



TESTING EQUIPMENT FOR CORE, RESERVOIR FLUIDS AND FRACTURING MATERIALS

02	ABOUT COMPANY
04	THE SCIENTIFIC AND LABORATORY CENTER
08	SERVICE CENTER
09	TESTING SAMPLES PREPARATION
15	STANDARD CORE ANALYSIS
26	SPECIAL CORE ANALYSIS
47	X-RAY ANALYSIS
54	PROPPANT TESTING
59	NON-STANDARD EQUIPMENT
63	«LN» SERIES LABORATORY PUMPS
66	«LN-P» SERIES LABORATORY PUMPS
68	FLUID STUDIES
78	COMPONENTS
93	CONTACT INFORMATION

ABOUT COMPANY

JSC Geologika develops and manufactures classic and innovative equipment for core, reservoir fluids and hydraulic fracturing materials, materials testing adapted to customers' tasks; provides services for unique domestic laboratory equipment development and manufacture and for small-scale and single-unit production; conducts core studies and fracturing materials advanced research; performs geomechanical modeling to ensure well construction and specify hydraulic fracturing design; provides expert and technological support (supervising) for hydraulic fracturing. Being one of the largest domestic manufacturers of laboratory equipment, the Company provides a full cycle of works - equipment design and manufacture, commissioning works, certification, consulting and training customers' personnel, as well as warranty and post-warranty repair.



OUR COMPANY HAS PRODUCED LABORATORY EQUIPMENT SINCE 2004

Main advantages of the Company are the flexibility in technical parameters coordination and laboratory equipment production, the ability to manufacture special laboratory installations with extended performance for non-standard core samples study; equipment development and implementation for highly specialized, innovative and unique types of research.

Research centers of large, medium and small mining and service companies, manufacturers and suppliers of related materials, government educational institutions cooperate with us.

The most popular laboratory installations produced by Geologika JSC are measuring instruments which included in the Rostest State Register:

- The «PIK-UZ» installation for studying elastic core properties at atmospheric conditions
- The «PIK-UES» automated device for measuring core samples electrical resistance
- The «PIK-P» gas-volumetric porosimeter
- The «PIK-PP» automated device for measuring porosity and permeability



JSC GEOLOGIKA

Is located in Novosibirsk Scientific Center (Akademgorodok). Cooperation with institutes of the Siberian Branch of the Russian Academy of Sciences allows to use multidisciplinary scientific and technical potential for solving urgent problems of Russian oil and gas industry.

Close connection with the independent accredited Scientific and Laboratory Center of JSC Geologika, which conducts general and special well core testing and fracturing materials advanced research, allows laboratory equipment engineers and developers to receive detailed feedback on the applicability of certain technological solutions and to configure and modify the equipment for the user's needs in real operating conditions.



OUR CUSTOMERS INCLUDE
MORE THAN

100
COMPANIES

IN RUSSIA
AND ABROAD.

MORE THAN **260** UNITS
OF LABORATORY EQUIPMENT

Over the years of the company's activity, more than 260 units of laboratory equipment have been produced and successfully operated, not counting auxiliary equipment and individual units.

MORE THAN **250** UNITS
LABORATORY PUMPS
OF THE LN SERIES

More than 250 units of precision laboratory pumps of the LN series have been produced since 2004.

MORE THAN **35**
«PIK-PP» DEVICES

The «PIK-PP» device production was launched in 2012, which is included in the State Register of Measuring Instruments. To date, more than 35 «PIK-PP» devices have been delivered.

MORE THAN
70
EMPLOYEES

The JSC Geologika team currently consists of more than 70 employees.

2000 M²
AREA FOR PRODUCTION
AND DESIGN

The production and office space of the Company is about 2,000 m² for today. The Company has its own subdivisions for development, project documentation preparation, programming, service, quality control, implementation, production and an accredited Scientific and Laboratory Center.

The laboratory equipment production begins with detailed consultations with the customer during the project documentation preparation and the development of individual units and equipment as a whole. The Company's Technical Councils are held on a weekly basis, at which technical solutions and equipment for installation are reviewed and approved. The assembly stage, which includes distribution of hydraulic and pneumatic lines and automatization, is followed by the stage of equipment testing for compliance with the technical task requirements and safety rules.

Laboratory testing of well core and reservoir fluids samples in oil and gas fields and hydraulic fracturing materials, engineering services in the well construction design and hydraulic fracturing works.

The Accredited (accreditation certificate RA.RU.21AP85) Scientific and Laboratory Center of JSC Geologika is an independent competent research unit performing general, special and high specialized laboratory testing of well core and reservoir fluids samples in oil and gas fields, hydraulic fracturing materials. The Scientific and Laboratory Center also provides expert and technological support services of hydraulic fracturing works at customer sites.



Testing is performed on laboratory equipment manufactured by JSC Geologika. Cooperation with the production and the Company's Service Center allows to performing preventive maintenance and equipment repairs with factory quality as soon as possible and carry out equipment modernization to meet the needs of our customers.

AREAS OF ACTIVITY

Full-size core processing and testing

Processing of a full-sized core is carried out to prepare it for general and special testing and includes core extraction from core boxes, its cleaning, longitudinal sawing, sampling of various sizes, geometry and purpose. In parallel with processing, full-size core testing is also usually performed, which provide initial information for assessing the lithological composition of a full-size core, the presence and nature of its saturation with hydrocarbons, and perform rapid assessment of permeability, mechanical and acoustic properties, the presence and distribution of internal heterogeneities:

- CT scan with quantitative interpretation of tomograms,
- core photography in daylight and ultraviolet light,
- circular core scanning with interpretation (cracks and caverns, layer elements, etc.) in daylight and ultraviolet light and comparison with well data (FMI, etc.),
- profile scratching with the construction of a continuous log of the Crush Strength
- profile gas permeability determination with the program clarification for drilling out samples for general and special testing.

Lithological and sedimentological studies of core

The complex of lithological studies begins with a brief lithological description of a full-size core, which is further refined by the results of instrumental types of analyzes:

- lithological description of core samples,
- petrographic thin sections study,
- grain size analysis,
- quantitative and mineralogical X-ray structural analysis,
- sedimentological (facial) analysis,
- cross-well correlation and conceptual sedimentological modeling.

Expert and technological hydraulic fracturing support (supervising)

Expert and technological hydraulic fracturing support:

- core samples elastic-strength properties research of the section main lithotypes,
- incoming and periodic quality control of the used hydraulic fracturing materials,
- current audit and adjustment of hydraulic fracturing designs based on well logging analysis and previous works experience,
- analysis of mini hydraulic fracturing results and giving recommendations to minimize risks,
- hydraulic fracturing works quality control at the field,
- final recommendations preparation to optimize hydraulic fracturing technology organization and implementation.

Main lithological types	Static Young's modulus, hPa		Crack resistance, kPa*m ^{1/2}	
	Preliminary fracture model	Lab-determined	Preliminary fracture model	Lab-determined
Sandstone	14.4	29	1100	432
Aleurolite	—	25	800	255
Argillite	14.3	21	800	588
Carbonated sandstone	22.2	64	800	626



Petrophysical core research is performed at all stages of reservoir study - from calculating hydrocarbon reserves to design and monitoring of exploitation:

- determination of reservoir properties at normal and reservoir RT conditions,
- determination of capillary, electrical and acoustic properties at normal and reservoir RT conditions for «water-gas», «water-oil», «gas-oil» systems,
- determination of the water flood (gas) oil recovery factor,
- effectiveness of physical and chemical methods of increasing oil recovery,
- determination of the damage ratio to the near-wellbore area when exposed to process fluids (drilling agent, hydraulic fracturing fluids, etc.),
- determination of relative permeability ratio at reservoir RT conditions for «oil-water», «oil-gas», «gas-water» systems,
- determination of reservoir properties of nano-permeable rocks on disintegrated (GRI method) and cylindrical samples,
- efficiency of technologies for sand production detection.

Elastic-strength (mechanical) core properties research

- determination of tensile strength under uniaxial tension (Brazilian test),
- crack resistance determination,
- determination of tensile strength under uniaxial and multiaxial single- stage or multi-stage loading with simultaneous acoustic properties determination and calculation of elastic modulus by static and dynamic methods,
- permeability dynamics in reservoir RT conditions with increasing load (axial, crimp, all-round),
- evaluation of poroelastic modulus (Bio coefficient) by a direct method,
- issuing of rock strength passports,
- evaluation of sand production and wellbore stability (thick-walled cylinders test).





Fracturing materials testing

Hydraulic fracturing is the main method of oil and gas wells stimulating; year after year, the number of operations performed and the complexity of hydraulic fracturing are steadily increasing, new technologies for hydraulic fracturing are being created and new materials are being developed for this process. Fracturing materials properties (proppants and fluids) have a decisive influence on the conductivity of the created hydraulic fracture and, thus, on the productivity of the stimulated well.

Using the correct materials properties in hydraulic fracturing design is the key to obtaining the planned production rates. Therefore, the ultimate users of hydraulic fracturing materials - producer companies - are interested in an independent objective assessment of the supplied materials properties not only at the stage of concluding an agreement for the provision / execution of hydraulic fracturing operations, but also as a part of ongoing monitoring.



Performed works:

- determination of the proppant granulometric composition,
- determination of absolute, bulk and apparent density,
- determination of proppant sphericity and roundness,
- determination of proppant crush resistance at different pressure levels,
- determination of acid solubility of the proppant (including a mixture of acids),
- determination of turbidity and loss on ignition of proppant,
- determination of tensile strength under polymerized proppant uniaxial compression,
- determination of the proppant pack long-term conductivity at different levels of closure pressure and with cyclic changes in closure pressure,
- determination of the proppant pack residual conductivity with hydraulic fracturing fluid.

The Service department of JSC Geologika carries out installation supervision and commissioning works when delivering new equipment to the place of operation, provides warranty and post-warranty maintenance for laboratory equipment, training and support for Customer's specialists, testing equipment certification and calibration of measuring instruments, existing or included in supplied laboratory equipment.

Specialists of the Service department take part in all stages of creating laboratory equipment manufactured by JSC Geologika, from setting up technical specifications and designing to final factory tests to confirm the technical characteristics and their compliance with the technical task. Service engineers have extensive experience in servicing both domestic and foreign technologically sophisticated laboratory equipment and in solving various technical issues.

Intermediate maintenance

JSC Geologika provides operational support for the produced equipment during entire warranty period.

Post-warranty maintenance

JSC Geologika offers its customers post-warranty annual maintenance for laboratory equipment in accordance with the attached technical regulations.

Equipment certification

Specialists of the Service department have the necessary qualifications and technical base for carrying out the primary and periodic certification of the JSC Geologika equipment in accordance with GOST R 8.568-2017.

One-time visit of the Service department specialists

Laboratory equipment downtime can lead to loss of property and reputation for the customer due to breakdown or other equipment malfunction. Our Service department is staffed to perform urgent repair works, adjust equipment and train customer's personnel.

Training of the Customer's personnel to work on the JSC Geologika laboratory equipment

Average service life of the JSC Geologika equipment is about ten years. During this time, several specialists working on equipment can be replaced and equipment may change ownership or the place of its operation. In this case, the necessary skills for efficient and safe operation of equipment can be never to return. The Service department of JSC Geologika offers one-time and periodic training courses for customer's personnel.



TESTING SAMPLES PREPARATION



THE «PIK-SOK» CORE CLEANING SYSTEM (EXTRACTOR)

The «PIK-SOK» system is designed to clean the core sample void space from reservoir and process fluids under pressure, toluene, with carbon dioxide dissolved in it. When the pressure in saturation chamber decreases, carbon dioxide is released from toluene and, expanding, displaces contaminated solvent from the samples void space. The extraction efficiency is achieved by repeated «saturation – degassing» cycle until solvent coloring terminated with the samples final drying. Extraction can be performed both for full-size core fragments, and for core samples of different sizes and shapes; however, there are no restrictions on the minimum and maximum load. The system is equipped with a toluene recovery module and a control unit located in a separate room.



» BENEFITS

MAXIMUM AUTOMATION
OF THE SYSTEM

EXPLOSION-PROOF
EXECUTION OF ALL NODES

SOLVENT RECOVERY
VISUAL CONTROL

TWO SATURATION
CHAMBERS (OPTIONALLY
4 OR 8)

ADJUSTABLE CHAMBERS HEATING
TO 100 °C WITH LONG-TERM
TEMPERATURE MAINTENANCE

CORE SAMPLES LOADING
INTO CHAMBERS USING
A SPECIAL CONTAINER

TECHNICAL SPECIFICATIONS

Core samples maximum diameter, mm	110
Number of saturation chambers, pcs	2 (optionally 4, 8)
Saturation chamber inner diameter, mm	130
Saturation chamber depth, mm, no more than	670
Saturation chamber volume, l	8,25
Maximum pressure created in the chamber, MPa	15
Saturation chamber material for core extraction	stainless steel
Tank volume for «pure» solvent, l	90
Tank volume for «dirty» solvent, l	40
Adjustable chamber heating for the extraction with temperature maintenance, °C	up to +100
Solvent recovery average rate, l / h	15
Sample full cleaning time, h	from 4 to 12

EXTERNAL REQUIREMENTS

Power supply parameters	
Voltage, V	380
Frequency, Hz	50±1
Power demand, kW	no more than 14
Compressed air line, MPa	pressure 0,5-0,7
Mass, kg	1000
Dimensions W×L×H, mm	800×1000×1700

THE «PIK-SK» INSTALLATION FOR CORE SAMPLES SATURATION (SATURATOR)

The Saturator «PIK-SK» is designed to saturate core samples with liquid (produced water or its model, oil, kerosene, etc.) in accordance with GOST 26450.1-85. The device is equipped with two saturation chambers, vacuum and pneumatic pumps and allows sequential vacuum treatment of core and liquid samples, and samples saturation at elevated or atmospheric pressure.



BENEFITS

PNEUMOHYDRAULIC PUMP FOR CORE SAMPLES SATURATION UNDER THE PRESSURE UP TO 15 MPa

LARGE INNER CHAMBER DIAMETER FOR WORKING WITH FULL-SIZE CORE

SET OF PLUGS TO FILL CHAMBER EMPTY VOLUME

CONTAINER FOR FLUSHING SYSTEM ELEMENTS FROM SATURATION FLUID

MOBILE VERSION

TECHNICAL SPECIFICATIONS

Maximum diameter of the saturated samples, mm	110
Number of saturation chambers, pcs	2
Saturation chamber inner diameter, mm	130
Saturation chamber depth, mm, not more than	300
Saturation chamber volume, l	4,1
Pressure created in the saturation chamber, Mpa	15
Minimum residual pressure in the saturation chamber, kPa	0,2
Number of samples (d = 30 mm, L = 60 mm) placed in one chamber, pcs., not more than	90
Vacuuming time, min	not limited

EXTERNAL REQUIREMENTS

Power supply parameters	
Voltage, V	220
Frequency, Hz	50±1
Power demand, kW	no more than 1
Compressed air line, MPa	pressure 0,5-0,7
Mass, kg	200
Dimensions W×L×H, mm	450×1000×1350

THE «PIK-VS» INSTALLATION FOR RESTORING ROCK SAMPLES NATURAL WETTABILITY AT THERMOBARIC CONDITIONS

The restoration of core natural wettability (artificial aging) is used for extracted rock samples intended for filtration and other special studies. For this, core samples are saturated with reservoir water (or its model), which is then displaced to residual values by reservoir oil. In this «initial» saturation state the samples are aged under reservoir RT conditions for the required time (up to several weeks) with periodic filtration of «fresh» oil through them. Achieving natural wettability is determined by stabilizing of electrical resistance values and oil permeability. The «PIK-VS» installation consists of two independent thermostatically controlled channels, including 8 core holders, own automatic maintenance systems of crimp pressure, pore pressure, back pressure, as well as thermal stabilization system.



TECHNICAL SPECIFICATIONS

Independent control channels numbers	2
Core holders number per each channel, pcs.	8
Core holders type	submersible
Core samples diameter, mm	30/38
Core samples length, mm	from 30 to 320
Maximum working temperature, °C	from +20 to +150
Thermostatic elements	core holders, separation tanks, supply lines
Maximum crimp pressure, Mpa	70
Maximum pore pressure, Mpa	40
Pore pressure system operation modes	maintaining constant flow rate maintaining constant pressure
Pumped fluid flow rate, cm ³ / min	from 0.001 to 50
Pore lines connection	2 pcs. at the inlet and 1 pc. at the output
Sample electrical resistance measurement	two-electrode circuit

EXTERNAL REQUIREMENTS

Power supply parameters	
Voltage, V	380
Frequency, Hz	50±1
Power demand, kW	no more than 6
Compressed air line, MPa	pressure 0,5-0,7
Mass, kg	1000
Dimensions W×L×H, mm	1200×2100×1700

THE «PIK-KPK» INSTALLATION FOR CORE CAPILLARY IMPREGNATION IN AUTOMATIC MODE (SATURATOR)

The «PIK-KPK» capillary impregnation Saturator is created for core samples automated saturation with liquid (reservoir water or its model, oil, kerosene, etc.) in accordance with GOST 26450.1-85. The presence of liquid level detection system in saturation chambers makes it possible to control the stage duration of samples capillary impregnation, providing high quality saturation of the void space even of low-porous samples. The installation includes from two to eight saturation chambers, a vacuum pump, a fluid pump and a control system. Saturation chambers allow uploading full-size core fragments of, as well as core samples of different geometries. There are no restrictions on the minimum load



BENEFITS «

FULLY AUTOMATED SATURATION PROCESS WITH A SPEED AND DURATION REFERENCE OF ALL STAGES

DYNAMIC FLUID LEVEL DETECTION IN SATURATION CHAMBERS AT ANY MOMENT OF THE EXPERIMENT

PNEUMOHYDRAULIC PUMP TO CREATE PRESSURE UP TO 15 MPa IN THE SATURATION CHAMBER

LARGE INNER DIAMETER OF THE SATURATION CHAMBER FOR WORKING WITH FULL-SIZE CORE

SET OF PLUGS TO FILL THE CHAMBER EMPTY VOLUME

TECHNICAL SPECIFICATIONS

Saturable samples maximum diameter, mm	110
Number of saturation chambers, pcs	2 (optionally 4, 8)
Chamber Inner diameter, mm	120
Saturation chamber depth, mm	670
Saturation chamber volume, l	8,25
Generated pressure in the saturation chamber, Mpa	15
Minimum residual pressure in the saturation chamber, kPa	0,2
Saturation chamber material	stainless steel
Number of samples (d = 30 mm, L = 80 mm) placed in each chamber, pcs	96
Vacuuming time, min	not limited

EXTERNAL REQUIREMENTS

Power supply parameters	
Voltage, V	220
Frequency, Hz	50±1
Power demand, kW	no more than 1
Compressed air line, MPa	pressure 0,5-0,7
Mass, kg	500
Dimensions W×L×H, mm	800×1000×1700

THE «AS-140-300» SOXHLET EXTRACTOR

The «AS-140-300 Soxhlet» device is designed to extract core samples in organic solvents mixture. It is a large-sized system for hydrocarbon reflux. The device is designed for single full-size core samples with a diameter up to 140 mm and a length up to 300 mm or for a number of cylindrical core samples.



» BENEFITS

- SAMPLES PLACEMENT CHAMBER IS MADE OF STAINLESS STEEL
- TRIPOD STAND FOR MOUNTING AND PLACEMENT OF ALL SYSTEM ELEMENTS
- CONDUCTING «COLD» AND «HOT» EXTRACTION
- STAINLESS MESH BASKET FOR PLACING SAMPLES INSIDE THE CHAMBER

TECHNICAL SPECIFICATIONS

Core samples diameter, mm	up to 140
Core samples length, mm	up to 300
Solvent volume, ml	5000
Solvent type (mixture)	alcohol, benzene, chloroform, toluene

EXTERNAL REQUIREMENTS

Power supply parameters	
Voltage, V	220
Frequency, Hz	50±1
Power demand, kW	no more than 2,0
Mass, kg	50
Dimensions W×L×H, mm	500×350×1500

STANDARD CORE ANALYSIS



THE «PIK-P» GAS-VOLUMETRIC POROSIMETER

The «PIK-P» device is designed to measure gas porosity. The measurement method is based on a physical model of the pressure drop in camera with core sample during volume expansion by known amount (Boyle's law). The device allows determining porosity and pore volume of weakly cemented rock samples without applying crimping pressure. The entire porosity determination procedure is fully automated to obtain reproducible data with the required accuracy. The porosimeter is supplied with cameras for measuring porosity and calibration inserts for cylindrical core samples and cubic samples. The using of cameras is very simple, it takes only 1 minute to configure the camera to switch from one core size to another. The complex management program is universal and designed to maximize productivity and workload. Analyzer maintenance procedures include calibration and leak testing.

