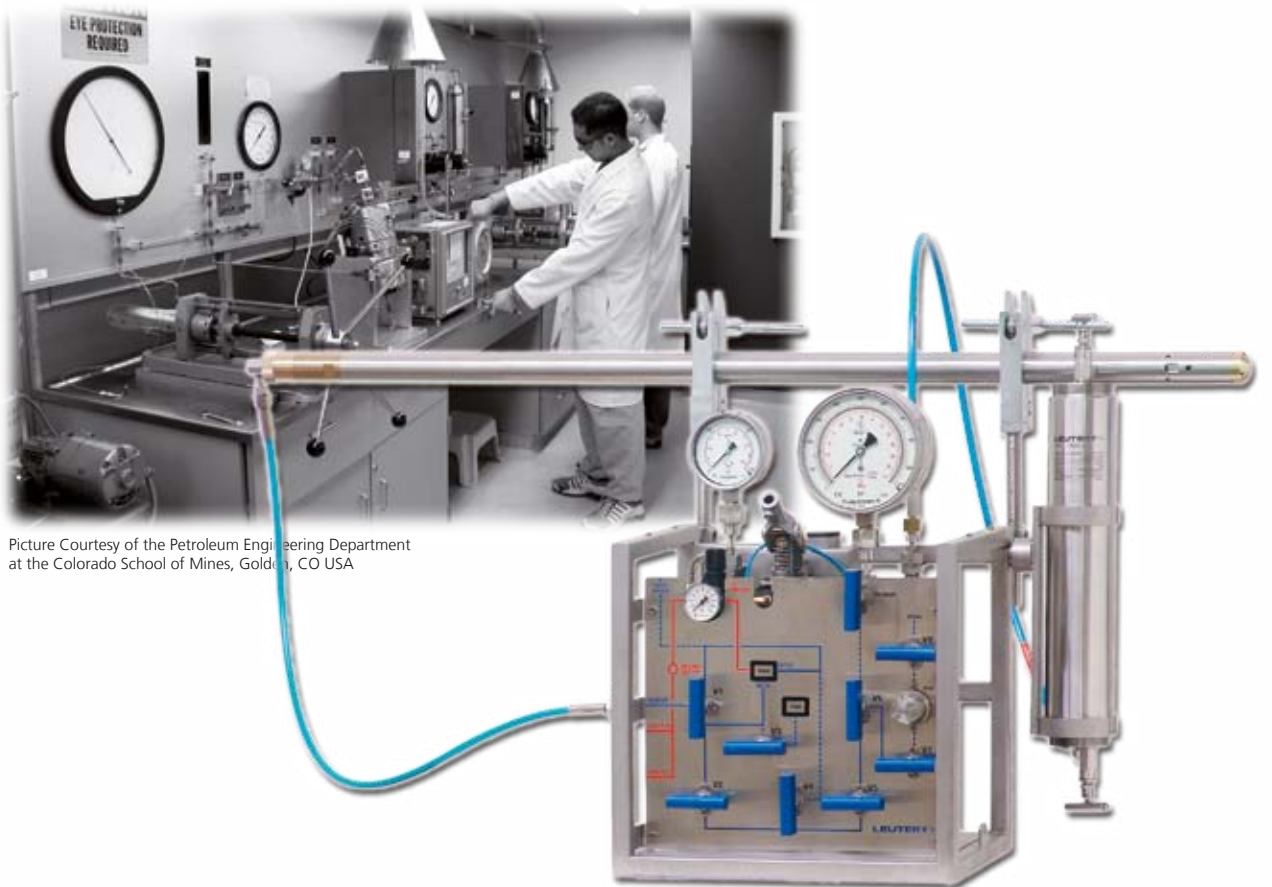


Positive Displacement Sampler PDS^{short}



Picture Courtesy of the Petroleum Engineering Department
at the Colorado School of Mines, Golden, CO USA

Sampling

The Positive Displacement Sampler PDS^{short} provides representative samples of well fluid which can be transferred to sample bottles without using mercury.

