

Sampling of groundwater using the BAT Sampler

- system description
- preparations
- sampling of groundwater
- BAT Sampling Kit

BAT®

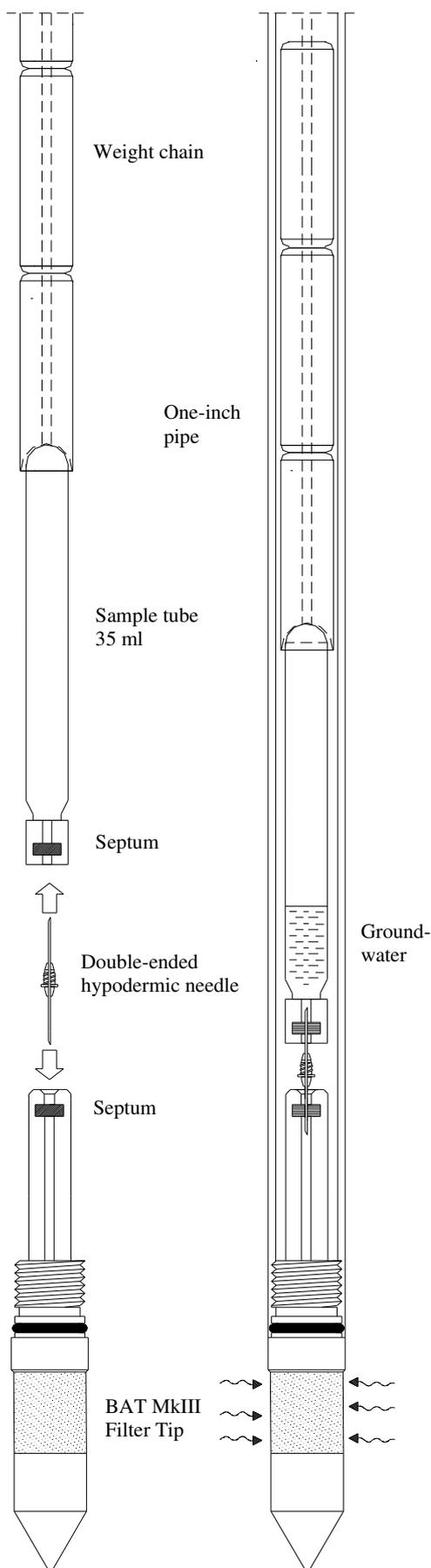
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System Description



BAT Groundwater Sampler

System description

The key components of the BAT Groundwater Sampler are:

- **BAT MkIII Filter Tip**
- **Evacuated sample tube**
(volume 35 ml for 1-inch system)
- **Double-ended hypodermic needle**

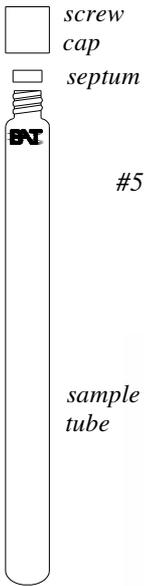
The BAT MkIII Filter Tip is connected to an one-inch extension pipe. In soft soils the filter tip can be installed into the soil simply by pushing it down to the desired depth. In harder soil strata predrilling may be required.

The sample tube is inserted into a tube housing which also is equipped with the double-ended hypodermic needle. The sampler is lowered down the one-inch extension pipe and simply by gravity the double-ended needle penetrates both the septum in the BAT MkIII Filter tip and the septum of the sample tube. A temporary, leak-proof connection is thus established between the sample tube and the BAT MkIII Filter Tip.

Due to the action of both the groundwater pressure and the suction in the sample tube, groundwater will be forced into the sample tube. The time needed for filling the sample tube is a function of the permeability of the actual soil layer. In medium to high permeable soils it is required only a couple of minutes for taking a full sample, whereas in low permeable soils, $k \leq 10^{-10}$ m/s, it will take several hours to fill the tube.

Upon lifting the BAT Sampler the flexible septa in both the BAT MkIII Filter Tip and the sample tube will automatically reseal. In case the sample tube has not been filled enough with groundwater, the BAT Sampler can simply be reconnected to the BAT MkIII Filter Tip.

