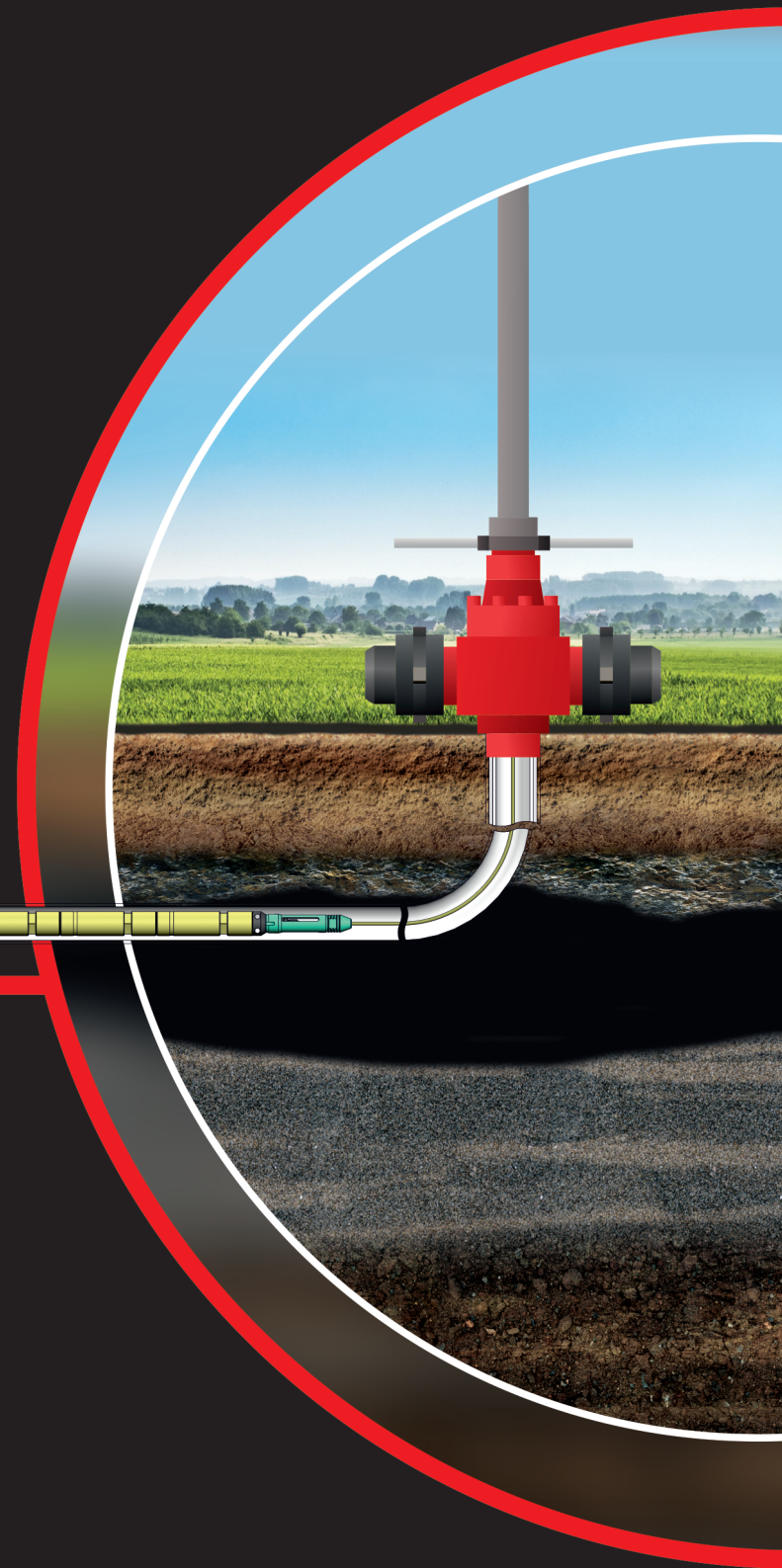


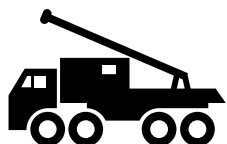
# PRODUCT PORTFOLIO





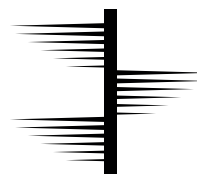


## ABOUT US



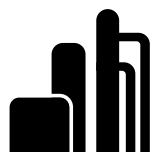
Over  
**10 000**

well operations  
annually



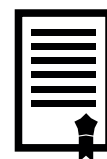
Over  
**3 million**

charges annually



Over  
**50**

customers — oil and gas  
producers and service  
companies from Russia  
and abroad



Certificates  
**ISO 9001: 2015,  
GOST R ISO 9001:  
2015, API Q1, Q2,  
RP 19B**

Shaped charges .....	5
Perforation systems.....	7
Detonation initiation and transmission devices.....	17
Coiled tubing perforation equipment.....	21
Equipment for repair and renewal operations.....	29
Equipment for technological operations .....	34
Technological solutions .....	35
PerfoLab .....	44

# SHAPED CHARGES

## Shaped charges with the maximum operating temperature up to 150 °C

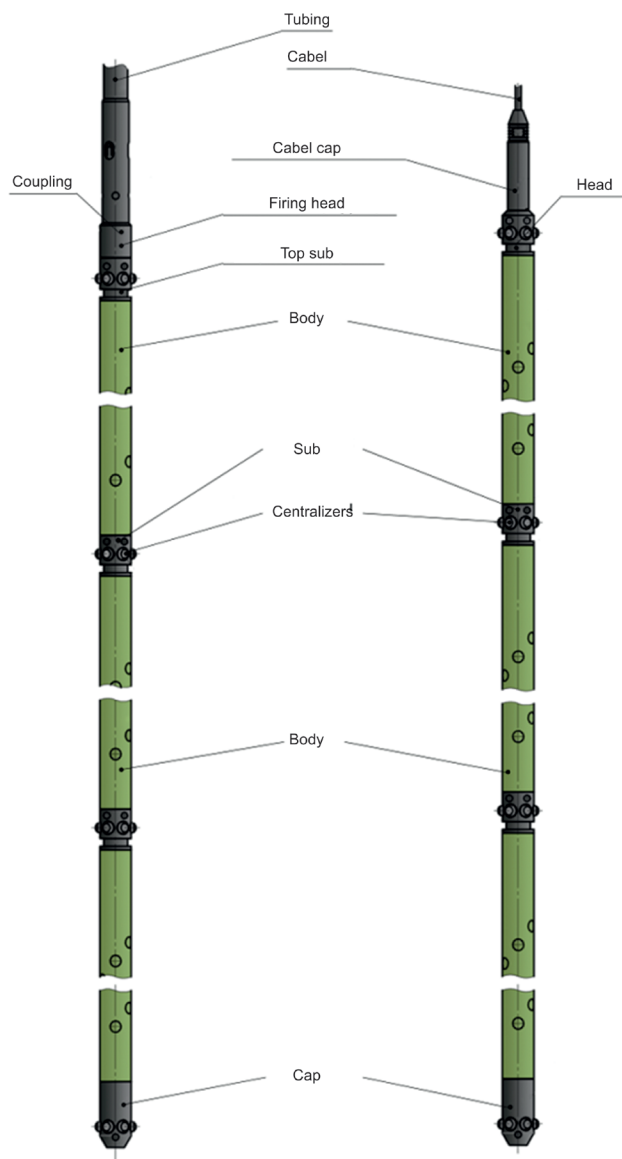
Charge type	Explosive weight, g	Penetration depth in concrete, API, RP 19B (mm)	Entrance hole diameter, API, RP 19B (mm)	Penetration depth in concrete, TU, minimum (mm)	Entrance hole diameter, TU, minimum (mm)
Shaped charges for hollow-carrier expendable perforating systems					
ZPK38-AT-M-03	3,5			270	5,5
ZPK 50-AT-M-03	5,5	608,0	5,56	610	5,5
ZPK 50-AT-M-10	6,7	154,0	12,27	155	12,0
ZPK 63-AT-M-03	11,5	636,0	7,97	630	8,0
ZPK 63-AT-M-04	11,7	753,0	7,69	750	8,0
ZPK 63-AT-M-10	14,0	249,0	19,93	250	19,0
ZPK 73-AT-M-01	18,0			650	12,0
ZPK 73-AT-M-02	19,0	319,0	20,83	320	21,0
ZPK 73-AT-M-04	18,0	785,0	9,43	780	10,0
ZPK73-AT-M-07	17,7			350	15,5
ZPK 89-AT-M-01	31,7			650	14,5
ZPK 89-AT-M-03	27,7	<b>1025,0</b>	11,07	1000	11,0
ZPK 89-AT-M-04	27,5	<b>1284,0</b>	9,79	1300	10,0
ZPK89-AT-M-07	29,7			360	18,0
ZPK 89-AT-M-09	27,2	356,8	18,69	360	19,0
ZPK 89-AT-M-10	22,5	262,0	<b>23,42</b>	260	23,5
ZPK 102-AT-M-03	27,8	1245,0	<b>12,28</b>	1250	12,0
ZPK 102-AT-M-04	27,7	<b>1400,0</b>	9,70	1400	10,0
ZPK 102-AT-M-07	28,0			360	18,0
ZPK 102-AT-M-09	27,2	365,9	18,93	370	19,0
ZPK 102-AT-M-10	27,5	175,0	<b>22,35</b>	200	23,0
ZPK114-AT-M-01	31,7			1000	12,7

Charge type	Explosive weight, g	Penetration depth in concrete, API, RP 19B (mm)	Entrance hole diameter, API, RP 19B (mm)	Penetration depth in concrete, TU, minimum (mm)	Entrance hole diameter, TU, minimum (mm)
Shaped charges for hollow-carrier expendable perforating systems					
ZPK 114-AT-M-03	32,5	1348	12,50	1350	12,0
ZPK 114-AT-M-04	32,7	<b>1620,0</b>	<b>10,78</b>	1600	11,0
ZPK 114-AT-M-07	28,0			360	18,0
ZPK 114-AT-M-09	27,5			440	19,7
ZPK 114-AT-M-10	27,5	189,0	<b>23,92</b>	200	24,0
SKIF-C-50-01	6,5			300	5,5
SKIF-M-50-01	6,5			150	11,0
SKIF-C-63-01	11,5			425	7,0
SKIF-M-63-01	15,0			400	14,5
SKIF-C-73-01	18,0			550	10,0
SKIF-M-73-01	20,0			500	17,0
SKIF-C-Y-01	27,5			800	11,0
SKIF-M-Y-01	27,0			625	18,5
Shaped charges for capsule-type expendable perforating systems					
ZPK43-AT (Link)	9,7	6,31	510	500	5,5
ZPK54-AT (Link)	12,7	8,55	761	700	6,5
ZPK43-AT (Strip)	9,7	6,73	518	500	5,5
ZPK54-AT (Strip)	12,7	8,47	659	700	6,5