The Design

LEUTERT has been manufacturing bottom hole samplers since the early 1950s. Our latest product, the Positive Displacement Sampler, has found universal acceptance and success in worldwide oilfield locations. The sampling system provides clients with representative samples of well fluids which can be transferred on location to the sample bottle without the use of mercury. The high quality samples taken by the LEUTERT Positive Displacement Sampler provide data vital to the economic and technical evaluation of the reservoir.

The main features of the Leutert sampling system are:

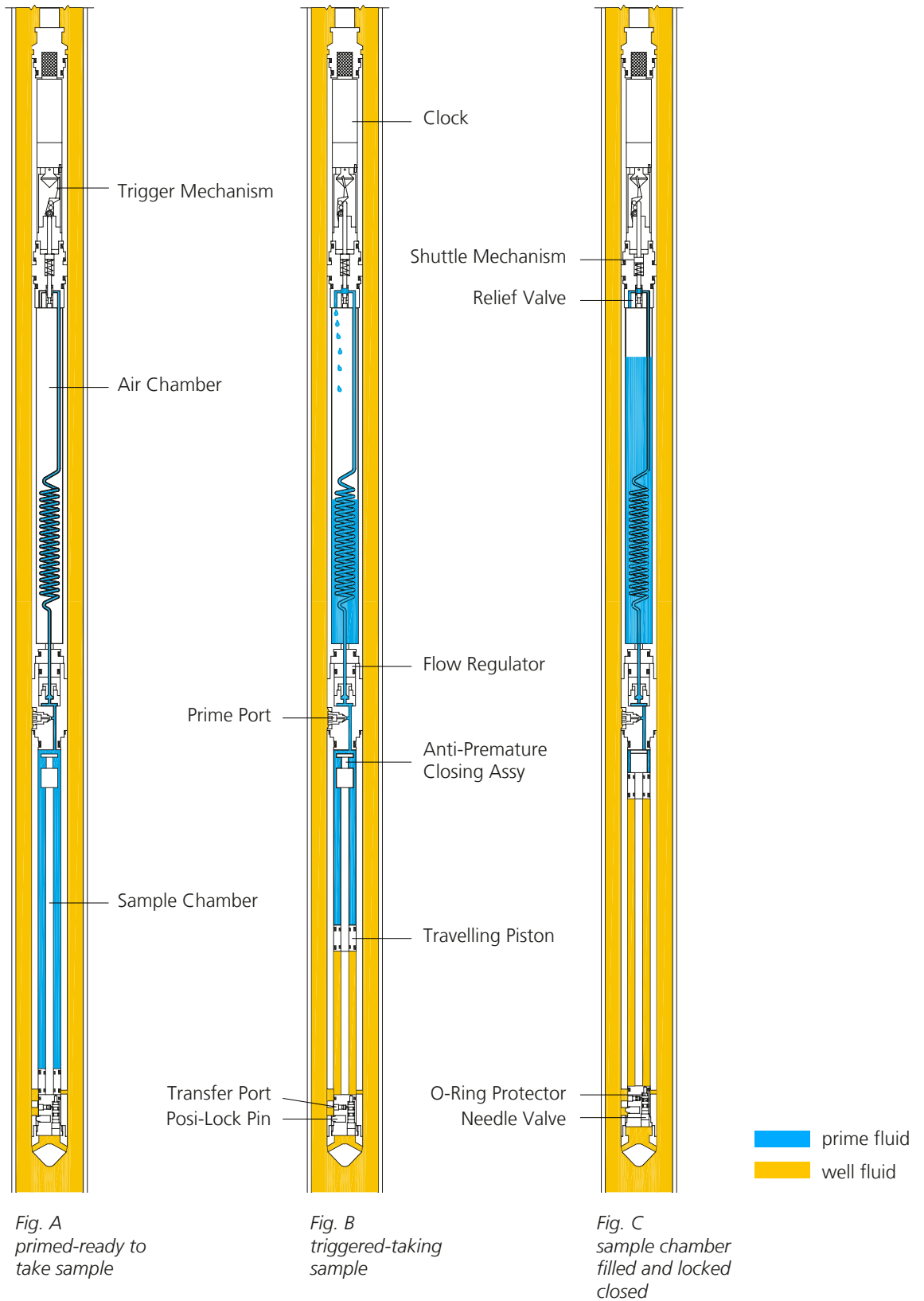
- Shortest sampler of its kind available in the market
- Confirmed sample volume (600 cc)
- Ability to operate in hostile well conditions
- Positive displacement operation
- No risk of contamination prior to or after sampling
- Adjustable sampling duration
- Mercury-free transfer to shipping bottle
- Positive locking after tool closure
- Ability to validate sample in sample chamber
- Rugged design with minimal components