» MEASURED PARAMETERS:

- OPEN POROSITY
- PORE VOLUME



» BENEFITS

- SIMPLE AND QUICK SAMPLE REPLACEMENT
- HIGH ACCURACY OF MEASUREMENTS
- MEASURING CAMERAS SET FOR WORKING WITH CYLINDRICAL CORE SAMPLES (DIAMETER UP TO 110 MM) AND CUBIC SAMPLES

TECHNICAL SPECIFICATIONS

Number of core holders, pcs	3
Tested cylindrical samples diameter, mm	25, 30, 38, 67, 80, 100, 110
Tested cylindrical samples length, mm	up to 110
Face dimensions of cubic samples, mm	30×30×30, 50×50×50
Working gas pressure, Mpa	0,3
Working gas type, Mpa	helium, compressed air, nitrogen
Average measurement time, min	2
Porosity measurement range of, %	from 0.1 to 40

EXTERNAL REQUIREMENTS

Power supply parameters	
Voltage, V	220
Frequency, Hz	50±1
Power demand, kW	no more than 0,5
Compressed air line, MPa	pressure 0,5-0,7
Gas supply line, MPa	pressure 1
Mass, kg	30
Dimensions W×L×H, mm	800×1000×1700

THE «PIK-PP» AUTOMATED DEVICE FOR MEASURING POROSITY AND PERMEABILITY

The device is designed to determine open porosity and gas permeability in baric conditions by the non-stationary filtration method. The pressure drop method is used in the device to determine permeability with the Klinkenberg correction, slip factor and inertial flow coefficients. The device is supplied with a core holder for manual core loading with a diameter of 30 mm, design of which ensures simplicity and ease of use. Research is fully automated. Service procedures are also automated, such as: device self-diagnosis and calibration. The management program is universal and designed to achieve maximum productivity and workload. Analyzer maintenance procedures include calibration and leak testing.

State register of measuring instruments of the Russian Federation No. 53157-13

State register of measuring instruments of the Republic of Kazakhstan (Certificate No. 12154 on the recognition of type approval as a measurement medium)

MEASURED PARAMETERS:

- ABSOLUTE GAS PERMEABILITY
- KLINKENBERG CORRECTED GAS PERMEABILITY
- EFFECTIVE GAS PERMEABILITY (WITH RESIDUAL WATER SATURATION)
- EQUIVALENT AIR PERMEABILITY AT A GIVEN AVERAGE PRESSURE
- ASSESSMENT OF OPEN POROSITY AND GAS PERMEABILITY DYNAMICS WITH A CHANGE IN CRIMP PRESSURE
- INERTIAL COEFFICIENTS (α AND β)
- OPEN POROSITY



BENEFITS

INTEGRATED POROSITY AND PERMEABILITY DETERMINATION

SIMPLE AND QUICK SAMPLE REPLACEMENT

HIGH ACCURACY OF MEASUREMENTS

POSSIBILITY TO WORK WITH SAMPLES WITH DIAMETER UP TO 110 MM AND CUBIC SAMPLES

Tested cylindrical samples diameter, mm	30 mm (optionally up to 110 mm)
Tested cylindrical samples length, mm	up to 100
Tested cube samples sizes, mm	30x30/50x50
Sample crimp pressure, Mpa	up to 70
Pore pressure, Mpa	up to 1,7
Porosity range, %	from 0.1 to 40
Permeability range, MD	from 0.01 MD to 10 000
Applicable gases	helium, nitrogen, air

TECHNICAL SPECIFICATIONS

Power supply parameters	
Voltage, V	380
Frequency, Hz	50±1
Power demand, kW	no more than 2
Compressed air line, MPa	pressure 0,5-0,7
Gas supply line, MPa	pressure 2
Mass (with core holder Ø 30 mm), kg	1000
Dimensions W×L×H, mm	600×700×800

EXTERNAL REQUIREMENTS

THE «PIK-P» GAS-VOLUMETRIC POROSIMETER FOR DETERMINING CORE SAMPLES POROSITY UNDER PRESSURE CONDITIONS

The «PIK-P» device is designed to measure pore volume, open porosity and mineralogical density of core samples by volumetric method according to Boyle's law under pressure conditions. The device is equipped with a core holder with plunger sets for cylindrical and cubic samples of various sizes. The generated crimping pressure (simulating rock pressure) is up to 70 MPa. The software provides device calibration and checking the system for gas leaks.

MEASURED PARAMETERS:

- OPEN POROSITY
- PORE VOLUME



BENEFITS

- SIMPLE AND QUICK SAMPLE REPLACEMENT
- HIGH ACCURACY OF MEASUREMENTS
- SET OF CORE HOLDER PLUNGERS FOR WORKING WITH CYLINDRICAL CORE SAMPLES UP TO 80 MM IN DIAMETER AND CUBIC CORE SAMPLES

TECHNICAL SPECIFICATIONS

Tested cylindrical samples diameter, mm	30, 38, 50, 80
Tested cylindrical samples length, mm	up to 100
Cubic samples sizes, mm	30×30×30, 50×50×50
Rock pressure, Mpa	up to 70
Rock pressure pump type	hand pump
Working gas pressure, Mpa	0,3
Working gas type	helium, compressed air, nitrogen
Average measurement time, min.	2
Range of porosity indications, %	from 0,1 to 40

EXTERNAL REQUIREMENTS

Power supply parameters	
Voltage, V	220
Frequency, Hz	50±1
Power demand, kW	no more than 0,5
Compressed air line, MPa	pressure 0,5-0,7
Gas supply line, MPa	pressure 1
Mass, kg	110
Dimensions W×L×H, mm	750×600×600

THE «PIK-UES» AUTOMATED DEVICE FOR MEASURING CORE SAMPLES ELECTRICAL RESISTANCE

The «PIK-UES» device is designed to measure electrical resistance of rock samples and reservoir water samples (or its models) at atmospheric conditions in accordance with GOST 25494-82. The measured values of samples electrical resistance are used to calculate resistivity, as well as porosity and saturation parameters, the Dakhnov-Archie indicators of a , «m» and «n» dependence. Measurements accuracy is achieved by using a pneumatic electrode close to the sample surface, providing stable clamping force.

Meet the requirements of GOST25494-82. The rocks. Method for determining electrical resistivity

MEASURED PARAMETERS:

- ROCK SAMPLES ELECTRICAL RESISTIVITY
- PORE FLUIDS ELECTRICAL RESISTIVITY
- POROSITY PARAMETER
- SATURATION PARAMETER «N»
- CEMENTATION COEFFICIENT «M»



BENEFITS

CARRYING OUT MEASUREMENTS ACCORDING TO 2 AND 4 ELECTRODE SCHEME

TRANSPARENT PROTECTIVE DEVICE PREVENTS SAMPLES DRYING DURING MEASUREMENTS

SPECIAL ELECTRODES USING IN THE DEVICE MINIMIZES CONTACT RESISTANCE

COMPUTER DATA ACQUISITION SYSTEM FOR MEASUREMENT RESULTS AUTOMATIC RECORDING

TECHNICAL SPECIFICATIONS

Measurement method	2 and 4 electrode
Electrical resistance measurement range, Ohm	from 0,1 to 10000
Current frequency, Hz	50 ÷ 10 000
Electrical resistivity determination Accuracy, %	3
Tested samples diameter, mm	from 20 to 103
Tested samples length, mm	from 10 to 85

EXTERNAL REQUIREMENTS

Power supply parameters	
Voltage, V	220
Frequency, Hz	50±1
Power demand, kW	no more than 0,5
Compressed air line, MPa	pressure 0,5-0,7
Gas supply line, MPa	pressure 1
Mass, kg	30
Dimensions W×L×H, mm	450×800×420

THE «PIK-GGC-4» GROUP GRAVIMETRIC CAPILLARYMETER

The «PIK-GGC-4» installation is a modified version of the «PIK-GGK-6» group capillarmeter and designed to determine core samples capillary properties and residual water saturation using a semipermeable membrane at atmospheric conditions in accordance with OST 39-204-86. Capillary properties are determined in the excess gas pressure range from 0.0007 to 1.38 MPa in the entire range of sample permeability and water saturation of samples pore space from 100% to residual values.

MEASURED PARAMETERS:

- CURRENT AND RESIDUAL WATER SATURATION OF THE SAMPLE
- SATURATION PARAMETER
- CAPILLARY PRESSURE CURVE



BENEFITS

DESATURATION CAMERA IS MADE OF STAINLESS STEEL, PROVIDING ITS RESISTANCE TO AGGRESSIVE ENVIRONMENTS AND DURABILITY

UP TO 4 DESATURATION CAMERA CAN BE CONNECTED TO THE CAPILLARYMETER CONTROL PANEL THROUGH 4 PRESSURE CONTROL UNITS

EACH UNIT HAS ITS OWN PRESSURE CONTROL RANGE: FROM 0 TO 0.1 MPa; FROM 0 TO 0.3 MPa; FROM 0 TO 0.5 MPa AND FROM 0 TO 1.5 MPa, WITH AN ACCURACY OF NOT MORE THAN 0.25%

PRESSURE MAINTENANCE IS ADJUSTED AUTOMATICALLY

TECHNICAL SPECIFICATIONS

Tested sample diameter, mm	30; 38,1; 100; 110
Inner camera diameter, mm	315
Tested sample length, mm, no more than	150
Working temperatures, °C, no more than	5-30
Maximum desaturation pressure, Mpa	1,38
Minimum desaturation pressure, Mpa	0,0007

EXTERNAL REQUIREMENTS

Power supply parameters	
Voltage, V	220
Frequency, Hz	50±1
Power demand, kW	no more than 1
Compressed air line, MPa	pressure 0,5-0,7
Gas supply line, MPa	2
Mass, kg	desaturation chamber – 20 control module – 25 vacuum module – 20
Dimensions W×L×H, mm	desaturation chamber – 370×360×370 control module – 450×540×360 vacuum module – 450×540×360

The group capillaritymeter «PIK-GGC-6» is designed to determine core samples capillary properties and residual water saturation using a semipermeable membrane at atmospheric conditions in accordance with OST 39-204-86. The method is considered classical and is based on displacement of the fluid saturating sample pore space under influence of excess gas pressure with periodic weighing of samples to assess their current saturation. The results of research are capillary pressure curves and values of the residual (irreducible) water saturation of each sample. Sample electrical resistance (PIK-UES) is usually measured simultaneously with its weighing to determine saturation parameter and calculate the Dakhnov-Archie dependence. Capillary properties are determined in the excess gas pressure range from 0.0007 to 1.38 Mpa in the entire range of sample permeability and water saturation of samples pore space from 100% to residual values.

MEASURED PARAMETERS:

- CURRENT AND RESIDUAL WATER SATURATION OF THE SAMPLE
- SATURATION PARAMETER
- CAPILLARY PRESSURE CURVE



BENEFITS

DESATURATION CAMERA IS MADE OF STAINLESS STEEL, PROVIDING ITS RESISTANCE TO AGGRESSIVE ENVIRONMENTS AND DURABILITY

UP TO 6 DESATURATION CHAMBERS CAN BE CONNECTED TO THE CAPILLARYMETER CONTROL PANEL THROUGH 6 PRESSURE CONTROL UNITS

PRECISION MECHANICAL PRESSURE REGULATORS ARE USED TO MAINTAIN PRESSURE

EACH CONTROL LINE WITH A CONNECTED CAMERA ALLOWS CREATING ANY PRESSURE LEVEL IN THE ENTIRE POSSIBLE RANGE

TECHNICAL SPECIFICATIONS

Tested sample diameter, mm	30; 38,1; 100; 110
Inner camera diameter, mm	315
Tested sample length, mm, no more than	150
Working temperatures, °C, no more than	5-30
Maximum desaturation pressure, Mpa	1,38
Minimum desaturation pressure, Mpa	0,0007

EXTERNAL REQUIREMENTS

Power supply parameters	
Voltage, V	220
Frequency, Hz	50±1
Power demand, kW	no more than 1
Compressed air line, MPa	pressure 0,5-0,7
Gas supply line, MPa	2
Mass, kg	desaturation chamber – 20 control cabinet – 50
Dimensions W×L×H, mm	desaturation chamber – 370×360×370 control cabinet – 600×600×1200

THE «PIK-IGC-PL» INSTALLATION FOR STUDYING CORE SAMPLES CAPILLARY PROPERTIES AT RESERVOIR CONDITIONS

The individual capillarmeter «PIK-IGC-PL» is designed to determine capillary and electrical properties, as well as residual water saturation of core samples using a semi-permeable membrane at reservoir conditions. The method is based on displacement of a liquid (formation water or its model, petroleum, oil, condensate, etc.) saturating the sample pore space under the overpressure of an immiscible fluid (gas or liquid) and continuous estimation of the current sample saturation by the displaced fluid volume. Results of the research are capillary pressure curves, values of residual (irreducible) saturation and electrical properties (resistivity, porosity and saturation parameters, a , m , n indicators) of each sample, measured at reservoir conditions. The measurements are carried out at crimping pressure up to 70 MPa, temperatures up to $+150^{\circ}\text{C}$, pore pressure up to 3 MPa, in the entire range of sample permeability and water saturation of samples pore space from 100% to residual values. The installation is a multi-channel laboratory stand with 14 (in the basic version) individual core holders, combined into groups of 7 core holders. Each core holder group is installed in a separate heating cabinet and is equipped with its own units for automatically maintaining crimp pressure, pore pressure control with a differential pressure sensor, a fluid supply container and a measuring electrical resistance system. Hydrophilic or petrophilic semipermeable membranes are used depending on the saturating fluid composition.

» MEASURED PARAMETERS:

- SAMPLE WATER SATURATION
- ELECTRICAL RESISTIVITY
- SATURATION PARAMETER
- POROSITY PARAMETER
- CAPILLARY PRESSURE CURVE



THE «PIK-IGC-PL» INSTALLATION FOR STUDYING CORE SAMPLES CAPILLARY PROPERTIES AT RESERVOIR CONDITIONS

TECHNICAL SPECIFICATIONS

Crimp pressure, Mpa	70	HYDRAULIC SYSTEM
Crimp pressure pump type	pressure booster	
Crimp pressure pump operating mode	maintaining constant pressure	
Inlet pore pressure, Mpa	up to 3	
Output pore pressure, Mpa	0,5	
Pressure differential range, Mpa	0,01 – 1,5	
Differential pressure accuracy,% of setting	0,1	
Working substance	gas, mineralized water, oil	
Core diameter, mm	30 or 38	CORE HOLDER
Column length of core samples, mm	90	
Maximum working crimp pressure, Mpa	70	
Maximum working pore pressure, Mpa	33	
Maximum working temperature, °C	150	
Resistivimetric saturation control	according to 2 or 4-electrode scheme	
Type	heating cabinet per group (7 core holders)	TEMPERATURE MAINTENANCE SYSTEM
Temperature, °C	up to +150	
Temperature measurement accuracy, °C	no more than ±1	
Sensor 1. Upper measurements limit, Mpa	0,02 – 2,0	DIFFERENTIAL PRESSURE MEASUREMENT SYSTEM
Measurement accuracy, %	no more than 0,1	
Type	digital resistivity tester	ELECTRICAL RESISTANCE MEASUREMENT MODULE
Frequency, kHz	1	
Accuracy, %	0,05	
Number of groups per rack, pcs	2	CHARACTERISTICS OF CORE HOLDER GROUPS
Number of core holder in the group, pcs.	7	
Saturation change accuracy, ml	0,1	DISPLACED FLUID VOLUME MEASUREMENT SYSTEM
Maximum volume of measuring flask, ml	20	

Power supply parameters		EXTERNAL REQUIREMENTS
Voltage, V	220	
Frequency, Hz	50±1	
Power demand, kW	no more than 4	
Compressed air line, MPa	pressure 0,5-0,7	
Mass, kg	500	
Dimensions W×L×H, mm	600×1500×1700	

THE «PIK-UZ» INSTALLATION FOR STUDYING ELASTIC CORE PROPERTIES AT ATMOSPHERIC CONDITIONS

The «PIK-UZ» installation is designed to measure propagation velocity of longitudinal and transverse acoustic waves in rock samples at atmospheric conditions in accordance with GOST 21153.7-75 with automatic calculation of dynamic Young's modulus and Poisson's ratio.
The installation complies with the requirements of GOST 21153.7-75.

MEASURED PARAMETERS:

- LONGITUDINAL AND TRANSVERSE ULTRASONIC WAVES SPEED
- DYNAMIC YOUNG'S MODULE
- DYNAMIC POISSON'S RATIO



ULTRASONIC WAVE MEASURING SYSTEM

Ultrasonic vibrations source	<ul style="list-style-type: none"> - independent excitation of longitudinal and transverse waves - smooth adjustment of signal power - computer and optionally manual control
Ultrasonic vibration preamplifier	<ul style="list-style-type: none"> - two independent channels - amplification up to + 40 dB - digital control interface - input protection
Vibration recorder	<ul style="list-style-type: none"> - 100 MHz bandwidth - 2 independent registration channels - digital signal transmission to a computer
Measurements storage and analysis	<ul style="list-style-type: none"> - marker determination of the first wave arrival time - possibility to save received signals in digital form - automatic calculation of sample elastic constants

BENEFITS

- EASY SAMPLE REPLACEMENT PROCEDURE
- AUTOMATIC CALCULATION OF THE SAMPLE ELASTIC CONSTANTS
- MARKER DETERMINATION OF THE FIRST ENTRY TIME OF WAVES
- SAVING RECEIVED SIGNALS IN DIGITAL FORM

TECHNICAL SPECIFICATIONS

Tested samples diameter, mm	from 30 to 110
Tested samples length, mm	from 30 to 130
Speed measurement range of ultrasonic waves passing, m / s	from 500 to 9000
Ultrasonic generator operating frequency, kHz	300

EXTERNAL REQUIREMENTS

Power supply parameters	
Voltage, V	220
Frequency, Hz	50±1
Power demand, kW	no more than 0,5
Mass, kg	20
Dimensions W×L×H (2 chambers), mm	200×700×700

THE «PIK-UZ-UES» INSTALLATION FOR STUDYING ELECTRICAL AND ELASTIC CORE PROPERTIES AT RESERVOIR CONDITIONS

The «PIK-UZ-UES» installation is designed to measure propagation velocity of longitudinal and transverse acoustic waves in rock samples in accordance with GOST 21153.7-75 and core samples electrical resistivity at reservoir conditions in accordance with GOST 25494-82. The dynamics of sample porosity is estimated by the volume of released fluid with a change in crimping pressure. The installation software automatically calculates the dynamic Young's modulus and Poisson's ratio.

The installation complies with the requirements of GOST 21153.7-75, GOST 25494-82.

MEASURED PARAMETERS:

- LONGITUDINAL AND TRANSVERSE ULTRASONIC WAVES SPEED
- DYNAMIC YOUNG'S MODULE
- DYNAMIC POISSON'S RATIO
- SAMPLE ELECTRICAL RESISTANCE
- LIQUID VOLUME DISPLACED AT RESERVOIR CONDITIONS CHANGE



ULTRASONIC WAVE
MEASURING SYSTEM

Ultrasonic vibration source	<ul style="list-style-type: none"> - longitudinal and transverse waves independent excitation - smooth adjustment of signal power - computer and optionally manual control
Ultrasonic vibration preamplifier	<ul style="list-style-type: none"> - two independent channels - amplification up to + 40 dB - digital control interface - input protection
Vibration recorder	<ul style="list-style-type: none"> - 100 MHz bandwidth - 2 independent registration channels - digital signal transmission to a computer
Measurements storage and analysis	<ul style="list-style-type: none"> - marker determination of the first wave arrival time - possibility to save received signals in digital form - automatic calculation of sample elastic constants

BENEFITS

EASY SAMPLE REPLACEMENT
PROCEDURE WITHOUT
DRAINING OIL

MARKER DETERMINATION OF
THE FIRST ENTRY TIME OF ULTRASONIC
WAVES

AUTOMATIC CALCULATION OF
THE SAMPLE ELASTIC CONSTANTS

SAVING RECEIVED SIGNALS
IN DIGITAL FORM

CAN BE EQUIPPED WITH
TWO CORE HOLDERS

Cylindrical core samples diameter, mm	30 (optionally up to 110 mm)
Cylindrical samples maximum length, mm	100
Maximum working crimp pressure, Mpa	100
Maximum working pore pressure, Mpa	40
Volume measurement resolution, ml	0,001
Maximum working temperature, °C	+150
Electrical resistance measurement circuit	2 or 4 electrode
Electrical resistance measuring range, Ohm	0,01-100 000
Ultrasonic generator operating frequency, Mhz	1
Speed measurement range of ultrasonic waves passing, m/s	from 500 to 9000

TECHNICAL
SPECIFICATIONS

Power supply parameters	
Voltage, V	220
Frequency, Hz	50±1
Power demand, kW	no more than 5
Compressed air line, MPa	pressure 0,5-0,7
Mass, kg	25
Dimensions W×L×H (2 chambers), mm	900×900×1700

EXTERNAL
REQUIREMENTS



SPECIAL CORE ANALYSIS

THE «PIK-UIDK» INSTALLATION FOR STUDYING CORE SAMPLES MECHANICAL PROPERTIES

The «PIK-UIDK» installation is a multifunctional system designed to determine the elastic-strength and filtration-capacitive properties of core samples at reservoir conditions. The strength camera allows one- and three-axis core sample loading with simultaneous measurement of its longitudinal (axial) and transverse (lateral) deformations up to sample destruction, determining passing speeds of longitudinal and transverse ultrasonic waves, as well as assessing the pore space sample dynamics. The installation can be equipped with a filtration system to assess samples properties in contact with reservoir or process fluids.

