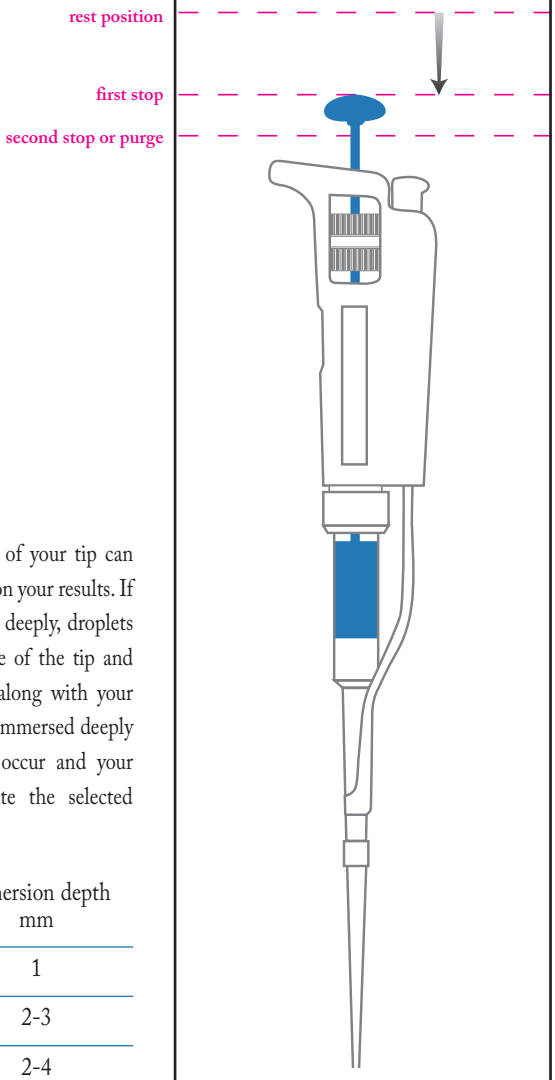
## Air-displacement / Forward mode

In general, the precision of the forward mode relies on precise draining by air pressure (air-displacement pipetters) or internal wiping of the pipette barrel (positive-displacement pipetters).

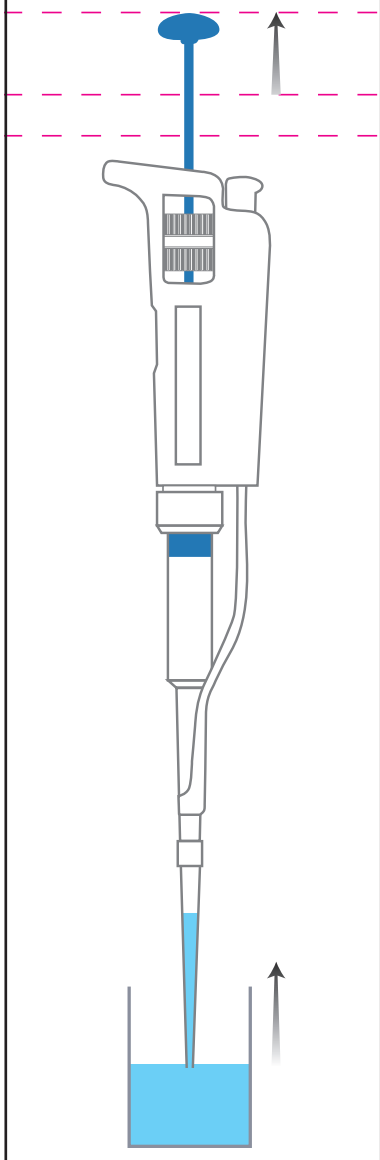
### 1 Preparation

Hold the instrument in a nearly vertical position. Depress the plunger smoothly to the first stop position.




### 2 Aspiration

Immerse the pipette tip in the liquid*. Allow the plunger to move up smoothly to the rest position. Wait one second so that all the liquid has time to move up into the tip.

