PKNM

PERM OIL MACHINE ENGINEERING COMPANY

President of PKNM
E. Mokronosov

Perm Oil Machine Engineering Company, Ltd. (PKNM, Ltd.) is one of the largest manufacturers of oil-field and drilling equipment in Russia.

PKNM plant manufactures all types of Subsurface Sucker Rod Pumps (SSRP) as per American Petroleum Institute Spec. 11 AX. Along with the API-type SSRP, Perm Oil Machine Engineering Company produces a range of the specialty sucker rod pumps designed and developed for complicated well conditions.

The other important branch of the manufactured products consists of Drill Collars, Heavy Weight Drill Pipes (HWDP), Kellys, Non-magnetic Drill Collars and Subs of any design.

PKNM conducts servicing and total SSRP overhaul repair. Besides, it conducts drill pipes servicing which includes drill pipes inspection done as per Standard DS-1 and API RP 7G-2 and drill pipes refurbishment.

Among the partners of PKNM there are the leading Russian and CIS oil-field and drilling companies as well as some foreign companies such as Schlumberger, Halliburton and Weatherford.

The products of the company are certified according to API and ISO Standards. The Quality Management System is certified in accordance with the international standards among which there are API Spec. Q1 and ISO 9001: 2008. The main products are manufactured as per API Spec. 11 AX and API Spec. 7-1. PKNM, Ltd. has a right to put the API Monogram on SSRP, Drill Collars, HWDP, Kellys and DP.

11AX-0077 7-1-0594 Q1-0463

CERTIFICATES

API

REGISTRATION NO. Q1-2567

Certificate of Registration

"PKNM-URAL", LTD.
47, ul Shosseynaya
Krasnokamsk, Perm Krai
Russian Federation

API Specification Q1

Design and Manufacture of Subsurface Sucker Rod Pumps and Pump Parts; Housings of Submersible Electric Pumps and Motors; Kellys, Drill Collars; Heavy Weight Drill Pipes, and Drill Stem Subs

No Exclusions Identified as Applicable

Effective Date: July 22, 2014
Expiration Date: May 14, 2015
Registered Since: September 24, 2007

Certificate of Authority to use the Official API Monogram

License Number: 11AX-0126

"PKNM-URAL", LTD.
47, ul Shosseynaya
Krasnokamsk, Perm Krai
Russian Federation

API Spec 11AX

11AX-0126

American Petroleum Institute

The scope of this license includes the following products: Pumps; Pump Parts

QMS Exclusions: No Exclusions Identified as Applicable

Effective Date: JULY 22, 2014
Expiration Date: MAY 14, 2015

Certificate of Authority to use the Official API Monogram

License Number: 7-1-1230

"PKNM-URAL", LTD.
47, ul Shosseynaya
Krasnokamsk, Perm Krai
Russian Federation

API Spec 7-1

7-1-1230

American Petroleum Institute

The scope of this license includes the following products: Drill Stem Subs; Drill Collars; Heavy Weight Drill Pipe

QMS Exclusions: No Exclusions Identified as Applicable

Effective Date: JULY 22, 2014
Expiration Date: MAY 14, 2015

QMS REGISTERED

Certificate of Registration

APIQR® REGISTRATION NUMBER

2711

"PKNM-URAL", LTD.
47, ul Shosseynaya
Krasnokamsk, Perm Krai
Russian Federation

ISO 9001:2008

Design and Manufacture of Subsurface Sucker Rod Pumps and Pump Parts; Housings of Submersible Electric Pumps and Motors; Kellys, Drill Collars; Heavy Weight Drill Pipes, and Drill Stem Subs

No Exclusions Identified as Applicable

Effective Date: July 22, 2014
Expiration Date: May 14, 2015
Registered Since: May 14, 2012

OUR CUSTOMERS

GAZPROM NEFT
СНГ
TATNEFT
BASHNEFT JOINT STOCK OIL COMPANY
PEMEX
BELORUSNEFT
ROSNEFT OIL COMPANY
Schlumberger
company RussNeft
БелкамНефть
Weatherford
LUKOIL OIL COMPANY

SALES GEOGRAPHY

SUBSURFACE SUCKER ROD PUMPS (SSRP)

The manufactured SSRP correspond to the API Spec. 11 AX.
The main component of SSRP is a barrel which is manufactured out of a precision pipe. The working area of the barrel is nitrided to the depth of 0.008...0.020 inches, the hardness of the nitrided coating is 870–1124 HV, or it can be chrome plated with the coating depth of 0,003 inches and the hardness of 700...900 HV.

BASIC CHARACTERISTICS OF PRECISION BARRELS

Conventional nominal ID, inch	1.06, 1.25, 1.50, 1.75, 2.25, 2.75, 3.75
Tolerance for ID, inch	0.002
Tolerance for barrel bore axis linearity per 3.3 ft base length, inch, no more	0.003
Maximum difference of internal diameter dimensions, inch	0.001
Roughness of inside surface, RA	32

All-metal plungers for SSRP, having the length from 4 to 15 ft, match the barrel in one of the five fit groups according to the API Spec. 11 AX. The plunger linearity tolerance is 0.002 inches on the length of 4 ft. The following three methods of hardening the outside plunger surface are offered: chrome plating, flame spraying with subsequent fusing and nitriding. The valves for SSRP are set in «ball-and-seat» couples made of stainless bearing steel (A1) *, cobalt alloy (B1, B2) *, tungsten carbide (C1) * and titanium carbide (C3) *; the two elements are grinded in pairs to provide leak-proofness.

*The symbols as per API Spec. 11 AX.

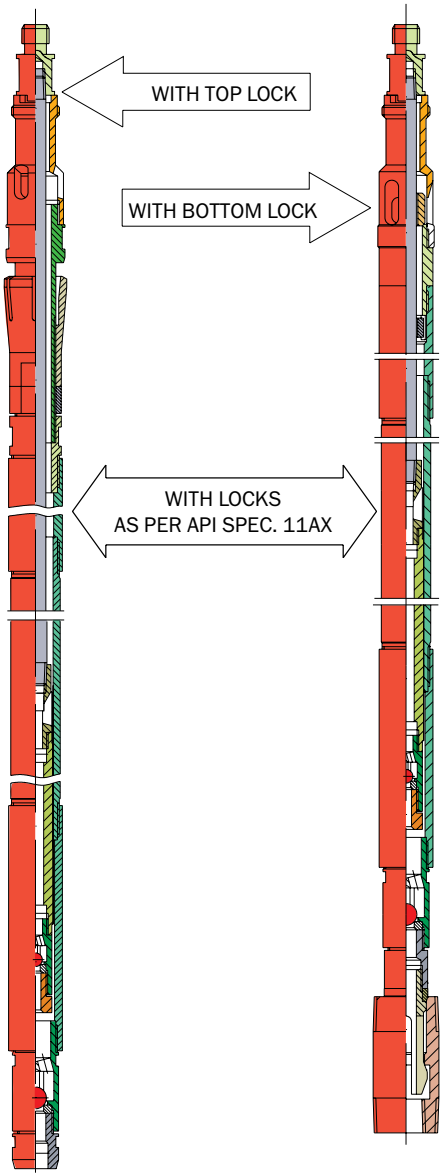
Specialty SSRP are designed for complicated well conditions (high viscosity, high GOR, sand presence) and boost the in-use reliability of SSRP.

SPECIFICATIONS OF SUBSURFACE SUCKER ROD PUMPS

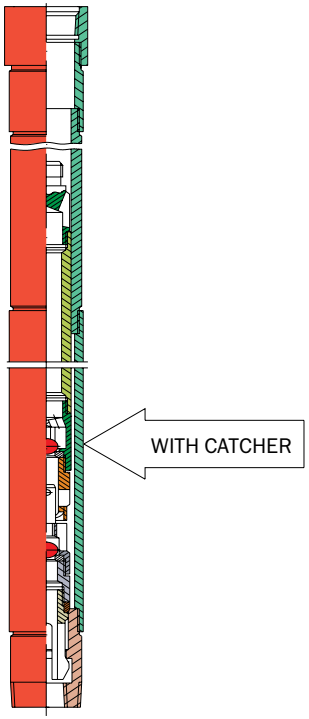
Pump type	Designation, API	Plunger stroke, ft	Head, ft	Tubing diameter, inch	Connecting thread to rods	Lock support
Insert pump with top lock	20-106 RHAM	4... 11.5 up to 13	up to 8200	2 3/8	3/4"	N14-20
	20-125 RHAM		up to 7200			
	25-150 RHAM			2 7/8		N14-25
	25-175 RHAM					
	30-225 RHAM			3 1/2	7/8"	N14-30
Insert pump with bottom lock	20-106 RHBM		up to 11500	2 3/8	3/4"	N14-20
	20-125 RHBM					
	25-150 RHBM			2 7/8		N14-25
	25-175 RHBM		up to 10000			
	30-225 RHBM		up to 8200	3 1/2	7/8"	N14-30
Tubing pump with a catcher	20-125 THM	4... 11.5 up to 13	up to 5000	2 3/8"-8EU 2 7/8"-8EU	3/4"	
	20-175 THM					
	20-225 THM					
	30-275 THM		Up to 3900	3 1/2"-8EU	7/8"	
	40-375 THM		up to 3300	4 1/8"-8EU	1"	
Tubing pump with a breakable pin*	20-125 TH		up to 5000	2 3/8"-8EU 2 7/8"-8EU	3/4"	
	20-175 TH					
	25-225 TH					
	30-275 TH		Up to 3900	3 1/2"-8EU	7/8"	
	40-375 TH		up to 3300	4 1/8"-8EU	1"	