The installation allows user to carry out measurements of elastic-strength properties of rock samples in accordance with GOST 27153.7-75, GOST 211532-84, GOST 21153.8-88, GOST 28985-91, ASTM standards for rock samples triaxial testing.

Performed experiments:

- Uniaxial compressive strength test (UCS),
- uniaxial tensile strength test (TSTR, Brazilian test strength),
- multiaxial tensile strength test with single-stage compression (CCS),
- multiaxial tensile strength test under multistage loading (MTXC),
- crack resistance test,
- thick-walled cylinder test (TWC),
- determination of the Biot constant by direct and indirect methods.

» MEASURED PARAMETERS:

- SAMPLE RESIZING UNDER COMPRESSION
- SAMPLE TENSILE STRENGTH UNDER UNIAXIAL AND TRIAXIAL COMPRESSION
- STATIC AND DYNAMIC YOUNG'S MODULUS AND POISSON'S RATIOS
- PASSING SPEED OF LONGITUDINAL AND TRANSVERSE ULTRASONIC WAVES DURING LOADING
- OPEN POROSITY CONTINUOUS ASSESSMENT DURING LOADING
- CORE SAMPLES ELECTRICAL RESISTANCE MEASUREMENT
- CORE SAMPLES LIQUID PERMEABILITY MEASUREMENT (WITH FULL CRIMPING BACKPRESSURE)



BENEFITS «

ADDITIONAL CONNECTORS FOR TRANSMITTING MEASURING AND CONTROL SIGNALS IN THE STRENGTH CAMERA FOR CONDUCTING SPECIALIZED TESTS (USING ADDITIONAL STRAIN SENSORS, ULTRASONIC SENSORS FOR STUDYING ANISOTROPIC ROCK SAMPLES PROPERTIES, BUILDING VOLUMETRIC MODELS OF CRACK DEVELOPMENT)

BALL BEARING FOR SAMPLES PROPER ALIGNMENT DURING TESTING

SPECIAL LOADING PLATES FOR CORE SAMPLES WITH SUPPLYING PORE PRESSURE PORTS, ALLOWING TO CONDUCT ELECTRICAL RESISTANCE MEASUREMENTS

THE «PIK-UIDK» INSTALLATION FOR STUDYING CORE SAMPLES MECHANICAL PROPERTIES

TECHNICAL SPECIFICATIONS

ULTRASONIC VELOCITY MEASUREMENT SYSTEM OF LONGITUDINAL AND TRANSVERSE WAVES

Tested cores diameter, mm	30, 38, 50
Maximum working crimp pressure, Mpa	80
Maximum working pore pressure, Mpa	40
Maximum working temperature, °C	up to +150
Axial load, kN	up to 1000
Working frequency, Mhz	1
Ultrasonic waves speed measurement range, m / s	from 500 to 9000

INCLUDES

- set of plates with compression and shear waves integrated sensors with pore pressure supply ports
- upper plate on a spherical support
- rigid fixation bottom plate

CELL AND TRIAXIAL COMPRESSION SYSTEM

Tested core diameter, mm	30, 38, 50
Tested cores length, mm	60, 80, 100
Comprehensive crimping pressure, Mpa	up to 80
Pore pressure, Mpa	up to 40
Axial static load, kN	up to 1000
Working temperature, °C	up to +150
Axial load control	force sensor
Maximum loading speed, MPa / min	60
Maximum loading speed, mm / min	5
Fluid-contact parts material	stainless steel, titanium
Capabilities	automatic control of axial and all-round crimping pressure testing with strain or deformation control

INCLUDES

- triaxial compression cell
- supplying and maintaining crimp pressure system
- axial sample loading system
- data collection and analysis system
- ten 4-pin sealed leads for connecting sensors built into the strength camera (axial, circumferential deformation sensors, ultrasonic wave measurement sensors, temperature sensor)
- 5 pressure ports: axial, comprehensive, pore lower, pore upper, dropping

EXTERNAL REQUIREMENTS

Power supply parameters	
Voltage, V	220
Frequency, Hz	50±1
Power demand, kW	no more than 9
Compressed air line, MPa	pressure 0,5-0,7
Mass, kg	1100
Dimensions W×L×H, mm	1100×2600×2300

TECHNICAL SPECIFICATIONS

TESTING PLATES SET IN THE STRENGTH CHAMBER

Tested core diameter, mm	30, 38, 50
Maximum working crimp pressure, Mpa	80
Maximum working pore pressure, Mpa	40
Maximum working temperature, °C	до + 150

- upper plate on a spherical base with pore pressure port
- bottom plate with pore pressure port

INCLUDES

AXIAL AND TRANSVERSE (CIRCUMFERENTIAL) DEFORMATIONS MONITORING SYSTEM

Tested cores diameter, mm	30, 38, 50
Maximum working crimp pressure, Mpa	80
Maximum working pore pressure, Mpa	40
Maximum working temperature, °C	up to +150
Axial strain sensors measuring range, mm	±3
Transverse strain sensors measuring range, mm	±2
Linear dimensions measurement accuracy, mm	±0,002

- mounting rings set (upper and lower) for two LVDT deformation sensors located on opposite sides at angle of 180 ° to control axial deformation, mounted directly on the sample
- roller chain and sensor mounting device for measuring transverse (circumferential) deformations, mounted directly on the sample

INCLUDES

PORE PRESSURE MAINTENANCE SYSTEM

Tested cores diameter, mm	30, 38, 50
Maximum working temperature, °C	up to +150
Maximum working pore pressure, Mpa	up to 40
Constant flow rate maintenance ml / min	from 0,001 to 15
Flow rate maintenance accuracy,%	0.5 of the current value
Pressure maintenance accuracy, %	0,25 % from VPI
Differential pressure sensor measurement upper limit, Mpa	1
Measurement accuracy, %	not more than 0,1
Working substance	water with a salinity of 300 g / l, oil
Capabilities	maintaining a constant pressure drop across the sample by changing fluid flow determination of pumped fluids volume

- pumps for maintaining constant pore pressure and constant pore fluid flow rate
- differential pressure measuring unit
- automatic back pressure regulator

INCLUDES

THE «PIK-ST» AUTOMATED INSTALLATION FOR CORE STRENGTH PROFILE CONSTRUCTING (SCRATCH-TEST)

The PIK-ST installation is designed to determine rock samples strength by cutting method. Analysis is based on cutting forces profiles recorded during core surface scratching process with a cutter placed on a movable carriage. The carriage is driven by a servo drive through a ball-screw transmission. Cutting depth is set by flywheel and is monitored by linear displacement sensor. The load occurring on the cutter is detected by accurate force sensor. Sensor register longitudinal and normal component of the cutting force. Rock strength characteristics are calculated from cut depth known values and cutting forces. Depending on the used theory, core material availability and time, PIK-ST tests can be carried out under various programs. For a preliminary assessment of rocks strength properties, cutting force profiles can be used as correlation basis with rock strength parameter for uniaxial compression (UCS – unconfined compressive strength). In the case of extended research program, UCS values can be significantly clarified for the selected lithotypes, as well as values assessment of internal friction angle can be carried out for these lithotypes. The software allows user to associate core strength with depth. There is a possibility of combining analysis of several wells in one card. Analysis results can be exported to a spreadsheet, compatible with Microsoft Office. The installation can additionally be equipped with photographing unit for creating continuous core images and unit for measuring ultrasonic wave propagation velocities and determining samples elastic properties. The software allows user to superimpose strength and elastic sample properties profile on the resulting photo image for detailed and visual display of measurement results. Measurement mode is automatic, that reduces human factor influence. The installation is controlled from a computer.

» MEASURED PARAMETERS:

- TENSILE STRENGTH (UCS)
- ANGLE OF INTERNAL FRICTION



TECHNICAL SPECIFICATIONS

Cutting speed, mm / s	0,01-30
Load measuring axis	2 (longitudinal and vertical)
Maximum longitudinal cutter load, kN	5
Maximum vertical cutter load, kN	25
Measured core strength limit, Mpa	350
Load measurement accuracy, %	0,5
Longitudinal movement accuracy, mm	0,005
Vertical movement accuracy, mm	0,005
Tested core maximum diameter, mm	up to 250
Tested core maximum length, mm	up to 1000
Cutter width, mm	5 and 10
Cutter material	polycrystalline diamond
Software	automatic mode start manual control measurement results recording data analysis

EXTERNAL REQUIREMENTS

Power supply parameters	
Voltage, V	380
Frequency, Hz	50±1
Power demand, kW	no more than 6
Mass, kg	200
Dimensions W×L×H (2 chambers), mm	600×1300×1600

THE «PIK-UIDK-M» MULTIFUNCTIONAL COMPLEX FOR STUDYING CORE SAMPLES MECHANICAL PROPERTIES

The «PIK-UIDK-M» multifunctional research complex is designed to study the elastic-strength and capacitive properties of rock samples of various sizes, the degree of lithification (from sands to sandstones and gneisses) and strength at normal and reservoir conditions. The strong and high mechanical rigidity design of the press makes it possible to implement uniaxial and multiaxial samples loading with simultaneous measurement of its longitudinal (axial) and transverse (lateral) deformations, velocities of longitudinal and transverse acoustic waves transmission, as well as porosity dynamics in the entire range of loads (up to sample destruction). The complex consists of a block for creating thermobaric reservoir conditions, a block for creating an axial load, a block for ensuring pore pressure (fluid injection), a block for measuring deformations, a block for measuring acoustic waves velocities, and a PC-based monitoring and control block. A rigid support column, installed under the strength cell base, is used when an axial load is created. The cell design excludes the use of screwed joints between the main body and the base. The press is equipped with protective panels and impact-resistant polycarbonate door.

The installation allows measuring the elastic-strength properties of rock samples in accordance with GOST 27153.7-75, GOST 211532-84, GOST 21153.8-88, GOST 28985-91, as well as ASTM standards for rock samples triaxial testing.

Performed experiments:

- uniaxial compressive strength test (UCS),
- multiaxial tensile strength test with single-stage compression (CCS),
- multiaxial tensile strength test under multistage loading (MTXC),
- thick-walled cylinder test (TWC),
- determination of the Biot constant by direct and indirect methods.



THE «PIK-UIDK-M» MULTIFUNCTIONAL COMPLEX FOR STUDYING CORE SAMPLES MECHANICAL PROPERTIES

MEASURED PARAMETERS:

- SAMPLE RESIZING UNDER COMPRESSION
- COMPRESSIVE STRENGTH
- YOUNG'S MODULUS AND POISSON'S RATIOS
- SAMPLES ELECTRICAL RESISTANCE MEASUREMENT
- CONTINUOUS POROSITY CHANGE DEPENDING ON THE PRESSURE
- CORE SAMPLES LIQUID PERMEABILITY MEASUREMENT (WITH FULL CRIMPING BACKPRESSURE)
- P-WAVE AND S-WAVE VELOCITIES MEASUREMENT IN SOFT SANDSTONE AND HARD ROCK SAMPLES

BENEFITS

ADDITIONAL CONNECTORS FOR TRANSMITTING MEASURING AND CONTROL SIGNALS IN THE STRENGTH CAMERA FOR CONDUCTING SPECIALIZED TESTS (USING ADDITIONAL STRAIN SENSORS, ULTRASONIC SENSORS FOR STUDYING ANISOTROPIC ROCK SAMPLES PROPERTIES, BUILDING VOLUMETRIC MODELS OF CRACK DEVELOPMENT)

BALL BEARING FOR SAMPLES PROPER ALIGNMENT DURING TESTING

SPECIAL LOADING PLATES FOR CORE SAMPLES WITH SUPPLYING PORE PRESSURE PORTS, ALLOWING TO CONDUCT ELECTRICAL RESISTANCE MEASUREMENTS

TECHNICAL SPECIFICATIONS

MEASUREMENT RANGES AND RELATIVE ERROR LIMIT

Force, error no more than $\pm 1\%$, kN	from 0 to 1700
Swaging pressure, error no more than $\pm 1\%$, MPa	from 0 to 140
Pore pressure, error no more than $\pm 0.1\%$, MPa	from 0 to 70
Back pressure, error no more than $\pm 0.1\%$, MPa	from 0 to 70
Experiment temperature, error no more than $\pm 0.5\%$, °C	from +20 to +150
Differential pressure, error no more than $\pm 0.5\%$, kPa	from 0 to 100
Relative axial and radial deformations, error no more than $\pm 0.01\%$, d./f.	from 0 to 0,5
Propagation velocity of acoustic waves, error no more than $\pm 3\%$	longitudinal wave velocity, V_p from 1000 to 7500 m / s, velocities of fast V_{s1} and slow V_{s2} shear waves from 500 to 4000 m/s
Capability	mineralized water at least 250 g / l, kerosene, oil, mineral oils

CELL AND TRIAXIAL COMPRESSION SYSTEM

Tested core diameter, mm	30, 38
Tested cores length, mm	60, 80
Comprehensive swaging pressure, MPa	up to 140
Pore pressure, MPa	up to 70
Axial static load, kN	up to 1700
Working temperature, °C	up to +150
Fluid-contact parts material	stainless steel, titanium
Electrical leads	at least 10 4-contact sealed leads

EXTERNAL REQUIREMENTS

Power supply parameters	
Voltage, V	380
Frequency, Hz	50 ± 1
Power demand, kW	no more than 10
Mass, kg	7000
Dimensions W×L×H, mm	3000×2000×3200

THE «PIK-UIDK-M» MULTIFUNCTIONAL COMPLEX FOR STUDYING CORE SAMPLES

MECHANICAL PROPERTIES

TECHNICAL SPECIFICATIONS

Tested core diameter, mm	30, 38, 50
Maximum working swaging pressure, MPa	80
Maximum working pore pressure, MPa	40
Maximum working temperature, °C	up to + 150
Axial load, kN	up to 1700

SET OF PLATES
FOR TESTING
IN THE STRENGTH
CHAMBER

- upper plate on a spherical base with pore pressure port
- bottom plate with pore pressure port

INCLUDES

Tested core diameter, mm	30, 38
Maximum working swaging pressure, MPa	140
Maximum working temperature, °C	up to + 150
Axial strain sensors measuring range, mm	±3
Transverse strain sensors measuring range, mm	±2
Linear dimensions measurement accuracy, mm	±0,002

AXIAL AND TRANSVERSE
(CIRCUMFERENTIAL)
DEFORMATIONS
MONITORING SYSTEM

- mounting rings set (upper and lower) for two LVDT deformation sensors located on opposite sides at angle of 180 ° to control axial deformation, mounted directly on the sample
- roller chain and sensor mounting device for measuring transverse (circumferential) deformations, mounted directly on the sample

INCLUDES

Tested core diameter, mm	30, 38
Maximum working swaging pressure, MPa	140
Maximum working pore pressure, MPa	70
Maximum working temperature, °C	up to + 150
Axial load, kN	up to 1070
Working frequency, MHz	1
Ultrasonic waves speed measurement range, m/s	from 500 to 9000

ULTRASONIC VELOCITY
MEASUREMENT SYSTEM
OF LONGITUDINAL
AND TRANSVERSE WAVES

- set of plates with compression and shear waves integrated sensors with pore pressure supply ports
- upper plate on a spherical support
- rigid fixation bottom plate

INCLUDES

Ultrasonic vibrations source	<ul style="list-style-type: none"> - independent excitation of longitudinal and transverse waves - signal power smooth adjustment - computer and optionally manual control
Ultrasonic vibration preamplifier	<ul style="list-style-type: none"> - two independent channels - amplification up to + 40 dB - digital control interface - input protection
Oscillation recorder	<ul style="list-style-type: none"> - 100 MHz bandwidth - 2 independent registration channels - digital signal transmission to computer
Storage and processing of measurement results	<ul style="list-style-type: none"> - marker determination of the first wave entry time - ability to save received signals in digital form - automatic calculation of sample elastic constants

THE «PIK-OFF» INSTALLATION FOR STUDYING CORE PHASE PERMEABILITY (2 PHASES, DESKTOP VERSION)

The «PIK-OFF» installation is designed to determine filtration, capacitive and electrical core sample properties during single and two-phase stationary and non-stationary filtration at reservoir conditions. The equipment is used to determine oil displacement coefficients by water/gas for evaluating effectiveness of increasing oil recovery physicochemical methods, determining relative phase permeabilities in «liquid-liquid» and «liquid-gas» systems.

MEASURED PARAMETERS:

- RELATIVE PHASE PERMEABILITIES DURING JOINT OIL AND WATER FILTRATION IN ACCORDANCE WITH OST 39-235-89
- CORE SAMPLE CURRENT SATURATION
- ELECTRICAL RESISTIVITY
- OIL DISPLACEMENT RATE
- OEN POROSITY COEFFICIENT AT RESERVOIR CONDITIONS
- OPEN POROSITY COEFFICIENT DEPENDING ON CHANGES AT RESERVOIR CONDITIONS



BENEFITS

- COMPACT DESKTOP VERSION
- AUTOMATIC PORE PRESSURE MAINTENANCE
- INSTALLATION SET ALLOWS USER TO CARRY OUT EXPERIMENTS TO STUDY TWO-PHASE RELATIVE PERMEABILITY ACCORDING TO OST 39-235-89
- AMPLE OPPORTUNITIES FOR RETROFITTING EQUIPMENT TO EXPAND THE RESEARCH RANGE

EXTERNAL REQUIREMENTS	Power supply parameters	
	Voltage, V	220
	Frequency, Hz	50±1
	Power demand, kW	no more than 4
	Mass, kg	200
	Dimensions W×L×H (2 chambers), mm	600×1500×1700

THE «PIK-OFP» INSTALLATION FOR STUDYING CORE PHASE PERMEABILITY (2 PHASES, DESKTOP VERSION)

Crimp pressure, Mpa	up to 70	TECHNICAL SPECIFICATIONS
Crimping pressure pump type	manual	
Pore pressure, Mpa	up to 40	
Pore pressure pump type	automatic, single plunger	
Reservoir pumps operating mode	- maintaining constant flow rate - maintaining constant pressure - maintaining predetermined proportion when filtering two fluid phases through core sample from 0 to 100%	HYDRAULIC SYSTEM
Working substance rate, ml / min	0,001 ÷ 50	
Pressure maintenance accuracy from VPI, %	0,5	
Flow rate maintenance accuracy, % from the current value	0,5	
Cylinder volume, ml	200	
Working substance	- water with a salinity of – up to 300 g/l - oil	
Working temperature range, °C	from +25 to +150	TEMPERATURE MAINTENANCE SYSTEM
Heated elements	core holder, supply pipes, pump hydraulic parts	
Upper measurements limit, Mpa	1,6	DIFFERENTIAL PRESSURE MEASURING SYSTEMS
Measurement accuracy, %	not more than $\pm 0,075$	
Type	visual control	FLUID VOLUME MEASUREMENT SYSTEMS
Meter separator volume, ml	200	
Resolution, ml	0,1	
Fluid-contacting parts material	stainless steel, glass	
Working pressure	atmospheric	
Pressure, Mpa	40	BACK PRESSURE REGULATOR
Control	automatic	
Fluid-contacting parts material	stainless steel, fluoroplastic, peek	
Type	Digital resistivity meter	ELECTRICAL RESISTANCE MEASUREMENT MODULE
Frequency, kHz	1	
Accuracy, %	0,05	
Measurement circuit	4 electrode	
Core diameter, mm	30	CORE HOLDER
Maximum column length of core sample, mm	150	
Maximum working crimp pressure, Mpa	70	
Maximum working pore pressure, Mpa	40	
Maximum working temperature, °C	up to 150	
Resistivometric saturation control	4-electrode circuit	
Fluid-contacting parts material	stainless steel	
Control	pumps flow rate, temperature, back pressure regulator	PC-BASED MONITORING AND CONTROL SYSTEM
Data collection	pressure/differential pressure digital sensors, pumps flow rate, thermocouples, separator meter, sample electrical resistance	

THE «PIK-SLIMTUBE» INSTALLATION FOR STUDYING DYNAMICALLY MIXED FLUIDS FILTRATION

The «PIK-Slimtube» installation is designed to study fluids dynamic mixing processes (determine minimum miscibility pressure) at reservoir conditions on a sand packed tube. A long (24 m) thin (3.2 mm diameter) tube filled with prepared quartz sand is used as a reservoir model. During the experiment, recombined oil is displaced from the reservoir model by gas (hydrocarbon, nitrogen, carbon dioxide, etc.) or liquid solvent to evaluate the displacement efficiency depending on the discharge pressure. Viewing window with a video recording system provides visual control of outgoing fluid nature. The outgoing fluid volume is measured with a burette, and the gas – with a gas meter. The installation can be equipped with a chromatograph and high pressure densitometer for continuous monitoring of outgoing fluid composition and properties during the experiment.