# SHAPED CHARGES

Thermally stable shaped charges with the maximum operating temperature up to 204°C					
Charge type	Explosive weight, g	Penetration depth in concrete, <b>API, RP 19B</b> (mm)	Entrance hole diameter, <b>API, RP 19B</b> (mm)	Penetration depth in concrete, <b>TU</b> , minimum (mm)	Entrance hole diameter, <b>TU</b> , minimum (mm)
ZPK38-AT-M-03 T	3,5	257	5,62	270	5,5
ZPK50-AT-M-03 T	6,0	645	6,12	640	6,0
ZPK50-AT-M-10 T	6,2			155	12,0
ZPK63-AT-M-03 T	11,5			630	8,0
ZPK63-AT-M-04 T	11,7			750	8,0
ZPK63-AT-M-10 T	14,0			250	19,0
ZPK73-AT-M-01 T	18,0			700	12,3
ZPK73-AT-M-02 T	18,2	279	20,68	320	21,0
ZPK73-AT-M-04 T	18,0	896	11,24	850	11,0
ZPK73-AT-M-07 T	17,7			360	16,5
ZPK89-AT-M-01 T	32,5	638	13,77	650	15,0
ZPK89-AT-M-03 T	29,0			1050	11,0
ZPK89-AT-M-04 T	28,0	<b>1226</b>	10,12	1300	10,0
ZPK89-AT-M-07 T	29,7			370	18,5
ZPK89-AT-M-10 T	22,5	197	20,24	270	24,0
ZPK102-AT-M-03 T	29,7			1300	12,3
ZPK102-AT-M-04 T	31,5	<b>1712</b>	11,15	1450	10,0
ZPK102-AT-M-07 T	27,5			370	18,5
ZPK102-AT-M-09 T	28,0			370	19,0
ZPK102-AT-M-10 T	26,0			220	25,0
ZPK114-AT-M-01 T	32,0			1000	12,7
ZPK114-AT-M-03 T	34,0			1350	12,0
ZPK114-AT-M-04 T	35,5	<b>1813</b>	11,60	1600	11,0
ZPK114-AT-M-07 T	27,5			370	18,5
ZPK114-AT-M-09 T	28,7			450	23,0
ZPK114-AT-M-10 T	28,5	246	<b>24,33</b>	250	25,0

# PERFORATION SYSTEMS



**JSC “BVT”** develops and sells perforating systems used in the oil and gas industry for blast and perforation operations (BPO). **The Research and Development Center** of our company creates new modifications of shaped charge devices that increase the efficiency of BPO and speed up the operational process during the secondary perforation of productive formations.

The perforation systems produced by BVT are used for blast and perforation operations in oil producing, injection and exploration wells of any structure. The units are lowered to the perforation interval on a logging cable, tubing or coiled tubing.

## **The major advantages of the perforation systems produced by BVT:**

- shaped charges of our own production;
- ease of assembly;
- high efficiency (due to the low blast capacity of the charges and the use of a unique explosive mixture of our own design);
- compliance with the safety standard API 67 RP;
- standard assembly method for hollow-carrier perforating systems Ø 38–114 mm.

**The product portfolio of the company** includes perforating systems with the outer diameter from 38 to 114 mm, as well as capsule-type expendable and tape perforators, size 43 and 54 mm.

**The quality of perforation systems** and their components determines the failure-free operation of BPO and the efficiency of work. The technological services and the quality control department at BVT enterprises perform constant monitoring and audit of the production in accordance with the requirements of the implemented QMS, which guarantees that the final products comply with the quality criteria.

## PKO38-AT



Characteristics	PKO 38-AT
Max temperature, °C	150/200
Outer diameter	38
Phasing, °*	60
Perforation density, holes/m **	20
Max allowable hydrostatic pressure, MPa***	140
Length of bodies, m ****	1/2/3
Min drift diameter	48
Max deviation rate per 10 m, deg.*****	from 2 to 8
Supplied with the charges	ZPK38-AT-M

\* — phasing 0, 45, 90, 180 is available upon the Customer's request

\*\* — other density is available upon the Customer's request

\*\*\* — ID can be produced according to the special order

\*\*\*\* — other lengths are available upon the Customer's request

\*\*\*\*\* — dependence on the outer diameter of the string:

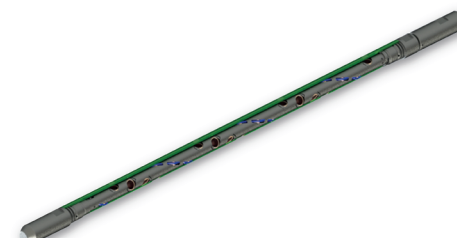
60 mm — 2°    102 mm — 6°    127 mm — 8°    168 mm — 8°    219 mm — 8°

73 mm — 4°    114 mm — 7°    140 mm — 8°    178 mm — 8°    245 mm — 8°

89 mm — 5°    120 mm — 8°    146 mm — 8°    194 mm — 8°

Can be used as a shaped-charge hole puncher for making a special hole in tubing.

## PKO50-AT



Characteristics	PKO 50-AT
Max temperature, °C	150/200
Outer diameter	53
Phasing, °*	60
Perforation density, holes/m **	12, 16, 20
Max allowable hydrostatic pressure, MPa***	80/103,5 150
Length of bodies, m ****	1/2/3/4/5/6
Min drift diameter	65
Max deviation rate per 10 m, deg.*****	from 4 to 8
Supplied with the charges	ZPK50-AT-M

\* — phasing 0, 45, 90, 180 is available upon the Customer's request

\*\* — other density is available upon the Customer's request

\*\*\* — ID can be produced according to the special order

\*\*\*\* — other lengths are available upon the Customer's request

\*\*\*\*\* — dependence on the outer diameter of the string:

73 mm — 4°    120 mm — 8°    168 mm — 8°    219 mm — 8°

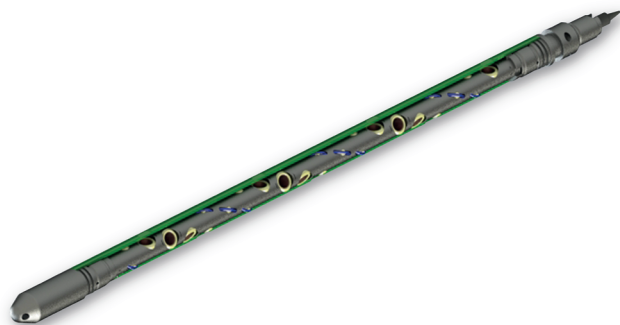
89 mm — 5°    127 mm — 8°    178 mm — 8°    245 mm — 8°

102 mm — 6°    140 mm — 8°    194 mm — 8°

114 mm — 7°    146 mm — 8°

Can be used as a shaped-charge hole puncher for making a special hole in tubing.

## PKO63-AT



Characteristics	PKO 63-AT
Max temperature, °C	150/200
Outer diameter	63,5
Phasing, °*	60
Perforation density, holes/m **	12, 16, 20
Max allowable hydrostatic pressure, MPa***	80/103,5 130
Length of bodies, m ****	1/2/3/4/5/6
Min drift diameter	73
Max deviation rate per 10 m, deg.*****	from 5 to 8
Supplied with the charges	ZPK63-AT-M

\* — phasing 0, 45, 90, 180 is available upon the Customer's request

\*\* — other density is available upon the Customer's request

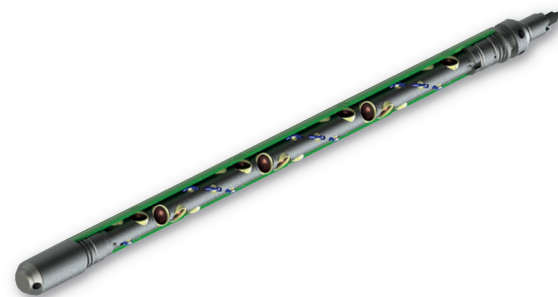
\*\*\* — ID can be produced according to the special order

\*\*\*\* — other lengths are available upon the Customer's request

\*\*\*\*\* — dependence on the outer diameter of the string:

102 mm — 5°	127 mm — 8°	168 mm — 8°	219 mm — 8°
114 mm — 6°	140 mm — 8°	178 mm — 8°	245 mm — 8°
120 mm — 7°	146 mm — 8°	194 mm — 8°	

## PKO73-AT



Characteristics	PKO 73-AT
Max temperature, °C	150/200
Outer diameter	73
Phasing, °*	60
Perforation density, holes/m **	10, 20
Max allowable hydrostatic pressure, MPa***	80/103,5 130
Length of bodies, m ****	1/2/3/4/5/6
Min drift diameter	88
Max deviation rate per 10 m, deg.*****	from 4 to 7
Supplied with the charges	ZPK73-AT-M

\* — phasing 0, 45, 90, 180 is available upon the Customer's request

\*\* — other density is available upon the Customer's request

\*\*\* — ID can be produced according to the special order

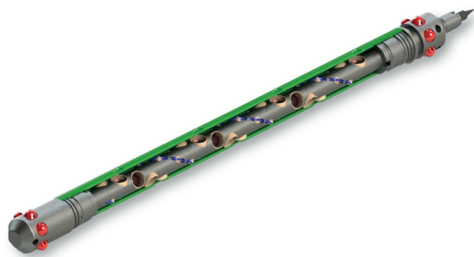
\*\*\*\* — other lengths are available upon the Customer's request

\*\*\*\*\* — dependence on the outer diameter of the string:

114 mm — 4°	140 mm — 7°	178 mm — 7°	219 mm — 7°
120 mm — 5°	146 mm — 7°	194 mm — 7°	245 mm — 7°
127 mm — 6°	168 mm — 7°		



## PKO89-AT



Characteristics	PKO 89-AT
Max temperature, °C	150/200
Outer diameter	89
Phasing, °*	60
Perforation density, holes/m **	10, 20
Max allowable hydrostatic pressure, MPa***	80/103,5 130
Length of bodies, m ****	1/2/3/4/5/6
Min drift diameter	115
Max deviation rate per 10 m, deg.*****	from 2 to 8
Supplied with the charges	ZPK89-AT-M

\* — phasing 0, 45, 90, 180 is available upon the Customer's request

\*\* — other density is available upon the Customer's request

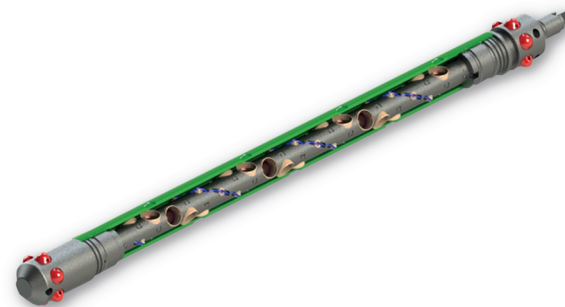
\*\*\* — ID can be produced according to the special order

\*\*\*\* — other lengths are available upon the Customer's request

\*\*\*\*\* — dependence on the outer diameter of the string:

127 mm — 2°	168 mm — 4°	219 mm — 7°
140 mm — 3°	178 mm — 5°	245 mm — 8°
146 mm — 2°	194 mm — 6°	

## PKO102-AT



Characteristics	PKO 102-AT
Max temperature, °C	150/200
Outer diameter	102
Phasing, °*	60
Perforation density, holes/m **	20
Max allowable hydrostatic pressure, MPa***	80/103,5 120
Length of bodies, m ****	1/2/3/4/5/6
Min drift diameter	125
Max deviation rate per 10 m, deg.*****	from 2 to 7
Supplied with the charges	ZPK102-AT-M

