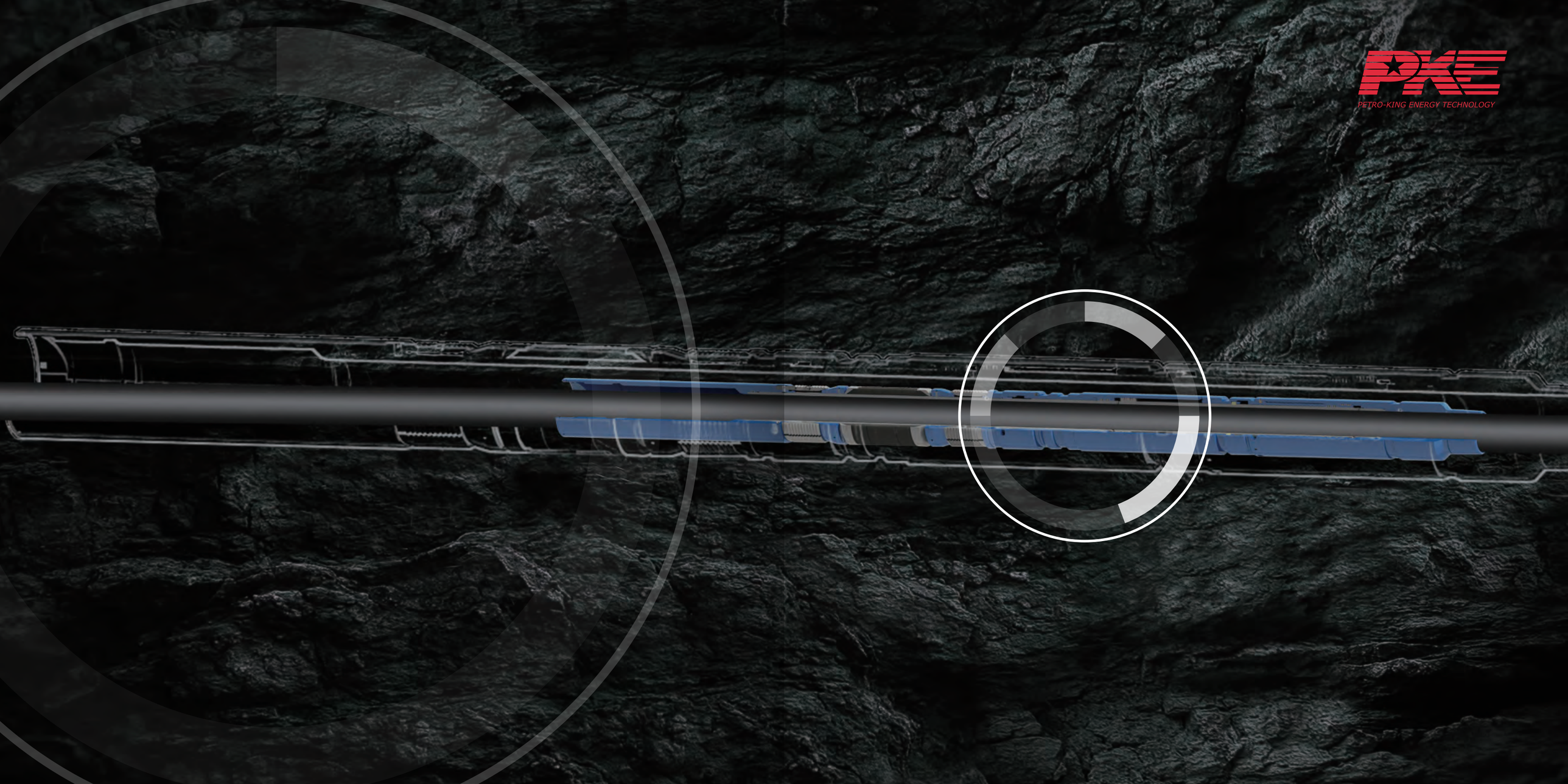
PETRO-KING ENERGY TECHNOLOGY



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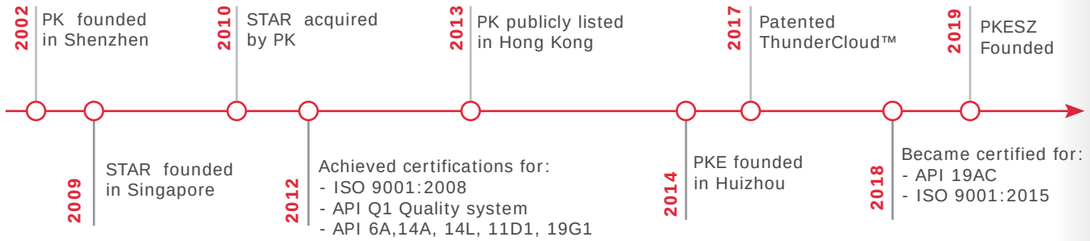
About PKE and its history

PKE is an **API** and **ISO** certified company that designs and manufactures downhole completion tools. PKE also has the capability to design and fabricate high tolerance parts or complete assemblies to meet customer requirements for Oil & Gas and High-Specification Industrial Applications.

PKE is headquartered in Shenzhen, China with R&D centers and manufacturing plants in **Huizhou, China** and **Singapore**. PKE is a subsidiary of the Petro-King Group that was established in 2002 and is listed on the Hong Kong Stock Exchange.

PKE maintains a team of innovative engineers and designers that design new tools, improve upon existing designs, and assist customers in the design of their products. PKE's research and development team's commitment to innovation has resulted in technology that is covered by 63 patents, API Certifications, and many outstanding achievements.



Innovation

- ***63 Patents (incl. pending)***
- ***The 1st in Southeast Asia to be certified API 19 AC***
- ***Being able to produce 7" Deep Set Safety Valve, 15K Packer, 20K Safety Valve***
- ***The world's 1st 365°F Ultra-high temperature Dissolvable Frac Plug deployment***

Quality

- ***API Q1 Quality system***
- ***API 6A,14A, 14L, 11D1, 19G1, 19AC***
- ***ISO 9001:2015***
- ***ISO 45001: 2018***
- ***ISO 14001: 2015***

AHEAD OF THE CURVE

Leading Innovative Manufacturer of Downhole Completion Equipment certified by API ISO

Total 367,867 sqft land area of state of the art Manufacturing Centers in China and Singapore

In-House R & D centers recognized by government

In-House Test Facility with capability up to 30,000 psi

Highly skilled Field Service Team

Global footprint in 6 Continents

Our Manufacturing Facilities

Optimized for Production and Quality

PKE has two manufacturing plants, **HZ Base in Huizhou, China** and **STAR PETROTECH in Singapore**.

Both facilities were designed from the ground up to streamline the manufacturing process from the receipt and inspection of raw material, machining, quality control, and factory acceptance testing. PKE has heavily invested in equipment that, in most cases, eliminates outsourcing. This gives PKE the ability to control costs and deliver finished products at exceptional prices and lead times.

PKE continuously invests in quality machining equipment and technologies, this allows us to provide cutting edge services at competitive prices. Our team of extremely talented machinists is able to produce multifaceted precision parts, from prototypes to large volume production in a safe, clean, and comfortable work environments.

PKE machining equipment consists of 3 Five-axis Machining Center, 22 Haas Milling Machine, 13 CNC Milling Machines, 35 CNC Lathes, 8 Manual Lathes, 3 Manual Milling Machines, 3 DBDM(Deep Bore Drilling Machine), 2 Radial Drilling Machines, 4 WEDM(Wire Electrical Discharge Machining), 3 Band Saws, 3 Breakout/Torque up Units, and 14 sets overhead cranes for material handling.

PKE has 5 pressure testing stations capable of testing up to 30,000 psi. PKE's Inspection equipment consists of 1 Olympus XRF Analyzer, 1 Tensile testing machine, 3 Profile Projector, 2 CMM (Coordinate Measuring Machine) and necessary micrometers and API gauges.

PKE's API Certified personnel manage a thorough testing, validation, and FAT system that is certified by both ISO and API to ensure that all products meet or exceed specifications.