MEASURED PARAMETERS:

- MINIMUM MISCIBILITY PRESSURE
- MINIMUM MISCIBILITY CONCENTRATION OF TESTED FLUIDS (MMC)
- OPTIMUM PARAMETERS OF DRY AND RICH GAS INJECTION
- OIL DISPLACEMENT COEFFICIENT BY GAS
- SENSITIVITY ASSESSMENT OF EXPERIMENTAL EXTRACTION CONDITIONS



EXTERNAL REQUIREMENTS

Power supply parameters	
Voltage, V	380
Frequency, Hz	50±1
Power demand, kW	no more than 9
Compressed air line, MPa	pressure 0,5-0,7
Mass, kg	1000
Dimensions W×L×H (2 chambers), mm	800×1300×1700

TECHNICAL SPECIFICATIONS

Maximum working fluid supply pressure, Mpa	70
System volume, cm	not less than 100
Fluid pump type	two-plunger, automatic
Pump operating mode	- maintaining constant pressure - maintaining constant flow rate
Pump cylinder volume, ml	100
Maximum gas supply pressure, Mpa	70
Pressure measurement accuracy,% VPI	0,15
Working substance	water, oil, hydrocarbon gases, carbon dioxide, solvent

HYDRAULIC SYSTEM

Type	heating chamber
Maximum temperature, °C	200
Heated elements	reservoir model, supply tubes, piston containers
Temperature measurement accuracy, °C	±1

TEMPERATURE MAINTENANCE SYSTEM

Maximum pressure, Mpa	70
Fluid-contact parts material	stainless steel, sapphire
Fixation	digital videocamera

VISUAL CONTROL SYSTEM OF OUTGOING MIXTURE

Maximum pressure, Mpa	70
Control	manual / automatic
Fluid-contact parts material	stainless steel

BACK PRESSURE REGULATOR

Type	drum continuous operation
Range, l	up to 10 000

GASOMETER

Tube length, m	24
Tube inner diameter, mm	3,2
Filler	quartz sand 230-310mkm
Estimated porosity,%	36

POROUS MEDIUM MODEL

Control	pump flow, temperature, pressure
Data collection	digital pressure sensors, flow rate pumps, thermocouples

PC-BASED MONITORING AND CONTROL SYSTEM

THE «PIK-OFP/EP» INSTALLATION FOR STUDYING CORE PHASE PERMEABILITY (2 PHASES)

The «PIK-OFP/EP» filtration installation is designed to determine filtration, capacitive and electrical properties of core samples during one-, two-, and three-phase stationary and non-stationary filtration at reservoir conditions. The equipment is used to determine oil displacement coefficients by water/gas for evaluating effectiveness of increasing oil recovery physicochemical methods. Fluid filtration can be carried out both in forward and reverse directions.

MEASURED PARAMETERS:

- RELATIVE PHASE PERMEABILITY FOR THE «LIQUID-LIQUID», «LIQUID-GAS», «LIQUID-LIQUID-GAS» SYSTEMS IN ACCORDANCE WITH OST 39-235-89
- ABSOLUTE AND EFFECTIVE PERMEABILITY FOR GAS AND LIQUID AT RESERVOIR CONDITIONS
- RESIDUAL OIL AND WATER SATURATION
- DISPLACEMENT RATE
- ELECTRICAL RESISTIVITY
- OPEN POROSITY COEFFICIENT AT RESERVOIR CONDITIONS
- OPEN POROSITY COEFFICIENT CHANGE DEPENDING ON THE RESERVOIR CONDITIONS



BENEFITS

FILTRATION PROCESSES DATA REGISTRATION WITH GRAPHICAL DISPLAY OF FLUID FLOW RATES, DIFFERENTIAL PRESSURE AND TEMPERATURE DATA

AUTOMATIC MAINTENANCE OF CRIMP PRESSURE AND PORE PRESSURE

THE INSTALLATION SET COMPLETE WITH GAS SUPPLY SYSTEM FOR MODELING THREE-PHASE FILTRATION

AMPLE OPPORTUNITIES FOR RETROFITTING SYSTEMS TO EXPAND THE ONGOING RESEARCH RANGE

TECHNICAL SPECIFICATIONS

HYDRAULIC SYSTEM

Crimp pressure, Mpa	up to 100
Crimp pressure pump, pcs.	1
Creating crimp pressure pump type	pneumatic hydraulic booster
Rock pump operating mode	maintaining constant pressure
Pore pressure, Mpa	up to 70
Pore fluid supply pumps, pcs	2 (for oil and saline)
Creating pore pressure pump type	automatic, two-plunger
Reservoir pumps operating mode	- maintaining constant flow rate - maintaining constant pressure - maintaining predetermined proportion when filtering two fluid phases through core sample from 0 to 100%
Working substance range, ml / min.	0,001÷50
Pressure from VPI, %	0,5
Flow rate maintenance accuracy, % from the current value	0,5
Cylinder volume, ml	200
Working substance	mineralized water – up to 300 g / l, oil, gas,

EXTERNAL REQUIREMENTS

Power supply parameters	
Voltage, V	380
Frequency, Hz	50±1
Power demand, kW	no more than 9
Compressed air line, MPa	pressure 0,5-0,7
Mass, kg	1500
Dimensions W×L×H (2 chambers), mm	1100×2200×1800

TECHNICAL SPECIFICATIONS

Type	heating chamber / thermostable volume + individual heaters	TEMPERATURE MAINTENANCE SYSTEM
Working temperature range, °C	from +25 to +150	
Heated elements	core holder, supply tubes, separation tanks	
Temperature measurement accuracy, °C	±1	
Sensor 1. Upper limit of measurements, Mpa	1,6	DIFFERENTIAL PRESSURE MEASUREMENT SYSTEM
Sensor 2. Upper limit of measurements, kPa	250	
Measurement accuracy, %	no more than ± 0,075 / ± 0,5	
Type	visual / acoustic	OUTLET FLUID VOLUME MEASUREMENT SYSTEM
Separator-meter volume, ml	200	
Discreteness, ml	0,1	
Fluid-contact parts material	stainless steel, sapphire	
Working pressure, Mpa	up to 70	
Maximum working temperature, °C	+150	
Type	with dividing piston	SEPARATION TANKS
Volume	500-1000 ml	
Working pressure, Mpa	up to 70	
Maximum working temperature, °C	+150	
Fluid-contact parts material	stainless steel	
Working pressure, Mpa	up to 70	BACKPRESSURE REGULATOR
Control	automatic, PC connection	
Fluid-contact parts material	stainless steel	
Type	digital resistivity meter	ELECTRICAL RESISTANCE MEASUREMENT MODULE
Frequency, kHz	1	
Accuracy, %	0,05	
Measurement circuit	4-electrode	
Core diameter, mm	30 (optionally up to 110 mm)	CORE HOLDER
Maximum column length of core samples, mm	300	
Maximum working crimp pressure, Mpa	70	
Maximum working pore pressure, Mpa	40	
Maximum working temperature, °C	+150	
Resistivometric saturation control	4-electrode circuit	
Fluid-contact parts material	stainless steel	
Control	pumps flow rate, temperature, back pressure regulator	PC-BASED MONITORING AND CONTROL SYSTEM
Data collection	pressure/differential pressure digital sensors, pumps flow rate, thermocouples, separator-meter, sample electrical resistance	

THE «PIK-OFP-FD» EQUIPMENT COMPLEX FOR ASSESSING RESERVOIR DAMAGE BY INJECTED FLUIDS, DRILLING FLUIDS

The «PIK-OFP-FD» complex is designed to determine filtration, capacitive and electrical core sample properties at reservoir conditions with stationary and non-stationary filtration and allows simulating process fluids impact on bottomhole reservoir zone. Core holder plungers design provides process fluids pumping along sample end to form a colmatant crust. Core holder is equipped with several differential pressure measurement ports that allow user to evaluate pressure distribution along the core sample (samples column). High-capacity pumps set provides process fluids continuous circulation. Special containers for process fluids are equipped with mixing system preventing solutions solid phase settling at reservoir conditions. Base fluid filtration can be performed in both forward and reverse directions. Installation elements can be made of acid-resistant chromium-nickel alloys (Hastelloy C-276) to assess the effectiveness of colmatant crust and core samples acid treatments.

MEASURED PARAMETERS:

- PHASE PERMEABILITY DURING TWO-PHASE FILTRATION
- PROCESS FLUIDS INFLUENCE STUDY
- AGGRESSIVE SUBSTANCE EFFECTIVENESS (ACID AND ALKALINE COMPOSITIONS) AFFECTING PERMEABILITY OF BOTTOMHOLE RESERVOIR ZONE
- ABSOLUTE EFFECTIVE LIQUID PERMEABILITY
- OPEN POROSITY COEFFICIENT DEPENDING ON CHANGES AT RESERVOIR CONDITIONS
- ACIDIC COMPOSITION EFFECTIVENESS WHEN REMOVING COLMATANT CRUST
- ELECTRICAL RESISTIVITY



BENEFITS

- DRILLING FLUID FILTRATION THROUGH CORE SAMPLES AND ALONG CORE SAMPLE END TO FORM A COLMATANT CRUST
- DRILLING FLUID FILTRATE CONTINUOUS CIRCULATION WITH LINEAR VELOCITIES UP TO 0.5 M/S.
- UP TO 7 PORTS BUILT INTO THE CORE HOLDER FOR DETERMINING DIFFERENTIAL PRESSURE AND RESISTIVITY PROFILES
- FILTRATION PROCESS DATA REGISTRATION WITH FLUID FLOW RATES, DIFFERENTIAL PRESSURE AND TEMPERATURE GRAPHICAL DISPLAY

EXTERNAL REQUIREMENTS

Power supply parameters	
Voltage, V	380
Frequency, Hz	50±1
Power demand, kW	no more than 9
Compressed air line, MPa	pressure 0,5-0,7
Mass, kg	1500
Dimensions W×L×H (2 chambers), mm	1100×2200×1800

THE «PIK-OFP-FD» EQUIPMENT COMPLEX FOR ASSESSING RESERVOIR DAMAGE BY INJECTED FLUIDS, DRILLING FLUIDS

TECHNICAL SPECIFICATIONS

Maximum crimp pressure, Mpa	up to 70
Maximum pore pressure, Mpa	up to 40
Working substance	- water with salinity up to 300 g/l - oil - drilling fluid and its filtrates - aqueous solutions of acids (acid-resistant): HCl – up to 20%; HF – up to 5%
Fluid-contact parts material	- stainless steel - Hastelloy-C276 or equivalent (acid resistant)
Pump type	automatic, plunger
Operating mode	- maintaining constant flow rate - maintaining constant pressure
Maintaining pressure accuracy, % (of full scale)	0,5
Maintaining the flow rate accuracy, % (of the current value)	0,5
Maximum working pressure, Mpa	40
Linear drilling fluid filtration rate, m/s	up to 0,5

HYDRAULIC SYSTEM

DRILLING FLUID SUPPLY AND CIRCULATION SYSTEM

Tested core diameter, mm	30 (optionally up to 110 mm)
Tested core length, mm	up to 300
Core sample type	composite
Fluid pumping ability	- in forward direction - in opposite direction - along core end to form colmatant crust - modeling solids deposition conditions on well wall
Maximum working crimp pressure, Mpa	70
Maximum working pore pressure, Mpa	40
Maximum working temperature, °C	up to +150
Saturation control	resistivimetric
Number of differential pressure measurement ports	from 2 to 7
Fluid-contact parts material	stainless steel, Hastelloy-C276 or equivalent (acid resistant)

CORE HOLDER

Type	trolley heating chamber
Maximum working temperature, °C	+150
Heated elements	core holder, supply tubes, separation tanks

TEMPERATURE MAINTENANCE SYSTEM

Type	with dividing piston
Volume, mm	500/1000/1500
Maximum working pressure, Mpa	40
Maximum working temperature, °C	+150
Fluid-contact parts material	stainless steel
Solution stirring	magnetic stirrer

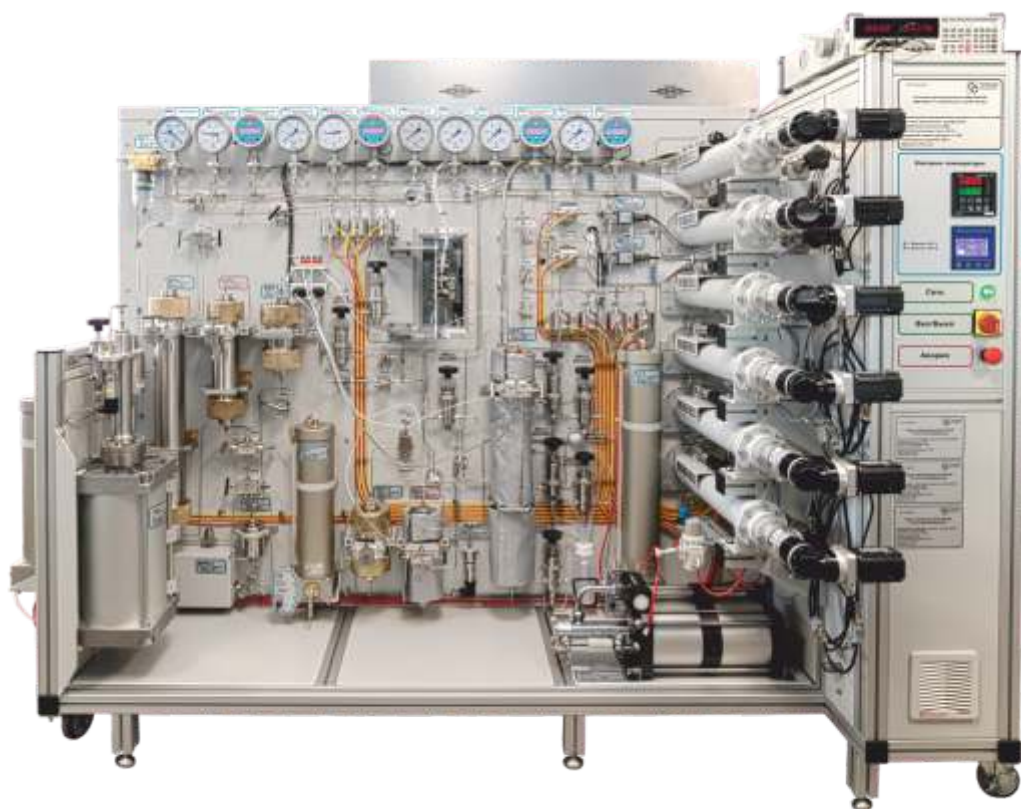
DRILLING FLUID TANKS

THE «PIK-/OFF-K-320» EQUIPMENT COMPLEX FOR HIGH-TEMPERATURE RESEARCH IN ACID-RESISTANT PERFORMANCE

The «PIK-OFP-K-320» complex is designed to study filtration, capacitive, elastic and electrical bulk model properties at reservoir conditions under stationary and non-stationary two-phase filtration when studying high-viscosity oils displacement processes by hot water, steam and chemically aggressive environments. The complex is equipped with high-temperature unit, including steam generator-superheater, heat-insulating box and temperature control system. Pore fluids (oil, water) filtration can be performed in forward and reverse directions.

» MEASURED PARAMETERS:

- RELATIVE PHASE PERMEABILITY FOR «LIQUID-LIQUID», «LIQUID-GAS», «LIQUID-LIQUID-GAS» SYSTEMS IN ACCORDANCE WITH OST 39-235-89
- ABSOLUTE EFFECTIVE LIQUID PERMEABILITY
- OIL DISPLACEMENT COEFFICIENT BY WATER/STEAM
- PROPAGATION TIME OF LONGITUDINAL AND TRANSVERSE ULTRASONIC WAVES
- OPEN POROSITY COEFFICIENT AT RESERVOIR CONDITIONS
- ACID AND ALKALINE COMPOSITIONS IMPACT EFFECTIVENESS ON RESERVOIR
- OPEN POROSITY COEFFICIENT DEPENDING ON CHANGES AT RESERVOIR CONDITIONS
- ELECTRICAL RESISTIVITY



» BENEFITS

UNIFORM TEMPERATURE
MAINTAINING FOR ENTIRE BULK
RESERVOIR MODEL
(UP TO 320 °C)

SEQUENTIAL INJECTION OF OIL,
COLD WATER, HOT WATER AND
STEAM IN ISOTHERMAL MODE

DETERMINATION OF THE INITIAL AND
RESIDUAL WATER SATURATION AFTER
OIL DISPLACEMENT BY COLD WATER,
HOT WATER OR STEAM

TEMPERATURE
CONTROL OVER
THE ENTIRE BULK
RESERVOIR MODEL

RESEARCH USING ACIDIC (HCL,
HF, ACETIC ACID) AND ALKALINE
COMPOSITION

THE «PIK-/OFP-K-320» EQUIPMENT COMPLEX FOR HIGH-TEMPERATURE RESEARCH IN ACID-RESISTANT PERFORMANCE

TECHNICAL SPECIFICATIONS

Maximum crimp pressure, Mpa	up to 70
Maximum pore pressure, Mpa	up to 40
Hydraulic working substance	- water with salinity up to 300 g/l - oil - acids solutions, HCL-14%, HF-5%, acetic acid – 0,2%
Fluid-contact parts material	stainless steel, acid resistant alloy (Hastelloy C-276 or equivalent)
Type	heating chamber
Maximum temperature, °C	+150
Heated elements	core holder, supply tubes, separation tanks, separator
Type	clamp heater
Maximum temperature, °C	320
Heated elements	bulk reservoir model
Type	flow
Pressure, Mpa	40
Maximum temperature, °C	320
Steam supply	dry, saturated
Diameter, mm	from 30 to 110
Bulk model length, mm	up to 1000
Pore pressure, Mpa	40
Maximum temperature, °C	320
Core diameter, mm	30
Maximum column length of core samples, mm	300
Maximum working crimp pressure, Mpa	70
Maximum working pore pressure, Mpa	40
Maximum working temperature, °C	+150
Resistivometric saturation control	4 electrode circuit
Fluid-contact parts material	stainless steel / acid resistant alloy

HYDRAULIC SYSTEM

TEMPERATURE MAINTENANCE SYSTEM 1

TEMPERATURE MAINTENANCE SYSTEM 2

STEAM GENERATOR – SUPERHEATER

BULK ISOTHERMAL RESERVOIR MODEL

CORE HOLDER

Power supply parameters	
Voltage, V	380
Frequency, Hz	50±1
Power demand, kW	no more than 9
Compressed air line, MPa	pressure 0,5-0,7
Mass, kg	1500
Dimensions W×L×H (2 chambers), mm	1100×2200×1800

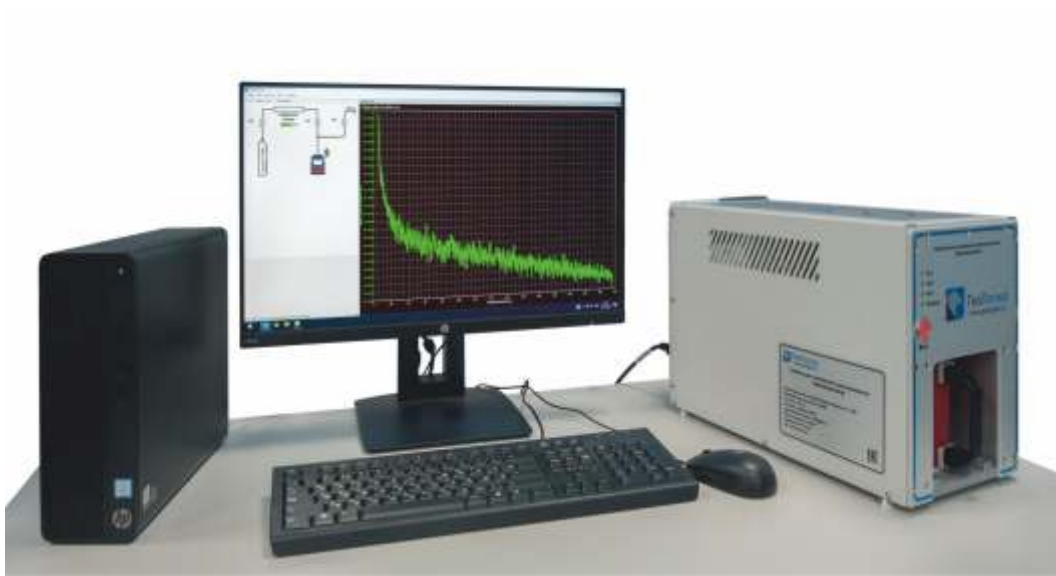
EXTERNAL REQUIREMENTS

THE «PIK-NANO-NSF» DEVICE FOR MEASURING DISINTEGRATED CORE SAMPLES PERMEABILITY

The device is designed to determine gas permeability of nano-permeable rocks (clay and carbonate shales, dense sandstones, etc.) using pressure drop method (GRI method). Measurements are carried out on disintegrated (fraction from 0.5 to 0.85 mm) core sample and characterize pore space permeability of rock matrix. Results of experiment, as well as interpretation curves determining permeability, are stored in results files and can be used to re-evaluate permeability without re-conducting the experiment. Device preparation procedures include calibration and checking for gas leaks.