\* — phasing 0, 45, 90, 180 is available upon the Customer's request

\*\* — other density is available upon the Customer's request

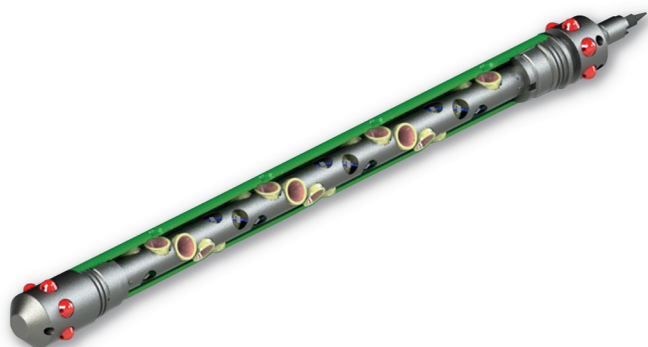
\*\*\* — ID can be produced according to the special order

\*\*\*\* — other lengths are available upon the Customer's request

\*\*\*\*\* — dependence on the outer diameter of the string:

140mm — 2°	178mm — 4°	219mm — 6°
146mm — 2°	194mm — 5°	245mm — 7°
168mm — 4°		

# ПКО 114-AT



Characteristics	ПКО 114-AT
Max temperature, °C	150/200
Outer diameter	114
Phasing, °*	60
Perforation density, holes/m **	20
Max allowable hydrostatic pressure, MPa***	80/103,5 110
Length of bodies, m ****	1/2/3/4/5/6
Min drift diameter	147
Max deviation rate per 10 m, deg.*****	from 2 to 5
Supplied with the charges	ZPK114-AT-M

\* — phasing 0, 45, 90, 180 is available upon the Customer's request

\*\* — other density is available upon the Customer's request

\*\*\* — ID can be produced according to the special order

\*\*\*\* — other lengths are available upon the Customer's request

\*\*\*\*\* — dependence on the outer diameter of the string:

168 mm — 2°    219 mm — 4°

178 mm — 2°    245 mm — 5°

194 mm — 3°

## SNAKE BVT



- \* — phasing 0, 45, 90, 180 is available upon the Customer's request
- \*\* — other density is available upon the Customer's request
- \*\*\* — ID can be produced according to the special order
- \*\*\*\* — other lengths are available upon the Customer's request

Characteristics		PKO 50-AT	PKO 63-AT	PKO 73-AT	PKO 89-AT	PKO 102-AT	PKO 114-AT
Outer diameter of a multicarrier perforator, mm	w/o centralizers	53	63.5	76.5	89	102	141
	with centralizers	-	-	-	116	130	114
Phasing, ° *		60					
Perforation density, holes/m **		20					
Max permissible hydrostatic pressure, MPa		80/103.5 150 ****	80/103.5 130 ****	80/103.5 130 ****	80/103.5 130 ****	80/103.5 120 ****	80/103.5 110 ****
Length of sections, m ***		1/2/3/4/5					
Maximum assembly length of a multisection perforating gun for one run, no more than, m		500					
Max deviation rate per 10 m, deg.*****		from 7 to 27	from 7 to 24	from 5 to 15	from 9 to 17	from 4 to 12	from 7 to 15

### Application

Snake BVT perforation systems increase the efficiency and technological effectiveness of blasting and perforating operations and eliminates and relieves constraints associated with the maximum deviation rate.

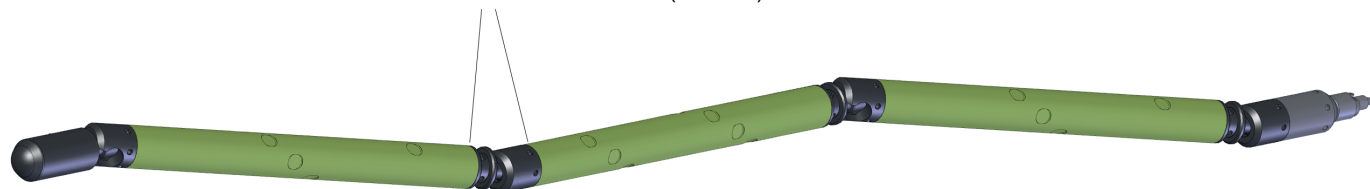
**A unique characteristic** of such perforation systems is the detachable swivel joints, which consist of the devices for receiving and transmitting detonation. The units remain intact after the triggering of shaped charges, which allows to use the chains of perforation systems up to 500 m long. This increases the efficiency significantly and expands the scope of the devices.

### Advantages:

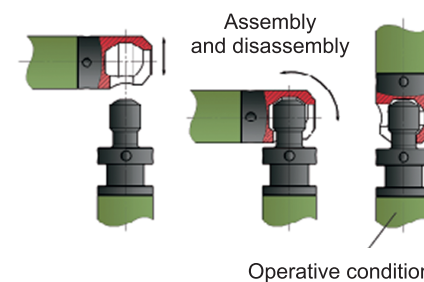
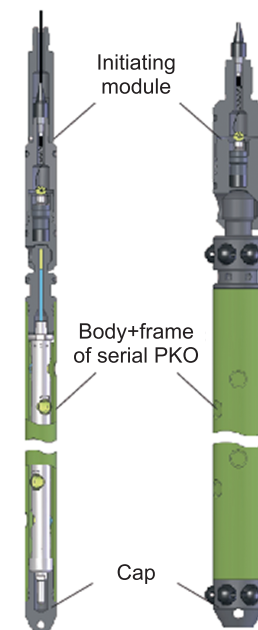
- a universal system for transferring a detonating impulse between sections;
- swivel joints accelerate stripping-down and reassembly of the systems during tripping operations in wells;
- the sections of perforation systems can be assembled in gun loading facilities, and the initiating module can be attached to them at the well.

**Snake BVT assembly (Ø50÷114 mm)**

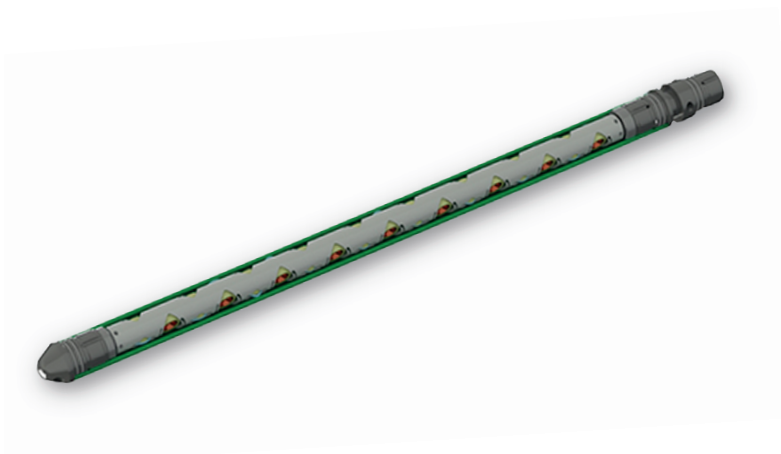
Universal connection  
and detonation transmission unit (UU-AT)



*****Max hole deviation rate per 10 m							
Casing string standard size		Standard size of SNAKE jet perforator (with the length of sections equal to 1 m)					
		50	63	73	89	102	114
	73	4°	-	-	-	-	-
	89	6°	-	-	-	-	-
	102	11°	7°	-	-	-	-
	114	12°	8°	5°	-	-	-
	120	13°	10°	7°	-	-	-
	127	16°	12°	9°	9°	-	-
	140	19°	16°	13°	9°	4°	-
	146	21°	17°	14°	10°	6°	-
	168	21°	23°	15°	15°	12°	7°
	178	21°	24°	15°	16°	12°	8°
	194	21°	24°	15°	17°	12°	9°
	219	21°	24°	15°	17°	12°	14°
	245	21°	24°	15°	17°	12°	15°



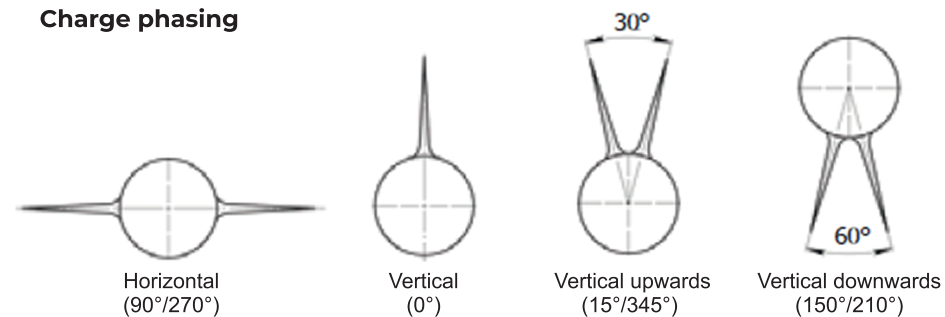
## Oriented perforating system



### Application

The oriented perforating system is used in inclined and horizontal wells and provide effective opening of the productive formations in the right direction. In addition, perforation systems allow to choose the phasing of shaped charges for perforation of V-shaped-type holes. The maximum length of one section is 2 m.

### Charge phasing



### Advantages:

- fast and easy assembly;
- provide for combined perforation with different types of shaped charges;
- high level of safety;
- increased efficiency;
- no additional manipulations for charge orientation required.

## Capsule-type expendable perforation system Link43-AT, Link54-AT



Characteristics	Link43-AT	Link54-AT
Outer diameter, mm	46	57
Min drift diameter, mm	50	62
Max allowable hydrostatic pressure, MPa	103.5	
Min allowable hydrostatic pressure, MPa	0.1	
Max operating temperature, °C (exposure for 1 hour)	204	
Charge phasing, degree	60	
Perforation density, holes/m	20	
Max length of the perforator, (a set for 200 shots), mm	10966	10997
Weight of the perforator, (a set for 200 shots), kg	39	49

### Application

These perforation systems are used for the perforation of casing, tubing and drill pipes in non-aggressive environments, they are designed for opening of productive formations in wells filled with water, oil or flushing fluid, when the tubing is lowered and the wellhead is sealed.

### Advantages:

- provide for placing heavier charges with greater penetration depth as compared to small hollow-carrier systems;
- provide for operation in a well with a small diameter with a deviated wellbore and local deformations in the casing string.

## Capsule-type perforation system Strip43-AT, Strip54-AT with a retrievable carrier (strip)



Characteristics	Strip43-AT	Strip54-AT
Outer diameter, mm	46	57
Min drift diameter, mm	58	62
Max allowable hydrostatic pressure, MPa	103.5	
Min allowable hydrostatic pressure, MPa	0.1	
Max operating temperature, °C (exposure for 1 hour)	204	
Charge phasing, degree	0	
Perforation density, holes/m	20	
Length of a one-section perforator, mm	1370	1400
Weight of a one-section perforator, kg	6.3	8.6

### Application

The perforation systems of this type are designed for opening formations in oil, gas and other wells, fixed with a casing string and filled with water, oil or flushing fluid, by creating channels in the rock in order to form a hydrodynamic connection between the formation and the well, when the tubing is lowered and the wellhead is sealed, including the cases of the pressure drawdown and the lowered level of liquid in the well.

### Advantages:

- the retrievable carrier allows to minimize clogging of the well with perforator fragments;
- can be used at low hydrostatic pressures;
- the perforator is characterized by an increased penetrative power as compared to small hollow-carrier systems.