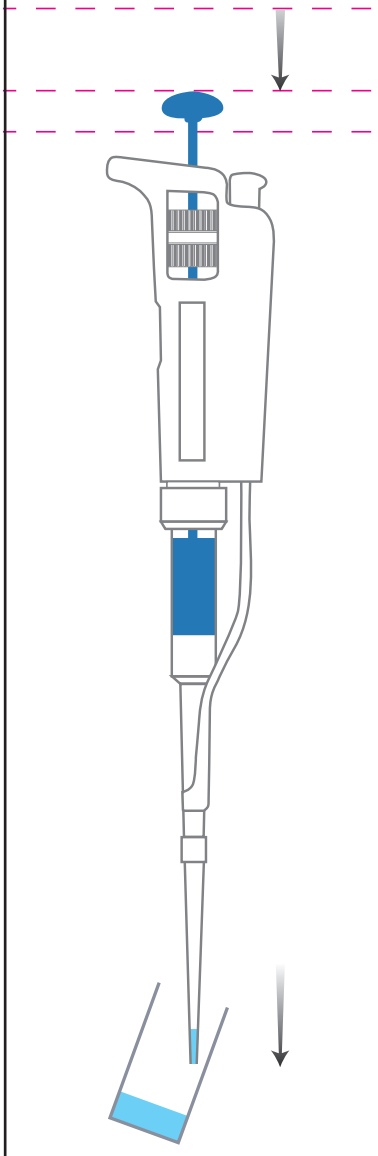


* The immersion depth of your tip can have a significant effect on your results. If the tip is immersed too deeply, droplets will form on the outside of the tip and they will be deposited along with your sample. If the tip is not immersed deeply enough, vortexing will occur and your pipette will not aspirate the selected volume.

| volume µl | immersion depth mm |
|---|---|
| 0.1 - 1 | 1 |
| 1 - 100 | 2-3 |
| 101 - 1000 | 2-4 |
| 1001 µl -10 ml | 3-6 |

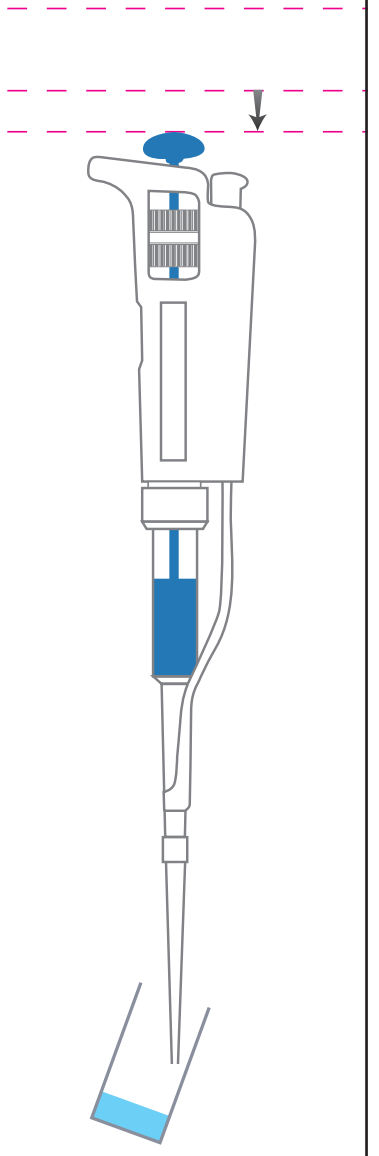
## 3 Distribution

Place the pipette tip at an angle (10 to 45°) against the inside wall of the receiving vessel. Depress the plunger smoothly to the first stop position.



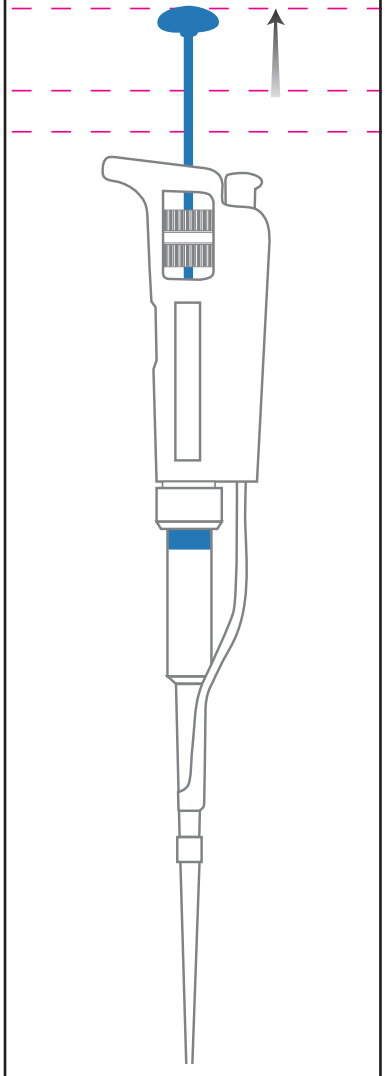
## 4 Purge

Wait one second, then depress the plunger to the second stop position. This "blow-out" stroke removes any remaining sample from the tip. Remove pipette tip end from sidewall by sliding it up the wall.



## 5 Home

Allow the plunger to move up to the rest position.