MEASURED PARAMETERS

GAS PERMEABILITY



BENEFITS

CORE SAMPLES PERMEABILITY TESTING BY THE GRI METHOD | SIMPLE AND QUICK SAMPLE REPLACEMENT | MEASUREMENT RANGE FROM 1 fD (10^{-15} D) TO 1 μ D (10^{-6} D)

TECHNICAL SPECIFICATIONS

Powder granules diameter, mm	0,5-0,85
Individual sample mass, g.	~30
Permeability measurement range	or 1 fD (10^{-15} D) to 1 μ D (10^{-6} D)
Gas pressure, MPa, (PSI)	1,38 (200 PSI)
Fluid-contact material	stainless steel
Applicable gases	nitrogen, helium

EXTERNAL REQUIREMENTS

Power supply parameters	
Voltage, V	220
Frequency, Hz	50 \pm 1
Power demand, kW	no more than 0,5
Compressed air line, MPa	pressure 0,5-0,7
Gas supply line, MPa	pressure 2
Mass, kg	25
Dimensions W×L×H, mm	500×200×300

THE «PIK-NANO-SF» DEVICE FOR MEASURING PERMEABILITY BY STATIONARY FILTRATION METHOD

The device is designed to determine gas permeability of rocks with ultra low permeability (clay and carbonate shales, dense sandstones, etc.) on cylindrical samples by stationary filtration under pressure conditions. The device is equipped with two core holders for samples with a diameter of 30 and 38.1 mm, as well as thermal stabilization system. Measurements are made under crimping pressure conditions, allowing modeling the reservoir effective pressure. Device preparation procedures include calibration and checking for gas leaks.

MEASURED PARAMETERS

- GAS PERMEABILITY
- KLINKENBERG-CORRECTED PERMEABILITY



BENEFITS

HIGH MEASURING
ACCURACY

SIMPLE AND QUICK SAMPLE
REPLACEMENT

MAINTAINING CONSTANT TEMPERATURE
IN THE DEVICE ENTIRE VOLUME

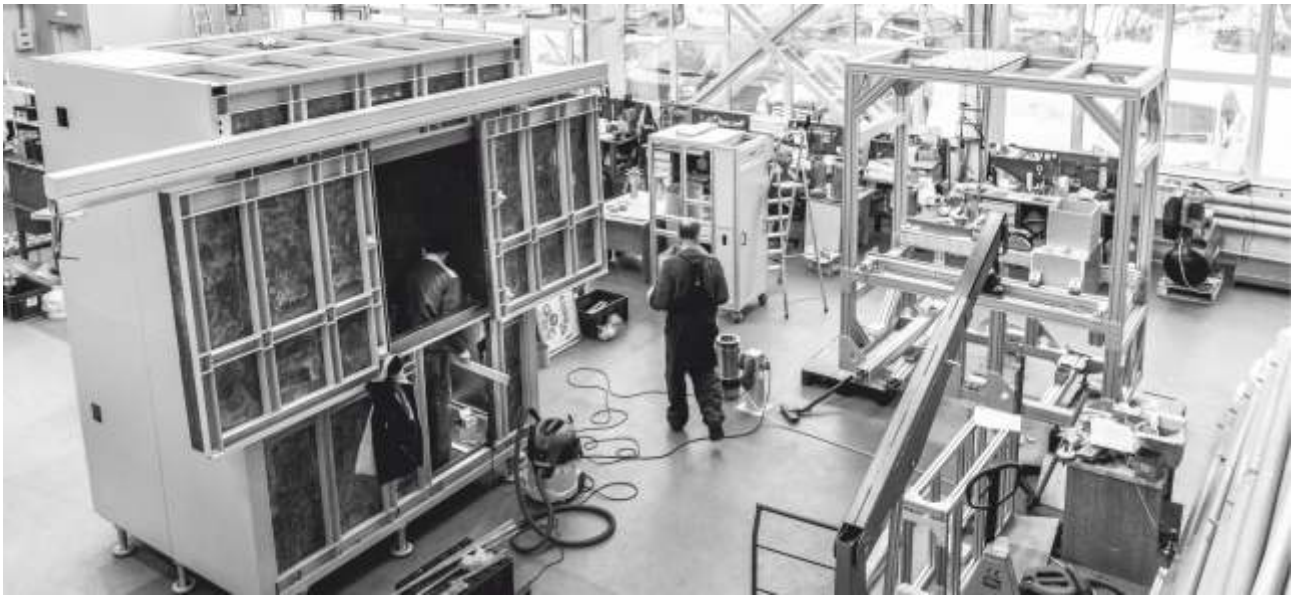
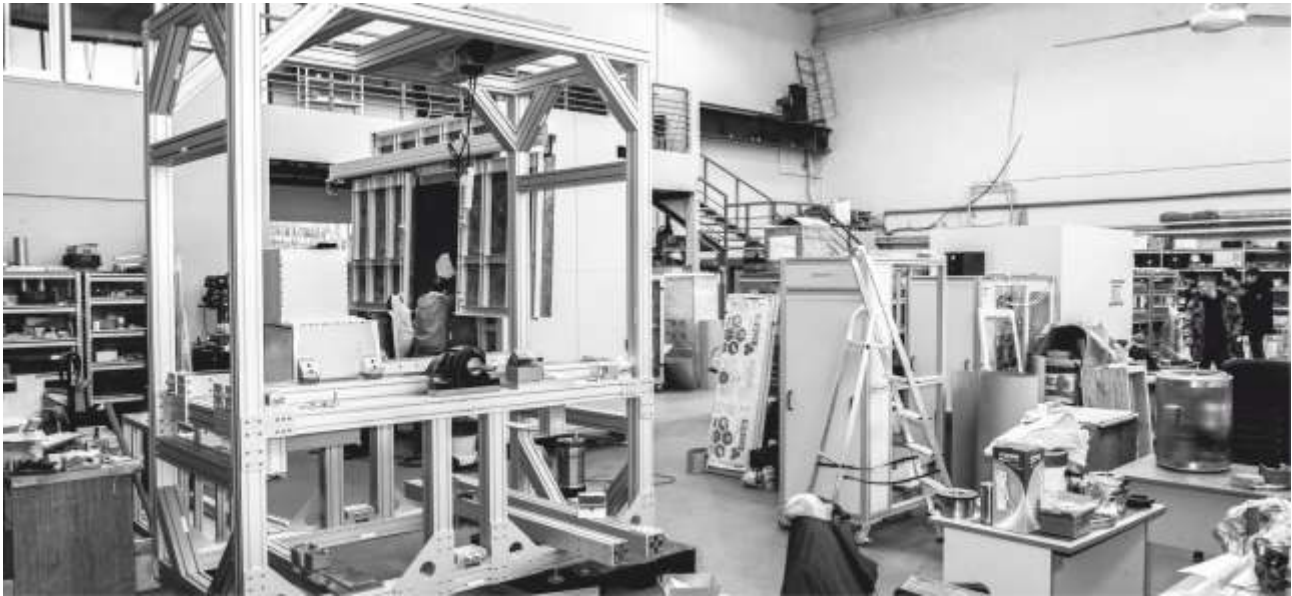
CRIMPING PRESSURE AUTOMATIC
MAINTENANCE

Core holders number	2
Core diameter, mm	30, 38
Core length, mm	20-100
Permeability measurement range	1 aD (10 ⁻¹⁸ D) до 1 μD (10 ⁻⁶ D)
Pore pressure, Mpa	0.1-1.7
Crimp pressure range, Mpa	1-70
Crimp pressure range, MPa: accuracy of temperature maintenance, °C stabilized temperature, °C	± 0,1 30-40
Fluid-contact material	stainless steel
Core holders sample loading type	dry, without oil drain
Applicable gases	helium, nitrogen

TECHNICAL SPECIFICATIONS

Power supply parameters	
Voltage, V	220
Frequency, Hz	50±1
Power demand, kW	no more than 2
Compressed air line, MPa	pressure 0,5-0,7
Gas supply line, MPa	pressure 2
Mass, kg	150
Dimensions W×L×H, mm	500×700×900

ВНЕШНИЕ ТРЕБОВАНИЯ



X-RAY ANALYSIS



THE «PIK-RKT-160» X-RAY CORE COMPUTER TOMOGRAPH

The «PIK-RKT-160» X-ray tomograph for a full-size core is designed for qualitative and quantitative characterization of core density inhomogeneities. Tomographic analysis is necessary, first of all, for fractured-cavernous core study, when traditional petrophysics methods are ineffective. The results of core tomographic study are logging of fractured and cavernous voids of a full-size core, cracks and caverns connectivity assessment, spatial orientation of planar elements (cracks, bedding planes, etc.), and in some cases it is possible to evaluate full-size core mineral composition. Core tomography is used to assess the condition of loose and poorly lithified core after its lifting and transportation (without opening containers), to select drilling location for standard and oversized samples to perform special core studies. The tomography software makes it possible to visualize selected density inhomogeneities and perform their qualitative analysis. Tomography results (tomogram) are compatible with commercial software products for spatial data analysis (Avizo and others). The protective cabinet provides effective protection of personnel from tomograph x-ray radiation and eliminates the need to place the device in a separate room. Measurements can be taken without removing the core from receiver pipe or insulating tube.

MEASURED PARAMETERS:

- GEOMETRIC PARAMETERS OF DENSITY INHOMOGENEITIES (LAYER THICKNESS, CRACK OPENING, CAVERN SIZES)
- DENSITY INHOMOGENEITIES PROPERTIES
- PLANAR INHOMOGENEITIES ORIENTATION (BEDDING PLANES, CRACKS, ETC.)
- HETEROGENEITIES PRESENCE (HIGH-DENSITY MINERAL CONTRACTION, OPEN AND CLOSED CAVERS, OPEN AND HEALED CRACKS)
- FULL-SIZE CORE MINERAL COMPOSITION (IN CASE OF A SIMPLE STRUCTURE)
- SPECIFIC CRACK SURFACE, VOLUME OF CAVERS /INCLUSIONS

TECHNICAL SPECIFICATIONS

GENERAL CHARACTERISTICS

Layout

subject vertical position

Scanning mechanism

vertical movement of the source-detector pair, subject rotation

Spatial resolution, microns

up to 150

Maximum diameter of the subject, mm

150

Maximum length of the subject, mm

1000

Tube voltage, kV

up to 160

Maximum power at anode, W

1800

En12543 focal spot size:
at 900 W
at 1800 W

0.4x0.4 mm
1.0x1.0 mm

Resolution, microns

100

Capacity, bit

12

Detector size, pix

1280x1280

Material

steel lead

Dose rate

less than 1.0 μ Sv h
at 10 cm distance from
the cabinet surface

X-RAY MACHINE

X-RAY DETECTOR

PROTECTIVE CABINET

EXTERNAL REQUIREMENTS

Power supply parameters

Voltage, V

380

Frequency, Hz

50 \pm 1

Power demand, kW

no more than 12

Compressed air line, MPa

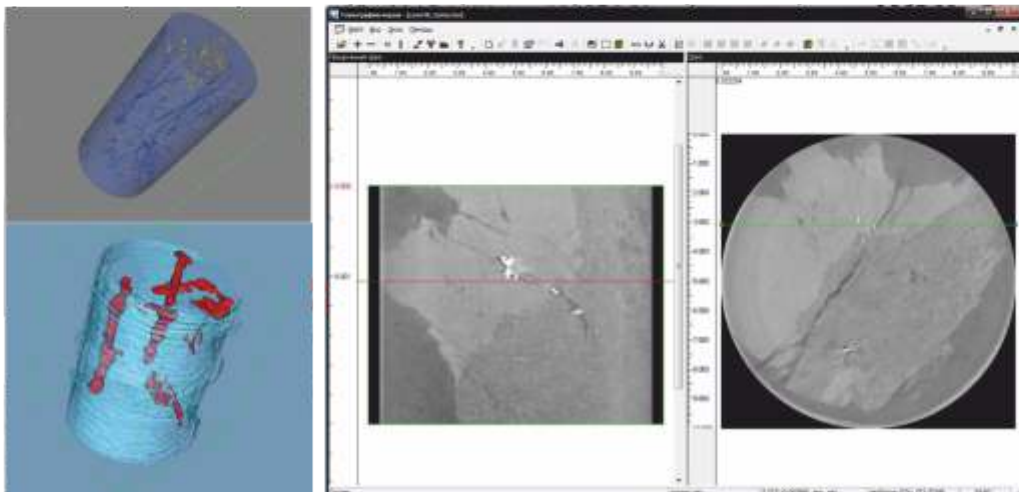
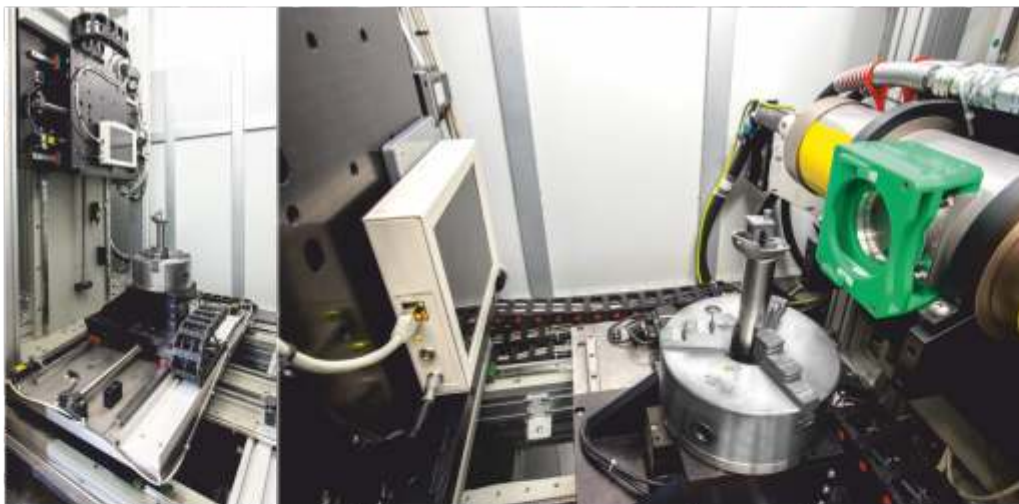
pressure 0,5-0,7

Mass, kg

7000

Dimensions W×L×H (2 chambers), mm

1500×2000×2600



«PIK-RKT-225-HPHT» X-RAY COMPUTER TOMOGRAPH FOR CORE AT RESERVOIR CONDITIONS

The «PIK-RKT-225-HPHT» X-ray computer tomograph is designed for core samples tomography at reservoir conditions and is used for the current assessment of reservoir model saturation and displacement front dynamics during filtration experiments (oil displacement by various agents, relative phase permeabilities in «liquid-liquid» and «liquid-gas» systems, etc.). The X-ray source and detector rotate around and move along a stationary subject, providing continuous control of the experimental parameters. The use of a solid-state detector and an x-ray tube with a small focal spot allows achieving maximum shooting resolution. X-ray transparent core holder made of composite materials ensures compliance with reservoir conditions for filtering experiments. Without a core holder, the tomograph can be used for tomography of a full-size core or its samples at atmospheric conditions.

MEASURED PARAMETERS:

- CORE SAMPLES SATURATION
- POSITION AND SHAPE OF THE DISPLACEMENT FRONT
- INTERLAYERS TILT ANGLES
- MINERAL INCLUSIONS
- SLOPE CRACK DISTRIBUTION SPECIFIC SURFACE OF CRACKS
- CAVERNS / INCLUSIONS VOLUME



EXTERNAL REQUIREMENTS

Power supply parameters	
Voltage, V	380
Frequency, Hz	50±1
Power demand, kW	no more than 15
Compressed air line, MPa	pressure 0,5-0,7
Mass, kg	10000
Dimensions W×L×H (2 chambers), mm	3200×4100×2600

		TECHNICAL SPECIFICATIONS
Layout	subject horizontal position	X-RAY TOMOGRAPHY
Scanning mechanism	rotating pair source-detector moving along the subject axis	
Spatial resolution, microns	150 (for core with a diameter of 30 mm)	
Contrast resolution, %	0,5	
Maximum length of the subject, mm	1000	
Maximum diameter of the subject, mm	250	DETECTOR
Type	CMOS x-ray sensor technology	
Active area, cm	12.8 x 12.8	
Capacity, bit	14	
Pixel size, microns	150	X-RAY MACHINE
Maximum voltage, kV	225	
Maximum current, mA	30	
Maximum power, W	1600	
Focal spot size IEC 336, mm: at 900 W at 1600 W	0.4x0.4 mm 1.5x1.5 mm	
Cooling system	water/antifreeze with flow and temperature control	PROTECTIVE CABINET
Material	steel lead	
Dose rate	less than 1.0 μ Sv /h at any point of 10 cm distance from the cabinet surface	
Resolution control	test sample with characteristic element sizes: 150 microns	TEST SAMPLES (PHANTOMS) SET FOR TOMOGRAPHY QUALITY CONTROL
Contrast control	test sample for checking contrast resolution: solid object with density variation insert of 0.5%.	
Maximum crimp pressure, Mpa	70	HYDRAULIC SYSTEM
Maximum pore pressure, Mpa	40	
Working substance	water mineralized up to 300 g/l	
Fluid-contact parts material	stainless steel, titanium	
Core diameter, mm	30	CORE HOLDER
Maximum column length of core samples, mm	300	
Maximum working crimp pressure, Mpa	70	
Maximum working pore pressure, Mpa	40	
Maximum working temperature, °C	+150	
Fluid-contact parts material	stainless steel, titanium	

PROGRAM-MEASURING «PIK-AEI» COMPLEX FOR FILTRATION EXPERIMENTS WITH CURRENT SATURATION X-RAY CONTROL

The «PIK-AEI» complex is designed to carry out filtration experiments (oil displacement by water/gas, determination of relative phase permeabilities and the effectiveness of physicochemical methods of enhanced oil recovery) by stationary and non-stationary methods at reservoir conditions. Core samples current saturation is estimated by the X-ray method, which also allows to record the dynamics of displacement front and end effects presence. The complex can be used to assess core samples density heterogeneity. The software allows conducting experiments in automatic mode.