System components



Sample tube

The sample tube consists of three pieces. A screw cap, a septum (rubber disc) and the glass tube itself. The volume is 35 ml.

All parts are designed to be hand tightened only. This applies to the rest of the system components as well. Do not over-tighten, finger tight is enough!



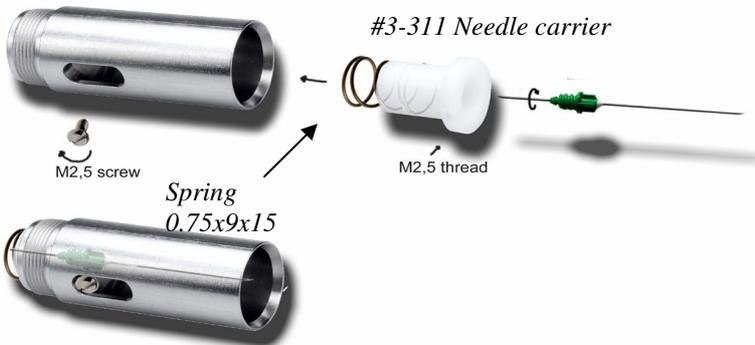
Sample tube housing

The sample tube housing is designed with threads in both ends. The quick coupling connects to the closed end. At the other end of the housing, the weight chain is connected.



The quick-coupling

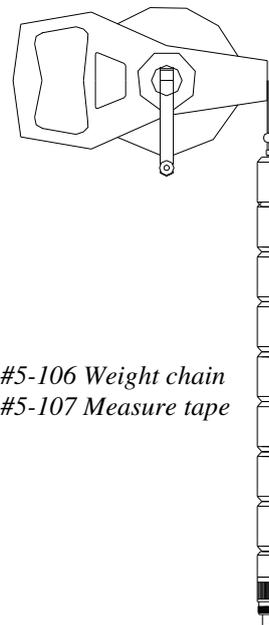
The quick-coupling consists of three movable parts, the needle carrier, a spring (0,75x9x15) and a M2,5 screw. A spare kit of two springs and two screws is included.



The screwdriver is equipped with an adapter which is used for the mounting of the double-ended needle into the needle carrier. The needle has a threaded connection.

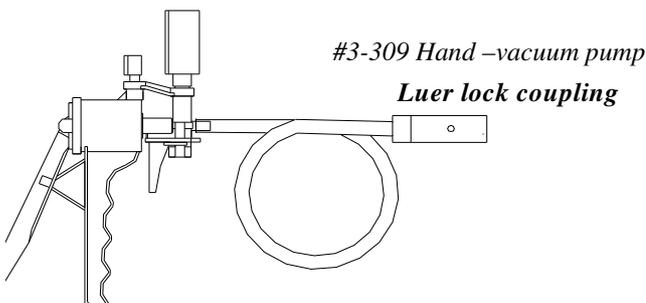
Measure tape, & Weight chain

The weight chain is connected to a measure tape of length 30 m.

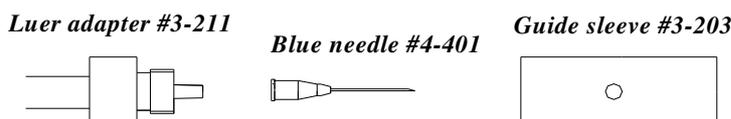


Hand vacuum pump

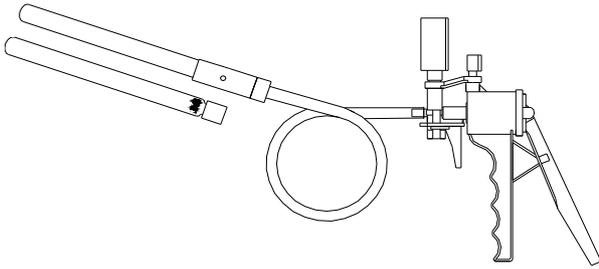
The hand vacuum pump is used for the evacuation of the sample tube. The hose is fitted with a "Luer-lock" coupling for connection of a blue hypodermic needle and a guide sleeve.



