Piston Type Sample Cylinder PDC

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

Fluid Sampling

The Piston Type Sample Cylinder PDC is a shipping bottle designed for transportation and storage of pressurized samples, especially hydrocarbon PVT samples.

The Piston Type Sample Cylinder

The Piston Type Sample Cylinder PDC is a shipping bottle designed for transportation and storage of pressurized hydrocarbon samples. Those samples might have been obtained through bottom hole or surface PVT sampling.

To separate the sample fluid from a secondary driving fluid, the bottles are equipped with a floating piston. The piston has a single o-ring seal and a slider ring and is designed to minimize friction and reduce pressure load.

The bottles are designed with a minimum of dead volume. A mixing ball is incorporated within the sample chamber.

The two end plugs are sealed with double O-ring seals and back-up rings. Both end plugs are held in place by strong circlips.

Right angle needle valves with 1/4" NPT female port connections are fitted to the 10,000 psi cylinders. A special valve is fit into the sample side which allows evacuation of the cylinder.

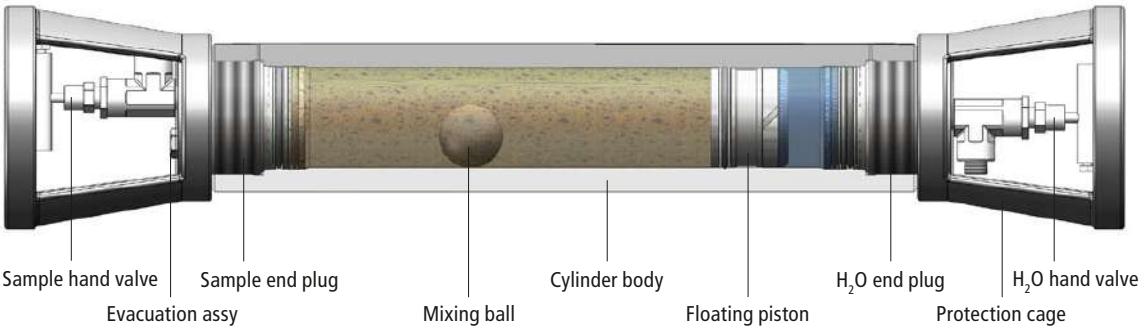
Protection cages on both ends aid as carrying mandrels the valves during handling and transportation. For shipment the cylinders are stored in an aluminum transportation box.

Due to the German engineering all Leutert sample cylinders have the same outer dimensions. As fluid sample cylinders are part of a system, standardized dimensions make it easy to use supplementary equipment such as stands, heaters and transfer benches, without the need for modification.

