FLOATING PISTON

CYLINDER

FPC-250

OPERATION MANUAL

M-V1.16 SW-V0.00

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GENERAL INFORMATION

The **FPC-250** is a general purpose floating piston cylinder and was originally designed for crude oil sampling to comply with the new ASTM standard for vapor pressure of crude oil (ASTM D 6377).

Incorporated PVDF valves avoid all extensions from the cylinder and a mechanical stirrer serves for uniform samples.

If the **FPC-250** is used with MINIVAP VPSH and/or MINIVAP VPXpert, please pay attention to the maximum pressure: MINIVAP VPSH and VPXpert maximum filling pressure is 300 kPa (44 psi).

MINIVAP VP Vision maximum filling pressure is 2000 kPa (290 psi).

1.1. Main Features

- Integrated inlet and purge valve
- Integrated valve for back pressure
- Quick connectors for inlet, purge and back pressure
- Manual shifting of the piston with the integrated stirrer
- Automatic back pressure at pressurized samples
- Manometer for sample pressure integrated in mixing handle
- Easy to clean
- Integrated rupture disk
- Lightweight and compact

1.2. Technical Data

Maximum working pressure	7000 kPa (1000 psi)
Sample volume	250 mL
Connector for sample and back pressure	Swagelok Series QM
Material of piston and cylinder	stainless steel
Material of valves	stainless steel and PVDF
Material of O-rings	Perlast
Physical dimensions:	D x L = 48 x 415 mm
	D x L = 1.9" x 16.3"
Weight:	approx. 2.5 kg (5.5 pounds)

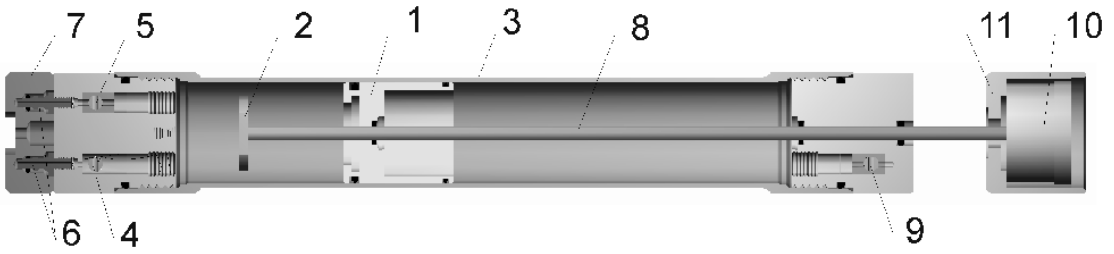
2. DESIGN AND INSTALLATION

2.1. Unpacking

Please check contents of the delivery box:

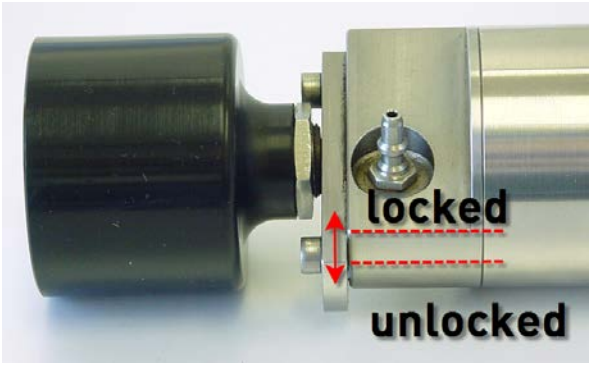
PI/END	Floating piston cylinder (FPC 250) for samples of crude oil or LPG, sample volume: 250 mL, maximum operation pressure: 7000 kPa (950 psi), mechanical stirrer, manometer - stainless steel
Required Accessories for VOLATILE crude oil (MINIVAP VPXpert)	
VPX-COUPLING	Proper instrument sample inlet for quick connector (mounted on the analyzer)
VPSG/DRUCKFILL	filling tube with 2 quick connectors for pressurized samples
VPSG/QUICKFILL	filling tube with 1 quick connector for non-pressurized samples
FILT-SIKA R200/D5.5X	200 µm metal filter for FPC (spare filters)
PI/SCHLAUCH	Filling tube for FPC 250 (connecting sample source and FPC 250), maximum pressure 20.000 kPA (3.000 psi), incl. 2 quick connectors
PI/MANOMETER	Additional manometer for back pressure measurement, built-in relief valve
VPX-PRESSURE-REG	Fixed pressure regulator to regulate the pressure for safe VPXpert use
Required Accessories for VOLATILE crude oil up to 2000 kPa (MINIVAP VP VISION)	
PI/SCHLAUCH	Filling tube for FPC 250 (connecting sample source and FPC 250), maximum pressure 20.000 kPA (3.000 psi), incl. 2 quick connectors
VPV-SUB018	Inlet nut for quick connector
Required Accessories for Pipeline Pressure from 2000 up to 7000 kPa (MINIVAP VP VISION)	
VPV-SUB020	High Pressure Pipeline Package
Spare parts:	
BERST-B11KMR120-01	Rupture disc for FPC 250 (120 bar)