*Specialty SSRP

INSERT PUMPS

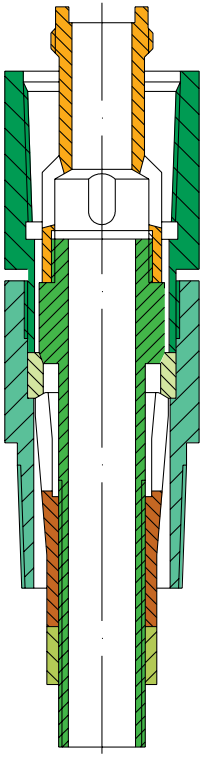


TUBING PUMPS



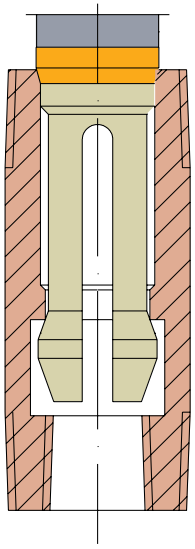
FIXATION OF ROD PUMPS IN TUBINGS

LOCK SUPPORT



FOR PUMPS WITH TOP LOCK AS PER API SPEC. 11AX, N14 TYPE

SEATING NIPPLE

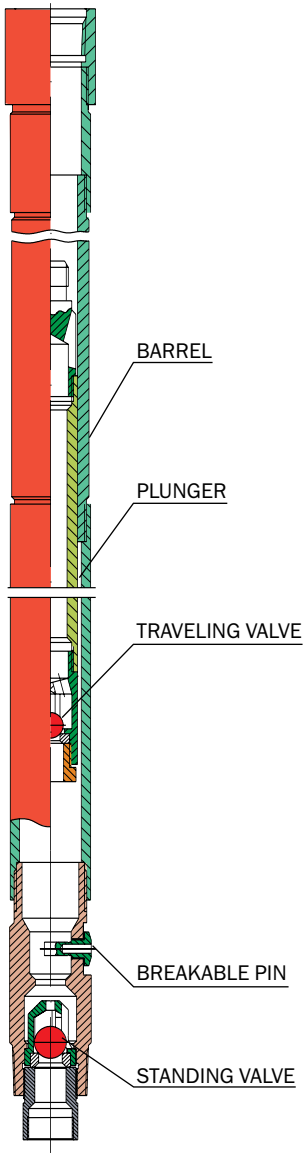


FOR PUMPS WITH BOTTOM LOCK AS PER API SPEC. 11AX

SPECIALTY SUBSURFACE SUCKER ROD PUMPS

TUBING PUMP WITH A BREAKABLE PIN

Tubing pump with a breakable pin is meant for crude production. When lifting the pump out of the well, the formation fluid draining from the tubing and the pump takes place in the hole of the breakable pin.
After lifting the plunger out of the well, a steel bar (OD – 1.5 inches; 4–5 ft length) is thrown down into the well to open the area of the breakable pin.
Thus, the breakable pin allows lifting the subsurface equipment without the formation fluid.



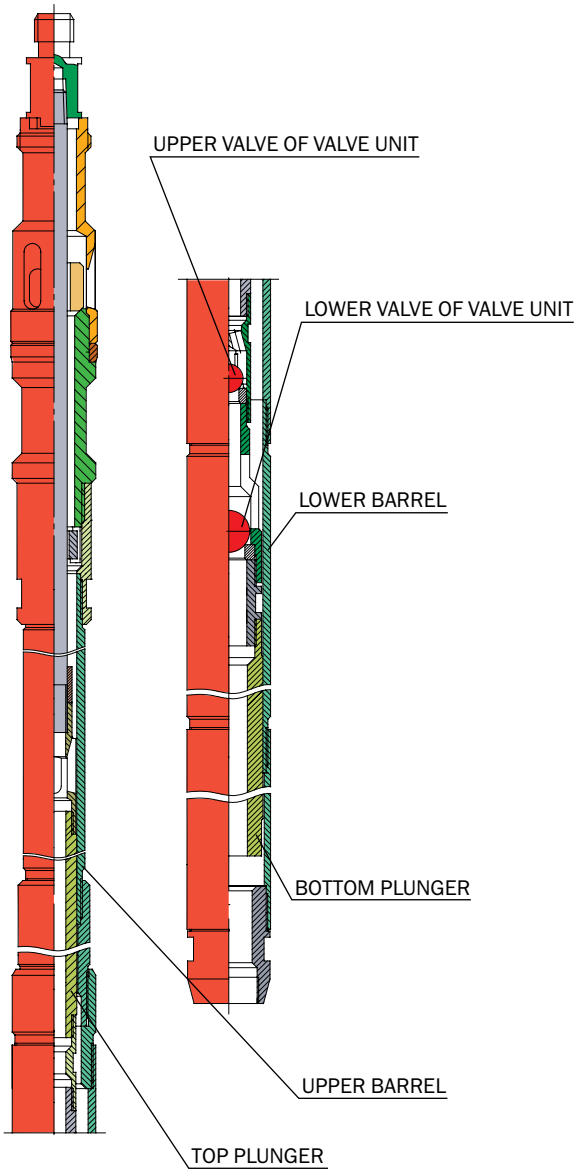
TWO-PLUNGER SSRP FOR PRODUCING HIGHLY VISCOUS OIL

The two-plunger insert pump with two-stage compression and an upper lock is designed for producing crude of high viscosity (up to 0.3 Pa•s), containing up to 0.062 lb/ft^3 of mechanical impurities.

On plungers downstroke, a rarefaction is created in the area of the barrels which is situated between the two plungers. It happens so that the lower valve of the valve unit opens and the formation fluid enters this area. The closed upper valve perceives the pressure of the fluid column and creates an extra downward-directed load useful to overcome hydraulic resistance in the pump and friction forces in the sucker rod string. The latter is very important, as the main obstacle for pumping out high-viscosity fluid is balking of the sucker rods because of excessive friction forces.

The superload is:
$P = p\, dp/4\, (H - h)\, g$,
where dp – diameter of plunger-divider;
H – pump setting depth;
h – depth of pump setting under dynamic head;
g – specific weight of produced fluid.

On the following upstroke of the plungers the fluid is displaced from the interplunger area through the open upper valve of the valve unit into the tubing string.

