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National Metrological Verification Regulation
of the People's Republic of China

JJG 646-2006

Locomotive Pipette

移液器

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Issued on: December 08, 2006

Implemented on: June 08, 2007

**Issued by: The State Administration of Quality Supervision, Inspection
and Quarantine**

**Verification Regulation of
Locomotive Pipette**

JJG 646-2006
replacing JJG 646-1990

This Regulation was approved by the General Administration of Quality Supervision, Inspection and Quarantine of the People's Republic of China on December 8, 2006 and was implemented on June 8, 2007.

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Verification Regulation of Locomotive Pipette

1 Scope

This Regulation applies to the initial verification, subsequent verification and in-service inspection of locomotive pipette.

2 Cited reference

This Regulation cites the following document:

GB 6682-1992 *Water for analytical laboratory use – Specification and test methods*

Pay attention to use the current valid version of the above cited reference in using this Regulation.

3 Terms and measurement units

3.1 Locomotive pipette

Measuring instrument with a certain scale range that can suck the liquid from container and transfer it into another container (Filling injector, sample-filling storage, aspirator etc. collectively referred to as locomotive pipettes).

3.2 Adjustable locomotive pipette

Locomotive pipette whose volume value can be adjusted.

3.3 Quantitative locomotive pipette

Locomotive pipette with single volume value.

3.4 Aspirating-nozzle

The part installed on the lower end of locomotive pipette and used to suck and discharge liquid.

3.5 Display window

The window on locomotive pipette displaying volume value.

3.6 Suction tube

The connecting member between locomotive pipette and aspirating-nozzle.

3.7 Volume regulator

The rotary knob of digital device used to regulate volume.

3.8 Measurement unit

The measurement unit of locomotive pipette is μL or mL .

4 Overview

Locomotive pipettes are mainly used in environmental protection, medicine, food and health research department, and other departments to sample liquid or add liquid in biochemical analysis and assays. It is a piston pipette working with the principle of air discharge and determining the volume of the locomotive pipette through the moving distance of piston in piston sleeve.

Locomotive pipette is ex-quantity measurement instrument, which is divided into quantitative locomotive pipette and adjustable locomotive pipette. Its type is divided into single-channel type and multichannel type. Its structure consists of display window, volume adjustable member, piston, piston sleeve, suction tube, aspirating-nozzle and so on (See Figure A.1-10).

5 Metrological properties requirements

At the standard temperature 20°C , the volume permissible tolerance and measurement repeatability of the locomotive pipette shall meet the requirements in Table 1.

Table 1 Volume permissible tolerance and measurement repeatability of locomotive pipettes

Nominal volume / μL	Monitoring points / μL	Volume permissible tolerance $\pm$ (%)	Measurement repeatability $\leq$ (%)
1	0.1	20.0	10.0
	0.5	20.0	10.0
	1	12.0	6.0
2	0.2	20.0	10.0
	1	12.0	6.0
	2	12.0	6.0
5	0.5	20.0	10.0
	1	12.0	6.0
	5	8.0	4.0
10	1	12.0	6.0
	5	8.0	4.0
	10	8.0	4.0

6 General technical requirements

6.1 Appearance requirements

6.1.1 The appearance of plastic parts of locomotive parts shall be flat and smooth; there shall be no obvious sink marks, scrap, cracks, blistering and deformation phenomena on it; the surface coating of metal parts shall be no fall-off, rust and flaking.

6.1.2 The body of locomotive pipette shall have the following tags: product name, manufacturer or trademark, nominal capacity (μL or mL), model specifications and manufacturing number.

6.2 Piston

The piston of locomotive pipette shall be able to move up and down flexibly with clear sub-block boundaries when being pressed.

6.3 Regulator

The display window of locomotive pipette shall be flexible in rotation with clear and complete indicating numbers in the action of regulating volume.

6.4 Aspirating-nozzle

6.4.1 Aspirating-nozzle shall be made of polypropylene material.

6.4.2 Aspirating-nozzle shall have no obvious bending phenomenon. The internal wall shall be clean and smooth; there shall be no residual liquid after draining.

6.4.3 Different specifications of locomotive pipettes shall use corresponding matching aspirating-nozzle.

6.5 Air-tightness

Under 0.04 MPa, the locomotive pipette shall have no air leakage phenomenon in 5 seconds.

6 Metrological measuring tool control

Metrological measuring tool control includes initial verification, subsequent verification and in-service inspection.