## Protective electric detonators



Characteristics	EDPN-M	PVPD-N
Height of the device, mm	87	82
Electrical impedance, ohm	0.5–1.0	
Safe current of electric detonator impulse within 5 min, A	0.18±0.01	
Humidity resistance at relative humidity (97.5±0.25)% and temperature (+25±10)°C, h	24	
Thermal stability for 2 hours, °C	150±5	145±5

### Application

JSC “BVT” supplies electric detonators EDPN-M and PVPD-N, designed to initiate the detonating cords in shaped charge perforation systems. The devices are used in blast and perforation operations in oil and gas wells to develop reservoirs or perform geophysical surveys.

### Advantages:

- high reliability and safety;
- resistance to dynamic loads, shaking and falling.

## Detonating cord



Characteristics	DETO CORD RDX	DETO CORD HMX	DShS 160	DShS 200	DShT 200	DShTV 150/800
Explosive weight	19	19	19	19	22	33.5
Heat resistance, °C	170	200	160	200	190±10 during 5 h	+150
Freeze resistance, °C	-60	-60	-50	-50	-50 during 2 h	-45
Detonation speed, m/s minimum	7700	8000	7500	7800	7200	7500
Outer diameter	5.3+/- 0.2	5.3+/- 0.2	5.3 +/- 0.2	5.3+/- 0.2	6.0-0.35	5.6+/-0.1
Sheath material	Zytel	Zytel	Poyamide	Polyamide	Polyethylene	Polyethylene
Sheath colour	Dark-blue (black)	Green	Orange	Red	Semitransparent	Red
Explosive type	RDX	HMX	RDX	HMX	HMX	RDX
Water resistance at 30 °C, h	+	+	+	+	-	+

### Application

The detonating cord is indented for the application in capsule and hollow carrier gun perforating systems during BPO and technological operations in oil and gas wells.

## Detonation transmission device



### Application

Detonation transmission devices (DTD) are designed to transfer a detonating impulse between sections in multisection hollow-carrier expendable jet perforation systems during BPO in oil and gas wells. DTD are used in combination with a detonating cord.

Characteristics		DTD
Outer diameter		7.2±0.2
Length, max., mm		35±0.1
Explosive weight		0.75
Inside case diameter, mm		6.45
Weight of one DTD, g		1.8
Max allowable operating temperature at hold time of 2 hours, °C		195
Maximum air space that guarantees transmission of detonation impulse between two DTDs, mm	axial position	20
	axial offset 4 mm	10

### Advantages:

- high heat resistance (withstand +195 °C for 2 hours);
- compact size and easy-to-handle shape of the body;
- compatibility with all models of BVT perforation systems;
- resistance to mechanical damage and other external impacts.

## PGN Cartridge



Characteristics	PGN-165	PGN-150
Max allowable operating temperature for 3 hours, °C	165	150
Max allowable pressure for 3 hours, MPa	60	50

### Application

PGN Cartridges are intended for initiation of detonating cords in unsealed blast and perforation equipment (for the initiation of capsule perforation systems).

## Percussion initiator UD BVT



Characteristics	Percussion initiator
Outer diameter	29.0
Explosive weight	1.0(±0.1)
Max allowable operating temperature at hold time of 2 hours, °C	195
Length, mm	56.2(±0.2)
Operational conditions	Leak-proof, air environment
Weight of one percussion initiator, g	259(±5.0)

### Application

The percussion initiator is designed to initiate detonation in an explosive chain of expendable jet guns conveyed on tubing. UD BVT is installed in the firing heads of UFH, MFH, HFH, AFH.

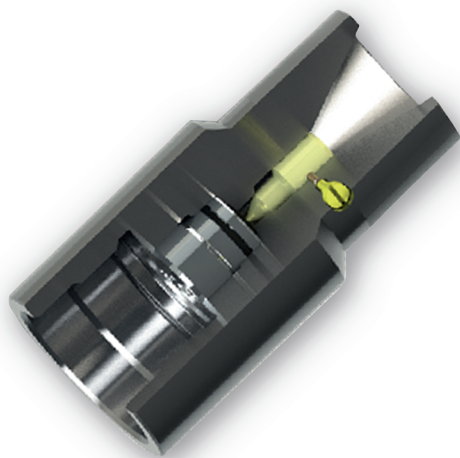
The device is initiated by a shock pulse from the firing head impactor and transfers the detonation to the detonation transmission device (DTD, Booster, etc.).

### Advantages:

- The device does not contain initiating explosives and is characterized by enhanced operational safety.

# COILED TUBING PERFORATION EQUIPMENT

## Mechanical firing head (MFH)



Characteristics	Value
Coupling outer diameter, max, mm	89
Length, max, mm	175
Head weight, max, kg	5.5
Explosive weight, max, g	1
Maximum permissible operating temperature, °C	150
Maximum permissible hydrostatic operating pressure, MPa	80
Maximum permissible zenith angle of an inclined well, °	45
Firing head lifetime	5 shots

### Application

MFH triggers shaped-charge perforators conveyed on tubing in oil and gas wells filled with water, oil or other flushing fluid.

The firing head operates with perforation systems **PKO89-AT**, **PKO102-AT**, **PKO114-AT**. The head is triggered mechanically.

### Advantages:

- can be used in vertical and inclined wells with a zenith angle up to 45°;
- increased safety provided by the design features of the head itself, the percussion device and the detonation device included in it, which do not contain initiating explosives;
- reliable operation provided by the design of the percussion device and the detonation device;
- workability after continuous exposure to high pressure and temperature.

## Universal firing head (UFH)



### Application

UFH triggers shaped-charge perforators conveyed on tubing in oil and gas wells filled with water, oil or other flushing fluid.

The firing head is compatible with the perforating systems **PKO 63-AT, PKO 73-AT, PKO 89-AT, PKO 102-AT, PKO 114-AT** in a firing circuit beginning with a percussion initiator PI BVT or another device similar to the PI in its susceptibility to detonation. The firing head is activated mechanically (hydraulically).

### Advantages:

- increased handling safety provided by the design of the firing head;
- reliability provided by the design of the head and the percussion initiator PI BVT;
- workability after a long exposure to high pressure and temperature;
- efficient operation in the wells of any curvature: vertical, horizontal and directional;
- possibility of creating depression in the hydraulic system of the well and the reservoir, if necessary;
- accidental actuation is excluded when the charged head is at the wellhead at a pressure not exceeding 1.5 MPa;

- compatibility with any equipment used in perforating systems (adapters, sludge traps, etc.);
- a reliable fuse excludes the possibility of accidental initiation of the layout by geophysical equipment;
- possibility of flushing the well through the circulation holes, possibility of formation fluid entering the tubing after perforation.

Characteristics	Value
Coupling outer diameter, mm, max	76 (89)
Length, mm, max*	480
Head weight, kg, max	12
Weight of the blasting explosive, max, kg	1.1
Maximum permissible operating temperature, 0 °C**	150 (204)
Maximum permissible hydrostatic operating pressure, MPa**	80 (103.5)
External hydrostatic pressure that does not cause head triggering, MPa	1.5
Minimum external hydrostatic pressure ensuring reliable head triggering, MPa	5
The maximum permissible deviation angle of a directional well, that allows to initiate the UFH with a drill stem, °	45
Firing head lifetime	5 shots

\* Outer diameter for PKO63-AT, PKO73-AT is 76 mm.

Outer diameter for PKO89-AT, PKO102-AT, PKO114-AT is 89 mm.

\*\* For the UFH versions designed for the pressure up to 103.5 MPa and temperature up to 204 °C marked as HP.

## Hydraulic firing head on absolute pressure (HFH)



### Application

Triggering the tubing type jet perforators in the wells filled with water, oil or other drilling fluid.

The firing head is compatible with the perforating systems **PKO 63-AT, PKO 73-AT, PKO 89-AT, PKO 102-AT, PKO 114-AT** in a firing circuit beginning with a percussion initiator PI BVT or another device similar to the PI in its susceptibility to detonation. The firing head is activated mechanically (hydraulically).

**JSC “BVT” supplies the following types of firing heads on absolute pressure:**

**Non-drained:** initiated by tubing pressure, without the connection between the tubing and the annulus before and after HFH operation:

- **BVT131.200.000-22** is designed to initiate PKO63-AT, PKO73-AT, PKO89-AT, PKO102-AT, PKO114-AT for the works on NKT-60;
- **BVT131.200.000-25** is designed to initiate PKO63-AT, PKO73-AT, PKO89-AT, PKO102-AT, PKO114-AT for the works on NKT-73.

**Drained, non-flow-through:** initiated by tubing pressure, after the operation

the tubing is connected with the annulus:

- **BVT131.200.000-20** is designed to initiate PKO63-AT, PKO73-AT, PKO89-AT, PKO102-AT, PKO114-AT for the works on NKT-60;
- **BVT131.200.000-23** is designed to initiate PKO63-AT, PKO73-AT, PKO89-AT, PKO102-AT, PKO114-AT for the works on NKT-73.

**Drained, flow-through:** initiated by tubing pressure generated when the HFH circulation holes are sealed by pumping the ball; there is the connection between the tubing cavity and the annulus initially:

- **BVT131.200.000-21** is designed to initiate PKO63-AT, PKO73-AT, PKO89-AT, PKO102-AT, PKO114-AT for the works on NKT-60;
- **BVT131.200.000-24** is designed to initiate PKO63-AT, PKO73-AT, PKO89-AT, PKO102-AT, PKO114-AT for the works on NKT-73.

### Advantages:

- increased handling safety provided by the design of the firing head;
- reliability provided by the design of the head and the percussion initiator PI BVT;
- workability after a long exposure to high pressure and temperature;
- efficient operation in the wells of any curvature: vertical, horizontal and directional;
- possibility of creating depression in the hydraulic system of the well and the reservoir, if necessary;
- possibility of perforating two intervals or one double-density interval in one trip;
- possibility of acid treatment, well flushing, reservoir testing after perforation.



## Technical Specifications:

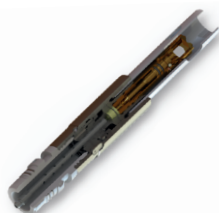
Characteristics		Non-drained		Drained, non-flow-through		Drained, flow-through	
		BVT131.200.000-22	BVT131.200.000-25	BVT131.200.000-20	BVT131.200.000-23	BVT131.200.000-21	BVT131.200.000-24
1	Coupling outer diameter, mm - for PKO63-AT, PKO73-AT, - for PKO89-AT, PKO102-AT, PKO114-AT	76 89					
2	Length, mm - for PKO63, PKO73, - for PKO89, PKO102, PKO114	479 460	499 480	545 526			
3	Weight, kg - for PKO63, - for PKO73, - for PKO89,102,114	12.3 11.8 13.2	12.7 12.2 13.5	14.2 13.7 15.1	14.1 13.7 15	13.8 13.3 14.7	14 13.4 14.8
4	Weight of the blasting explosive, max*, g	1,1					
5	Pin shear pressure**, MPa	2,6					
6	Max number of pins, pcs	36					
7	Min hydrostatic operating pressure, MPa	5					
8	Maximum hydrostatic operating pressure, MPa	80					
9	Deviation of actuation pressure from the design pressure, %	±5					
10	Actuation pressure injected by the unit into the well to initiate the perforation system top assembly (single-layout scheme), MPa	+7 to hydrostatic					
11	Actuation pressure injected by the unit into the well to initiate the perforation system middle (lower) assembly (two-layout scheme), MPa	+6 to hydrostatic					
12	Max allowable operative pressure, °C	150					
13	Firing head lifetime, min, shots***	5					

\*The blasting explosive in the percussion initiator UD BVT. The percussion initiator UD BVT is not included in the scope of delivery and shall be ordered separately.