3 x Five-axis Machining Center

22 x Haas Milling Machine

13 x CNC Milling Machine

35 x CNC Lathes

3 x DBDM

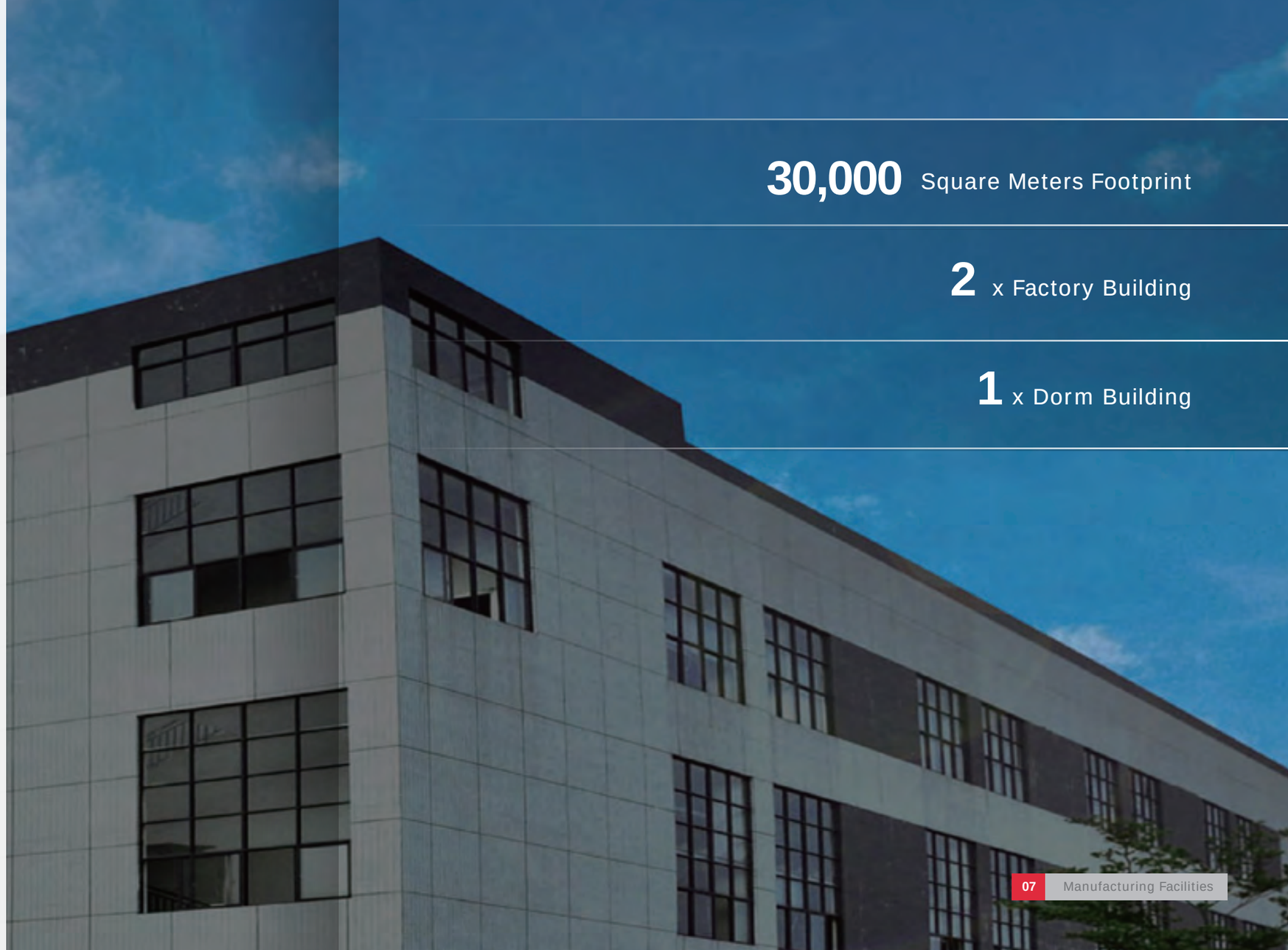
4 x WEDM

5 x Pressure Test Station

HZ Base

Huizhou Guangdong

PKE built this facility in 2013, and it is located in Huizhou Guangdong. HZ Base consists of 28,000 square meters of manufacturing space, 2,000 square meters of office space and dormitory building. The size of this facility makes it ideal for the fulfillment of large orders. HZ Base is capable of manufacturing the full line of PKE Downhole Tools, Dissolvable Solutions, Aerospace, and High-Specification Industrial parts and assemblies.



30,000 Square Meters Footprint

2 x Factory Building

1 x Dorm Building

STAR PETROTECH

Singapore

PKE acquired this facility in 2010. This facility is capable of manufacturing the complete line of PKE Downhole tools, custom design and manufacture of special purpose downhole tools, and parts for other downhole tool manufacturers.

STAR PETROTECH is committed to provide the highest quality product through our highly skilled and well-trained employees using state-of-the-art manufacturing processes.

Over the years, STAR has earned a good reputation for their innovative designs of completion tools in the Middle East, South America, Africa, Russia, Europe and in Central and Southeast Asia markets.

STAR's Quality Management System is certified by ISO and API Q1.

STAR's Downhole Completion Tools are certified to bear the following API Monograms:
6A, 14A, 14L, 11D1, 19G1, 19AC.



Quality Management

PKE attaches great importance to our Quality Management System (QMS) and its effective implementation. Our quality management system exists to deliver our customers market leading service quality. At all stages of the project or operations lifecycle, we are looking for continuous, timely improvements that help create further value and guarantee PKE's future growth.

PKE maintains an absolute focus on meeting the needs and expectations of its customers. We seek excellence in products and services through continual improvement by providing our customers with high-quality and cost-effective services and products.

CERTIFICATIONS



API Q1



API 14A



API 6A



API 19G1



ISO 9001:2015



API 11D1



API 14L



API 19AC



ISO 45001: 2018



ISO 14001: 2015



High and New Technology Enterprises Qualification



Safety Production





Precision Machining Equipment

■ High-end Five-Axis Machining

The Five-Axis Machining Center is a high efficient, high precision machining center capable of milling, drilling, and boring on multiple planes. This allows our operations to do a single setup for a complex process. A single setup means that the part does not have to be moved from one machine to another and this results in unmatched precision.

Five-Axis machining achieves the desired surface finish of a complex surface by continuous movement of the cutter. This prevents surface imperfections and ensures a quality product.



DMC 125U LS5 X1250 x Y880 x Z800

Complete processing

- The milling and turning operations are completed in one setting, with a Direct-Drive table and a speed of 500 rpm.
- It integrates grinding processing technology and has a higher surface quality.



High precision

- Comprehensive water-cooled feed drive for higher accuracy.

Performance

- Standard, fast and ultra-compact rotary pallet exchange system provides the ability to clamp while processing, also provides milling and turning composite version.

High efficiency

- Ultra-compact 453-position wheeled tool magazine with less floor space and short tool change time, up to 5.6 seconds.
- Excellent proximity performance, easy access to maintenance parts and comfortable operation.
- Up to 95% machine availability.

MIKRON HPM 1350U X1350 x Y1150 x Z895

- NC-turntable diameter: 1100 mm
- Spindle motor: 38 kW
- Maximum spindle speed: 15000 rpm
- Tool holder: HSK-63
- Tool magazine : 48no
- Infrared Renishaw OMP60 measuring system
- Dual laser measurement system
- Advanced process analysis system
- Intelligent thermal control system
- Motion trajectory analysis system
- Rotating observation window
- Handwheel operation SmartNC



FAGIMAR SPIN FAST 2200 X2200 x Y700 x Z820

- Workbench: 2400*800mm
- Turntable diameter : 800mm
- Rapid moving speed X/Y/Z/: 40 m/min
- System: HEIDENHAIN ITNC 640
- Range of rotation : 18000 rpm
- Handle: HSK-A63
- Tool magazine : 48no
- Maximum tool weight :5 kg
- Maximum diameter of tool : 70 mm
- The diameter of the empty adjacent tool position : maximum 80mm
- Maximum tool length : 250 mm
- Accessories: five axis with grating ruler, electronic handwheel, RenisHAW workpiece probe, spindle oil cooler, chip remover.



Haas Four-Axis Machining Center

The main characteristics:

- High speed spindle X/Y/Z Rapid moving
- High speed side-mounted tool magazine

The Haas vertical machining center provides the necessary high spindle speed, rapid traverse and rapid tool change to achieve mass production and shorten cycle time.



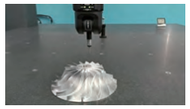
Inspection & Testing

LEAD G201515 3-D Dimension Testing System

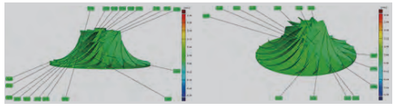
Stroke range: 1500x1500x2000
Max.Part Weight(Kg): 2400Kg
MPEE/(μm): 4.5+L/200 μm
MPEP/(μm): 4.9 μm
Resolution of grating ruler: 0.1 μm

The main advantages:

- Surface anodized aviation aluminum alloy
- High-precision self-cleaning air bearing
- High-precision grating ruler imported from Europe
- Patented technology of precision triangle beam



Testing



3D Drawing



PressureTesting Equipment

- ***2 x Hydro Testing Equip.***
- ***Max. Pressure 15,000 psi /103MPa***

Measuring & Inspection

- ***Vernier Calipers Micrometers Rigiscan Tensile tester***
- ***Optical projector Long stroke CMM***
- ***X-Y-Z 1800-3500-1400***

Our Portfolio

Positioned to win

We deliver across the energy value chain through our leading business segments:

Completion Tools

Dissolvable Solutions

High Specification Contract Manufacturing



Our Portfolio

Completion Tools

Your source for completion tools

We bring together a portfolio of differentiated completion tool products and solutions to address the most pressing needs of the global well completions marketplace. Our tools include the following product line:

- Packers
- Subsurface Safety Valve
- Downhole Flow Control Tools
- Completion Tools Accessories
- Multi-stage Frac System

Packer

Certified with API 11D1, V0



Permanent Packer



Retrievable Packer



ESP Packer



Mechanical Packer

Type:

- Permanent series Packer
- Retrievable series Packer
- ESP series Packer
- Mechanical series Packer

Engineering Data:

- WoWorking Pressure: 3,000 - 15,000psi
- Working Temperature: 400°F
- Casing Size: 4-1/2” - 10-3/4”

Safety Valve

Certified with API 14A



S Type



N Type



W Type



WLRSV

Type:

- Tubing Retrievable Safety Valve
- Wireline Retrievable Safety Valve

Engineering Data:

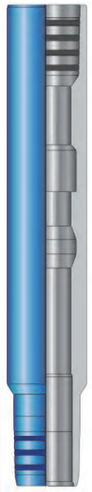
- Working Pressure: 5,000 - 20,000psi
- Working Temperature: 752°F
- Tubing Size: 2-3/8” - 7”
- Pass API test by authorized facility (SWRI)

Flow Control Tools

Certified with API 14L



SSD



Landing Nipple



Lock Mandrel



Equalizing Prong

Completion Tools Accessories

Certified with API 19AC



Travel Joint



Chemical Injection Valve



Cable Pack-Off



Anchor Seal



Ball Seat

Multi-Fracturing Tools System



ABV Hanger Packer



IPP Open hole Packer



Packer Setting Tools



HPP Open hole Packer



Anchor Seal



HFS Fracturing SSD

HRM Hydraulic Set Permanent Packer

The HRM Packer is designed for applications where one trip completion and frac is required. The packer is a hydraulic set, single trip, permanent, millable packer with a smaller OD that is used for a restrict ID casing or a small size frac string. The packer top connection can come with tubing thread or latch thread. Bottom sub can be threaded for a mill-out extension or for the customer's liner. The packer is designed upon proven sealing integrity, slip anchoring system, and utilizes an integral one-piece mandrel. The packer is designed with premium seal for harsh down hole environments such as high H2S and HTHP.