The Bottom Hole Sampler

Manufactured from corrosion resistant materials, the sampler is particularly suited for operations where sour gas may be present. High manufacturing standards and regular tests of the tool minimize the enhanced risk for this high pressure tool. Continuous improvements led to the shortest Positive Displacement Sampler ever manufactured by LEUTERT.

The „positive displacement“ design of the tool is achieved by pressurizing a buffer fluid prior to running the tool. When the tool is fired, the well fluid pressure progressively displaces the buffer fluid at a precise, predetermined rate, which takes into account the well temperature and pressure characteristics. When the sampling process is completed, the chamber is automatically sealed and locked.

Volume	:	600 ccm	
Max. operating pressure	:	15,000 psi	1034 bar
Test pressure	:	22,500 psi	1551 bar
Max. operating temperature	:	360 °F	180 °C
Length	:	11.4 Ft	3474 mm
Diameter	:	1-11/16"	43 mm
Weight	:	55 lbs	25 kg
Top connection	:	15/16-10 UN	
Material	:	Seamless Stainless Steel according to NACE MR-01-75 Bronze Alloy	



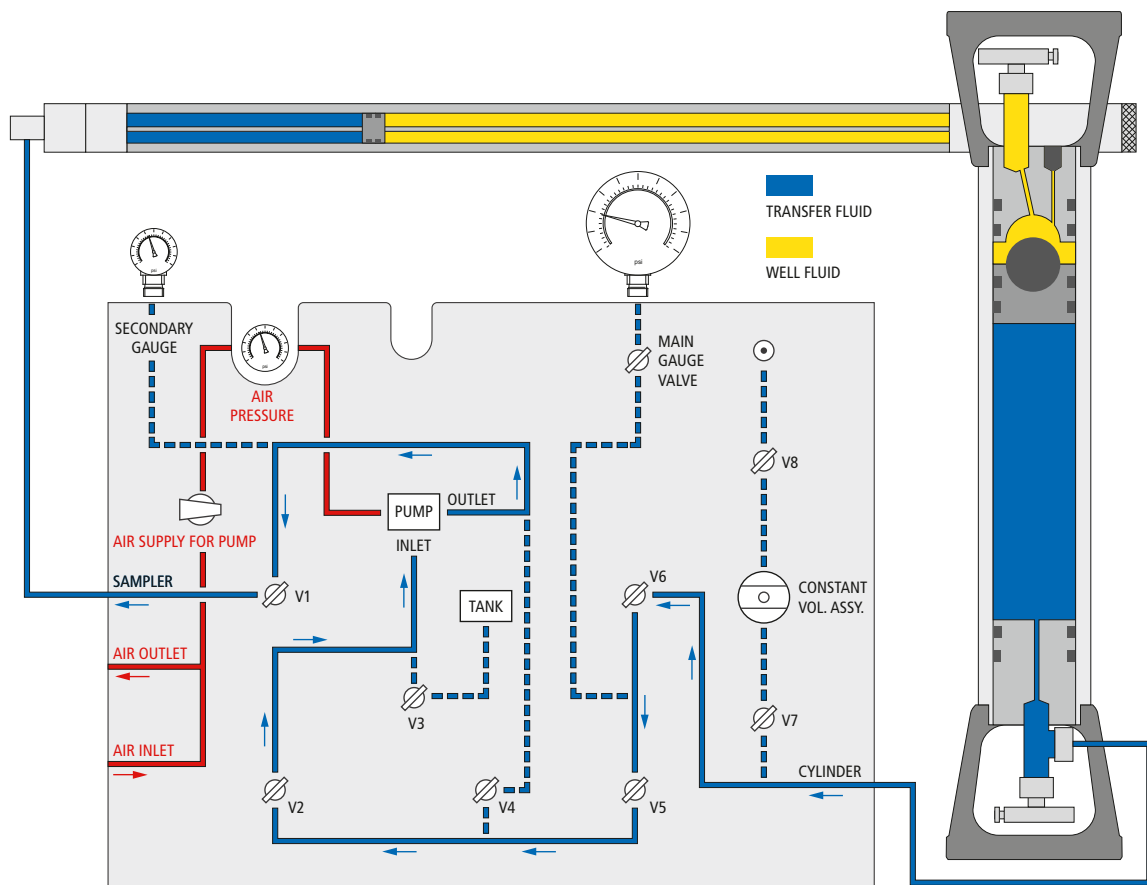
The Transfer

After the sample is trapped, the tool is pulled back to surface. The sample chamber may be removed from the tool assembly and installed into the transfer unit. The sample may now be transferred to a piston sample bottle. The bottle has a capacity of 700 cc and is available with 10,000 psi or 15,000 psi working pressure.