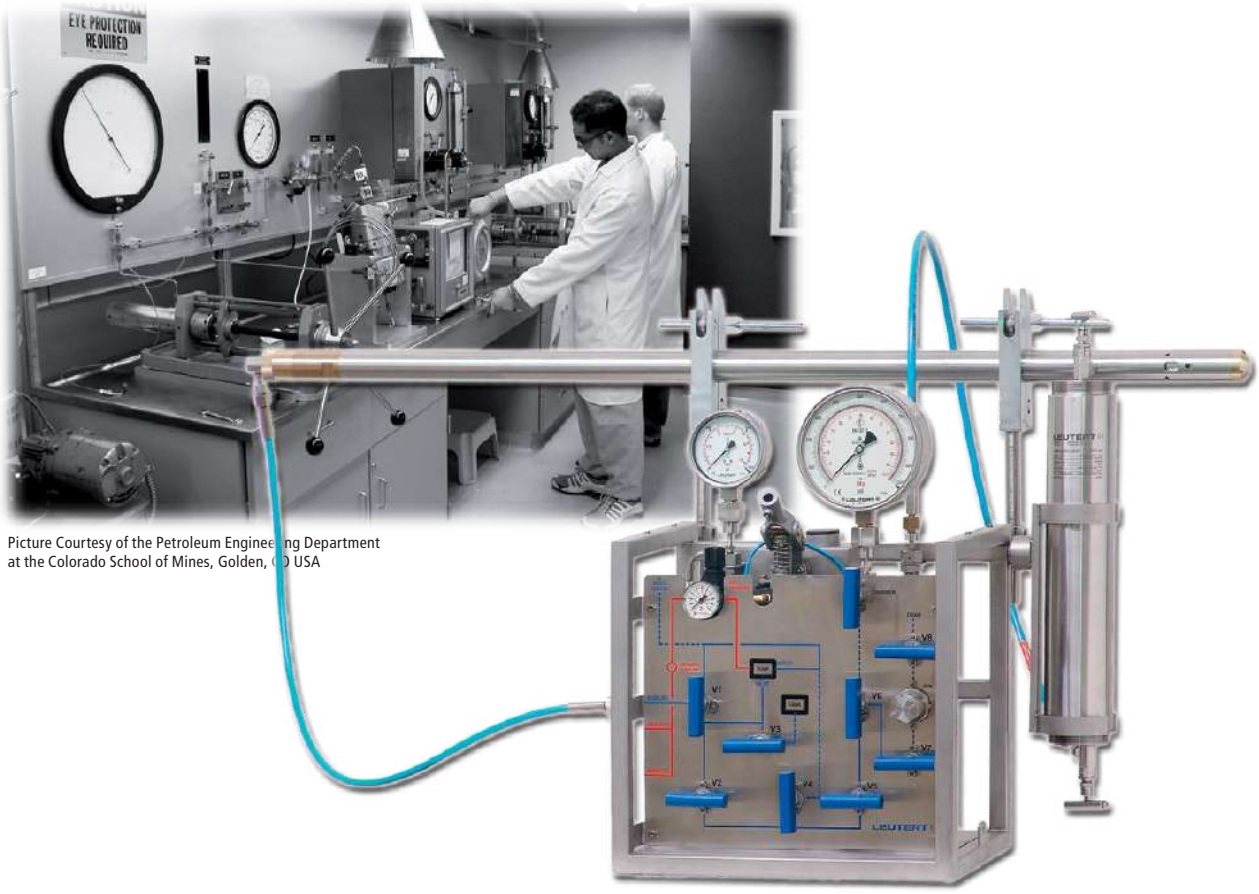
Technical Specifications

Capacity (nominal)	:	600 cm³ standard, other capacities available
Volume	:	700 cm³
Operating pressure	:	10,000 psi (690 bar)
Operating temperature	:	-4 °F to 300 °F (-20 °C to 150 °C)
Weight	:	37.9 lbs (17.2 kg)
Material	:	stainless steel, resistant to H_2S and CO_2 ANSI / NACE MR0175 / ISO 15156-1 (second edition 2009-10-15)
Certificates	:	TPED & Hydrostatic

Design



Downhole Fluid Sampler



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

Fluid Sampling

The Positive Displacement Sampler PDS^{short} provides representative downhole fluid samples which can be transferred to sample bottles and send to a laboratory for PVT analysis. The One Phase™ Sampler OPS maintains the sample in single phase throughout the entire operation.

The Design

High quality fluid samples provide data vital to the economic and technical evaluation of the reservoir. The LEUTERT Positive Displacement Sampler provides clients with such representative samples of well fluids all over the world. Collected fluid may be transferred on location to sample bottles. A modified version of the PDS^{short}, the One Phase™ Sampler OPS, allows the sample to be pressurized above reservoir pressure after it has been taken from the reservoir. This compensates any temperature induced pressure drop (e.g. as the sample is returned to surface) and maintains the sample in single phase.

The main features of the LEUTERT downhole sampling system are:

- Shortest sampler of its kind available in the market
- Confirmed sample volume (600 cm³)
- No risk of contamination prior to or after sampling
- Maintaining the sample in single phase
- Short redress time due to minimum seals and cross over nipples
- Adjustable sampling duration
- Ability to validate sample in sample chamber
- Positive displacement operation which eliminates the necessity to use mercury during transfer

The Bottom Hole Sampler

While using the standard PDS^{short} sampler samples will efficiently be restored to original sub surface conditions by heating if the fluid has a low heavy component content. However, when fluid contains asphaltenes and paraffins in a colloidal dispersion state, and when these products have been segregated, it is very difficult to reintegrate them into the fluid. In such 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, these 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 keeps the fluid in a monophasic state. This is achieved by adding a second volume chamber 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 caused by temperature changes, and keeping the sample pressure well above the dew point or bubble point at all times.