Features and Benefit

- Field proven reliable design
- Minimized potential leak paths
- Simple to operate
- Large ID
- Designed for high tensile loads
- Metal to metal premium thread connection, or seal anchor assembly
- Single piece mandrel and seal bore
- Up to 15,000 psi

Applications

- Highly deviated and horizontal wells
- Single trip production and injection wells
- Frac and stimulation
- High pressure and high temperature wells
- Extreme completion environments



Technical Data

Casing Size		Casing Weight		Packer OD		Packer ID		Sealbore ID	
in.	mm	lb/ft	kg/m	in.	mm	in.	mm	in.	mm
5	127.00	15-21	22.32-31.25	3.96	100.58	1.91	48.51	3.12	79.25
5 1/2	139.70	14-20	20.83-29.76	4.54	115.32	2.36	59.94	3.50	88.90
		23-26	34.22-38.69	4.36	110.74	2.36	59.94	3.50	88.90
6 5/8	168.28	17-32	25.30-47.62	5.47	138.89	3.17	80.52	4.25	107.95
		17-20	25.30-29.76	5.88	149.23	3.88	98.43	5.00	127.00
7	177.80	17-23	25.30-34.22	6.8	156.97	3.17	80.52	4.25	107.95
		17-20	25.30-29.76	6.25	158.75	3.88	98.43	5.00	127.00
		20-32	29.76-47.62	5.88	149.25	3.88	98.55	5.00	127.00
		32-38	47.62-52.09	5.55	140.97	3.02	76.71	4.25	107.95
		32-44	47.62-65.48	5.47	138.89	3.02	76.71	4.25	107.95
7 5/8	193.68	26.4-39	39.29-59.04	6.38	161.95	3.88	98.55	5.00	127.00
		33.7-45.3	50.15-67.41	6.17	156.72	3.88	98.55	5.00	127.00
		33.7-47.3	50.15-70.39	6.18	156.97	3.17	80.52	4.25	107.95
9 5/8	244.48	36-59.4	53.57-88.40	8.13	206.40	4.85	123.19	6.50	165.10
		40-47	59.53-69.94	8.42	213.87	6.00	152.40	7.00	177.80
		53.50	79.62	8.31	211.07	6.02	152.98	7.25	184.15
10 3/4	273.05	55.5-60.7	82.59-90.33	9.28	235.71	6.00	152.40	7.00	177.80
		60.7-65.7	90.33-97.77	9.28	235.71	6.00	152.40	7.00	177.80

- Other ID available depending upon tubing size selected.
- Other sizes available upon request.

RHA Hydraulic-Set Retrievable Packer

The RHA packer is a hydraulic-set retrievable single-string packer which is design for high pres- sure, large ID or TCP applications. The packer allows multiple bores or control line feed –through.

Except straight-shear release features, the RHA packer can be set to cut to release which is used for high pressure or heavy tailpipe. The barrel slip distributes more of the packer load to casing.

Features and Benefit

- Field proven reliability
- Production and Injection application
- Large ID
- Single piece mandrel
- No mandrel movement for multi zone stacked packer application
- Multiple bores or control line feed–through
- Straight pull to release or cut to release
- Used in high pressure, large ID or TCP well condition
- Field adjustable the setting pressure and shear release
- Upper tubing connection or Latch head



Applications

- Single or multi-packer production completions
- Production and injection wells
- TCP application

Technical Data

Casing Size		Casing Weight		Packer OD		Packer ID	
in.	mm	lb/ft	kg/m	in.	mm	in.	mm
5 1/2	139.70	13-17	19.34-25.30	4.71	119.63	2.89	73.41
		20-23	29.76-34.22	4.47	113.54	2.89	73.41
7	177.80	26-29	38.69-43.16	5.95	151.13	3.92	99.57
		32-35	47.62-52.09	5.83	148.08	3.92	99.57
7 5/8	193.68	29.7-39	44.20-58.03	6.43	163.32	3.92	99.57
9 5/8	244.48	40-47	59.53-69.94	8.48	215.39	4.88	123.95
		43.5-53.5	64.74-79.60	8.29	210.57	4.88	123.95

- Other ID available depending upon tubing size selected.
- Other sizes available upon request.

ESP Hydraulic-Set Retrievable Packer

The ESP packer is designed to be run with Electric Submersible Pumps. The packer is a hydraulic-set, straight pull shear release, upper single-string, dual-bore retrievable packer.

The packer has several additional optional ports for venting of annular pressure, fluid injection through the packer, and/or instrument and wire port bypass.

The vent valve is designed to be threaded to the top of the packer. The valve is hydraulically operated and allows for gas bypass around the packer.

Features

- Hydro-test capability of feed through connection.
- A pack-off power cable feed-through system is provided with thread connections
- Additional bores for venting of annular pressure, chemical-injection lines, control lines, and well-monitoring devices through the packer
- Slip design offers exceptional hang weight capability
- Carburized bi-directional slips anchor the packer against pressure from above and below

Benefits

- Field redress is quick, easy, and cost effective
- Efficiently reduce the overall costs of submersible pump completions
- Performance is long-term and dependable
- No relative movement between tubing and cable
- Low pressure set
- Requires only straight pull to release
- Field adjusted the setting pressure and shear force
- Allows adjustment of pull-to-release in the field



Technical Data

Casing			Max.OD		Packer ID		Pressure Rating	
Size		Weight						
in.	mm	lb	in.	mm	in.	mm	psi	MPa
6 5/8	168.3	24-28	5.64	143.26	2.360	59.94	3000-5000	20.7-35
7	177.8	23-26	6.10	154.94	2.360	59.94	3000-5000	20.7-35
		26-29	5.99	152.15				
		29-32	5.94	150.88				
9 5/8	244.5	36-40	8.59	218.19	2.918	74.12	3000-5000	20.7-35
		40-47	8.50	215.90				
		47-53.5	8.26	209.80				

- Other ID available depending upon tubing size selected.
- Other sizes available upon request.

ABV Retrievable Seal Bore Packer

The ABV Packer is a retrievable, single-bore packer that has the completion features of a large-bore packer. The packer delivers high performance with simplicity of design and desirable economics. It is a 10,000 PSI plus rated packer and can be equipped to withstand severe corrosion and high temperatures.

The packer is designed to be used in Frac or gravel pack service, or suspend tools, or provide a pressure isolation point in the casing, which can be set by using hydraulic setting tool, and be pulled by running and latching the retrieving tool then applying a straight upward pull if needed.

Features and Benefit

- Field proven reliability
- Simple to operate
- Cost Effective
- Provides an upper connector for attachment to seal unit locators
- Full seal bore ID through the packer
- Designed for high tensile loads
- Wireline and Hydraulic setting tools set
- Protected from pre-setting when run in hole
- Tubing rotation available when run in hole
- Retrievable
- Able to be milled out if retrieval attempts fail
- Standard 10,000 psi



Applications

- Sand control
- Horizontal completion assemblies
- Hanger packer in frac and stimulation jobs
- Production and Injection sealbore packer
- Retrieval required

Technical Data

Casing Size		Casing Weight		Packer OD		Packer Bore	
in.	mm	lb/ft	kg/m	in.	mm	in.	mm
4 1/2	114.30	9.5-11.6	14.14-17.26	3.82	97.03	2.38	60.45
5	127.00	15-18	22.32-26.79	4.09	103.89	2.55	64.77
5 1/2	139.70	17-20	25.30-29.76	4.61	117.09	2.75	69.85
		23-26	34.22-38.69	4.36	110.74		
6 5/8	168.28	28	41.66	5.53	140.46	3.25	82.55
		20-24	29.76-35.71	5.73	145.54		
7	177.80	49.5-50.1	73.66-74.56	5.30	134.62	3.00	76.20
		41-44	61.01-65.47	5.53	140.46	3.25	82.55
		32-38	47.62-56.54	5.73	145.54		
		23-29	34.22-43.15	6.00	152.40		
		17-23	25.30-24.22	6.19	157.23		
		32-35	47.62-52.09	5.82	147.83	3.88	98.55
		23-29	34.22-43.15	6.00	152.40		
		17-23	25.30-34.22	6.19	157.23		
7 5/8	193.7	42.4-47.1	35.72-70.79	6.19	157.23	3.25	82.55
		29.7-39	44.19-58.03	6.44	163.58	3.88	98.55
		24-29.7	35.71-44.19	6.68	169.67		
7 3/4	196.85	46.1-48.6	68.6-72.32	6.19	157.23	3.25	82.55
						3.88	98.55
8 5/8	219.08	28-36	41.67-53.57	7.63	193.80	3.88	98.55
9 5/8	244.48	43.5-53.5	64.73-79.62	8.30	210.83	3.88	98.55
		36-43.5	53.57-64.73	8.52	216.41	5.00	127.00
		43.5-47	64.74-69.94	8.45	214.63	6.00	152.40
10 3/4	273.05	51-65.7	75.90-97.77	9.31	236.47	5.00	127.00
13 3/8	339.73	68-72	101.18-107.14	12.13	308.10	6.00	152.40

HHP Hydraulics Set Retrievable Packer

HHP packer is a hydraulic set retrievable packer used in HTHP wells. It combines the pressure and temperature ratings and reliability of a permanent packer with the convenience of a retrievable packer. The HHP retrievable packer is designed using unique design features that result in a retrievable packer suitable for use at differential pressures up to 15,000 psi at temperatures up to 400°F.

The barrel slip uniformly provides the minimum damage to the casing. The packer provides reliably seals the high pressures and can be retrieved by retrieving tool.

Features and Benefit

- Barrel slip
- Minimum casing deformation or damage is desired
- No-mandrel movement operation
- Hydraulic Set
- Retrievable
- Differential Pressure up to 15,000psi
- Working Temperature up to 400°F

Applications

- HTHP Wells
- Highly deviated and horizontal wells



Technical Data

Casing Size		Casing Weight		Packer OD		Packer ID	
in.	mm	lb/ft	kg/m	in.	mm	in.	mm
7	177.80	26-32	38.69-47.62	5.92	150.36	3.80	96.52
		29-32	43.16-47.62	5.92	150.36	3.72	94.48
		29-32	43.16-47.62	5.92	150.36	3.88	98.55
		32-35	47.62-52.08	5.82	147.82	3.72	94.48
		35-38	52.08-56.54	5.730	145.54	2.75	69.85
7 5/8	193.68	39	58.03	6.405	162.69	2.972	75.49
		47.1	70.08	6.125	155.57	3.32	84.32
8 5/8	219.08	55.83	83.08	7.125	180.97	4.60	116.84
		57.4	85.41	7.125	180.97	3.32	84.32
		61.4	91.36	6.935	176.14	3.32	84.32
9 5/8	244.48	47-53.5	69.94-79.62	8.35	212.09	5.06	128.52
						5.80	147.32
9 7/8	250.83	62.8-66.4	62.8-66.4	8.25	209.55	4.465	113.41
10 3/4	273.05	97.1-99.5	97.1-99.5	8.64	219.46	4.65	118.11

- Other ID available depending upon tubing size selected.
- Other sizes available upon request.

