

## Eppendorf Research® Series 2100 fix · adjustable · multi

Instruction Manual · Mode d'emploi · Manual de Instrucciones



**eppendorf**

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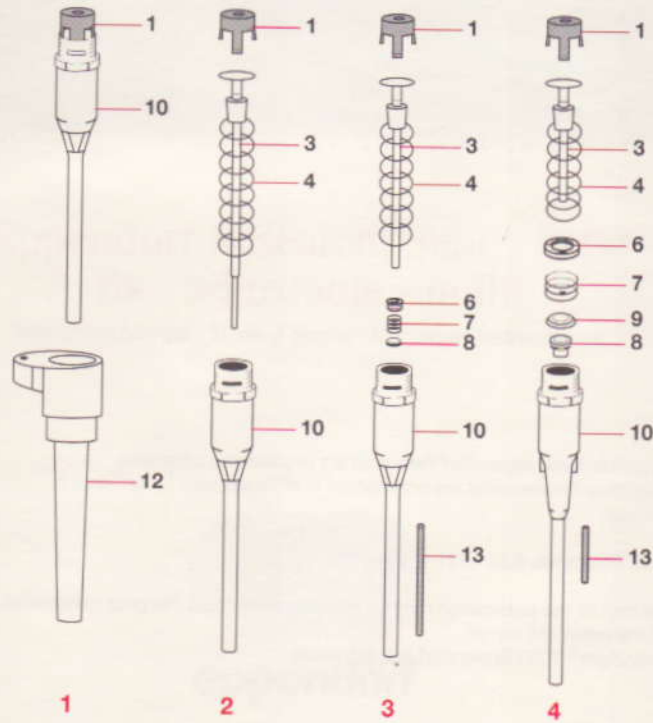
U.S. Patent No. 5,531,131; 4,961,350

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**Fig. 1 Research Series 2100 – adjustable / fix**

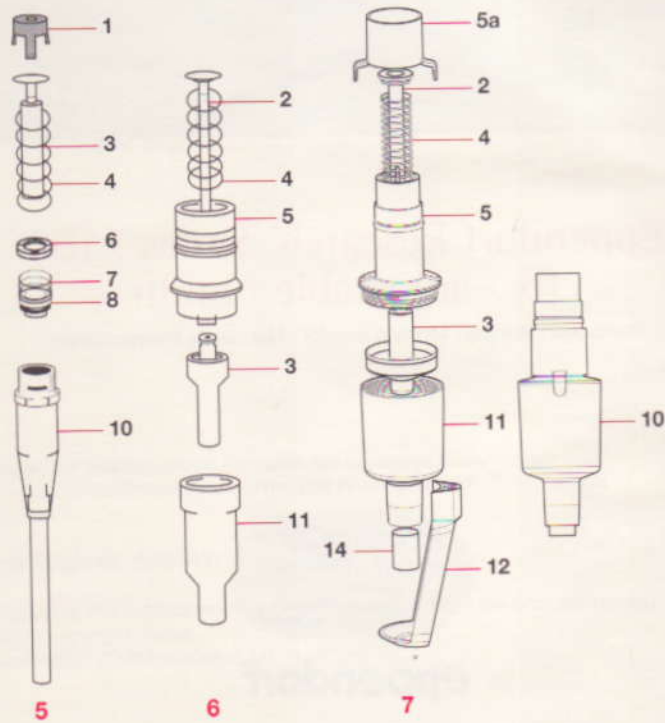
**Single-Channel / Monocanal**

Research variable	0.1 – 2.5 $\mu$ l		
	0.5 – 10 $\mu$ l		
	2 – 20 $\mu$ l	10 – 100 $\mu$ l	20 – 200 $\mu$ l
Research fix	- 20 $\mu$ l	- 100 $\mu$ l	



Single-Channel / Monocanal

100-1000  $\mu$ l      500-5000  $\mu$ l      1-10 ml      Research variable  
-1000  $\mu$ l      Research fix



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**1 Safety precautions and applicational limitations**

Before working with the Research pipette, please read the operating manual. To ensure safe, problem-free experiments with the Research pipette, it is essential to observe the following points:

**1.1 Handling**

- Only use pipettes in the Research family when a pipette tip has been attached.
- Use the 1 – 10 mL pipette only with filter inserted.
- Do not lay down the pipette when a filled pipette tip is attached.
- When using infectious, radioactive, toxic and/or solutions that pose a health risk, please observe the safety precautions valid for the country in which the pipette is being used.
- When using organic solvents and aggressive chemicals, check the chemical compatibility of the pipette tips (made of PP = polypropylene) and the pipettes.
- When using solutions with physical characteristics which are considerably different to those of water (e.g. glycerol), check the dispensing volume as described in Section 5.2.
- Avoid differences in temperature between pipettes and pipette tips as well as the liquid used as this may lead to incorrect volumes being dispensed.
- The above may also occur when liquids with a high vapor pressure are used.

**1.2 Care and maintenance**

- Do not allow any liquid to enter into the pipette.
- Do **not** clean the pipette with acetone or aggressive solutions.
- Use Eppendorf spare parts and accessories (including pipette tips) only.

2 Technical data

2.1 Research, fixed-volume

Model / volume	ep Tip	Systematic error (Inaccuracy)	Random error (Imprecision; CV)
10 µL	2– 200 µL	± 1.2 %	≤ 0.6 %
20/25 µL	2– 200 µL	± 1.0 %	≤ 0.3 %
50 µL	2– 200 µL	± 0.7 %	≤ 0.3 %
100 µL	2– 200 µL	± 0.6 %	≤ 0.2 %
200–1,000 µL	50–1,000 µL	± 0.6 %	≤ 0.2 %

