



## A P P L I C A T I O N      N O T E

maximum pipetting force is less than the minimum pipetting force of other pipettors. The difference in pipetting work can be up to 4 times greater with conventional pipettors. Due to its low pipetting and tip ejection force, the precision values easily stay within the specifications, even after hours of pipetting. Moreover, as the operating mechanism is thermally insulated from the handle, the warmth of the hand does not affect the pipetting results at all, which can happen especially after several hours of continuous use.

### Tip sealing & tip ejection force

Tip mounting and ejection demands significant force in multichannel pipetting and is directly related to tip sealing and the force tips are being mounted to the pipettor. As the pipettor and the tip are designed as a system to reach a perfect fit, only tips specified by the pipettor manufacturer should be used. A compromise in tip selection might result in uneven sample pick-up, especially with 12-channel pipettors.

However, even when the tips of the original manufacturer are being used, traditional multichannel pipettors require a high insertion force (up to ten kilograms) because of the large sealing area. This, in turn, leads to a large force required to eject the tips, especially when using a 12-channel pipettor. The tip ejection force with multichannel pipettors can vary even 3-fold, depending on the number of channels, tip mounting force, manufacturer and model. Some manufacturers recommend rocking the pipettor over the tip rack and tightening the tips by hand to ensure secure tip fitting. This is both time consuming and causes a possible risk of contamination. Moreover, it results in laborious tip ejection, requiring much force. O-rings or elastomer tip cones omit that problem, but they require regular maintenance and wear particles can contaminate samples.

The Biohit mLINE Optiload system, featuring spring loaded tip cones (Figure 2 and 3) allows pipettor tips to be picked up easily with a constant low force. In practice, tips cannot be sealed too tightly to the tip cones, which prevents over-insertion and jamming of the tips. This system ensures that all tips are always sealed on at the same height, which is particularly important in microplate pipetting as it is necessary that all 12 tips reach the well bottom evenly. Thus, the springs secure optimal and even tip sealing, consistent sample loading and reduce tip ejection force considerably, even up to 65% (Figure 2). Moreover, the tip ejector



Figure 3 The Biohit Optiload system, featuring spring loaded tip cones, allows pipettor tips to be picked up with a constant force. This, in turn, guarantees even tip sealing and sample pick-up and reduces tip ejection force considerably, compared to conventional pipettors.

design has a large rounded surface, which makes it ergonomically convenient and allows one-handed, low-force tip ejection. Therefore, when hundreds of tip ejections are carried out daily, optimal tip loading and ejection significantly reduces the risk for RSI.

### Volume range

A great deal of variety exists in the volume ranges of different multichannel pipettors. For example, if 50  $\mu\text{l}$  is to be dispensed, the pipettor of choice can be as follows: 50–300  $\mu\text{l}$ , 30–300  $\mu\text{l}$ , 40–350  $\mu\text{l}$ , 20–200  $\mu\text{l}$  or 20–300  $\mu\text{l}$ , depending on the manufacturer. However, large volume ranges should not mean a compromise in accuracy and precision, which is often the case. In the Biohit mLINE, the piston travel, even in low volumes, is longer than normal, which makes pipetting more accurate in small volumes. In addition, the minimised dead volume, i.e., the air space between the tip and the piston further improves the accuracy.

### Protective tip cone filters & filter ejection

The pipettor can be contaminated very easily if no protection (filter tips or filter in the pipettor tip cone) is used. Even when working with buffers or aqueous solutions, small amounts of liquid may get inside the tip cone, thereby causing contamination. However, special attention should be paid to the problem when working with infectious, radioactive or DNA

samples. An economical and effective way to protect both the pipettor and the sample from contamination is to use a filter in the pipettor tip cone<sup>5</sup>. Standard tips can be used with the tip cone filter in many applications instead of the more expensive filter tips. Biohit offers this feature in their multichannel pipettors. Moreover, the mLINE<sup>®</sup> features a unique thumb-activated filter ejection system with which the filters can be removed safely without touching them<sup>6</sup> (Figure 4). Very often the filter is enough to protect the pipettor. However, only autoclaving ensures that the pipettor is almost certainly free from dangerous pathogens or the agent of concern.



Figure 4 With the unique filter ejection mechanism, filters can be removed simply by pressing the piston all the way down to the third position.

### Decontamination & autoclaving

Easy disassembling and autoclaving are regarded as important features for pipettor maintenance. To be able to autoclave the entire pipettor without disassembling the liquid end or having to change the O-rings that many multichannels feature is always an advantage, even if total disassembling is sometimes needed for cleaning. However, there are also convenient and effective decontamination solutions available on the market, which are used simply by spraying and wiping instead of time consuming autoclaving<sup>5</sup>.

When choosing a multichannel pipettor, ensure it is fully autoclavable, as in many pipettors only the lower part can be autoclaved or it is not autoclavable at all. If autoclaving is done frequently, make sure that the pipettor is fully autoclavable (numerous cycles) and does not need disassembling first.

## Calibration & in-house service

When purchasing a multichannel pipettor, ensure it is CE-marked, has a 3-year warranty and can be easily calibrated and serviced in-house when required. In many multichannel pipettors, service is time-consuming, requires extra tools and many different parts need to be disassembled, cleaned and reassembled in the correct order. Therefore, in many traditional multichannel pipettors, self-service is practically impossible, especially if one broken tip cone requires the time-consuming change of the whole liquid end. To be able to service the pipettor quickly and effectively, the multichannel pipettor should have individual piston/tip cone assemblies and only 1-2 parts to be cleaned.

The calibration of the mLINe has been made as user-friendly as possible. The calibration tool, which also acts as a tube cap opener, enables fast and accurate calibration. More importantly, it allows fine adjustment. Due to a special

transmission mechanism, even very small increments in calibration can be done easily and safely.

## Conclusions

There are several types of multichannel air displacement pipettors on the market. The best way to find the right tool for each application is to go through the pipetting procedures and find out which pipetting techniques and volumes are required. However, less force in pipetting and tip ejection means less fatigue and discomfort, which results in improved productivity and user satisfaction. Therefore, one should look for a lightweight, low-force, ergonomic multichannel pipettor without compromising accuracy and precision. It is preferable to use tips designed for the particular pipettor. As a summary, before choosing the multichannel pipettor, it should preferably be used and tried out. The best decision comes through evaluation and the user's own experience.

## References

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