

Pipetting

ClipTip technology – part 2

Transform your daily pipetting

Key words

- **Tip fitting**—is the lower part of the pipette that positions, connects and seals the tip to the pipette.
- **Conical tip fitting**—utilizes a mechanical locking connection of the pipette and tip equipped with a light opening mechanism.
- **Cylindrical tip fitting**—the system by which a cone or cylindrical shaped pipette fitting utilizes friction to attach to a compatible cone or cylindrical shape tip fitting.
- **Precision**—refers to the repeatability of pipetting. It is expressed as coefficient of variation (CV%), a relative value obtained from statistical standard deviation and the mean value of dispensed volumes.

Introduction

The most common type of pipettes in the lab are air displacement pipettes. Its function is based on piston movement in a capillary. An airtight seal between the pipette and the tip is crucial for the pipette's functionality, and any compromise on the sealing affects pipetting performance. Traditionally air displacement pipettes have relied on friction between the pipette and the tip to form a seal. The sealing is depended on many factors including the tip attachment force used and might also be compromised through general use or when touching the vessel wall during pipetting. With the [Thermo Scientific™ F1-ClipTip™ Pipetting System](#) the attachment of tips is accomplished with an interlock technology between pipette and tip.



Breakthrough ClipTip technology

ClipTip interlock technology utilizes flexible clips positioned evenly around the top of the tip. During attachment, the unique tip fitting shape opens the clips allowing it to pass over the fitting flange and return to closed position. The clips lock the tip behind the flange creating a complete seal with the sealing ring (figure 1). In addition, the lock helps ensure the tip will not loosen compromising the seal, or even potentially falling of during routine pipetting or touch-off.

In this technical note we demonstrate the benefits of the revolutionary ClipTip interlocking tip attachment technology by pipetting into 96-well plate as an example.

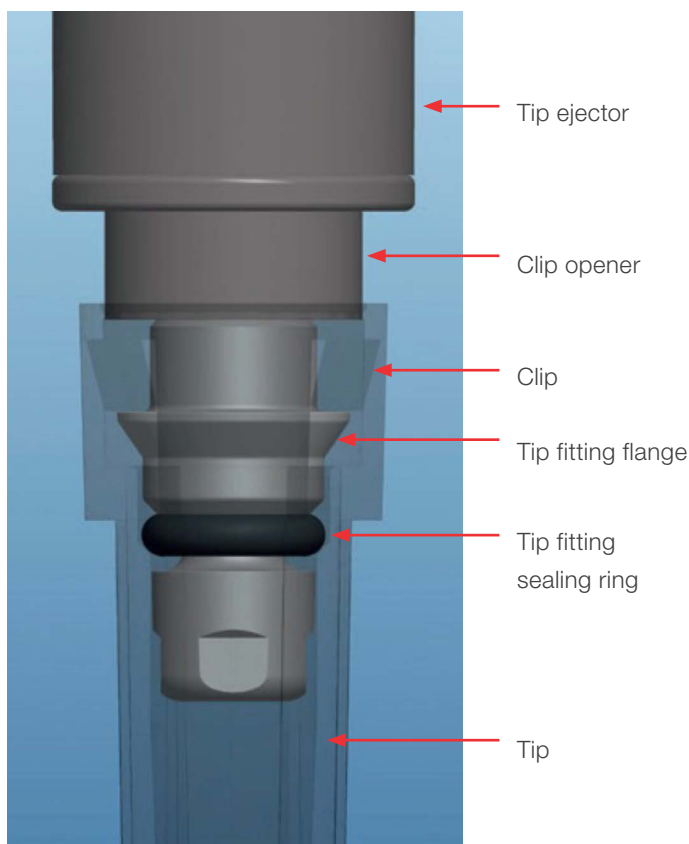


Figure 1. Clips closed behind the flange. The tip is sealed.

Test set-up

Test pipettes and tips:

- F1-ClipTip 12-channel pipette (30-300 μ l) with ClipTip 300.
- 300 μ l 12-channel pipettes from Manufacturers A and B with manufacturers' tips recommended for the particular pipette as well as generic tips. The pipettes had friction-based tip sealing mechanisms.