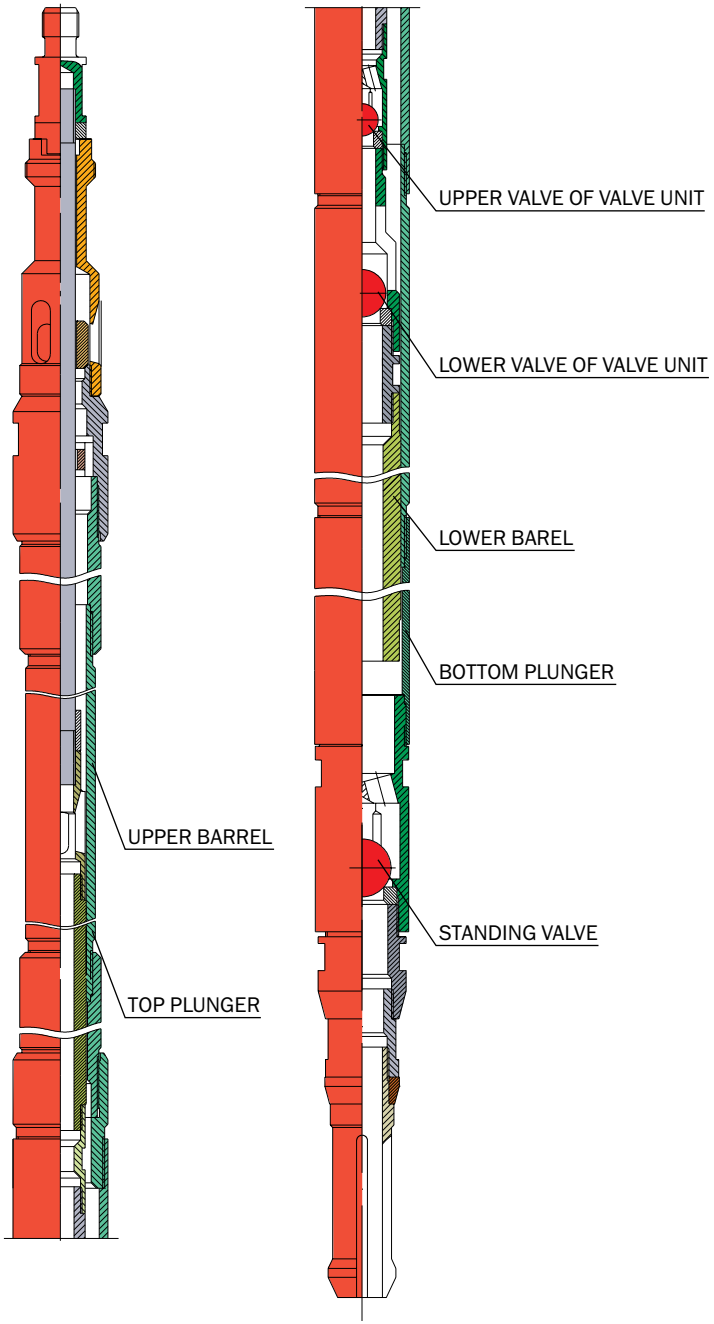


TWO-PLUNGER SSRP FOR PRODUCING OIL WITH EXCESSIVE MECHANICAL IMPURITIES CONTENT AND HIGH GOR

The two-plunger insert pump with two-stage compression and with a bottom lock is designed for fluid production, containing up to 0.062 lb/ft^3 of mechanical impurities and up to 25 % of free gas at the pump inlet.

On plungers upstroke a rarefaction is created in the area of the lower barrel, located over the standing valve. This allows the formation fluid entering this area with the standing valve opened. On the following downstroke the fluid being compressed flows from this area into the area, located between the plungers, the lower valve opened. Since the interplunger area is smaller by volume than the lower barrel area, the pressure of the gas-liquid mixture in it will be greater than a suction one. On the next upstroke the fluid between the plungers, being again compressed, is displaced into the tubing string with the upper valve opened.

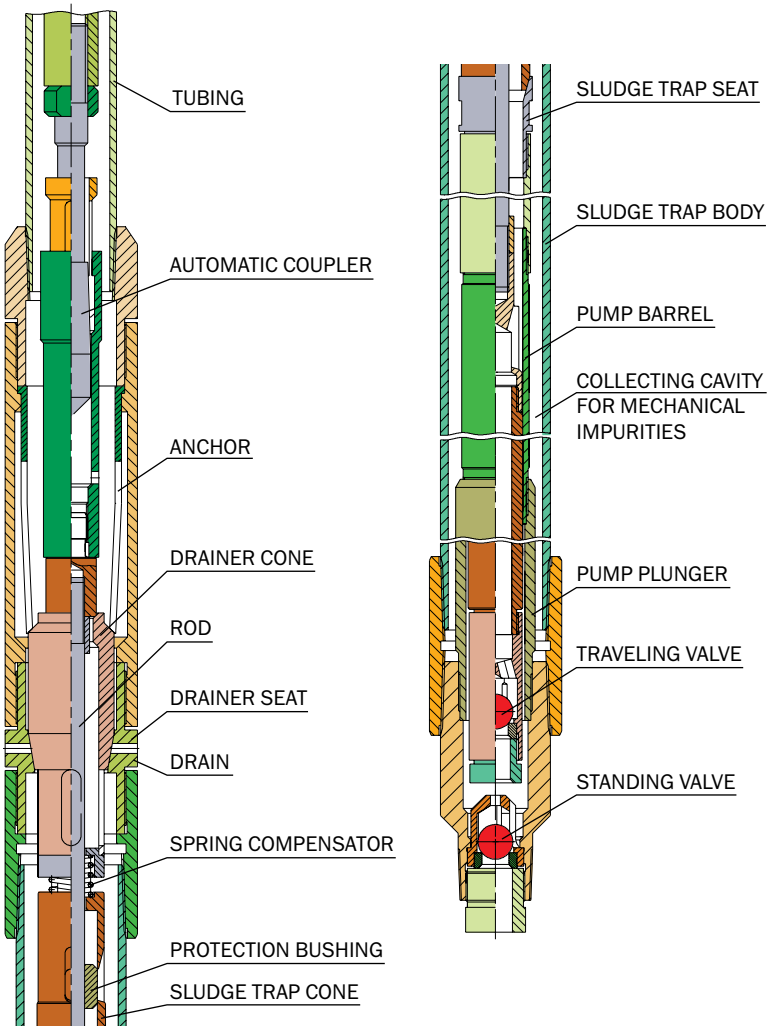
The repeated compression of the fluid in the pump allows avoiding pump blocking when the gas content is high.



TUBING PUMP WITH A TOP DRAINER, AN AUTOMATIC COUPLER AND A SLUDGE TRAP

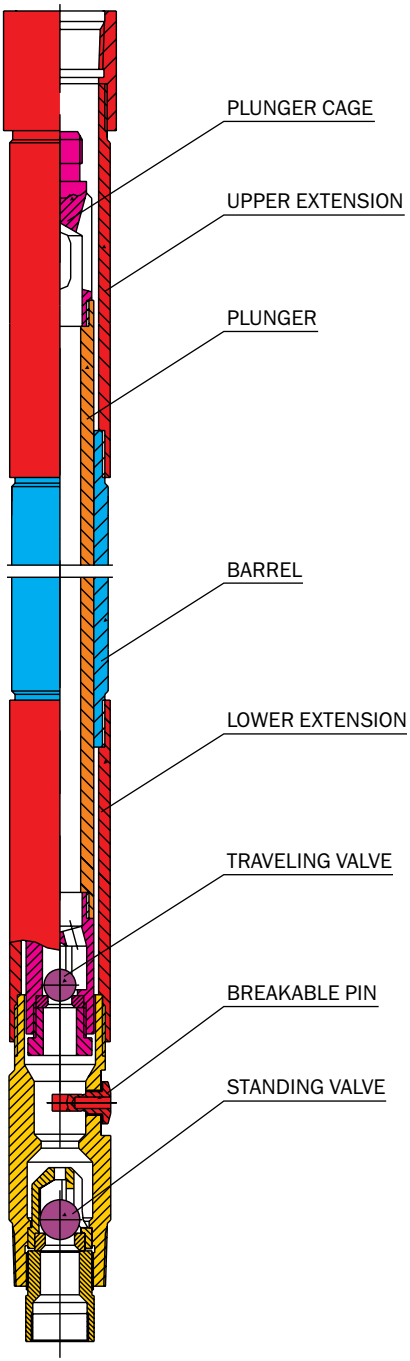
The drainer device provides fluid drain from the tubings directly when withdrawing (pulling out) the plunger before lifting the pump, without using a catcher or a breakable pin.

The automatic coupler allows lowering the pump with the drainer device cone preliminary mounted in the seat, thus providing reliable sealing of the drain unit.
The cavity between the sludge trap body and the external barrel surface serves as a collector for mechanical impurities, settling down when lowering sucker rods into a well and on pump shutdown. The protection bushing, fitted in the sludge trap cone prevents from the ingressing of contaminants into the pump barrel cavity. The pump design permits to minimize the amount of «adverse space» (the cavity between the standing and traveling valves with the lower plunger position), and also to equalize pressure inside and outside of the barrel and to allow relieving its tensile stress.