Volume	:	600 cm³
Max. operating pressure	:	15,000 psi (1,035 bar)
Test pressure	:	22,500 psi (1,550 bar)
Max. operating temperature	:	360 °F (180 °C)
Diameter	:	1 - 11/16" (43 mm)
Length	:	PDS^{short}: 11.45 ft (3,491 mm); OPS: 15.2 ft (4,632 mm)
Weight	:	PDS^{short}: 55 lbs (25 kg); OPS: 68 lbs (31 kg)
Material	:	Seamless stainless steel to NACE, bronze alloy

Positive Displacement Sampler PDS^{short}

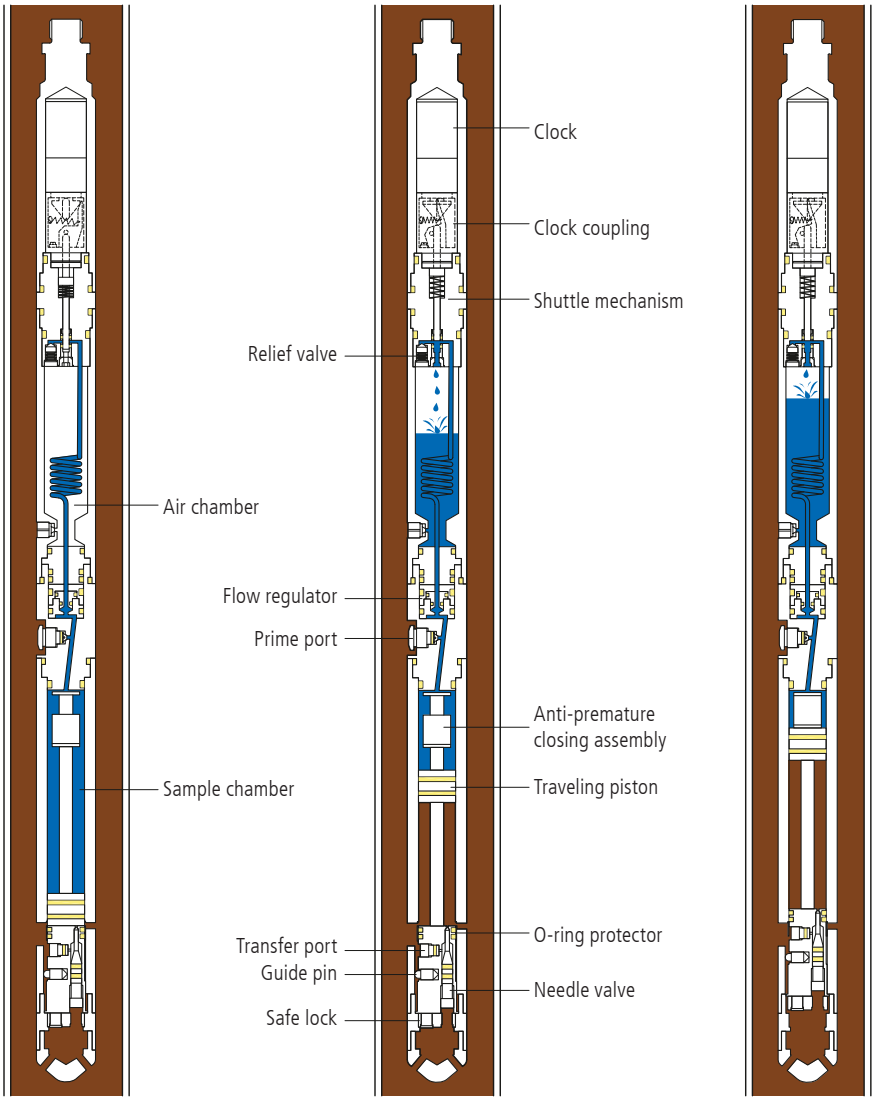


Fig. A – Primed-ready to take sample

Fig. B – Triggered-taking sample

Fig. C – Sample chamber filled and locked closed

Well fluid

Priming fluid

One Phase™ Sampler OPS

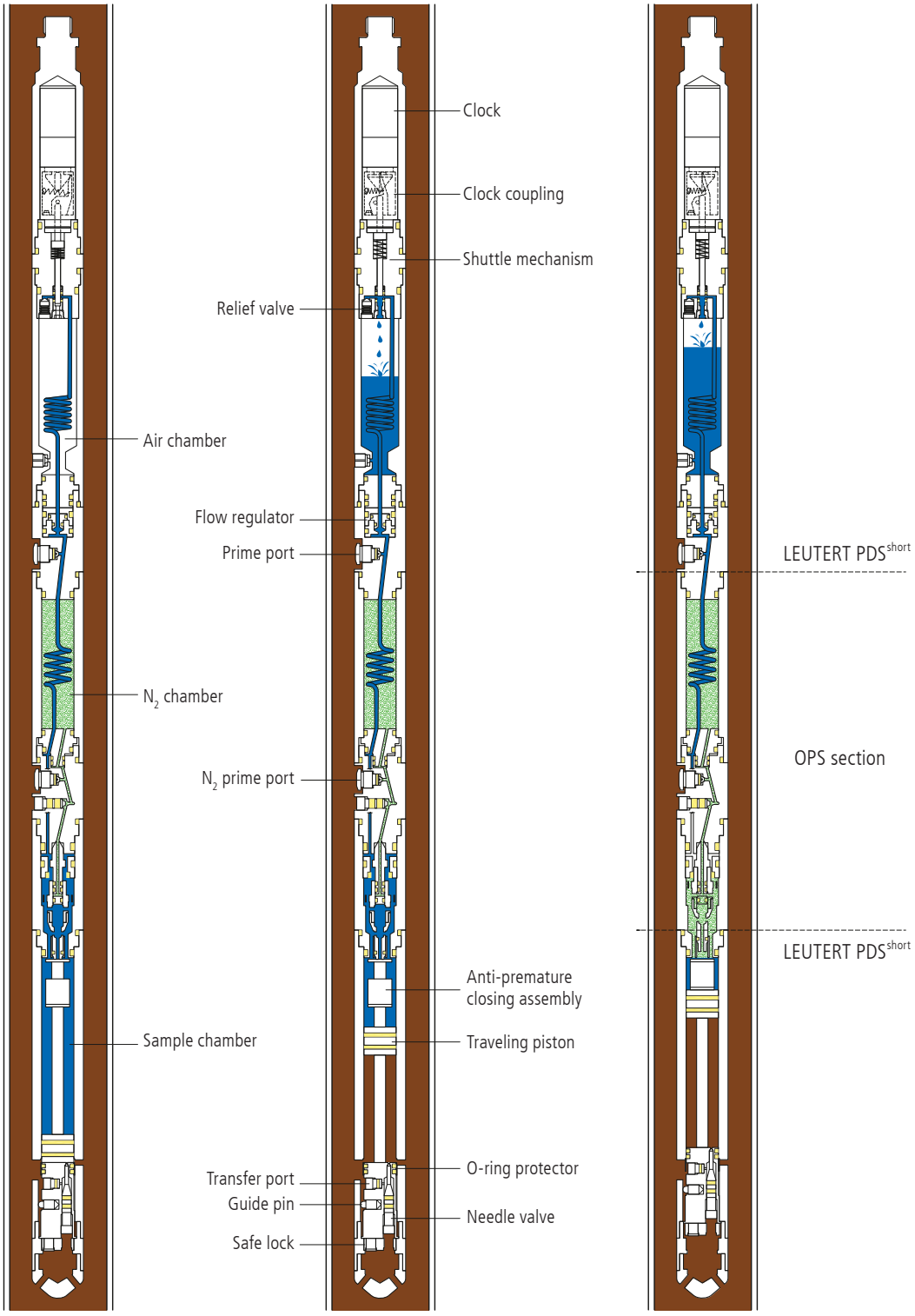


Fig. A – Primed-ready to take sample
Fig. B – Triggered-taking sample
Fig. C – Sample chamber filled and locked closed

