Eppendorf Research® plus

Chemical Resistance

eppendorf

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For user adjustment with adjustment display, spring to reduce force for tip fitting and for further features patents are pending.

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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. 9). 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	Purified polypropylene (PP), polycarbonate (PC), polyetherimide (PEI), foil
Exterior and interior of lower parts	Purified polypropylenen (PP), polyvinylidene fluoride (PVDF), polyetherimide (PEI), polyphenylene sulfide (PPS), polyetheretherketone (PEEK), polytetrafluorethylene (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 article. The epT.I.P.S. and the epDualfilter T.I.P.S. can be used for the single dosing of all chemicals which are included in the following tables. It is also important to note that PVDF (polyvinylidene fluoride) is resistant to all chemicals tested. PVDF is used for the tip cone in many Research plus pipettes. As an alternative to PVDF, stainless steel or PPS is also used for the tip cone. Since all chemicals in the following tables can be dispensed with epT.I.P.S., the following evaluation criteria were defined for the materials of Research plus:

■■■	**Resistant** The chemical can be used. However, if liquid is aspirated into the pipette due to improper handling, the pipette will have to be cleaned and a gravimetric test performed. This ensures that the Research plus will continue to function properly and the specified measurement errors are not exceeded.
■■	**Limited resistance and/or suitable for limited use** The chemical can be used for a limited period of time. If the liquid (also consider the formation of condensation!) is not removed from the surface or in the lower part of the Research plus after use, consequential damage is possible. After use, detach the lower part of the Research plus and allow it to dry in the air*. The procedure in the event of improper handling is identical to "Resistant“. Read the explanatory footnotes in the tables!
■	**Increased risk and/or increased wear** The chemical can only be used with utmost caution. In the event of improper handling, the chemical must be removed immediately as otherwise there is an immediate risk of consequential damage. After use, detach and clean the lower part of the Research plus and then allow it to dry in the air*. It may be necessary to replace wear parts earlier than usual. Regularly check the systematic and random errors! Read the explanatory footnotes in the tables!

* Further important 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. After the lower parts have been assembled, check the systematic and random errors. This check verifies correct assembly and proper functioning.

4 Material compatibility

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	20%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Caustic soda	4%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Perchloric acid	10%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Nitric acid	65%	■■*3	■■*3	■■*3	■■■	■■*3	■■■	■■■	■*4	■■
Nitric acid	6%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Hydrochloric acid	32%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■*2
Hydrochloric acid	4%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■*2
Sulfuric acid	95%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■*4	■■■
Sulfuric acid	16%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Trichloroacetic acid	40%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Trichloroacetic acid	10%	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
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 Material compatibility

4.2 Organic solvents

Designation Organic solvents	Concentration	PP	PEI	PPS	PVDF	PC*1	PEEK	EPDM	Silicone
Acetone*2		■■■	■■■	■■■	■■■	■*5	■■■	■■■	■■■
Acetonitrile		■■■	■■■	■■■	■■■	■*5	■■■	■■■	■■■
Petroleum ether		■■■	■■■	■■■	■■■	■■■	■■■	■■*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 Material compatibility

4.3 Cleaning agents and disinfectants

Designation Cleaning agents and disinfectants	Concentration	PP	PEI	PPS	PVDF	PC	PEEK	EPDM
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	12%	■■■	■■■	■■■	■■■	■■■	■■■	■■■
RNase AWAY™	*2	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Sterillium® (alcohol-based)	*2	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Hydrogen peroxide	35%	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Cidex Activated Dialdehyde Solution (aldehyde-based)	*2	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Clorox regular bleach (chlorine-based)	Corresponds to sodium hypochlorite 12%							
	*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 Material compatibility

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	■■■	■■■	■■■	■■■	■■■	■■■	■■■	■■■
Petroleum		■■■	■■■	■■■	■■■	■■■	■■■	■■*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!

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