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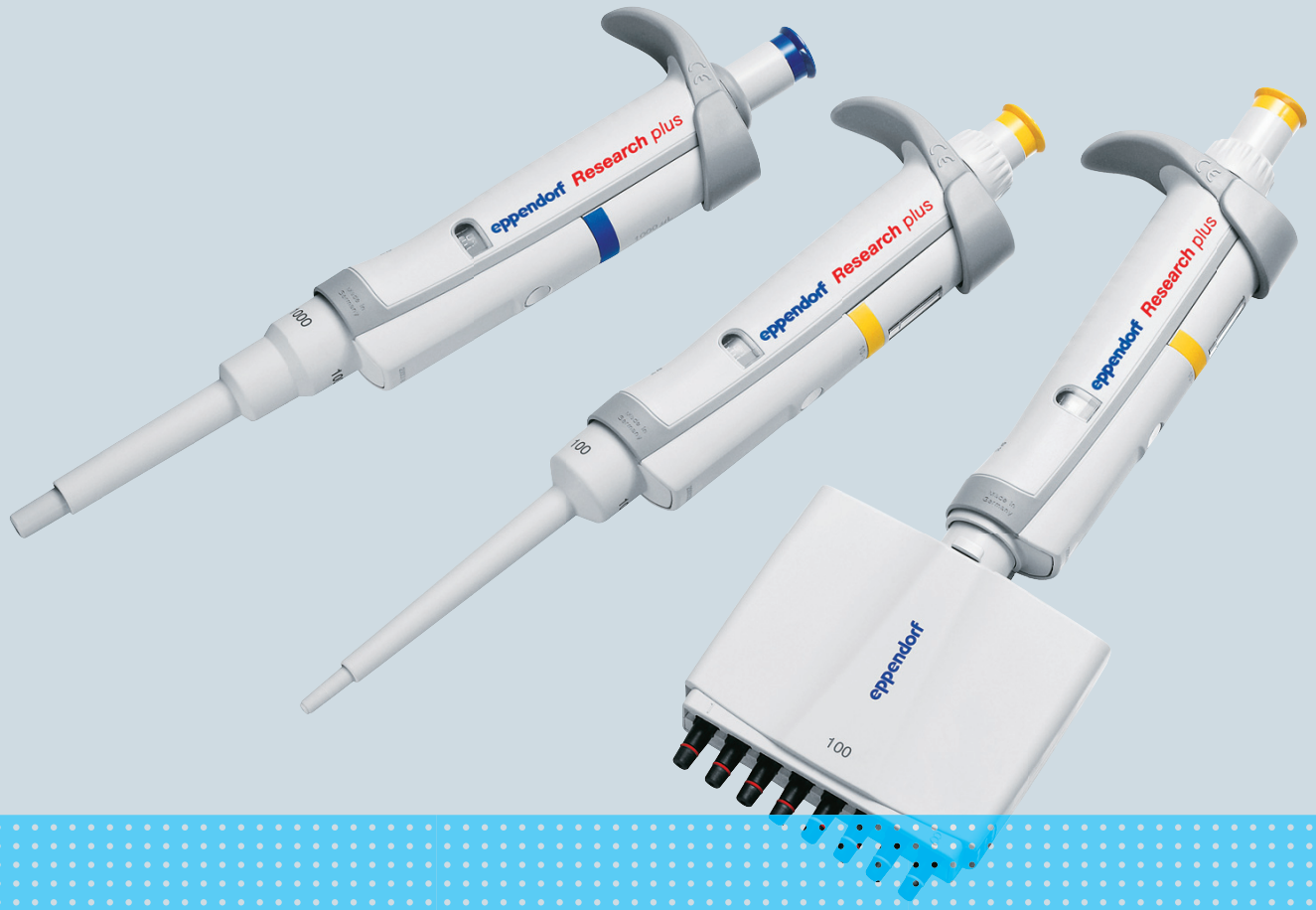

Eppendorf Research® plus

Chemical Resistance

Trademarks

Research plus - Chemical resistance - en-04/042013

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1 Important notes

The plastics used in the Research plus have to meet high requirements concerning form stability, wear resistance, temperature resistance (steam autoclavable at 121°C), UV resistance and chemical resistance.

To meet these requirements, the plastics have been specially treated in order to improve the standard properties of the respective plastic. It should be noted therefore that the data contained in the following tables does not generally apply to plastics with the same names and abbreviations in other products.

The resistance data specified in the following tables is derived from storing the test material in the respective liquid for over 24 hours.