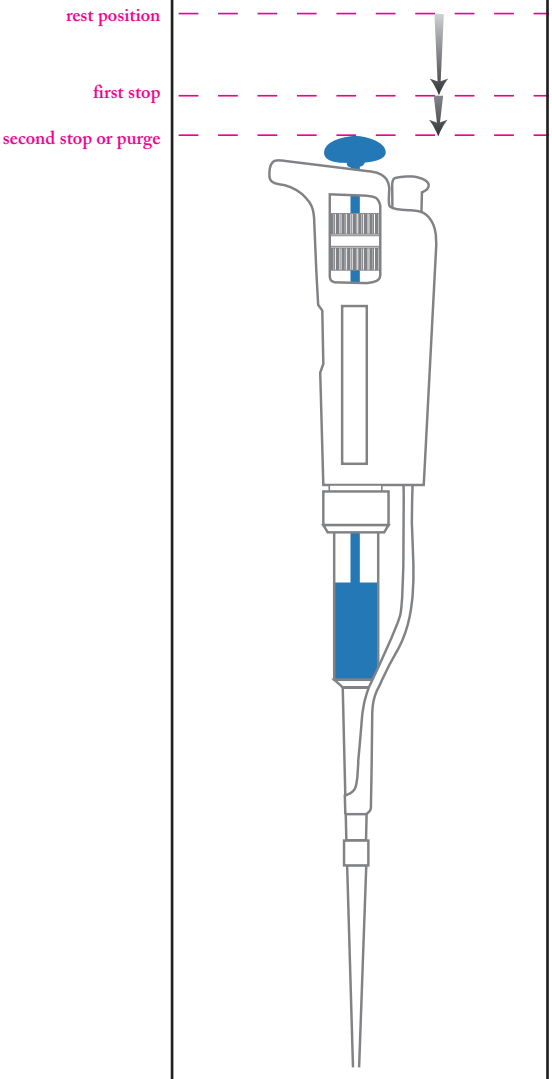


## Air-displacement / Reverse mode

In reverse mode pipetting, the purge stroke is used during preparation. During aspiration, an amount of liquid equal to the amount of purged air is added. This amount compensates for the liquid that remains as film inside the tip during dispensing.

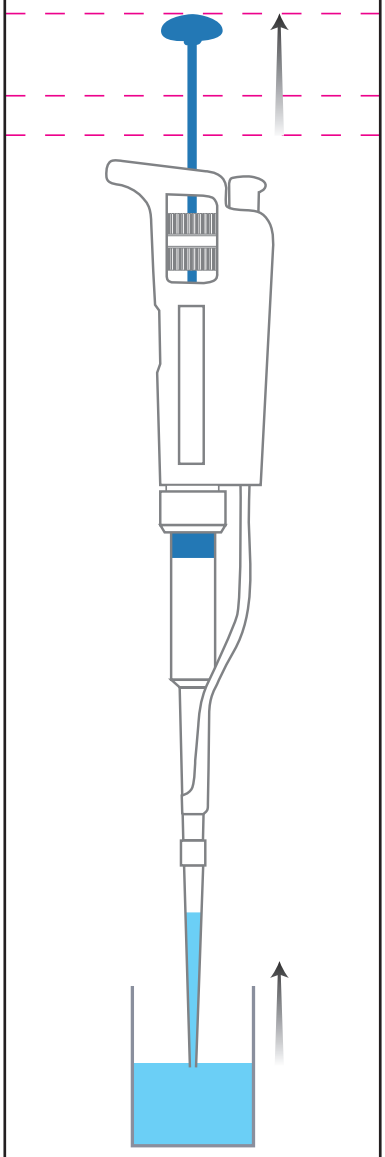
### 1 Preparation

Hold the instrument in a nearly vertical position. Depress the plunger smoothly to the second stop position.



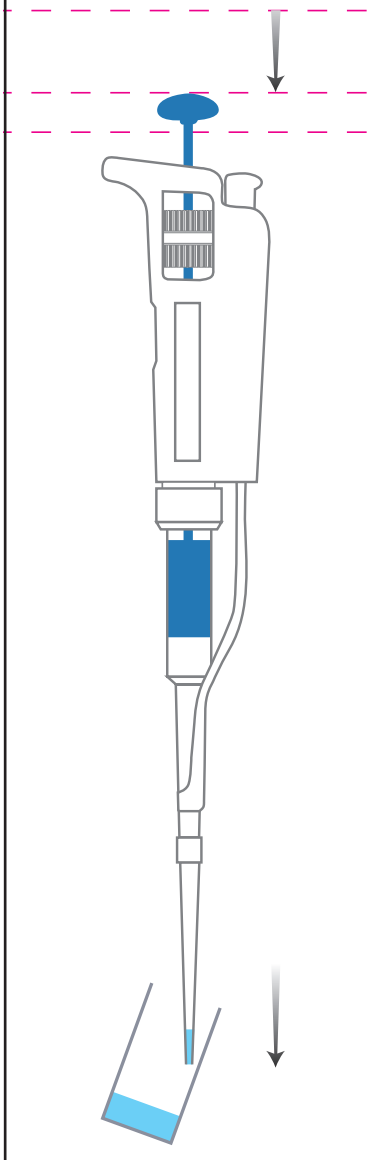

### 2 Aspiration

Immerse the pipette tip in the liquid*. Allow the plunger to move up smoothly to the rest position. Wait one second so that all the liquid has time to move up into the tip.