2.2. MINIVAP FPC-250 Cross Section



1. Piston with O-ring and free volume in the back. The small O-ring is for better gliding only.
2. Stirrer plate
3. Cylinder tube
4. Inlet head with inlet and purging valve
5. Inlet head with inlet and purging valve
6. Inlet and purging quick connector (SS-QM2-B-200MB [1/8"])
7. Protection plate and seal for quick connector
8. Stirrer rod with 1 mm bore
9. Back pressure head with back pressure valve
10. Manometer for sample pressure
11. Handle for manual stirrer

2.3. Stirrer Lock



The hollow rod of the stirrer has a diameter of 6 mm. If the sample is filled with a maximum pressure of 7000 kPa (1000 psi), the stirrer would be pushed out with a force of 200 N. In order to prevent this, a lock for the stirrer is installed in the back pressure head.

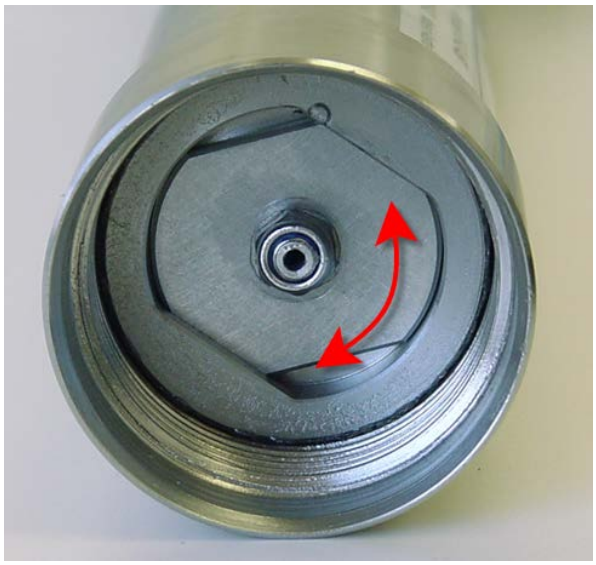
The lock is a 4.5 mm plate which can be shifted between two positions. When it is unlocked, it extends from the head. At the end of the stirring handle is a stainless steel ring attached to the thread. This ring fits through the big hole of the lock when it is released. Engaging the lock, the ring cannot shift through the lock lever.

When the stirrer is pushed completely into the cylinder, the lock can be engaged.

ATTENTION!
ALWAYS LOCK THE STIRRER WHEN FILLING THE PISTON WITH PRESSURIZED SAMPLE.

When the cylinder is filled with a pressurized sample, the lever is locked against unwanted opening. Press the stirrer handle against the cylinder to unlock the lever.

