



Air displacement pipette or repetitive pipette?

Make the right choice for your application

Overview

Selecting the correct liquid handling device based on the medium used, the delivery volume, and the frequency of delivery is essential for precise and reliable work. The device must also provide optimum support for the application and contribute to efficiency in the laboratory.

BRAND provides various air displacement pipettes and repetitive pipettes. This Technical Note shows the main differences between these groups and points out important selection criteria that make it easy to choose the right device.

Introduction

Every day, various liquids and volumes are dispensed in the laboratory. The instruments used for this purpose are a key element in the lab. Their choice determines whether an experiment can be carried out successfully and reproducibly. Pipettes and dispensers are necessary tools. High-quality dispensing units enable precise and fast work and support the user in every application. But there are technologies and instruments to choose from. How do you find the right one for your application?

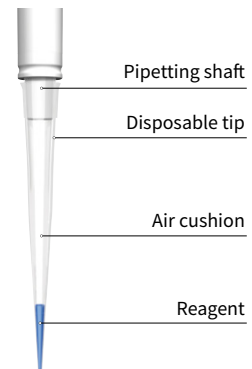
The most common distinction is between positive displacement and air displacement systems. The two systems, which function very differently, allow you to work with almost any liquid without any loss of accuracy or reproducibility. But how do these two systems differ? And what are their advantages and disadvantages?

This report compares the two functional principles, shows which properties should be considered, and will help you make the right choice for the respective application. BRAND offers a wide range of devices so that the right system is available for every user and every application.

Technical differentiation

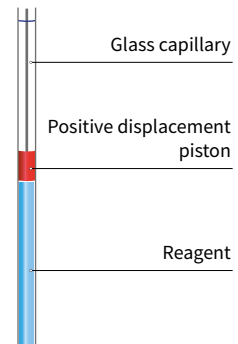
The air displacement principle

The air displacement principle is used mainly for pipettes and enables precise dispensing with fast and easy handling. By moving the piston in the pipette shaft up and down, a negative or positive pressure is created. This causes liquid to be aspirated into or expelled from the tip. However, the liquid is always separated from the inner piston and the pipette shaft by an air cushion and does not come into contact with the pipette itself when handled correctly. This enables contamination-free yet simple handling with the highest precision. But this is also where the application limits of the system lie. Media that strongly influence the air cushion can affect the accuracy of the result. For example, liquids with high viscosity or highly volatile media make precise work difficult.



The positive displacement principle

The positive displacement principle is often used for repetitive pipettes or specialized positive displacement pipettes. In contrast to air displacement systems, the piston of the positive displacement pipette is in direct contact with the liquid to be pipetted. The piston aspirates the liquid through a vacuum and wipes the walls of the tip clean during dispensing – down to the last drop, which clearly leaves the tip. This principle ensures highly reproducible results regardless of the liquid and the influence of an air cushion. The piston, which is built into the device in air displacement models, is located in the tip cylinder in positive displacement models and must always be replaced in order to ensure contamination-free operation. Depending on the model, this can result in more time needed to change the tip and higher consumable costs.

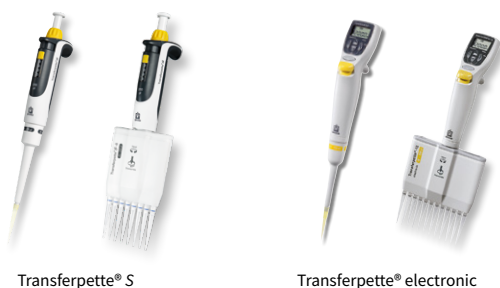


In summary, air displacement pipettes are the right choice for fast serial pipetting whereas positive displacement pipettes are better for viscous or volatile fluids.

BRAND's large portfolio makes it possible to provide the right device for every user, both for positive displacement pipettes and for air displacement pipettes.

Working principle	Advantages	Limits
Air displacement principle	<ul style="list-style-type: none"> Easy and quick exchange of pipette tips Fast serial pipetting of long test series 	<ul style="list-style-type: none"> Pipetting of problematic solutions (high viscosity, highly volatile, high density or foaming) limited Air cushion depends on many factors
Positive displacement principle	<ul style="list-style-type: none"> Suitable for problematic solutions (high viscosity, highly volatile, high density, or foaming) 	<ul style="list-style-type: none"> Replacing the tip can be time-consuming Higher costs for tips

Air displacement models from BRAND



Positive displacement models from BRAND



How to make the right choice



The medium used plays a decisive role, especially for the air displacement principle.

The criteria used to select the optimal device are as varied as the different models on the market. The properties of the medium used are often the limiting factor in the selection process and determine the use of a positive displacement pipette. The properties of the medium used is therefore one of the most important criteria in selecting a suitable dispensing system. There is often a large selection even within a group and there are usually many different models that all work according to the same principle.