2.2 Research, adjustable-volume

Model	ep Tip	Volume	Systematic error (Inaccuracy)	Random error (Imprecision; CV)
0.1– 2.5 µL	0.1– 10 µL	0.25 µL	± 12.0 %	≤ 6.0 %
		1.25 µL	± 2.5 %	≤ 1.5 %
		2.5 µL	± 1.4 %	≤ 0.7 %
0.5– 10 µL	0.5– 20 µL	1 µL	± 2.5 %	≤ 1.8 %
		5 µL	± 1.5 %	≤ 0.8 %
		10 µL	± 1.0 %	≤ 0.4 %
2– 20 µL	2– 200 µL	2 µL	± 5.0 %	≤ 1.5 %
		10 µL	± 1.2 %	≤ 0.6 %
		20 µL	± 1.0 %	≤ 0.3 %
10– 100 µL	2– 200 µL	10 µL	± 3.0 %	≤ 1.0 %
		50 µL	± 1.0 %	≤ 0.3 %
		100 µL	± 0.8 %	≤ 0.2 %
20– 200 µL	2– 200 µL	20 µL	± 2.5 %	≤ 0.7 %
		100 µL	± 1.0 %	≤ 0.3 %
		200 µL	± 0.6 %	≤ 0.2 %
100–1,000 µL	50–1,000 µL	100 µL	± 3.0 %	≤ 0.6 %
		500 µL	± 1.0 %	≤ 0.2 %
		1000 µL	± 0.6 %	≤ 0.2 %
500–5,000 µL	100–5,000 µL	500 µL	± 2.4 %	≤ 0.6 %
		2,500 µL	± 1.2 %	≤ 0.25 %
		5,000 µL	± 0.6 %	≤ 0.15 %
1– 10 mL	1– 10 mL	1,000 µL	± 3.0 %	≤ 0.6 %
	Standard	5,000 µL	± 0.8 %	≤ 0.2 %
		10,000 µL	± 0.6 %	≤ 0.15 %

**2.3 Research, multi-channel, adjustable volume (8- and 12-channel)**

Model	ep Tip	Volume	Systematic error (Inaccuracy)	Random error (Imprecision; CV)
0.5– 10 $\mu\text{L}$	0.5– 20 $\mu\text{L}$	1 $\mu\text{L}$	$\pm 8.0\%$	$\leq 5.0\%$
		5 $\mu\text{L}$	$\pm 4.0\%$	$\leq 2.0\%$
		10 $\mu\text{L}$	$\pm 2.0\%$	$\leq 1.0\%$
10– 100 $\mu\text{L}$	2– 200 $\mu\text{L}$	10 $\mu\text{L}$	$\pm 3.0\%$	$\leq 2.0\%$
		50 $\mu\text{L}$	$\pm 1.0\%$	$\leq 0.8\%$
		100 $\mu\text{L}$	$\pm 0.8\%$	$\leq 0.3\%$
30– 300 $\mu\text{L}$	20– 300 $\mu\text{L}$	30 $\mu\text{L}$	$\pm 3.0\%$	$\leq 1.0\%$
		150 $\mu\text{L}$	$\pm 1.0\%$	$\leq 0.5\%$
		300 $\mu\text{L}$	$\pm 0.6\%$	$\leq 0.3\%$

The technical data is valid only when the quoted Eppendorf pipette tips are used.

Tests carried out in accordance with ISO 8655 for piston-stroke pipettes with an air cushion using a fine balance with moisture trap approved by the standardization authorities.

**Note:** on the 1– 10 mL pipette, when the 1– 10 mL tip, long (see ordering information) is used, the quoted tolerance range increases by a factor of 2 compared to when the standard tip is used.

Number of determinations:

10 (for the multi-channel model: 10 per channel); degassed, bidistilled water, 20 °C – 25 °C, constant to  $\pm 0.5$  °C; with pre-wetted pipette tip; dispensing carried out on inner wall of vessel; for volumes  $\leq 10$   $\mu\text{L}$ , the test must be carried out upon removal from the weighing vessel, due to the risk of evaporation.

**3 Function principle**

The Research family of pipettes are piston-stroke pipettes that operate according to the air-cushion principle.

The Research family consists of fixed-volume pipettes, adjustable-volume pipettes and eight- and twelve-channel pipettes, which also have an adjustable volume setting.

All models belonging to the Research family have a separate ejector button.

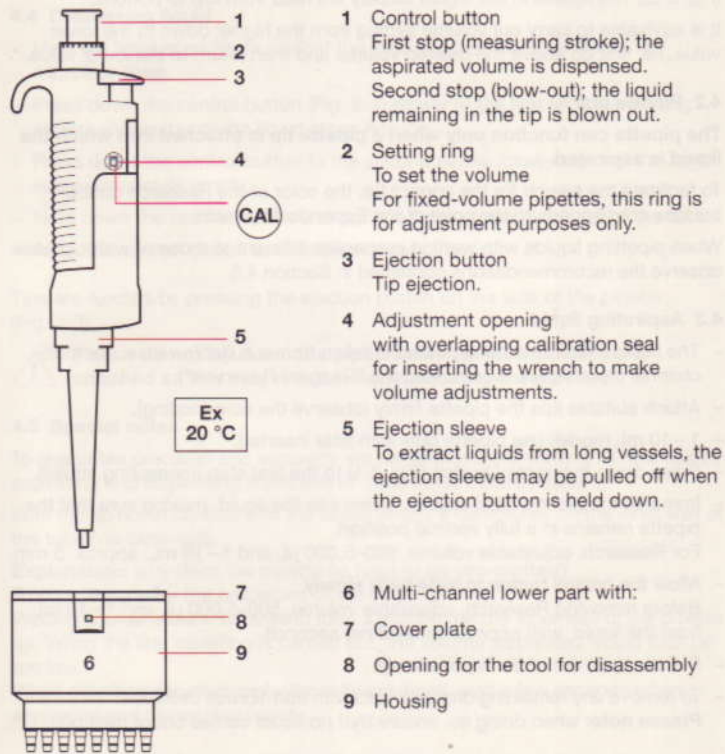
Each channel of the multi-channel model has its own piston, which means that it is possible to attach fewer than eight or twelve tips.

In addition, the lower part can be rotated into a user-defined position as required.



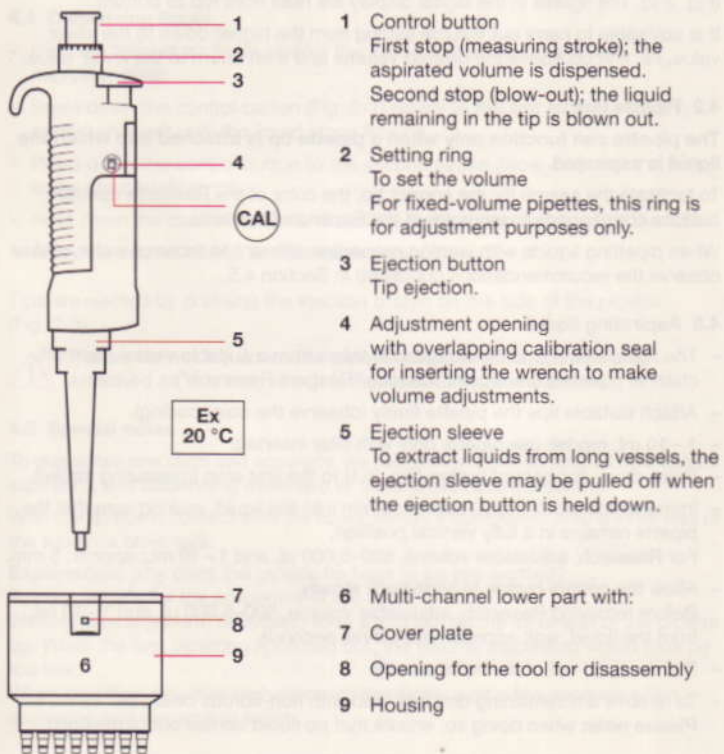
It is possible to switch between 8- and 12-channel manifolds within the same volume range.

