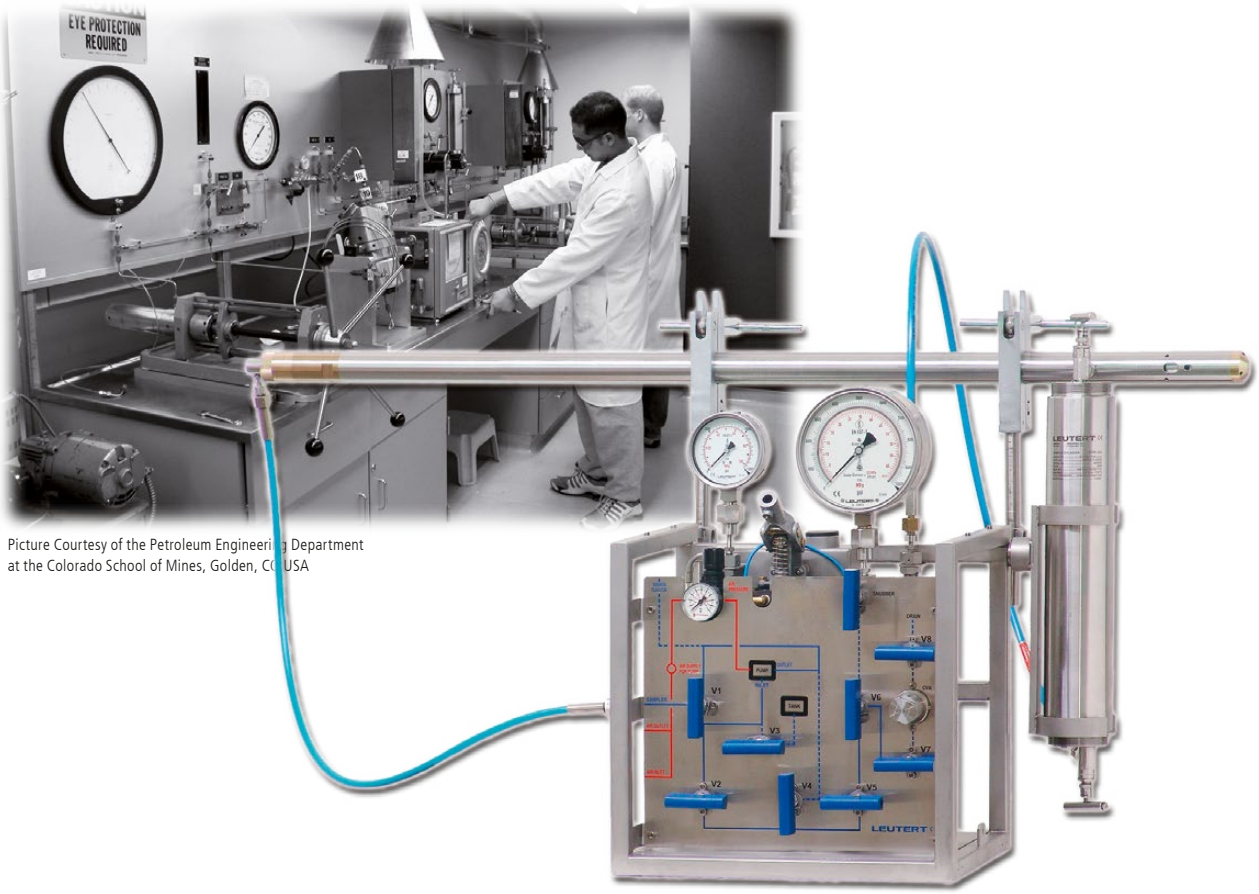
JULY 2015

Positive Displacement Sampler PDS^{short}
One Phase Sampler OPS

Operating Instructions



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

Sampling

The Positive Displacement Sampler PDS^{short} and the One Phase Sampler OPS provide representative samples of well fluid which can be transferred to sample bottles without the use of mercury.

Contents

Introduction

This operating manual provides instructions on how to use this product correctly, effectively and safely for the intended purpose. Please, read all instructions carefully and familiarize yourself with all danger, warning, and notes. Please follow all safety instructions and precautionary notes in order to avoid damage to people or property during operation. LEUTERT can not be held responsible for damage or injury resulting from improper use, incorrect operation or lack of maintenance.

This operating manual is designed mainly for technically trained personnel. If any questions arise regarding any safety or operational aspects, please do not hesitate to contact LEUTERT for assistance. Should you notice a faulty description or depiction, or, if you would like to suggest points for improvement, we are looking forward to hearing from you.