The transfer unit is built to the same high quality as the sampler. Its rugged design of stainless steel is equipped with the necessary high pressure hydraulics. The transfer pump is pneumatically operated to enable a controlled transfer to be effected both automatically and quickly.

The sampling system operates with a complete range of sample bottles, available for surface or sub-surface samples in various working pressures, such as the LEUTERT Type 600 Cylinder.

Max. operating pressure	: 15,000 psi	1034 bar
Test pressure	: 22,500 psi	1551 bar
Max. operating temperature	: 302 °F	150 °C
Dimensions	: 18.5" x 17" x 13"	470 mm x 430 mm x 330 mm
Weight	: 77 lbs	35 kg
Material	: Stainless steel according to NACE MR-01-75	



Schematic of Field Transfer Unit Showing Sample Transfer into Sample Cylinder

The Heating Jackets

When the sampler travels back to the surface the temperature inside the tool and consequently the pressure inside the sample chamber drops. The decrease in temperature and the reduction of pressure may bring the fluid to conditions of temperature and pressure corresponding. The sample will separate to a multiphase condition.

In general, this process may be reversed by re-heating the sample. Thus, the sample will resume its initial monophasic state. Heating also reduces the viscosity of crude oil and the sample can be transferred easily. For that purpose, LEUTERT Heating Jackets may be used.