Fig. 2 Research (single-channel) and multi-channel lower part



It is possible to switch between 8- and 12-channel manifolds within the same volume range.

Fig. 2 Research (single-channel) and multi-channel lower part



#### 4 Operation

##### 4.1 Volume setting (not valid for fixed-volume model)

The volume can be changed continuously by rotating the setting ring (Fig. 2-2). The figures in the digital display are read from top to bottom.

It is advisable to carry out volume setting from the higher down to the lower value. i.e. first go above the desired volume and then return to the lower value.

##### 4.2 Pipette tips

**The pipette can function only when a pipette tip is attached into which the liquid is aspirated.**

To facilitate the search for the correct tip, the color of the Research control buttons corresponds to the color of the Eppendorf tip racks.

When pipetting liquids with wetting properties different to those of water, please observe the recommendations contained in Section 4.5.

##### 4.3 Aspirating liquid

- The liquid which is to be aspirated is taken from a suitable vessel (for multi-channel pipettes, we recommend the "Reagent Reservoir").
  - Attach suitable tips the pipette firmly (observe the color coding).
  - 1 – 10 mL model: use pipette only with filter inserted.
  - Press down the control button (Fig. 2-1) to the first stop (measuring stroke).
  - Immerse the pipette tip(s) approx. 3 mm into the liquid, making sure that the pipette remains in a fully vertical position.  
For Research, adjustable volume, 500–5,000  $\mu\text{L}$  and 1 – 10 mL: approx. 5 mm.
  - Allow the control button to slide back **slowly**.  
Before removing Research, adjustable volume, 500–5,000  $\mu\text{L}$  and 1 – 10 mL from the liquid, wait approximately three seconds.
  - Pull the tip(s) out of the liquid **slowly**.
  - To remove any remaining droplets, dab with non-fibrous cellulose.
- Please note:** when doing so, ensure that no liquid comes out of the tip(s).

**Note:**

For Research, adjustable volume, 500–5,000  $\mu\text{L}$  and 1–10 mL: if the tip is removed from the liquid too quickly, coaxial forces may push liquid out of the tip. This may result in the pipetted volume being too low.

**4.4 Dispensing liquid**

- Hold the tip(s) at an angle against the inside wall of the tube/well of the microtiter plate.
- Press down the control button (Fig. 2-1) slowly to the first stop (measuring stroke) and wait until the liquid stops flowing.
- Press down the control button to the second stroke (blow-out) until the tip(s) is/are completely empty.
- Hold down the control button and pull the tip(s) up the inner wall of the tube.
- Allow the control button to slide back slowly.

Tips are ejected by pressing the ejection button on the side of the pipette (Fig. 2-3).



**Please do not lay down the pipette when a filled pipette tip is attached as this may result in liquid entering the pipette!**

**4.5 Special notes**

To guarantee precision and accuracy, we recommend pre-wetting all new tips by aspirating and dispensing liquid two or three times before pipetting.

With the tip not in contact with the liquid, empty it completely on the inner wall of the tube (via blow-out).

**Explanation:** why does the pipette tip have to be **pre-wetted**?

To compensate for the properties of the liquid.

Wetting liquids (serum, detergent) form a thin film on the inner wall of the pipette tip. When the first pipetting is carried out, the volume dispensed would thus be too low.

When pipetting serum or high-viscosity solutions, wait a few seconds when aspirating and dispensing liquid.

## 5 Testing / Calibration

The serial number is on the setting ring on the control button.

### 5.1 Testing

#### Research, single-channel

##### Volumes < 1 $\mu\text{L}$

we recommend the photometric test. Our brochure "Photometric test for testing the precision and accuracy of small volumes" is available upon request.

##### Volumes $\geq 1 \mu\text{L}$

for volumes  $\geq 1 \mu\text{L}$ , the test can be performed by weighing the volume using an analytical balance with a suitable level of sensitivity.



**The bidistilled water, weighing vessel, pipette and pipette tip must all be the same temperature!**

To calculate the volume, divide the weight by the density of the water (at 20 °C: 0.9982).

##### Volumes 1–10 $\mu\text{L}$

the test is performed by taking the volume from a weighed, water-filled tube.

##### Volumes > 10 $\mu\text{L}$

distilled water is dispensed from a pre-wetted tip into a tube and is then weighed.

#### Research, multi-channel

multi-channel pipettes are usually tested by dispensing the volume from a pre-wetted tip into a tube.

### 5.2 Calibration

#### 5.2.1 When should calibration be carried out?

The pipettes belonging to the Research family were tested during production in accordance with the test conditions for water listed in Section 2 and provided with a calibration seal at the factory.

In the case of doubts arising with regard to the accuracy of the pipetted volume the following points should be clarified prior to making any adjustments to the pipette:

- Is the pipette leaking? (This is one possible reason for dispensed volumes being too low; troubleshooting and solutions are contained in Sec. 7.)

- What is the temperature of the sample? (In open tubes, water at room temperature evaporates)
- What is the temperature of the pipette?
- What is the temperature of the air?
- Has mL been converted into  $\mu\text{L}$ ?
- Does the sample have a different density to that of water?
- Is the pipetting speed too high?

Assistance with these questions is contained in Eppendorf's SOP (Standard Operation Procedure), which is available upon request or can be downloaded from the Brinkmann website at [www.brinkmann.com](http://www.brinkmann.com)

**If these checks prove to be unsuccessful, it is safe to assume that the alignment of the pipette has altered (e.g. due to several components having been replaced).**

### 5.2.2 Follow-up calibration in the case of error

From a technical point of view, this is a zero-point shift. The value by which the setting of the pipette is shifted remains constant across the entire measuring range. If, for example, in the case of a 10–100  $\mu\text{L}$ , follow-up alignment of 1  $\mu\text{L}$  takes place at 100  $\mu\text{L}$  (=1 %), the pipette is also adjusted by 1  $\mu\text{L}$  at 10  $\mu\text{L}$  (= 10 %!)