For this reason, the requirements of the application must also be considered. For example, it is necessary to check how often a delivery must be repeated, which vessels are used, or which volume is required. A device must therefore optimally support users in their work; it must be intuitive to operate, deliver accurate volumes, and meet the necessary requirements.

The following explanations are intended to show the differences between the individual devices so that a decision can be made more easily.



Selection based on the medium used

The medium used has a decisive influence, especially in devices that work according to the air displacement principle, and can negatively affect the accuracy of dispensing. Certain media can make precise and reproducible work with the air displacement models difficult or even impossible:

- + High viscosity or wetting media
- + High density media
- + Foaming media (e.g., detergents)
- + Highly volatile liquids
- + Infectious media

With a certain amount of experience and using special techniques (e.g., reverse pipetting, the use of surface-treated low retention tips, saturation of the air cushion by repeated intake and delivery of the medium before the actual pipetting step, and working slowly), these media can also be used to some extent in air displacement models.

Most frequently, high-viscosity media in particular, cause problems and inevitably lead to the change to positive displacement. Of course, proper technique (e.g., slow dispensing) offers optimization possibilities. But as can be seen from the viscosity limits of the individual devices, the differences are clear.

	Air displacement pipettes	Positive displacement pipettes	Repetitive pipettes
Viscosity	Up to 260 mPa s	Up to 140.000 mm ² /s (100 µl nominal volume with Transferpettor _{micro}) Up to 40.000 mm ² /s (500 µl nominal volume with Transferpettor _{macro})	20 mPa s at 50 ml PD-Tip 260 mPa s at 5 ml PD-Tip 977 mPa s at 1.25 ml PD-Tip

In these or similar cases, a positive displacement model should be used. Because of the direct contact to the piston, the influence of the air cushion is eliminated, and exact working without loss of accuracy is guaranteed.



Selection based on the volume range

In addition to the usability of the medium, the volume range can be a further criterion according to which the dispensing unit is selected. Devices such as the Transferpette®, which must work with high precision in small volume ranges, cover only a limited volume range. However, it is extremely import-

ant for the application that the desired volume can be dispensed in a single step in order to achieve reproducibility. It is therefore necessary to check which range must be covered and which device has the necessary requirements for this.



0,5 – 300 µl



0,5 µl – 5 ml



2 µl – 5 ml



0,1 µl – 10 ml



1 µl – 10 ml



1 µl – 50 ml



0,5 – 300 µl

Volume range (nominal volume)

Selection based on the number of deliveries

Both the volume to be dispensed and the frequency of dispensing are decisive. In some experiments, each sample must be dispensed individually. However, in some cases, it is useful if a volume can be dispensed several times in succession or even in parallel. Here too, the possibilities are as varied as the applications themselves.



If it is absolutely necessary for the application to dispense a single volume without risk of contamination, **single-channel pipettes** – such as the **Transferpette® S** – are suitable for this purpose. This is often the case when valuable samples or molecular diagnostic tests are involved. The continuous change of pipette tips – which is quick and easy – reliably prevents sample mixing and contamination.



But what can you do if the medium is not suitable for use with the air displacement pipette? Even for problematic liquids, BRAND has a solution that ensures contamination-free work. With the electronic **HandyStep® touch** and its pipetting function, the repetitive pipette turns into a practical positive displacement pipette. The PD tips ensure that no contamination occurs and allow even critical solutions to be handled safely.



The **Transferpette** is ideal if you only occasionally need to dispense problematic solutions and preventing contamination is not your top priority. Thanks to its longer tip use, the positive displacement pipettes can facilitate routine disposable applications and save time and money compared with the repetitive pipette, which requires regular tip changes.



However, if a procedure is complex and time consuming, it may be useful to fill several vessels or wells in parallel. Dispensing individual reagents in several wells saves time and allows a reproducible procedure. Depending on the vessels used, different systems can be used to simplify the application. If the customer uses plates in SLAS/ANSI format, **multichannel pipettes** or a pipetting robot are ideal for filling several wells in parallel. The distances correspond exactly to this format, and 8 or 12 wells can be reliably filled in parallel. Depending on the desired volume, the **Transferpette® electronic** can also be used to fill several rows up to entire plates.

Things become a bit more complicated if the desired vessels do not correspond to a standard SLAS/ANSI format. Multi-channel systems can not be used in such cases. BRAND also offers a convenient solution for this. With the **Transferpette® electronic** in dispensing mode, the **HandyStep® S**, or **HandyStep® touch/touch S**, continuous multiple dispensing into each vessel is possible. Depending on the complexity of the application, it ranges from manual dispensing to complex series with the **HandyStep® touch S**. Here, too, the workload can be greatly reduced, and reliable and precise dispensing is guaranteed.



Do you now know which device fits your application? If not, we offer you a further decision aid on the next page.