\*\* The minimum number of pins to be installed at the minimum hydrostatic operating pressure (5 MPa) is 5 pcs.

\*\*\* In case of operation in a well with an aggressive environment, the firing head resource can be reduced down to one shot. After each shooting, check the surfaces under the sealing rings to determine if the head can be used further.

## Automatic release firing head (AFH)



### Application

AFH triggers shaped charge perforators in vertical and inclined wells filled with water, oil or other drilling fluid and ensures their automatic release after initiating. The firing head is designed for the tubing with the inside diameter not less than 62 mm (the AFH is initiated by the ball) and the inside diameter not less than 55 mm (the AFH is initiated by the drill stem or the pressure).

The firing head is compatible with the perforating systems **PKO 73-AT, PKO 89-AT, PKO 102-AT, PKO 114-AT** in a firing circuit beginning with a percussion initiator PI BVT or another device similar to the PI in its susceptibility to detonation. The firing head is activated mechanically or hydraulically.

### Advantages:

- workability in case of tubing rotation;
- increased handling safety provided by the design of the firing head;
- reliability provided by the design of the head and the percussion initiator PI BVT;
- workability after a long exposure to high pressure and temperature;
- efficient operation in vertical, horizontal and directional wells with the zenith angle up to 45°;
- possibility of flushing the well and possibility of formation fluid entering the tubing after perforation;
- the possibility of extracting the device from the tubing cavity for well logging and (or) hydraulic fracturing after initiating the perforator and its automatic release;

Characteristics	Initiating by the drill stem	Initiating by the ball	Initiating by the pressure
	BVT131.300.000-03	BVT131.300.000-04	BVT131.300.000-05
AFH outer diameter, mm	93		
Length, mm	508	550	568(598)*
Firing head weight, kg	13.2	14.1	16.1(16.2)*
Weight of the blasting explosive, max*, g	1.1		
Minimum hydrostatic pressure ensuring reliable operation of PI BVT, MPa	5		7.2
Pin shear pressure, MPa	-		3.6
Max number of pins, pcs	-		24
Min hydrostatic operating pressure for two steel pins, Mpa	-		7.2
Deviation of actuation pressure from the design pressure, %			±5
Actuation pressure injected by the unit into the well to initiate the perforation system top assembly, Mpa	-		+7
Max allowable hydrostatic operating pressure, MPa	80		
Max allowable hydrostatic operating temperature, °C	150		
Max drift diameter after releasing the perforation system, mm	62	55	62
Firing head lifetime	1 shot		
Max carrying capacity	30		
Maximum torque transmitted through AFH from tubing to the perforating system, N*m	800		

\* When using a nozzle BVT 132.300.005-07

## Hydraulic-mechanical release device (HRD)



Characteristics	NKT-73-G
External diameter	89
Length, max, mm	393
Weight, kg	9.21
Inner drift diameter before triggering, mm	50
Inner drift diameter after triggering, mm	62
Max allowable hydrostatic operating temperature, °C	150
Max allowable hydrostatic operating pressure, MPa	80
Activation pressure, min, Pa	20
Maximum bearing capacity, t	20
Maximum torque transmitted via AFH from tubing to PKO, N*m	2000

### Application

HRD enables the release of the perforation system into the well after shooting. The product triggers perforation assemblies conveyed on tubing with a diameter of at least 62 mm.

The device is used during BPO in vertical and inclined wells filled with oil, water or other flushing fluids.

### The release device works as follows:

- The perforation system is triggered (by drop bar/ball).
- If necessary, the ball is not dropped into the hole, after that the perforation system is removed from the well.
- Otherwise, after the ball is dropped, the perforation system is released. Later, geophysical exploration of wells and/or hydraulic fracturing is possible.

## Differential sub



### Application

The differential sub creates dynamic depression when operating perforating systems conveyed on tubing into the wells filled with oil or other liquid.

Characteristics	DS-1
External diameter, mm	89
Maximum permissible hydrostatic pressure, MPa	68.5
Length, max, mm	353
Head weight, max, kg	7.6

### Advantages:

- can be used in inclined and vertical wells;
- creates depression in hydraulic systems and collector layers of wells;
- the well can be washed through circulating holes; formation fluid enters the tubing after perforation;
- the ceramic membrane has enhanced resistance to pressure — unlike glass discs, ceramics breaks into smaller pieces;
- quick assembly and disassembly of the devices.

## Sludge trap



Characteristics	Value			
	BVT208.000.000	BVT208.000.000-01	BVT208.000.000-02	BVT208.000.000-03
External diameter, mm	89			73
Length, mm	267			245
Weight, kg	4.7			2.7
Top thread, collar	NKT73 smooth	NKT73 smooth	NKT73 upset	NKT60 smooth
Bottom thread, nipple	NKT73 smooth			NKT60 smooth
Central hole diameter, mm	65	70	71	55
Central hole area, mm <sup>2</sup>	3320	3850	3960	2380
Total area of the circulation holes, mm <sup>2</sup>	4420			3420

### Application

Sludge trap prevents clogging of the firing heads during BPO and to ensure their correct triggering. The device is a specialized filter with the circulating holes that provide connection between the tubing and the annulus.

### Advantages:

- the glass disk of the sludge trap serves as a barrier for debris, but does not create a pressure difference between the tubing and the annulus;
- the total diameter of the circulating holes exceeds the section area of tubing;
- the product is durable and easy to assemble.

The sludge trap is compatible with all models of firing heads produced by BVT.

## EQUIPMENT FOR REPAIR AND RENEWAL OPERATIONS

### Explosive packer (EP)



Characteristics	EP-88	EP-92	EP-102	EP-110	EP-118	EP-135	EP-146
Weight, kg	5.2	6.3	7.9	9.6	11.6	15.7	19.0
Outer diameter Ø, mm	88	92	102	110	118	135	146
Length, mm	475.0	490.0	535.0	570.0	605.0	605.0	630.0
Internal Ø of casing pipe, mm	96.3–98.3	100.3–102.3	109.0–115.0	117.7–124.0	125.2–133.0	144.0–152.0	156.0–164.0
Max hydrostatic pressure difference in the parts of the well separated by a packer, MPa	15						

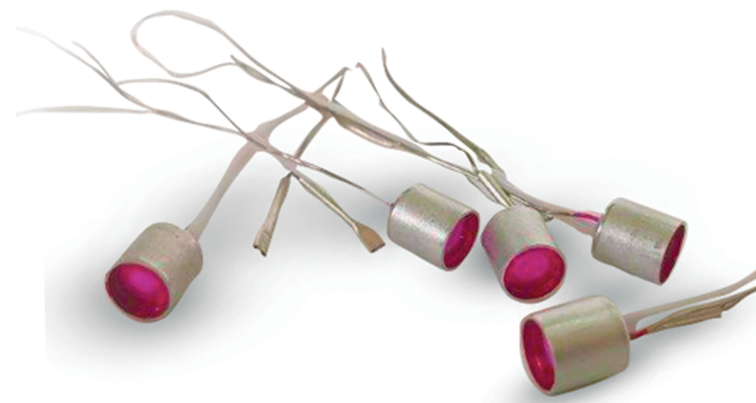
#### Application

Explosive packers are used to install drillable bridges in fixed well intervals.

#### Advantages:

- automatic disconnection of a cable cap from the packer installed in the well;
- seven standard sizes for the main diameters of casing strings.

### Electrical ignitors and pyrotechnic cartridges



Characteristics	PPT-230	EP-PT-Gr	TEZ-ZP
Electrical impedance, ohm	0.8–2.0	0.8–1.5	1.5–4.0
Max allowable pressure at hold time of 6 hours, °C	230	270	165
Safe current, A	1.5	1.0±0.02	1.0±0.02
Safe current, A	0.05	0.05±0.005	0.05±0.005

#### Application

Electrical ignitors and pyrotechnic cartridges are designed to ignite powder charges of packers during blast and perforation operations, repair and insulation works.

## Slips explosive packer (SEP)



Characteristics	SEP 82	SEP 92	SEP 97	SEP 102	SEP 110	SEP 118	SEP 135	SEP 146	SEP 162	SEP 182	SEP 203
Max temperature, C	150										
Max permissible hydrostatic pressure, MPa	150										
Weight, kg	6.2	8.6	9.6	10.5	14.0	16.5	22.5	26.5	40.0	50.3	56.0
Outer diameter, mm	82	92	97	102	110	118	135	146	162	182	203
Length, mm	375	415	410	410	465	465	530	515	580	595	630
Max hydrostatic pressure difference in the parts of the well separated by a packer, MPa	50	50	50	50	50	50	40	30	30	30	30
Min internal diameter of casing pipe, mm	88	98	105	109	117	125	144	154	170	195	220
Max internal diameter of casing pipe, mm	96	104	109	118	124	133	152	164	180	205	228

### Application

Slips packers are used to install drillable bridges in fixed well intervals. This equipment is used to separate cased intervals and pipes in exploration, production and injection wells, isolate layers from water or separate a particular perforation interval when analyzing the technical characteristics of a string.

### Advantages:

- lowering into the well on cable and pipes;
- good permeability in the well due to the reduced outer diameter;
- setting in the well regardless of the depth;
- unification with other types of explosive devices;
- the possibility of liquidation by drilling out;
- has original design features that increase safety of restoration and repair activities.



## Axial action jet torpedo



Characteristics	TKOT 38-800/ 150	TKOT 38-1500/ 150	TKOT 60-800/ 150	TKOT 60-1500/ 150	TKOT 70-1- 800/ 150	TKOT 70-1000/ 150	TKOT 120-1- 600/ 120
Max temperature, C	150	150	150	150	150	150	120
Max permissible hydrostatic pressure, MPa	80	150	80	150	80	100	60
Outer diameter, mm	38	38	60	60	70	70	120

### Application

The equipment is designed to make a directed explosion to destroy foreign metal, bits and their parts, couplings, wedges and other objects that impede the drilling process.

The elements that cannot be removed and interfere with further passage of the drill (metal, bits and their parts, couplings, wedges and other objects) often remain in the well during the drilling process. Axial action jet torpedoes are used to eliminate such elements.

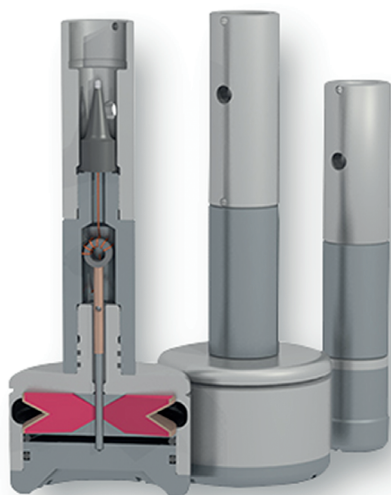
The purpose of the equipment is to eliminate obstacles in the way of the drill head or pipe and clear the well. The torpedoes are also used to eliminate the consequences of accidents at hydrocarbon fields and to restore wells. The torpedo has a streamlined shape, contains a fuse and an explosive element.

Several sizes of torpedoes are available, they are used depending on the type of an obstacle and the size of clogging. The outer diameter of the equipment varies from 38 to 120 mm.

### Advantages:

- fast and safe elimination of obstacles in wells;
- work efficiency improvement and time saving;
- reduction of the costs for restoration and repair operations;
- clever design ensuring the directional action;
- reliable control.