Provided that only the pipette tip will come into contact with the liquid and proper handling procedures are followed, the careful use of aggressive liquids is possible for a limited period of time. This limited time is shortened in the case of aggressive liquids with a high vapor pressure. In the case of liquids with a high vapor pressure, gases will enter the Research plus during dispensing. In addition, the piston movement leads to increased aerosol formation. Gases or aerosols can condense at many places in the Research plus. The prolonged residence time of these condensates in the Research plus can cause material damage.

Therefore, after using aggressive chemicals in the Research plus, it is always advisable to ventilate the lower part and to clean it if necessary. Further information on detaching and opening the lower parts is provided in the film sequences on the Research plus CD and in the chapter *Maintenance* in the operating manual of Research plus.

Furthermore, using an air-cushion pipette in combination with liquids with a high vapor pressure is likely to result in a deterioration of the measurement errors due to the enrichment of the vapor in the air cushion between the piston and the liquid. This resulting deterioration can be minimized by pre-wetting the pipette tip. For liquids with a high vapor pressure also check whether using a positive displacement system, such as the Multipette or Repeater with Combitips, can provide a better solution.

Also refer to the information on setting the user adjustment for Research plus provided on the Research plus CD.

If liquid is dispensed incorrectly and it enters the Research plus, the Research plus must be cleaned immediately. This is the only way to ensure that the liquid which has penetrated into the pipette will not falsify subsequent dispensing results, or cause consequential damage. If you allow such liquid to dry in the Research plus, this could result in the formation of crystalline substances which will act like sandpaper during piston movement and cause mechanical damage to the Research plus.

Using aggressive liquids may reduce the service life of the Research plus because incorrect dispensing operations can result in liquid entering the Research plus by mistake. When using aggressive chemicals it is also advisable to check the systematic (accuracy) and random (precision) errors of the Research plus in shorter intervals than usual. By adhering to regular maintenance schedules and carrying out gravimetric tests of the systematic and random errors, you can ensure that the Research plus will meet the measurement errors required by you.

The information contained in the tables applies only to handling and cleaning at room temperature. A combination of cleaning and sterilization methods, for example cleaning the surface with a spray disinfectant followed by irradiation with UV light, may lead to other effects than described in the chapter

Cleaning agents and disinfectants (see p. 10). The simultaneous use of different cleaning and sterilization methods is not permitted.

Before commencing any chemical dispensing operations make sure to read the associated safety data sheets and the safety instructions on the bottle.

If you have questions relating to chemicals which are not listed in the respective tables, you can contact one of our Application Support Centers. We can assist you in determining chemical resistance and dispensing properties based on analogical conclusions within a substance class.

No warranty is provided by Eppendorf AG if chemicals which present an increased risk are used or in the case of improper handling.

2 Materials used

The following materials used in the Research plus are of importance to the user:

Component	Material
External surfaces of the upper part	• Improved polypropylene (PP) • Polycarbonate (PC) • Polyetherimide (PEI) • Foil
Exterior and interior of lower parts	• Improved polypropylene (PP) • Polyvinylidene fluoride (PVDF) • Polyetherimide (PEI) • Polyphenylene sulfide (PPS) • Polyetheretherketone (PEEK) • Polytetrafluoroethylene (PTFE) • Ethylene propylene diene rubber (EPDM) • Silicone • Steel (stainless steel and spring steel)

Pipette tip	Material
epT.I.P.S.	Polypropylene (PP)
epDualfilter T.I.P.S. filter	Polyethylene (PE)

3 Evaluation criteria

The pipette tip is a single-use item. The epT.I.P.S. and epDualfilter T.I.P.S. can be used for a single dispensing of all chemicals that are listed in the following tables. Furthermore, it is important to note that the PVDF (polyvinylidene fluoride) is resistant to all tested chemicals. PVDF is used for the tip cone for many Research plus. Sometimes, stainless steel or PPS are used for the tip cone instead of PVDF. Because all of the chemicals in the following tables can be dispensed using the epT.I.P.S., the following evaluation criteria has been defined for the Research plus materials:

■■■	**Resistant** The chemical can be used. If liquid is nevertheless aspirated into the pipette as the result of improper handling, the pipette must be cleaned and gravimetrically checked. This ensures that the Research plus continues to function correctly and that the required error limits are not exceeded.
■■	**Limited resistance and/or suitable for limited use** The chemical can be used for a limited period of time. If the chemical has not been removed from the surface or the lower part of the Research plus after the liquid has been used (observe condensation!), subsequent damages are possible. After the lower part of the Research plus has been used, detach it and ventilate it*. For improper handling, follow the procedure listed under "Resistant". Observe explanatory footnotes in the tables!
■	**Increased risk and/or increased wear** The chemical can only be used with utmost caution. If handled improperly, the chemical must be removed immediately because subsequent damages can occur very quickly. After the lower part of the Research plus has been used, detach, clean, and ventilate it*. Wear parts may need to be exchanged earlier than normal. Regularly check the systematic and random errors! Observe explanatory footnotes in the tables!