- a The pipette, tip and water must all be the same temperature (20 – 25 °C, constant to  $\pm 0.5$  °C).
- b In the case of adjustable pipettes, the pipette is set to the nominal volume required.
- c With a pipette tip attached to the pipette, the desired volume is pipetted and weighed 10 times (for multi-channel pipettes, this is carried out for each channel). The mean of this weighing is converted into  $\mu\text{L}$  using the following formula:

$$\text{Volume} = \frac{\text{Weight}}{\text{Density of liquid}} \\ \text{(at the temperature specified)}$$

The value obtained is the actual setting (density of water at 20 °C: 0.9982).

- d To align to the volume displayed, side D (or side B with multi-channel pipettes) of the wrench is inserted horizontally through the calibration seal into the alignment opening (Fig. 2-4) in the pipette grip. (When doing so,

hold the pipette vertically.) The wrench is then rotated into a vertical position. The calibration seal is thereby destroyed and removed.

**e Research, adjustable-volume and multi-channel**

When the setting ring is rotated (either in the + or - direction), the piston stroke of the pipette is altered (although the volume-setting dial remains unchanged).

One rotation is equal to the following:

**Research, adjustable-volume**

0.1 – 2.5 $\mu\text{L}$ approx.	0.1 $\mu\text{L}$
0.5 – 10 $\mu\text{L}$ approx.	0.5 $\mu\text{L}$
2 – 20 $\mu\text{L}$ approx.	1 $\mu\text{L}$
10 – 100 $\mu\text{L}$ approx.	5 $\mu\text{L}$
20 – 200 $\mu\text{L}$ approx.	10 $\mu\text{L}$
100 – 1,000 $\mu\text{L}$ approx.	50 $\mu\text{L}$
500 – 5,000 $\mu\text{L}$ approx.	250 $\mu\text{L}$
1 – 10 mL approx.	510 $\mu\text{L}$

**Research, multi-channel**

0.5 – 10 $\mu\text{L}$ approx.	0.5 $\mu\text{L}$
10 – 100 $\mu\text{L}$ approx.	5 $\mu\text{L}$
30 – 300 $\mu\text{L}$ approx.	10 $\mu\text{L}$

**Research, fixed-volume**

To reduce the volume, turn the setting ring clockwise. To increase the volume, turn the setting ring counterclockwise.

One rotation is equal to the following:

**Research fix**

5 $\mu\text{L}$ approx.	0.8 $\mu\text{L}$	200 $\mu\text{L}$ approx.	38 $\mu\text{L}$
10 $\mu\text{L}$ approx.	0.8 $\mu\text{L}$	250 $\mu\text{L}$ approx.	38 $\mu\text{L}$
20 $\mu\text{L}$ approx.	0.8 $\mu\text{L}$	450 $\mu\text{L}$ approx.	38 $\mu\text{L}$
25 $\mu\text{L}$ approx.	4 $\mu\text{L}$	500 $\mu\text{L}$ approx.	38 $\mu\text{L}$
50 $\mu\text{L}$ approx.	4 $\mu\text{L}$	1,000 $\mu\text{L}$ approx.	38 $\mu\text{L}$
100 $\mu\text{L}$ approx.	4 $\mu\text{L}$		

- f Remove the wrench and move the setting ring backwards and forwards until the counter and the stroke system lock together.
- g Repeat step c). The readings must be within the tolerances specified in the technical data.

If the nominal volume does not correspond with the measuring result, repeat steps d) and e).

Since this adjustment affects the entire measuring range, it is imperative to check the other volumes of this pipette specified in the technical data.

Next, close the adjustment opening with one of the supplied calibration seals.

### 5.2.3 Adjustment for liquids with a density different to that of water

It is possible to adjust one **specific volume** of liquid with a density different to that of water in such a way that the volume displayed corresponds to the volume pipetted.

**All other values for the adjustable pipettes are now out of alignment, i.e. an adjustable-volume pipette has been converted into a fixed-volume pipette!**

Proceed as described in steps a) to g) of Section 5.2.2.



A pipette set in this way delivers a pipetting value that correlates with that in the display **only for the liquid used and for the volume tested!** For this reason, we recommend labeling the converted pipette as a **fixed-volume pipette** for "Solution y"!

The error for liquids with a higher vapor pressure (e.g. organic solvents) cannot be aligned in this way. In this case, we recommend using an Eppendorf positive-displacement pipette.

## 6 Care / sterilization

### 6.1 Care

Depending on the frequency of use, all pipettes should be cleaned in a soap solution or should be sterilized using 60 % Isopropanol. They should then be rinsed in distilled water and dried.

The seals are maintenance-free and the pistons should be lubricated lightly (using the silicone grease provided) when cleaned or replaced.

With the multi-channel model, the visible O-rings on the tip holder should be lightly lubricated after cleaning and then wiped using a lint-free cloth. Defective O-rings must be replaced (see Part B, "Maintenance").

Severe contamination caused by the liquid entering the pipette can be removed after the pipette has been disassembled (see Part B, "Maintenance").

In order to ensure the consistent quality of the pipettes, we recommend using the corresponding parts of the same generation (PhysioCare Concept + PhysioCare Concept, Standard + Standard\*).

\* please review old operating instructions



Visual differentiating features of PhysioCare Concept pipettes:



Single-channel



Black piston holder

Multi-channel



Black tip holder

**6.2 Sterilization**

The lower half of the pipette can be sterilized by means of steam-autoclaving (121 °C, 1 bar, 20 minutes).

It is recommended to allow the autoclaved parts to dry at room temperature. Do not re-assemble the pipette until it has cooled down completely.

**6.2.1 Single-channel model**

With single-channel models, the ejection sleeve (Fig. 1-12) and the lower part (Fig. 1-10) may be autoclaved.

To do so, hold down the ejection button and pull off the ejection sleeve, then unscrew the pipette's lower part (with pipettes up to 1,000 µL, this may require the assistance of opening A of the wrench provided).

**Variant 1 – 10 ml**

Pull filter (14) down out of the nose cone. The filter swells up slightly during autoclaving. Compress gently when reinserting. This does not impair function. Only autoclave filter 1x. Unscrew the complete lower part (10) from the grip by turning to the left, **not** turning the ejection sleeve (12) at the same time. The ejection sleeve comes out of its bracket automatically during turning and can be removed from the lower part.

**Single-channel, adjustable-volume  
500 – 5,000 µL**

The piston must be removed before the pipette's lower part can be unscrewed (see Part B, "Maintenance").