## Jet pipe cutter JPC



Characteristics	JPC 45	JPC 55	JPC 68	JPC 75	JPC 85	JPC 90	JPC 110	JPC 118	JPC 135	JPC 146
Explosive weight, g	11.6	25.4	42.0	63.0	102.4	102.4	243.0	243.0	318.4	318.4
Outer diameter, mm	45	55	68	75	85	90	110	118	135	146
The pipe to be cut: outer diameter, mm	60	73	89	102	114	114	140	146	168	178
Max wall thickness, mm	5.0	5.5	6.5	6.5	10.0	9.0	10.0	10.0	10.0	10.0
Type	NKT	NKT	NKT	NKT	drill	casing	drill casing	casing	casing	casing

### Application

JPC is used to cut casing, drilling and tubing pipes in the wells with hydrostatic pressure up to 80 MPa and temperature up to 150 °C. The weight of the charge of the jet pipe cutter is significantly less than the weight of demolition torpedoes traditionally used for pipe breakage, which guarantees minimal side effects, providing pipe breakage with less deformation.

The equipment is used to cut tubing, casing and drill pipes with hydrostatic pressure up to 80 MPa, temperature up to 150 degrees and external upset end-holes. The pipe cutters are used in dry wells, as well as in the wells filled with liquid and gas. Pressure and temperature limits may vary for different sizes.

### Advantages:

- the weight of charges of jet pipe cutters is much less in comparison with demolition torpedoes traditionally used for pipe breaking, which ensures minimal side effects;
- high pressure of the explosive impulse ensures a clean pipe cut, almost without deformation;
- efficiency, reliability, and time saving when cutting pipes;
- a wide range of sizes allowing to choose an optimal size of a pipe cutter in accordance with current conditions.

## Jet pipe cutter TK-C



Characteristics	TK-C44	TK-C54	TK-C67	TK-C108	TK-C115
Max permissible hydrostatic pressure, MPa	80				
Outer diameter, mm	44	54	67	108	115
Max allowable pressure at hold time of 6 hours, °C	150				
Type of the pipe to be cut	NKT	NKT	NKT	drill, casing	drill, casing
Nominal diameter, mm	60	73	89	140	146
Wall thickness, mm	5	5,5	5	8...11	8...11
Explosive weight of the shaped charge, g, max	11.6	25.4	42.0	63.0	102.4

### Application

The device is designed for cutting tubing, casing and drilling (external upset) pipes in wells. The device is conveyed on a logging cable. The pipe cutter is initiated by a PCN-150 explosive cartridge.

The equipment is designed for cutting pipes in wells. Tubing, casing, and drill pipes are cut. Due to the high pressure of the blast wave, the TK-C pipe cutter provides an even cut of the pipe without its deformation. The equipment is initiated by an explosive cartridge. The equipment is conveyed into the wells on a logging cable.

### Advantages:

- effective cutting of any types of pipes used in wells;
- acceleration of production, cost and time savings at oil, gas and condensate fields;
- reliable engineering design;
- high level of security;
- trouble-free operating principle;
- a wide range of standard sizes depending on the type and diameter of pipes.

## Mechanical disconnecter



### Application

The disconnecter is installed in assemblies conveyed on tubing, between the instrument part of the assembly and the perforating system, and is designed for emergency disconnection of these parts in case of an emergency (for example, sticking of the perforating system).

### Advantages:

- after disconnection, it ensures tightness of sections of the perforation systems.

Characteristics	Value
Outer diameter, mm	70
Connection threads	M48x3/ 1,625-6TPI-ACME, M48x3 / M48x3,
M30x2 / M48x3	6
Weight, max, kg	6
Minimum breaking force, kg	500
Minimum quantity of the installed pins allowed, pcs.	2
Maximum breaking force, kg	4000
Max quantity of the installed pins allowed, pcs.	16
Step of the breaking force increase when adding one pin, kg	250
Maximum allowable operating temperature, °C	150
Operating environment	Water, oil, gas, water-oil emulsions
Lifetime, applications*	3
Weight, kg	5.1

\* If the spare parts from the repair kits are used

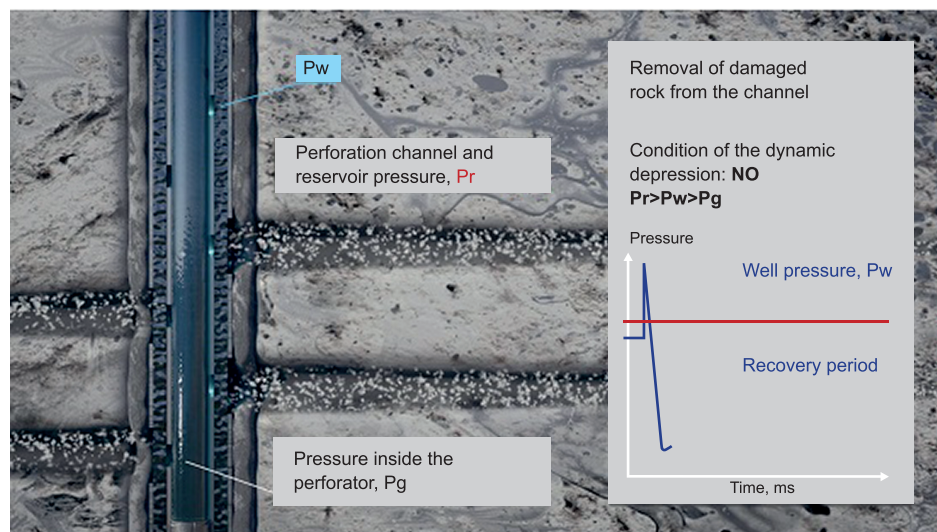
## Perforation on dynamic depression technology $\Delta P$ (DeltaP)

### Application

The technology is a highly effective method for removing damage (high-density zone) of the perforation channel when perforating with jet guns, and for achieving better productive capacity or injection rate.

### Operating principle

After the action of the shaped charges is over, the process of abrupt filling (collapse) of the implosion chambers and the internal cavities of the perforation gun with the well fluid begins — a high-speed impulse of dynamic depression is formed, a compacted rock crust with reduced permeability is detached from the surface of the channels.

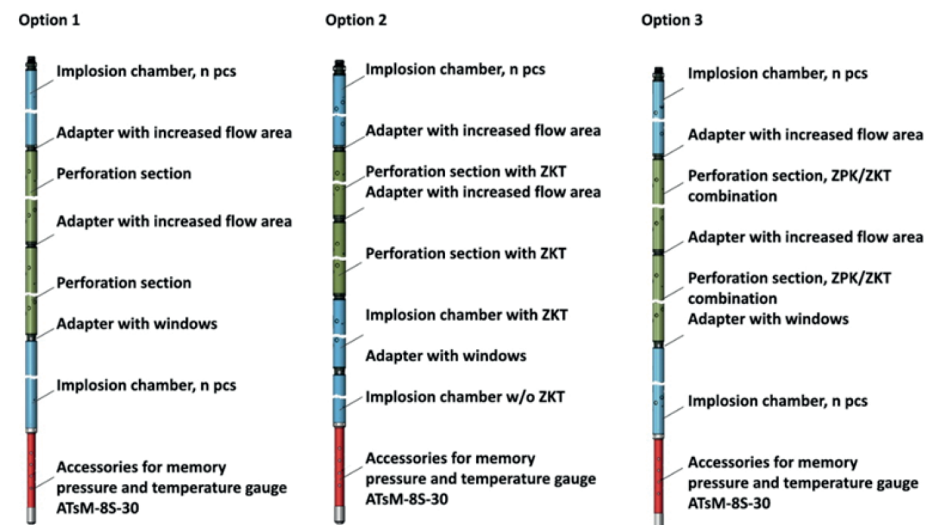


### Advantages

If a perforation system on dynamic depression is used, the rock permeability in the high-density zone compared to the undisturbed formation zone can be close to 1.0, in contrast to 0.05–0.3 typical for perforation on static depression.

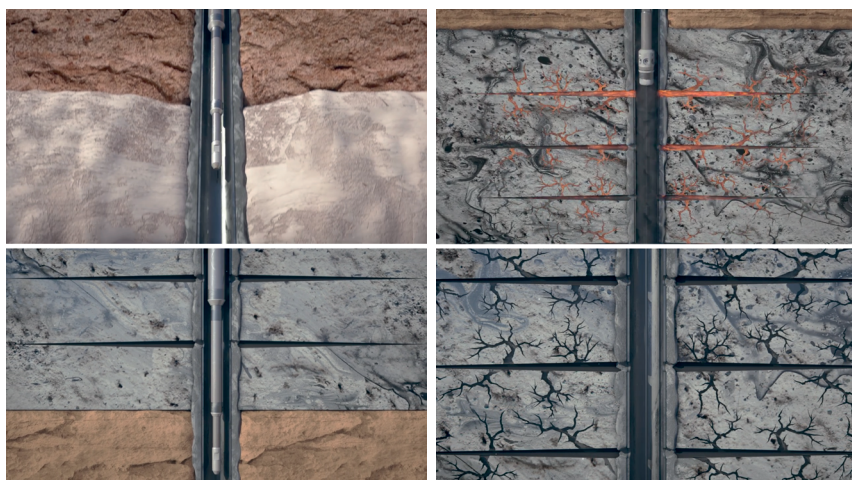
### Perforation technology on dynamic depression DP (DeltaP) can be used for:

- perforations on wireline;
- perforations on tubing;
- perforation of several intervals with different (different from each other) permeability.





## The technology of high-energy gas-dynamic fracturing using solid fuel pressure generators (TGDU)



Characteristics	TGDU-105	TGDU-85	TGDU-65	TGDU-55	TGDU-40
Charge type	ZGTD-105	ZGTD-85	ZGTD-65	ZGTD-55	ZGTD-40
Explosive weight,kg	7.1	5.1	2.9	1.9	0.9
Max. temperature, C	200				
Outer diameter,mm	105	85	65	55	40
Max permissible hydrostatic pressure, MPa	80				
Inner diameter of the sleeve, mm	16				
Length, mm	500				

### Application

The technology is used to intensify the production capacity, increase the injection capacity, obtain reliable data on the potential of productive formations of various wells.

### Tasks

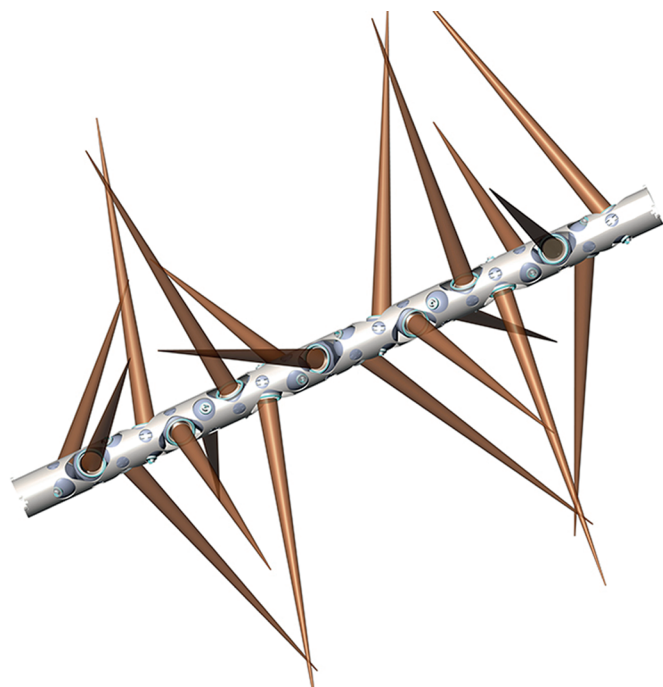
Hydrogasdynamic fracturing, increasing reservoir properties of reservoir rocks by forming a system of residual cracks and cleaning the well site.

