Petro Azma
Petroleum Appraising Technologies

PetroAzma offers a wide range of upstream petroleum laboratory instruments, wich meet the highest standard levels. The valuable experiences in PetroAzma on laboratory equipment design and manufacturing provide the capability of supplying the products in three different categories in order to satisfy the requirements of individual customers with different aims of teaching, research, and service.

PetroAzma is also in a unique position to give excellent consultancy on design of laboratories; equipment procurement and manufacturing with full technical and theoretical training and support.

Petroleum Engineering Laboratory Equipment:

- RCAL & SCAL Laboratory
- PVT Laboratory
- EOR Laboratory
- Well Stimulation Laboratory
- Geomechanic Laboratory
- Customized Laboratory Setups

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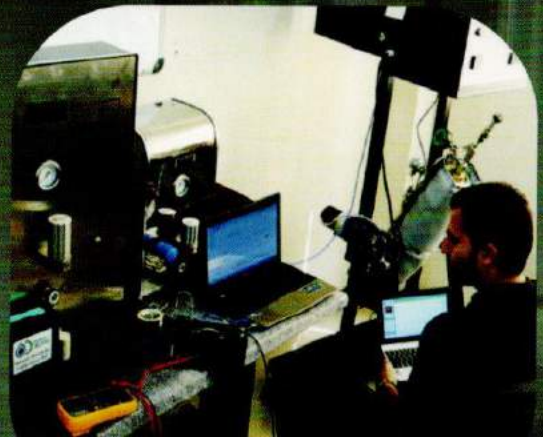
A wide range of professional reservoir description services are offered by PetroAzma and its distinguished partners and associates to the oil and gas industry. The Reservoir Labratories at **PetroAzma** offers high quality integrated rock and fluid analysis to provide the information required for reservoir caracterization. These services include but not limited to:

- Core Preparation
- Routine Core Analysis
- Special Core Analysis
- PVT Analysis
- EOR/IOR Studies

PetroAzma exists to tackle the hard problems other laboratories are unable to. For this reason we have created a brilliant team with multidisciplinary skills to make improvements and push the boundaries of what is possible.



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پارک علم و فناوری خلیج فارس

دانشگاه صنعتی شاهرود

دانشگاه صنعتی امیرکبیر
(پلی تکنیک تهران)

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واحد امیدیه

دانشگاه شهید چمران اهواز

پژوهشگاه میراث فرهنگی

انرژی توانا

مشتریان ارزشمند ما:

Porosity Measurement

Porosity determination of a core plug

Measuring of porosity of a rock is necessary in order to interpret the reservoir behavior and capabilities in terms of hydrocarbon storage and production. Moreover, this main property of rock is beneficial to geotechnical researches as well as non-petroleum areas. The porosity of a material is defined as the ratio of the volume of open space (pore volume) to the total volume (bulk volume).

Experiment Description

In this experiment, helium percolates to the sample from a reference volume. Pressure drop during the test is measured. Pore volume is estimated from Boil-Mariot's law. Considering the bulk volume of the sample, effective porosity of the sample can be estimated.

Specification	HPR -BR01	HPR -PR01	HPR -PS01
Reference Cell Pressure	120 Psi	Up to 120 Psi	Up to 120 Psi
Pressure Accuracy	1% F.S.	0.5% F.S.	0.05% F.S.
Core Diameter	1" & 1.5"	1" & 1.5"	Up to 1.5", Up to 4"
Core Length	up to 4"	up to 4"	up to 4"
Input Power Supply	220 VAC, 50 or 60 Hz	220 VAC, 50 or 60 Hz	220 VAC, 50 or 60 Hz
Computer System Control	×	✓	✓
User Friendly Automated Data Acquisition, Calculating and Reporting Software	×	✓	✓
Automatic Core Loading	×	×	✓
Control Valves	×	×	✓

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PorPerm System

PorPerm System measures the porosity and permeability to gas (helium/nitrogen) of plug sized core samples. The apparatus mainly comprises a quick release Hassler type core holder, a matrix cup, pressure transducers and a calculation software. Permeability to gas measurements are performed by steady-state Darcy law's method. .In this method, an isothermal helium/nitrogen expansion is occurred and the pore volume and grain volumes are determined by the Boyle's and Charles' laws.

Specification	PPS-BR01
Permeability Range	1 to 500 md
Core Diameter	1.5"
Core Length	4"
Working Temperature	Ambient
Max. Pore Pressure	Up to 145 Psi
Pressure Accuracy	0.1% F.S.
Flow Range	0 – 200 cc/min
Flow Accuracy	1% F.S.
Input Power Supply	220 VAC, 50/60Hz
Calculation Software	✓

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Steady State Liquid Permeability

The robust liquid permeameter allows the determination of a plug-sized core sample's absolute permeability at ambient temperature and moderate confining pressure. This is achieved by virtue of the steady-state method; specifically, permeability is obtained by inputting the measured pressure gradient and flow rate into Darcy's law for one dimensional flow in porous media.

Specification	SLP-R01
Working Temperature	Ambient
Pore Pressure	Up to 6,000 Psi
Confining Pressure	Up to 6,500 Psi
Core Diameter	1.5″
Core Length	2″ to 4″
Core Holder Position	Horizontal
Pressure Tap	Inlet of Core Holder
Pressure Accuracy	0.5% F.S.
Number of Accumulators	1
Wetted Parts Material	Stainless Steel 316
Input Power Supply	220 VAC, 50Hz
Hydraulic Hand Pump	✓
Hassler Type Core Holder	✓
High Pressure HPLC Pump is Included	✓

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Electrical Properties System

Archie's Coefficient Determination

Resistivity Index is an electrical property of rock that is the ratio of rock resistivity when it is partially saturated with water to that when is fully saturated with water. Utilizing Archie's Famous saturation of rock, through saturation exponent, in situ water saturation can be calculated. Therefore, based on the material balance equation (i.e. $S_o + S_g + S_w = 1$), hydrocarbon in place can also be determined.

Experiment Description

Two conductive pads are used for measuring the resistivity of both sides of the sample at fully and partially water saturated conditions. Based on the amount of saturation and resistivity index, Archie's coefficients can be calculated. Measuring is performed at ambient pressure and temperature conditions.

Specification	EPS -BR01	EPS -PR01	EPS -PR01
Resistivity Measurement Method	2 Electrodes	4 Electrodes	4 Electrodes
Rock Electrical Properties Measurement Frequency	50 Hz 1000Hz 10 KHz	50 Hz 1000Hz 10 KHz	50 Hz 1000Hz 10KHZ
Working Temperature	Ambient	Ambient	Up to 120 C
Working Pressure	Atmospheric	Up to 6500 Psi	Up to 6500 Psi
Core Length	1" and 1.5"	1" and 1.5"	1" and 1.5"
Core Diameter:	up to 4"	up to 4"	up to 4"
Input Power Supply	220 VAC, 50Hz	220 VAC, 50Hz	220 VAC, 50Hz
Computer System	×	✓	✓
Automatic Data Acquisition and Monitoring System	×	✓	✓
Porous Plate System	×	×	✓
Heating System	×	×	✓
Maximum Confine Pressure	100 Psi	6500 Psi	6500 Psi

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Permeability Measurement

Determination of absolute permeability of a core by flowing air Steady State Method

Darcy's law, is the main equation by which one can describe laminar flow of an incompressible fluid in a porous medium. It is the relationship of the macroscopic velocity (i.e. flux) of a fluid with a known viscosity to the pressure gradient by a proportionality factor called absolute permeability, expressed in darcies. Permeability is the ability of a rock or porous medium to conduct flow. It is totally dependent to the geometry of the rock and pore network.