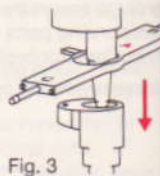


Fig. 3

**6.2.2 Multi-channel model**

With the multi-channel model, the complete lower part (Fig. 2-6) is placed into the autoclave.

To do so, hold down the ejection button and unscrew the lower part from the grip by rotating it counterclockwise.

All pipettes belonging to the Research family may be exposed to UV light. Any discoloration which may occur has no effect on the function of the pipette.

**7 Troubleshooting**

Error	Cause	Solution
Droplets on the inner wall of the pipette tip.	<ul style="list-style-type: none"> <li>- Uneven wetting of the plastic wall.</li> <li>- A pipette tip with poor wetting properties has been used.</li> </ul>	<ul style="list-style-type: none"> <li>- Attach a new pipette tip.</li> <li>- Use an original Eppendorf tip.</li> </ul>
Pipette is dripping and/or the volume pipetted is incorrect.	<ul style="list-style-type: none"> <li>- The tip is loose.</li> <li>- A poorly fitting pipette tip has been used.</li> <li>- Liquid with a high vapor pressure has been pipetted.</li> <li>- The tip was removed too quickly from the liquid.</li> <li>- The pipette is dripping because: piston is contaminated.</li> <li>- Piston is damaged.</li> <li>- Seal is damaged.</li> </ul>	<ul style="list-style-type: none"> <li>- Press the tip on firmly.</li> <li>- Use an original Eppendorf tip.</li> <li>- In this case, we recommend pipetting using a positive-displacement pipette.</li> <li>- Pull the tip slowly out of the liquid.</li> <li>- Clean and lightly lubricate the piston (Part B, "Maintenance").</li> <li>- Replace the piston and seal (Part B, "Maintenance").</li> <li>- Replace the seal; with the 500–5,000 <math>\mu\text{L}</math> and 1–10 mL model, replace the piston (Part B, "Maintenance").</li> </ul>

Error	Cause	Solution
Pipette is dripping and/or the volume pipetted is incorrect.	<ul style="list-style-type: none"> <li>- The pipette lower part is loose.</li> <li>For 500-5,000 <math>\mu\text{L}</math>/1-10 mL pipette:               <ul style="list-style-type: none"> <li>- Pipetting was too fast.</li> </ul> </li> <li>For multi-channel model:               <ul style="list-style-type: none"> <li>- The O-ring of the channel is damaged.</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>- Tighten the pipette lower part by hand.</li> <li>- Allow the control button to slide back slowly.</li> <li>- Replace defective O-ring (Part B, "Maintenance").</li> </ul>
The control button jams and does not move smoothly.	<ul style="list-style-type: none"> <li>- The piston is contaminated.</li> <li>- The seal is contaminated.</li> <li>- Solvent vapors have entered the pipette.</li> </ul>	<ul style="list-style-type: none"> <li>- Clean the piston and lubricate lightly (Part B, "Maintenance").</li> <li>- Remove the piston from the pipette lower part (Part B, "Maintenance"). Rinse out the lower part with warm water, then rinse with distilled water and allow to dry. Replace the seal if necessary.</li> <li>- Remove the piston from the lower part (Part B, "Maintenance") and aerate the lower part. Clean and lightly lubricate the piston.</li> </ul>
Pipette is blocked; too little liquid is aspirated.	<ul style="list-style-type: none"> <li>- Liquid has entered the nose cone and dried.</li> </ul>	<ul style="list-style-type: none"> <li>- Remove the piston from the pipette lower part (Part B, "Maintenance"). Rinse out the lower part with warm water, then rinse with distilled water and allow to dry.</li> </ul>

**Maintenance**

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**Please use only the accessories recommended by Eppendorf.**  
 Using spare parts and consumables that we have not recommended may reduce the precision, accuracy and life of the devices. We do not honor any warranty or accept any responsibility for damage resulting from such action.

For information on replacing pistons and seals as well as on disassembling and assembling the different members of the Research family, please refer to the fold-out cover at the front and back of this manual.

#### Single-channel pipettes

All maintenance work is carried out using this wrench.



Fig. 4

Opening A: to loosen the pipette lower part from the grip.

Side B: to replace the seals.

Side C: to replace the seals.

Side D: to align the pipette.

#### Multi-channel pipettes

All maintenance work is carried out using this tool.

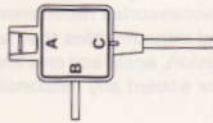


Fig. 5

Side A: to replace the O-rings on the nose cones.

Side B: to remove the lower housing, to loosen the metal clips, to remove the press piece and to align the pipette.

Side C: to replace the seals.


#### I. Single-channel model

Please open the fold-out cover (Fig. 1) at the front of this manual.

A general description of disassembly and assembly for all single-channel models is followed by instructions on how to replace specific parts for special pipette types.

**A Disassembly and assembly (Fig. 1 / point 1)**

## Disassembly

- Hold down the ejection button on the side of the pipette and pull off the ejection sleeve (12) using force.  
An exception is the 1 – 10 mL model:  
see Section B "Replacing pistons and seals".
- Unscrew the lower part of the pipette (10) from the grip by turning it to the left (if necessary, use position A of the wrench provided).
- Press the piston holder (1) together and remove it.  
 **The piston is subject to spring tension!**
- Remove the piston (3) with spring (4) and replace if necessary.

## Assembly

- Insert the piston (3) with spring (4) into the pipette lower part.
- Place the piston holder (1) over the piston, press it together and slide it into the grooves on the lower part.
- Screw the pipette lower part hand-tight into the grip. (Do not use the wrench.)
- Hold down the ejection button and re-attach the ejection sleeve.

**B Replacing pistons and seals**

For fixed- and adjustable-volume pipettes up to **20 µL** (see Fig. 1 / point 2):

- Disassemble the pipette.
- The seal is changed by replacing the entire pipette lower part (10).

For fixed- and adjustable-volume pipettes up to **100 µL** (see Fig. 1 / point 3):

- Disassemble the pipette.
- Using side B of the wrench, undo the screw (6) and tap out the internal spring (7).
- Press in side C of the wrench, pull out the seal and O-ring (8) and replace.
- Push the screw, followed by the spring, followed by the seal (with the O-ring facing downwards) onto side B of the wrench and then rotate it into the pipette lower part (do not over-tighten).

The pipette lower part (10) is also available as a complete unit, with seal.

Replacing the filling tube (13)

- Disassemble the pipette lower part.
- After removing the seal, push out the filling tube from below using the wire punch and push in a new tube from above. Replace the seal at the same time.