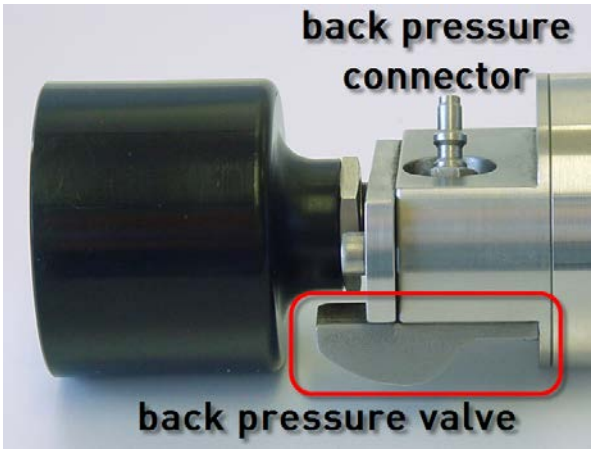
2.4. Manual Operation of Piston



The stirring plate can be inserted into the front of the piston and turned approximately 45 degrees. Now it is locked in the piston and the piston can be moved forward without back pressure. Turn back the stirring plate to unhook it and move it forward another 3 mm. Now the stirrer is free again and can be locked.

The manual shift can also be used after rinsing the system with sample. Open both valves and move the piston forward to expel all the sample.

2.5. Automatic Back Pressure at Pressurized Samples



When the cylinder is filled with a pressurized sample and the back pressure valve is closed during the filling procedure, the air inside the cylinder behind the piston is compressed into the free volume of the piston to produce a back pressure of 1000 kPa (143 psi).

This way, the sample is under the required back pressure without applying an external pressure.

2.6. Inlet- and Outlet Protection Cover

The protection cover for the inlet and outlet quick connector is pushed over the connectors and fixed with the M4 screw to protect the connectors during transport but also to make an additional seal. Inside the protection cover are two respective O-rings which seal each connector in case a valve starts leaking.

The protection cover also locks both valve levers against unwanted opening.

2.7. Disassembling of the FPC-250

Both heads with the integrated valves and quick connectors are thread-on.

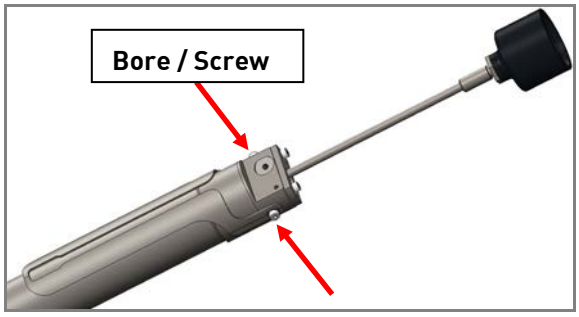
The front head with the inlet and outlet can be extracted by turning it off.

The back pressure head with the back pressure inlet and the manual stirrer is turned off and extracted together with the piston. For complete disassembly, the M5 nut at the end of the stirring rod is opened to take off the stirring plate. Now the stirring rod can be extracted from the piston and the back pressure head.

2.8. 80% Filling Guide for safe transportation

The 80% filling guide has been designed to allow safe transportation of crude oils in the floating piston cylinder. Connect the 80% filling guide with the screws delivered.

Closed position



80% Full position

Option to attach the filling guide is only possible for FPC models that already have bores for mounting the filling guide.

3. FILLING OF THE FPC-250

3.1. Filling with Pressurized Sample

ATTENTION!
Ensure that the pressure in the sample source does not exceed the working pressure of the FPC-250.

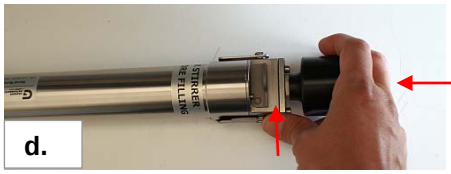
1. **Preparation**

- Take the cap from the FPC.

- Open the inlet valve (x), the outlet valve (y) and the backpressure valve (z). Unlock the stirrer plate and pull out the piston.