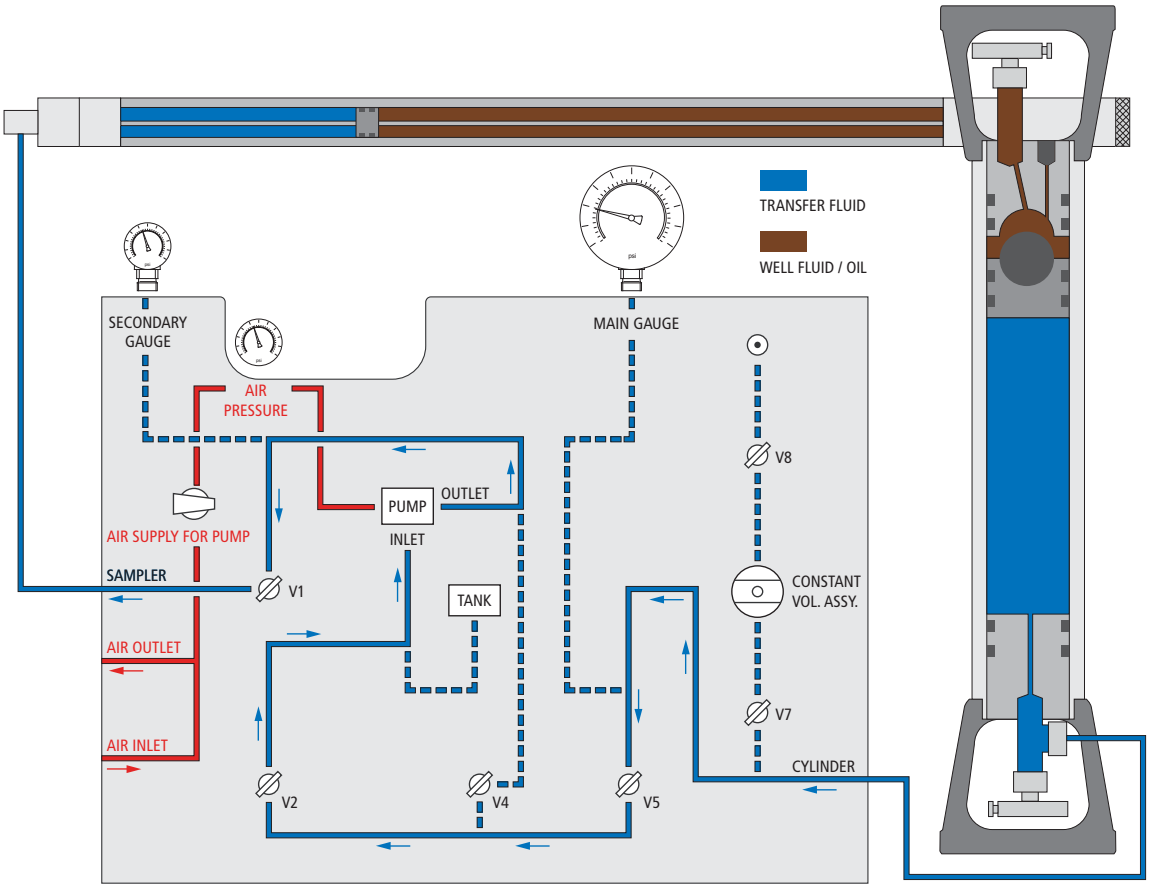
The Transfer

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 cm³ 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 (1,035 bar)
Test pressure	:	22,500 psi (1,550 bar)
Max. operating temperature	:	300 °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



Schematic of Field Transfer Unit Showing Sample Transfer into Sample Cylinder

The Heating Jackets

During the retrieval of the OPS Sampler from the well, the sample will remain in Single Phase owing to the Nitrogen over pressure within the sample chamber. Therefore the drop in temperature during pull out of hole has no effect on the phase status of the sample.