Details of Luer-lock coupling



Preparation of the BAT Sampler



1) Evacuation of sample tube

Connect a blue needle to the Luer lock coupling. Puncture the septum of a **clean** sample tube. Evacuate the sample tube using the vacuum pump. Normally, 95% vacuum is achievable.

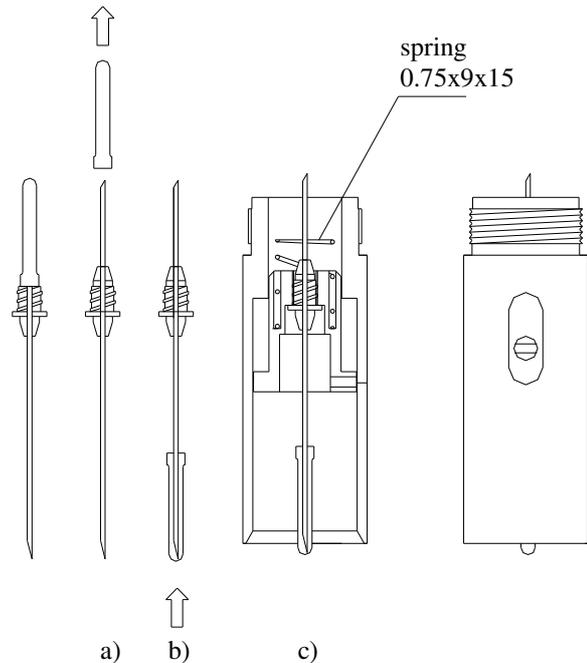
2) Preparation of the quick-coupling

Unpack the double-ended needle

a) Remove the rubber guard from the short end of the needle.

b) Slide the rubber guard on the long end of the needle to protect the needle from contamination prior to sampling. Be sure not to pierce the rubber guard.

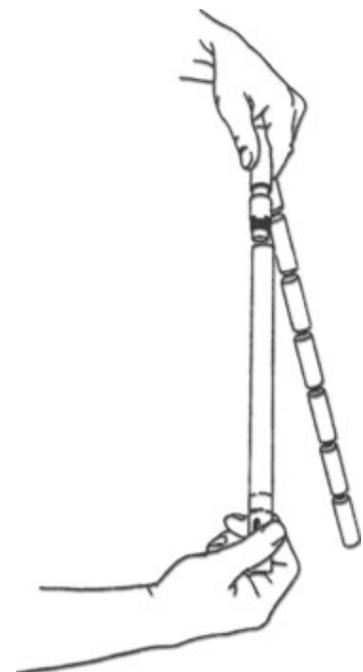
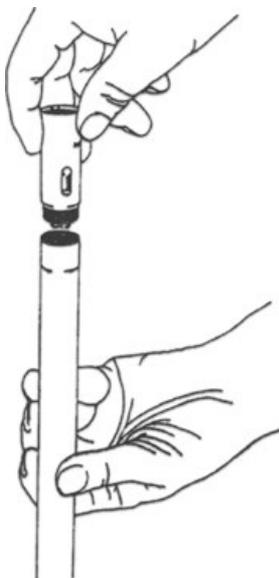
c) Screw the double ended needle into the needle carrier, using the adapter in the handle of the screw-driver. Make sure the needle seats properly in the thread.



3) Attach the prepared quick-coupling onto the sample tube housing.

4) Insert the evacuated sample tube into the sample tube housing.

5) Finally, attach the housing onto the weight chain. Hand-tighten only. Now the BAT Sampler is ready for use.