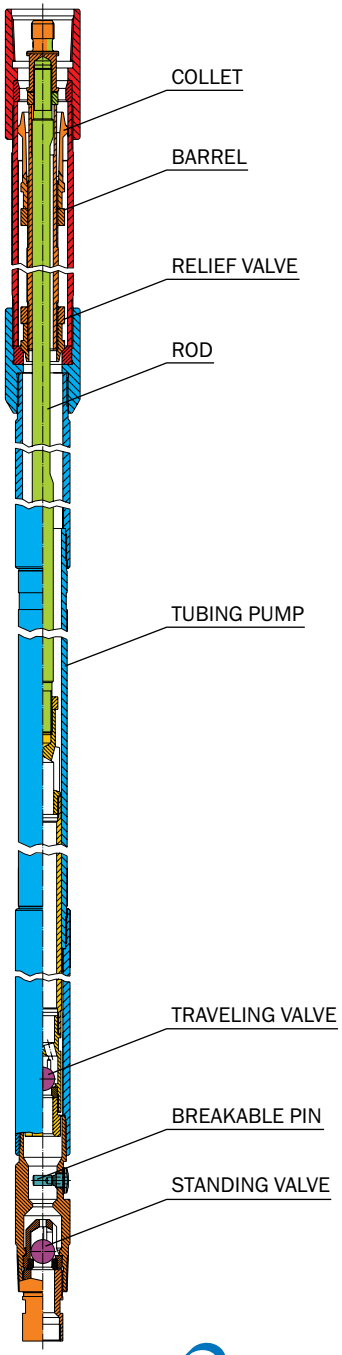
SSRP, EXCLUDING THE PLUNGER PAIR BALKING

This design of the pump employs a short barrel and an oversized standing valve with a breakable pin.
The pump is used when the mechanical impurities content is more than 0.062 lb/ft3.
Increased lifetime because of the constant contact of the barrel and the plunger makes it so that the mechanical impurities practically do not enter into the plunger-pair clearance.
Nowadays the pumps are used in Tatar Republic, Bashkiria, Kazakhstan and Sakhalin. The working time of PKNM equipment is increased in 1.5–2 times if to compare it with the standard SSRP.
The SSRP construction is patented.



SSRP WITH A RELIEF VALVE FOR PRODUCING OIL WITH A HIGH GOR

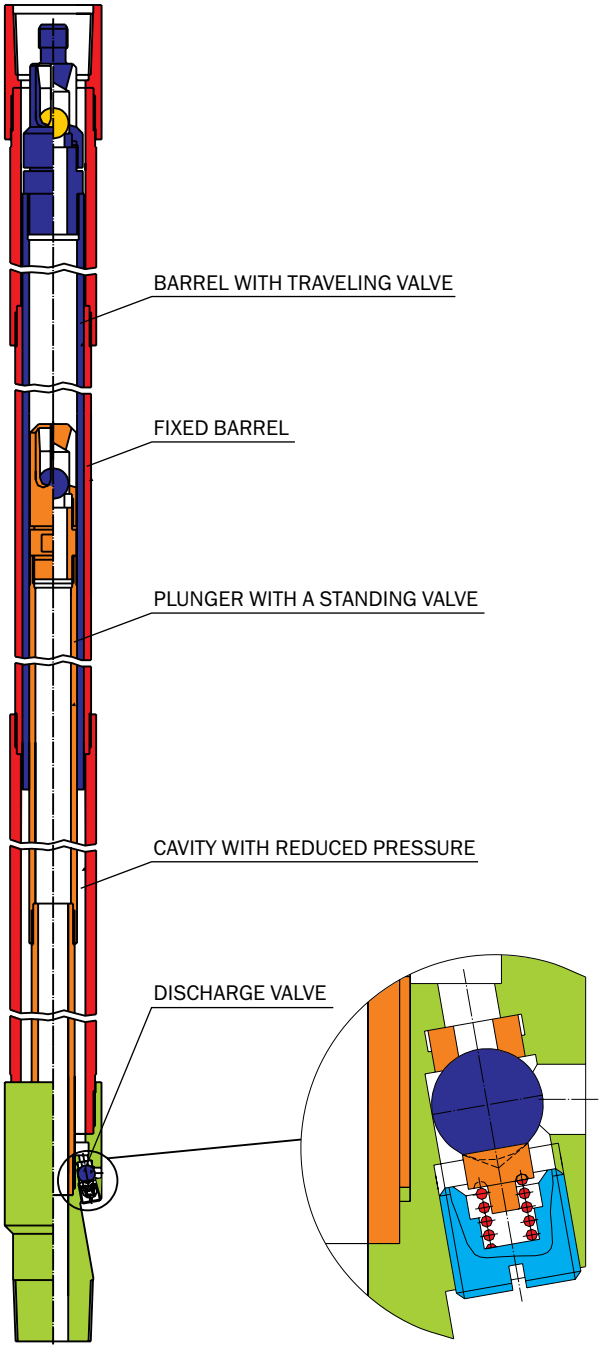
The pump design includes a relief valve that excludes standing valve's blocking by gas that is released in the cavity under the traveling valve.
The pump is equipped with the standing valve that has a breakable pin.



SSRP FOR PRODUCING HIGH VISCOSITY OIL

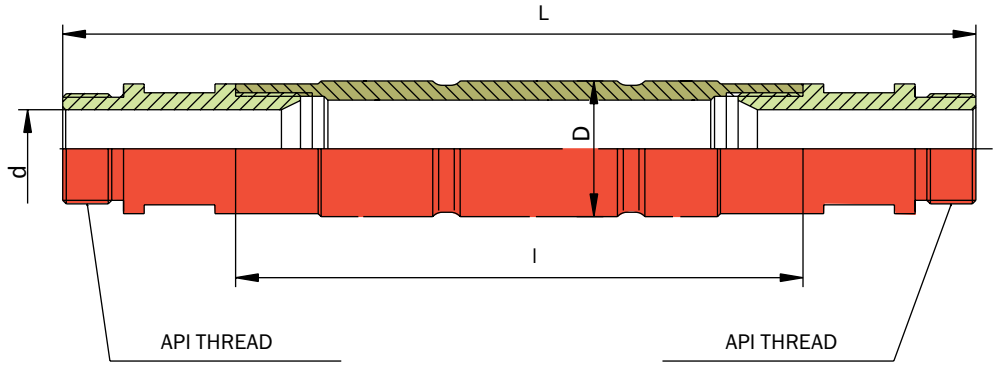
The pump is meant for producing high viscosity crude.

The pump of a special design includes a fixed barrel inside of which a barrel with a traveling valve is moving. Inside of the movable barrel there is fitted a plunger with a standing valve rigidly linked with the fixed barrel. When fluid is delivered, there is created a cavity in the pump with a reduced pressure that allows the decreasing of forces moving the fixed barrel with the sucker rod string on its return stroke. This prevents the sucker rod string against «hanging-up» because of the excessive friction forces in pumping out high-viscosity oil.



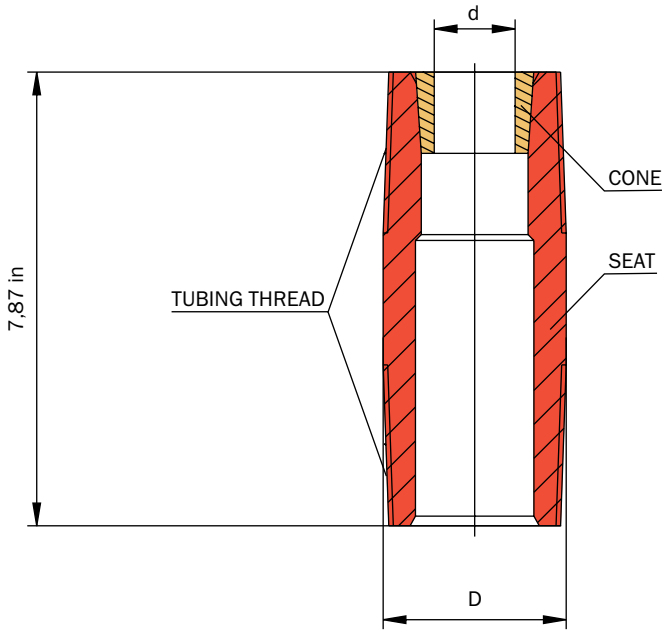
ADDITIONAL DEVICES FOR SSRP

SECTIONAL NIPPLE PLUNGER



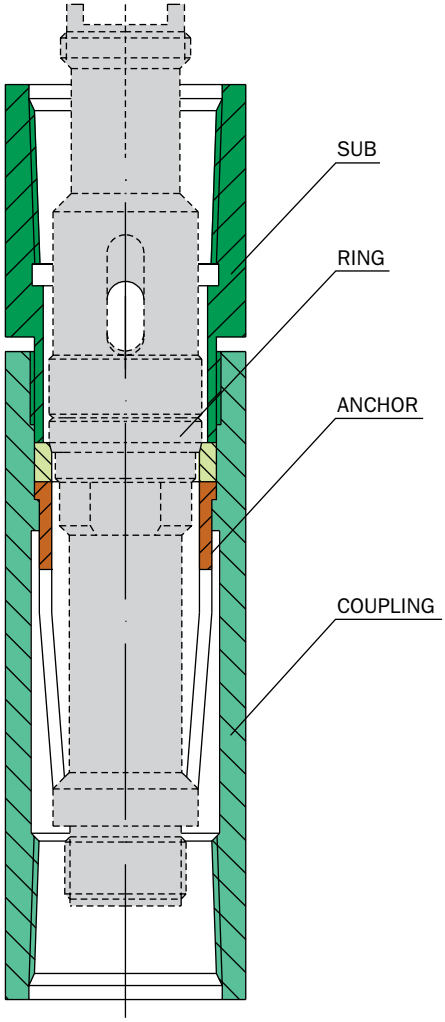
Conventional pump size	L, ft	l, ft	Designation, API	D, inch	d, inch	Tubing thread
125	4.373	4	P22-125-4	1.25	0.6299	1.0000–14
	5.374	5	P22-125-5			
	6.375	6	P22-125-6			
175	4.386	4	P22-175-4	1.75	1.024	1.4704–14
	5.384	5	P22-175-5			
	6.388	6	P22-175-6			
225	4.396	4	P22-225-4	2.25	1.22	1.8024–14
	5.397	5	P22-225-5			
	6.398	6	P22-225-6			
275	4.406	4	P22-275-4	2.75	1.457	2.1095–11 ½