Experiment Description

In this experiment nitrogen flows through the Sample from a cylinder. Pressure drop during the test is measured. Permeability of the sample will be estimated using Darcy's equation for compressible fluids.

Specification	SGP -BR01	SGP -PR01	SGP -PS01
Permeability Range	1-500 md	0.1-2000 md	0.01-5000 md
Core Diameter	1.5"	1.5"	1.5" & 4"
Core Length	1 Up to 4"	1 Up to 4"	2 up to 4 inches/ 2 up to 10 inches
Max. Pore Pressure	Up to 145 Psi	Up to 145 Psi	Up to 145 Psi
Max. Confining Pressure	Up to 145 Psi	Up to 400 Psi	Up to 400 Psi
Gas Flow Range	0-200 cc/min	0-10 cc/min; 0-1000 cc/min	0–0.5 cc/min, 0–5 cc/min, 0–100 cc/min, & 0–2000 cc/min
Flow Accuracy	1% F.S.	0.2% F.S.	0.1% F.S.
Pressure Reading Accuracy	0.5% F.S.	0.1% F.S.	0.05% F.S.
Input Power Supply	220 VAC, 50 or 60 Hz	220 VAC, 50 or 60 Hz	220 VAC, 50 or 60 Hz
One Mass Flow Controller	✓	✓	✓
Back Pressure Regulator	×	✓	✓
Computer System	×	✓	✓
Digitalized Confining Pressure	×	✓	✓
Digitalized Upstream and Downstream Pressure	×	✓	✓
User Friendly Automated Data Acquisition, Calculating and Reporting Software	×	✓	✓
Electronic or Pneumatic Control Valves	×	×	✓
Automatic Core Loading	×	×	✓

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Unsteady State Relative Permeameter

Determination of water-oil relative permeability of a plug Unsteady State Method

Relative permeability is the ratio of the effective permeability of a fluid to the absolute permeability of the rock that is an indication of motion ability of the fluid in the presence of another fluid in a porous medium. It is totally affiliated to saturation level.

Experiment Description

Water (or oil) is injected at a suitable pressure to the plug, which is saturated with oil (or water). By measuring the volume of the produced oil and water at the outlet, water-oil relative permeability curves can be obtained for imbibition or drainage utilizing Jones & Roszelle Method.

Specification	URP-PS02
Pressure Accuracy	0.05% F.S.
Core Length	2″ to 3″
Working Temperature	120 ˚C
Max. Pore Pressure	10,000 Psi
Max. Confining Pressure	10,500 Psi
Core Diameter	1.5″
Core Holder Orientation	Horizontal
Number of Differential Pressure Transmitter	2(145 Psi, 1450 Psi)
Input Power Supply	220 VAC, 50/60Hz
Pressure Taps: Inlet and Outlet of Core Holder	✓
Downstream Pressure Controller	✓
Hydraulic Hand Pump	✓
Digital Upstream and Downstream pressure (Indicator)	✓
Digital Confining and Back Pressure (Indicator)	✓
Digital Cell Pressure (Indicator)	✓
Special Designed Hassler Type Core Holder for Relative Permeability	✓
High Pressure HPLC Pump is included	✓
Computer System	✓
User Friendly Automated Data Acquisition, Calculating Software	✓
Stainless Steel Material	✓
Automatic Valve for DP Protection	✓
Ambient Fluid Separator	✓
Fraction Collector	✓
Automatic Fluid Production Monitoring System	✓

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Integrated Resistivity Index and Capillary Pressure System

The system provides critical reservoir description data at reservoir temperature, pore pressure and confining stress. The system is configured to provide steady state porous plate capillary pressure data and simultaneous electrical properties ("F", "RI", "Sw", "m", "n", "Ro", "Rt") data with reservoir fluids. The capability to determine Rw at test conditions is also included in the system.

Specification	RCP-PR01	RCP-PR11	RCP-PR02
Core Diameter	1.5″	1.5″	1.5″
Core Length	2″ up to 3″	2″ up to 3″	2″ up to 3″
Working Temperature	Up to 120 ˚C	Ambient	Up to 120 ˚C
Core Holder Position	Vertical	Vertical	Vertical
Overburden Pressure	Up to 6,500 Psi	Up to 6,500 Psi	Up to 6,500 Psi
Max. Pore Pressure	145 Psi	145 Psi	145 Psi
Capillary Pressure Range	-145 to + 145 Psi	-145 to + 145 Psi	-145 to + 145 Psi
Pressure Accuracy	0.05% F.S.	0.05% F.S.	0.05% F.S.
Resistivity Measurement Method	6 Electrodes	6 Electrodes	6 Electrodes
Input Power Supply	220 VAC, 50/60Hz	220 VAC, 50/60Hz	220 VAC, 50/60Hz
Wetted Material	Stainless Steel 316	Stainless Steel 316	Stainless Steel 316
Rock Electrical Properties Measurement at Various Range of Frequencies	✓	✓	✓
Hydrostatic Core Holder	1	1	3
Hydraulic Hand Pump	✓	✓	✓
Force Convection Oven	✓	×	✓

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Aging Cell Apparatus

Restoration of core sample to the initiat reservoir condition

In the most Special Core Analysis experiments, initial wettability of the core is a vital factor of the sample. Hence, it is necessary to restore it before performing the experiments.

Experiment Description

In this experiment, the core sample is restored to the irreducible reservoir water saturation conditions using proper reservoir crude oil. The sample remains at the reservoir pressure and temperature conditions for several weeks in order to restore the initial reservoir condition.

Specification	AGC -BR01	AGC -PR01
Pressure Accuracy	1% F.S.	0.5% F.S.
Core Length	Up to 7″	Up to 7″
Number of Independent Cells	3	6
Core Diameter	Up to 1.5″	Up to 1.5″
Working Temperature	120 ˚C	120 ˚C
Working Pressure	Up to 6,000 Psi	Up to 6,000 Psi
Input Power Supply	220 VAC, 50Hz	220 VAC, 50Hz
Stainless Steel Material	✓	✓
Force Convection Oven	✓	✓
Computer System	×	✓
Automatic Data Acquisition and Monitoring System	×	✓

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Cell Porous Plate Capillary Pressure System

Plug samples of known porosity and permeability are saturated with simulated formation brine. The core plugs and downstream water wet (hydrophilic) ceramic plates are saturated with the brine, wetting phase, and placed in the core holder. The upstream pump cylinder injects the displacing phase (oil) at constant pressure whilst the downstream pump cylinder maintains the differential pressure (PC) across the porous plate and collects the effluent wetting phase (brine) from the core holder providing accurate fluid measurement that is logged by the host computer along with all experimental parameters. The experimental data for each sample are logged to hard in the host computer and used in the report generation software for final report generation.