Please keep the operating manual near the product to have it available if needed. Make sure that the manual is protected from dirt and moisture.

Explanation of symbols:

 DANGER
indicates a hazardous situation which, if not avoided, will result in death or serious injury.

 WARNING
indicates a hazardous situation which, if not avoided, could result in death or serious injury.

 CAUTION
indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

 NOTICE
is used to address practices not related to personal injury.

1 General Safe Handling Procedures

While handling the following items, always take into consideration that you are operating with high pressure. Its inherent danger is caused by the enhanced pressurized fluid. This energy varies depending on the volume, pressure and characteristics of the fluid. The compressibility of liquids is generally low, resulting in relatively low enhanced energy. Nevertheless caution is always advised.

Pressure vessels containing gas enhance a very high energy. Damaged gas cylinders might break apart. Driven by escaping gases, exploding cylinders can be hauled several hundred meters (yards). Shrapnel inflicted injuries may also occur.

As crude oil always contains gas, anyone using this product must be thoroughly familiar with these instructions and other applicable product instructions and manuals. According to this norm maintenance, repair and/ or reconditioning shall be performed by LEUTERT trained personnel only.

Standard operating procedures for processes or procedures which use corrosive, toxic or highly toxic gases, such as H_2S, shall be developed that include emergency response actions. All involved employees should be trained and be familiar with these procedures.

Finally all users must comply fully with all local laws, rules or regulations in force.

DANGER

Do not use flammable gases near to ignition sources. Ignition sources include open flames, sparks, and sources of heat, oxidizing agents and ungrounded or not intrinsically safe electrical or electronic equipment.

Flames shall not be used for detecting leaks. A compatible leak detection solution shall be used.

Use spark proof tools when working with or on a flammable compressed gas cylinder or system.

Do not smoke near equipment.

WARNING

Safety shoes are required when operating or moving the equipment.

Safety glasses are required if pressure equipment is in use.

Never allow the equipment to become part of an electrical circuit.

Portable fire extinguishers should be available for fire emergencies. These fire extinguishers must be compatible with the apparatus and the materials in use.

The tool should be located in a designated area, restricted to operating personnel and technicians. All safety guidelines pertaining to pressure testing of hydraulic units should apply.

Care must be taken when testing/priming the sampling equipment. All seals and fittings should be original, inspected for wear and periodically pressure tested.

Leutert will not accept any liability if others but origin Leutert spare parts and consumable are used.

Access doors to areas where flammable gases are stored or used should be clearly marked „No open flames".

CAUTION

Open valves only to the point where fluid can flow into the system with pressure. This will allow for quicker shutoff in the event of a failure or emergency.

2 The Sampler

2.1 Safe Handling Procedures

DANGER

The posi-lock pin should NOT be used for pressure or direct force retention. It was only designed to combat gravity, well vibration and to indicate the position of the needle valve body.

The air chamber pressure must be bled down before removing the air chamber.

The N_2 gas pressure must be bled down before removing the OPS section.

WARNING

Before commencing the transfer process the safe lock assembly should be checked for engagement. This is critical. Serious injuries could result. Also the sample could be lost during transfer.

The difference between the nose cone and the transfer lock should be recognized. While the nose cone prevents the needle valve assembly moving out of the sample chamber prior to running, the transfer lock when fitted prevents movement of the needle valve body after a sample has been taken, essential for safety when pressurizing or transferring a sample.

The sampler should be handled with care avoiding any mechanical shock while the system is under pressure. Therefore the sample must not be transported within the sample chamber. It has to be transferred into a proper sample transport cylinder at the location.

CAUTION

The relief valve within the shuttle assembly should be regularly checked by a hand-operated hydraulic pump. As the prime pressure of the tool at surface temperature will increase on exposure to downhole well temperature. The integrity of the tool particularly the shuttle assembly is protected by the relief valve.

After the tool is retrieved from the well it should be kept in a secure area, accessible only to qualified technicians.

Open the vent screw inside the air chamber immediately after the sampler is retrieved from well.

Open the prime port valve and the prime port plug located in the flow regulator prime port nipple assembly immediately after the sampler is retrieved from well. Make sure not to open the N_2 prime port valve and plug.