S Tubing Retrievable Safety Valve

The S type tubing retrievable safety valve is a single rod-piston non-elastomer flapper valve designed for where ultimate reliability is required. The piston achieves a metal-to-metal seal at its uppermost and lowermost positions to seal well pressure from the control system. The spherical radius flapper design provides full metal-to-metal sealing integrity.

Features and Benefit

- Non-elastomer dynamic piston seals
- Metal-to-metal static seal at upper and lower piston positions
- Clean-out ports in flow tube's upper end
- Flow tube shock absorber
- Positive debris barrier at both ends of flow tube in full-open position
- Metal-to-metal face seat at flow tube downstop

Applications

- Gas Well
- HTHP Well
- Deep Set Application
- Hostile Environments



Technical Data

Tubing Size		Max.OD		Internal Packing Bore		Pressure Rating	
in.	mm	in.	mm	in.	mm	psi	MPa
2 3/8**	60.33	3.62-3.97	92-102	1.875	48	5,000-10,000	35-70
2 7/8**	73.03	5.41-5.49	137-139	2.313	59	7,500-20,000	50-140
3 ½**	88.9	5.03-5.86	128-149	2.313-2.813	59-71	5,000-20,000	35-140
4 ½**	114.3	7.35-7.57	187-190	3.25-3.813	83-97	5,000-15,000	35-105
5 ½**	139.7	7.69-8.38	195-192	4.437-4.750	113-121	5,000-12,500	35-85
6 5/8	168.3	8.75	222	4.875	124	11,500	80
7**	177.8	8.90-9.60	226-244	5.750-6.000	146-152	5,000-7,500	35-50
		8.38-8.52	213-216	5.750-5.875	146-149	5,000-6,000	35-41
9 5/8	244.5	11.75-12.02	299-305	8.375-8.500	213-216	5,000	35

- Other profile and size available upon request

** Depend upon material and pressure rating

N Tubing Retrievable Safety Valve

The N Type tubing retrievable safety valve is a single rod piston non elastomer flapper valve. The valve includes the non-elastomer hydraulic actuator along with metal-to-metal body joints and closure mechanism.

Features and Benefit

- Non-elastomer dynamic piston seals
- 100% metal-to-metal flapper
- Clean-out ports in flow tube's upper end
- Metal-to-metal face seat at flow tube downstop

Applications

- Gas Well
- HTHP Well
- Deep-set Application



Technical Data

Tubing Size		Max.OD		Internal Packing Bore		Pressure Rating	
in.	mm	in.	mm	in.	mm	psi	MPa
2 3/8	60.33	3.63	92	1.875	48	5,000	35
		3.70	94			5,000	35
		3.97	101			10,000	70
2 7/8	73.03	4.56	116	2.125-2.313	54-59	5,000	35
		4.65	118			5,000	35
		4.91	125			10,000	70
3 1/2	88.9	5.03	128	2.562-2.813	70-71	5,000	35
		5.20	132			5,000	35
		5.38	137			10,000	70
		5.62	143			15,000	105
4 1/2	114.30	5.965	151	3.750-3.813	95-97	7,500	50
		6.62	168			10,000	70
		6.73	171			15,000	105
		6.97	177			20,000	140

- Other profile and size available upon request.

W Tubing Retrievable Safety Valve

The W Tubing-Retrievable Safety Valve (TRSV) is used in general production completion to shut in a well at a point below the surface. The valve contains a piston, opposed by a compression spring and the well pressure, which operates a flapper mechanism. When pressure is released from the piston chamber, the spring moves the piston up and the torsion spring rotates the flapper to the “closed” position. The simple, compact design enhances the valve’s overall reliability while featuring an economical price.

Features and Benefit

- Simple, compact design
- Complete metal-to-metal well containment in the closed position (body/seat connections and flapper)
- Hydraulic chamber construction isolates the majority of the internal valve components and exposes them to clean hydraulic fluid
- Positive debris barrier at both ends of flow tube in full-open position

Applications

- General production completions



Technical Data

Tubing Size		Max.OD		Internal Packing Bore		Pressure Rating	
in.	mm	in.	mm	in.	mm	psi	MPa
2 3/8	60.33	3.63	92	1.875	48	5,000	35
		3.70	94			5,000	35
		3.97	101			10,000	70
2 7/8	73.03	4.56	116	2.125-2.313**	54-59	5,000	35
		4.65	118			5,000	35
		4.74	120			10,000	70
		4.91	125			10,000	70
3 1/2	88.9	5.03	128	2.562-2.813**	65-71	5,000	35
		5.20	132			5,000	35
		5.37	136			10,000	70
		5.62	143			10,000	70
4 1/2	114.30	6.62	168	3.750-3.813**	95-97	5,000	35
		6.73	171			5,000	35
		6.97	177			7,500	50

- Other profile and size available upon request

** Depend upon material and pressure rating

Wireline Retrievable Safety Valve

The wire retrievable safety valve (WRSV) has the same function as the tubing safety valve - shut-in in an emergency. Install in a pre-run special landing nipple or tubing-retrievable safety valve with a lockout function. Compared with the traditional safety valve, the WRSV only need cooperate the slickline equipment to retrieving and re-running. Regular maintenance or emergency replacement of downhole control systems can be performed when the rig is not available, or surface equipment is limited.

Features and Benefit

- Need to be used with special landing nipple or with the lockout function of the safety valve
- Same pressure rating as the tubing retrievable safety valve
- Complete metal-to-metal well containment in the closed position (body/seat connections and flapper)
- Retrieve maintenance and re-running does not require retrieving of tubing string

Applications

- General production completions with surface equipment limited



Technical Data

Tubing Size		Tubing Weight		ValveID		Nipple Seal Bore	
in.	mm	lb/ft	kg/m	in.	mm	in.	mm
2 3/8	60.3	4.6	6.85	0.75	19.05	1.875	47.63
		4.7	6.99	0.75	19.05		
2 7/8	73.0	6.4	9.52	1.13	28.58	2.312	58.72
		6.5	9.67	1.13	28.58		
3 1/2	88.9	9.2	13.69	1.52	38.61	2.812	71.42
		10.3	15.33	1.52	38.61	2.750	69.85
4	101.6	10.9	16.22	1.75	44.45	3.312	84.12
		11	16.37	1.75	44.45		
4 1/2	114.3	12.6	18.75	2.12	53.85	3.812	96.82
		12.75	18.97	2.12	53.85		
		15.2	22.62	1.89	48.00	3.688	93.68
5 1/2	139.7	17	25.30	2.56	65.02	4.562	115.87
		23	34.23	2.25	57.15	4.437	112.70
7	177.8	35	52.09	3.38	85.85	5.875	149.22

- Other profile and size available upon request

Our Portfolio

Dissolvable Solutions

ThunderCloud™ Dissolvable Frac Plugs

The Interventionless Solution

- Increased Efficiency
- Controlled Dissolution
- Faster time to Production





WHY ThunderCloud™?

Experience

We have been a pioneer in the plug-and-perf technique for decades, and lead the industry with the most reliable completion systems available because of our field experience in the challenging China shale plays.

Technology

Our First Dissolvable Plug was introduced to the market in 2017 after rigorous in-house testing and extensive trial runs in the field. We now offer complete series of Thunder-Cloud™ dissolvable frac plug for your applications.

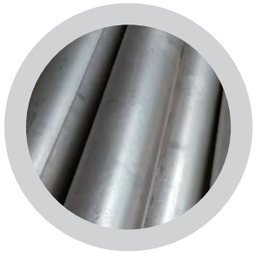
Reliability

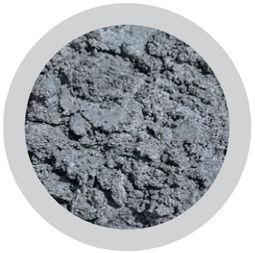
ThunderCloud™ has been deployed successfully in thousands of plug-and- perf operations. ThunderCloud™ has successfully held pressure during fracking, dissolved at predictable rates, and eliminates the cost, time, risks, and limitations of milling out composite plugs.



Dissolvable Alloy

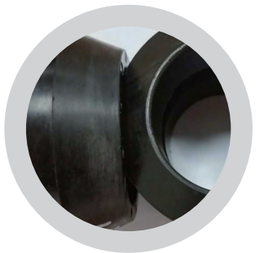
- Environmental friendly
- Dissolution time is controllable by adjusting formula
- Dissolution time direct ratio with concentration of CL^- and Temperature
- Tensile strength meet HTHP requirements
- Dissolve into powder that is easily flowed back

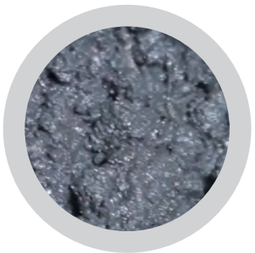




Dissolvable Elastomer

- Dissolves based upon temperature in clean water
- Dissolution time is in a direct ratio with temperature, not CL^- content
- First breaks up into small pieces; eventually degrades into a fine powder





ThunderCloud™ Selection Criteria

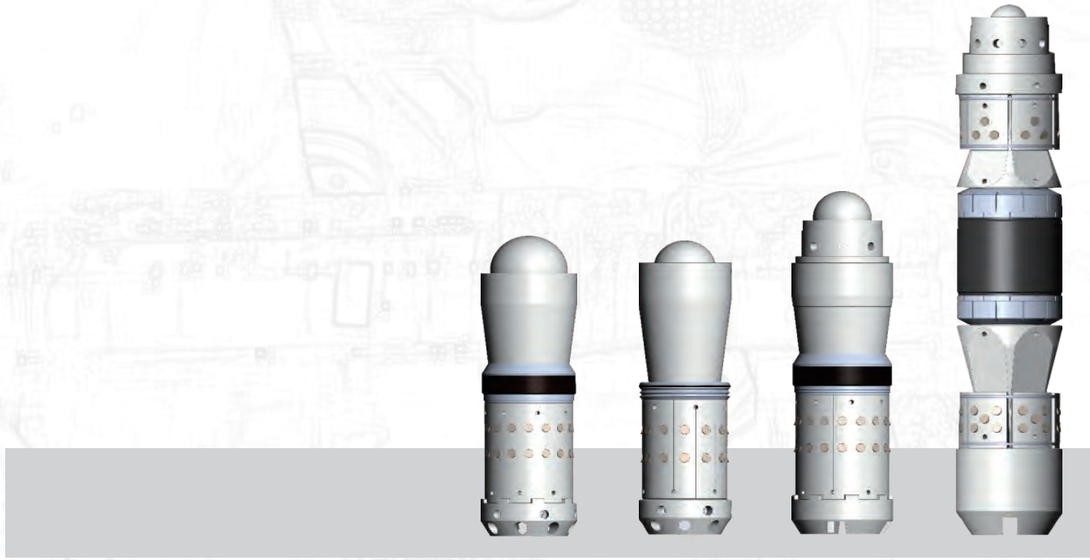
Formation and well data
Downhole temperature, Casing Specifications, Formation Pressure