- Hook the stirrer plate into the piston. Once the stirrer plate is hooked, you will feel resistance when pushing the piston in.

- Push the piston to the front and lock the stirrer. By locking the stirrer, the piston cannot move during rinsing, and only the front end of the FPC is rinsed, to ensure safe use even for high filling pressures.

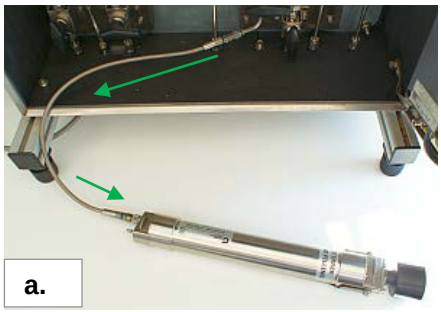


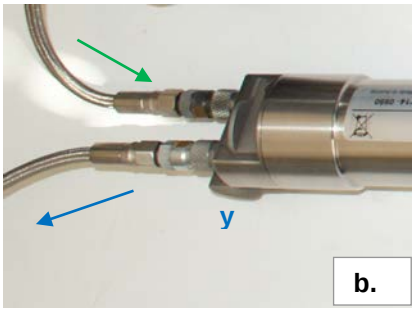
- Close the inlet valve (x), the outlet valve (y) and the backpressure valve (z).

2. **Rinsing**

- Connect the high pressure tube to one of the inlet connectors and the other side to the pressurized sample source.

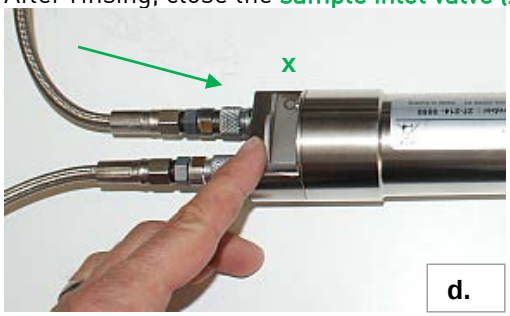
- Put a stainless steel tube over the other connector (drain) and lead it into a barometric drain. Open this valve (y).





- Carefully open the sample inlet valve (x) and rinse the cylinder with sample. Make sure the FPC is securely fixed and does not move.

- After rinsing, close the sample inlet valve (x).



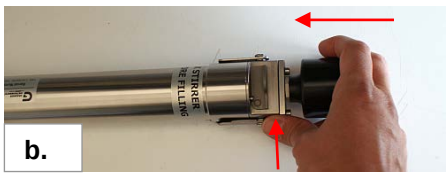
3. Filling

- **Filling without Filling Guide**

a. Unhook the stirrer plate from the piston.

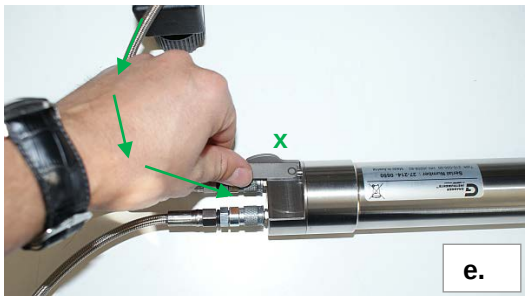
b. Push the stirrer completely in and lock it. The FPC can now be filled, while the piston is securely locked.

c. To create back pressure, make sure the back pressure valve is closed (z).



d. Close the drain valve (y).

e. Open the sample valve (x) carefully and let the sample flow into the FPC-250. The sample should enter the FPC-250 as slowly as possible in order to prevent outgassing.



f. After filling close the sample inlet valve (x).

g. Remove the high pressure inlet tube (x) and the outlet tube (y).

h. Attach the protection cover for the quick connectors and fix the M4 screw. The FPC is now safe for transport.

- **Filling with 80% Filling Guide**

a. Hook the stirrer plate into the piston. Once the stirrer plate is hooked, you will feel resistance when pushing the piston in.

b. Push the piston to the front. **DO NOT LOCK THE STIRRER.**

c. The piston must be able to move freely.