Overview

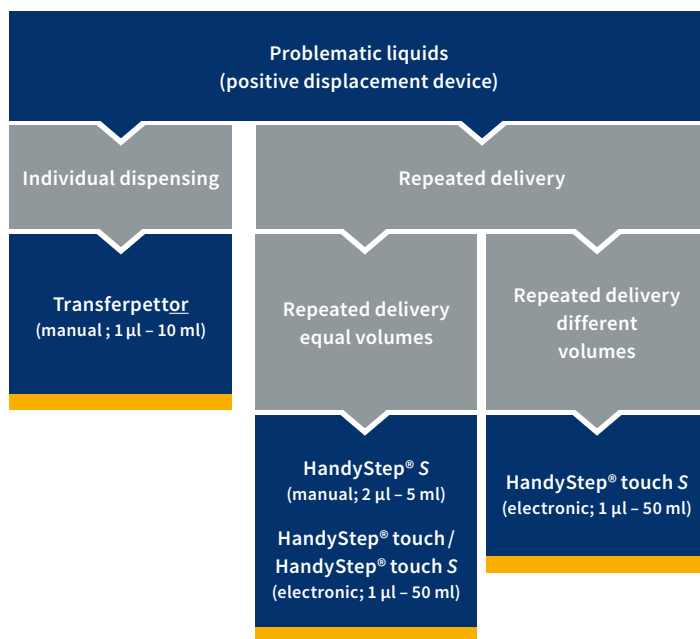
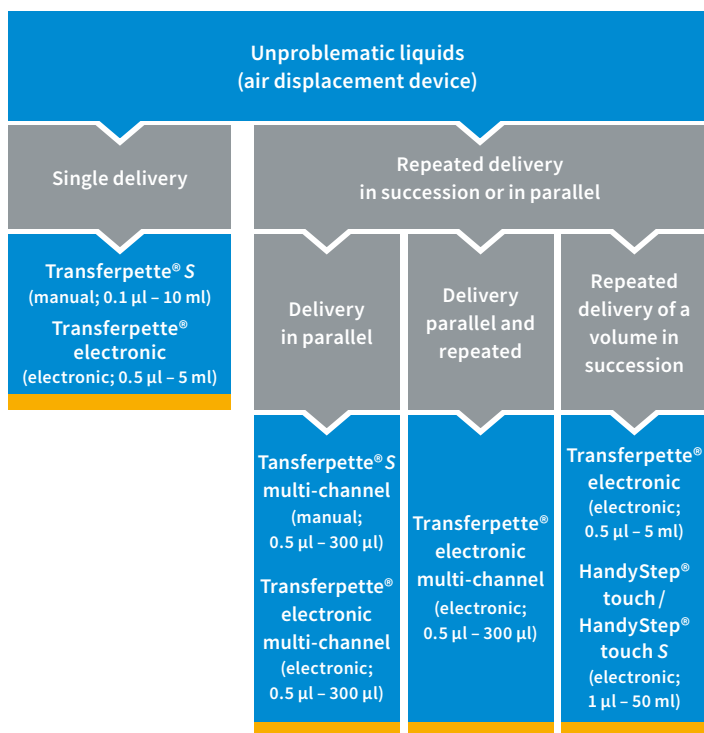
As explained in the previous chapters, the arguments or criteria for selecting a suitable dispensing unit are numerous. A decision must be made individually in each case after

weighing the individual criteria. The overview summarizes the criteria described above and thus serves as a decision-making aid.

Device	Positive displacement / air displacement model	Volume range	Delivery options
Transferpette® S	Air displacement pipette	0,1 µl – 10 ml	Single delivery
Transferpette® S multi-channel	Air displacement pipette	0,5 µl – 300 µl	Multiple deliveries in parallel
Transferpette® electronic	Air displacement pipette	0,5 µl – 5 ml	Step-by-step dispensing possible
Transferpette® electronic multi-channel	Air displacement pipette	0,5 µl – 300 µl	Multiple deliveries in parallel; Step-by-step dispensing possible
Transferpettor	Positive displacement pipette	1 µl – 10 ml	Single delivery
HandyStep® S	Repetitive pipette Positive displacement pipette	2 µl – 5 ml	Step-by-step dispensing possible
HandyStep® touch / touch S	Repetitive pipette Positive displacement pipette	1 µl – 50 ml	Stepwise dispensing possible; illustration of complex dispensing processes



Detailed information on the individual devices is available at shop.brand.de. Our sales department will be happy to explain individual functions in more detail or send you a demo unit with which you can test specific applications individually.



Conclusion

The selection of the right liquid handling device depends on numerous criteria. In addition to the medium, which is an important and, in some cases, limiting criterion, the application parameters such as volume, dispensing frequency, and dispensing vessel play a decisive role.

There is the right device for every application. An application-related decision must be made after evaluating the individual selection criteria. With our user knowledge, we would like to offer you assistance in this decision and show you different arguments for the individual devices.

More information about our products:



Microliter pipette
[Transferpette® S](#)



Repetitive Pipettes
[HandyStep® S](#) and
[HandyStep® touch](#)



Positive displacement
pipette [Transferpettor](#)

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