MEASURED PARAMETERS:

- PHASE PERMEABILITY FOR TWO- AND THREE-PHASE SYSTEMS (LIQUID-LIQUID-GAS) IN ACCORDANCE WITH OST 39-235-89
- CORE SAMPLES CURRENT SATURATION
- DISPLACEMENT FRONT POSITION
- OPEN POROSITY AT RESERVOIR CONDITIONS
- OPEN POROSITY DYNAMICS WHEN CHANGING RESERVOIR CONDITIONS
- ABSOLUTE AND EFFECTIVE LIQUID AND GAS PERMEABILITY
- OIL DISPLACEMENT COEFFICIENT BY WATER/GAS



TECHNICAL SPECIFICATIONS

HYDRAULIC SYSTEM

Crimp pressure, Mpa	up to 70
Pore pressure, Mpa	up to 70
Pore fluid supply	in forward and reverse direction
Working substance	water mineralized up to 300 g/l; oil; gas

EXTERNAL REQUIREMENTS

Power supply parameters	
Voltage, V	380
Frequency, Hz	50±1
Power demand, kW	no more than 12
Compressed air line, MPa	pressure 0,5-0,7
Mass, kg	2000
Dimensions W×L×H (2 chambers), mm	1100×3000×1800

PROGRAM-MEASURING “PIK-AE” COMPLEX FOR FILTRATION EXPERIMENTS WITH CURRENT SATURATION X-RAY CONTROL

TECHNICAL
SPECIFICATIONS

TEMPERATURE
MAINTENANCE SYSTEM

PUMP
GROUPS

DIFFERENTIAL PRESSURE
MEASURING SYSTEM

BACKPRESSURE
REGULATOR

X-RAY
SATURATION SCANNER

X-RAY TRANSPARENT
CORE HOLDER

PC-BASED MONITORING
AND CONTROL SYSTEM

Type	heating chamber/ thermostable volume + individual heaters
Operating temperature range, °C	from +25 to +150
Heated elements	core holder, supply tubes, separation tanks
Rock pressure pump type	pneumohydraulic booster
Rock pressure pump operating mode	maintaining constant pressure
Reservoir pumps for supplying liquids and gas	3 pcs. (for oil, saline and gas)
Reservoir pumps type	two-plunger
Reservoir pumps operating mode	- maintaining constant flow rate - maintaining constant pressure - maintaining predetermined proportion when filtering three phases of fluids through a core sample from 0 to 100%
Flow rate, ml / min	0,001-50
Cylinder volume, ml	200
Maintaining reservoir pumps pressure accuracy of the rock pressure system,% (of the current value)	0,5
Maintaining reservoir pumps flow rate accuracy of the rock pressure system,% (of the current value)	0,5
Sensor 1. Upper measurements limit, Mpa	1,6
Sensor 2. Upper measurements limit, kPa	250
Measurement accuracy, %	not more than $\pm 0,075$
Pressure, Mpa	up to 70
Control	automatic, PC connection
Fluid-contact parts material	stainless steel
Detector Type	linear/point
Clearance, mm	0,4
X-ray source, kV	120
Core diameter, mm	30
Maximum column length of core samples, mm	300
Maximum working crimp pressure, Mpa	70
Maximum working pore pressure, Mpa	40
Maximum working temperature, °C	+150
Fluid-contact parts material	stainless steel
Control	pumps flow rate, temperature, back pressure regulator, automatic valves
Data collection	pressure/differential pressure digital sensors, pumps flow rate, temperature sensors, core saturation distribution



PROPPANT TESTING

THE «PIK-PN» SYSTEM FOR STUDYING PROPPANT PACKAGE STRENGTH

The system is designed to study the proppant and sands flowback (RCP, RCS) from a cell simulating hydraulic fracture. The system allows conducting research using water/oil or a water-oil emulsion. Pressure drop, fluid flow rate and gap width are measured at fixed compression force of the package and constant temperature. The cell design provides the ability to simulate open barrel or perforation conditions, as well as the effect of pressing proppant into the plates made of core. Control and data collection are carried out using a computer.

MEASURED PARAMETERS:

- PROPPANT PACKAGING STABILITY WITH INCREASING FLOW RATE
- PACKAGING HEIGHT

- CRITICAL SPEED AT WHICH THE PACKAGE IS DESTROYED



TECHNICAL SPECIFICATIONS OF INSTALLATION NODES

Size, mm	133×133 (5.25"×5.25")
Slit thickness, mm	up to 25,4 (1")
Maximum compression force, tons	up to 100
Temperature, °C	up to 150
Type	four-column
Minimum diameter of supports, mm	63,5
Maximum force of axial compression, tons	100
Control	automatic
Maintaining effort accuracy, %	0,5
Consumption, l/min	from 0.1 to 100
Pressure, Mpa	up to 4
Flow rate measurement accuracy, %	±1
Pressure measurement accuracy, %	±0,25
Temperature, °C	up to +150

CELL

HYDRAULIC
PRESS

FLUID SUPPLY
SYSTEM

Power supply parameters	
Voltage, V	380
Frequency, Hz	50±1
Power demand, kW	no more than 6
Mass, kg	1000
Dimensions W×L×H, mm	600×1300×1800

EXTERNAL
REQUIREMENTS

THE «PIK-API RP 61» INSTALLATION FOR MEASURING PROPPANT PACK CONDUCTIVITY

The «PIK-API RP 61» installation is designed for studying operational characteristics of proppant pack in thermobaric conditions corresponding to reservoir or established regulatory documents. The equipment allows evaluating long-term and residual packs conductivity of all types of proppants (ceramic proppants and quartz sands) by performing continuous measurements of compression forces of the pack, its height and liquid permeability at pore pressure up to 5.2 MPa (720 psi) and compression pressure up to 138 MPa (20,000 psi).

The equipment and measurement procedures comply with the standards: GOST-P 51761-2013, ISO 13503-5, API RP-61.

» MEASURED PARAMETERS:

- LONG-TERM PROPPANTS CONDUCTIVITY
- LONG-TERM PROPPANTS PERMEABILITY
- SHORT-TERM PROPPANT PACKAGING CONDUCTIVITY AND PERMEABILITY
- PROPPANT PACK HEIGHT DEPENDING ON APPLIED PRESSURE
- RESIDUAL CONDUCTIVITY WITH HYDRAULIC FRACTURING GEL FILTRATION EFFECT INTO LAYER AND FILTER CAKE FORMATION
- RESIDUAL CONDUCTIVITY AND PERMEABILITY OF THE HYDRAULIC FRACTURING FLUID – PROPPANT SYSTEM IN RESERVOIR CONDITIONS
- CRUSH RESISTANCE (MASS FRACTION OF BROKEN GRANULES) (OPTIONAL)



» BENEFITS

WIDE STUDYING RANGE OF ADDITIONAL PARAMETERS (PROPPANT PACKAGING STRENGTH («LEAK-OFF»), DETERMINATION OF GAS FLOW TURBULENCE FACTOR («BETA-FACTOR»), CRUSH RESISTANCE EQUIPMENT («CRASH-TEST»))

THE INSTALLATION CAN BE EQUIPPED WITH AN ADDITIONAL SET OF CELLS AND A PRESS FOR SIMULTANEOUS STUDY OF FOUR PROPPANT SAMPLES

EXTERNAL REQUIREMENTS

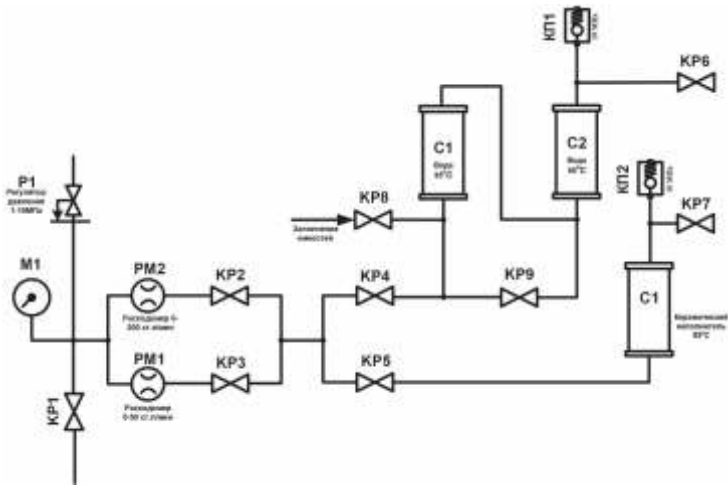
Power supply parameters	
Voltage, V	220
Frequency, Hz	50±1
Power demand, kW	no more than 1
Compressed air line, MPa	pressure 0,5-0,7
Mass, kg	1500
Dimensions W×L×H, mm	1400×3200×1750

TECHNICAL SPECIFICATIONS OF INSTALLATION NODES

Standard	ISO 13503-5	ROD MEASURING SYSTEM CELL
Material	stainless steel	
Pack thickness measurement	Mitutoyo ID-U1025E sensor	
Pack thickness measurement accuracy, microns	25	
Proppant leveling device	included	
Maximum working pressure, Mpa	10	SILICON DIOXIDE SATURATOR
Maximum working temperature, °C	+150	
Volume, ml	300	
Type	four-column	HYDRAULIC PRESS
Minimum diameter of supports, mm	63,5	
Maximum force of axial compression, tons	100	
Control	automatic	
Maintaining effort accuracy, %	0,5	
Type	double plunger	PUMP LN-100 SUPPLYING PORE FLUID
Maximum pressure, Mpa	10	
Minimum flow rate, ml / min	0,001	
Maximum flow rate, ml / min	100	
Cylinder volume, ml	100	
Pressure maintenance accuracy, % VPI	0,5	
Flow rate accuracy, % of current value	0,5	
Working environments	saline/oil	
Operating modes	- maintaining constant flow rate - maintaining constant pressure - programmable cycles with gradual change of the set parameter (change in pressure/ flow rate by a predetermined amount in a given time)	
Fluid preheating	+	HEATING SYSTEM
Cell heating	+	
Maximum temperature, °C	150	
Temperature maintenance accuracy, °C	±0,5	
Heated elements	conductivity cells, saturator, lead-in tubes	
Measuring range, kPa (PSI)	from 0 to 7 (from 0 to 1,0)	DIFFERENTIAL PRESSURE SENSORS
Accuracy, %	±0,045	
Number of containers	1	FLUID PREPARATION SYSTEM
Container volume (not less), liters	15	
Maximum pressure, Mpa	0,5	
Oxygen removal system	+	
Vacuum system	+	

THE SUBSYSTEM DETERMINING GAS FLOW TURBULENCE FACTOR FOR THE «PIK-API RP 61» INSTALLATION MEASURING PROPPANT PACKAGING CONDUCTIVITY

The gas supply subsystem is designed to determine gas flow turbulence factor (beta-factor) for proppant. The subsystem allows supplying prepared gas to the cell of «PIK-API RP 61» installation measuring proppant packaging conductivity. Gas flow preparation involves supplying dry or humidified heated gas to the cell with flow rate measurement.



TECHNICAL SPECIFICATIONS INSTALLATION NOTES

CONTROLLED GAS SUPPLY MODULE	Working environment	nitrogen
	Gas consumption, nl / min	up to 400
	Flowmeter block, pcs.	2
	Pressure, Mpa	up to 7
	Measurement point	to gas preparation module
GAS SUPPLY CONTROL	Flow meter 1, nl / min	1 — 50
	Flow meter 2, nl / min	8 — 400
GAS PREPARATION MODULE	Gas preparation lines	saturated gas supply, dry gas supply
	Saturated gas supply	two thermostatic containers with water for gas passage
	Dry gas supply	container with ceramic particles
	Temperature, °C	95
	Pressure, Mpa	up to 7
EXTERNAL REQUIREMENTS	Power supply parameters	
	Voltage, V	380
	Frequency, Hz	50±1
	Power demand, kW	no more than 6
	Mass, kg	1500
	Dimensions W×L×H, mm	600×1300×1800

NON-STANDARD EQUIPMENT



THE «PIK-FL» INSTALLATION FOR STUDYING PROPPANT AND HYDRAULIC FRACTURING FLUIDS TRANSPORTATION

The «PIK-FL» installation is designed to evaluate hydraulic pressure losses in pipes, as well as to study proppant transport characteristics in a hydraulic fracture model. The installation consists of a hydraulic fracturing fluid preparation and mixing unit with a metering pump for the precise supply of chemical additives and hydraulic fracturing fluid and proppant mixer. The system for studying rheological properties makes it possible to determine shear stress, apparent viscosity of hydraulic fracturing fluid and other parameters. Transparent hydraulic fractures model has a variable geometry (optional) and allows user to visualize proppant transport and deposition process.



EXTERNAL REQUIREMENTS

Power supply parameters		
Voltage, V		380
Frequency, Hz		50±1
Power demand, kW		no more than 22
Compressed air line, MPa		pressure 0,5-0,7
Mass, kg		1800
Dimensions W×L×H (2 chambers), mm		1000×8000×2300

THE PIK-FL INSTALLATION FOR STUDYING PROPPANT AND HYDRAULIC FRACTURING FLUIDS TRANSPORTATION

TECHNICAL SPECIFICATIONS

LINEAR HYDRAULIC FRACTURING GEL PREPARATION UNIT

LINEAR GEL INJECTION PUMP

STAPLER METERING PUMP

CHEMICAL METERING PUMP

DETERMINING PRESSURE LOSSES SECTION 1 (DUE TO FRICTION)

DETERMINING PRESSURE LOSSES SECTION 2 (DUE TO FRICTION)

FLOW METER

SLIT RHEOMETER

SYSTEM FLUSH PUMP

PC-BASED MONITORING AND CONTROL SYSTEM

«PIK-GP» STEAM GENERATION SYSTEM

The «PIK-GP» system is designed to prepare and create steam in order to evaluate the efficiency of displacing viscous and high-viscosity oils with high-temperature steam. The main system parts are sequentially placed heating circuits. Accurate temperature sensors and high temperature sensors allow user to control vaporization process at all its stages.



BENEFITS

- HIGH-PERFORMANCE DRY, SUPERHEATED AND WET STEAM GENERATION SYSTEM
- HIGH DEGREE OF PROTECTION FOR OPERATING PERSONNEL
- AUTOMATED CONTROL AND DATA COLLECTION

TECHNICAL SPECIFICATIONS

HYDRAULIC PRESS

Maximum pressure of generated steam, Mpa	40
Maximum temperature of generated steam, °C	360
Liquid pump type	piston
Pump operating mode	maintaining constant pressure, maintaining constant flow
Flow rate, ml / min	0,01-50 (optionally up to 200)

STEAM GENERATION SYSTEM

Heating	composite linear heaters
Maximum temperature of generated steam, °C	360
Basic temperature measurement error, °C	±1
Diameter of pipeline, inch	1/8-1/4
Steam generation monitoring system	temperature, pressure

EXTERNAL REQUIREMENTS

Power supply parameters	
Voltage, V	380
Frequency, Hz	50±1
Power demand, kW	no more than 12
Compressed air line, MPa	pressure 0,5-0,7
Mass, kg	300
Dimensions W×L×H (2 chambers), mm	1000×1500×1800

«LN» SERIES LABORATORY PUMPS



«LN» SERIES LABORATORY PLUNGER PUMPS

Laboratory plunger pumps of the «LN» series are designed to create a continuous fluid flow without pressure pulsations. The plunger pump operation principle based on fluid displacement from the cylinder cavity due to rod (plunger) movement from its lowest position to its highest. The pump consists of two independent pressure cylinders, equipped with automatic valves for smooth switching from one cylinder to another. The pump parts in contact with the liquid are made of corrosion-resistant materials (stainless steel, titanium). Pumps can be designed heat-resistant for operating at temperatures up to 150 °C. The pump is controlled by a touch screen located on the front panel. The pump controller can be connected to PC by provided software. The pump software allows user to work both in twin and in separate cylinder operating modes: each pump cylinder can operate in its own independent mode.

» BASIC MODES OF THE PUMP OPERATION:

- CONSTANT PRESSURE
AUTOMATIC MAINTENANCE
- CONSTANT FLOW AUTOMATIC
MAINTENANCE WITH PUMPED
VOLUME ACCURATE CALCULATION
- AUTOMATIC BACKPRESSURE MODE:
MAINTAINING PRESSURE BY FLUID
WITHDRAWAL
- PROGRAMMABLE CYCLES WITH GRADUAL
CHANGE OF GIVEN PARAMETER: PRESSURE /
FLOW RATE CHANGE BY A SET VALUE IN
A DEFINITE TIME
- EXACT LIQUIDS DOSAGE
- MANUAL DEVICE CONTROL



TECHNICAL SPECIFICATIONS

	LN-100	LN-400	LN-700
Versions	Double plunger	Double plunger	Double plunger
Max. pressure, Mpa	10	40	70
Min. flow rate, ml / min	0,001	0,0001	0,0001
Max. flow rate, ml / min	100	25	15
Volume supply resolution, nl	32	8,2	5,2
Cylinder volume, ml	100	30	20
Flow rate accuracy, % of the current value	0,5	0,5	0,5
Pressure maintenance accuracy, % of VPI	0,5	0,5	0,5

EXTERNAL REQUIREMENTS

Model	LN-100	LN-400	LN-700
Mass, kg	60	60	60
Dimensions W×L×H, mm	410×460×900	410×460×900	410×460×900
Voltage, V	220	220	220
Frequency, Hz	50±1	50±1	50±1
Power demand, kW	no more than 0,6	no more than 0,6	no more than 0,6
Compressed air line, MPa	pressure 0,5-0,7	pressure 0,5-0,7	pressure 0,5-0,7



TECHNICAL SPECIFICATIONS

LN-400-200

Single /
Double plunger

40

0,001

50

44,8

200

0,5

0,5

LN-700-100

Single /
Double plunger

70

0,001

25

23,2

100

0,5

0,5

LN-1400-50

Single /
Double plunger

140

0,001

100

8,2

50

0,5

0,5

LN-400-1000

Single
plunger

40

0,1

500

100

1050

0,5

0,5

Versions

Max. pressure, Mpa

Min. flow rate, ml / min

Max. flow rate, ml / min

Volume supply resolution, nl

Cylinder volume, ml

Flow rate accuracy, % of the current value

Pressure maintenance accuracy, % of VPI

LN-400-200

110

530×510×1500

220

50±1

no more than 0,6

pressure 0,5-0,7

LN-700-100

110

530×510×1500

220

50±1

no more than 0,6

pressure 0,5-0,7

LN-1400-50

110

530×510×1500

220

50±1

no more than 0,6

pressure 0,5-0,7

LN-400-1000

300

900×900×2000

220

50±1

no more than 0,6

pressure 0,5-0,7

EXTERNAL REQUIREMENTS



«LN-P» SERIES LABORATORY PUMPS

The «LN-P» series laboratory piston pumps are designed to create continuous fluid flow without pressure pulsations. Piston pump operation principle is based on displacement of fluid from cylinder cavity by moving piston from its lowest position to its highest. This version of hydraulic pump part allows using it for pore fluids and aggressive substance direct supply without additional separation tanks (piston containers). The pump consists of two independent pressure cylinders, equipped with automatic valves to ensure smooth switching from one cylinder to another. Fluid-contact parts are made of corrosion-resistant materials (stainless steel, titanium). Pumps can be designed heat-resistant for operating at temperatures up to 150 °C. The pump is controlled by a touch screen located on the front panel. The pump controller can be connected to PC by provided software. The pump software allows user to work both in twin and in separate cylinder operating modes: each pump cylinder can operate in its own independent mode.

» BASIC MODES OF THE PUMP OPERATION:

- CONSTANT PRESSURE AUTOMATIC MAINTENANCE
- CONSTANT FLOW AUTOMATIC MAINTENANCE
WITH PUMPED VOLUME ACCURATE CALCULATION
- EXACT LIQUIDS DOSAGE
- AUTOMATIC BACKPRESSURE MODE: MAINTAINING
PRESSURE BY FLUID WITHDRAWAL
- PROGRAMMABLE CYCLES WITH GRADUAL
CHANGE OF GIVEN PARAMETER: PRESSURE / FLOW
RATE CHANGE BY A SET VALUE IN A DEFINITE TIME
- MANUAL DEVICE CONTROL



LN-P-210-520

LN-P-520-260

Versions	Single / Double plunger	Single / Double plunger
Max. pressure, Mpa	21	52
Min. flow rate, ml / min	0,0001	0,0001
Max. flow rate, ml / min	100	50
Volume supply resolution, nl	32	8,2
Cylinder volume, ml	520	260
Flow rate accuracy, % of the current value	0,5	0,5
Pressure maintenance accuracy, % of VPI	0,15	0,15

TECHNICAL
SPECIFICATIONS

Power supply parameters, model	LN1-P-210-520 / LN1-P-520-260
Voltage, V	220
Frequency, Hz	50±1
Power demand, kW	no more than 0,6
Compressed air line, MPa	pressure 0,5-0,7
Mass, kg	65
Dimensions W×L×H (2 chambers), mm	310×520×1320

EXTERNAL
REQUIREMENTS



FLUID STUDIES

THE «PIK-GEOVIS-700» PROGRAM-MEASURING COMPLEX FOR DETERMINING GASES AND LIQUIDS VISCOSITY

The «PIK-GEOVIS-700» capillary viscometer is designed to measure gas and liquid viscosity at reservoir conditions in the range from 0.1 mPa·s to 10,000 mPa·s in accordance with GOST 7163-84. Fluid viscosity is calculated by solving the Hagen-Poiseuille equation in accordance with the set pressure drop and flow rate values when flowing through one of the three capillaries of known geometry. Sample is supplied through capillary by piston pump, which ensures necessary pressure and flow rate accuracy. Tanks and capillaries are in thermostatically controlled volume.

