

Applications of the Eppendorf 5.0 mL system

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Abstract

The new Eppendorf Tube 5.0 mL is a practical alternative for sample volumes in the range between 2 and 5 mL. It provides comfortable and ergonomic handling, combined with a lower risk of contamination. Compared with aliquoting the sample into several smaller tubes, considerably less work is required. Owing to its conical shape, which is akin to that of a 15 mL tube, it can be easily integrated into many existing workflows. Simultaneously, an extensive collection of accessories is now available, providing the basis for safe performance of standard applications such as pipetting, centrifugation, mixing, temperature control and storage.



Figure 1: Eppendorf 5.0 mL system: Centrifuge 5430 with rotor FA-45-16-17, ThermoMixer® C with 5 mL exchangeable thermoblock, 5 mL Rack and Storage Box

Introduction

Tubes in the small volume range between 0.5 and 2.0 mL have been established as standard vessels for preparation and storage of samples in molecular and cell biological applications. For larger sample amounts, 15 mL and 50 mL screw cap tubes are the standard choice. In cases where the volume falls between 2 mL and 5 mL, the sample may be divided among several smaller tubes. However, the handling of double or triple the number of tubes increases the workload considerably, as well as increasing the need for space in instruments and racks. On the other hand, the use of 15 mL conical tubes presents with more difficult handling. The separate screw cap, along with the necessary deep insertion of the pipette into the tube, carries an increased risk of contamination. For this reason, longer serological pipettes, or pasteur pipettes, are employed in tissue culture, where 15 mL tubes are often used to passage cells.

While tubes between 2.0 and 15 mL are available, features which are critical for laboratory use are frequently lacking, e.g. high centrifugation stability or a secure seal. Furthermore, carrying out standard protocols may prove difficult, as they are hardly compatible with current laboratory equipment such as centrifuges, mixers and racks.

A new alternative is presented by the Eppendorf Tube 5.0 mL. With its size, it closes the gap between currently available vessel types and thus enables practical handling of sample volumes up to 5 mL. The equipment required for important laboratory applications is also available (Fig. 1). In addition, the bottom shape of the 5 mL tube resembles that of a typical 15 mL conical tube, so that many current laboratory instruments and accessories may be easily used either directly, or with the help of adapters. Like other Eppendorf Tubes®, it is made from the material polypropylene, thus featuring high chemical resistance as well as high thermal and mechanical stability [1].

>> Introduction

In addition to variants made from Eppendorf LoBind® material and the proven purity grades of Tubes (Eppendorf Quality, PCR clean, Eppendorf Biopur®), it is also available in the purity grade “Sterile”, which is additionally tested to be pyrogen-free. It is thus ideally suited for a large variety of methods in the areas of cell and bacterial culture, as well as for work with nucleic acid or protein samples.

This Application Note informs about the use of the Eppendorf Tube 5.0 mL in the areas centrifugation, liquid handling, mixing and temperature control, as well as storage. Other compatible Eppendorf products, along with possible uses, will be demonstrated.

Areas of application

1. Centrifugation

1.1. Centrifugation stability

All variants of the Eppendorf Tube 5.0 mL (including sterile and LoBind tubes) are highly stable up to 25,000 x g*, thus enabling the performance of centrifugation steps in a safe and time-saving manner.

1.2. Use in Eppendorf Centrifuges

The 5 mL tube is compatible with all current Eppendorf Centrifuges which accommodate tubes larger than the 1.5/2.0 mL format. For this purpose, rotors specifically designed for the Tube 5.0 mL (Fig. 2) and adapters (Fig. 3 and 4) are available. In addition, one universal adapter allows for the tube to be centrifuged in rotors, or adapters, respectively, designed for conical 15 mL tubes. Table 2 lists all details pertaining to compatibility with respective Eppendorf products.

*Experimental conditions: 45° fixed-angle rotor at 40 °C with aqueous saline solution (density 1.0 g/mL) and 90 min.