Specification	CCP -PR01	CCP-PR11	CCP-PS01
Core Diameter	1.5"	1.5"	1.5"
Core Length	2" to 3"	2" to 3"	2" to 3"
Working Temperature	Up to 120˚C	Ambient	Up to 120˚C
Max. Pore Pressure	145 Psi	145 Psi	145 Psi
Capillary Pressure Range	-145 to +145	-145 to +145	-145 to +145
Core Holder Position	Vertical	Vertical	Vertical
Overburden Pressure	Up to 6,500 Psi	Up to 6,500 Psi	Up to 6,500 Psi
Pressure Accuracy	0.05% F.S.	0.05% F.S.	0.05% F.S.
Wetted Material	Stainless Steel 316	Stainless Steel 316	Stainless Steel 316
Power Supply	220 VAC, 50/60Hz	220 VAC, 50/60Hz	220 VAC, 50/60Hz
Hydraulic Hand Pump	✓	✓	✓
Force Convection Oven	×	×	✓
Hydrostatic Core Holder	✓	✓	✓
Automatic Upstream, Downstream, and Confining Pressure Control (Three high Pressure Pumps)	×	×	✓
Computer System	×	×	✓
User Friendly Automated Data Acquisition, Calculating and Reporting Software	×	×	✓

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HPHT Imbibition Cell

Determination of Spontaneous Imbibition at Reservoir Conditions

This device is specially designed to determine the end points of spontaneous imbibition curve. It can then be used in conjunction with that of the forced imbibition curve (e.g. obtained by centrifugation or core flooding) to estimate the wettability indices via the Amott formula.

Experiment Description

The device is mainly comprised of two flow controlled loops to displace water or oil over a core at reservoir condition to recreate spontaneous imbibition phenomenon. The wetting and non-wetting phase volumes are continuously measured in a graduated glass separator. Multiple core sample configurations are also available upon request.

Specification	HIC-PR01
Working Pressure	6,000 Psi
Core Diameter	Up to 2 inches
Core length	Up to 4 inches
Pressure Accuracy	0.5% F.S.
Power Supply	220 VAC, 50 Hz
Working Temperature	Ambient up to 120 ˚C
Number of Fluid Transfer Vessel	1
Stainless Steel 316 Wetted Material (Other on Request)	✓
Force Convection Oven	✓
Downstream Pressure Controller	✓

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Unsteady State Relative Permeameter

Measurement of two phase relative permeability of a plug sample

Relative permeability is the ratio of the effective permeability of a fluid to the absolute permeability of the rock that is an indication of flowing behavior of different fluids in a porous medium.

Experiment Description

Water (or oil) is injected at a suitable pressure to the plug, which is saturated with oil (or water). By measuring the volume of the produced oil and water at the outlet, water-oil relative permeability curves can be obtained for imbibition or drainage utilizing Jones & Roszelle Method.

Specification	URP-BR02	URP-BR05	URP-BR12	URP-BR15
Pressure Accuracy	0.5% F.S.	0.5% F.S.	0.05% F.S.	0.5% F.S.
Core Length	2″ to 3″	2″ to 3″	2″ to 3″	2″ to 3″
Working Temperature	Ambient	Ambient	Ambient	Ambient
Max. Pore Pressure	6,000 Psi	6,000 Psi	6,000 Psi	6,000 Psi
Max. Confining Pressure	6,300 Psi	6,500 Psi	6,500 Psi	6,500 Psi
Core Diameter	1.5″	1.5″	1.5″	1.5″
Core Holder Orientation	Horizontal	Horizontal	Horizontal	Horizontal
Number of Accumulators	4	4	2	2
Input Power Supply	220 VAC, 50/60Hz	220 VAC, 50/60Hz	220 VAC, 50/60Hz	220 VAC, 50/60Hz
Pressure Taps: Inlet and Outlet of Core Holder	✓	✓	✓	✓
Stainless Steel Material	✓	✓	✓	✓
Downstream Pressure Controller	✓	✓	✓	✓
Hydraulic Hand Pump	✓	✓	✓	✓
Digital Upstream and Downstream pressure (Indicator)	✓	✓	✓	✓
Digital Confining and Back Pressure (Indicator)	✓	✓	✓	✓
Digital Cell Pressure (Indicator)	✓	✓	×	×
Special Designed Hassler Type Core Holder for Relative Permeability	✓	✓	✓	✓
High Pressure HPLC Pump is included	×	✓	×	✓

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Unsteady State Relative Permeameter

Determination of water-oil relative permeability of a plug Unsteady State Method

Relative permeability is the ratio of the effective permeability of a fluid to the absolute permeability of the rock that is an indication of motion ability of the fluid in the presence of another fluid in a porous medium. It is totally affiliated to saturation level.

Experiment Description

Water (or oil) is injected at a suitable pressure to the plug, which is saturated with oil (or water). By measuring the volume of the produced oil and water at the outlet, water-oil relative permeability curves can be obtained for imbibition or drainage utilizing Jones & Roszelle Method.

Specification	URP-PR01	URP-PR05
Pressure Accuracy	0.1% F.S.	0.1% F.S.
Core Length	2″ to 3″	2″ to 3″
Working Temperature	120 ˚C	120 ˚C
Max. Pore Pressure	6,000 Psi	6,000 Psi
Max. Confining Pressure	6,500 Psi	6,500 Psi
Core Diameter	1.5″	1.5″
Core Holder Orientation	Horizontal	Horizontal
Number of Accumulators	4	4
Input Power Supply	220 VAC, 50/60Hz	220 VAC, 50/60Hz
Pressure Taps: Inlet and Outlet of Core Holder	✓	✓
Stainless Steel Material	✓	✓
Downstream Pressure Controller	✓	✓
Hydraulic Hand Pump	✓	✓
Digital Upstream and Downstream pressure (Indicator)	✓	✓
Digital Confining and Back Pressure (Indicator)	✓	✓
Digital Cell Pressure (Indicator)	✓	✓
Special Designed Hassler Type Core Holder for Relative Permeability	✓	✓
High Pressure HPLC Pump is included	✗	✓
Computer System	✓	✓
Automatic Data Acquisition and Monitoring System	✓	✓

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Benchtop Core Flooding System (BR)

Flowing a fluid (oil/gas) at desired temperature and pressure

Generally, a core flood system is a system that flows a fluid (gas or liquid) through a core sample at controlled pressure and temperature conditions and measures or monitors flow parameters.

Experiment Description

The dry core is saturated with brine. Then saturated core is flooded by oil until the saturation water reaches to the reservoir initial water saturation conditions. Afterwards oil saturated core will be flooded by brine at high pressure/temperature condition. The relative permeability of oil/brine will be estimated. Total oil production versus time will be plotted.

Specification	BCF-BR02	BCF –BR05	BCF –BR12	BCF-BR15
Pressure Accuracy	0.5% F.S.	0.5% F.S.	0.5% F.S.	0.5% F.S.
Core Length	2″ to 4″	2″ to 4″	2″ to 4″	2″ to 4″
Working Temperature	120˚C	120˚C	Ambient	Ambient
Max. Pore Pressure	6,000 Psi	6,000 Psi	6,000 Psi	6,000 Psi
Max. Confining Pressure	6,500 Psi	6,500 Psi	6,500 Psi	6,500 Psi
Core Diameter	1.5″	1.5″	1.5″	1.5″
Number of Accumulators	3	3	2	2
Input Power Supply	220 VAC, 50Hz	220 VAC, 50Hz	220 VAC, 50Hz	220 VAC, 50Hz
Core Holder Position	Horizontal	Horizontal	Horizontal	Horizontal
Hassler Type Core Holder	✓	✓	✓	✓
Force Convection Oven	✓	✓	×	×
Downstream Pressure Controller	✓	✓	✓	✓
Hydraulic Hand Pump	✓	✓	✓	✓
Stainless Steel Material	✓	✓	✓	✓
Pressure Taps: Inlet and Outlet of Core Holder	✓	✓	✓	✓
High Pressure HPLC Pump	×	✓	×	✓
Digital Back Pressure	✓	✓	✓	✓
Digital Upstream and Downstream Pressure	✓	✓	✓	✓

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Formation Damage Evaluation System

Formation Damage Evaluation System, is designed to measure the effect on the permeability of reservoir rock samples from various drilling and completion fluids at reservoir pressure and temperature. Core samples are placed in a thick walled Viton sleeve with end-plugs designed to facilitate the introduction of completion acid mixes and to allow insertion of ring spacers for accumulation of filter cake at the upstream end of the sample. Free-piston fluid accumulators are provided to accommodate the fluids required for flow tests. Data acquisition hardware and software logs system parameters including flow rates, pressures, differential pressure, temperatures and overburden pressure.