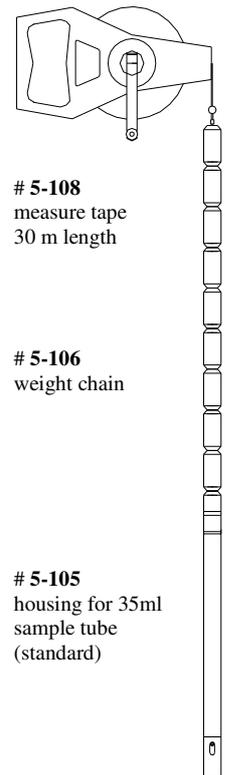
Sampling of groundwater

- 1) Connect the weight chain to the measuring tape (std. length 30m).
- 2) Lower the BAT Sampler gently down the extension pipe. Don't let the sampler fall free by gravity! To avoid sedimentation inside the extension pipe always wipe off any dirt on the wire by holding a rag around it.
- 3) Simply by gravity, the quick-connection system will automatically go into operation, and a hydraulic connection between the fluid in the BAT MkIII Filter Tip and the sample tube will be established.
- 4) Depending on both the permeability of the surrounding soil and the pressure difference between the groundwater and the sample tube it will take a certain time for the tube to be filled. The initial sampling rates varies between 0.02 ml/min in impervious clays ($k=10^{-10}$ m/s) and 80 ml/min in porous sands. At most, a sample volume of 35 ml can be collected in one tube.
If pressurized samples are desired, you must wait long enough so that the pressure in the sample tube equalizes the groundwater pressure.
- 5) In case the sampler is disconnected from the filter tip before the sampling is considered to be finished you simply reconnect the sampler to the filter tip to continue the sampling process. Due to the action of the quick-coupling, the remaining underpressure in the sample tube will be automatically maintained upon disconnection from the filter tip.

BAT Cascaded Groundwater Sampler

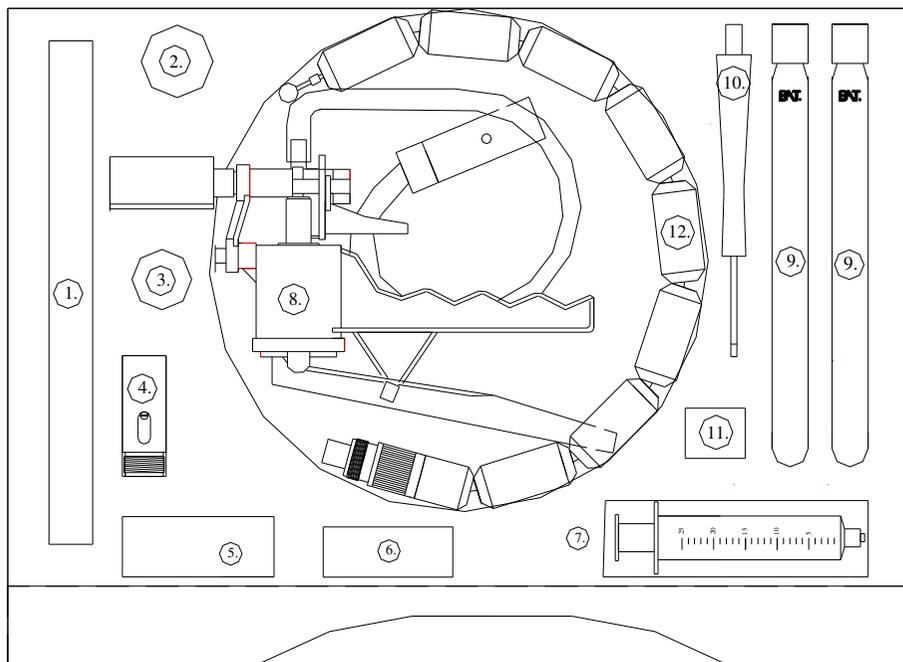
In the Cascaded Sampler, described in APPENDIX 1, two sample tubes are cascaded together using an additional double-ended hypodermic needle. Upon completion of sampling the lower sample tube will be entirely full, with all head-space restricted to the upper sample tube. This technique may also be utilized when it is desired to obtain simultaneous, duplicate samples.

Purging of the BAT MkIII Filter Tip. The BAT MkIII Filter Tip has a “dead” volume of 10 ml which ought to be purged before taking a fresh sample of the groundwater. Prior to sampling it is therefore recommended to purge a volume of 20 ml through the filter tip, i.e. two times the “dead” volume of the filter tip.