Figure 2: Rotor FA-45-12-17 (Centrifuge 5427 R) for 12 Eppendorf Tubes 5.0 mL

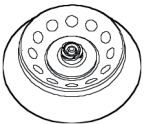

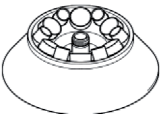


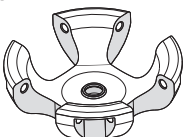

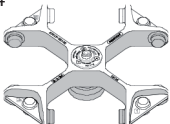


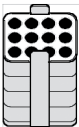
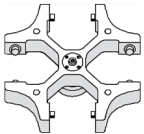
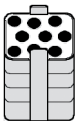


Figure 3: Rotor S-4-72 (Centrifuges 5804/5804 R and 5810/5810 R) with modular adapter for round buckets accommodating 8 Eppendorf Tubes 5.0 mL each

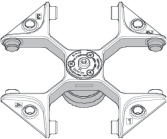
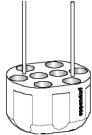
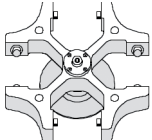
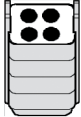

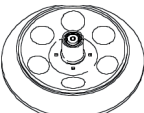






Figure 4: a) Rotor FA-45-6-30 (Centrifuges 5804/5804 R and 5810/5810 R) for 6 tubes with adapter for 50 mL bore. b) Adapter for 50 mL bore

Table 2: Compatibility of the Eppendorf Tubes 5.0 mL with Eppendorf Centrifuges and Rotors

Rotor	Adapter*	Number of tubes per adapter/rotor	Max. g-force
Centrifuge 5427 R			
FA-45-12-17 (Fig. 2)	Not required	- / 12	20,600
			
Centrifuge 5430/5430 R			
FA-45-16-17 (Fig. 1)	Not required	- / 16	21,191
			
F-35-6-30	Adapter for large bore	1 / 6 (12**)	7,129
			
	Adapter for small bore	1 / 6 (12**)	6,237
			
Centrifuge 5702/5702 R/5702 RH			
A-4-38	Adapter for round bucket	1 / 4	2,943
			
Centrifuge 5810/5810 R			
S-4-104	Modular adapter for 750 mL round bucket	14 / 56	3,214
			
A-4-81	Modular adapter for 500 mL rectangular bucket***	12 / 48	3,100
			
A-4-62	Modular adapter for 250 mL rectangular bucket***	9 / 36	3,150
			

>> Table 2: Compatibility of the Eppendorf Tubes 5.0 mL with Eppendorf Centrifuges and Rotors

Rotor	Adapter*	Number of tubes per adapter/rotor	Max. g-force
Centrifuge 5804/5804 R and 5810/5810 R			
S-4-72 (Abb. 3)	Modular adapter for 250 mL round bucket	8 / 32	3,215
			
A-4-44	Modular adapter for 100 mL rectangular bucket***	4 / 16	4,300
			
FA-45-20-17	Not required	20	20,913
			
F-34-6-38	Adapter	1 / 6	14,150 (5810 R: 16,824)
			
FA-45-6-30	Adapter	1 / 6	16,369 (5810 R: 19,806)
			
Eppendorf Centrifuges for conical 15 mL screw cap tubes			
Rotors for conical 15 mL tubes	Universal adapter for rotor bores or adapters made for 15 mL tubes	1 / variable	variable
			

* Tubes should not be centrifuged without an adapter in a rotor specified for different tube types.

** When "large" and "small" adapters are used together.

*** For use of these modular adapters with the Tubes 5.0 mL the upper two modular elements are removed.

2. Liquid Handling

2.1. Use for manual liquid handling with Eppendorf pipettes and dispensers

With the use of relatively narrow and deep containers, the pipette cone needs to be partially inserted into the tube in order to remove the sample or supernatant of pellets entirely. The deeper the pipette reaches into the tube, the higher the probability for contact with the inner wall and, therefore, the risk of contamination. This way, sample material originating from one tube can easily be transferred to another. For this reason it is advantageous to choose, for volumes up to 5 mL, a tube which is as short as possible. It will simplify handling and increase safety.

A comparison in handling between the Eppendorf Tube 5.0 mL and a conical 15 mL tube is shown in Figure 5. In addition, Table 3 provides an overview of the sizes of epT.I.P.S.[®] and Combitips[®] which reach the bottom of the tube and at the same time may be inserted in such a way that sample or supernatant is removed in its entirety, without contamination.

