STANDARD OPERATING PROCEDURE

Pipette Calibration SOP

Document no.	SOP-LAB-006
Revision	1.0
Owner	QA Manager
Effective date	September 15, 2026
Review cycle	Every 12 months

1. Purpose

To confirm each pipette delivers volumes within its stated accuracy and precision so that dilutions, dosing and test results made with it stay reliable.

2. Scope

Applies to all single-channel and multichannel air-displacement pipettes used for testing or sample preparation. General instrument calibration is covered by the equipment calibration SOP.

Definitions

Gravimetric test	A calibration method that weighs dispensed water on an analytical balance to calculate the actual volume delivered.
Accuracy	How close the average delivered volume is to the target volume.
Precision (CV%)	How consistent repeated deliveries are with each other, expressed as a coefficient of variation.

3. Responsibilities

Lab Technician	Submits pipettes for calibration on schedule and reports suspected inaccuracy between calibrations.
Calibration Technician	Performs the gravimetric test, records results and applies the pass or fail label.
QA Manager	Sets tolerance criteria, reviews failed results and approves pipettes returning to service.

RACI matrix

Activity	Lab Technician	Calibration Technician	QA Manager
Submit pipette for scheduled calibration	R/A	I	-
Perform gravimetric calibration test	I	R/A	C
Approve pipette adjustment or service	I	R	A
Review calibration records and trends	-	R	A

R = Responsible, A = Accountable, C = Consulted, I = Informed

4. Materials and PPE

Materials, tools and systems

- Analytical balance with calibration weights
- Distilled or deionized water and thermometer
- Calibration weights table for water density at temperature
- Manufacturer-approved pipette tips
- Calibration log or CMMS asset register
- Pass or fail calibration labels

Personal protective equipment

- Disposable nitrile gloves

5. Procedure

Step	Task	Owner	Done
5.1	**Check the calibration due date** Check the label on the pipette or the CMMS asset register to confirm it is due, and remove it from the bench rotation for testing.	Lab Technician	☐
5.2	**Record room conditions** Record the ambient temperature, humidity and barometric pressure in the calibration log, since these affect the water density calculation.	Calibration Technician	☐
5.3	**Inspect the pipette for damage** Check the shaft, tip cone, piston and seals for cracks, debris or wear, and clean the exterior before testing.	Calibration Technician	☐
5.4	**Perform a leak test** Attach a tip, draw up liquid, and hold the pipette vertically for 20 to 30 seconds to check for a falling meniscus, which indicates a seal leak. **Warning:** Do not proceed to gravimetric testing on a pipette that fails the leak test; tag it out of service.	Calibration Technician	☐
5.5	**Set the balance and tare** Place the weighing vessel on the analytical balance, close the draft shield, and tare the balance to zero before each dispense.	Calibration Technician	☐
5.6	**Dispense at minimum, mid and maximum volume** Dispense the target volume into the weighing vessel and record the weight for at least ten replicates at each of the minimum, mid and maximum volumes for that pipette. **Checkpoint:** At least ten replicate weighings are recorded at each test volume before calculations begin.	Calibration Technician	☐
5.7	**Calculate accuracy and precision** Convert each weight to volume using the water density at the recorded temperature, then calculate the mean volume, percent accuracy and percent CV for each test volume.	Calibration Technician	☐
5.8	**Compare results to tolerance** Compare the calculated accuracy and precision against the manufacturer's stated tolerance for that pipette model and volume.	Calibration Technician	☐

Step	Task	Owner	Done
5.9	**Adjust or tag out of service if failing** If results are out of tolerance, adjust the pipette per the manufacturer's instructions and retest, or tag it out of service and arrange vendor service.	Calibration Technician	☐
5.10	**Apply the pass or fail label** Attach a label to the pipette showing the calibration date, due date, result and technician initials.	Calibration Technician	☐
5.11	**Log results and notify the owner** Enter the results into the calibration log or CMMS and notify the pipette's regular user that it is back in service or remains out for repair.	Calibration Technician	☐
5.12	**Review failure trends** Review pipettes with repeated failures or adjustments across calibration cycles and decide whether replacement is more cost-effective than continued repair.	QA Manager	☐

6. Quality checks

- Every calibration record shows at least ten replicates per tested volume.
- Room temperature is recorded and used in the volume calculation.
- Pipettes that fail the leak test are not gravimetrically tested until repaired.
- Pass or fail labels match the result recorded in the calibration log.

7. Records

- Calibration log or CMMS asset register
- Gravimetric test data sheets
- Pass or fail calibration labels
- Vendor service records

8. KPIs

- Percentage of pipettes calibrated on schedule
- First-time pass rate on gravimetric testing
- Number of pipettes requiring adjustment per cycle
- Average pipette downtime for repair

9. Common mistakes

- Skipping the leak test and going straight to gravimetric testing.
- Not recording room temperature before calculating volumes.
- Testing with tips that are not the manufacturer-approved brand for that pipette.
- Using fewer than the required number of replicates per volume.

10. Revision history

Revision	Date	Description	Reviewed by
1.0	September 15, 2026	Initial release	Ilia Pirozhenko

Approval

Prepared by	Approved by	Date

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