Test method:

- Tip attachment was achieved with constant forces using machine to press the tested pipette downward against the tip rack box with a lever. The lever was equipped with a weight, which directed a constant downward force to the test pipette. This procedure simulated the tip attachment procedure with a known force. The used attachment weight forces were 3.8kg, 4.8kg and 6.3kg (37.3N, 47.1N and 61.8N respectively).
- After tip attachment 100 μ l of green dye solution was dispensed into 96-well microplates using the reverse pipetting technique. After each dispensing the tips were touched against the wall of the wells to wipe off possible droplets on the outside of the tip. It was recorded if tips fell off. After filling two microplates, 100 μ l was aspirated and the amount of liquid was measured gravimetrically. Precision values (CV%) were calculated for each attachment force used.

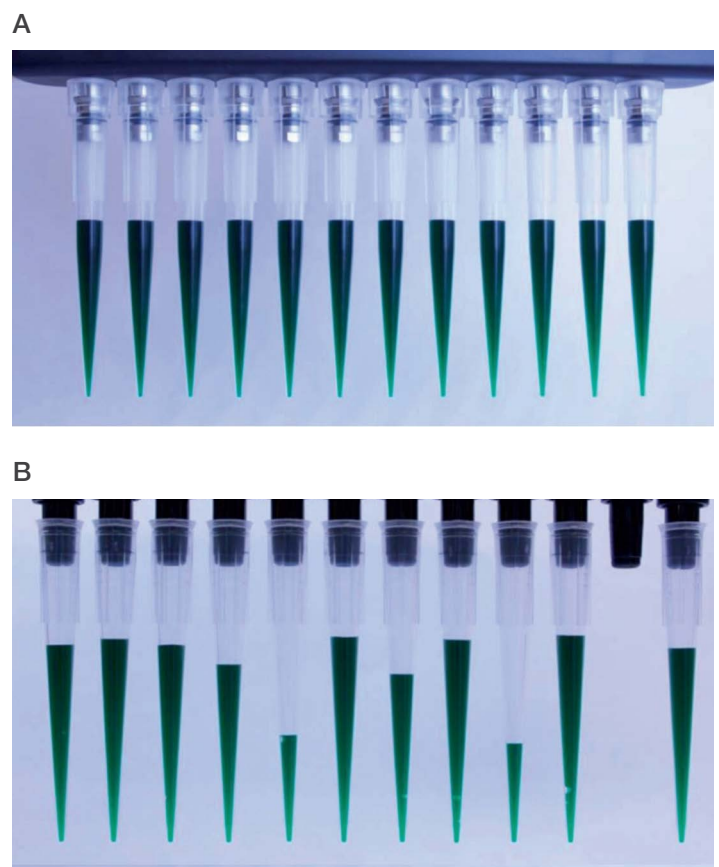


Figure 2. ClipTip tips (A) and Generic tips (B) after dispensing into two 96-well microplates. The tip attachment force used was 3.8 kg.

Results

1. Tip attachment

Attachment force 3.8 kg was sufficient to attach tips to all pipettes tested. However, tips from Manufacturer B and generic tips fell off during pipetting when 8 rows of microplate had been dispensed. Figure 2 shows ClipTip tips (a) and Generic pipette tips (b) after filling two 96-well microplates. The ClipTip pipette tips did not fall off and secured an equal liquid level in all 12 tips. The Generic tips had one tip fall off and obtained uneven liquid levels in the remaining tips. In order to keep tips attached the force needed to be increased from 3.8 kg to 4.8 kg. The tips of manufacturer A stayed attached, but the variation between dispensed volumes of different channels was higher than with F1-ClipTip pipette (Fig. 3). This variation could not be observed visually.

2. Precision

Precision value of manufacturer A was 68% higher than with F1-ClipTip system (Figure 4) after dispensing into two 96-well microplates. The figure shows that with F1-ClipTip pipette the variation between channels was lower than with a pipette with a friction-based tip fitting mechanism. With friction-based mechanisms the precision varied with the tip attachment force used.

Manufacturer A tips stayed attached, but the variation between dispensed volumes of different channels was higher when compared to the results of the F1-ClipTip system (Fig. 3).