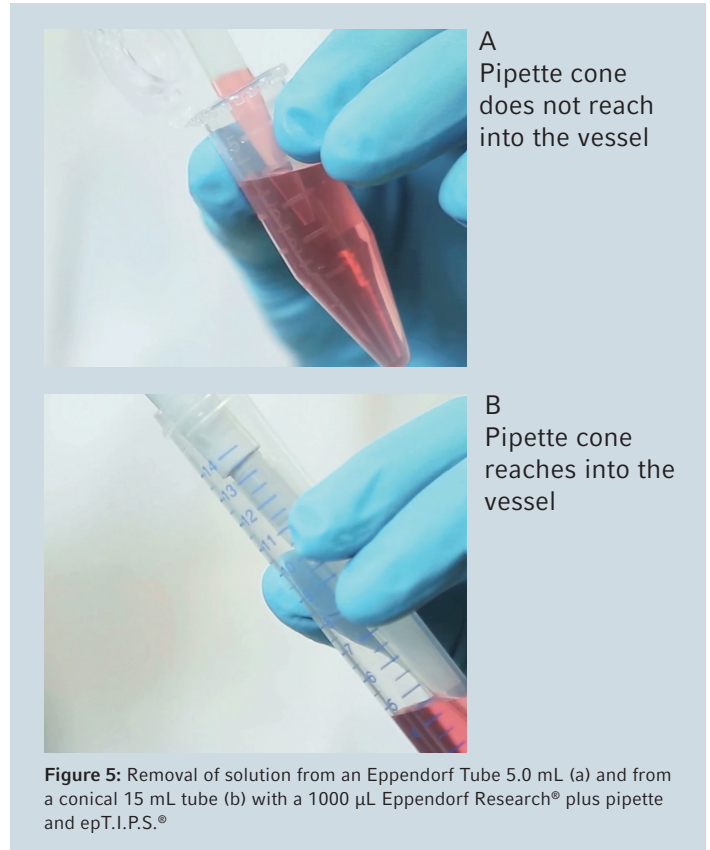


Figure 5: Removal of solution from an Eppendorf Tube 5.0 mL (a) and from a conical 15 mL tube (b) with a 1000 µL Eppendorf Research[®] plus pipette and epT.I.P.S.[®]

Table 3: Compatibility* of the Eppendorf Tube 5.0 mL with Eppendorf pipettes and dispensing systems compared to the 15 mL conical tube

Eppendorf Liquid Handling Systems	Eppendorf Tube 5.0 mL	Conical 15 mL tube
Eppendorf Pipettes with epT.I.P.S.	300 µL epT.I.P.S. and up	2.5 mL epT.I.P.S. and up
Eppendorf Multipettes (Repeaters) with Combitips [®]	Combitips plus [®] : 0.1 mL – 5 mL Combitips advanced [®] : 0.1 mL – 5 mL	Combitips plus: - Combitips advanced: 2.5 mL + 5.0 mL

* Compatibility is defined here as touching the bottom of the tube with only the consumable (tip, Combitip) reaching inside the tube.

2.2. Use for automated liquid handling with the Eppendorf epMotion[®]

Accessories for the use of the 5 mL tube are also available for the automated pipetting system epMotion: Four Eppendorf Tubes 5.0 mL may be inserted into the module, and the reservoir accommodates three of these modules (Fig. 6).