MEASURED PARAMETERS:

- FLUID VISCOSITY AT RESERVOIR CONDITIONS



Type	capillary
Maximum working pressure, Mpa	70
Maximum working temperature, °C	150
Temperature maintenance accuracy, °C	± 1
Determined viscosity minimum value, Mpa·c	0,1
Determined viscosity maximum value, Mpa·c	10000
Minimum flow rate, ml / min	0,001
Maximum flow rate, ml / min	25
Volume supply resolution, nl	23,8
Cylinder volume, ml	100
Maintaining flow rate accuracy,% of current value 0	0,5
Pressure maintenance accuracy,% of VPI	0,5
Material	stainless steel

TECHNICAL SPECIFICATIONS

Power supply parameters	
Voltage, V	220
Frequency, Hz	50±1
Power demand, kW	no more than 5
Compressed air line, MPa	pressure 0,5-0,7
Mass, kg	1000
Dimensions W×L×H (2 chambers), mm	800×1400×1600

EXTERNAL REQUIREMENTS

THE «PIK-PVT» INSTALLATION FOR RESERVOIR FLUID SAMPLES PVT STUDIES

The «PIT-PVT» installation is designed to study the reservoir fluids phase behavior at conditions from reservoir to normal. The system includes a high-pressure cell with transparent window and movable piston for accurate volume and pressure measurement of reservoir mixture and test sample complete visualization. Phase boundary determination with volumes estimation is carried out using an optical-digital subsystem with a video camera. Magnetic mixer increases mixing speed and efficiency.

Research is carried out in accordance with GOST 153-39.2-048-2003.

» BENEFITS

MERCURY-FREE SYSTEM

AUTOMATED CONTROL AND DATA COLLECTION

PHASE BOUNDARY VISUAL DETERMINATION

OIL AND GAS CONDENSATE RESEARCH



MEASURED PARAMETERS:

- GAS SATURATION PRESSURE
- OIL COMPRESSIBILITY FACTOR
- OIL DENSITY AT DIFFERENT STAGES OF DIFFERENTIAL DEGASSING
- VOLUMETRIC OIL COEFFICIENT AT RESERVOIR PRESSURE AND TEMPERATURE
- VOLUMETRIC OIL COEFFICIENT AT DIFFERENT STAGES OF DIFFERENTIAL DEGASSING
- OIL VISCOSITY AT RESERVOIR PRESSURE AND TEMPERATURE
- OIL DENSITY AT RESERVOIR PRESSURE AND TEMPERATURE
- OIL VISCOSITY AT DIFFERENT STAGES OF DIFFERENTIAL DEGASSING
- GAS CONTENT OF OIL AT RESERVOIR PRESSURE AND TEMPERATURE
- GAS CONTENT OF OIL AT DIFFERENT STAGES OF DIFFERENTIAL DEGASSING
- GAS CONDENSATES PHASE BEHAVIOR STUDIES AT RESERVOIR CONDITIONS
- RECOMBINED SAMPLES PREPARATION

TECHNICAL SPECIFICATIONS

TEMPERATURE MAINTENANCE SYSTEM

Type	heating chamber, individual heaters
Operating mode	heating / cooling
Operating temperature range, °C	from +5 to +200
Temperature measurement accuracy, °C	no more than ± 1
Temperature setting resolution, °C	$\pm 0,1$
Heated elements	PVT cell, supply tubes, separation tanks
Indication	temperature, cell pressure
Material	stainless steel

Maximum working pressure, Mpa	70
Maximum working temperature, °C	200
Sample volume with isolating piston, ml	130 (other volumes – on request)
Sample volume without isolating piston, ml	152 (other volumes – on request)
Viewing window size, mm	165 x 9,5
Fluid-contact parts material	stainless steel
Sampling system	from PVT-cell bottom and top
Cell rotation	360°
Mixer rotation frequency, rpm	300 - 2500
Fluid viscosity for mixer operation, cP at 25°C	up to 100
Level control system type	optical (video control)
Level control system resolution, mm (ml)	0,005 (0,015)

PVT CELL

Power supply parameters	
Voltage, V	380
Frequency, Hz	50 \pm 1
Power demand, kW	no more than 7
Compressed air line, MPa	pressure 0,5-0,7
Mass, kg	1000
Dimensions W×L×H (2 chambers), mm	1050×2000×1800

EXTERNAL REQUIREMENTS

THE «PIK-PVT-LIGHT» INSTALLATION FOR RESERVOIR FLUID SAMPLES PVT STUDIES

The «PIT-PVT-light» installation is designed to study the reservoir fluids phase behavior at conditions from reservoir to normal. Main element of the system are pumps installed in a heating cabinet and providing a fluid sample circulation in a closed circuit. The circuit includes a high-pressure and temperature densitometer, a capillary for viscosity measuring, and a high-precision differential pressure sensor. The installation includes a manual gas meter.

Research is carried out in accordance with GOST 153-39.2-048-2003.

» MEASURED PARAMETERS:

- GAS SATURATION PRESSURE
- OIL COMPRESSIBILITY FACTOR
- OIL DENSITY AT RESERVOIR PRESSURE AND TEMPERATURE
- OIL DENSITY AT DIFFERENT STAGES OF DIFFERENTIAL DEGASSING
- VOLUMETRIC OIL COEFFICIENT AT RESERVOIR PRESSURE AND TEMPERATURE
- VOLUMETRIC OIL COEFFICIENT AT DIFFERENT STAGES OF DIFFERENTIAL DEGASSING
- OIL VISCOSITY AT RESERVOIR PRESSURE AND TEMPERATURE
- OIL VISCOSITY AT DIFFERENT STAGES OF DIFFERENTIAL DEGASSING
- GAS CONTENT OF OIL AT RESERVOIR PRESSURE AND TEMPERATURE
- GAS CONTENT OF OIL AT DIFFERENT STAGES OF DIFFERENTIAL DEGASSING
- GAS CONDENSATES PHASE BEHAVIOR STUDIES AT RESERVOIR CONDITIONS



BENEFITS

MERCURY-FREE SYSTEM

AUTOMATED CONTROL AND DATA COLLECTION

OIL AND GAS CONDENSATE RESEARCH

TECHNICAL SPECIFICATIONS

PVT pump type	piston
Maximum working pressure, MPa 21	21 (optional 52)
PVT pump plunger volume, ml	500 (optional 260)
Maximum working temperature, °C	200
Oil pump type	double plunger
Maximum working pressure, Mpa	21 (optional 52)
Pump plunger volume, ml	500 (optional 260)
Viscosity measurement	two circuits
Densitometer maximum working temperature, °C	200

HYDRAULIC SYSTEM

Type	heating chamber, individual heaters
Operation mode	heating / cooling
Working temperature range, °C	from +5 to +200
Temperature measurement accuracy, °C	no more than ±1
Temperature setting resolution, °C	± 0,1
Heated elements	PVT pumps, supply tubes, densitometer, viscosity measurement circuits
Material	stainless steel

TEMPERATURE MAINTENANCE SYSTEM

Control type	manual
Measuring cylinders number	2
Gas meter total volume, m	3000
Volume resolution, ml	0,2
Working pressure	atmospheric
Fluid-contact parts material	stainless steel, glass, PEEK

EMITTED GAS VOLUME MEASURING SYSTEM (GAS METER)

Power supply parameters	
Voltage, V	380
Frequency, Hz	50±1
Power demand, kW	no more than 7
Compressed air line, MPa	pressure 0,5-0,7
Mass, kg	1000
Dimensions W×L×H (2 chambers), mm	1050×2500×1800

EXTERNAL REQUIREMENTS

THE «PIK-GAZMETER» GAS VOLUME MEASURING DEVICE

The gas meter is designed to determine free gas volume at atmospheric conditions. The gas meter includes two glass piston measuring chambers with hydraulic strapping and piston position measuring system. Chamber volumes hold 2000 and 1000 ml. Manual gas meter taps switch gas flow or discharge into one of the chambers. Chambers can be hydraulically connected to use their total volume. Linear displacement sensors are used for accurate measurement the piston position; pistons position indicator is provided on the front panel. The gas meter is equipped with gas temperature measuring system. The software calculates gas volume at normal conditions based on temperature.

MEASURED PARAMETERS:

- FREE GAS VOLUME AT NORMAL CONDITIONS
- GAS TEMPERATURE



BENEFITS

- TWO MEASURING CHAMBERS WITH THREE WORKING VOLUMES: 1000 CM³, 2 000 CM³, 3 000 CM³
- DATA DIGITAL ACQUISITION AND CALCULATION
- SULFUR-CONTAINING GASES STUDIES
- PRECISE LINEAR DISPLACEMENT SENSORS FOR ACCURATE VOLUME DETECTION

TECHNICAL SPECIFICATIONS

Operation mode	manual
Gas meter total volume o, l	3
Measuring chamber volume I, l	1
Measuring chamber volume II, l	2
Volume resolution, ml	0,35
Working pressure	atmospheric
Working temperature range, °C	from room temperature to +40
Fluid-contact parts material	stainless steel, glass

EXTERNAL REQUIREMENTS

Power supply parameters	
Voltage, V	220
Frequency, Hz	50±1
Power demand, kW	no more than 0,5
Mass, kg	50
Dimensions W×L×H (2 chambers), mm	650×350×1200

THE «PIK-GAZMETER» AUTOMATIC DEVICE FOR GAS VOLUME DETERMINING

The «PIK-Gasmeter» automatic gas meter is designed to determine gas amount released at atmospheric conditions. Gas enters the measuring cylinder with a motorized movable piston. The pressure in the cylinder is automatically maintained at 0.1 MPa; when it is exceeded, the piston automatically moves, increasing gas volume. Piston movement is monitored by a linear sensor, its records are converted into incoming gas volume value. The gas meter is equipped with thermal stabilization system.

MEASURED PARAMETERS:

- FREE GAS VOLUME AT NORMAL CONDITIONS
- GAS TEMPERATURE



BENEFITS

AUTOMATED CONTROL AND DATA COLLECTION

THERMAL STABILIZATION DURING MEASUREMENTS

MIXING SYSTEM

OIL AND GAS CONDENSATE RESEARCH

TECHNICAL SPECIFICATIONS

Operation mode	automatic
Gas meter total volume, l	10
Maximum gas flow rate, l / h	40
Volume resolution, cm ³	0,253
Working pressure	atmospheric
Working temperature range, °C	from room temperature to +40
Fluid-contact parts material	stainless steel

GENERAL

Type	thermostatically controlled volume
Working temperature range, °C	from room temperature to +40
Temperature measurement accuracy, °C	no more than ±1
Temperature resolution, °C	± 0,1

TEMPERATURE MAINTENANCE SYSTEM

Power supply parameters	
Voltage, V	220
Frequency, Hz	50±1
Power demand, kW	no more than 1,5
Mass, kg	200
Dimensions W×L×H (2 chambers), mm	550×700×1450

EXTERNAL REQUIREMENTS

THE «PIK-RP (A)» AUTOMATIC INSTALLATION FOR RESERVOIR FLUIDS SAMPLES RECOMBINATION

The «PIK-RP (a)» installation is designed for recombination of wellhead (separated) oil / water samples and hydrocarbon gases for further PVT studies or filtration experiments. The main installation element is a high-pressure piston tank (recombination cell) into which the required (usually in accordance with the working gas factor) fluids volumes are transferred using a plunger pump. Required phase volumes are calculated using installation software. The recombination cell swing mechanism and additional magnetic stirrer provide efficient fluid recombination.

» BENEFITS

RESISTANCE TO HYDROCARBON GASES
WITH A HYDROGEN SULFIDE UP TO 20%

WORKING SAMPLE
VISUALIZATION

AUTOMATED SWINGING MECHANISM
OF RECOMBINATION TANK

AUTOMATED LOADING SAMPLES PROCESS WITH
UPLOADED VOLUMES EXACT CALCULATION

MINIMUM «DEAD»
VOLUMES OF THE SYSTEM

MAGNETIC STIRRER AND MOVABLE SPHERE
FOR EFFICIENT SAMPLE MIXING AT RESERVOIR
PRESSURE AND TEMPERATURE



TECHNICAL SPECIFICATIONS

PRESSURE MAINTENANCE SYSTEM

Maximum working pressure, Mpa

100

Pump type

plunger

Pump operating mode

maintaining constant pressure
maintaining flow rate

Flow rate, ml/min

0,001 - 50,000

Flow rate accuracy, % of current value

0,5

Pressure measurement accuracy, % of VPI

0,01

RECOMBINATION CELL

Type

with dividing piston

Volume, ml

2000

Maximum working pressure, Mpa

100

Maximum working temperature, °C

+200

Fluid-contact parts material

stainless steel, titanium

Benefits

video recording system

MIXING SYSTEM

Rotation angle of tank swing mechanism

270

Agitator type

magnetic

Additional agitator

sphere

EXTERNAL REQUIREMENTS

Power supply parameters

Voltage, V

380

Frequency, Hz

50±1

Power demand, kW

no more than 9

Compressed air line, MPa

pressure 0,5-0,7

Mass, kg

500

Dimensions W×L×H (2 chambers), mm

800×1400×1600

THE «PIK-RP» INSTALLATION FOR RESERVOIR FLUIDS SAMPLES RECOMBINATION

The «PIK-RP» installation is designed for recombination of wellhead (separated) oil / water samples and hydrocarbon gases for further PVT studies or filtration experiments. The main installation element is a high-pressure piston tank (recombination cell) into which the required fluids volumes are transferred. Oil and gas samples loading volumes are accurately recorded in the installation software. Fluids in the recombination cell are mixed together using a swing mechanism, the cell is heated to required temperature.



BENEFITS

RESISTANCE TO HYDROCARBON GASES WITH A HYDROGEN SULFIDE UP TO 20%

MINIMUM «DEAD» VOLUMES OF THE SYSTEM

AUTOMATED LOADING SAMPLES PROCESS WITH UPLOADED VOLUMES EXACT CALCULATION

SWINGING MECHANISM OF RECOMBINATION TANK

MOVABLE BALL FOR EFFECTIVE SAMPLE MIXING AT RESERVOIR PRESSURE AND TEMPERATURE

TECHNICAL SPECIFICATIONS

RECOMBINATION CELL

Type	with dividing piston
Volume, ml	1000 (other volumes on request)
Maximum working pressure, Mpa	up to 70
Maximum working temperature, °C	+150
Fluid-contact parts material	stainless steel
Sample mixing system	free falling ball

TEMPERATURE MAINTENANCE SYSTEM

Type	individual heating
Maximum working temperature, °C	+150
Heated elements	recombination cell, plug-in samplers
Temperature maintenance accuracy, °C	no more than $\pm 0,1$

EXTERNAL REQUIREMENTS

Power supply parameters	
Voltage, V	380
Frequency, Hz	50 \pm 1
Power demand, kW	no more than 9
Compressed air line, MPa	pressure 0,5-0,7
Mass, kg	500
Dimensions W×L×H, mm	800×1400×1600



COMPONENTS

The high-pressure visual cell is designed to provide the possibility of direct observation in transmitted light of filtration experiments. The cell provides reservoir conditions for fluid flow. The visual cell is a body equipped with two transparent inserts for direct light passage with a direct channel for fluid flow monitoring. Channel sectional area is 25 mm².

The visual cell is equipped with a direct light source operating at reservoir temperatures.



Working pressure, MPa	40/70
Working temperature, °C	up to +150
Flow observation area length, mm	50
Channel sectional area, mm ²	25
Fluid-contact parts material	stainless steel, titanium
Weight, kg	11

EXTERNAL
REQUIREMENTS

SUBMERSIBLE CORE HOLDERS

Submersible core holders are used in installations for studying core samples reservoir properties at reservoir conditions. The core holder is a cylindrical shape vessel with end caps (nuts). Plungers, flanges and rubber cuff for core placement are located inside the core holder body. Plungers and flanges have inlet and outlet ports for supplying pore fluids, ports for creating crimp pressure, as well as ports for temperature control sensors and reserve ports for filling and draining crimp volume. Delivery set can include a special tripod to work with a core holder. Sample change in the core holder occurs with a partial discharge of hydraulic crimping fluid. Core holders can be equipped with separate heating system including clamp heaters, temperature sensors, temperature measurement and control system with a PC connection.



» BENEFITS

VARIOUS DESIGN OPTIONS FOR CORE HOLDER PLUNGERS; CONNECTION OF SEVERAL FLUID SUPPLY LINES AND INDIVIDUAL PRESSURE MEASUREMENT LINES; CONSTRUCTION FOR DRILLING FLUID SUPPLYING AND FILTERING, INCLUDING ALONG SAMPLE END; ACID RESISTANT PERFORMANCE

RESISTIVITY MEASUREMENTS OF SAMPLES INSTALLED IN CORE HOLDER

HIGH TEMPERATURE CORE HOLDER (UP TO +320 °C)

TECHNICAL SPECIFICATIONS

Tested samples diameter, mm	from 25 to 110
Tested samples length, mm	up to 1600
Sample crimp pressure, Mpa	up to 100 (other values on request)
Pore pressure, Mpa	up to 70
Maximum working temperature, °C	up to +320 (standard version +150)
Measuring electrical resistance scheme	2
Cuff	Viton
Fluid-contact parts material	stainless steel/titanium /acid resistant alloy (Hastelloy)/Viton
Connection types	NPT/Autoclave/HIP
Working positions	horizontally/vertically /at any angle
Working substance	water with salinity up to 300 g/l oil gas acids solutions, HCL-14%, HF-5%, acetic acid – 0.2% drilling mud filtrates

Dry-type core holders or Hassler core holders are used in installations for studying core samples reservoir properties at reservoir conditions. Cylindrical core sample is installed in the cuff of core holder body. Space between body and cuff is filled with hydraulic fluid. Pressure generated in core holder body is transmitted through the cuff, creating core sample radial compression. Hydraulic jack creates axial compression. Hydraulic jack working area is equal to core sample sectional area, thus uniform (triaxial) compression is created. Sample change in the core holder occurs without hydraulic fluid crimping draining. Core holders are equipped with special plungers through which samples pore pressure and pore fluids supply and filtration are created. Core holders can be equipped with a separate heating system including clamp heaters, temperature sensors, temperature measurement and control system with a PC connection.



BENEFITS

RESISTIVITY MEASUREMENTS OF SAMPLES
INSTALLED IN CORE HOLDER USING 4-ELECTRODE
CIRCUIT

HIGH TEMPERATURE CORE HOLDER
(UP TO +320 °C)

INSTALLATION OF SEVERAL PRESSURE MEASUREMENT PORTS ALONG
THE CORE SAMPLES COLUMN (PRESSURE DROPS REMOVAL FROM
CYLINDRICAL SAMPLES SIDE SURFACE)

VARIOUS DESIGN OPTIONS FOR CORE HOLDER PLUNGERS: CONNECTION OF SEVERAL
FLUID SUPPLY LINES AND INDIVIDUAL PRESSURE MEASUREMENT LINES; PLUNGERS
FOR MEASURING SAMPLES ELECTRICAL RESISTANCE; CONSTRUCTION FOR DRILLING
FLUID SUPPLYING AND FILTERING, INCLUDING ALONG THE SAMPLE END; ACID RESISTANT
PERFORMANCE; BUILT-IN ULTRASONIC WAVE TRANSMITTERS; ACID RESISTANT PERFORMANCE

Tested samples diameter, mm	up 25 to 110
Tested samples length, mm	up to 1000
Sample crimp pressure, Mpa	up to 100 (other values on request)
Pore pressure, Mpa	up to 70
Maximum working temperature, °C	up to +320 (standard version +150)
Measuring electrical resistance scheme	2/4-electrode
Cuff	Viton
Fluid-contact parts material	stainless steel /titanium /acid resistant alloy (Hastelloy) / Viton
Connection types	NPT/Autoclave/HIP
Working positions	horizontally / vertically /at any angle
Working substance	water with salinity up to 300 g / l oil gas acids solutions, HCL-14%, HF-5%, acetic acid – 0.2% drilling mud filtrates

TECHNICAL SPECIFICATIONS

X-RAY TRANSPARENT CORE HOLDERS

X-ray transparent core holders are designed for X-ray scanners and computed tomographs, for studying the core samples reservoir properties at reservoir conditions. X-ray transparent core holders can be the «dry» (Hassler) and submersible types. Core holder design provides 3-axis core compression by crimp pressure. Depending on construction type, sample change in core holder takes place without draining or with partial discharge of hydraulic crimping fluid. Core holders are equipped with special plungers through which samples pore pressure and pore fluids supply and filtration are created. Core holders can be equipped with a separate heating system including band and clamp heaters, temperature sensors, temperature measurement and control system with a PC connection.