* Additional information on loosening and opening the lower parts can be found in the film sequences on the Research plus CD and in the *Maintenance* chapter of the Research plus operating manual. Check the systematic and random errors after the lower parts have been assembled. This inspection allows you to guarantee the correct assembly and proper functioning of the Research plus.

4 Chemical resistance

4.1 Acids and alkalines

Designation Acids and alkalines	Concentration	PP	PEI	PPS	PVDF	PC[*1]	PEEK	EPDM	Silicone	Steel
Ammonia solution	25%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Ammonia solution	2%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Acetic acid	96%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Acetic acid	12%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Caustic soda	40%	■■■	■■■	■■■	■■■	■■	■■■	■■■	■■■	■■■
Caustic soda	20%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Caustic soda	4%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Perchloric acid	10%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Phosphoric acid	85%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Nitric acid	65%	■■[*3]	■■[*3]	■■[*3]	■■■	■■[*3]	■■■	■■■	■[*4]	■■
Nitric acid	6%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■[*4]	■■■
Hydrochloric acid	32%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■[*4]	■[*2]
Hydrochloric acid	4%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■[*2]
Sulfuric acid	95%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■[*4]	■■■
Sulfuric acid	16%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Trichloroacetic acid	40%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■[*4]	■■■
Trichloroacetic acid	10%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■[*4]	■■■
Trifluoroacetic acid (TFA)	100%	■■■	■[*4]	■■■	■■■	■[*5]	■■■	■■■	■[*4]	■■■
Trifluoroacetic acid (TFA)	10%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■

[*1] Polycarbonate (PC) is only used for the inspection windows "Volume display" and "Adjustment display“.

[*2] Corrosion will form on the tip cone (stainless steel) if the hydrochloric acid is not removed after incorrect dispensing. With hydrochloric acid with a concentration of 32% and a higher hydrochloric acid concentration, prolonged and intensive use will lead to corrosion on the piston spring made of spring steel and other interior parts.

[*3] Discoloration; this does not affect functioning.

[*4] Silicone O-rings and wear parts made of PEI will have to be replaced in shorter intervals.

[*5] Careful working is necessary to avoid causing damage to the inspection windows.

4.2 Organic solvents

Designation Organic solvents	**Concentration**	**PP**	**PEI**	**PPS**	**PVDF**	**PC**[*1]	**PEEK**	**EPDM**	**Silicone**
Acetone[*2]		■■■	■■■	■■■	■■■	■[*5]	■■■	■■■	■■■
Acetonitrile		■■■	■■■	■■■	■■■	■[*5]	■■■	■■■	■■■
Benzine		■■■	■■■	■■■	■■■	■■■	■■■	■■[*3]	■■[*3]
Trichloromethane (chloroform)		■■■	■[*4]	■■■	■■■	■[*5]	■■■	■■[*3]	■■■
Dichloromethane (methylene chloride)		■■■	■[*4]	■■■	■■■	■[*5]	■■■	■■[*3]	■■■
Diethyl ether		■■■	■■■	■■■	■■■	■[*5]	■■■	■■[*3]	■■■
DMSO (dimethyl sulfoxide)	10%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
DMSO (dimethyl sulfoxide)	50%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
DMSO (dimethyl sulfoxide)	100%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Acetic acid ethyl ester[*2]		■■■	■■■	■■■	■■■	■[*5]	■■■	■■[*3]	■■■
Ethanol		■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Formaldehyde	40%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Isoamyl alcohol		■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Isopropanol		■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■
Methanol		■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Petroleum ether		■■■	■■■	■■■	■■■	■■■	■■■	■■[*3]	■■[*3]
Phenol (water saturated)		■■■	■[*4]	■■■	■■■	■[*5]	■■■	■■■	■■■
Carbon tetrachloride		■■■	■■■	■■■	■■■	■[*5]	■■■	■■[*3]	■■■
Toluol		■■■	■■■	■■■	■■■	■[*5]	■■■	■■[*3]	■■■
Xylol		■■■	■■■	■■■	■■■	■[*5]	■■■	■■[*3]	■■[*3]

[*1] Polycarbonate (PC) is only used for the inspection windows "Volume display" and "Adjustment display".

