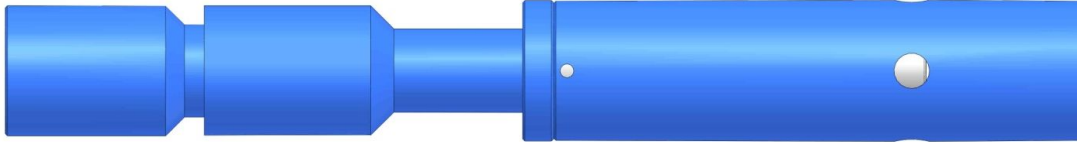
Thread	2 3/8" PAC, 2 3/8" API, 2 7/8" PAC, 2 7/8" API
Nozzle Diameter	Ø2.0MM~Ø5.0MM
Pressure Rating	10,000 PSI[70 MPa]
Temperature	300°F[150°C]
Working Environment	STD



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5. Reverse Circulation Valve



Working Principle

SD-1 reverse circulation valve is applied matching with SD-1 packer. When well-logging and packer setting, releasing, the reverse circulation valve is open, the reverse sand-flushing and well flushing can be down at this time; after the packer setting, the non-return valve stand the pressure from the upper tubing to complete the frac work.

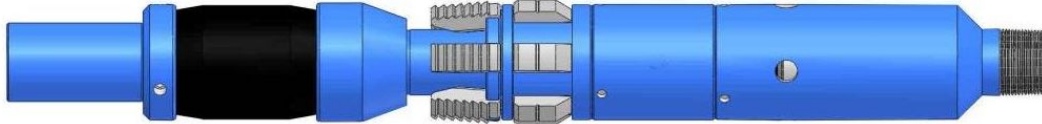
Thread	2 3/8" PAC, 2 3/8" API, 2 7/8" PAC, 2 7/8" API
Circulation Mode	Normal Circulation or Reverse Circulation
Pressure Rating	10,000PSI [70MPa]
Working Temperature	300°F [150°C]
Working Environment	STD



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6. SG packer



Working Principle

SG packer is a kind of high pressure packer, which is specially used for packing the coiled tubing jet frac bottom. It is particularly used for coiled tubing well-logging which don't need the torque, and adopts the setting way of upper loading. Through one operation of uplift-downdip, the packer can transfer from the well-logging to the condition of setting, then uplift-downdip again, the packer change to the condition of well-logging from the condition of setting, the operation is repetitive and circulating. When releasing, directly lift the packer.

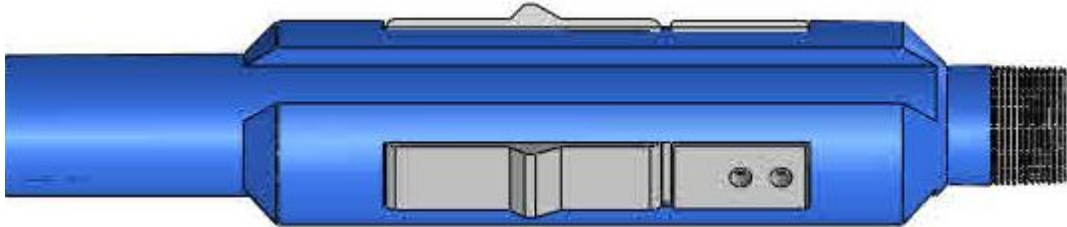
Item	Casing OD in	Casing Weight Lbs/ft	Tool OD in(mm)	Tool ID in(mm)
1002045001	4 1/2	12.6-15.1	3.609(91.7)	1.894(48.1)
1002045002		9.5-13.5	3.786(96.2)	
1002050001	5	15-18	4.140(105.2)	
1002050002		11.5-15	4.265(108.3)	
1002055002	5 1/2	20-23	4.515(114.7)	1.973(50.1)
1002055003		15.5-20	4.656(118.3)	
1002070003	7	26-29	5.983(152.0)	2.416(61.4)
1002070004		20-26	6.093(154.8)	



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7. Coupling Locator



Working Principle

Coupling locator is a positioning device in the well, which make the tool strings can find the correct positions. Coupling locator can be installed in the copling, which make sure the right working positions of the packer and hydraulic jet unit.

Casing OD in	Casing Weight Lbs/ft	Body OD in(mm)	Tool ID in(mm)
4 1/2	12.6-15.1	3.609(91.7)	1.894(48.1)
	9.5-13.5	3.786(96.2)	
5	15-18	4.140(105.2)	
	11.5-15	4.265(108.3)	
5 1/2	20-23	4.515(114.7)	1.973(50.1)
	15.5-20	4.656(118.3)	
7	26-29	5.983(152.0)	2.416(61.4)
	20-26	6.093(154.8)	



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The benefits of the system:

- Coil tubing conveying or tubing conveying
 - Safe, fast, economic, efficient
 - All the downhole tools can be get out after finish the multi-stage frac modification
 - No need of packer, fracturing sliding sleeve, composite bridge plug and cement plug
- Optional perforating and fracturing layer-by-layer
 - Abrasive blasting perforation joints under the coiled tubing
 - Complete with a repeatedly setting SG packer
 - Packer the lower casing annulus

Various modification plans comparison

Features	Cement plug staged fracturing	Bridge plug/staged perforation fracturing	Packer/fracturing slide sleeve	Coiled tubing dragging fracturing
Lower the energy consumption during the operation	X	X	X	✓
No differential stage limits	✓	✓	X	✓
Accurately evaluate	?	✓	✓	✓
One operation of string	✓	X	✓	✓
Backwash the sand	✓	X	X	✓
Circulate the acid fluid	✓	X	X	✓
Oil well controlled during operation	X	X	✓	✓
Precisely control the fracturing	✓	?	X	✓
Accurately locate	✓	X	X	✓
Pressure rating	?	12,000Psi	5,000Psi-12,000Psi	8,500Psi
Blind tube	✓	X	X	✓
Backwashing or need drill away	X	X	X	✓
Verifiability	✓	?	X	✓



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Construction Technique Advantages

- Lower the energy consumption during the operation
- No differential stage limits
- One operation of string
- Circulate the acid fluid and backwash the sand
- Oil well controlled during operation
- Accurately locate and control the fracturing
- High pressure rating
- Circulate liquid without rearrangement of string
- Production carry out immediately when tools are get out