Operation
Fracking pressure, Volume, Operational Procedures, Shut-in time, Flow back time

Fluids
Formation fluids, Fracking fluids

Customized Solutions

- Customized Size for non-standard casing
- Customized Material for all applications
- Optional Coating – prevents early dissolution for Zipper Frac or in acidizing application



Wide Range of Applications

- Rated to 10,000 psi at temperatures ranging from 70°F to 350°F
- Field proven for reliable performance and demanding frac stimulation



Compatibility

- Compatible with standard setting tools
- Easy Assembly and quick connection

Compact Design

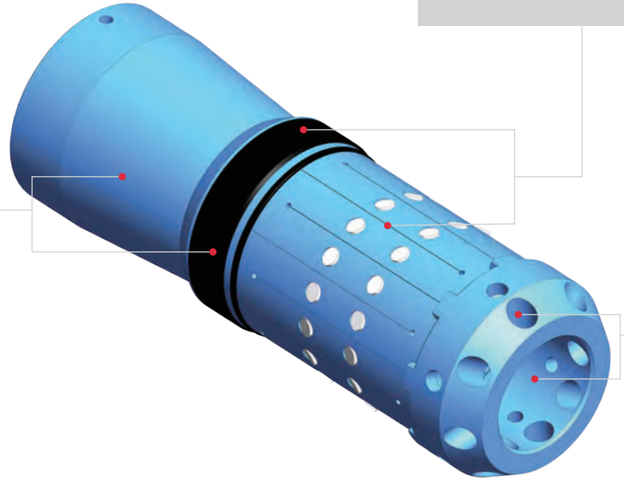
- Effective plug placement without the need for ID profiling
- Less material for faster dissolution which minimizes the time needed for wellbore cleanout
- Simple Design lowers costs and operational risks

Anti-Preset

Integrated Anti-Preset features minimize the risk of premature setting and allow for quicker tripping times and higher pump rates.

Large Reacting Area

Larger external and internal contact area to reacting fluids for consistent and fast dissolution.



Advanced Material

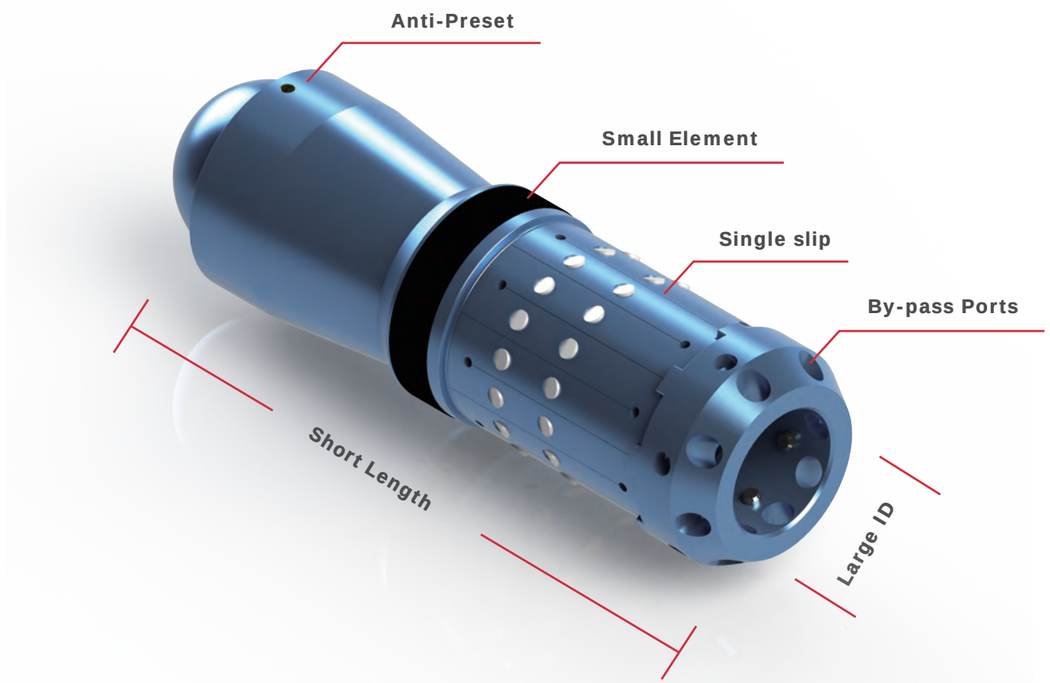
- Constructed of the most advanced dissolving Alloy and Elastomer degrades completely and predictably.
- Available in various material formulas offers solutions for any challenging downhole conditions.

Engineering Design

Large Bore ID and By-pass ports promotes immediate flowback and higher production prior to full dissolution

ThunderCloud™

Single Slip



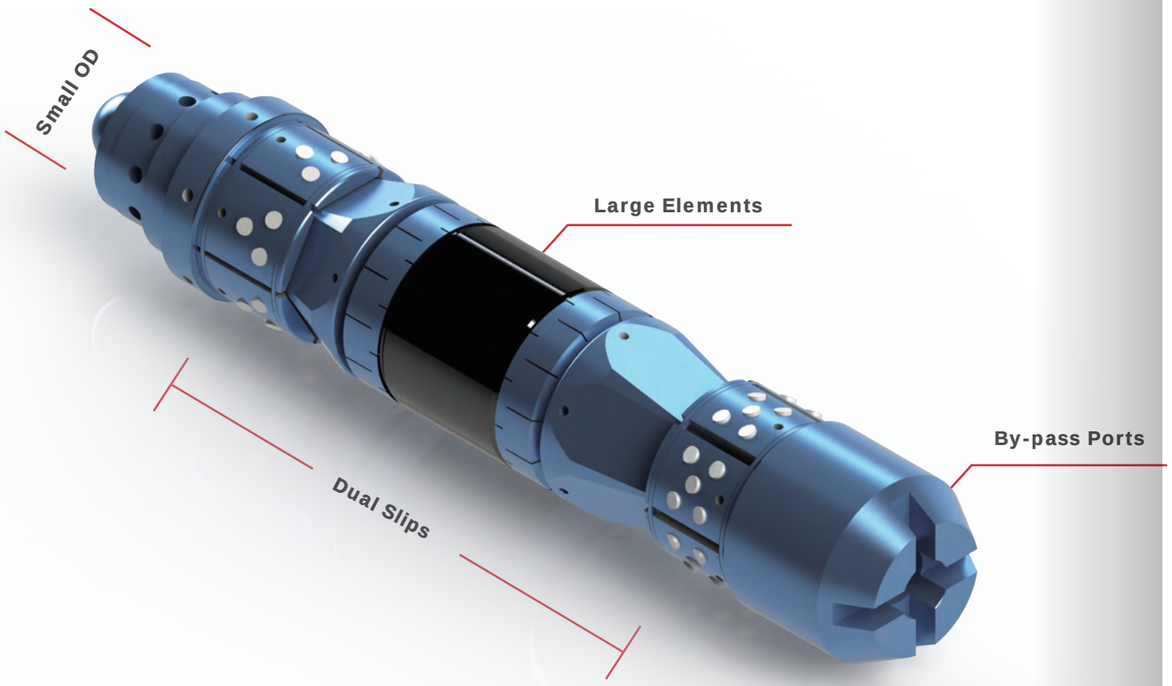
WP	Temp Rating	Formation Temp	Dissolution time (Vary by Temp and CL^-)
10,000psi	H	194-248°F	2-5 days
	M	140-194°F	2-5 days
	L	77-140°F	3-7 days

CASING			ThunderCloud™			
CASING SIZE	WEIGHT	ID	MAX OD	MIN ID	LENGTH	BALL
in. (mm)	Lb/ft	in. (mm)	in. (mm)	in. (mm)	in. (mm)	in. (mm)
5.5 (139.7)	17-20	4.778-4.892 (121.36-124.26)	4.409 (112)	2.48 (63)	13 (330)	3.5 (88.9)
	20-23	4.670-4.778 (118.62-121.36)	4.331 (110)	2.48 (63)	13 (330)	
	23-26.8	4.500-4.670 (114.3-118.62)	4.134 (105)	1.811 (46)	13 (330)	2.5 (63.5)
			3.898 (99)	1.378 (35)	15.51 (394)	
5 (127)	21.4	4.126 (104.8)	3.752 (95.3)	1.811 (46)	12.48 (317)	
4.5 (114.3)	11.6	4 (101.6)	3.752 (95.3)	1.811 (46)	12.48 (317)	
	13.5-15.1	3.826-3.920 (97.18-99.56)	3.583 (91)	1.811 (46)	12.36 (314)	
3.5 (88.9)	9.2-10.2	2.922-2.992 (74.22-76)	2.64 (67)	0.945 (24)	12.31 (312.75)	1.75 (44.5)

ThunderCloud™

Dual Slips

(Compatible with Ball-in-Place running)



WP	Temp Rating	Formation Temp	Dissolution time (Vary by Temp and CL^-)	Features
10,000psi	Ultra H	248-338°F	3-5 days	• Dual slips design and large element ensure setting and seal capability • Greater temperature rating(77°F-338°F) • Smaller OD allows to be run in deformed casing • Ball-in-place design.Pumping down ball procedure is saved • Design allows the ball to either be dropped or run in place
	H	194-248°F	4-6 days	
	M	140-194°F	4-6 days	
	L	77-140°F	5-8 days	