Specification	CCP -PR01
Temperature	Up to 120 °C
Pressure	6,000 Psi
Pressure Accuracy	0.05% F.S.
Tube Size	1/8″ & 1/16″
Number of Accumulators	2
Wetted material	Stainless Steel 316
Power Supply	220 VAC, 50/60 Hz
Force Convection Oven	✓
High Pressure HPLC Pump is included (X2)	✓

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Drop Shape Analysis System

Measurement of Interfacial Tension and Contact Angle

Measurement of interfacial tension at reservoir conditions is critical both for the IFT measurement at harsh reservoir condition and minimum miscibility pressure measurement if gas is used as the EOR agent.

Experiment Description

A liquid drop is brought in contact with gas or solid in a cell at reservoir conditions.A camera connected to a computer records the shape of the liquid drop to estimate the interfacial and contact angle properties.The Drop Shape Analysis System software allows the fast estimation of surface and interfacial tension of pendent drop and contact angles of sessile drops.

Specification	DAS-BR01	DAS -R01	HDS- PS01	HDS- PS02
IFT Measuring Range	5 – 72 mN/m	5 – 72 mN/m	5 – 72 mN/m	5 – 72 mN/m
Working Temperature	Ambient	Ambient	Ambient to 120 ˚C	Ambient to 120 ˚C
Max. Working Pressure	Ambient	Ambient	6000 Psi	6000 Psi
Dosing System	Manual	Automatic	Manual	Automatic
Input Power Supply	220 VAC, 50/60 Hz	220 VAC, 50/60 Hz	220 VAC, 50/60 Hz	220 VAC, 50/60 Hz
Wetted Material	Manual	Automatic		
Image Capturing and Processing Software	Glass & Stainless Steel	Glass & Stainless Steel	Glass (Quartz) & Stainless Steel	Glass (Quartz) & Stainless Steel
Contact Angle Measurement System	✓	✓	✓	✓
Computer system	✓	✓	✓	✓
Automatic data Acquisition and Monitoring	×	✓	✓	✓
Pressure Accuracy	×	×	0.05 % FS	0.05 % FS

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Micromodel Experimental Set Up

To study Thermal, Chemical and Microbial Enhanced Oil Recovery, and their effectiveness, the most accurate way is to use a physical rock. However, the use of rocks have several major drawbacks. Micro Model chip technology makes it possible to create surrogate rocks to conduct experiments. Therefore, PetroAzma has developed two types of Enhanced Oil Recovery Micro Model system. These devices can be used for research into Enhanced Oil Recovery, reservoir engineering and the environment.

Specification	MES-BR01	MES-BR02
Working Pressure	Atmospheric	Atmospheric
Pressure Accuracy	0.1% F.S.	0.1% F.S.
Computer Control System	Pump + Camera + Pressure Log	Pump + Camera + Pressure Log
Input Power Supply	220 VAC, 50Hz	220 VAC, 50Hz
Infusion Pump	Pressure Safety Limit	Pressure Safety Limit
Temperature Control System	×	Recirculating Bath
Working Temperature	×	Up to 90 ˚C
Back Light System	✓	✓
Camera System	✓	✓
Accurate Gas Injection System	×	✓

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Benchtop Core Flooding System

Flowing a fluid (oil/gas) at desired temperature and pressure

Generally, a core flood system is a system that flows a fluid (gas or liquid) through a core sample at controlled pressure and temperature conditions and measures or monitors flow parameters.

Experiment Description

The dry core is saturated with brine. Then saturated core is flooded by oil until the saturation water reaches to the reservoir initial water saturation conditions. Afterwards oil saturated core will be flooded by brine at high pressure/temperature condition. The relative permeability of oil/brine will be estimated. Total oil production versus time will be plotted.

Specification	BCF-PR01	BCF -PR05
Core Length	2″ to 6″	2″ to 6″
Core Diameter	1.5″	1.5″
Working Temperature	120˚C	120˚C
Max. Pore Pressure	6,000 Psi	6,000 Psi
Max. Confining Pressure	6,500 Psi	6,500 Psi
Pressure Accuracy	0.1% F.S.	0.1% F.S.
Number of Differential Pressure Transmitter	1 (145 Psi)	1 (145 Psi)
Number of Accumulators	3	3
Input Power Supply	220 VAC, 50Hz	220 VAC, 50Hz
Pressure Taps: Inlet and Outlet of Core Holder	✓	✓
Stainless Steel Material	✓	✓
Force Convection Oven (500 Liter)	✓	✓
Hassler Type Core Holder	✓	✓
Core Holder Position: Horizontal	✓	✓
Downstream Pressure Controller	✓	
Hydraulic Hand Pump	✓	✓
Computer System	✓	✓
Automatic Data Acquisition and Monitoring System	✓	✓
Digital Upstream and Downstream Pressure	✓	✓
Digital Confining Pressure and Back Pressure	✓	✓
Digital Cell Pressure	✓	✓
High Pressure HPLC Pump	✗	✓

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Experiment Description

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Specification	BCF-PS01	BCF -PS05
Core Length	2″ to 10″	2″ to 10″
Core Diameter	1.5″	1.5″
Working Temperature	120˚C	120˚C
Max. Pore Pressure	6,000 Psi	6,000 Psi
Max. Confining Pressure	6,500 Psi	6,500 Psi
Pressure Accuracy	0.05% F.S.	0.05% F.S.
Number of Differential Pressure Transmitter	2 (145 Psi, 1450 psi)	2 (145 Psi, 1450 psi)
Number of Accumulators	3	3
Input Power Supply	220 VAC, 50Hz	220 VAC, 50Hz
Pressure Taps: Inlet and Outlet of Core Holder	✓	✓
Stainless Steel Material	✓	✓
Force Convection Oven (500 Liter)	✓	✓
Hassler Type Core Holder	✓	✓
Core Holder Position: Horizontal	✓	✓
Downstream Pressure Controller	✓	
Hydraulic Hand Pump	✓	✓
Automatic Valve DP Control	✓	✓
User Friendly Automated Data Acquisition, Calculating and Reporting Software	✓	✓
Digitized Upstream and Downstream Pressure	✓	✓
Digitized Confining Pressure and Back Pressure	✓	✓
Digitized Cell Pressure	✓	✓
Ambient Glass Fluid Separator	✓	✓
Fraction Collector	✓	✓
Gas Meter	✓	✓
High Pressure HPLC Pump	×	✓

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Sand Pack System

The sand pack system provides an alternative porous medium to perform EOR studies at different conditions of temperature and pressure. The sand pack is a tube which is filled with calibrated sand having a known grain geometry. Optionally, several pressure taps can be integrated along the tube to monitor the pressure gradient as a function of injection distance. The versatile apparatus warrants various EOR tests including water flooding, polymer injection, ASP injection, miscible and immiscible gas flooding, microbial flooding and steam injection.