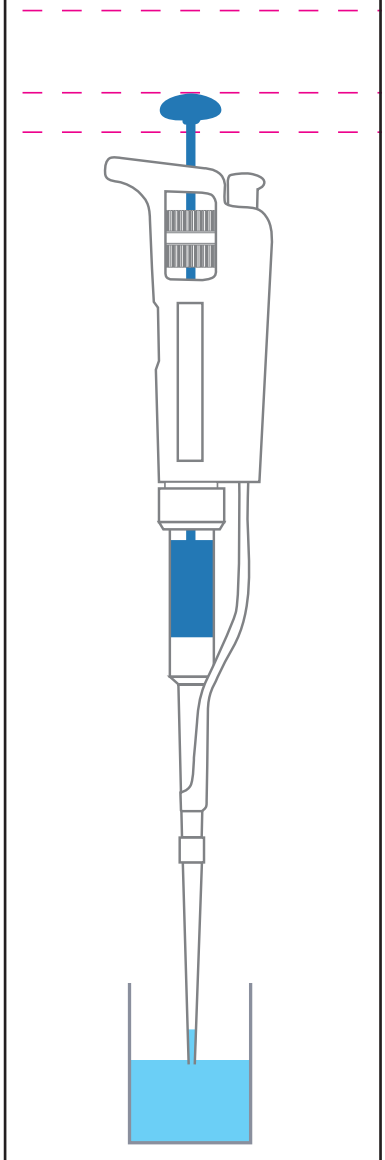
## 3 Distribution

Place the pipette tip at an angle (10 to 45°) against the inside wall of the receiving vessel. Depress the plunger smoothly to the first stop position. Wait one second.



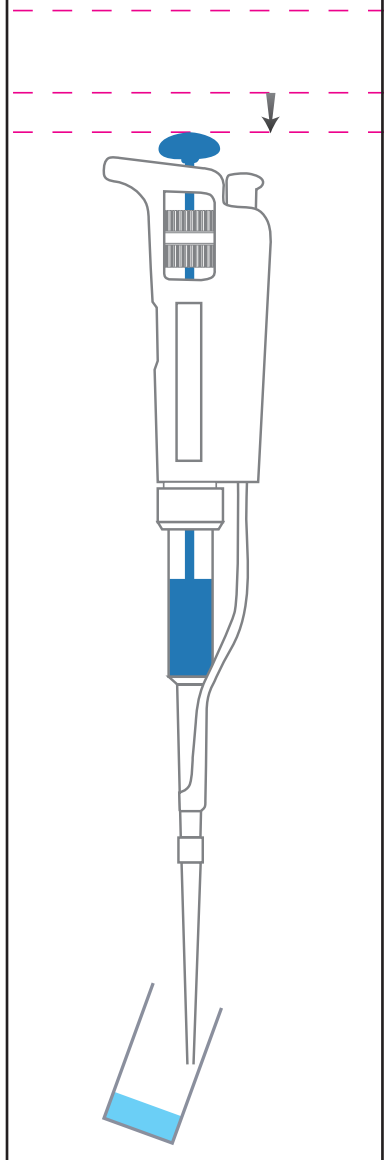
## 4 Re-aspiration

If the pipette tip is to be reused for the same sample, maintain the plunger in the intermediate position for subsequent immersion for the next pipetting cycle and restart operation 2.



## 5 Complete purge

Wait one second and purge. If the pipette tip is not to be re-used, depress the plunger to purge position over an appropriate waste container and then eject the tip.