ATTENTION!
When under pressure, the piston will automatically move out of the FPC!
Make sure the FPC is securely fixed and nothing is in the way of the piston!

d. To create back pressure, make sure the back pressure valve is closed (z).

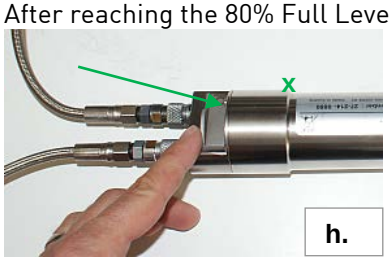
A closed back pressure valve ensures the piston is moving back slowly when under pressure.

e. Close the drain valve (y).

f. Open the sample valve (x) carefully and let the sample flow into the FPC-250.

g. During filling extend the 80% Filling Guide. The 80% Full Level is reached when the piston knob is level with the max. extension of the Filling Guide.

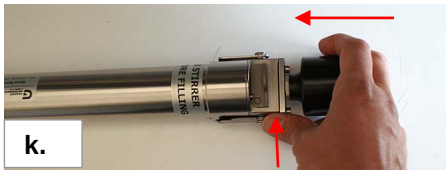
h. After reaching the 80% Full Level, close the sample inlet valve (x).



i. Attach the 80% Filling Guide to the FPC.

j. Unhook the stirrer plate from the piston.

k. Push the stirrer completely in and lock it.



l. Remove the high pressure inlet tube (x) and the outlet tube (y).

m. Attach the protection cover for the quick connectors and fix the M4 screw. The FPC is now safe for transport.

4. **Verifying**

- If unsure about proper rinsing, keep FPC-250 in an upright position and open the drain valve a little until a small amount of sample is expelled. That allows for removal of kept air.
- Monitor the sample pressure on the gauge. It should read approximately 800 kPa (110 psi).
- Unlock the stirrer and move to verify the position of the piston. At 1000 kPa the force is only 30 N. Push back the stirrer and lock it.

3.2. Filling with non pressurized Sample

If the sample is not under pressure use the following procedure:

1. **Rinsing**
    a. Unscrew the filling head.
    b. Open back pressure valve, unlock piston and pull piston back.
    c. Fill sample into the cylinder for rinsing.
    d. Screw back the filling head with at least one valve open.
    e. Close valves and shake piston.
    f. Open valves and discard sample by moving piston.
2. **Filling (without unscrewing piston head)**
    a. Connect tubing from sample to inlet valve and pull piston back.
3. **Filling (with unscrewing piston head)**
    a. Unscrew the filling head.
    b. Open back pressure valve, unlock piston and pull piston back.
    c. Fill sample into the cylinder.
    d. Screw back the filling head with at least one valve open.
4. **Verifying**
    a. Place FPC-250 in an upright position and push piston to expel entrained air until the sample appears at the quick connector. A plastic tube on the quick connector prevents the spilling of sample.
    b. Close the inlet valve.
5. **Back pressure**
    a. Apply 300 to 800 kPa (45 to 110 psi) of back pressure and close the back pressure valve.
    b. Attach the protection cover for the quick connectors and fix the M4 screw.

3.3. Filling with High Back Pressure

To protect the sample gassing out, it is preferable to fill the FPC-250 with high pressure against a back pressure equivalent to the sample stream pressure.

1. **Back pressure**
    a. Make sure that the stirrer is in locked position and the piston is all the way in.
    b. Connect the back pressure valve against the back pressure line and fill with a back pressure of about 1/6 of the filling pressure. The filling pressure will compress the back pressure part of the cylinder, so the back pressure increases.
    c. Open back pressure valve to apply back pressure.
    d. Close back pressure valve and disconnect back pressure line.
2. **Rinsing**
    a. Remove protection plate and lock stirrer and the piston.
    b. Ensure that the pressure in the sample source does not exceed the working pressure of the FPC-250.
    c. Connect the high pressure in tube to one of the connectors (inlet) and the other connector (drain) to the back line of the pressurized sample source.

d. Carefully open the inlet valve and outlet valve to rinse the cylinder with sample.