LOCK SUPPORT «CONE IN CONE»



Conventional pump size	Lock support	№	D, inch	d, inch	Tubing thread
106; 125	27-32	1	2. 874	1. 47	2 7/8 -10 NURD
		2			
150; 175	38-44	1	2. 874	1. 805	2 7/8 -10 NURD

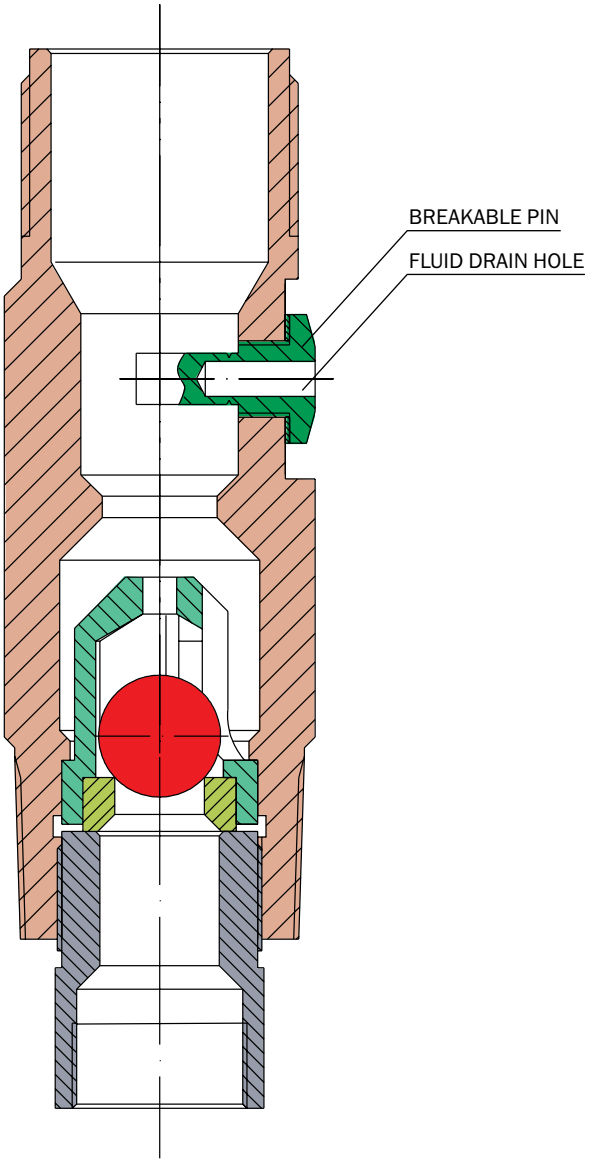
LOCK SUPPORT (OM TYPE)



FOR PUMPS
WITH TOP LOCK

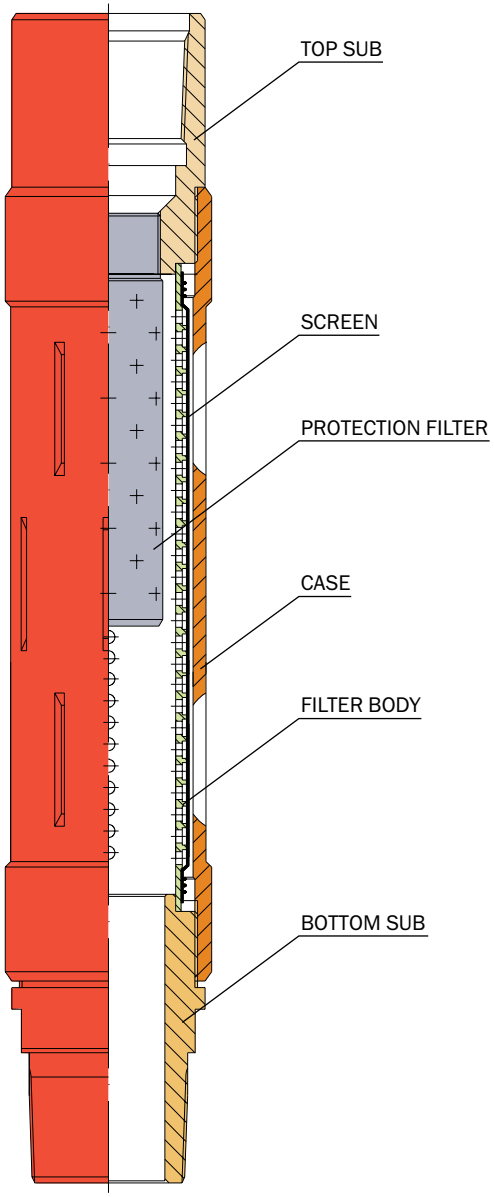
VALVE WITH A BREAKABLE PIN

It is used for draining the fluid off the tubing string, when pulling up. The fluid drain takes place when a bar is dropped in the tubing string, cutting away the breakable pin and opening the drain hole. The advantage of this design is absolute reliability as opposed to the commonly used valve with a bayonet-type catcher, and this makes it possible to exclude cases of pulling out the tubings, filled up with formation fluid. For production of viscous oil there is used the standing valve with a larger flow area, also equipped with a breakable pin.



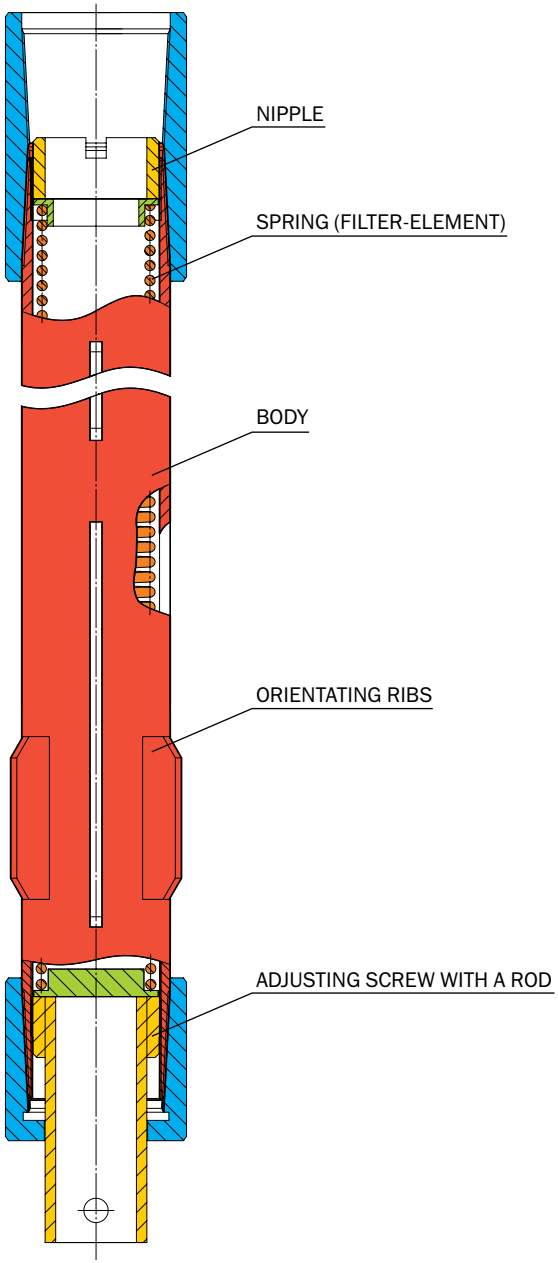
FINE FILTER

The fine filter is mounted at the pump inlet and provides the purifying of the formation fluid from contamination when it enters the pump simultaneously through the tubing and from the annular space. Fluid filtration takes place when it goes through the screen, fixed in the body, and through the holes in the sleeve, built in the top sub of the filter. The fine filter is designed to avoid the ingress of mechanical impurities at the inlet of the Subsurface Sucker Rod Pumps.