» BENEFITS

COMPOSITE CORE HOLDER BODY PROVIDES X-RAY TRANSPARENT PROPERTIES, WITH POSSIBILITY OF CREATING HIGH RESERVOIR PRESSURE AND TEMPERATURE

VARIOUS DESIGN OPTIONS FOR CORE HOLDER PLUNGERS: CONNECTION OF SEVERAL FLUID SUPPLY LINES AND INDIVIDUAL PRESSURE MEASUREMENT LINES; BUILT-IN ULTRASONIC WAVE TRANSMITTERS; ACID RESISTANT PERFORMANCE

TECHNICAL SPECIFICATIONS

Tested samples diameter, mm	from 25 to 110
Tested samples length, mm	up to 1000
Sample crimp pressure, Mpa	up to 80
Pore pressure, Mpa	up to 70
Maximum working temperature, °C	+150
Cuff	Viton
Fluid-contact parts material	нержавеющая сталь/титан /кислотостойкий сплав (Hastelloy)/Viton
Connection types	NPT/Autoclave/HIP
Working positions	horizontally / vertically / at any angle
Working	water with salinity up to 300 g / l oil gas acids solutions, HCL-14%, HF-5%, acetic acid – 0.2%

HIGH PRESSURE AUTOMATIC VALVE (PNEUMATICALLY CONTROLLED)

Automatic valve with pneumatic control is designed to operate as remote control locking device for fluid or gas flows in pipelines. Valves are used to organize pulseless fluid flow in laboratory pumps and to automate experiments on laboratory equipment. The valve locking element is a needle. Valve closing/opening occurs when compressed air is supplied to the working cavity, activation takes place in less than 0.1 seconds. Additional electromagnetic valves are used to control compressed air flow. Pneumatic valves have a constant volume design in which internal fluid volume does not change while opening / closing. Two-way and three-way valve models are available.



BENEFITS <<<

WORKING PRESSURE UP TO 140 MPa

OPERATING TEMPERATURE UP TO 250 °C

FLUID-CONTACT PARTS MATERIAL: VITON, STAINLESS STEEL, ACID-RESISTANT ALLOY (HASTELLOY C276), LOCKING NEEDLE MATERIAL – PEEK

TECHNICAL SPECIFICATIONS

Model	Type	Maximum working pressure, Mpa	Maximum working temperature, °C	Cv	Fluid-contact parts material	Connection type	Overall dimensions (diameter * length), mm
GEOL 393.01	2-way	70 (10 000 PSI)	150	0,11	stainless steel / acid resistant alloy	1/8 FNPT	60*74
GEOL 393.02	3-way	70 (10 000 PSI)	150	0,31	stainless steel / acid resistant alloy	1/8 FNPT	60*128
GEOL 146.21	2-way	140 (20 000 PSI)	150	0,22	stainless steel / acid resistant alloy	LF4 (HIP) (7/16-20UNF)	60*82
GEOL 146.22	3-way	140 (20 000 PSI)	150	0,62	stainless steel / acid resistant alloy	LF4 (HIP) (7/16-20UNF)	60*142
GEOL 523.01	2-way	40 (6 000 PSI)	250	0,11	stainless steel / acid resistant alloy	3/8-24UNF	60*74
GEOL 523.02	3-way	40 (6 000 PSI)	250	0,31	stainless steel / acid resistant alloy	3/8-24UNF	60*133

PISTONLESS CONTAINERS FOR FLUID/GAS SAMPLES

Pistonless containers are designed for oil and gas samples transportation and storage. The pistonless container can be equipped with needle valves installed on both ends of the container and having protective arcs against damage during transportation. Transportation case also can be included. Pistonless containers can be made of corrosion-resistant steel (12X18H10T or analogue) or acid-resistant nickel alloy (C-276 HASTELLOY or analogue). Containers are designed for temperatures up to 150°C.

Pistonless containers are provided by EAECN RU Д-РУ.АД35.В.03244 declaration of conformity.



» BENEFITS

AGGRESSIVE SUBSTANCE
RESISTANCE

OPERATION AND TRANSPORTATION
SAFETY

MINIMUM «DEAD» VOLUME

CONTAINERS WITH OTHER PARAMETERS (VOLUME, WORKING
PRESSURE, TEMPERATURE, CONNECTION TYPE) ON REQUEST

TECHNICAL SPECIFICATIONS

Model	Volume, ml	Pressure, Mpa	t°C	Weight, kg	Length, mm	Diameter, mm	Material	Connection type
KB25.20	200	25	150	4,0	239	64	Ss316 / Hc276	1/8" FNPT
KB40.50	500	40	150	18,0	382	120	Ss316 / Hc276	1/8" FNPT
KB40.70	700	40	150	20,0	453	120	Ss316 / Hc276	1/8" FNPT
KB40.100	1000	40	150	23,0	557	120	Ss316 / Hc276	1/8" FNPT
KB70.20	200	70	150	12,6	249	130	Ss316 / Hc276	1/8" FNPT
KB70.35	350	70	150	22,0	377	130	Ss316 / Hc276	1/8" FNPT
KB70.50	500	70	150	24,7	453	130	Ss316 / Hc276	1/8" FNPT

Piston containers are designed for oil and gas samples transportation and storage. Piston containers can be used in laboratory tests for pore fluids storage, preparation and delivery. Piston containers can be equipped with a magnetic level system that allows user to accurately determine the current liquid level. Piston container can be equipped with needle valves installed on both ends of the container and having protective arcs against damage during transportation. Transportation case also can be included. Piston containers can be made of corrosion-resistant steel (SS316 or analogue) or acid-resistant nickel alloy (C-276 HASTELLOY or analogue). Containers are designed for temperatures up to 150 °C.

Piston containers are provided by EAECNRUD-RU.AD5.B.03244 declaration of conformity.



BENEFITS

AGGRESSIVE SUBSTANCE
RESISTANCE

OPERATION AND
TRANSPORTATION SAFETY

MINIMUM «DEAD»
VOLUME

MAGNET INTEGRATED IN THE PISTON ALLOWS
USER TO ACCURATELY DETERMINE FLUID LEVEL

CONTAINERS WITH OTHER PARAMETERS
(VOLUME, WORKING PRESSURE, TEMPERATURE,
CONNECTION TYPE) ON REQUEST

TECHNICAL SPECIFICATIONS

Model	Volume, ml	Pressure, Mpa	t°C	Weight, kg	Length, mm	Diameter, mm	Material	Connection type
KP40.500	500	40	150	18,5	382	120	stainless steel / acid resistant alloy	1/8" FNPT
KP40.700	700	40	150	20,5	453	120	stainless steel / acid resistant alloy	1/8" FNPT
KP40.1000	1000	40	150	23,5	557	120	stainless steel / acid resistant alloy	1/8" FNPT
KП40.2000	2000	40	150	46,5	673	150	stainless steel / acid resistant alloy	1/8" FNPT
KP40.3000	3000	40	150	47,1	742	155	stainless steel	1/8" FNPT
KP40.400	4000	40	150	49,4	873	155	stainless steel	1/8" FNPT
KP40.5000	5000	40	150	51,9	1004	155	stainless steel	1/8" FNPT
KP70.350	350	70	150	22,5	377	130	stainless steel / acid resistant alloy	1/8" FNPT
KP70.500	500	70	150	25,2	453	130	stainless steel / acid resistant alloy	1/8" FNPT
KP70.700	700	70	150	28,8	555	130	stainless steel / acid resistant alloy	1/8" FNPT
KP70.1000	1000	70	150	34,2	708	130	stainless steel / acid resistant alloy	1/8" FNPT

ACOUSTIC MULTIPHASE HIGH PRESSURE SEPARATOR

Acoustic multiphase high pressure separator is designed to accurately determine incoming mixture fractional composition during filtration experiments. The separator is a device consisting of two or three interconnected high pressure vessels. The first vessel receives the mixture from core holder output and fluids gravitational separation. The second and third vessels are equipped with high-precision acoustic level sensors and accurately determine the entering them phases volume (water-oil; oil-gas). Detection of phase boundary position during the experiment is carried out by digital measurement system consisting of ultrasonic signal source, ultrasonic signal receiver and software. The software automatically defines liquid / liquid and gas / liquid section boundary, calculates phases volume and core sample saturation degree changes. Calibration procedures are provided that allows user to accurately measure volume and makes the measurements independent of incoming fluids type. Optionally, the acoustic separator can be equipped with an automatic valves system.



TECHNICAL SPECIFICATIONS

Type	two-phase / three-phase
Working pressure, Mpa	up to 70
Maximum working temperature, °C	+150
Separator total volume, ml	200/300
Volume measurement resolution, ml	0,05
Volume determination accuracy, ml	± 0,1
Fluid-contact parts material	stainless steel, Viton
Working	water with salinity up to 300 g / l oil gas

Optical multiphase high pressure separator is designed to accurately determine the incoming mixture fractional composition during filtration experiments. The separator is a device consisting of two pressure vessels connected to each other in the upper and lower parts. The first vessel receives the mixture from core holder output and fluids gravitational separation. The second vessel is equipped with visual control sapphire windows and accurately determines the entering it phases volume. Detection of phase boundary position during the experiment is carried out by video measurement system consisting of high-resolution camera, backlight installed behind the separator, and software. The software automatically defines liquid / liquid and gas / liquid section boundary, calculates phases volume and core sample saturation degree changes. Calibration procedures are provided that allows user to accurately measure volume and makes the measurements independent of incoming fluids type. Video measurement system allows not only to measure received volumes, but also to save process image throughout the experiment. Optionally, the optical separator can be equipped with an automatic valves system.



Working pressure, Mpa	70
Maximum working temperature, °C	+150
Separator total volume, ml	230
Volume measurement resolution, ml	0,005
Volume determination accuracy, ml	±0,1
Fluid-contact parts material	stainless steel, sapphire, Viton
Working substance	water with salinity up to 300 g / l oil gas

TECHNICAL SPECIFICATIONS

PROPPANT PACK CONDUCTION CELL (FOR PIK-API)

The proppant pack conduction cell is designed for linear velocity distribution flow with reservoir and proppant area 64.5 cm^2 (10 in²). Two versions are available: single and double cell. Delivery set includes: cell body (two bodies for double version), upper, lower and middle pistons with connecting hydraulic lines ports, heating system (heating of pistons and cell bodies), rod system for installing proppant pack width sensors, molding for filling sandstone plates with sealant, device for proppant leveling in the cell, set of installation probes.

The equipment is fully compliant with standards: ISO 13503-5, API RP-61.

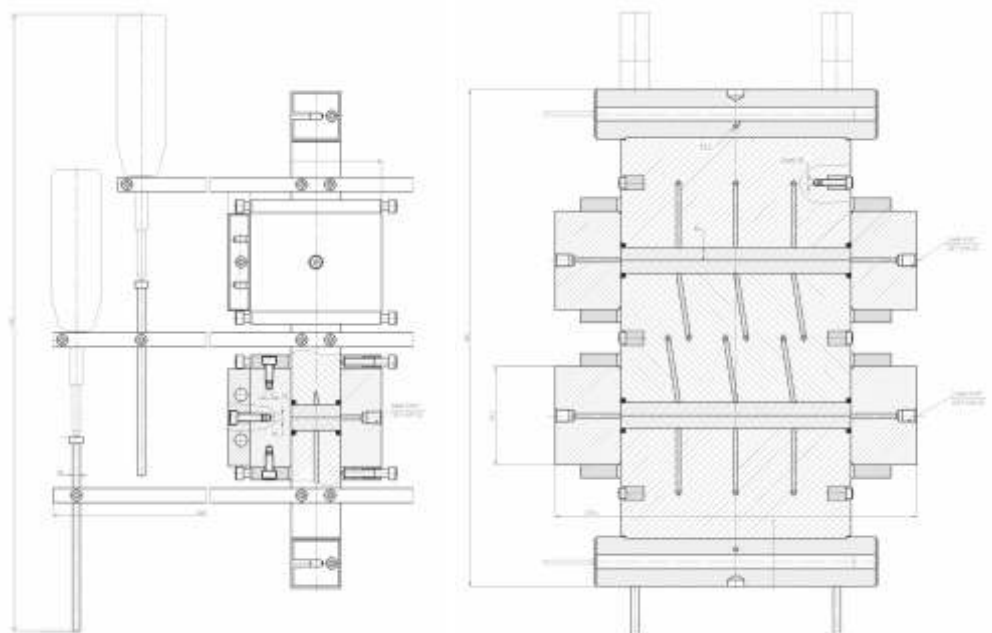


» BENEFITS

THE CELL CAN BE MADE OF BOTH STAINLESS STEEL AND ACID-RESISTANT ALLOY (HASTELLOY)

DIFFERENT HEIGHT OPTIONS FOR THE MAIN CELL BODY (76, 100, 200 MM)

TECHNICAL SPECIFICATIONS





TECHNICAL
SPECIFICATIONS

Model	Max pressure, MPa	Membrane diameter, mm	Body material	Membrane material /saddle needle	Damper capacity, l
GEOL 236	70	needle	Stainless steel / acid resistant alloy	Stainless steel/acid resistant alloy -PEEK	0,2
GEOL 381	40	69,7	Stainless steel / acid resistant alloy	PEEK	0,2
GEOL 2110	15	50,8	Stainless steel / acid resistant alloy	ftoroplast	Not required

GAS PRESSURE AMPLIFIER

The amplifier (booster) is a gas compression system supplied from an external source to create increased pressure. System structurally consists of power block and control panel. Pressure data is displayed on remote control panel and on pressure booster block. The amplifier generates gas pressure by increasing supplied gas pressure by control air. Gas is pumped continuously through two-way structure. When changing amplifier plunger travel direction, slight pressure pulsations are possible. When the set pressure is reached, there are no pressure pulsations.



Working inlet pressure, Mpa	7-14
Working output pressure, Mpa	up to 40
Control pressure (compressed air), MPa	0,1-0,6
Working temperatures range, °C	25-60
Working substance	nitrogen, air

TECHNICAL
SPECIFICATIONS

CORE LOADING PLATES WITH ULTRASONIC SENSORS (FOR PIK-UIDK)

Set of ultrasonic plates (plungers) is designed to test samples in the PIK-UIDK / PL, PIK-UIDK-M installations.



» BENEFITS

PORE PRESSURE PORTS

OPERATION AT ELEVATED
TEMPERATURES UP TO +150 °C

OPERATION UNDER CRIMPING
PRESSURE UP TO 140 MPa

FULL MECHANICAL AND ELECTRICAL COMPATIBILITY
WITH PIK-UIDK / PL AND PIK-UIDK-M INSTALLATIONS

TECHNICAL SPECIFICATIONS

Contact surface diameter (test sample diameter), mm	25 -110
Hydrostatic crimp pressure, Mpa	not more than 140
Working substance	mineral or synthetic oil
Working substance temperature, °C	not more than 150
Set and its components material	titanium
Maximum axial force, kN	1700
Operating frequency, Mhz	1
Excited and recorded waves type	longitudinal and shear (separately under 90 ° to each other, or together)

DEVICE FOR DETERMINING PROPPANT BULK DENSITY

The GEOL.100.01.000-02 device is designed to determine bulk density by weighing proppants in a calibrated metal cylinder using a special system.

The device meets the requirements of regulatory documents:

GOSTR 54571-2011 Magnesia quartz proppants. Technical specifications

GOSTR 51761-2013 Aluminosilicate proppants. Technical specifications

ISO 13503-5, API RP-61

Documentation: Device for measuring bulk density (Example).



- funnel stand with a square metal base $(305.0 \pm 1.0) \text{ mm} \times (305.0 \pm 1.0) \text{ mm}$ and tripod with a height of $(305.0 \pm 1.0) \text{ mm}$
- calibrated metal measuring cylinder of non-magnetic metal or alloy (about 100 cm^3 capacity and inner diameter $(38.9 \pm 0.1) \text{ mm}$)
- stainless steel funnels with smooth inner seams and a shut-off valve at the outlet
- Marks are placed on the device base for a guaranteed cylinder location in the center of the funnel outlet

TECHNICAL
SPECIFICATIONS

DEVICE FOR DETERMINING PROPPANT CRUSH RESISTANCE

The device meets the requirements of regulatory documents:

GOSTR 54571-2011 Magnesia quartz proppants. Technical specifications

GOSTR 51761-2013 Aluminosilicate proppants. Technical specifications

ISO 13503-5, API RP-61

Documentation: Granular crushing cell



Material	steel 40X13/ 40XH2MA
Form (body) hardness, HRC	more than 43
Poisson Hardness, HRC	more than 43
Cover hardness, HRC	more than 43
Average inner form (body) diameter, mm	38,1/50,8
Poisson average diameter, mm	38/50,7

TECHNICAL
SPECIFICATIONS

FLUID PRESSURE PNEUMOHYDRAULIC AMPLIFIER

Fluid pressure pneumohydraulic amplifier maintains the necessary line pressure by compressed air acting on a large diameter piston. Due to the installed pressure sensor feedback automatic regulator controls compressed air pressure. Automatic pneumatic control valve carries out pump piston return stroke. When pump plunger reaches its extreme positions, the valves open or close, discharging or collecting hydraulic fluid from a low-pressure tank. Crimp pressure unit control can be manual or automatic.



» BENEFITS

- PNEUMATIC DRIVE IS APPLICABLE IN EXPLOSIVE ENVIRONMENT
- AUTOMATIC MAINTENANCE OF THE SET PRESSURE LEVEL
- LOW NOISE FACTOR

TECHNICAL SPECIFICATIONS

Plunger working volume, ml	75
Maximum developed fluid pressure, Mpa	70
Working substance	oil, water
Control pressure (compressed air), MPa	0,1-0,6
Working temperature, °C	20-65
Operating mode	pressure rise pressure maintenance depression

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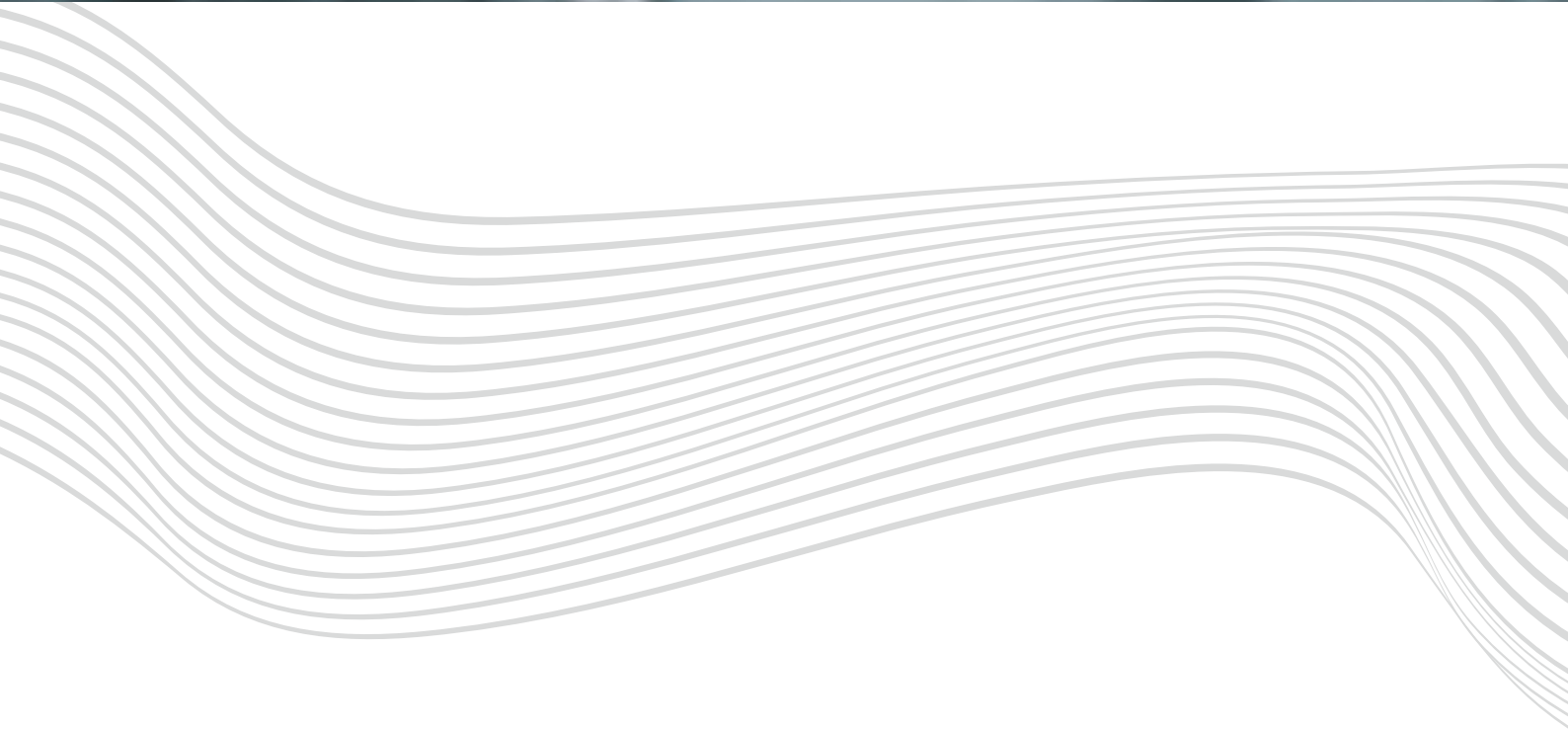
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