Specification	SPS-BR01	SPS-BR02	HSS-PR01	HSS-PR05
Max. Working Temperature	Ambient	Ambient	120 ˚C	120 ˚C
Max. Working Pressure	Atmospheric	Atmospheric	6,000 Psi	6,000 Psi
Pressure Accuracy	0.05% F.S.	0.05% F.S.	0.05% F.S.	0.05% F.S.
Tube Diameter	1.5″	1.5″	1.5″	1.5″
Tube Length	30 cm	30 cm	10 cm, 20cm, 30 cm	10 cm, 20cm, 30 cm
Position	Horizontal	Horizontal	Horizontal	Horizontal
Wetted Material	Poly (methyl methacrylate)	Poly (methyl methacrylate)	Stainless Steel 316	Stainless Steel 316
Input Power Supply	220 VAC, 50/60Hz	220 VAC, 50/60Hz	220 VAC, 50/60Hz	220 VAC, 50/60Hz
Infusion Pump	✓	✓	×	×
Computer System	✓	✓	×	×
Automatic Data Acquisition (Pressure Log)	✓	✓	×	×
Accurate Gas Injection System	×	✓	×	×
Force Convection Oven	×	×	✓	✓
Number of Accumulator	×	×	2	2
Downstream Pressure Controller	×	×	✓	✓
High Pressure HPLC Pump is included	×	×	×	✓

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Core Cutting Saw

Cutting End Sides of a Plug

Single Blade

Core cutting saw is the first step of preparation of samples for core laboratory experiments. The radial core cutting saw is a machine for cutting rocks into the smaller parts. This is basically for cutting a big size outcrop rock into the smaller parts and/or cutting the longer cores to the shorter ones.

Dual Blades Description

After preparing plugs in core drill machine, all of them should be cut into desired size. This can be done by dual blade machine. Dual blade machine is a bench model designed to produce fast, high quality thin sliced samples from all materials without disturbing the structure of the sample.

Specification	CCS-BR01	DCS-BR01
Saw Blade Diameter	400 mm (15.7")	200 mm (7.8")
Maximum Cutting Depth	130 mm (5.1")	50 mm (5.5")
Max Core Length	300 mm (11.8")	75mm (3")
Weight	66.4 kg	70 kg
Compatible Coolants	Water, Z1 Cooling Oil	Water, Z1 Cooling Oil
Dimensions	1080 × 686 × 1220 mm	1100 × 700 × 1200 mm
Power Supply	220VAC, 50/60 Hz	220VAC, 50/60 Hz
Circulation Cooling System	✓	✓

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Manual Saturator

For Core Saturating with Liquid

The manual saturator permits to perform a sequence of vacuum and saturation cycles on plug size samples.

Experiment Description

The standard apparatus includes a plug sized core cell, a vacuum pump, a hand operating pressure pump (3,000 psi output), a vacuum tank and hand operated valves and plumbing. A larger cell to accommodate full size core samples is also available.

Specification	MCS -BR01
Max saturating pressure:	3,000 psi
Number of Core Cell	1
Saturating Fluid	water, brine, and oil or Other Liquids
Manual liquid pump	✓
316 Stainless steel Wetted materials (other upon request)	✓
Electrical vacuum system	✓

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Plugging Machine

Core Plugging from a whole core sample

Core plugging could be a very important tools to delivering specific data requirements for reservoir. It is important to take plug samples within the first 24 hours after the core has arrived on surface in order to isolate the center section of core for accurate invasion analysis data.

Experiment Description

Under supervision of reservoir engineers and geologists, core samples taken from the reservoir are evaluated. Suitable locations for plugging is determined. Core plug with proper diameter is drilled using a diamond drill bit in order to proceed to the desired experiments.

Specification	CPM-BR01
Maximum Coring Depth	5" (12.7 cm)
Bit Internal Diameter	1.5"
Weight	300 kg
Drip Pan Dimension	400 * 300 * 300 mm
Compatible Coolant	Water and Z1 Cooling Oil
Drill Speed	Adjustable
Motor Power	1100 watts
Height	1800 mm
Power Supply	380 VAC 3 Phase, 50/60 Hz
Circulating Cooling System	✓

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Viscosity Measurement System

Measurement of Viscosity by Capillary Based Method

Ambient Viscosity Measurement System (AV-BR01) is an instrument used to measure the viscosity of a fluid at temperature range from ambient to 90 ˚C and atmospheric pressure. This measuring instrument which uses a capillary based method of measuring viscosity is recommended for Newtonian liquids.

Experiment Description

In this system, capillary tube is immersed in an accurate temperature controlled bath. The liquid sample is suctioned into the tube until it reaches the start point. Then, the suction is released to make the liquid flow by gravity through the controlled capillary section of the tube. An operator observes the oil meniscus as it passes the start point and then measures the time taken for the oil to pass the final mark. The tubes are chosen, making it easier for manual timekeeping.

Specification	AV-BR01
Temperature Control System	Water Bath
Working Temperature	Ambient to 90˚C
Working Pressure	Atmospheric
Wetted Material	Glass
Glass Capillary Viscometer	✓
Stop Watch	✓

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Asphaltene and Wax Detection and Investigator Apparatus

The Asphaltene and Wax Detector and Investigator Apparatus is designed to detect the onset of asphaltene precipitation, the effect of fluid inhibitor on asphaltene flocculation, precipitation, and deposition, and to study the growth of wax crystals and asphaltene solids due to pressure, and temperature changes, and in presence of inhibitors.

Experiment Description

The high pressure sample is injected into fluid visual chamber in application of Back Pressure regulator. Following by desired pressure and temperature changes, the onset of asphaltene precipitation is determined through visual observation of formation of solid particles in the fluid. Subsequent studies regarding physical change of solid particles and/or effect of inhibitors can be hold by the versatile apparatus.

Specification	AWI -PS01
Max. Working Pressure:	6,000 Psi
Max. Working Temperature:	120 °C
Particle Size Detection:	From 0.2 µm
Wetted Material:	Stainless Steel, Quartz
Microscope Zoom	✓
House Software for Particle Size Distribution Measurement	✓

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Capillary Tube Viscometer

Measurement of Reservoir Fluid Viscosity by Poiseuille's Law

The capillary viscometer module is designed to measure viscosity of the reservoir fluids. It includes a receiving accumulator, one capillary column and a pressure system

Experiment Description

It operates on the principle that any fluid displaced in laminar flow through a capillary tube of known dimensions, exerts a pressure drop across the tube, which is related to the flow rate of the fluid passing through it. The relationship is a function of the fluid viscosity.

Specification	CTV-PR01
Viscosity Range	0.2 cp to 10,000 cp
Pressure	6,000 psi
Pressure Accuracy	0.05% F. S.
Temperature	Ambient to 120 ˚C
Pressure Accuracy	0.05% F.S
Wetted Parts	stainless steel
Tube Size	1/8” (1/16” optional)
Power Supply	220 VAC 50/60 Hz
Force Convection Oven	✓

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Density Measurement System

Reservoir Fluid Density Determination

The density, or more precisely, the volumetric mass density, of a substance is its mass per unit volume. The density of a material varies with temperature and pressure. Increasing the pressure on an object decreases the volume of the object and thus increases its density. Increasing the temperature of a substance (with a few exceptions) decreases its density by increasing its volume.

Experiment Description

The principle consists of transferring the sample into the cell at desired conditions and weighing it using a high resolution balance. The sample density is calculated by simply dividing the weight of the sample (i.e. weight of the filled cell minus weight of the evacuated cell) by the known, precisely measured cell volume.