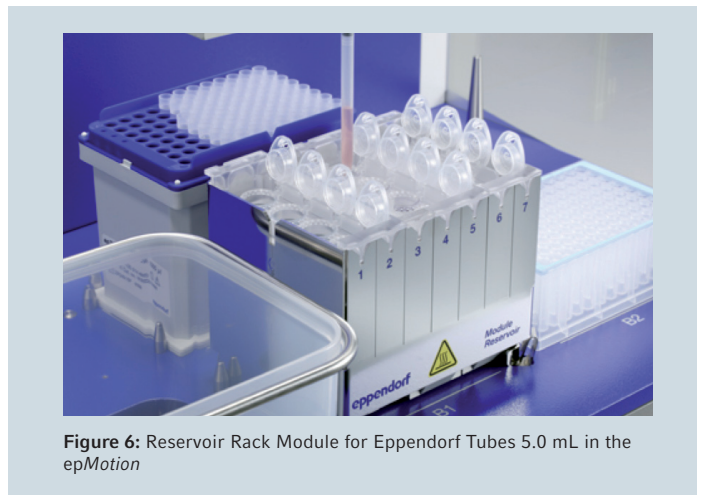


Figure 6: Reservoir Rack Module for Eppendorf Tubes 5.0 mL in the epMotion

3. Mixing and temperature control

Eppendorf offers different instruments for mixing and/or temperature control of samples in tubes and plates. For the Tube 5.0 mL, appropriate thermoblocks are available (Fig. 7 + 8). Table 4 shows the compatibility of this tube with the respective instruments and the resulting methods.

Temperature range of Eppendorf Tubes 5.0 mL is -86 °C to 80 °C. For incubation up to 100 °C the Tube Clip must be used to prevent tubes from opening.



Figure 7: Exchangeable thermoblock 5.0 mL for Thermomixer comfort and ThermoStat plus



Figure 8: ThermoMixer C with SmartBlock 5.0 mL

Table 4: Application options for the Eppendorf Tube 5.0 mL with Eppendorf instruments for mixing and temperature control

Instrument	Block	Capacity	Methods
Thermomixer compact (Thermomixer)		Not compatible (suitable for 1.5 mL tubes only)	
Thermomixer comfort (Thermomixer R)	Exchangeable thermoblock 5.0 mL	8 tubes	Heating, mixing, cooling (max. 750 rpm)
ThermoMixer C	SmartBlock 5.0 mL	8 tubes	Heating, mixing, cooling (max. 1000 rpm)
ThermoMixer F1.5		Not compatible (suitable for 1.5 mL tubes only)	
ThermoMixer FP		Not compatible (suitable for plates only)	
ThermoStat plus	Exchangeable thermoblock 5.0 mL	8 tubes	Heating, cooling
ThermoStat C	SmartBlock 5.0 mL	8 tubes	Heating, cooling
MixMate®		May be used with vortex function only	

4. Storage

Since the lower part of the Tube 5.0 mL is akin to that of conical 15 mL tubes, the Eppendorf Tube 5.0 mL is easily used in combination with a variety of existing standard laboratory accessories. This is also true for racks and storage boxes. For use on the laboratory bench, Eppendorf offers a rack for the 5.0 mL tubes, with 16 place-capacity (Fig. 9). Conical 15 mL tubes can also be accommodated. Also available is a box for storage of these tubes in the refrigerator or freezing to -86 °C (Fig. 9). It is 67 mm high, with a capacity for 25 tubes, and it was designed specifically for the 5 mL tubes. Thus, samples with a volume between 2 mL and 5 mL may be stored efficiently.



Figure 9: Racks and Storage Boxes for Eppendorf Tubes 5.0 mL

Literature

[1] Application Note 56: The best material for original Eppendorf Tubes® and Plates: Properties and chemical resistance of polypropylene. (www.eppendorf.com)