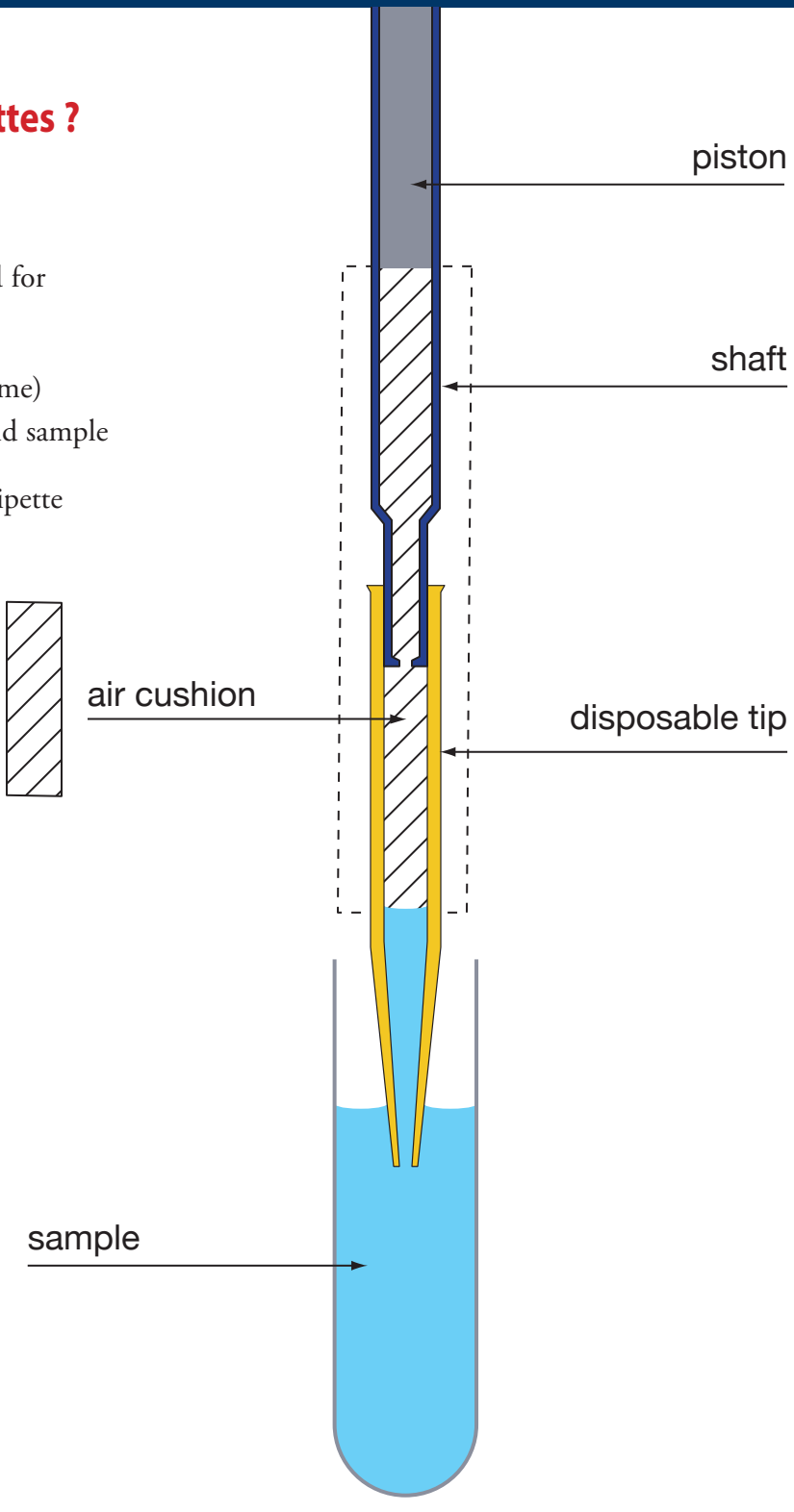


# The working principle of air-displacement pipettes

## What are air-displacement pipettes ?

### Three things to remember

1. Recommended for aqueous samples and for general laboratory work
2. Always have a cushion of air (dead volume) between the pipette piston and the liquid sample
3. The piston is a permanent part of the pipette

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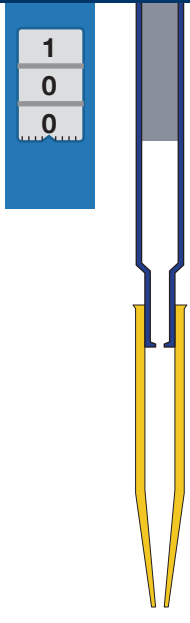
# How do air-displacement pipettes work?

When the push-button is pressed on an air-displacement pipette, the piston inside the instrument moves down to let air out. Air is displaced by the piston. The volume of air displaced is equivalent to the volume of liquid aspirated.

The schematic drawings (below) show how the piston determines the volume of air displaced and subsequently the volume of sample aspirated.

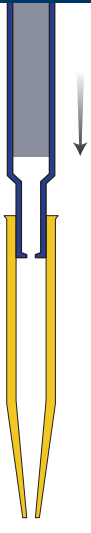
## One




**Set the volume**

The required volume is set. The piston moves to the appropriate position.

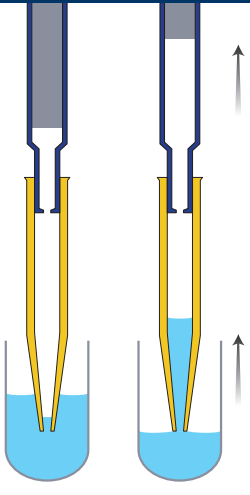
## Two



**Prepare for aspiration**

The push-button is pressed prior to sample aspiration. The piston descends and expels a volume of air equal to the selected volume of liquid.