However it may be desired to transfer the sample on surface at reservoir temperature. This can be achieved by utilizing LEUTERT Heating Jackets for Sample Chamber and Sample Cylinder.

In addition, if the reservoir sample is very viscous or contains paraffins / asphaltenes, surface transfer may be difficult. For the purpose of facilitating easy Transfer into the Sample Cylinder, LEUTERT Heating Jackets may be used.

Temperature range	:	68 °F to 360 °F (20 °C to 180 °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

Heating Jacket for Cylinder

Heating Jacket for Sampler

The Operating Tools

To operate the positive displacement or one phase™ sampler a lot more tools are required. Especially, in the field orderliness and completeness will help saving time and money. Therefore, Leutert has reduced the number of necessary operating tools by 10% and designed a proper toolbox in which every tool got its own place.

Box with tools for samplers and cylinders

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 cm³ can be flexibly combined to collect a total volume of 1,200 cm³.

Max. operating pressure	:	15,000 psi (1,035 bar)
Test pressure	:	22,500 psi (1,550 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

The Nitrogen Booster Station

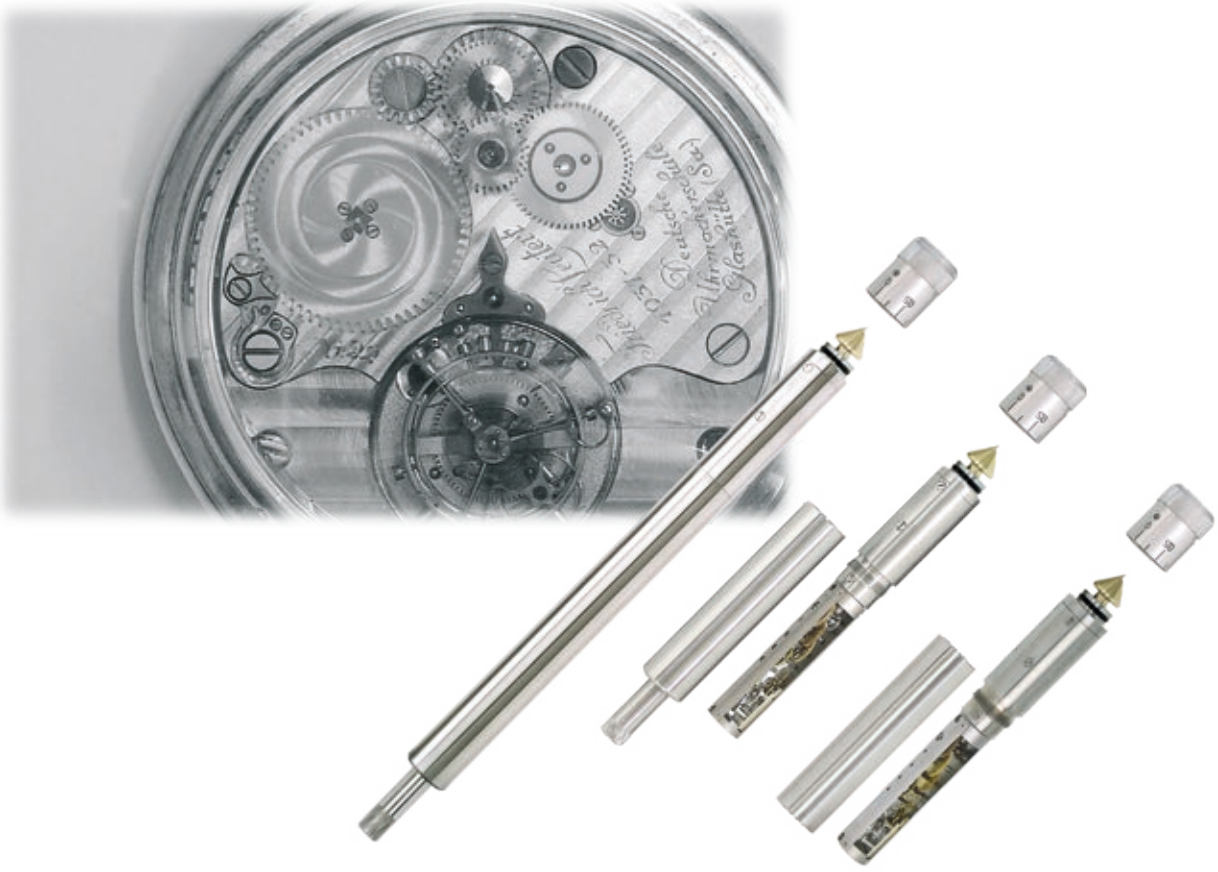
The LEUTERT Nitrogen Booster Station is used to compress nitrogen into the sample chambers of the one phase™ samplers and cylinders to a pressure rate above the well pressure. The sample chambers are pressurized across a piston with a nitrogen gas chamber. This compensates any temperature induced pressure drop (e.g. as the sample is returned to surface).