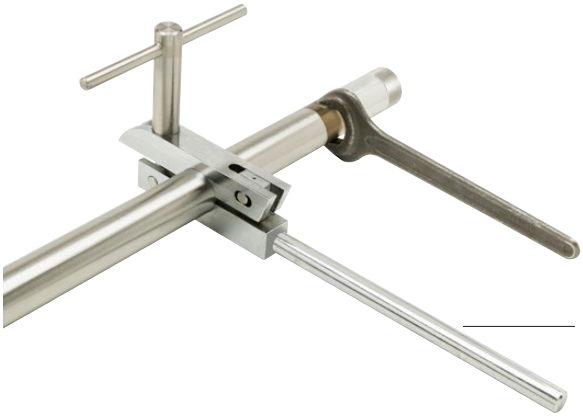
Metals become brittle when used in corrosive gas service such as H_2S. Check equipment and lines frequently for leaks. Disassemble the manifold after use and flush with dry air or nitrogen.

NOTICE

For sampling wells with high H_2S concentration special samplers machined from Inconel are available.

The OPS section should be left connected to the sample chamber assembly and must only be disconnected immediately before transfer, therefore maintaining contact between sample and the nitrogen charge and compensating any further pressure change due to temperature change during transit.

The Leutert bottom hole sampler is a precision instrument. Use the tools supplied i.e. quick clamp and OE spanner to make up joints (Fig. below). Never use pipe wrenches which damage tube walls and can cause galling of thread joints. Do not attempt to over tighten joints.



Quick Clamp
Part-No. 5351.98.00015

2.2 Description of the Sampler

2.2.1 Positive Displacement Sampler PDS^{short}

The LEUTERT Positive Displacement Sampler PDS^{short} is a device for taking downhole samples in oil wells.

Positive displacement means that the synthetic fluid is replaced by the well fluid. The purpose of the tool is to provide high quality samples which when analyzed at reservoir conditions may provide data vital for the economic and technical evaluation of that reservoir. The tool has been designed to operate in all environments and consistently produce representative samples regardless of well fluid or hostile conditions.

Premature sampling is prevented by a floating piston held at the bottom of the sample chamber by special synthetic oil under pressure in the air chamber. The piston is closing the inlet for the well fluid. When a mechanical clock at the top of the sampler has run the set time, the lever assembly drops into a cutaway in the clock cone, allowing the shuttle valve to move upwards, exposing a port in the shuttle assembly. The pressurized buffer fluid is then allowed to dump into the air chamber, its rate being metered by the flow regulator assembly. As the buffer pressure drops, the floating piston is pushed up the rod by well pressure and slowly draws in a sample. As the floating piston bottoms out on the premature closing assembly, the outer sleeve of the assembly is raised allowing the locking balls to release. The central core which is attached to the rod moves upwards when the floating piston fully bottoms out on the premature closing assembly, dragging the rod and needle valve body assembly upwards. The o-ring protector bottoms on the guide into the sample chamber and the needle valve body assembly slides the last part of its travel into the sample chamber. After the second o-ring has passed into the sample chamber the brackets of the split collets enlarge to lock the sampler shut.

The transfer system allows the sample to be validated prior to dispatch to the PVT laboratory where it will be analyzed. The data from the laboratory helps to determine such things as field development programs, oil and gas recovery factors, production forecasts and design of production facilities. The PDS^{short} may also be used to retrieve sub-surface samples of water. It is an improper tool to sample condensates and gases.

The mechanical version of the sampler is a wireline operated tool which is activated by a mechanical clock. The tool comprises of a sample chamber, and air chamber and the mechanical firing device. Other options available are:

– Surface firing through electric line.
– Pressure activated while run in a carrier integral with a tubing string (DST).

When run on electric wireline it is only the top sampler that is triggered electrically, additional samplers are connected by a mechanical link that is activated when the sampler above completes the sampling process.

As further option LEUTERT can supply a gauge by-pass carrier which provides electrical connection to an electronic gauge with surface read- out and simultaneously to the sampler. The electronic trigger system operates on the reverse polarity to the standard used to power and read electronic gauges.

Running in combination with a gauge allows for the real time surface read out of downhole pressure. When the well is deemed suitably conditioned and ready for sampling, by the turn of a switch the polarity of the electric line is reversed and the sampler is activated to take a sample. A positive indicator shows that the sampler has been activated and the switch is reversed to continue monitoring the pressure. The operation to activate the sampler takes only a matter of seconds so that very little time is lost in the recording of the pressure readings.

The mechanical tool may be run individually or in tandem with another.

There is an additional safety device which is fitted to the needle valve body called the sure lock assembly which locks in the sample.

After the sampler is returned to surface the sample can be transferred into any piston type sample cylinder by using the LEUTERT transfer bench.