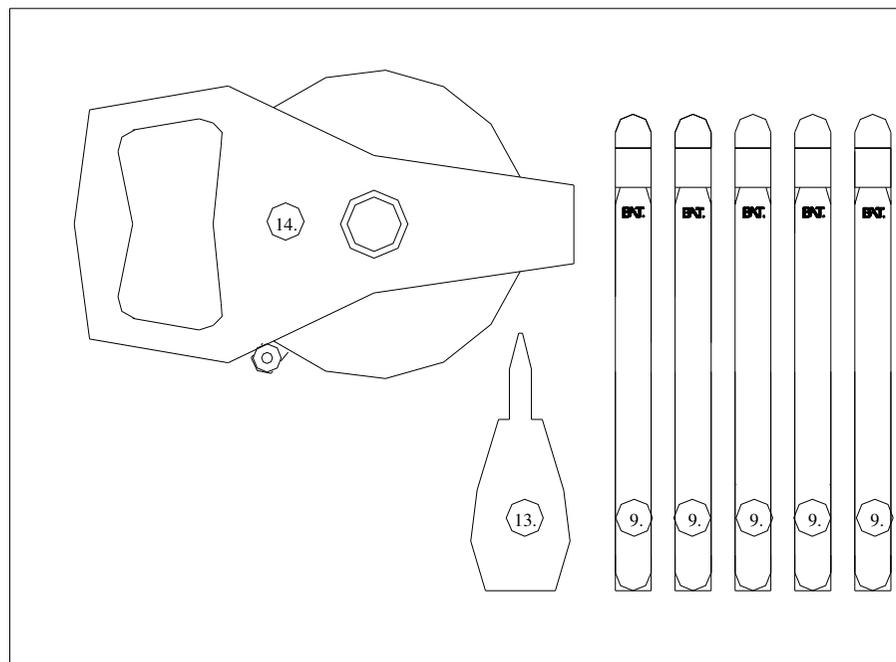


BAT Groundwater Sampling Kit, art.no. 5-100

BOTTOM



LID



Contents

	<u>art.no.</u>
1) Housing for sample tube	5-105
2) Container for used needles	5-110
3) Blue needle, 10pcs	4-401
4) Quick coupling	3-305
5) Double-ended needle, 20pcs	4-403
6) Spare septum, 10pcs	3-306
7) Syringe, 25ml	4-404
8) Hand vacuum-pump	3-309

	<u>art.no.</u>
9) Sample tube, 35ml, 7pcs	5-102
10) Screw-driver with needle adapter	3-308
11) Spare spring and screw for quick-coupling, 2+2pcs	3-307
12) Weight chain	5-106
13) Pliers	3-206
14) Measure tape, 30m, with adapter to weight chain	5-107

Maintenance and Trouble Shooting

Post sampling

When the equipment is subject to storage please do the following steps:

- 1) Remove any visual dirt outside and check the inside of the guide sleeve.
- 2) Disassemble the Groundwater Sampler.
- 3) Remove and discard any needles.
- 4) Remove caps and septa from the sample tubes.
- 5) Let all parts dry out keeping the case-lid opened.

Trouble Shooting

- No sample is collected

Possible errors:

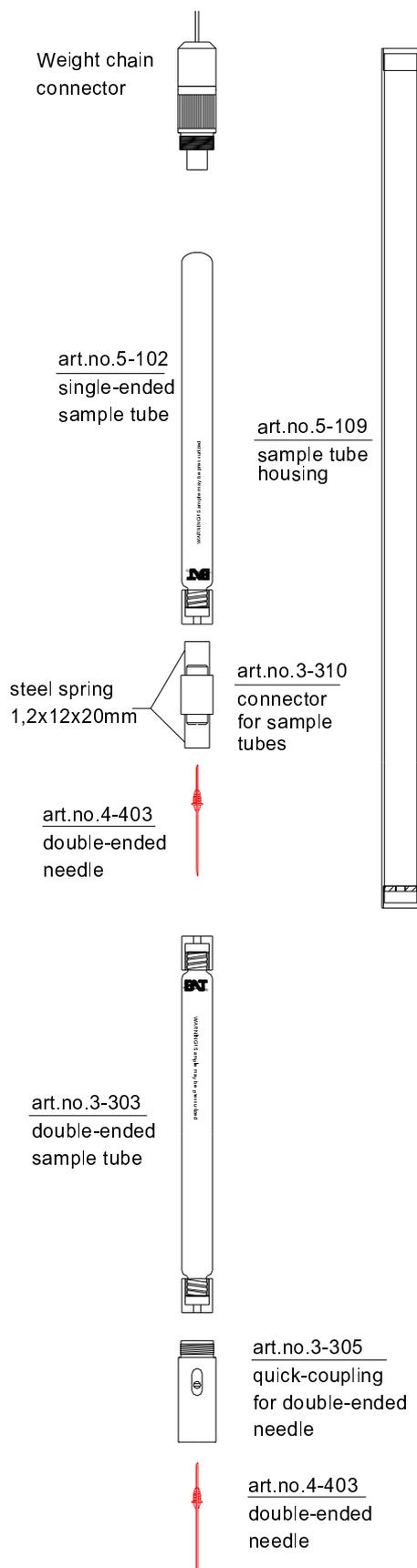
- 1) The double-ended needle is bent or broken. Check and replace if necessary.
- 2) The individual parts are not tightened enough. Screw them until they seats to each other.
- 3) Check the sample tubes caps and septa. Tight them if necessary and/or replace the septa.
- 4) The sample may consist completely of soil gas.



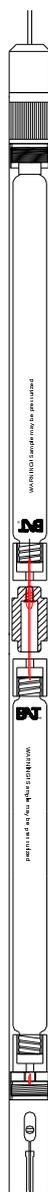
BAT Cascaded In-situ Groundwater Sampler

APPENDIX 1.

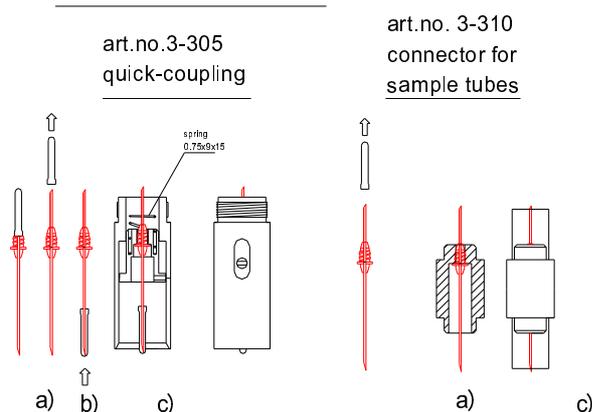
Components



Assembly & Evacuation



Assembly of articles 3-305 & 3-310



- remove the small rubber guard from the double-ended needle.
- attach the small rubber guard to the long end of the double-ended needle mounted in the quick-coupling (art.no.3-305) .
- attach the double-ended needle to the quick-coupling and the connector respectively.

Disconnection of sample tube housing

After retrieval of the BAT Sampler the sample tubes are removed from the sample tube housing by unscrewing the weight chain connector.

N.B. When unscrewing the weight chain connector, the action of the springs, mounted on the sample tube connector (art.no. 3-310) will automatically seal the sample tubes. This means for example, in case the sample tubes are not properly filled with water, that the sample tubes can simply be re-inserted into the sample tube housing, and thus be reconnected, to resume the sampling procedure.

Assembly & evacuation

- Prepare articles 3-305 & 3-310 as shown on drawings above.
- Insert the sample tubes and the sample tube connector into the sample tube housing, see drawing.
See also "Instruction Manual for BAT Groundwater Sampler".
- Insert the sample tubes into the housings, see drawing.
- Connect the weight chain connector to the sample tube housing.
N.B. Do not overtighten - finger-tight is enough!
- EVACUATE the sample tubes with the aid of the hand-operated vacuum pump. Connect the needle of the vacuum pump to the lower vacuum of about 90%. Connect the needle of the vacuum pump to the lower end of the double-ended sample tube. 25 full pump strokes will be sufficient for creating a vacuum of about 90%.
N.B. Alternatively the sample tubes can be pre-evacuated in the laboratory.
- Attach the quick-coupling to the lower end of the housing.