### Scope:

- Treatment of medium and low permeability formations at various stages of exploration and exploitation of oil and gas fields;
- Treatment in conjunction with hydrochloric acid to increase efficiency;
- Pre-treatment before hydraulic fracturing to reduce the initial fracturing pressure;
- Treatment of injection wells without the involvement of a workover crew;
- Degassing of gas-bearing coal seams and industrial production of methane;
- Extraction of minerals by underground leaching methods.

### Advantages:

- scientific and high-tech approach to the intensification of hydrocarbon production;
- real savings compared to the hydraulic fracturing technology (does not require the delivery of a large amount of equipment to the well, which is especially important for remote fields);
- obtaining reliable data on the potential of productive formations;
- safety for the well and the personnel;
- efficiency, mobility;
- interoperability.



## CLUSTER technology

### Application

The CLUSTER technology is designed to increase the efficiency of BPO for well completion with stimulation.

### It is recommended for the BPO aimed at:

- hydraulic fracturing (the Cluster system can show particular efficiency in selective cluster perforation using the Plug&Perf technology in horizontal sections of wells as part of multistage hydraulic fracturing);
- gas-dynamic stimulation.

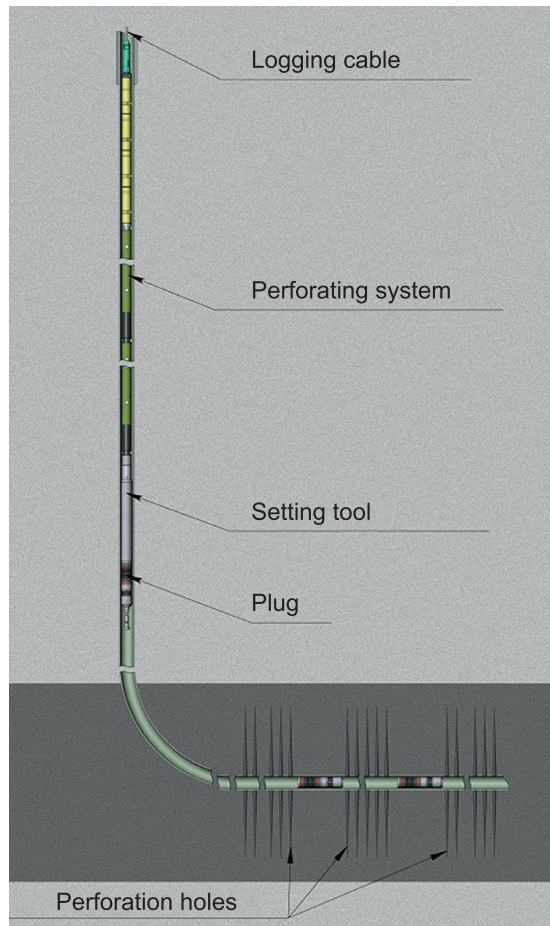
### • Due to the possibility of grouping the types of charges and the angular deviation of their axes, this constructive solution allows to:

- provide a high concentration of perforation channel endings in a volume, which is more than 2.6 times smaller as compared to the standard perforation systems with a combination of charge types. This forms a zone with higher concentration of rock damage by the channels of jet streams — stress concentrators.
- as a result of a closer location of the ends of several channels to each other, increase the probability of connecting the systems of cracks of these channels via the shortest distances and forming a three-dimensional system of cracks hydraulically connected to each other.

The mathematical model and design of the CLUSTER perforating system allow to select the most optimal configuration based on specific technical requirements for the results by varying and selecting shaped charges with different penetration patterns, changing them in different versions, changing the inclination angles and phasing of the perforating gun.

### Advantages

CLUSTER shows almost 2.7 times greater efficiency compared to the standard perforation system due to providing a higher density of channel concentration both in the volume and in the length of the perforation interval.



## Plug&Perf perforation technology

### Application

The perforation by the Plug&Perf technology is designed for secondary drilling of several intervals with the installation of a plug during MSHF. The technology allows to run an assembly which includes up to twenty sections of perforation systems during one trip.

### The Plug&Perf perforation technology can be used for:

- wireline perforation;
- perforation on coiled tubing with a wireline.

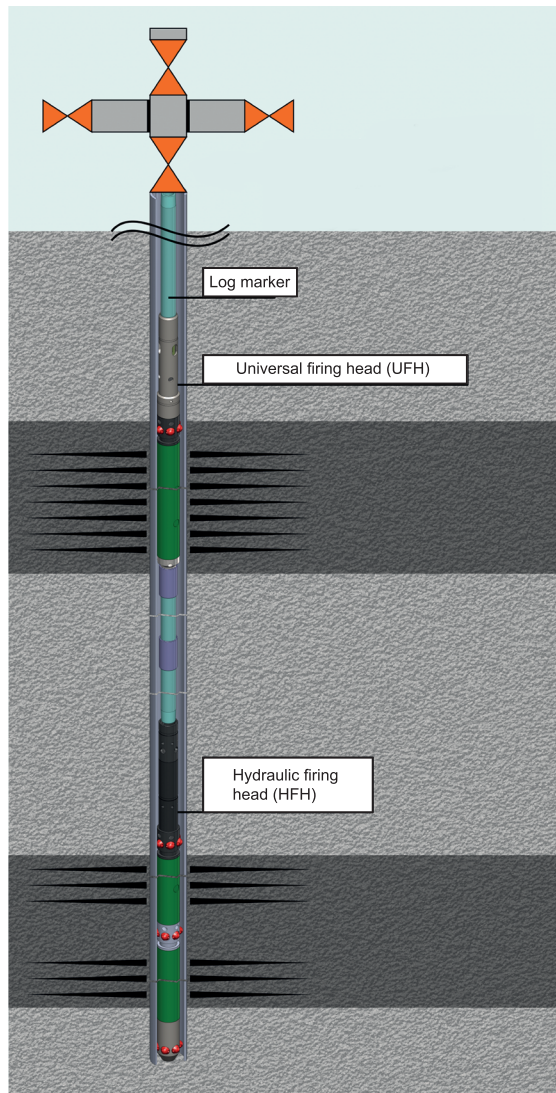
### Operating principle

When working by the Plug&Perf technology, an assembly including telemetric devices, a setting tool with a packer plug and up to 20 sections of the perforation system is run at once to open MSHF intervals. The initiation is managed by means of addressable electronic keys.

### Advantages:

- the equipment used for perforation allows real-time control of the positioning and initiation of each section of the perforating systems or the landing nipple of the packer-plug;
- increases operational safety;
- reduces the perforation time in multisection systems.





## Perforation technology with two initiating heads

### Application

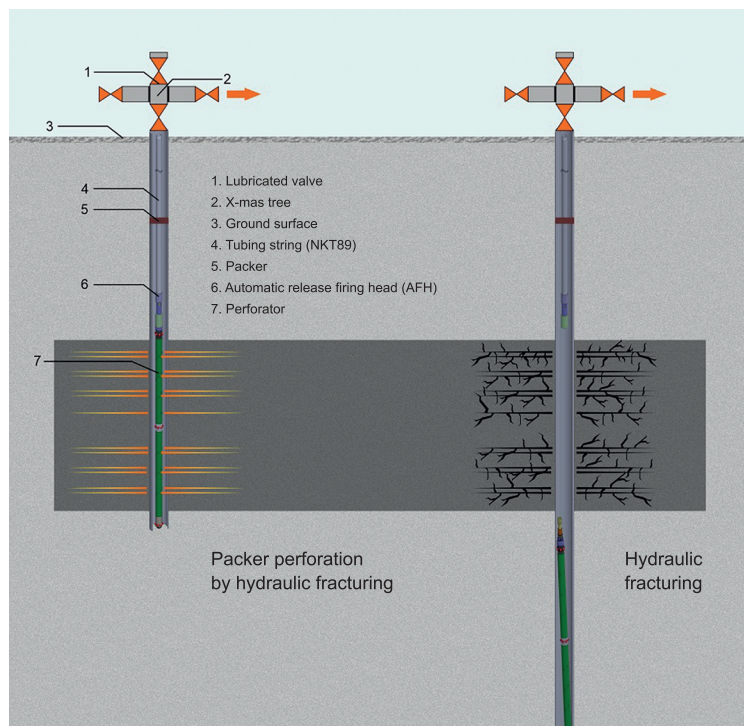
The technology is used when perforating in wells in hydrocarbon fields with increased reservoir pressure and two development areas, as well as in sidetracking wells that require double perforation density.

### Operating principle

When the lower perforator is triggered, pressure is generated (using the TsA-320 unit) in the annulus. The hydraulic impact socket trips due to the increasing pressure of the liquid on the socket piston — the pins are cut off, the striker initiates the impact detonator, then the perforator is triggered.

### Advantages:

- the time required for BPO is reduced by the period of one tripping operation — on average, the time saving is up to 24 hours;
- resources are saved: less well-killing fluid is used;
- well workover costs are reduced.



## The technology of packer perforation followed by hydraulic fracturing or well logging

### Application

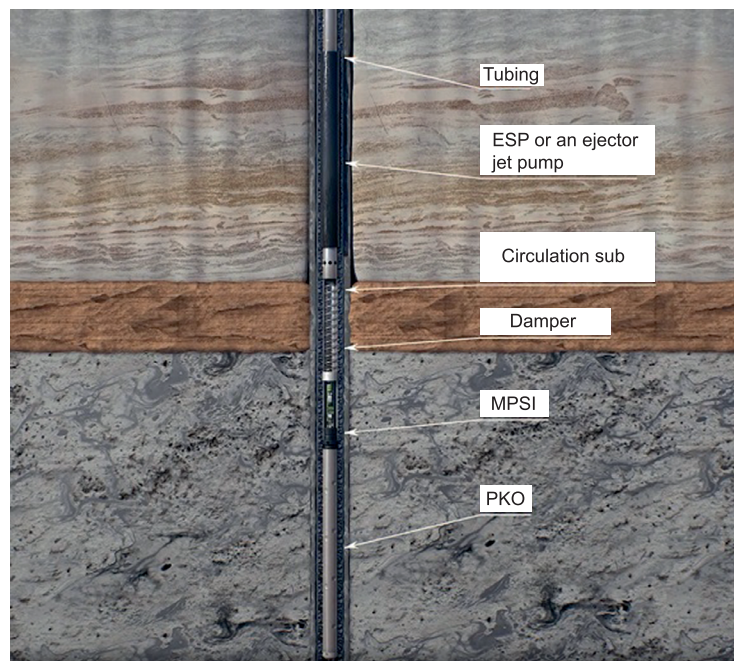
Secondary drilling of the formation, hydraulic fracturing and geophysical surveys are performed in one round-trip operation with subsequent release of perforation systems into the well without the need for subsequent killing.