Ordering information

Description	Order no. international	Order no. North America
Eppendorf Tubes® 5.0 mL, Eppendorf Quality , 200 tubes (2 bags of 100 pcs.)	0030 119.401	0030119401
Eppendorf Tubes® 5.0 mL, PCR clean , 200 tubes (2 bags of 100 pcs.)	0030 119.460	0030119460
Eppendorf Tubes® 5.0 mL, Sterile , 200 tubes (10 bags of 20 pcs.)	0030 119.487	0030119487
Eppendorf Tubes® 5.0 mL, Eppendorf Biopur® , 50 tubes (individually wrapped)	0030 119.479	0030119479
Eppendorf Protein LoBind Tubes 5.0 mL, PCR clean , 100 tubes (2 bags of 50 pcs.)	0030 108.302	0030108302
Eppendorf DNA LoBind Tubes 5.0 mL, PCR clean , 200 tubes (4 bags of 50 pcs.)	0030 108.310	0030108310
Starter Pack Eppendorf Tubes® 5.0 mL, PCR clean , 400 tubes (2 packs with 2 bags each of 100 pcs.), 2 racks (16 spaces), blue and white, 8 universal adapters for rotors with bore for 15 mL conical vessels	0030 119.380	0030119380
Tube Clip 5.0 mL , 10 pcs., secures lid for boiling	0030 119.509	0030119509
Rack 5.0 mL (16-place-capacity) , 2 pcs., blue and white, also fits conical screw cap tubes 15 mL	0030 119.495	0030119495
Storage Box 5.0 mL (25-place-capacity) , 2 pcs., 5x5 grid, blue and red, made from polypropylene, for freezing to -86 °C, with lid and alpha-numerical coding, height 67 mm	0030 127.943	0030127943
Centrifuge 5427 R: Rotor Rotor FA-45-12-17, for 12 x Eppendorf Tubes® 5.0 mL, up to 20,600 x g, aerosol-tight Eppendorf QuickLock® lid	5409 700.006	5409700006
Centrifuge 5430/5430 R: Rotore and adapter Rotor FA-45-16-17, for 16 x Eppendorf Tubes® 5.0 mL, up to 21,191 x g, aerosol-tight Eppendorf QuickLock® lid	5427 750.002	5427750002
Adapter for Rotor F-35-6-30 (large bore), 2 pcs., for 2 x Eppendorf Tubes® 5.0 mL, up to 7,129 x g	5427 747.001	5427747001
Adapter for Rotor F-35-6-30 (small bore), 2 pcs., for 2 x Eppendorf Tubes® 5.0 mL, up to 6,237 x g	5427 746.005	5427746005
Centrifuge 5702/5702 R/5702 RH: Adapter Adapter for Rotor A-4-38, 2 pcs., for 2 x Eppendorf Tubes® 5.0 mL, up to 2,943 x g	5702 733.008	5702733008
Centrifuge 5804/5804 R and 5810/5810 R: Rotor and adapter Rotor FA-45-20-17, for 20 x Eppendorf Tubes® 5.0 mL, up to 20,913 x g, aerosol-tight QuickLock lid	5820 765.003	5820765003
Adapter for Rotor F-34-6-38, 2 pcs., for 2 x Eppendorf Tubes® 5.0 mL, up to 16,824 x g (with 5810R)	5804 777.000	5804777000
Adapter for Rotor F-45-6-30, 2 pcs., for 2 x Eppendorf Tubes® 5.0 mL, up to 19,806 x g (with 5810R)	5820 730.005	5820730005
Adapter for Rotor A-4-44, 2 pcs., for 15 mL Falcon® (suitable for 8 x Eppendorf Tubes® 5.0 mL, up to 4,300 x g)	5804 755.006	022637606
Adapter for Rotor S-4-72, 2 pcs., for 16 x Eppendorf Tubes® 5.0 mL, up to 3,215 x g	5804 793.005	5804793005
Centrifuge 5810/5810 R: Adapter Adapter for Rotor S-4-104, 2 pcs., for 28 x Eppendorf Tubes® 5.0 mL, up to 3,214 x g	5825 739.000	5825739000
Adapter for Rotor A-4-81, 2 pcs., for 15 mL Falcon® (suitable for 24 x Eppendorf Tubes® 5.0 mL, up to 3,100 x g)	5810 722.004	022638742
Adapter for Rotor A-4-62, 2 pcs., for 15 mL Falcon® (suitable for 18 x Eppendorf Tubes® 5.0 mL, up to 3,150 x g)	5810 755.000	022638289
Centrifuges with rotors for conical screw cap tubes 15 mL: Universal adapter Universal adapter, 8 pcs., for 8 x Eppendorf Tubes® 5.0 mL	5820 732.008	5820732008
Thermomixer® comfort and ThermoStat plus: Exchangeable thermoblock , for 8 x Eppendorf Tubes® 5.0 mL	5309 000.333	5309000333
ThermoMixer® C and ThermoStat C: Eppendorf SmartBlock™ 5.0 mL , for 8 x Eppendorf Tubes® 5.0 mL	5309 000.007	5309000007
epMotion®: Reservoir Rack module , for 4 x Eppendorf Tubes® 5.0 mL	5075 799.340	5075799340

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