

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

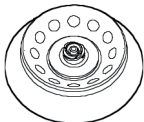

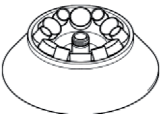


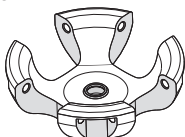

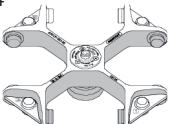


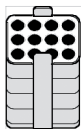
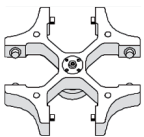
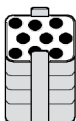


Figure 3: Rotor S-4-72 (Centrifuges 5804/5804 R and 5810/5810 R) with modular adapter for round buckets accommodating 8 Eppendorf Tubes 5.0 mL each

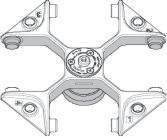
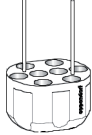
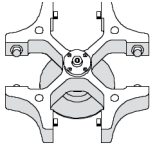
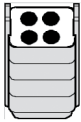

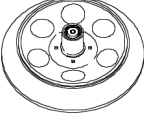






Figure 4: a) Rotor FA-45-6-30 (Centrifuges 5804/5804 R and 5810/5810 R) for 6 tubes with adapter for 50 mL bore. b) Adapter for 50 mL bore

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.

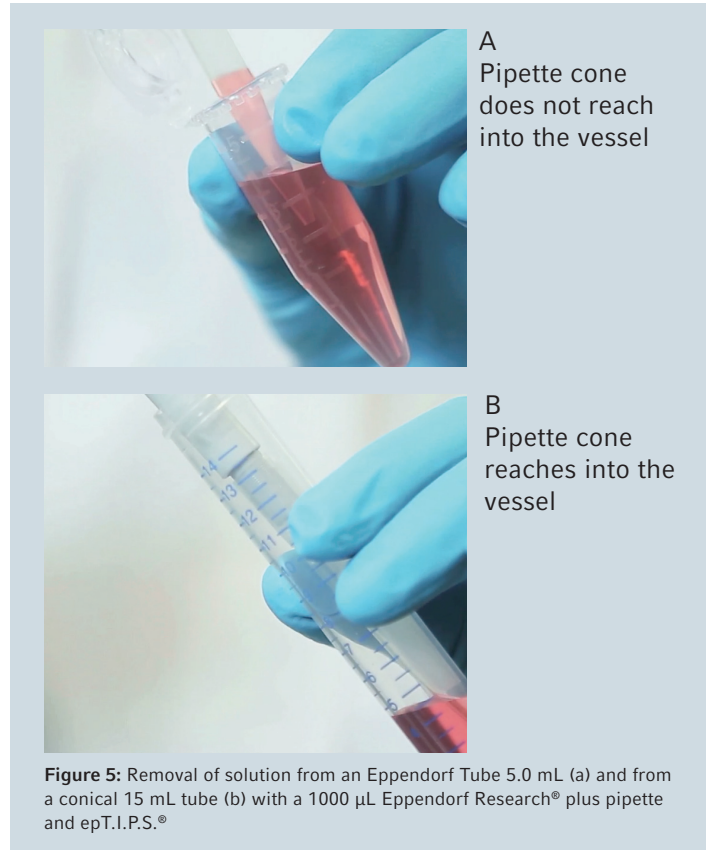


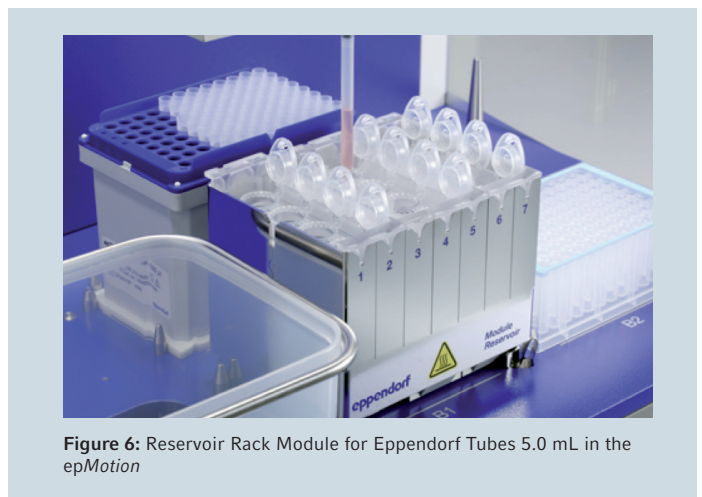
Table 3: Compatibility* of the Eppendorf Tube 5.0 mL with Eppendorf pipettes and dispensing systems compared to the 15 mL conical tube

| 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).



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.

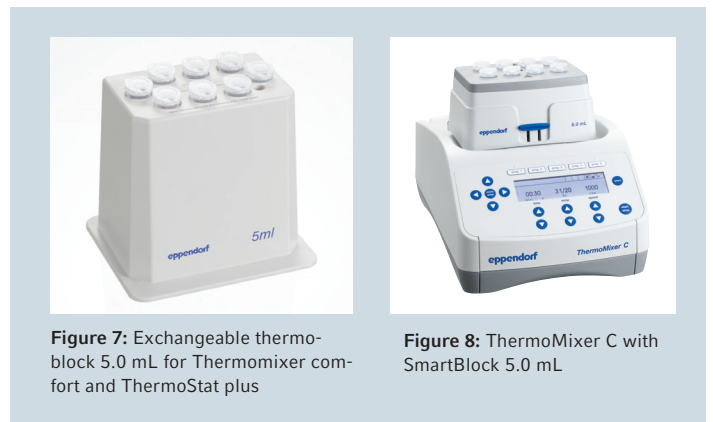


Figure 7: Exchangeable thermoblock 5.0 mL for Thermomixer comfort and ThermoStat plus

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.

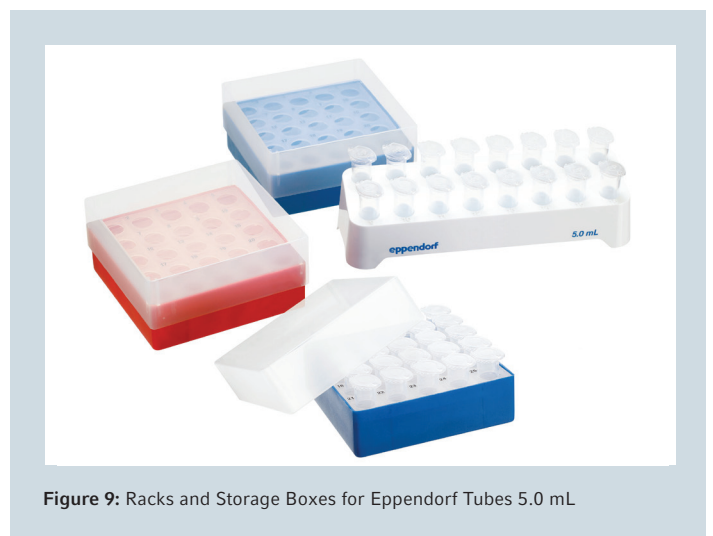


Figure 9: Racks and Storage Boxes for Eppendorf Tubes 5.0 mL

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 733.102 | 5702733102 |
| 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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