[*2] Wiping can attack the colored printing.

[*3] Absorption of solvent on contact; temporary swelling behavior; after prolonged use thoroughly ventilate the lower part.

[*4] Wear parts made of PEI have to be replaced in shorter intervals than usual.

[*5] Careful working is necessary to avoid causing damage to the inspection windows and occasionally the printing.

4.3 Cleaning agents and disinfectants

Designation Cleaning agents and disinfectants	Concentration	PP	PEI	PPS	PVDF	PC	PEEK	EPDM	Silicone
COUNT-OFF™ (disinfectant)	*2	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Dismozon® pure (peroxide-based)	*2	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
DNA *AWAY*™	*2	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Helipur® (phenol-based)	*2	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Hexaquart® S (QAV – based*1)	*2	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Hi - TOR Plus (QAV - based*1)	*2	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Korsolex® basic (aldehyde-based)	*2	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Meliseptol® (alcohol-based)	*2	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Sodium hypochlorite	4%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
RNase AWAY™	*2	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Sterillium® (alcohol-based)	*2	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Hydrogen peroxide	35%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Cidex Activated Dialdehyde Solution (aldehyde-based)	*2	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■

*1 Based on a quaternary ammonium compound

*2 The information relating to the cleaning agents and disinfectants is based on the commercially available product composition from 2009.

4.4 Saline solutions, buffers, surfactants, oils and other solutions

Designation Miscellaneous	Concentration	PP	PEI	PPS	PVDF	PC	PEEK	EPDM	Silicone
Cesium chloride	Saturated	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
EDTA*1* ; pH 8	1.8 g/L	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Ficoll (polysaccharide)	1.077 g/L	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Formamide	50%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Glutaraldehyde	25%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Glycerine	50%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Guanidinium thiocyanate	4 mol/L	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Mineral oil		■■■	■■■	■■■	■■■	■■■	■■■	■■*2	■■■
Na - acetate; pH 5.2	2 mol/L	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Paraffin oil		■■■	■■■	■■■	■■■	■■■	■■■	■■*2	■■■
Na dodecyl sulfate (SDS; Na lauryl sulfate)	1%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
TRIS buffer; pH 7.5	1 mol/L	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Triton® X-100	1%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Tween® 20	1%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Water		■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■

*1 Ethylene diamine tetra acetate, ethylenediaminetetraacetic acid, ethylenediamine tetraacetic acid, $C_{10}H_{16}N_2O_8$

*2 EPDM exhibits swelling behavior after prolonged contact with the oils. No contact is possible if dispensing is performed correctly.

Technical specifications subject to change!

5 Patents

U.S. Patent No.	7,434,484	Is used by Research plus pipettes with variable volume setting (single-channel and multi-channel) and fixed volume with following nominal volumes:	2.5 µL, 10 µL, 20 µL, 25 µL, 50 µL, 100 µL, 200 µL, 250 µL, 300 µL, 500 µL and 1000 µL
U.S. Patent No.	7,674,432	Is used by Research plus pipettes with variable volume setting (single-channel and multi-channel) and fixed volume with following nominal volumes:	2.5 µL, 10 µL, 20 µL, 25 µL, 50 µL, 100 µL, 200 µL, 250 µL, 300 µL, 500 µL, 1000 µL, 5 mL and 10 mL
U.S. Patent No.	7,673,532	Is used by Research plus pipettes with variable volume setting (multi-channel) with following nominal volumes:	10 µL, 100 µL, 300 µL
U.S. Patent No.	8,133,453	is used by Research plus pipettes with variable volume setting (single-channel and multi-channel) and fixed volume with following nominal volumes:	2.5 µL, 10 µL, 20 µL, 25 µL, 50 µL, 100 µL, 200 µL, 250 µL, 300 µL, 500 µL, 1000 µL, 5 mL and 10 mL
U.S. Patent No.	8,297,134	is used by Research plus pipettes with variable volume setting (single-channel and multi-channel) and fixed volume with following nominal volumes:	2.5 µL, 10 µL, 20 µL, 25 µL, 50 µL, 100 µL, 200 µL, 250 µL, 300 µL, 500 µL, 1000 µL, 5 mL and 10 mL

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