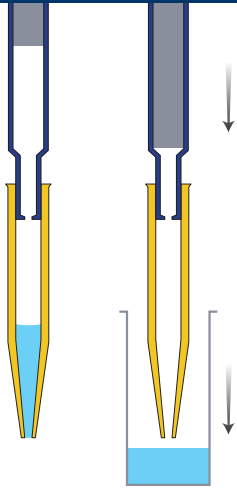
## Three



**Aspirate the sample**

As the push-button is released, a partial vacuum is created inside the tip. The ambient atmospheric pressure forces the desired volume of liquid through the orifice into the tip.

## Four



**Dispense the sample**

The push-button is pressed again. Air pressure increases inside the shaft and the tip. The compressed air pushes the liquid out of the tip.

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## Positive-displacement

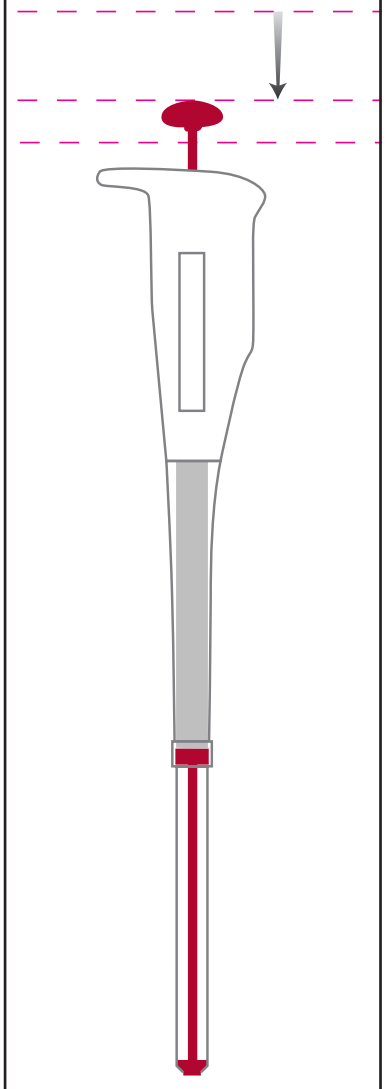
In positive displacement pipettes, the piston enters into direct contact with the liquid; there is no air interface.

Direct contact enhances accuracy and precision for liquids which are too heavy or too viscous to be displaced by air. Direct contact allows aspiration of volatile liquids without evaporation. In addition, the absence of air permits rapid pipetting without cavitation.

1

### Preparation

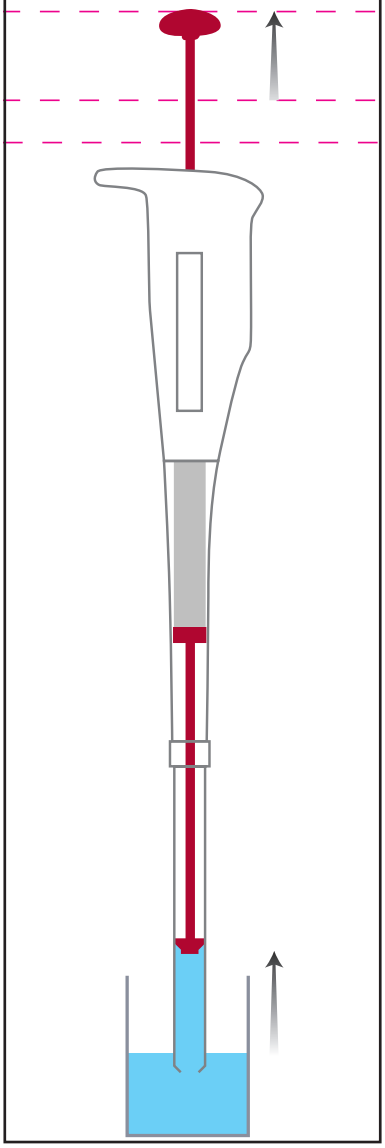
Press the plunger button to the first stop. The piston moves to the appropriate position.