Research, adjustable-volume, **20 – 200  $\mu\text{L}$**  (see Fig. 1 / point 4):

- Disassemble the pipette.
- Undo the screw (6) using side C of the wrench.
- Tap out the spring (7), the press piece (9) and the seal (8). Replace the seal.
- Slide the centering aid (tube) over side C of the wrench. Push the screw, spring, press piece and new seal (in the order shown) on to the wrench and screw it into the lower part.

The pipette lower part (10) is also available as a complete unit, with seal.

Replacing the filling tube (13)

- Disassemble the pipette lower part.
- After removing the seal, push out the filling tube from below using the wire punch and push in a new tube from above.

Fixed- and adjustable-volume pipettes **up to 1,000  $\mu\text{L}$**  (see Fig. 1 / point 5):

- Disassemble the pipette.
- Undo the screw (6) using side C of the wrench.
- Tap out the spring (7), the press piece (9) and the seal (8). Replace the seal.
- Attach the spring to the new seal and then insert both parts, together with the screw, into the pipette lower part and tighten.

The pipette lower part (10) is also available as a complete unit, with seal.

Research, adjustable-volume, **500 – 5,000  $\mu\text{L}$**  (see Fig. 1 / point 6):

- The seal is changed by replacing the piston (6).
- Hold down the ejection button and pull off the ejection sleeve (12) using force.
- Unscrew the cylinder (11) by turning it to the left.
- Press and hold down the operating button and pull off the piston (3) using force.

- Slide the new piston onto the piston rod up to the stop.
- Screw the cylinder onto the cylinder attachment (5).

For autoclaving Research, adjustable-volume, 500 – 5,000  $\mu$ L:

- Remove the piston (3), as described above.
- Slide the disassembly aid over the cylinder attachment (5) and unscrew it from the pipette upper part by turning it to the left.
- After autoclaving, screw the cylinder attachment with the piston rod (2) and stroke spring (4) into the pipette upper part.
- Slide the piston (3) onto the piston rod up to the stop.
- Screw the cylinder onto the cylinder attachment.

Research variable 1 – 10 mL (see Fig. 1 / point 7):

the seal is changed by replacing piston (3).

- Pull filter (14) down out of the nose cone.
- Unscrew the complete lower part (10) from the grip by turning to the left, **not** turning the ejection sleeve (12) at the same time. The ejection sleeve comes out of its bracket automatically during turning and can be removed from the lower part.
- Pull the locking mechanism (5a), which is located on the cylinder attachment (5), off upwards.
- Unscrew cylinder (11) from the cylinder attachment (5) by turning to the left.
- Put the disassembly aid supplied over the cylinder attachment (5) from above and press down, which pushes the piston down at the same time.
- Keep the disassembly aid depressed on the cylinder attachment in the lowest position using your forefinger and thumb and use the other hand to pull off the piston (3) using force.
- Keep the disassembly aid depressed and push a new piston onto piston rod (2) up to the stop. Remove the disassembly aid.
- Screw cylinder (11) back up tightly so that the grooves of the cylinder and the cylinder attachment line up.
- Place locking device (5a) on cylinder attachment (5) from above so that the lugs extend into the grooves.



- Put ejection sleeve (12) on the lower part and hold steady.
- Push lower part of pipette (10) into grip with one hand, using the other to fix the ejection sleeve in position in its bracket.
- Screw up the lower part of the pipette firmly.
- Insert a new filter if necessary.

## II. Multi-channel model

### A Replacing the O-rings

- Hold down the ejection button on the side of the pipette and unscrew the lower part counterclockwise from the grip.
- Push opening A of the tool (suitable for the pipette size at hand) from below over the nose cones in such a way as to ensure that the sharp edge in the opening of the tool is overlapping with the O-ring (see Fig. 6).

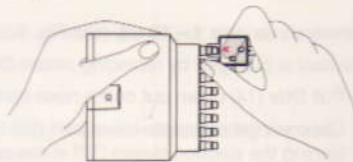


Fig. 6

- Using your index finger, press the tool from behind against the nose cone. Using your thumb, apply pressure from the other side.

The O-ring is severed at one point and can be removed from the nose cone.


Attaching a new O-ring

- Attach the assembly aid (shortened pipette tip) onto the nose cone.
- Slide the new O-ring over the tip and onto the nose cone.

### B Replacing the piston seals

Please open the fold-out cover at the back of this manual.


- Hold down the ejection key and unscrew the lower part (Fig. 2-6) counterclockwise from the grip.
- With the cone facing downwards, place the pipette lower part horizontally onto a table and press it down slightly.

- Press side B of the tool into the opening (Fig. 2-8) in the housing (Fig. 2-9).
  -  **The two stop hooks on the inside are depressed and the cover plate (Fig. 2-7) pops up!**
- Pull the housing off the cover plate.
- Hold the lower part firmly, as shown in Fig. 7.
- Press side B of the tool under the metal clip and slide it upwards. Lever the clip off the safety hook.
- Turn the lower part until the second clip is facing forwards. When doing so, grip the tip holder with your thumb (the tip holder is subject to spring tension). Lever off the second clip from the safety hook.
- Pull off the tip holder (Fig. 8).
- To **clean the piston**, pull off the springs (the pistons were deliberately loaded unevenly), wipe all pistons (with 60 % isopropanol as required) and lubricate lightly.
- Re-attach the springs and turn them slightly.
- Arrangement of the pistons:
 

<b>8-channel 0.5 – 10 µL</b>	Pistons 4 and 5
<b>8-channel 10 – 100 µL / 30 – 300 µL</b>	Pistons 3, 4 and 5
<b>12-channel 0.5 – 10 µL</b>	Pistons 6 and 7
<b>12-channel 10 – 100 µL / 30 – 300 µL</b>	Pistons 4, 5, 6 and 7

**Removing the seals**

- The tip holder contains the following for each channel: press piece, spring and spring plate, with the piston seal underneath (Fig. 9).
- To remove the seals, put your index finger onto the opening of the channel in the tip holder which contains the defective seal.

 **The press piece is under spring tension and may pop out during removal!**

**0.5 – 10 µL and 10 – 100 µL**

- Press the wire punch (side B) on the tool into the openings on the tip holder and slide the press piece upwards slightly. This loosens the press piece and it can be removed (Fig. 10).

**30 – 300 µL**

- Proceed as with the other sizes, The press piece is discarded.
- Using side C of the tool, pull out the spring, spring plate and seal (Fig. 11a) and replace the defective seal.