### Operating principle

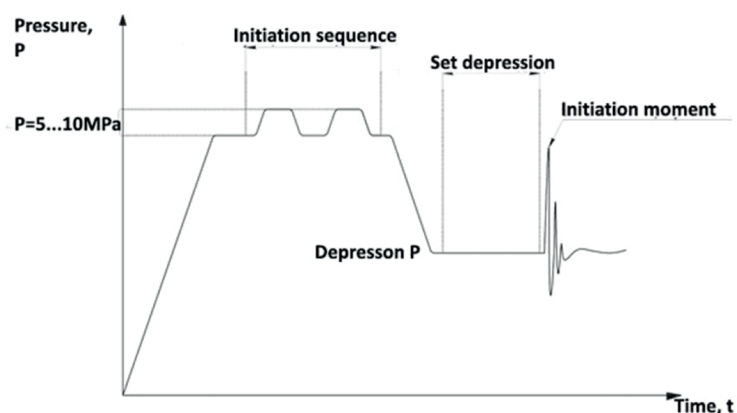
Running the assembly with a packer, logging and perforating system on tubing. Next — setting the packer in the required interval. Activation of the initiating head, perforation with automatic release of the perforation assembly to the bottom with the option of subsequent well logging and (or) hydraulic fracturing.

### Advantages:

- well development time is reduced (by at least 48 hours);
- the consumption of the well-killing fluid is reduced;
- it is possible to work without the involvement of a well workover team for retrieval of tubing strings.



**PRESSURE CHART FOR UNDERBALANCE PERFORATION USING MPSI AND ESP**



## Underbalance perforation technology with subsequent development using an ESP or a jet pump

### Application

Underbalance perforation technology with the assembly initiation using a (MPSI) microprocessor system of initiation and subsequent development using an ESP, ensuring minimal impact on the reservoir during the secondary drilling.

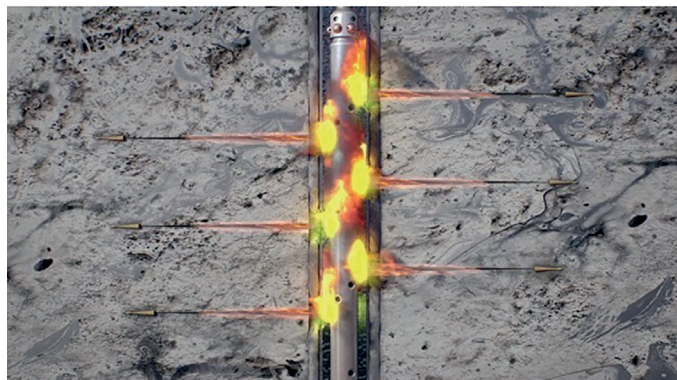
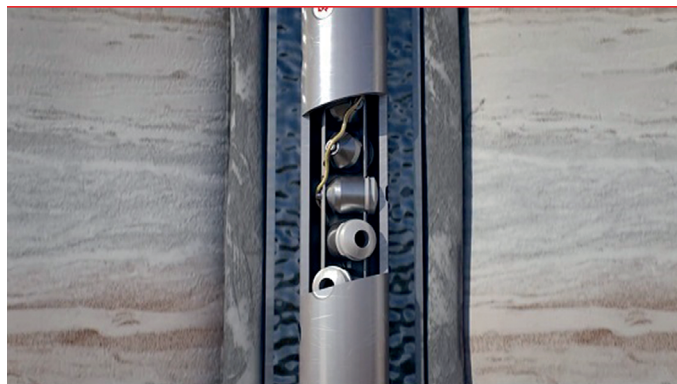
### Operating principle

The perforation system assembly is run on tubing together with the process equipment (ESP). After the installation to a predetermined perforation interval, the MPSI is activated by generating successive pressure pulses. Further, the ESP pump creates a depression, the time for this is determined in the MPSI. When the target level of depression is reached, an explosive chain is initiated. The well development can be started immediately after perforation without additional technological operations.

### Advantages:

- combined trip of the perfosystem and technological equipment;
- perforation and the beginning of development in one trip;
- programming the MPSI for shooting to achieve the required level of depression;
- the option to cancel the initiation at any time;
- can be used with a packer or anchor;
- the possibility of offline data recording before and during perforation.
- the presence of a safety depreciation system to protect the process equipment.





At the stage of pilot work

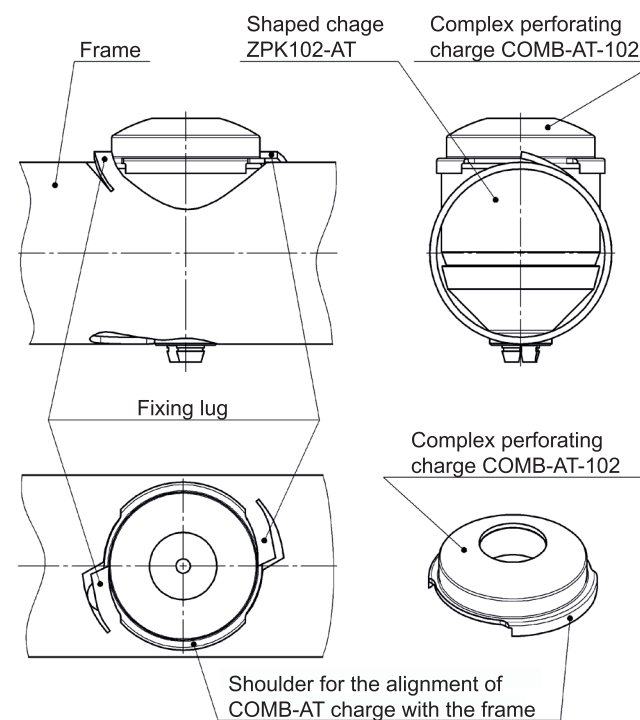
## COMB-AT technology

### Application

The device is designed for the treatment of the bottomhole area in oil, gas and other wells filled with liquid at temperatures up to 170 °C.

It is used in conjunction with shaped charges ZPK102-AT-M as part of the PKO102-AT perforation system in order to increase the filtration area of the channel and intensify the flow of hydrocarbons.

The device is designed to create pressure impulses that impact the productive formation during one gun burst and increase the channel fracturing and, accordingly, increase oil production.



Characteristics	The technology COMB-AT
Max. temperature, °C	150
Perforation density, holes/m	20
Max permissible hydrostatic pressure, MPa	80
Explosive weight, kg	0.01340...0.01345
UN code	1325
Classification Code	4.1
Specific volume of gas release, min, l/kg	700
Combustion temperature of explosive, °C	3200

**Advantages:**

- High efficiency of the technology and reduction of operating costs due to the secondary drilling of the hydrocarbon reservoir and enhancing oil recovery in one trip.
- High reliability and ease of assembly, due to the increased workability of fixing the COMB-AT charges in the frame of the hollow carrier gun without additional fasteners.
- Use of regular perforation systems and frames.

# PERFOLAB

BVT specialists have created software aimed at maximizing the efficiency and safety of secondary drilling by means of shaped charge perforation.

## Advantages and peculiarities of using PerfoLab

The application of software in the area of service technologies in the oil and gas industry is steadily on the rise. New services appear, designed to increase the production process efficiency, and reduce financial and time expenditures. PerfoLab software package belongs to the most advanced software for blast and perforation operations.

Perforation is one of the most important stages of well development, so the prediction of its results, and the choice of the most optimal equipment for each specific task multiply the efficiency of well intervention and the level of oil and gas recovery.

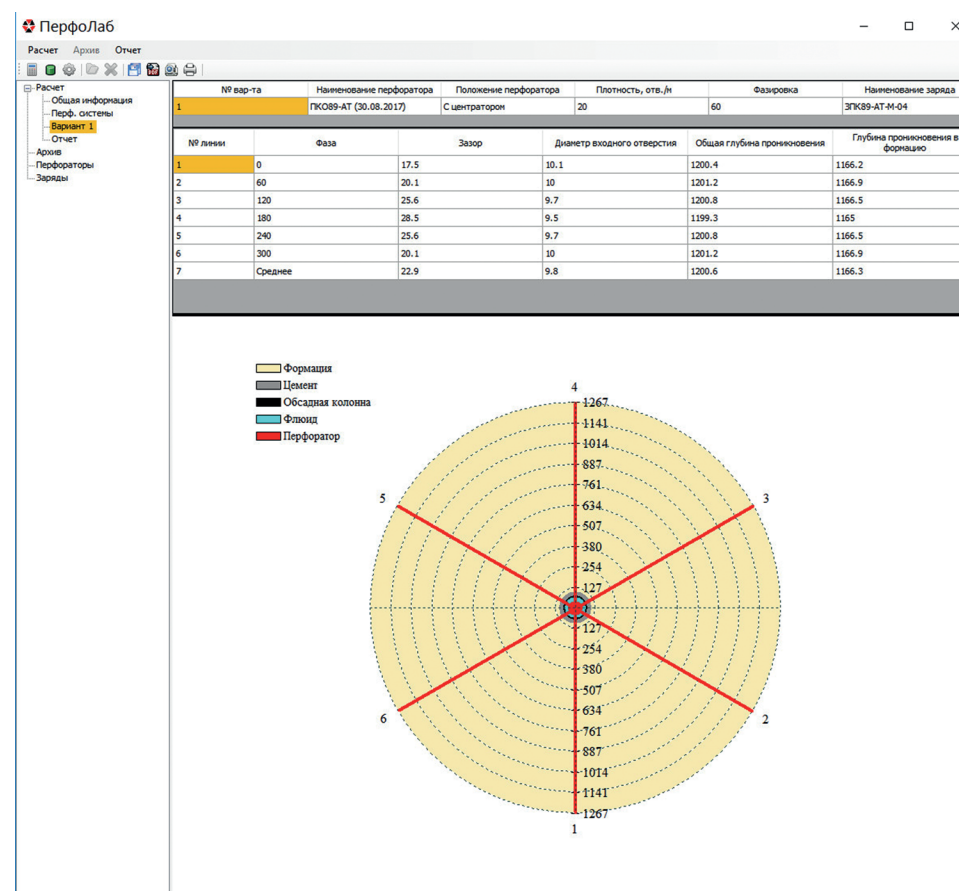
BVT provides its customers with multifunctional software, which helps to choose the best engineering solution for blast and perforation operations at oil and gas condensate fields. The software users can make precise calculation of several options of application of perforation systems (including the oriented perforators) and shaped charges based on the comparison of the performance characteristics, well design and reservoir parameters.

## The following inputs are taken into account:

- types of perforating systems and shaped charges;
- relative position of the perforator and the casing string (are the perforators equipped with centralizers, are the elements on line);
- borehole fluid type and characteristics;
- typical size of the casing string, wall thickness, strength group;
- hardness and density of the cement sheath;
- hardness, density and reservoir features of the formation;
- reservoir pressure.

## PerfoLab software package provides for the following calculations:

- entry hole diameters in the casing string and penetration depth;
- skin factor (one of the critical characteristics of the reservoir);
- reservoir productivity parameters.









**BVT Head Office:**

41 Rabochaya St., Samara, 443041,  
Russia

Phone: +7 (846) 977 10 00  
(multichannel)

[sekretar@bvt-s.ru](mailto:sekretar@bvt-s.ru)

**Representative Office in Moscow:**

6, Presnenskaya nab. St., bld. 2, Moscow, 123112,  
Russia

Phone: +7 (499) 951 06 04  
(multichannel)

[moscow@bvt-vostok.ru](mailto:moscow@bvt-vostok.ru)