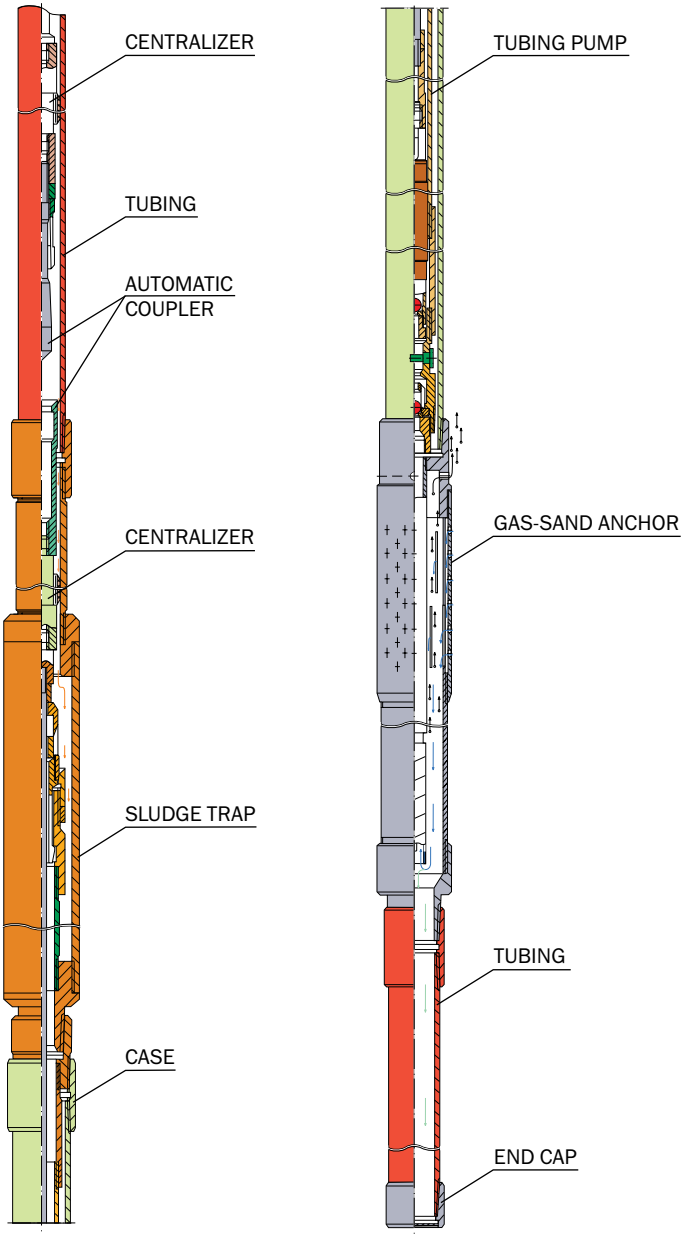
ADJUSTABLE DOWNHOLE FILTER

The filter is intended for protection of the sucker rod pump against ingress of contaminations contained in the pumped-out fluid. The filter consists of a body with orientating ribs and longitudinal slots, inside of the body there is a spring acting as a filter-element. Fineness of filtration (from 0.0078 to 0.0314 in) is provided by adjustment of between-coil clearance of the spring with the help of the adjusting screw with a rod.



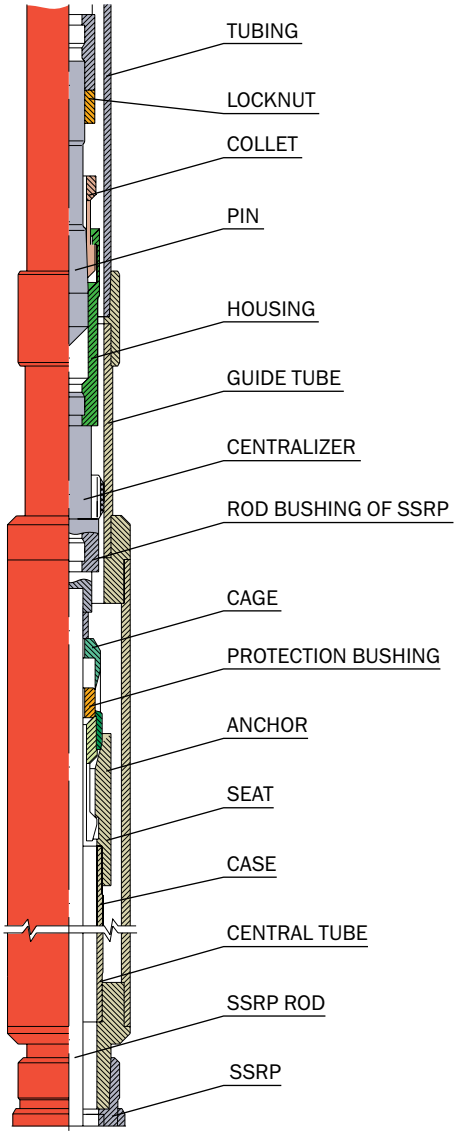
PROTECTIVE DEVICES FOR SSRP

THE OPERATION SCHEME OF THE SSRP PROTECTIVE DEVICES



AN AUTOMATIC COUPLER AND A SLUDGE TRAP

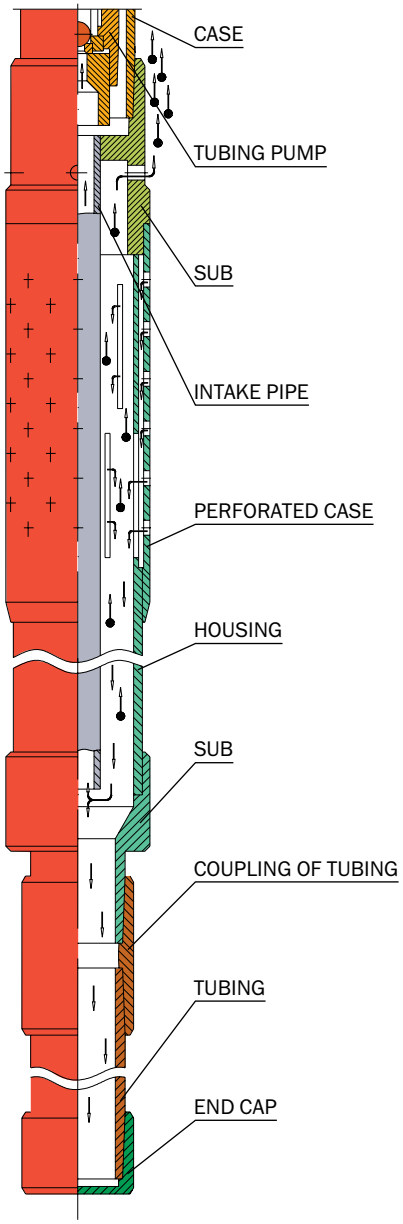
The automatic coupler is designed to connect the sucker rod string with the SSRP plunger directly in the well. This allows lowering of the tubing pump barrel and plunger together and to avoid fouling of the barrel with mechanical impurities (scale, mud etc.), that occurs when the barrel and the plunger are separately run into the well. The sludge trap protects the pump from the side of the tubing space. The contaminants (scale, mud etc.), settling down when lowering the rod string, are accumulated in the trap cavity and do not get into the pump.



GAS-SAND ANCHOR

The Gas-Sand Anchor is installed at the pump inlet of SSRP and serves for protection against free gas and mechanical impurities.
Gas-sand anchor dimensions, inch:
Longitude (without mechanical impurities collector) – 93.31 inches; OD – 4.134 inches; Weight – 125.9 pounds; Tubing diameters – 2 3/8; 2 7/8; 3 inches. The number of tubings installed as mechanical impurities collector – 2-3 pcs. Production rate – 314.5 bls/day.
Anchor setting depth under the dynamic head – up to 197 ft.
Fluid characteristics:
Watercut, % - up to 99;
H2S content, lb/oz – not more than 0.0037;
Hydrogen ion consentration – pH 4...8;
Mechanical impurities content, lb/oz – more than 0.0969;
Viscosity, mPa•s – 200;
Free gas content at the pump inlet, % - up to 50.

Gas-sand anchor is connected with the lower coupling of the lock support with the help of the tubing, connected with the upper sub. Or it can be installed on the standing valve body in the tubing pump, using the upper sub as a help. Gas-sand anchor operates on principles of centrifugal, gravitational and mechanical cleaning.
The anchor consists of a body, the upper part of which has perforations (b), through the perforations the pumped fluid goes to the inner part(c) of the anchor.
Getting to the cavity (c), the fluid goes down between the body walls and intake tube having slow velocity, which lets the gas, that the fluid contains, go up and then go out through the perforations (b) into the intake tube space.
The intake tube (3) is extended at the bottom (4), it helps to increase the flow velocity with mechanical impurities content. When getting into the intake tube opened at the bottom (3), the fluid flow changes direction on 180o, thus separating the mechanical impurities and the fluid. Through the inner cavity (d) of the intake tube (3), the fluid goes to the pump.
The separated mechanical impurities are collected in the collector which consists of tubings and is installed on the bottom sub (5). The bottom tube has an end cap (6).