7.1 Verification conditions

7.1.1 Verification environment

The locomotive pipette shall be verified under the condition at $(20\pm 5)^{\circ}\text{C}$ of room

7.3.3.1 Preparation before verification

The selected aspirating-nozzle shall match with the aspirating-rod. At the lower end of the aspirating-rod of locomotive pipette, gently turn the aspirating-nozzle to ensue the air-tightness of locomotive pipette; there shall be no hanging-water phenomena after the process of several times of aspirating and discharging.

Ensure the fixing installation of each aspirating-nozzle of multichannel locomotive pipette before verification.

7.3.3.2 Verification steps

- (1) Place the measuring glass in electronic balance; press the control rod to make the electronic balance to reset to zero, after the indication is stable.
- (2) Regulate the volume of the locomotive pipette to the verified point.
- (3) Hold the locomotive pipette vertically; press the button to the verification point; at this time, place the aspirating-nozzle in the container that contains distilled water; keep it 2mm-3mm under the liquid level; slowly release the button; after 1 s ~ 2 s, remove it out of the liquid; wipe out the liquid at aspirating-nozzle (At this time, do not touch the liquid outlet, so as to avoid sucking away the liquid in aspirating-nozzle).
- (4) Take the measuring glass out of the electronic balance; the liquid-discharge mouth of aspirating-nozzle is leaned to the inner wall of measuring glass, and is formed 45° with it; slowly press the button to the first stop point; wait for 1 s ~ 2 s; fully press down the button; then remove the aspirating-nozzle along the inner wall of measuring glass.
- (5) Place the measuring glass on balance's pan; recode the value displayed by the balance at this time; meantime, measure and recode the temperature of the distilled water in the container.
- (6) Repeat item (1) to item (5) for six times; the error of each measurement must not exceed the provisions in Table 1.

7.3.4 Data processing

7.3.4.1 Calculation of the actual volume of locomotive pipette

Substitute the mass value, temperature value, and air density value measured by implementing 7.3.3.2(1) ~ (5) into the following equation; the actual volume of the locomotive pipette at the standard temperature, 20°C, can be obtained.

$$V_{20} = \frac{m(\rho_B - \rho_A)}{\rho_B(\rho_w - \rho_A)} [1 + \beta(20 - t)] \quad (1)$$

Where:

σ_{n-1} - Standard deviation;

n - The verification times;

v_i - The difference between the single measurement value and the average value of the measured value, μL ;

S - Repeatability.

7.4 Verification results processing

For locomotive pipette which passes the verification, it shall issue the verification certificate (the format of inner pages of verification certificate is shown in Annex D); for locomotive pipette which does not pass the verification, it shall issue notice of verification results (the format of inner pages of notice of verification results is same as Annex D), and note the un-qualified items.

7.5 Verification period

The verification period of locomotive pipette is one year.

Annex C

Recording format of locomotive pipette verification

(For reference only)

Inspection-submission organization _____; Instrument manufacturer _____;

Specification model _____; Instrument serial number: _____; Recoding number: _____;

Standard apparatus used _____; Verification basis: _____;

1. Visual inspection record _____; 2. Air-tightness inspection records _____;

3. Environment condition record: temperature in laboratory $t =$ _____ $^{\circ}\text{C}$;

Air density in laboratory $\rho_A =$ _____ g/cm^3 ;

4. Verification record of distilled water:

S/N	Test point / μL	Temperature / $^{\circ}\text{C}$	Mass value /g	K (t) value	Actual volume in V_{20} / μL	Calibration results
1						$\bar{V} =$ $E =$ % $S =$ %
2						
3						
4						
5						
6						
7						$\bar{V} =$ $E =$ % $S =$ %
8						
9						
10						
11						
12						
13						$\bar{V} =$ $E =$ % $S =$ %
14						
15						
16						
17						
18						

5. Verification results and treatment: This metrological apparatus is allowed to be used as _____;

Issuing identification certificate number: _____; Verification date: __YY__MM__DD

Verification officer: _____; Examination and verification officer: _____;

Valid until: __YY__MM__DD

Annex D

Format of inner pages of verification certificate

Certificate number

Verification results

Instrument serial number	Specifications model / μ L	Nominal volume / μ L	Volume permissible tolerance /%	Repeatability /%	Verification result

(Blank below)

Verification officer:

Examination and verification officer:

END

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