CASING			ThunderCloud™			
CASING SIZE	WEIGHT	ID	MAX OD	MIN ID	LENGTH	BALL
in. (mm)	Lb/ft	in. (mm)	in. (mm)	in. (mm)	in. (mm)	in. (mm)
5.5 (139.7)	17-20	4.778-4.892 (121.36-124.26)	4.45 (113)	1.378 (35)	23.62 (600)	1.75 (44.45)
	20-23	4.670-4.778 (118.62-121.36)	4.33 (110)	1.378 (35)	23.62 (600)	
	20-23	4.670-4.778 (118.62-121.36)	4.134 (105)	1.181(30)	20.86(530)	
	23-26.8	4.5-4.670 (114.3-118.62)	4.055 (103)	1.378 (35)	22.32 (567)	
	23-29.7	4.376-4.670 (111.2-118.62)	3.897 (99)	1.181 (30)	22.32 (567)	
	26.8-29.7	4.376-4.5 (111.2-114.3)	3.74 (95)	1.181 (30)	22.32 (567)	
5 (127)	21.4	4.126 (104.8)	3.675 (93.35)	1.181 (30)	21.97 (558)	
5 (127)	21.4-24.1	4-4.126 (101.6-104.8)	3.543 (90)	1.181 (30)	20.86 (530)	
4.5 (114.3)	11.6-13.5	3.92-4 (99.57-101.6)				
4.5 (114.3)	11.6-13.5	3.92-4 (99.57-101.6)	3.675 (93.35)	1.181 (30)	21.97 (558)	
	13.5-15.1	3.826-3.920 (97.18-99.57)	3.6 (91.44)	1.181 (30)	21.97 (558)	
	13.5-15.1	3.826-3.920 (97.18-99.57)	3.5 (89)	1.181 (30)	22.22 (564.5)	
3.5 (88.9)	9.2-10.2	2.992-2.922 (76-74.22)	2.66 (67.56)	0.95 (24.13)	17.20 (437)	1.25 (31.75)

ThunderCloud™

Metal Seal

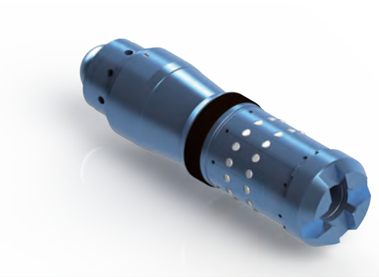


WP	Temp Rating	Formation Temp	Dissolution time (Vary by Temp and CL^-)	Features
10,000psi	H	194-248°F	2-5 days	• Metal to Metal seal • 50%-80% larger ID than conventional • Compact design with anti-preset feature • Shorter length for running in deformed casing • Small in size for quicker dissolution • Temperature rating(77°F-248°F)
	M	140-194°F	2-5 days	
	L	77-140°F	3-7 days	

CASING			ThunderCloud™			
CASING SIZE	WEIGHT	ID	MAX OD	MIN ID	LENGTH	BALL
in. (mm)	Lb/ft	in. (mm)	in. (mm)	in. (mm)	in. (mm)	in. (mm)
5.5 (139.7)	17-20	4.778-4.892 (121.36-124.26)	4.410 (112)	58	260	3.5 (88.9)
	20-23	4.670-4.778 (118.62-121.36)	4.331 (110)	58	260	
	26.8-29.7	4.500-4.670 (114.3-118.62)	4.134 (105)	40	260	2.5 (63.5)
5 (127)	18	4.276 (108.6)	4.028 (102.3)	40	260	
	21.4	4.126 (104.8)	3.937 (100)	40	260	
4.5 (114.3)	11.6	4 (101.6)	3.752 (95.3)	40	250	
	13.5-15.1	3.8263.920 (97.18-99.56)	3.583 (91)	46	250	

ThunderCloud™

Ball-in-Place



WP	Temp Rating	Formation Temp	Dissolution time (Vary by Temp and CL^-)	Features
10,000psi	H	194-248°F	2-5 days	• 50%-80% larger ID comparing to conventional • 90% less elements comparing to conventional • Compact design with anti-preset feature • Shorter length for running in deformed casing • Small in size for quicker dissolution
	M	140-194°F	2-5 days	
	L	77-140°F	3-7 days	

CASING			ThunderCloud™		
CASING SIZE	WEIGHT	ID	MAX OD	MIN ID	LENGTH
in. (mm)	Lb/ft	in. (mm)	in. (mm)	in. (mm)	in. (mm)
5.5 (139.7)	17-20	4.778-4.892 (121.36-124.26)	4.409 (112)	1.75 (44.45)	15.15 (385)
	20-23	4.670-4.778 (118.62-121.36)	4.331 (110)	1.75 (44.45)	14.76 (375)
	23-26.8	4.500-4.670 (114.3-118.62)	4.134 (105)	1.18 (30)	15 (381)
5 (127)	21.4	4.126 (104.8)	3.752 (95.3)	1.10 (28)	15 (381)
4.5 (114.3)	11.6	4 (101.6)	3.752 (95.3)	1.10 (28)	15 (381)
	13.5-15.1	3.826-3.920 (97.18-99.56)	3.583 (91)	1 (25.4)	15 (381)
4 (101.6)	11-11.6	3.476-3.516 (88.30-89.33)	3.188 (81)	0.905 (23)	14.29 (363)

Our Portfolio

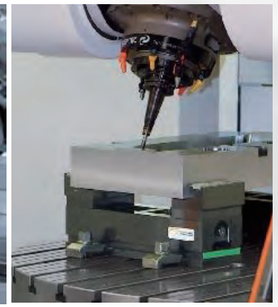
High Specification Contract Manufacturing

PKE continues to invest in innovative machining equipment and technologies. This allows us to provide cutting edge services at competitive prices. PKE's safe, clean, and comfortable work environment enables our team of extremely talented machinists to produce multifaceted precision parts, from prototypes to large volume production.

Both facilities use factory specific software, allowing us instant access to scheduling, manufacturing, and data collection from the shop floor. PKE specializes in tight tolerance work. Our services include turning, milling, EDM, gear-hobbing, welding, and electro-mechanical assembly. For customer convenience, we offer inventory stocking programs and turn-key assemblies.





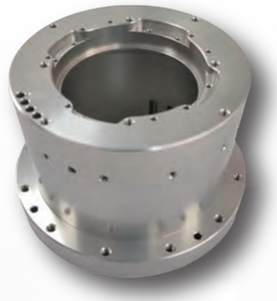


High Specification Contract Manufacturing

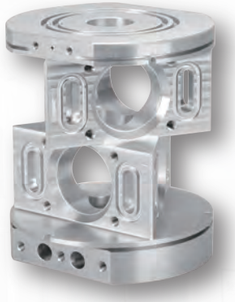
Robotic Parts

Robot shell

- Material: 7075 Aviation aluminum
- Processing equipment: Haas, CNC lathe
- Processing technology: lathe roughing: 0.5mm margin, 4-axis finishing
- Tolerance range: ±0.03
- Concentricity: 0.03 Flatness: 0.03





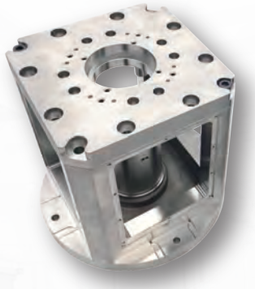


High Specification Contract Manufacturing

Aerospace Products

- Material: 7075 Aviation aluminum
- Processing equipment: Haas, CNC lathe
- Processing technology: lathe roughing to finishing, 3-axis to 4-axis finishing
- Tolerance range: ±0.05
- Concentricity: 0.03 Flatness: 0.03





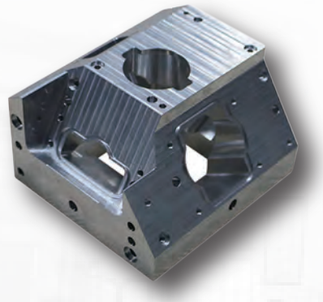


High Specification Contract Manufacturing

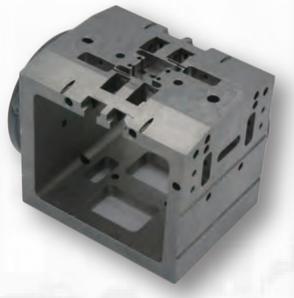
Automation Equipment

Structural Parts of Automation Equipment

- Material: 45#
- Processing equipment: Haas, FAGIMAR 5 axis
- Processing technology: three axis open rough: 0.54mm margin, 5-axis finishing
- Tolerance range: ±0.02
- Concentricity: 0.03 Flatness: 0.03 Perpendicularity: 0.02







High Specification Contract Manufacturing

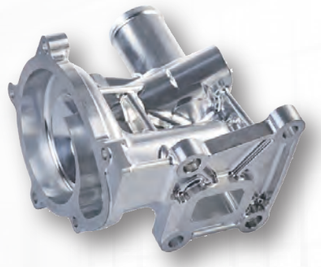
Car Parts

Air cylinder

- Material: 17-4
- Processing equipment: Hass
- Processing technology: blank margin detection, 4-axis finishing
- Tolerance range: ±0.02±0.03
- Concentricity: 0.03 Flatness: 0.03





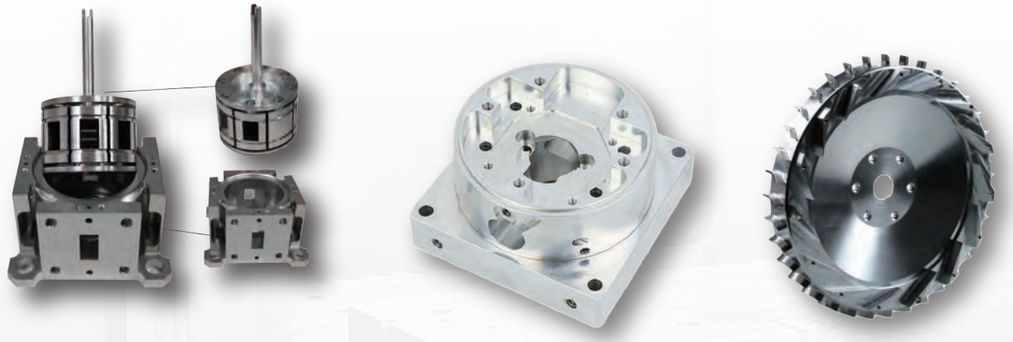


High Specification Contract Manufacturing

Precision metal processing

Stator

- Material: 7075 Aviation aluminum
- Processing equipment: Hass, CNC lathe, Grinder, Cylindrical grinding Processing
- Processing technology: roughing: 1mm margin, heat treatment, semi-finishing: margin: 0.5mm, 4-axis finishing
- Tolerance range: ±0.03
  Concentricity: 0.01 Flatness: 0.01 Perpendicularity: 0.01