OIL EQUIPMENT SERVICING

SSRP overhaul is conducted in field and shop conditions.
Servicing includes:

- servicing and equipment inspection,
- maintenance overhaul of the equipment,
- equipment overhaul in the service center,
- equipment total overhaul at PKNM territory.

COMPLETE SET OF EQUIPMENT AND MACHINING

Description	Quantity per set, pcs	Time of delivery*
1. Stand for hydraulic testing of pumps, including:	1	5 months
1.1. Hydraulic station with booster (pressure up to 40 MPa)	1	
1.2. Set of adapters for connecting different standard size pumps	1	
1.3. Jig to install pumps	1	
1.4. Set of reference standards for calibration of hydraulic station	1	
2. Stand for testing plungers and lock supports, including:	1	5 months
2.1. Hydraulic station (pump station) with booster (pressure up to 40 MPa)	1	
2.2. Jig for testing plungers and lock supports	1	
2.3. Set of adapters for hydraulic testing of plungers	1	
2.4. Set of connectors for hydraulic testing of lock supports	1	
3. Stand for hydraulic testing of valves, including:	1	5 months
3.1. Hydraulic station with booster (pressure up to 40 MPa)	1	
3.2. Set of connectors for testing of valves	1	
4. Stand to assemble and disassemble SSRP with manual prismatic clamps	1	3 months
5. Special prismatic and ring clamps	2	2 months
6. Height-adjustable post to support long-sized items: rod, barrel	7	2 months
7. Set of special wrenches to assemble and disassemle SSRP (pipe type, chain type)	1	2 months
8. Device for measuring deviation from straightness of barrel bore generating axis	1	2 months
9. Manual tester for checking leak-proofness of seat-and-ball	1	2 months
10. Set of tools to measure bore diameter of barrel, including:	1	2 months
10.1. Set of extenders for calipers, each 30.3 inches long	4	
10.2. Unit of calibration rings to tune calipers	1	
10.3. Set of go-gauges	6	
11. Instrument for inspection of barrel bore surface	1	4 months
12. Manual screw press to straigten plungers and rods	1	2 months
13. Manual device to check tear-off force of lock support	1	2 months
14. Lapping machine («seat-ball pair»)	1	2 months
15. Technological Documentashion, Including:		
15.1. Set of maintenance requirement cards and repair manuals for SSRP	1	
15.2. Set of manuals for incoming inspection and pre-operating preparation of new SSRP	1	
15.3. Set of maintenance manuals for the equipment	1	
15.4. Proposed technological layout of SSRP service shop	1	

DRILLING AND WELL SERVICING EQUIPMENT

PKNM, Ltd. manufactures drilling and well servicing equipment: Drill Collars, Kellys, HWDP, Non-magnetic Drill Collars, Subs and Pup-joints.

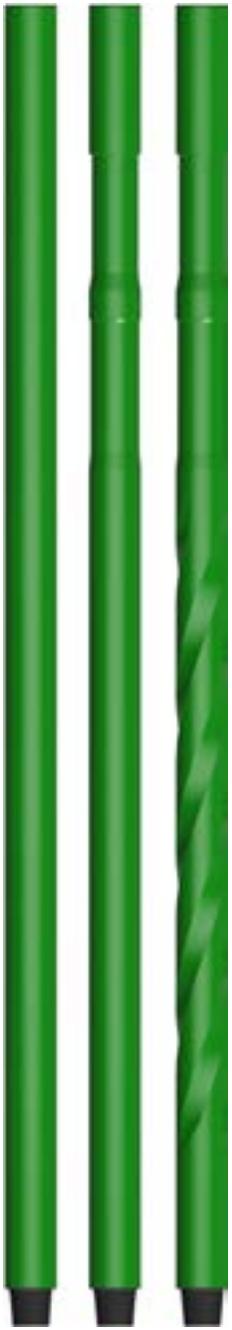
PKNM, Ltd. has the certificates of the QMS conformity to API Spec. Q1, ISO 9001:2008 and licenses that give a right to put monograms of API 7-1. Also the company has the drill pipes, subs and pup-joints' conformity certificates that meet the Russian normative documents' requirements.
The mechanical characteristics of Drill Collars, Kellys, and HWDP correspond to API Spec. 7 – 1.

MECHANICAL CHARACTERISTICS OF DRILL COLLAR, KELLY AND HWDP

OD, inch	Ultimate Strength, psi, min	Yield point, psi, min	Relative elongation, % min	Brinell Hardness, HBW min
From 3 $^{1}/_{8}$ up to 6 $^{7}/_{8}$	140 000	110 000	13	285
From 7 up to 11	135 000	100 000	13	285

DRILL COLLAR

Drill collar is designed for creating axial load to the bit, for improving rigidity and stability of the lower part of the drill string when drilling wells.



BASIC SIZES OF DRILL COLLARS

Drill collar diameter, inch	Bore, inch	Tool joint thread, API
3 1/8	1 1/4	NC-23
3 1/2	1 1/2	NC-26
4 1/8	2	NC-31
4 3/4	2	NC-35
5	2 1/4	NC-38
6	2 1/4	NC-44
6	2 13/16	NC-44
6 1/4	2 1/4	NC-44
6 1/4	2 13/16	NC-46
6 1/2	2 1/4	NC-46
6 1/2	2 13/16	NC-46
6 3/4	2 1/4	NC-46
7	2 1/4	NC-50
7	2 13/16	NC-50

Type of design:
-plain;
- with a recess of the elevator;
- with a recess of the elevator and power slips;
- spiral and a wide range of type mixtures.

A spiral drill collar is the most widely spread type because of its characteristics. Due to the spiral groves the contact area between the well's wall and the pipe is diminished; the possibility of pipe's balking is lessened and the drill stem rotation torque is increased. The spiral drill collars can be done with recesses for elevator and power slips at the same time.

Length: 30 – 31 ft ± 6 ft.

HEAVY WEIGHT DRILL PIPE (HWDP)

Heavy Weight Drill Pipe is designed for creating axial load to the drill bit, for improving rigidity and stability of the lower part of the drill string when drilling inclined and horizontal wells.

BASIC SIZES OF HWDP

Diameter of tool-joint part, inch	Diameter of HWDP body, inch	Bore, inch	Tool joint thread, API
4 3/4	3 1/2	2 1/4	NC-38
5 1/2	4	2 1/2	NC-40
6 1/4	4 1/2	2 11/16	NC-46
6 5/8	5	3	NC-50
7	5 1/2	3 1/4	5 1/2 FH

Types of HWDP design:
With a tapered elevator shoulder, without center upsets, with spiral grooves;
With a square elevator shoulder, without central upsets, with spiral grooves;
With a tapered elevator shoulder, with one central upset;
With a square elevator shoulder, with one central upset;
With a tapered elevator shoulder, with two central upsets;
With a square elevator shoulder, with two central upsets.

Length: 31 ft (standard), other lengths can be done on demand of the customer (from 26 ft up to 37.7 ft).

KELLY

Kelly is designed to transfer the rotor torque to the drill string when drilling wells.

Kelly can be:
– Square section;
– Hexagonal section.