2.2.2 One Phase Sampler OPS

While using the standard PDS^{short} sampler the sample will efficiently be restored to original sub surface conditions by heating if 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.

The OPS section may be attached to the LEUTERT PDS^{short} sampler in order to keep a fluid in a monophasic state. The OPS section is filled with compressed nitrogen gas prior to sampling. The OPS section is fitted between the sample chamber and air chamber of the PDS^{short}. The basic operation of the sampler with OPS section fitted does not change from that described for the PDS^{short}. However, once the sample chamber is filled and the sample trapped, a stinger assembly shuts off the communication to the air chamber. Simultaneously, nitrogen flow ports are exposed releasing the pressure of the nitrogen gas to act upon the top of the floating piston, thus maintaining the sample above reservoir pressure as it cools during retrieval from the well. 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.

By this process the sample cannot go through any phase change due to the lowering of temperature and subsequent shrinkage of the sample as the sampler is retrieved from the well.

The One Phase Sampler is the right tool to obtain gas condensate samples.

2.3 Specification of the Sampler

2.3.1 Positive Displacement Sampler PDS^{short}

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)
Length	:	11.45 ft (3,491 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

2.3.2 One Phase Sampler OPS

Volume	:	600 cm³
Max. operating pressure	:	15,000 psi (1,035 bar)
Test pressure	:	22,500 psi (1551 bar)
Max. operating temperature	:	360 °F (180 °C)
Length	:	15.2 ft (4,632 mm)
Diameter	:	1 - 11/16"(43 mm)
Weight	:	68 lbs (31 kg)
Material	:	Seamless stainless steel according to NACE MR-01-75 bronze alloy

