

7.2 Fixed-volume piston pipettes of types A and D1

For air-displacement piston pipettes (type A) with fixed volume and for positive-displacement piston pipettes with reusable plunger and capillary (type D1) and with fixed volume, the maximum permissible errors of Table 1 apply.

For the maximum permissible errors of piston pipettes with intermediate nominal volumes between those given in Table 1, the absolute values for the next greater nominal volume shall apply.

NOTE This means that the maximum permissible systematic error of a piston pipette with a nominal volume of 25 µl is ± 0,5 µl and its maximum permissible random error is ± 0,2 µl.

Table 1 — Maximum permissible errors for types A and D1

Nominal volume µl	Maximum permissible systematic error		Maximum permissible random error	
	± %	± µl ^a	± % ^b	± µl ^c
1	5,0	0,05	5,0	0,05
2	4,0	0,08	2,0	0,04
5	2,5	0,125	1,5	0,075
10	1,2	0,12	0,8	0,08
20	1,0	0,2	0,5	0,1
50	1,0	0,5	0,4	0,2
100	0,8	0,8	0,3 ^d	0,3 ^d
200	0,8	1,6	0,3 ^d	0,6 ^d
500	0,8	4,0	0,3	1,5
1 000	0,8	8,0	0,3	3,0
2 000	0,8	16	0,3	6,0
5 000	0,8	40	0,3	15,0
10 000	0,6	60	0,3	30,0

^a Expressed as the deviation of the mean of a tenfold measurement from the nominal or selected volume (see ISO 8655-6:2002, 8.4).

^b Expressed as the coefficient of variation of a tenfold measurement (see ISO 8655-6:2002, 8.5).

^c Expressed as the repeatability standard deviation of a tenfold measurement (see ISO 8655-6:2002, 8.5).

^d For piston pipettes of type D1 the maximum permissible errors may be ± 0,4 %.

7.3 Fixed-volume piston pipettes of type D2

For positive-displacement piston pipettes with disposable plunger and capillary (type D2) and with fixed volume, the maximum permissible errors of Table 2 apply.

For the maximum permissible errors of piston pipettes with intermediate nominal volumes between those given in Table 2, the absolute values for the next greater nominal volume shall apply.

7.4 Variable-volume piston pipettes

In the case of variable-volume piston pipettes, the nominal volume is the greatest possible user-selectable volume which is specified by the manufacturer. For example, a piston pipette with a useful volume range from 10 µl to 100 µl has a nominal volume of 100 µl.

In the conformity test, the maximum permissible errors for the nominal volumes in Tables 1 and 2 apply to every selectable volume throughout the useful volume range of the piston pipette; i.e. the maximum permissible systematic errors of variable-volume piston pipette types A and D1 with a useful volume range of 10 µl to 100 µl are ± 0,8 µl and the maximum permissible random errors are ± 0,3 µl for every measured volume.

NOTE It is recognized that the errors of measurement of intermediate volumes in the useful volume range of a variable-volume piston pipette may be considerably better than those specified for the nominal volume of the piston pipette.

Table 2 — Maximum permissible errors for type D2

Nominal volume μl	Maximum permissible systematic error		Maximum permissible random error	
	$\pm \%$	$\pm \mu\text{l}^a$	$\pm \%^b$	$\pm \mu\text{l}^c$
5	2,5	0,13	1,5	0,08
10	2,0	0,2	1,0	0,1
20	2,0	0,4	0,8	0,16
50	1,4	0,7	0,6	0,3
100	1,5	1,5	0,6	0,6
200	1,5	3,0	0,4	0,8
500	1,2	6,0	0,4	2,0
1 000	1,2	12,0	0,4	4,0

^a Expressed as the deviation of the mean of a tenfold measurement from the nominal or selected volume (see ISO 8655-6:2002, 8.4).
^b Expressed as the coefficient of variation of a tenfold measurement (see ISO 8655-6:2002, 8.5).
^c Expressed as the repeatability standard deviation of a tenfold measurement (see ISO 8655-6:2002, 8.5).

Repetitive piston pipettes with a continuously selectable volume shall be considered as variable-volume piston pipettes of type D2 and the maximum permissible errors of Table 2 shall apply.

7.5 Multi-channel piston pipettes

The maximum permissible systematic and random errors of multi-channel piston pipettes shall be equal to twice the values specified in Table 1 for single-channel piston pipettes. Each channel of the multi-channel piston pipette, considered independently, shall meet these specifications.

In the case of variable-volume multi-channel piston pipettes, the maximum permissible errors for the nominal volume apply to every selectable volume throughout the useful volume range (see 7.4 for further details).

7.6 Pipette tips

The maximum permissible errors always apply to the total system of piston pipette and tip. When using pipette tips not delivered by the pipette supplier, the supplier's declaration or the certificate of conformity does not apply. In such cases, the evaluation of the maximum permissible errors shall be performed using the alternative tips with the method of test specified in ISO 8655-6.

Before the conformity evaluation of the piston pipette with the alternative tips, it shall be ascertained, that the piston pipette in combination with the original tips conforms to the metrological requirements specified in this part of ISO 8655.

Users may test the metrological performance for routine quality assurance procedures of the total system of

- piston pipette and tip (type A) and operator, or
- tip and piston combination (type D) and operator

in accordance with ISO 8655-6 or with alternative test methods (see note to clause 1).