Temperature range : 68 °F to 350 °F | 20 °C to 177 °C

Dimensions without Controller

Heating Jacket for Sampler : 3.9" x 3.9" x 51.2" | 100 mm x 100 mm x 1300 mm

Heating Jacket for Cylinder : 5.9" x 5.9" x 15.7" | 150 mm x 150 mm x 400 mm

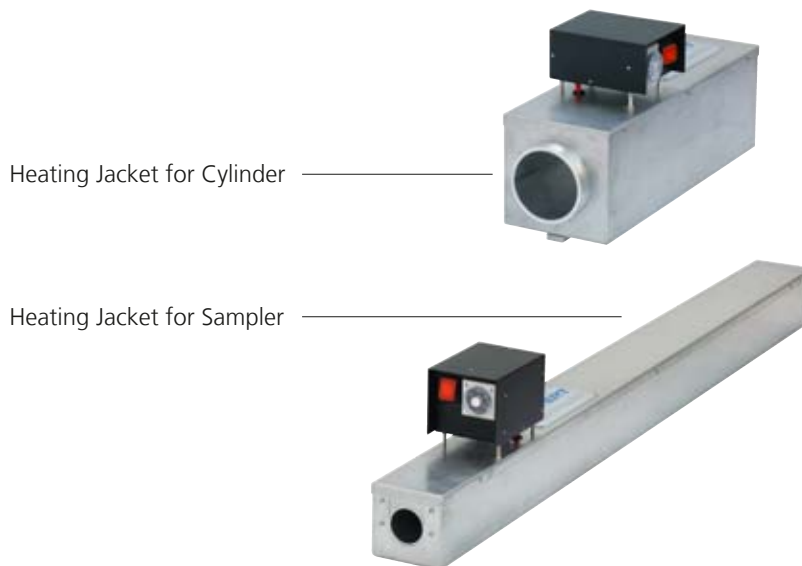
Weight

Heating Jacket for Sampler : 15.4 lbs | 7 kg

Heating Jacket for Cylinder : 25.3 lbs | 11 kg

Material : Stainless steel according to NACE MR-01-75

Power supply : 110 V AC to 240 V AC



The Maximum Thermometer

In addition to the Heating Jackets, LEUTERT provides Maximum Temperature Thermometers to determine the temperature attained at the location where the sample was taken.

Knowing the maximum temperature and the pressure of the samples taken allows the operator to verify the quality of the trapped sample on site.

One Phase Sampler (OPS)

Restoring the sample to original sub surface conditions by heating is achieved efficiently when the fluid has a low heavy-component content. However, when the fluid contains asphaltenes and paraffins in a colloidal dispersion state, and when these products have been segregated, it is no longer possible to reintegrate them into the fluid. In such a case, the properties of the fluid on which the thermodynamic measures are taken in the laboratory do not any longer exactly correspond to those of the fluid in the deposit. Therefore, in such cases the sample must remain in monophasic condition during the complete sampling process.

For this purpose, LEUTERT has designed a modified version of the PDS^{short}, the One Phase Sampler (OPS) unit. This unit may be attached to the LEUTERT Positive Displacement Sampler PDS^{short}. In order to keep a fluid in a monophasic state, the pressure variations of this fluid are compensated during temperature variations by equally varying the volume of the fluid sample to match the temperature variations. This is achieved by making the volume of the sample complementary to an auxiliary variable volume containing a pressurized gas whose critical temperature is lower than the lowest temperature possible during the handling of the sample. This pressurized gas is allowed to act on the sample via a floating piston, thus compensating the volume changes, and keeping the sample pressure well above the dew point or bubble point at all times.

Volume	:	600 ccm	
Max. operating pressure	:	15,000 psi	1034 bar
Max. operating temperature	:	360 °F	180 °C
Test pressure	:	22,500 psi	1551 bar
Diameter	:	1 - 11/16 inches	43 mm
Length	:	15.25 Ft	4648 mm
Weight	:	68 lbs	31 kg
Material	:	Seamless stainless steel to NACE, bronze alloy	

The Tandem Firing Mechanism

A Tandem Firing Mechanism allows the operation of two samplers at the same time. In this case, the lower sampler will be triggered immediately after the upper sampler has taken its sample. Due to its function as a knuckle joint in diverted wells, two samplers of 600 cc can be flexibly combined to collect a total volume of 1200 cc.

Max. operating pressure	:	15,000 psi	1034 bar
Test pressure	:	22,500 psi	1551 bar
Max. operating temperature	:	360 °F	180 °C
Length	:	15.5"	394 mm
Diameter	:	1-11/16"	43 mm
Weight	:	15.4 lbs	7 kg
Material	:	Seamless stainless steel according to NACE MR-01-75	