2

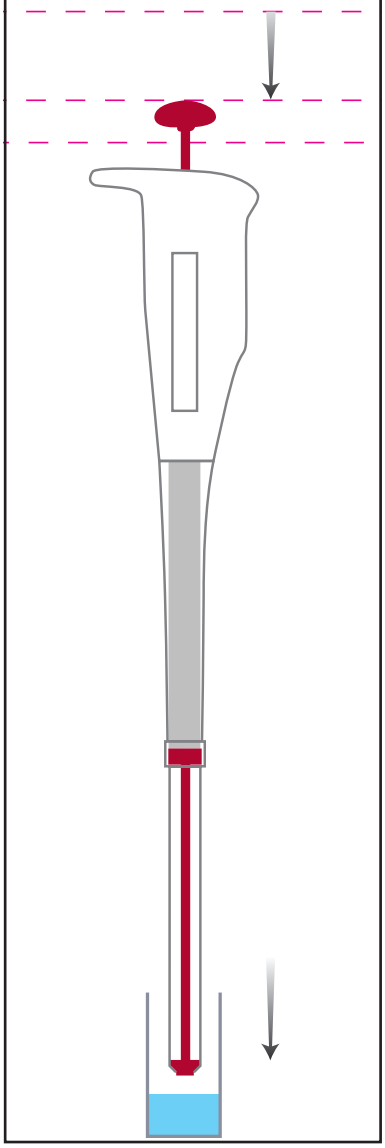
### Aspiration

Immerse the capillary/piston in the liquid*. Release the plunger letting it move up to the home position. The piston moves up and the ambient pressure forces the desired volume of liquid through the orifice into the capillary.



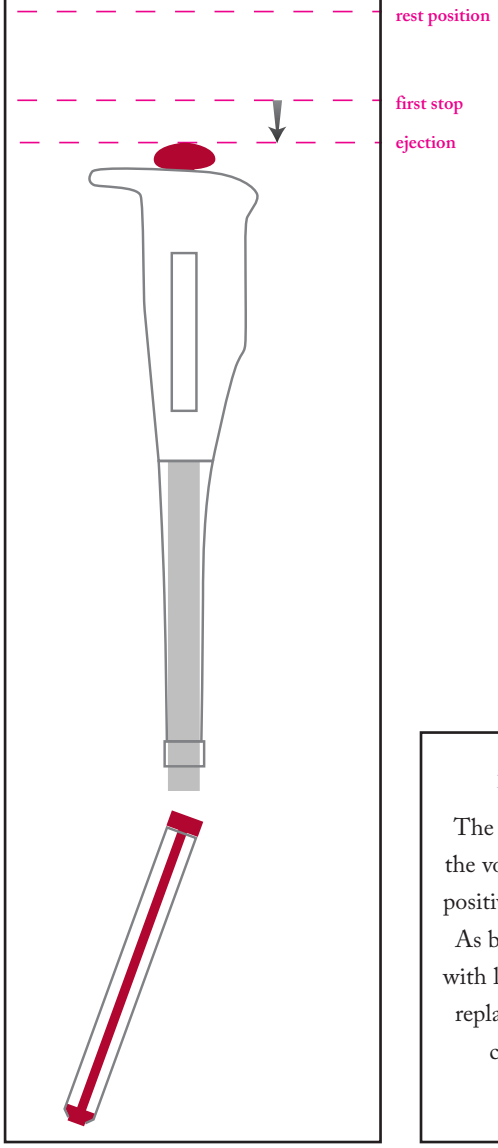
## 3 Distribution

Press the plunger button to the first stop. The piston moves down and expels the liquid out of the capillary.



## 4 Ejection

Press the plunger all the way down to the second and last stop. Capillary and piston are ejected without hand contact.