3. **Filling**

a. Close the sample inlet and sample drain valve.
b. Unlock piston
c. Place FPC-250 in an upright position and open the inlet valve to fill.
d. Monitor the sample pressure on the gauge. It should read approximately 800 kPa (110 psi).
e. Close inlet valve.
f. Disconnect lines from inlet and outlet valves.

4. **Verifying**

a. Unlock the stirrer and move to verify the position of the piston. At 1000 kPa the force is only 30 N. Push back the stirrer and lock it.
b. Attach the protection cover for the quick connectors and fix the M4 screw

4. FPC-250 and MINIVAP VPXpert and VP Vision

4.1. Filling MINIVAP with Pressurized Sample

Optionally, MINIVAP VPXpert and VP Vision are equipped with a quick connector sample inlet.

Make sure that the back pressure of the FPC-250 is lower than the maximum pressure of the tester.

MINIVAP VPXpert maximum filling pressure is 300 kPa (45 psi)

MINIVAP VP Vision maximum filling pressure is 2000 kPa (290 psi)

Connect the FPC-250 to the inlet of the tester. The transparent PTFE tube is recommended to allow the observation of the sample flow. The stainless steel tube is recommended for high pressures.

Follow the manual to make a vapor pressure determination.

5. MAINTENANCE

5.1. Exchange of O-Rings

5.1.1. Piston:

Main O-ring: (Perlast 35 x 3 mm)

Gliding O-ring (Perlst 34 x 2 mm)

Remove the old O-ring and replace it with a new one.

O-ring for the stirrer rod (Perlast 6 x 2)

Remove the security ring and the washer

Replace the O-ring and put back the washer and security ring.

5.1.2. Filling head:

O-ring for the cylinder (Perlast 38 x 3)

Remove the old O-ring and replace it with a new one.

5.1.3. Back pressure head:

O-ring for the cylinder (Perlast 38 x 3)

Remove the old O-ring and replace it with a new one.

O-ring for the stirrer rod (Perlast 6 x 2)

Remove the security ring and the washer

Replace the O-ring and put back the washer and security ring.

5.1.4. Valve stem: (Perlast 3.5 x 1.5 mm)

Remove the old O-ring and replace it with a new one.

5.2. Exchanging the Rupture Disc

The rupture disc with a maximum working pressure of 7000 kPa (1000 psi) and a rupture pressure of 8000 kPa (1143 psi) is mounted in the front head.

To exchange the disc, open the Allen screw and push the disc out from the head by inserting a thin stick into the rupture outlet.

Replace the rupture disc with a new certified disc and tighten it with the Allen screw.

5.3. Exchanging a Valve Packing

The valve packings are made of PVDF and can easily exchanged when they start leaking.

1. Open the small M3 Allen screw blocking the valve lever.
2. Open the respective M8 Allen screw on the inside of the head.
3. Take out the spring washers and the thick washer from the now open hole. Pull out the lever.
4. Take a small wood screw, turn it into the concentric hole of the now accessible valve and pull out the valve packing. If cannot pull out the valve packing, put the whole front head into a deep freeze. The PVDF packing shrinks and you should pull it out easily.
5. Push the new packing (use some lubricating fat for the packing) into the hole in a position that the hole for the valve stem is looking in the direction were the valve stem is inserted.
6. Push the valve stem into the respective hole and lock it with the M3 Allen screw.
7. Put back the thick washer and the spring washers.
8. Screw in the M8 Allen screw and tighten it very hard. Afterwards turn it back about 30 degrees. (This way, you put the valve packing very strong into the hole and then you release it again until the springs are properly loaded)

Now the valve stem should need some force to be opened and the valve should be tight.

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