BASIC SIZES OF KELLY (SQUARE SECTION)

Distance between faces, inch	Total length, ft
$2\,{}^{1}/_{2}$	37
3	37
$3\,{}^{1}/_{2}$	37
$4\,{}^{1}/_{4}$	37

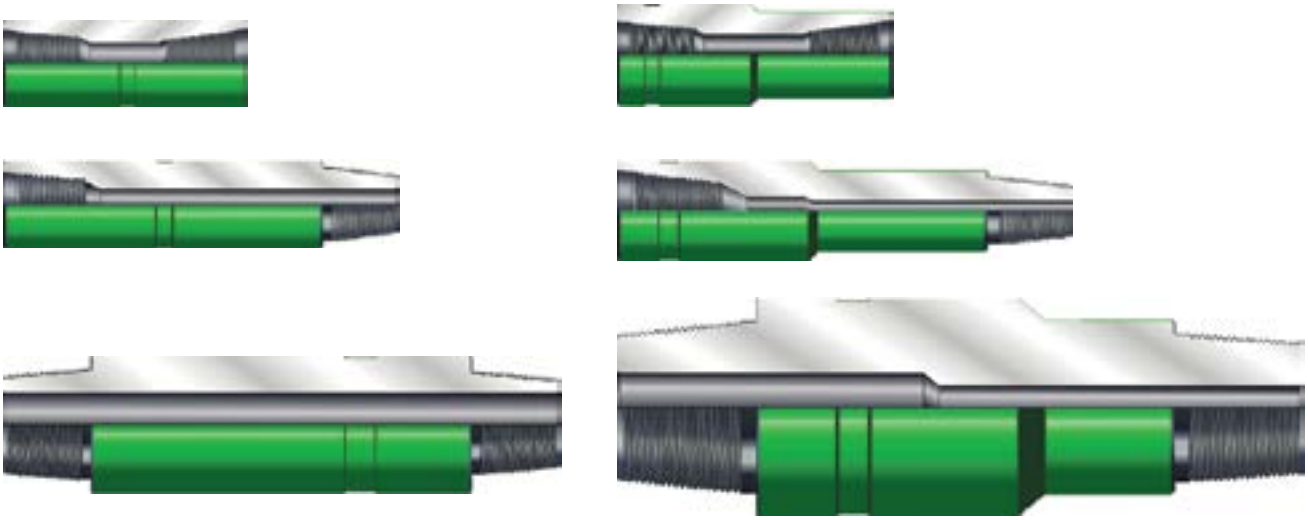
BASIC SIZES OF KELLY (HEXAGONAL SECTION)

Distance between faces, inch	Total length, ft
3	37
$3\,{}^{1}/_{2}$	37

SUBS

PKNM manufactures a wide range of subs in accordance with API Spec. 7–1 and the customers' design. All the products are made from steel the mechanical qualities of which correspond to API Spec. 7–1.

Subs are used to connect different parts of the drill stem or for connecting an instrument to it that has different type and size of the thread for performing drilling, servicing and geological surveys in oil-and-gas fields.



Subs' types:
Adapter subs (with box and pin ends);
Box subs (both are box threads);
Pin subs (both are pin threads);
Elevator subs with flat shoulder for elevator;
Elevator subs with taper shoulder for elevator.

Subs are manufactured of different configurations. Threads can be both right and left.
The heat-treatment is done with the help of a modern equipment INT4–630 / 1.0 and a complex volume heat-treatment "Nakal". The material quality is checked on the complex impulse system of Ultrasonic tube Testing UPNK-2 and a special system of Ultrasonic Testing.
The subs are supplied having the hardened thread connection which is achieved by phosphatizing and thread root deep rolling. The subs' threads are nitrided using the technology "Nitroprotect". The thread connections are covered with anticorrosion coating.

PUP-JOINTS

PKNM also manufactures pup-joints. They are used for adjusting the drill string length while drilling oil and gas wells.

Length =3.3 ft, 4.9 ft, 6.6 ft, 9.8 ft, 13.1 ft.

NDT LABORATORY (NONDESTRUCTIVE TESTING)

The NDT laboratory was established in PKNM in 2008.
The NDT laboratory has the following equipment:
The universal ultrasonic multichannel unit UPNK-2 for automatic inspection of tubular billets in a wide range of outside and inside diameters;
The mechanized bench for ultrasonic and magnetic powder inspection of the subs;
Electromagnetic unit EZW-II for drill pipes inspection;
The ultrasonic pulse flaw detectors with a wide range of capabilities;
The ultrasonic thickness gauge;
The magnetic-field flaw detector.

The NDT laboratory includes specialists of ultrasonic and magnetic powder inspection, certified to qualification levels 1 and 2.
At present, there are successfully developed and included into the production cycle the following inspection methods:
- Automatic 100 % ultrasonic inspection of the drill collar body for linear and transverse defects;
- Automatic 100 % ultrasonic inspection of wall thickness of the tubular billet;
- Electromagnetic drill pipe body inspection;
- Ultrasonic inspection of tool joint threads on the drill pipes under repair;
- Magnetic powder inspection of subs.

LABORATORY OF MECHANICAL TESTING

PKNM has a laboratory of mechanical testing. Only high quality equipment is implemented into the laboratory. It includes:
- Testing tensile machine Z250RED (by Zwick);
- Pendulum impact machine (Charpy machines) RKP450GE (by Zwick);
- Equipment for chemical analysis inspection;
- Emission spectrometer.

DRILL PIPES REPAIR

TOTAL OVERHAUL OF THE DRILLING EQUIPMENT (DRILL PIPE, DRILL COLLAR, KELLY, HWDP)

RECEIVING INSPECTION

First of all, the pipes are checked for being suitable for the overhauling by means of the visual and gage inspection of the tool joint geometrical pattern, the drill pipe body and the thread. Having received the inspection results the presorting of the drill pipes is carried out.

EXTERNAL SURFACE CLEANING
(HYDRO ABRASIVE AND SHOT-BLASTING CLEANING)

Cleaning is conducted for determining the mechanical damages and other defects (tearing, scabs, chips, cracks, washouts) on the drill pipe body. The main aim is to perform the 100 % nondestructive testing of the drill pipe body, tool joint, seam-welded zones and drill pipes thread.

STRAIGHTENING THE DRILL PIPE BODY

The straightening of the drill pipes (including those pipes that fall down and deform in the process of drilling) is done using a press installation with a loading of 55120 lb, on a base 3.3 x 3.3 ft, with a tolerance of 0.04 in on 3.3 ft.
A great number of tests showed that in the places of bending and in the places of load application the metal structure doesn't change if to compare it with the initial one.

NONDESTRUCTIVE TESTING

NDT types:
- Total Ultrasonic Wall Thickness Inspection of the Drill Pipe Body;
- Total Ultrasonic Testing of the Drill Pipe Body;
- Ultrasonic Testing of the Seam-welded Zone;
- Magnetic Particle Inspection of the Thread;
- Electromagnetic Inspection of the Drill Pipe Body.

HARDBANDING

Hard bands are welded on the tool joint in the shielding gas environment in order to decrease the mechanical damages and to prevent the tool joint OD from wearing. For hardbanding the following material is used: Dratek and Castolin which comply with the NS Standard requirements.
One layer of hardbanding is applied on the tool joint. The layer thickness is equal to 0.1377 inches.
A continuous control of the hardbanding process is conducted during the operation. The thickness of the welded coating is even, the metal structure is maintained.
The welded coating hardness is 500…550 HB. The efficiency of the welded material is certified by one of the Russian Research Universities.

RECUTTING THE THREAD ON A CNC-LATHE

The process of the DP thread recutting is performed using the CNC-lathe. The CNC-machine program excludes the so-called “human factor”, increases the precision and makes the quality of the surface better. The tools made by Vargus Company are used for thread cutting.
Every recutted thread is controlled by using the thread calibers, which are checked and certificated.

HARDENING OF THE DRILL PIPES SURFACE

THREAD ROOT DEEP ROLLING

Thread hardening is performed by applying thread root deep rolling procedure; the fatigue strength of the thread connection is increased enormously.

Thread hardening is done in accordance with DS-1 Standard. The efficiency of the technology is proved by the Russian Research Institute of Drilling Equipment.

ELECTROMECHANICAL MACHINING

Electromechanical Machining – is an innovative method of increasing wear resistance, material strength and durability limit of the drill pipes and subs. The method is based on using the electrical energy of industrial frequency (50 Hz), concentrated in the contact area between the tool and the machining surface.

Electromechanical surface quenching of the drill pipes outside surface.

THREAD PHOSPHATING

When applying the phosphating solution on the thread connections the following happens:

- The coating boosts the corrosion resistance;
- The possibility of tearing is diminished;
- As a result of having coarse-grain structure the lubricant on the thread connection surface is maintained for more prolonged time.

There are cold phosphating, rinsing type phosphating, hot phosphating and phosphating performed in tanks.

The materials and technology of Chemetall Company are used for phosphating.

CONSERVATION, PROTECTIVE CAPS, PACKING

The thread conservation is done using the lubricant RUSMA-1. After applying the lubricant on the thread, the protective caps are put on it. The protective caps prevent the thread connection from damages during transportation and maintaining. The protective cap contains a pipe shell which helps to screw and unscrew the cap in different temperature conditions. All the above-mentioned operations all together or separately allow using the DP 20..45% more effectively.

The plan of the total overhaul can be changed. The repair is done only after coordinating the plan of the works with the customer.
A continuous inspection is conducted at every stage of the repair process.
Each pipe under repair, even those which were supposed to be defective, have ID number, repair date, the name of the company who conducts the refurbishment.
Every pack of repaired drill pipes is accompanied by a certificate that contains the results of the final inspection, dimensions and NDT information, including the certificates for the defective products, indicating the reason of not being repaired.

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