### important

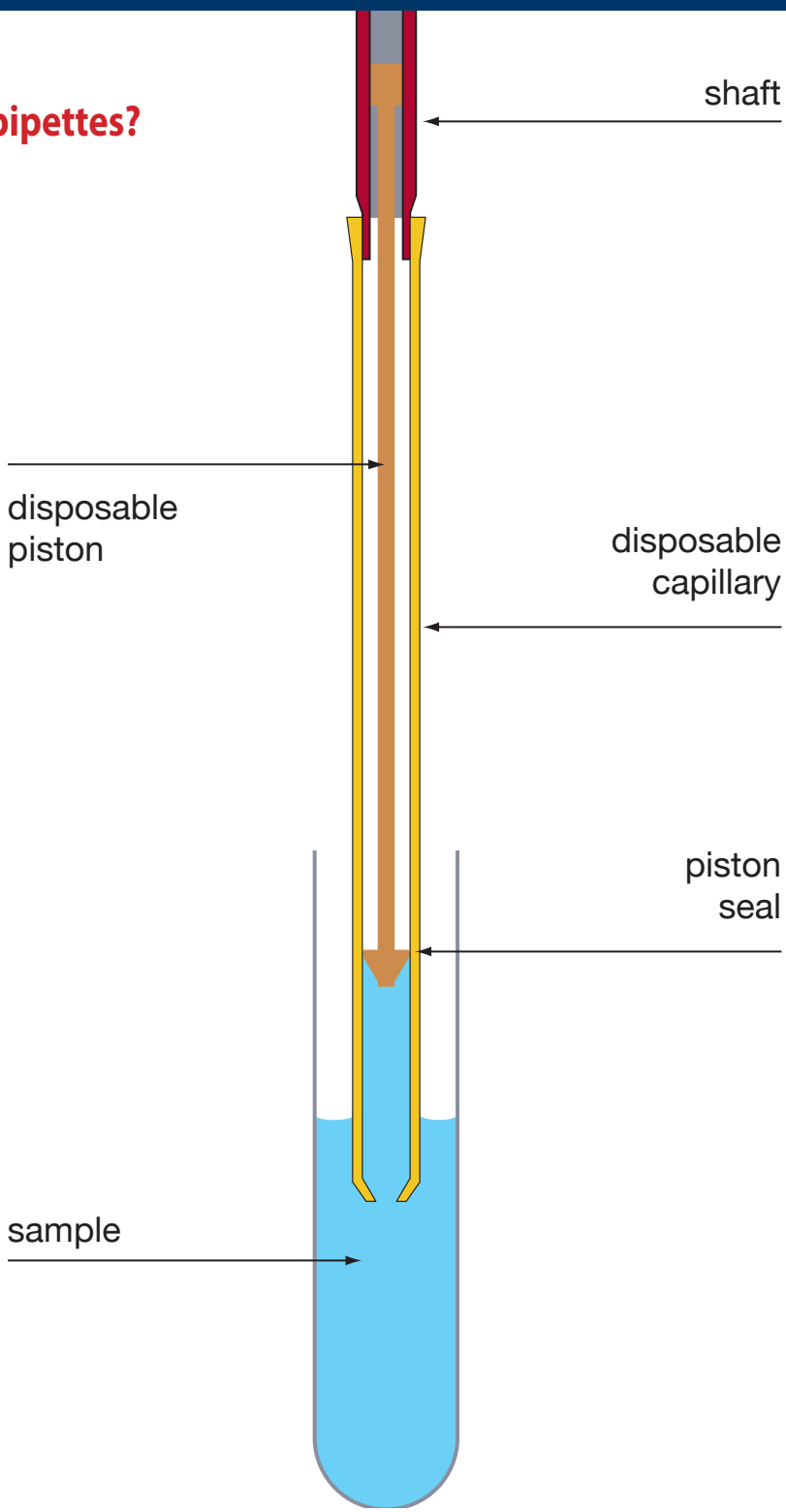
The piston and capillary are the volumetric components of positive displacement pipettes. As both parts are in contact with liquid, they must both be replaced frequently to avoid cross-contamination.

# The working principle of positive-displacement pipettes

## What are positive-displacement pipettes?

### Three things to remember

1. Recommended for problem samples (viscous, dense, volatile, radioactive, corrosive)
2. Direct contact of the piston with the sample (no air cushion)
3. Disposable piston (not a permanent part of the pipette)

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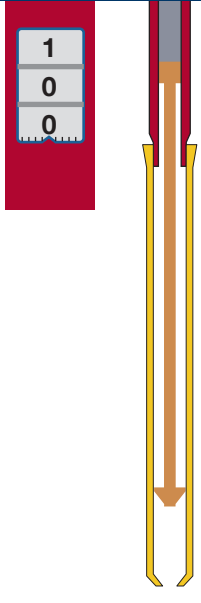
# How do positive-displacement pipettes work?

Positive-displacement pipettes work like a syringe. There is no air cushion between the disposable piston and the sample. With no elastic air cushion to expand or contract, the aspiration force remains constant, unaffected by the physical properties of the sample.

This allows the Microman operator to pipette very viscous or high density samples, such as mercury or toothpaste.

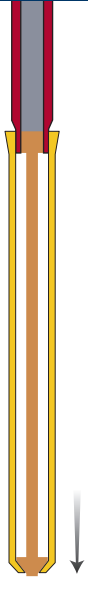
## One




**Set the volume**

The required volume is set. The piston moves down to the appropriate start position

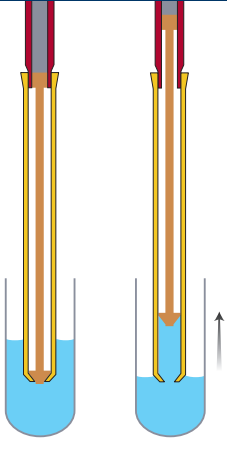
## Two



**Prepare for aspiration**

The push-button is pressed prior to sample aspiration. The piston descends down to the end of the capillary.

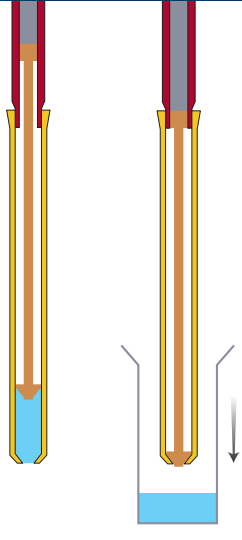
## Three



**Aspirate the sample**

The orifice is then immersed below the liquid surface. As the push-button is released, the piston moves up and the ambient pressure forces the desired volume of liquid through the orifice into the capillary.

## Four



**Dispense the sample**

The push-button is pressed again. The piston moves down and expels the liquid out of the capillary.

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