**Assembly**

**0.5 – 10 µL and 10 – 100 µL**

- Load side C of the tool with the press piece, then the spring, then the spring plate and then the seal. Re-insert side C into the tip holder and press it in (Fig. 11b). Make sure that the press piece is in the correct position.

**30 – 300 µL**

- Place a **new** press piece onto the tool and proceed as with the other sizes.

**For all sizes**

- The press piece locks into place in the opening of the tip holder.
- Slide the tip holder completely over the piston. When doing so, hold it as shown in Fig. 7.
- Using your thumb, press the first clip firmly upwards over the safety hook. Then rotate the lower part, pressing the tip holder against the upper part when doing so. Using your thumb, press the second clip firmly over the hook.
- Slide on the housing, press the stop hooks together slightly and press down the cover plate until it locks into place.



**After the spare parts have been inserted or any other interventions have been made, the pipette must be tested to see whether it is functioning correctly (calibration included).**

**If these instructions for eliminating faults prove to be unsuccessful, send the pipette to your authorized dealer for repair.**

In order to ensure the consistent quality of the pipettes, we recommend using the corresponding parts of the same generation (PhysioCare Concept + PhysioCare Concept, Standard + Standard\*).

\* please review old operating instructions

**I. Fixed-volume pipettes**

**Pipettes / spare parts**

Models:

5 µL	Light gray control button	022443003
10 µL	Yellow control button	022443054
20 µL	Yellow control button	022443101
25 µL	Yellow control button	022443151
50 µL	Yellow control button	022443208
100 µL	Yellow control button	022443259
200 µL	Blue control button	022443305
250 µL	Blue control button	022443356
450 µL	Blue control button	022443381
500 µL	Blue control button	022443402
1,000 µL	Blue control button	022443453
1	Piston mount (5 pcs.)	022476211
3	Pistons	
2 -	20 µL	022476271
10 -	100 µL	022476289
100 -	1,000 µL	022476327
4	Lifting spring	022476386
5 -	100 µL	022476378
200 -	1,000 µL	022476394
6	Screw	not sold separately
7	Spring	not sold separately
8	Seal	
10 -	100 µL, incl. (6), (7)	022475282
100 -	1,000 µL, incl. (6), (7)	022476467
10	Pipette lower part	
2 -	20 µL, incl. seal	022476670
10 -	100 µL, incl. (6), (7), (8), (13)	022476696
100 -	1,000 µL, incl. (6), (7), (8)	022476726
12	Ejection sleeve	
10 -	100 µL	022476491
200 -	1,000 µL	022476521

13 Reducing tube (5 pcs., 1 wire punch)	022476556
Wrench	022476581
Silicone grease for pistons, 60 g	022348501
Silicone grease for pistons, 2 g	022348515

**II. Adjustable-volume pipettes**

**Pipettes / spare parts**

<b>Models</b>		
0.1 – 2.5 $\mu$ L	Dark gray control button	022471856
0.5 – 10 $\mu$ L	Light gray control button	022471902
2 – 20 $\mu$ L	Yellow control button	022471953
10 – 100 $\mu$ L	Yellow control button	022472003
20 – 200 $\mu$ L	Yellow control button	022472054
100 – 1,000 $\mu$ L	Blue control button	022472101
500 – 5,000 $\mu$ L	Violet control button	022472151
1 – 10 mL	Turquoise control button	022472208
26 1 Piston mount (5 pcs.)	022476211	
27 2 Piston rod		
500 – 5,000 $\mu$ L	022476360	
1 – 10 mL	022476360	
28 3 Pistons		
0.1 – 2.5 $\mu$ L	022476220	
0.5 – 10 $\mu$ L	022476254	
2 – 20 $\mu$ L	022476271	
10 – 100 $\mu$ L	022476289	
20 – 200 $\mu$ L	022476301	
100 – 1,000 $\mu$ L	022476327	
500 – 5,000 $\mu$ L	022476343	
1 – 10 mL	022476351	
29 4 Lifting spring		
0.1 – 2.5 $\mu$ L	022476378	
0.5 – 10 $\mu$ L	022476378	
2 – 20 $\mu$ L	022476378	
10 – 100 $\mu$ L	022476378	
20 – 200 $\mu$ L	022476378	
100 – 1,000 $\mu$ L	022476394	
500 – 5,000 $\mu$ L	022476408	
1 – 10 mL	022476408	

5	Cylinder mount	
	500 – 5,000 $\mu$ L	022476424
	1 – 10 mL	022476416
6	Screw	not sold separately
7	Spring	not sold separately
8	Seal	
	10 – 100 $\mu$ L, incl. (6), (7)	022475282
	20 – 200 $\mu$ L, incl. (6), (7), (9), centering aid	022476441
	100 – 1,000 $\mu$ L, incl. (6), (7)	022476467
9	Press piece	not sold separately
10	Pipette lower part	
	0.1 – 2.5 $\mu$ L, incl. seal	022476629
	0.5 – 10 $\mu$ L, incl. seal	022476653
	2 – 20 $\mu$ L, incl. seal	022476670
	10 – 100 $\mu$ L, incl. (6), (7), (8), (13)	022476696
	20 – 200 $\mu$ L, incl. (6), (7), (8), (9), (13)	022476700
	100 – 1,000 $\mu$ L, incl. (6), (7), (8)	022476726
	500 – 5,000 $\mu$ L, incl. (2), (3), (4), (5), (11)	022476742
	1 – 10 mL, incl. (2), (3), (4), (5), (5a), (11)	022476114
11	Cylinder	not sold separately
12	Ejection sleeve	
	0.1 – 2.5 $\mu$ L	022476483
	0.5 – 10 $\mu$ L	022476491
	2 – 20 $\mu$ L	022476491
	10 – 100 $\mu$ L	022476491
	20 – 200 $\mu$ L	022476505
	100 – 1,000 $\mu$ L	022476521
	500 – 5,000 $\mu$ L	022476548
	Ejector	
	1 – 10 mL	022476611
13	Reducing tube (5 pcs., 1 wire punch )	
	10 – 100 $\mu$ L	022476556
	20 – 200 $\mu$ L	022476564
14	Filter (50 pcs. in bag)	022472305
	Wrench	022476581
	Silicone grease for piston, 60 g	022348507
	Disassembly aid (for 500 – 5,000 $\mu$ L and 1 – 10 mL)	022476602

## III. Multi-channel pipettes

## Pipettes/spare parts

## 8-channel:

0.5 – 10 $\mu$ L Control button light gray	022452002
10 – 100 $\mu$ L Control button yellow	022452029
30 – 300 $\mu$ L Control button yellow	022452045