2.4 Schematic of the Sampler

2.4.1 Positive Displacement Sampler PDS^{short}

Part No. 5300.11.00000

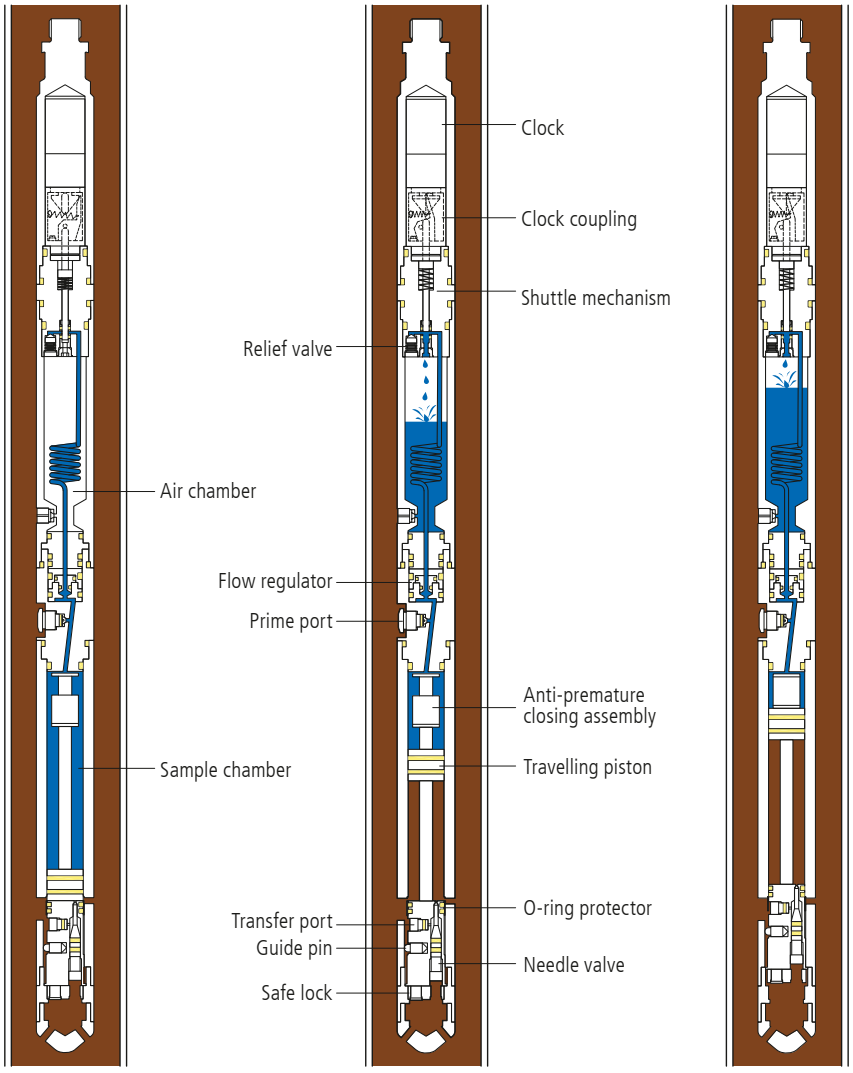


Fig. A Fig. B Fig. C

Priming fluid
Well fluid

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

2.4.2 One Phase Sampler OPS

Part No. 5300.10.00000

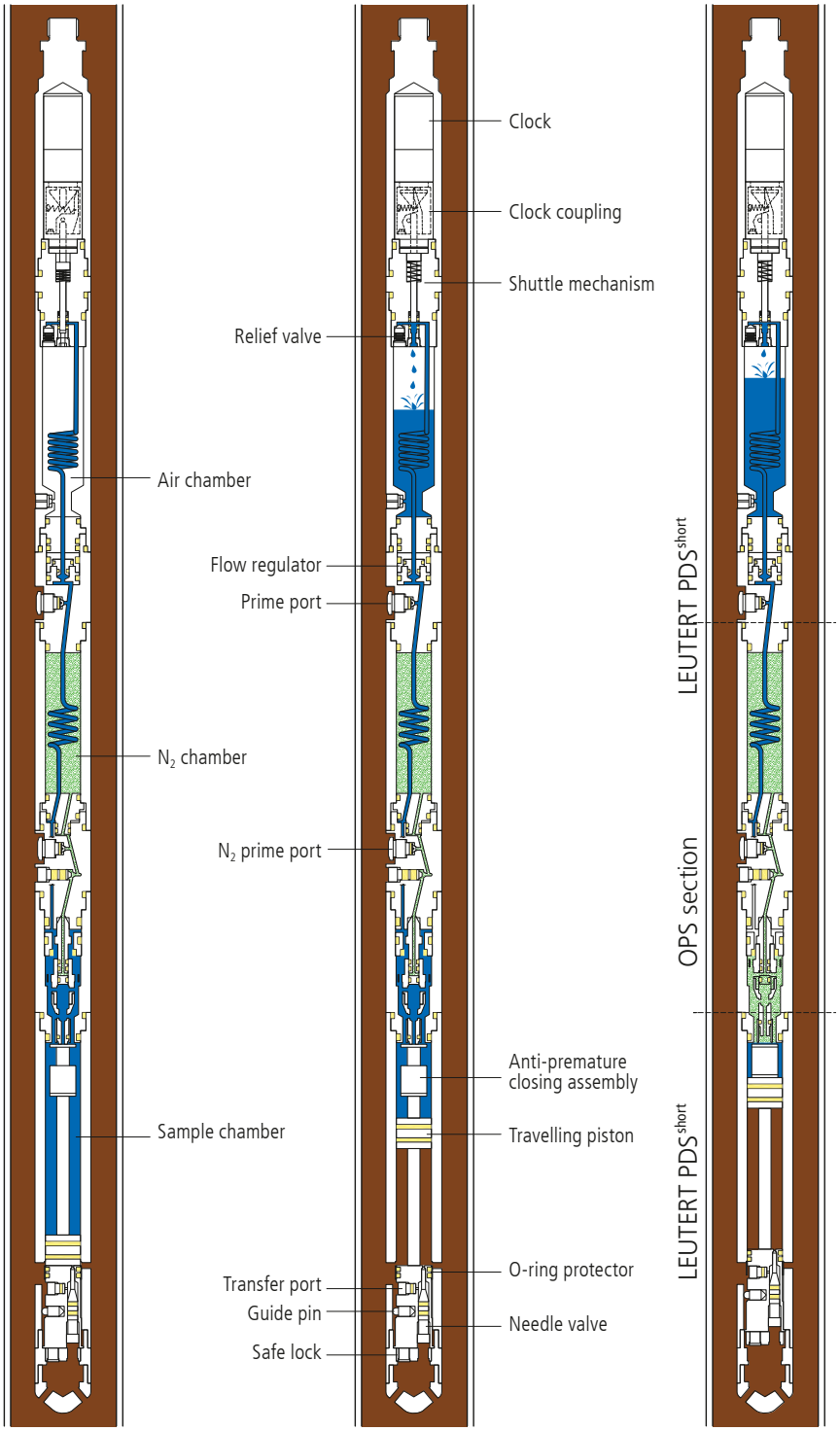


Fig. A Fig. B Fig. C

Priming fluid
Well fluid
Nitrogen

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

2.5 Assebly Drawings and Inventory

For a complete instruction manual do not hesitate to contact us:
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