High Specification Contract Manufacturing

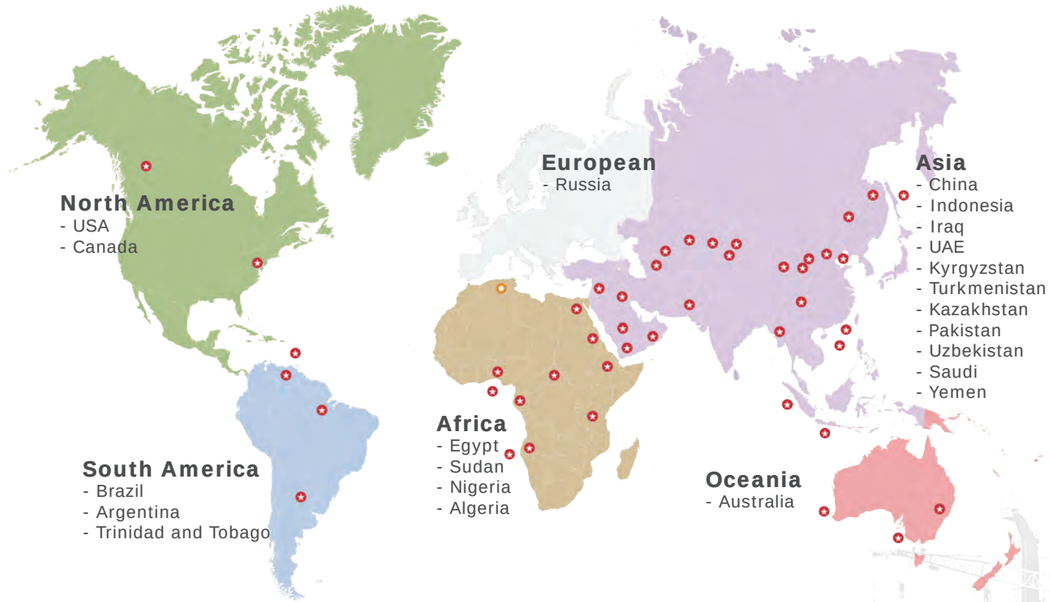
Communication Equipment

- Material: 6061
- Processing equipment: Hass
- Processing technology: roughing: margin 2mm, Neuro stress release, finish in place
- Tolerance range: ±0.03
- Concentricity: 0.03 Flatness: 0.03



Our Performance

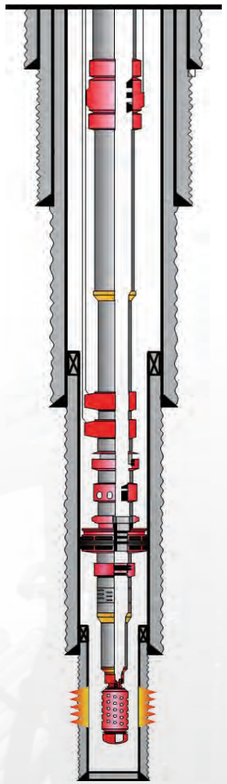
Geographic Footprint





Customers Who Trust PKE

HTHP Completion



Well Data

- Sinopec Middle East Oil Field
- Temperature: 302°F
- Depth: 13,123 Ft
- Pressure: 9,500 psi
- CO2: 2.32-5.85 mol%
- H2S: 0.84-3.24 mol%

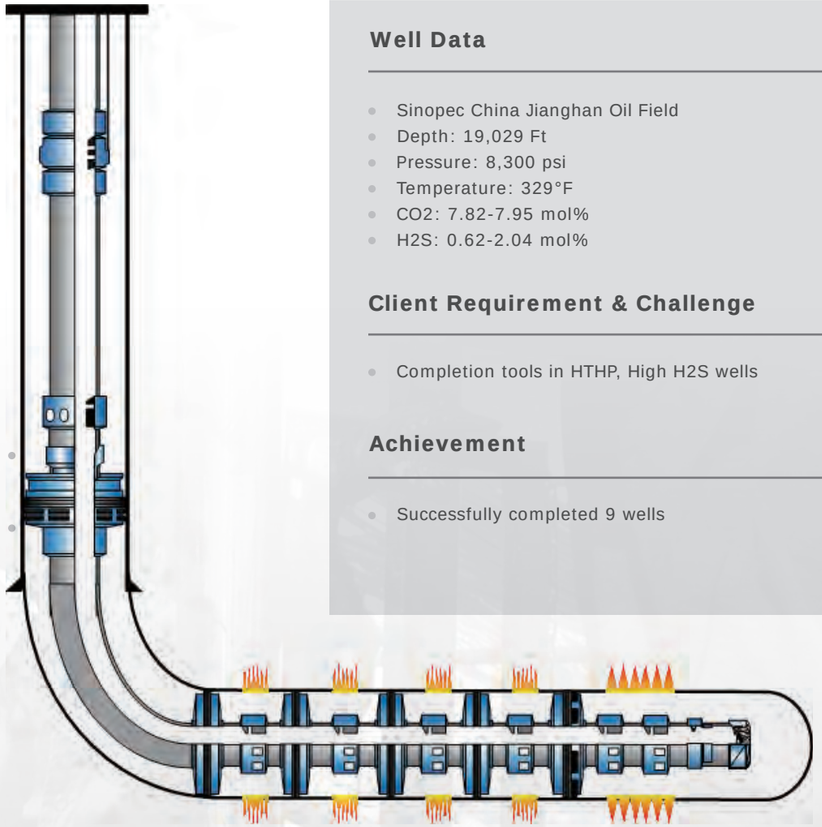
Client Requirement & Challenge

- Completion tools in a HTHP, High H2S well
- Perforation and Completion in one trip
- Wax & Asphalt may plug tubing during production
- Slickline job in HP and Asphalt condition

Achievement

- Completed 26 wells, production rate between 5000-6000 bbl/day

HTHP Completion



Well Data

- Sinopec China Jianghan Oil Field
- Depth: 19,029 Ft
- Pressure: 8,300 psi
- Temperature: 329°F
- CO2: 7.82-7.95 mol%
- H2S: 0.62-2.04 mol%

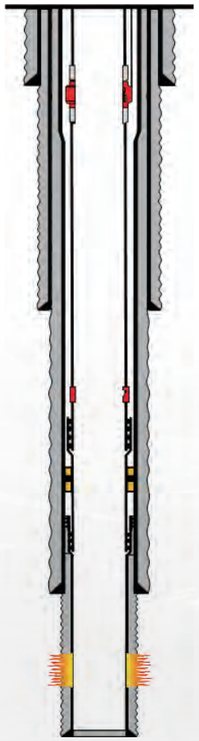
Client Requirement & Challenge

- Completion tools in HTHP, High H2S wells

Achievement

- Successfully completed 9 wells

HTHP Completion



Well Data

- The Arabian Gulf Oil Fields
- Depth: 11,155 Ft
- Production: 7”
- Pressure: 5,080 psi

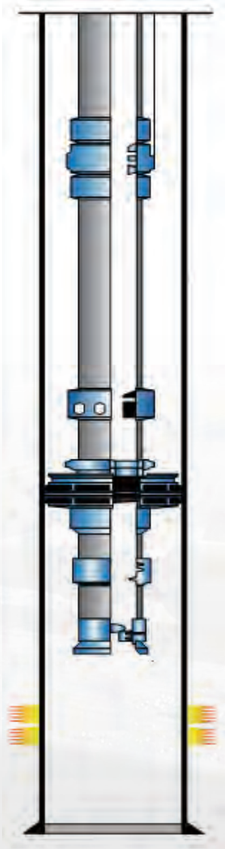
Client Requirement & Challenge

- Large completion tools (TRSV up to 7”)
- High production rate for gas (Estimate 150-200 million cubic meter per day)

Achievement

- Successfully completed 78 wells

Gas Storage Completion



Well Data

- Gas Storage Project in China
- Depth: 11,155 Ft
- Pressure: 3,500 psi
- Temperature: 275°F

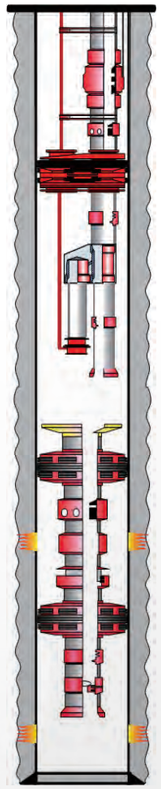
Client Requirement & Challenge

- Completion Tools Suitable for Injection Well

Achievement

- Successfully completed over 50 wells

ESP Completion



Well Data

- CNOOC Indonesia and China
- Depth: 4,921 Ft
- Pressure: 1,500 psi
- Casing Size: 7”

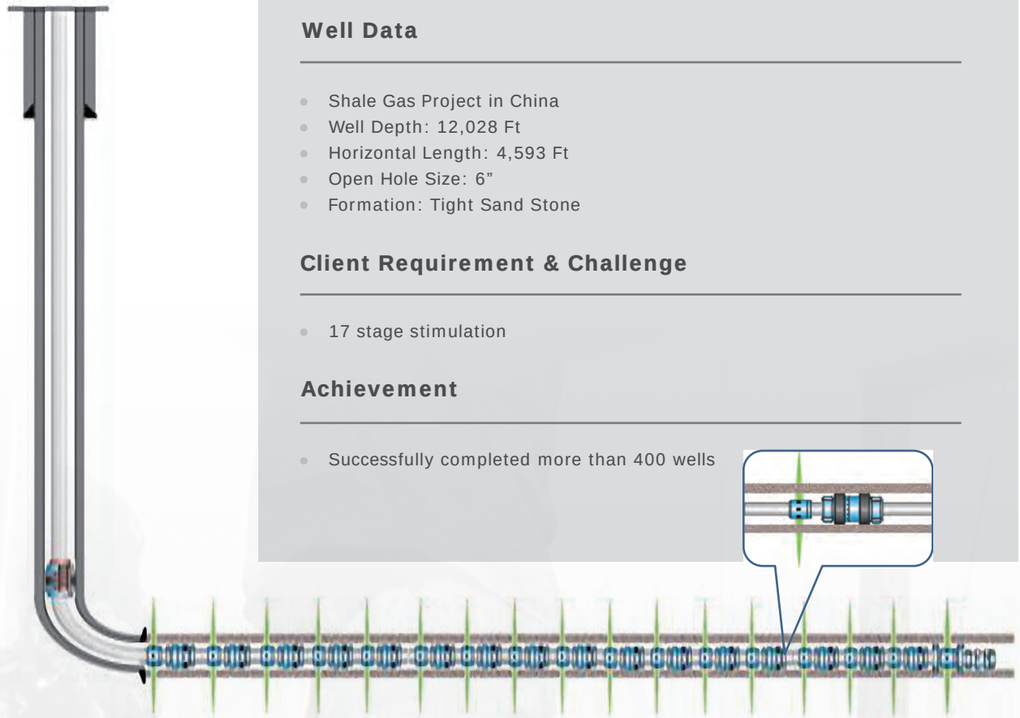
Client Requirement & Challenge

- Integrity service including installation of Completion Tools, ESP, and surface equipment to be provided by single service company
- High rate, stable ESP to be used