Specification	ADM-BR01	HDS-BR01
Working Temperature	Ambient to 90˚C	Up to 120 ˚C
Working Pressure	Atmospheric	Up to 6,000 Psi
Temperature Control System	Water Bath	Force Convection Oven
Wetted Material	Glass	Titanium
Ten Hydrometer (Density Range from 0.7 to 1.2 g/cc)	✓	×
Downstream Pressure Controller	×	✓
Digital Balance	×	✓

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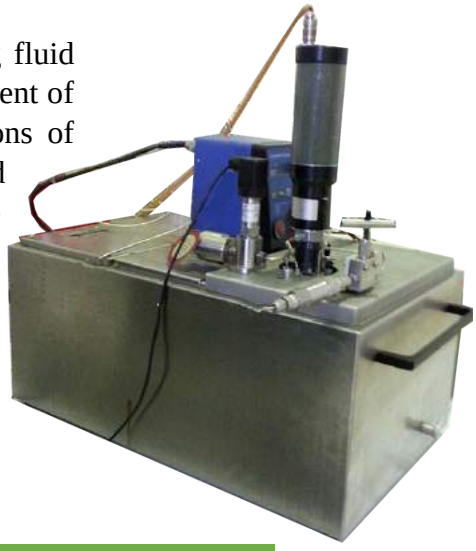
Dynamic Scale System

The Dynamic Scale System is a lab-scale simulated flowing fluid which is designed to measure asphaltene (and other solid content of petroleum fluids) deposition under realistic flowing conditions of production and transportation. The deposition rate is measured in terms of pressure loss in the pipe. The pipe is designed to investigate the effects of temperature, pressure and flow regime on the deposition behavior of asphaltenes. Moreover, inhibitor performance can be assessed with the apparatus. The wetted parts is made from stainless steel.



Specification	DSS -PR01
Temperature	Up to 120 °C
Pressure	6,000 Psi
Pressure Accuracy	0.05% F.S.
Tube Size	1/8″ & 1/16″
Number of Accumulators	2
Wetted material	Stainless Steel 316
Power Supply	220 VAC, 50/60 Hz
Force Convection Oven	✓
High Pressure HPLC Pump is included (X2)	✓

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Recombination Cell Apparatus

Mixing oil and gas samples to produce live oil

Recombination cell enables us to mix oil/gas sample with the help of a hydraulic piston with a packing in PTFE Bronze/Viton. It is compatible with high pressure (400 bar) and high temperature (120 °C) with a sample of 1 or 2 Liters. The cell can be upturned. The head of the cell is equipped with two manual valves.

Experiment Description

Oil and gas solutions are injected at desired volume, heated at a desired temperature and pressurized at pressure above the saturation pressure for few hours to provide a homogeneous mixture of sample representing reservoir fluid.

Specification	RC-BR01	RC –PR01
Pressure Accuracy	1% F.S.	0.1% F.S.
Working Temperature	Up to 120°C	Up to 120°C
Cell Volume	1,000 cc	2,000 cc
Working Pressure:	Up to 6,000 Psi	Up to 6,000 Psi
Stainless Steel Material	✓	✓
Input Power Supply:	220 VAC, 50Hz	220 VAC, 50Hz
Mixing System	Manual	Electrical
User Friendly Automated Data Acquisition Software	×	✓
Computer System	×	✓

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Rolling Ball Viscometer

Measurement of Reservoir Fluid Viscosity by Rolling Ball Method

The Rolling Ball Viscometer is specifically designed to determine the relative viscosity of reservoir liquids under reservoir conditions. The principle of operation is to measure the time it takes for a metal ball to fall through the sample fluid. This simple effective approach is yet the most reliable technique to estimate oil viscosity at high pressure conditions required to simulate reservoir conditions.

Experiment Description

The instrument is very easy to use. The pressurized sample is injected into the test chamber. A magnetic solenoid holds a steel ball at the top of the cell. When it is released, a highly accurate digital timer is automatically started as the ball rolls down through the sample. When the ball reaches the end of its travel, the timer automatically stops providing a precise falling time measurement. Viscosity values are then obtained by correlation of the falling time and ball diameter with curves of fluids with known viscosities and densities.

Specification	RBV-PR01
Maximum Working Pressure	6000 Psi
Pressure Accuracy	0.1 % F.S.
Viscosity Range	0.2 – 10000 cP
Temperature	Ambient to 150 ˚C
Launcher	Electrical Magnet
Receiver	Electrical Switch
Time Accuracy	0.01 Sec
Wetted Material	Stainless Steel
Connections	NPT 1/8″
Power Supply	220 VAC, 50-60 Hz
Computer System	✓
Automatic Data Acquisition and Monitoring System	✓
Circulating Bath Temperature Control Unit	✓
Automatic Rolling Time Measurement	✓

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Flash Separator

Measurement of gas oil ratio (GOR)

The purpose of the Single Stage Separator apparatus is to flash pressurized liquids and measure the gas oil ratio at equilibrium conditions. The liberated gas is measured with the gasometer at ambient conditions while the dead oil flashed is determined by gravity technique

Experiment Description

Live oil from fluid vessel enters the separator. Velocity of fluid decreases because of expansion in cross section. Two phases have enough time to separate. Because of different specific gravity of oil and gas, oil settles down and gas goes to the top of the separator chamber.

Specification	FS-BR01	FS-PR01
Maximum Accumulator Pressure	50 Psi	350 Psi
Pressure Accuracy	0.5 % F.S.	0.1 % F.S.
Working Temperature	Ambient	Ambient
Power Supply	220 VAC, 50/60 Hz	220 VAC, 50/60 Hz
Connections	NPT 1/8 "	NPT 1/8 "
Computer System	✓	✓
User Friendly Automated Data Acquisition, and Calculating Software	✓	✓
Gas Meter	✓	✓

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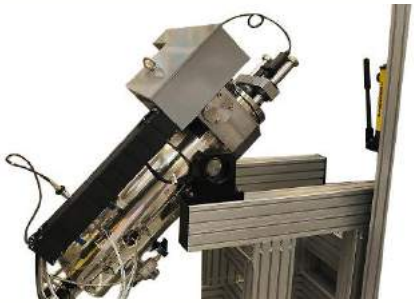
PVT System for Reservoir Fluids

Measuring Phase Behavior at Reservoir Conditions

The Fluid PVT system is designed to study phase behavior of reservoir fluids at reservoir conditions of pressure and temperature. This apparatus includes two models which are professional and education. The professional model has a visual cell, which warrants excellent reliability on black oil, volatile oil and gas condensate samples.



The PVT cell is based on a window through cell offering full sample visibility. It is particularly interesting when visual observation of the fluid must be accomplished such as swelling tests, volatile oil studies, gas condensate studies, etc. The system uses an embedded high pressure pump to control the pressure and volume of the reservoir fluid in the cell. A video camera system records in real time the fluid phases while video tools enable the end-user to retrieve the volume of each phase versus pressure and temperature..