The booster is driven by compressed air. The output pressure is controlled by an adjustable pressure regulator with build-in filter/water separator. The cycle speed of the booster is controlled by a ball valve. A build-in bleed valve is used to release the pressure. The supply pressure of the air driven booster, the pressure in the bottle and the pressure at the high pressure side can be monitored by liquid filled pressure gauges.

A storage compartment for the hoses is also provided.

Air drive pressure	:	14 to 100 psi (1 to 7 bar)
Air input connection	:	½" NPT female bulkhead
Air drive pressure gauge	:	145 psi (10 bar) ø 63
N_2 supply pressure	:	1,200 to 4,350 psi (83 to 300 bar)
N_2 supply pressure gauge	:	5,800 psi (400 bar) ø 63
N_2 output pressure	:	max. 18,270 psi (1,260 bar)
N_2 output pressure gauge	:	23,000 psi (1,600 bar) ø 100
N_2 input connection	:	¼" NPT female bulkhead
N_2 output connection	:	7/16"-20 UNF female bulkhead
Weight	:	86 lbs (39 kg)
Dimensions (L x W x H)	:	25.4" x 16.5" x 18" (645 mm x 420 mm x 460 mm)
Gauges	:	dual-scale psi, bar

Downhole Sampler Clock



Fluid Sampling

The Leutert Driving Clock is a high temperature mechanical actuator. It has originally been designed to activate the Leutert PDS and OPS Bottom Hole Samplers.

Description

The Leutert Driving Clock is a high temperature mechanical actuator. It has originally been designed to activate the Leutert PDS and OPS Bottom Hole Samplers. Today it is also used to trigger other downhole instruments such as calipers and mechanical measuring devices. In conjunction with a clock coupling the actuator converts rotary motion into linear movement. It may be described as an adjustable time delayed trigger.

Clock ranges are available in different hours of total shut-off time. The winding head allows setting of partial times of respective total running time of the clock.

The clock is of extremely rugged construction and is designed to resist vibration, shock and temperature extremes encountered in oilfield and geothermal operations. It is not sensitive to shock, vibration and jarring. As such the Leutert clock is suitable for multiple downhole applications.

Technical Specifications

	Fig. A	Fig. B	Fig. C
Clock ranges	5 h, 10 h, 24 h	5 h, 10 h, 24 h	5 h, 10 h, 24 h
Max. working temperature	360 °F (180 °C)	360 °F (180 °C)	360 °F (180 °C)
Diameter	1.18″ (30 mm)	1.18″ (30 mm)	1.18″ (30 mm)
Length (approx.)	15.7″ (400 mm)	10.6″ (270 mm)	9.0″ (230 mm)
Weight (approx.)	2.1 lbs (950 g)	1.8 lbs (800 g)	1.6 lbs (750 g)

Design and Dimensions