Top Tips for Pipette Maintenance

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A guide to keeping your pipettes & results accurate, precise and reliable
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1. Accuracy and Precision
2. Pipetting Errors
3. Preventative Maintenance
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5. ISO 8655 Pipetting Techniques
Accuracy and precision: pipette or user error?

1. Accurate Precise
2. Precise inaccurate
3. Accurate imprecise
4. Inaccurate imprecise

1. Neither
2. Incorrect pipetting technique, no Z Factor correction and/or over-winding
3. Worn piston/seal and/or internal contamination
4. All of the above!
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Pipette Design Overview

**Picus parts and materials**

- On/off button (POM)
- ID Window (PC)
- USB Hatch (POM)
- Start button (PP)
- Control wheel (PP/EPDM)
- Charge contact/cover (Gold plated brass/POM)
- Tip ejector button (POM)
- Keyboard (PA)
- Display (PC)
- Handle (ASA/PC)

**Seal**
- 10µl, 10ml (FKM)
- 120µl, 300µl, 1000µl, 5000µl (EPDM)

**Tip cone**
- 10µl, 120µl (PVDF)
- 300µl, 1000µl (PEI)
- 5000µl, 10ml (PPS)

**Tip ejector collar**
- 10µl, 120µl, 300µl, 1000µl (PVDF)
- 5000µl, 10ml (PP)

**Piston**
- 10µl (SS)
- 120µl, 5000µl, 10ml (PPS)
- 300µl, 1000µl (PEI)

**Safe-Cone standard filter** (PE)
Main sources of pipetting errors

- A. Leaky piston/tip-cone
- B. Poor tip fitting
- C. Reuse of tip
- D. Failure to wipe pipette tip on vessel wall
- E. Difference in humidity – Z Factor
- F. No pre-rinsing/pre-wetting tip
- G. Variable pipetting cycle time
- H. Depth of tip and angle of pipetting
- I. Variable pipetting speed
- J. Difference in pipette, tip, liquid and room temperature

Source: ISO8655-2
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Preventative Maintenance:

- Pipettes are precision instruments
  - Containing high-precision mechanical (and electronic) parts
  - Parts are subject to wear, accidental damage & contamination
  - The functionality and condition has direct influence on pipetting results

- Regular checking and cleaning ensures
  - Accuracy and precision
  - Prolongs the pipettes lifetime
  - Reduces the risk of contamination
Preventative Maintenance: Cleaning & Decontamination

- **Outer surface**
  - Wipe the outer surface daily with Distel, Virusolve or equivalent (or 70% ethanol or 60% iso-propanol)
  - Wipe with soft lint-free cloth

- **Tip cones/tip holders**
  - Any damage or contamination may cause problems in tip sealing and might cause leakage – although the tip fits
  - Clean any visible contamination and check that there’s no wear, usually a groove caused by poor-quality tips

- **Safe Cone filters**
  - Replace tip cone filters regularly daily or after 50 – 250 pipettings & immediately in case of over aspiration
Preventative Maintenance: Pipette Handling

**Do:**

- Ensure pipettes are serviced annually and checked at least 3 monthly
- Use racked tips if possible to minimise the risk of damaging the tip-cone(s)
- Eject tips using the tip-ejector button only – not with fingers
- Use pipette stands to keep pipettes vertical when not in use
- Adjust the volume from a slightly higher setting down to the desired volume and depress the plunger 2x - in case of wear in the mechanism
Preventative Maintenance: Pipette Handling

Don’t:

• Disassemble the tip-cone or piston for cleaning – you will need to re-calibrate. Use autoclavable pipettes with tip-cone filters.
• Overwind beyond the volume range of the pipette
• Keep holding the pipette when not actually pipetting – as it warms the volume will change slightly
• Rock the pipette in any direction when loading tips from a rack – push downwards only
• Twist single channel pipettes when loading tips from a rack – can cause RSI
• Do not twist or push tips using excessive force when fitting to the tip cone(s) – if you have to do this - change the tip brand for a perfect fit
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1. Clean the outer surface of the pipette with alcohol wipes, Distel® or Virusolve®

2. Inspect the pipette for damage: tip-holder & ejector, volume-lock/friction ring

3. Check the volume will adjust over the full range

4. Remove ejector & tip-holder & inspect piston, seals/o-rings

5. Always replace PTFE seals & o-rings on Gilson®-style pipettes

6. Spare parts & Preventative Maintenance Kits should always be available from the manufacturer. Before purchasing new pipettes – check they are and prices are reasonable
1. Grease the piston and/or seal if and as specified by the manufacturer with the correct grade of grease – essential for autoclavable pipettes

2. Reassemble pipette, adjust to the nominal (max) volume and check the plunger operates smoothly – to the 2nd stop

3. Check the systematic & random error at the nominal volume and 10% of the nominal volume with 4 readings minimum at each. A single point calibration is not recommended

4. ISO 8655 Maximum Permissible Errors is recommended – manufacturers’ specifications are often challenging

5. Recalibrate the pipette if needed – ideally using a 5 decimal place balance & Z Factor correction

6. Apply a label to each pipette with the date & next scheduled calibration
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Pipetting Techniques (ISO 8655-2) - Summary

- **PIPETTING SKILLS:**
  - Hold the pipette vertically when aspirating
  - Immerse the tip 2-3mm under the liquid surface
  - Pre-rinse 3-5 times before pipetting
  - Pause consistently for 1 second minimum after aspiration
  - Dispense at a 30-45º angle touching the receiving vessel wall & wipe upwards 10-15mm
  - Be smooth and consistent -

**PIPETTING PRINCIPLES & TECHNIQUES**

- Choose forward or reverse pipetting as appropriate
- Use good quality pipette tips
- Minimise the air space inside the tip by using the pipette as near it’s maximum volume as possible
- Minimise hand-warming effect by using the pipette stand
Pipetting skills and experience

**Conclusion**: Pipetting skills and experience have a bigger impact, when using a mechanical pipette compared to an electronic. With electronic pipettes the motor controls the piston movement consistently, with any user.
Pipetting Techniques - TOP TIPS

1. Reverse pipetting is a great way to deal with problem (viscous & foaming) liquids to ensure consistency.

2. Electronic pipettes remove (almost) all user-related errors.

3. Good tip fit is critical in ensuring accurate results, the manufacturer's brand is always best, regardless of manufacturer!

4. Low retention tips are excellent at increasing sample recovery for viscous & foaming liquids.

5. Filter tips are extremely effective in decreasing cross-contamination risks.

6. RSI and Pipette ergonomics is a significant factor in results and user safety and comfort, ask for free trials before any pipette purchase!
Thank you very much for your attention!