Specification	PVT-PR01	PVT-BR01
Max. Working Pressure	6000 Psi	6000 Psi
Working Temperature	Ambient to 150 ˚C	Ambient to 150 ˚C
Pressure Accuracy	0.05 % F.S.	0.1 % F.S.
Wetted Material	Stainless Steel	Stainless Steel
Power Supply	220 VAC, 50/60 Hz	220 VAC, 50/60 Hz
Embedded Syringe Pump	✓	×
Volume	500 ml	250 ml
Volume accuracy	0.01 ml	0.1 ml
Visual Window	✓	×
Mixer	✓	×
Automated Data Acquisition, Reporting and Calculation Software	✓	×
Computer System	✓	×
Motorized Rocking Mechanism	✓	✓

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Slim Tube
Measuring MMP at Reservoir Conditions

The miscibility tests allow for the evaluation of the minimum miscibility pressure (MMP), the minimum miscibility composition (MMC), the optimization of injection parameters and composition of lean and enriched gas, the determination of oil in place recovery and the assessment of sensitivity of experimental conditions on oil recovery.

Experiment Description

The slim tube apparatus is used to obtain dynamic miscibility information at reservoir conditions. The gas to be tested is injected at a desired pressure through the slim tube, which is already cleaned and saturated with oil by means of a high pressure pump. A back pressure regulator maintains a constant pressure within the system. The effluents flowing from the slim tube can be observed through a capillary sight glass tube. They are then expanded to atmospheric pressure and temperature conditions through a back pressure regulator. The volume of liquid effluents is then continuously monitored and recorded. The recovery curve is then plotted based on the raw data obtained during the different miscible displacement experiments.

Specification	STA-PR01	STA-PS01
Packed Tube Length	12 m	12m
Packed Tube External Diameter	1/4”	1/4”
Porous Media Material	Glass Bead	Glass Bead
Particle Diameter	100 – 125 µm	100 – 125 µm
Working Temperature	Ambient to 120 ˚C	Ambient to 120 ˚C
Max. Working Pressure	6000 Psi	10,000 Psi
Pressure Accuracy	0.1 % F.S.	0.1 % F.S.
Wetted Material	Stainless Steel	Stainless Steel
Power Supply	220 VAC, 50/60 Hz	220 VAC, 50/60 Hz
Gas Meter	✓	✓
Computer System	✓	✓
Automated Data Acquisition, Reporting and Calculation Software	✓	✓
High Pressure Pump Is Included	✓	✓

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Triaxial Core Holder (TCH)

The TRC Series are standard triaxial type core holders employed in studies involving fluid displacement in porous media. One great advantage of these core holders is the application of independent radial and axial confining pressures; independent axial pressure is applied via a floating distribution plug. An inlet and outlet distribution plug enable fluid injection through the core sample. A convenient characteristic of the TRC series core holder is that the sleeve remains inside the core holder; the core is loaded from one end without the need of filling/draining the confining fluid. By releasing the confining radial and axial pressures and unscrewing the end plug, the core sample can easily be removed without exposure to the hydraulic fluid. The core holder can be configured for Hassler, Hydrostatic or Triaxial loading.

Specification	TCH -BR01
Core Diameter	1.5 Inches (Customizable)
Core Length	2 to 4 Inches (Customizable)
Max pressure	6000 psi
Wetted parts	Stainless Steel 316 (Other on Request)
Inlet Port	One (Other on Request)
Outlet port	One
Fitting	NPT
Sleeve Material	Viton
Max.Working Temperature	150 ˚C

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High Pressure Fluid Accumulator (HFA)

A hydraulic accumulator is a pressure storage reservoir in which a non-compressible hydraulic fluid is held under pressure that is applied by an external source. The external source can be a spring, a raised weight, or a compressed gas. An accumulator enables a hydraulic system to cope with extremes of demand using a less powerful pump, to respond more quickly to a temporary demand, and to smooth out pulsations. It is a type of energy storage device.

Specification	HFA -BR01
Max pressure	6000 psi
Wetted parts	Stainless Steel 316 (Other on Request)
Capacity	500 cc (Customizable)
Max.Working Temperature	150 ˚C

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Hydrostatic Whole Core Holder (HWC)

The HWC Series are standard Hydrostatic type core holders employed in studies involving fluid displacement .One great advantage of these core holders is the application of both radial and axial (equal) confining pressures. A cylindrical core sample is fitted in a Viton sleeve and mounted onto a fixed platen at one end while at the other end, there is a floating platen through which the fluid passes via a ¼" diameter tubing. This design enables firm contact between the platen and core sample for a wide range of core lengths. To change a core sample, the confining fluid must be drained and the end plug unscrewed by manually rotating it counter- clockwise. This will withdraw the entire assembly: fixed platen, sleeve, core and floating platen. Subsequently the core can be removed from the sleeve. Loading a new core sample is carried out by performing this procedure backwards.

Specification	HWC-BR01
Max. Working Pressure	6000 Psi
Working Temperature	Ambient to 150 ˚C
Core Diameter	4 Inches (Customizable)
Core Length	12 Inches (Customizable)
Wetted Material	Stainless Steel
Inlet Port	One (Other on Request)
Outlet port	One
Fitting	NPT
Sleeve Material	Viton

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Electrical core Holder (ECH)

The ECP Series are standard hydrostatic type core holders equipped with electrical facilities rendering them ideal for reservoir-representative resistivity studies. Capillary pressure is generated by means of semi-permeable, pressure calibrated water-wet ceramic placed between the flow distribution and the core sample. Special Viton sleeves with two embedded circumferential electrodes are employed for high-accuracy sample resistivity measurements. Two other electrodes are in contact with the electrically isolated distribution plugs, thus allowing both two and four point resistivity measurements.

Specification	ECH -BR01
Core Diameter	1.5 Inches (Customizable)
Core Length	2 to 3 Inches (Customizable)
Max pressure	6000 psi
Wetted parts	Stainless Steel 316 (Other on Request)
Inlet Port	One (Other on Request)
Outlet port	Two
Fitting	NPT
Number of Porous Plates	One
Sleeve Material	Viton
Resistivity Measurement	2 Points (Other on Request)
Max.Working Temperature	150 ˚C

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Down Stream Pressure Controller (DPC)

Down Stream Pressure Controller Series (Back Pressure Regulator) provides precise control of inlet, upstream or back pressure in an instrument or analyzer system

Specification	DPC -BR01
Max pressure	6000 psi
Wetted parts	Stainless Steel 316 (Other on Request)
Type of Fluids	Gas, Liquid, Supercritical Fluids
Max.Working Temperature	150 ˚C

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Hassler Type Core Holder (HTCH)

The Capri Series are standard hydrostatic type core holders equipped with electrical and capillary pressure facilities rendering them ideal for reservoir-representative capillary pressure/ resistivity studies. Capillary pressure is generated by means of semi-permeable, pressure calibrated water-wet or oil-wet ceramics placed between the flow distribution plugs and the core sample. Special Viton sleeves with two embedded circumferential electrodes are employed for high-accuracy sample resistivity measurements. Two other electrodes are in contact with the electrically isolated distribution plugs, thus allowing both two and four point resistivity measurements.

Specification	HTCH -BR01
Core Diameter	1.5 Inches (Customizable)
Core Length	2 to 4 Inches (Customizable)
Max pressure	6000 psi
Wetted parts	Stainless Steel 316 (Other on Request)
Inlet Port	one (Other on Request)
Outlet port	one
Fitting	NPT
Sleeve Material	Viton
Max.Working Temperature	150 ˚C

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High Pressure Manual Pump

Manually provides hydraulic pressure in an easy and efficient manner. The device consists of a cylindrical corrosion proof chamber with a threaded spindle-actuated piston. They are manually operated via a rotary crank which drives a threaded spindle-piston assembly into a corrosion resistant stainless steel chamber. Four arms extend from the rotary crank to facilitate pressure incrementing. The low friction piston greatly increases seal durability. Each pump come fully equipped with a pressure gauge and frame & control valves for fluid handling.