## 12-channel:

0.5 – 10 $\mu$ L Control button light gray	022452061
10 – 100 $\mu$ L Control button yellow	022452088
30 – 300 $\mu$ L Control button yellow	022452100

## Lower part, 8-channel:

0.5 – 10 $\mu$ L, cpl.	022453882
10 – 100 $\mu$ L, cpl.	022453904
30 – 300 $\mu$ L, cpl.	022453921

## Lower part, 12-channel:

0.5 – 10 $\mu$ L, cpl.	022453947
10 – 100 $\mu$ L, cpl.	022453963
30 – 300 $\mu$ L, cpl.	022453980

## Tool

0.5 – 10 $\mu$ L, cpl.	022456890
10 – 100 $\mu$ L, cpl.	022467034
30 – 300 $\mu$ L, cpl.	022456911

1 set of O-rings for nose cones, 24 pcs.,  
for 100 and 300  $\mu$ L

022456351

## Piston seals

(incl. press piece, piston seals, spring, spring plate)

0.5 – 10 $\mu$ L, cpl.	022456539
10 – 100 $\mu$ L, cpl.	022467212
30 – 300 $\mu$ L, cpl.	022456555

Reagent Reservoir, for extracting reagents;  
individually autoclavable

1 set (10 Reagent Reservoir and 10 lids)

022265806

Silicone grease, 60 g

022458507

## IV. Pipette holder

Adapter <b>only</b> for pipette carousel 4807 (old)	
Adapter for pipette clamp (for Research 500 – 5,000 $\mu$ l)	022472178
Adapter for pipette clamp (for Research multi-channel)	022455311
Research carousel stand	
Research carousel stand, incl. 6 pipette supports	022444905
Research pipette holder (replacement for stand)	022260588
Research pipette wall mount	022444913

## V. Pipette tips

## epT.I.P.S.

(The packaging units stated represent the minimum ordering quantity).

	Color code	Order no.
<b>Bulk</b> , in bags, 2x 500=1000 tips		
0.1 – 10 $\mu$ L	anthracite	022492004
0.1 – 20 $\mu$ L	dark gray	022492012
0.5 – 20 $\mu$ L L	light gray	022492021
2 – 200 $\mu$ L	yellow	022492039
20 – 300 $\mu$ L	orange	022492047
50 – 1,000 $\mu$ L	blue	022492055
500 – 5,000 $\mu$ L (500 tips)	violet	022492080
1 – 10 mL, standard (200 tips)	turquoise	022492098
1 – 10 mL, long (200 tips)	turquoise	022492101
<b>Set</b> , 1 box, incl. 5x96 tips		
0.1 – 10 $\mu$ L	anthracite	022491407
0.1 – 20 $\mu$ L	dark gray	022491415
0.5 – 20 $\mu$ L L	light gray	022491423
2 – 200 $\mu$ L	yellow	022491431
20 – 300 $\mu$ L	orange	022491440
50 – 1,000 $\mu$ L	blue	022491458
<b>Reloads</b> , 10x96=960 tips		
0.1 – 10 $\mu$ L (in stacks)	anthracite	022491504
0.1 – 20 $\mu$ L	dark gray	022491512
0.5 – 20 $\mu$ L L	light gray	022491521
2 – 200 $\mu$ L (in stacks)	yellow	022491539
20 – 300 $\mu$ L	orange	022491547
50 – 1,000 $\mu$ L	blue	022491555



	Color code	Order no.
<b>Reloads PCR-clean, 10x96=960 tips</b>		
0.1 – 10 µL (in stacks)	anthracite	022491709
0.1 – 20 µL	dark gray	022491717
0.5 – 20 µL L	light gray	022491725
2 – 200 µL (in stacks)	yellow	022491733
20 – 300 µL	orange	022491741
50 – 1,000 µL	blue	022491750
<b>Box, 1 box plus 96 tips</b>		
0.1 – 10 µL	anthracite	022491300
0.1 – 20 µL	dark gray	022491318
0.5 – 20 µL L	light gray	022491326
2 – 200 µL	yellow	022491334
20 – 300 µL	orange	022491342
50 – 1,000 µL	blue	022491351
500 – 5,000 µL (24 tips)	violet	022491385
<b>Racks, plus 10x96=960 tips</b>		
0.1 – 10 µL	anthracite	022491903
0.1 – 20 µL	dark gray	022491911
0.5 – 20 µL L	light gray	022491920
2 – 200 µL	yellow	022491938
20 – 300 µL	orange	022491946
50 – 1,000 µL	blue	022491954
500 – 5,000 µL (120 tips)	violet	022491989
<b>Racks PCR-clean, plus 10x96=960 tips</b>		
0.1 – 10 µL	anthracite	022491806
0.1 – 20 µL	dark gray	022491814
0.5 – 20 µL L	light gray	022491822
2 – 200 µL	yellow	022491831
20 – 300 µL	orange	022491849
50 – 1,000 µL	blue	022491857
500 – 5,000 µL (120 tips)	violet	022491881
<b>Racks, sterile, plus 10x96=960 tips</b>		
0.1 – 20 µL	dark gray	022492250
2 – 200 µL	yellow	022492276
20 – 300 µL	orange	022492284
50 – 1,000 µL	blue	022492292
100 – 5,000 µL (240 tips)	violet	022492314

	Color code	Order no.
<b>Racks Eppendorf Biopur</b> , colorless, sterile, pyrogen-free, DNA-free, RNase-free, ATP-free, 5x96=480 tips		
0.1 – 20 µL	dark gray	022491067
2 – 200 µL	yellow	022491083
20 – 300 µL	orange	022491091
50 – 1,000 µL	blue	022491105
1 – 10 mL standard (120 tips)	turquoise	022491164
<b>Singles (Eppendorf Biopur)</b> , colorless, pyrogen-free, DNA-free, RNase-free, ATP-free, individually wrapped, 100 pcs.		
0.1 – 20 µL	dark gray	022491130
2 – 200 µL	yellow	022491148
50 – 1,000 µL	blue	022491158
<b>Filter</b> , sterile, PCR-clean, in racks, 10x96=960 tips		
0.1 – 10 µL S	anthracite	022491202
0.1 – 10 µL M	dark gray	022491211
0.5 – 10 µL L	light gray	022491229
2 – 20 µL	yellow	022491270
2 – 100 µL	yellow	022491237
20 – 300 µL	orange	022491245
50 – 1,000 µL	blue	022491253
1 – 10 mL long (100 pcs.) individually blister-packed	turquoise	022491288
<b>GELoader® tips</b> (f. 0.5–10 µL)		
1 set = 200 tips	light gray	022351656

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