Achievement

- Successfully completed over 400 wells

Multi Stage Fracture Completion



Well Data

- Shale Gas Project in China
- Well Depth: 12,028 Ft
- Horizontal Length: 4,593 Ft
- Open Hole Size: 6”
- Formation: Tight Sand Stone

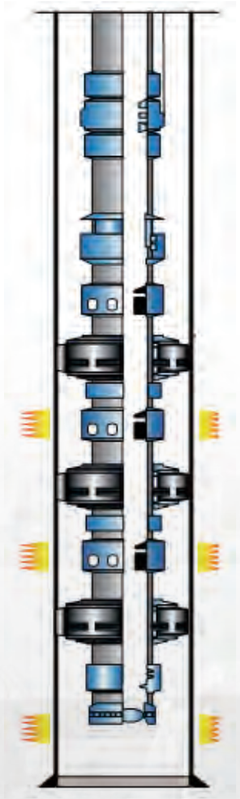
Client Requirement & Challenge

- 17 stage stimulation

Achievement

- Successfully completed more than 400 wells

Multi-stage Completion



Well Data

- IOC in Middle East
- Depth: 8,002 Ft
- Pressure: 4,080 psi

Client Requirement & Challenge

- Big Size slick line tools (4.562”)
- Slick line operation in high deviated wells: up to 62°

Achievement

- Successfully completed over 60 wells

ThunderCloud™ Achieves Great Success in 347°F Ultra-High Temperature Application

SET RECORD FOR THE HIGHEST TEMPERATURE DISSOLVABLE PLUGS APPLICATION IN CHINA
QINGHAI, NORTHWEST, CHINA

WELL PROFILE

- Oil well
- MD 16,174 Ft TVD 13,451 Ft
- 2,060 Ft Hor. Interval
- 5” 21.4# Csg.
- DHT 347°F
- Formation Fluid CL- >100,000mg/l

CHALLENGES

- 347°F Ultra-High Temperature High Pressure downhole
- 10% HCL lead acid pumped for each stage

SOLUTIONS

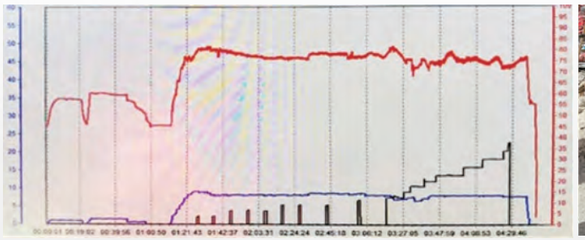
- Innovative UHT Series that work at 365°F
- Special coating to prevent premature dissolution

RESULTS

- Packer Set and Ball Seated with no issues
- Pressure held up when fracturing
- Complete dissolution confirmed by wiper trip conducted 20 days later

OPERATIONS

6 ThunderCloud™ UHT plugs were set, setting tools was released, packer set and balled seated without any issues, pressure was holding as planned and plugs dissolvable as designed. The operation went smoothly and all objectives achieved successfully. ThunderCloud™ UHT is the industry’s first DFP to withstand such ultra-high downhole temperature.



Success In Acid Fracking Application

PKE PROVIDES ZONAL ISOLATION IN ACID FRACKING APPLICATION AT CONTROLLED DISSOLUTION RATE
INNER MONGOLIA, NORTH, CHINA

WELL PROFILE

- Gas well
- MD 15,721 Ft TVD 9,878 Ft
- 4,593 Ft Hor. Interval
- 4-1/2" 11.6-13.5# Csg.
- DHT 200°F
- Formation Fluid CL- 10,000mg/l

CHALLENGES

- Acid Fracking with 20% HCL

SOLUTIONS

Lab test for the selection of correct grade of dissolving materials in acidic conditions

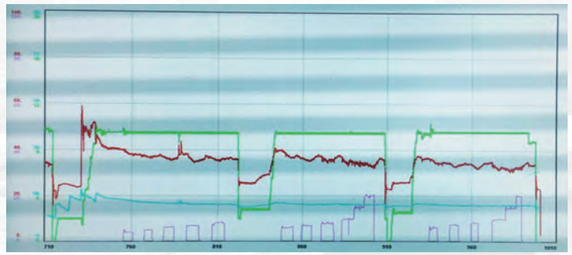
Special coating to protect plugs from acid.

RESULTS

- Plug set and ball seated with no issues
- Held pressure while fracturing All 4 plugs fully dissolved
- Drillout of 4 composite plugs in the toe section took 1-2 days. Dissovable plugs saved the cost, time, and risk of 1-2 days of drillouts

OPERATIONS

5 stages frac with 20% HCL acid. Customized design of Thunder-Cloud™ help client in the challenging acidic conditions. The operation went smoothly. The well flow back and put into production as planned.





Success In Low BHT Low Chlorine Content Application

DISSOLVABLE FRAC PLUGS FULLY DISSOLVED
IN LOW TEMPERATURE, LOW CHLORINE ION APPLICATION
TUHA, NORTHWEST, CHINA

WELL PROFILE

- Oil Well
- MD 9,442Ft TVD 5,344Ft
- 2,641 Ft Hor. Interval
- 5-1/2" 23# Csg.
- DHT 98°F
- Formation Fluid CL- ＜500mg/l

CHALLENGES

- Low BHT
- Low Chlorine Content

SOLUTIONS

- Special Dissolving materials with self-heating features
- Slim size single slip design shorten dissolution time

RESULTS

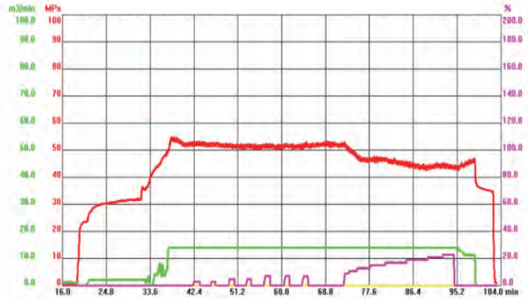
- Plug set and ball seated with no issues
- Pressure held up when fracturing Immediate flowback after frac.
- Full Dissolution confirmed by fine returns in flowback 20 days later

OPERATIONS

8 plugs were set.

Due to the large ID of the dissolvable frac plug, the customer was able to successfully flow back the wellbore and start production while the frac plugs were dissolving.

20 days later, fine returns confirmed that all 8 plugs were fully dissolved.





Fully Dissolution in High Pressure Shale Gas Application

ThunderCloud™ PROVES ITS RELIABILITY IN 31 STAGE FRAC OPERATION
CHONGQING, SOUTHWEST, CHINA

WELL PROFILE

- Shale Gas
- MD 18,608 Ft TVD 10,006 Ft
- 7,545 Ft Hor. Interval
- 5-1/2" 26.8# Csg.
- DHT 230°F
- Formation Fluid CL- 15,000mg/l
- 13,488 psi rated

CHALLENGES

- 31 stages and high pumping pressure require the most reliable dissolvable frac plugs

SOLUTIONS

- ThunderCloud™ Dual slips design that withstand higher pumping pressure recommended

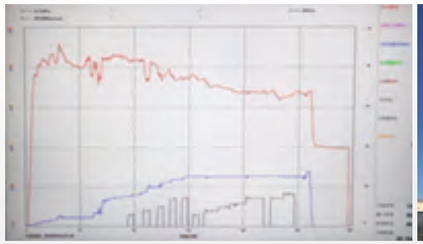
RESULTS

- Plugs Set Ball Seated with no issues
- Pressure held up when fracturing
- Complete dissolution confirmed by wiper trip conducted 14 days later

OPERATIONS

30 ThunderCloud™ plugs tripped in, set and seated smoothly with no issues.

Wiper trip conducted 14 days later verified that all plugs dissolved completely.





Two Wells vertical test in Oklahoma, USA

DISSOLVABLE FRAC PLUG SUCCESSFULLY SET AND HOLDS PRESSURE IN VERTICAL SECTION OF TWO WELLS.
ANADARKO BASIN, CANADIAN COUNTY, OKLAHOMA, USA

WELL PROFILE

- Oil well
- STACK Formation
- MD 18,686 Ft
- 39 stages
- 11,500 psi
- 2% KCL

CHALLENGES

- Other DFPs slipping or skidding

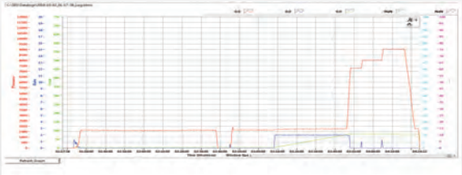
RESULTS

- Plug 1 set in Well 1
- Plug 2 set in Well 2
- Both held pressure and position
- Ball took less than 5 minutes to seat

OPERATIONS

Frac plugs were umped downhole, and set in the vertical section of each well. After setting, the ball was dropped. The ball took under 5 minutes to seat. Pressure was increased to 1,500 psi and held for ~150 minutes with no increase in water used or pressure drop. This verifies that the plug both held position without slipping and effectively isolated the zone. Pressure was incrementally increased to 9,000 psi and held for ~30 minutes. When pressure reached 7,250 psi, total barrels pumped plateaued and did not increase, verifying that the plug effectively held pressure and maintained position. After the test, the plug was easily milled out.







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