Specification	HMP -BR01
Volume	120 ml
Max pressure	6000 psi
Wetted parts	Stainless steel
Outlet port	1/8 inch NPT
Max.Working Temperature	120 ˚C

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HPHT Density Cell

The HP HT density cell handles reservoir fluids at pressures and temperatures up to 10 Kpsi and 175 °C, respectively. The principle consists of transferring the sample into the cell at reservoir conditions and weighing it using a high resolution balance. The sample density is calculated by simply dividing the weight of the sample (i.e. weight of the filled cell minus weight of the evacuated cell) by the known, precisely measured cell volume. This method provides reliable, exact and repeatable results under any condition. The density resolution is mainly dependent upon the accuracy of the balance used. Combined with a balance with a weighing accuracy of 1 mg, a resolution of 0.0006 g/cm3 is achieved.

Specification	HDC -BR01
Max pressure	6000 psi
Wetted parts	Titanium
Max.Working Temperature	120 ˚C

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RICP Core Holder (RPC)

The Capri Series are standard hydrostatic type core holders equipped with electrical and capillary pressure facilities rendering them ideal for reservoir-representative capillary pressure/ resistivity studies. Capillary pressure is generated by means of semi-permeable, pressure calibrated water-wet or oil-wet ceramics placed between the flow distribution plugs and the core sample. Special Viton sleeves with two embedded circumferential electrodes are employed for high-accuracy sample resistivity measurements. Two other electrodes are in contact with the electrically isolated distribution plugs, thus allowing both two and four point resistivity measurements.

Specification	RPC -BR01
Core Diameter	1.5 Inches (Customizable)
Core Length	2 to 3 Inches (Customizable)
Max pressure	6000 psi
Wetted parts	Stainless Steel 316 (Other on Request)
Resistivity Measurement	2 Points (Other on Request)
Inlet Port	Two
Capillary Pressure	Positive and Negative
Outlet port	Two
Number of Porous Plates	Two
Fitting	NPT
Sleeve Material	Viton
Max.Working Temperature	150 ˚C

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IFT Cell (ITC)

The IFT system includes a high pressure viewing cell with capillary injector to generate the drop at reservoir conditions. It is equipped with sapphire windows in both ends for complete visibility.

Specification	HMP -BR01
Max pressure	6000 psi
Wetted parts	Stainless Steel 316
Dimension	70*100 mm
Volume	40 cc
Fitting	NPT
Two Visual Sides	✓
Max.Working Temperature	120 ˚C

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High Pressure Single Syringe Pump

High Precision Fluid Injection

The syringe pumps are designed for applications requiring accurate pulseless flow and pressure control for delivery of low viscosity liquids. The pumps are capable of constant flow operation over a wide pressure range. The pump design incorporates motor driven piston, pressure and an optional temperature measurement to comply with most application requirements. The pump architecture gives user control flexibility.

Specification	HPS-BR11	HPS –PR11
Volume	100 ml	100 ml
Pressure Accuracy	0.1% F.S.	0.1% F.S.
Max Flow Rate	50 ml/min	50 ml/min
Min Flow Rate	0.05 ml/min	0.01 ml/min
Flow Accuracy	± 0.05 ml/min	± 0.01 ml/min
Max. Working Pressure	6000 Psi	6000 Psi
Input Power Supply	220 VAC, 50Hz	380 VAC 3 Phase, 50/60 Hz
Stainless Steel 316 Wetted Material (Other on Request)	✓	✓
Pulseless Constant Flow/Constant Pressure Modes	✓	✓
Injection/Withdrawal Modes	✓	✓
Computer Controlled System	✓	✓
User Friendly Automated Data Acquisition, And Reporting Software	✓	✓
Triple Position Safety Limit	✓	✓
Dual Pressure Safety Limit	✓	✓
Linear Sensor Controller	×	✓

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High Pressure Single Syringe Pump

High Precision Fluid Injection

The syringe pumps are designed for applications requiring accurate pulseless flow and pressure control for delivery of low viscosity liquids. The pumps are capable of constant flow operation over a wide pressure range. The pump design incorporates motor driven piston, pressure and an optional temperature measurement to comply with most application requirements. The pump architecture gives user control flexibility.

Specification	HPS-BR21	HPS –PR21
Volume	250 ml	250 ml
Pressure Accuracy	0.1% F.S.	0.1% F.S.
Max Flow Rate	50 ml/min	50 ml/min
Min Flow Rate	0.05 ml/min	0.01 ml/min
Flow Accuracy	± 0.05 ml/min	± 0.01 ml/min
Pressure	6000 Psi	6000 Psi
Input Power Supply	220 VAC, 50Hz	380 VAC 3 Phase, 50/60 Hz
Stainless Steel 316 Wetted Material(Other on Request)	✓	✓
Pulseless Constant Flow/Constant Pressure Modes	✓	✓
Injection/Withdrawal Modes	✓	✓
Computer Controlled System	✓	✓
User Friendly Automated Data Acquisition, And Reporting Software	✓	✓
Triple Position Safety Limit	✓	✓
Dual Pressure Safety Limit	✓	✓
Linear Sensor Controller	×	✓

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High Pressure Single Syringe Pump

High Precision Fluid Injection

The syringe pumps are designed for applications requiring accurate pulseless flow and pressure control for delivery of low viscosity liquids. The pumps are capable of constant flow operation over a wide pressure range. The pump design incorporates motor driven piston, pressure and an optional temperature measurement to comply with most application requirements. The pump architecture gives user control flexibility.

Specification	HPS-BR51	HPS-PR51
Volume	500 ml	500 ml
Pressure Accuracy	0.1% F.S.	0.1% F.S.
Max Flow Rate	50 ml/min	50 ml/min
Min Flow Rate	0.05 ml/min	0.01 ml/min
Flow Accuracy	± 0.05 ml/min	± 0.01 ml/min
Max. Working Pressure	6000 Psi	6000 Psi
Input Power Supply	220 VAC, 50Hz	380 VAC 3 Phase, 50/60 Hz
Stainless Steel 316 Wetted Material (Other on Request)	✓	✓
Pulseless Constant Flow/Constant Pressure Modes	✓	✓
Injection/Withdrawal Modes	✓	✓
Computer Controlled System	✓	✓
User Friendly Automated Data Acquisition, And Reporting Software	✓	✓
Triple Position Safety Limit	✓	✓
Dual Pressure Safety Limit	✓	✓
Linear Sensor Controller	✗	✓

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High Pressure Dual Syringe Pump

High Precision Fluid Injection

The syringe pumps are designed for applications requiring accurate pulseless flow and pressure control for delivery of low viscosity liquids. The pumps are capable of constant flow operation over a wide pressure range. The pump design incorporates motor driven piston, pressure and an optional temperature measurement to comply with most application requirements. The pump architecture gives user control flexibility.

Specification	HPD-PS21
Volume	250 ml + 250 ml
Pressure Accuracy	0.1% F.S.
Max Flow Rate	50 ml/min
Min Flow Rate	0.01 ml/min
Flow Accuracy	± 0.01 ml/min
Pressure	6000 Psi
Input Power Supply	380 VAC 3 Phase, 50/60 Hz
Stainless Steel Material	✓
Pulseless Constant Flow/Constant Pressure Modes	✓
Injection/Withdrawal Modes	✓
Computer Controlled System	✓
User Friendly Automated Data Acquisition And Reporting Software	✓
Triple Position Safety Limit	✓
Dual Pressure Safety Limit	✓
Linear Sensor Controller	✓

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