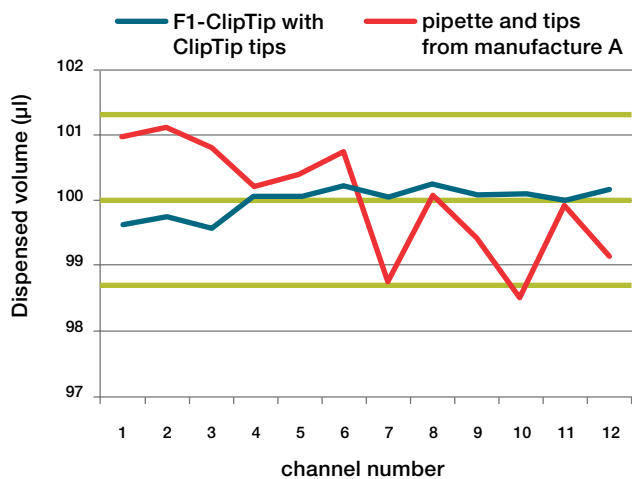


Figure 3. Dispensed volumes of F1-ClipTip 12-channel pipette and Manufacturer A's 12-channel pipette after dispensing into two 96-well microplates. The set volume was 100 µl and the tip attachment force used was 3.8 kg.

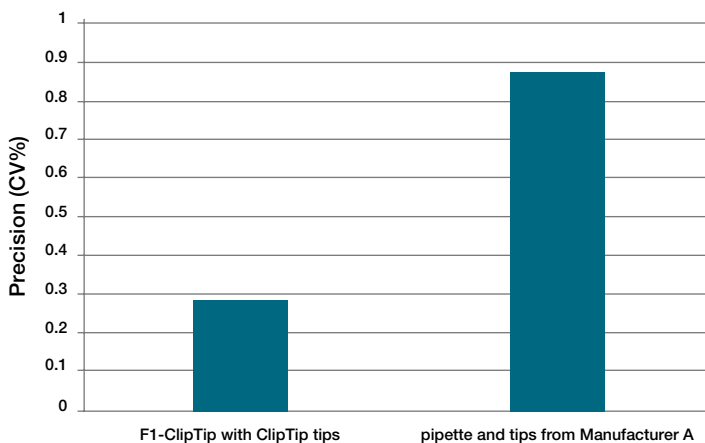


Figure 4. Precision values with 12-channel pipettes after dispensing into two 96-well microplates. The set volume was 100 µl and the tip attachment forces used were as 3.8 kg.

Summary

An optimal pipette and tip system increase confidence in reproducibility, reduces forces required to attach and eject tips, and secures the best possible accuracy and precision. In microplate applications, demand for optimum pipetting performance, and comfort is even greater due to higher number of repetitions and samples.

Compared to Manufacturer A and B, the F1-ClipTip pipetting system demonstrates excellent precision and minimal variation between dispensed volumes of different channels. Results show that pipetting performance of the F1-ClipTip system is not affected by the tip attachment force used. All tips remained attached and variation between channels was minimal. In addition, tip attachment did not require banging or rocking.

With friction-based tip attachment systems the seal between the tip and the tip cone is accomplished by friction between the pipette and tip. In this experiment impaired precision after dispensing and touching tips to the walls of a microplate was observed. This is likely due to loosening of the tips, which affects the seal. The sealing may be tight enough to avoid visible leakage, but not tight enough to give optimal pipetting results. In the worst case the tips fell off in the middle of pipetting. In a real research application this would mean repeating the experiment. Loss of samples and/or reagent, as well as time wasted, have a large impact on daily research and can especially be seen with microplate applications. Dropped tips may also present a severe contamination risk particularly in clinical applications. With Manufacturer A and B more effort was needed to attach the tips firmly, and prevent tips getting loose or dropping off.

The complete seal between the sealing ring and the ClipTip tips support optimal pipetting performance as demonstrated by the excellent precision. The unique interlocking tip attachment mechanism help ensure that the tips stayed firmly attached through the entire application. These innovative features make F1-ClipTip Pipetting System an excellent choice for microplate applications by saving valuable samples/ reagents as well as time and resources while increasing confidence in pipetting results. In addition, the ergonomic benefits of this system help reduce the risk of Repetitive Strain Injuries while pipetting.



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