Technical Appendix

Quality Standards at Greiner Bio-One

Greiner Bio-One is certified according to the international standards ISO 9001 and ISO 13485 for Medical Devices. On the right you can find the corresponding certificates of both quality standards.

ISO 9001 Certification

ISO 13485 Certification

Technical appendix is subject to error and technical modifications.

Catalogue Overview Microplates

All Greiner Bio-One microplates listed in this catalogue are summarised with their respective page number below.

96 Well Microplates

Bottom	Colour	Well profile	Optical bottom base		Surface Quality										
			µClear® bottom base	glass bottom base	TC treated, sterile	Advanced TC™, sterile	sterile	non-sterile	med. binding	high binding, sterile	non-binding	Strepta-vidin-coated	Poly-D-Lysine	Poly-L-Lysine	Collagen Type I
Polystyrene															
solid	clear	U-bottom			1 | 13		1|13,2|7	2 | 7	3 | 5	3 | 5	2 | 31				
		V-bottom			1 | 13		2 | 7	2 | 7	3 | 5	3 | 5	2 | 31				
		F-bottom/standard					2 | 7	2 | 7	3 | 5	3 | 5					
		F-bottom/chimney well			1 | 13	1 | 30	1 | 13		3 | 5	3 | 5	2 | 31		1 | 35	1 | 36	1 | 33
		F-bottom/half area			1 | 15		2 | 9	2 | 9	3 | 5	3 | 5					
		C-bottom										2 | 33			
	white	F-bottom/chimney well			1 | 14				2 | 8	2 | 8	2 | 31				
		F-bottom/half area			1 | 15				2 | 9	2 | 9					
		C-bottom										2 | 33			
	black	F-bottom/chimney well			1 | 14				2 | 8	2 | 8	2 | 31				
		F-bottom/half area			1 | 15				2 | 9	2 | 9					
		C-bottom										2 | 33			
optical	white	F-bottom/chimney well	•		1 | 15	1 | 30			2 | 8	2 | 8	2 | 31		1 | 35		
		F-bottom/half area	•		1 | 15	1 | 30			2 | 9	2 | 9					
	black	F-bottom/chimney well	•		1 | 15	1 | 30			2 | 8	2 | 8	2 | 31		1 | 35	1 | 36	1 | 33
		F-bottom/half area	•		1 | 15	1 | 30			2 | 9	2 | 9					
		F-bottom/chimney well		•			2 | 35								
UV-Star®															
optical	clear	F-bottom/chimney well	•					2 | 37							
		F-bottom/half area	•					2 | 37							
	black	F-bottom/chimney well	•					2 | 37							
Polypropylene															
solid, standard microplate	natural	U-bottom/chimney well					2 | 11	2 | 11							
		F-bottom/chimney well						2 | 11							
		V-bottom/chimney well						2 | 11							
	white	U-bottom/chimney well						2 | 11							
		F-bottom/chimney well						2 | 11							
		V-bottom/chimney well						2 | 11							
	black	U-bottom/chimney well						2 | 11							
		F-bottom/chimney well						2 | 11							
		V-bottom/chimney well						2 | 11							
solid, MASTERBLOCK® 0.5 ml	natural	V-bottom					2 | 24	2 | 24							
solid, MASTERBLOCK® 1 ml	natural	U-bottom					2 | 23	2 | 23							
	yellow	U-bottom					2 | 23	2 | 23							
	red	U-bottom					2 | 23	2 | 23							
	blue	U-bottom					2 | 23	2 | 23							
	green	U-bottom					2 | 23	2 | 23							
solid, MASTERBLOCK® 2 ml	natural	V-bottom					2 | 24	2 | 24							
	yellow	V-bottom					2 | 24								
	red	V-bottom					2 | 24								
	blue	V-bottom					2 | 24								
	green	V-bottom					2 | 24								

Technical appendix is subject to error and technical modifications.

384 Well Microplates

Bottom	Colour	Well profile	Optical bottom base		Surface Quality										
			µClear® bottom base	glass bottom base	TC-treated, sterile	Advanced TC™, sterile	sterile	non-sterile	med. binding	high binding, sterile	non-binding	Streptavidin-coated	Poly-D-Lysine	Poly-L-Lysine	Collagen Type I
Polystyrene															
solid	clear	F-bottom			1 | 16		2 | 13	2 | 13		2 | 13	2 | 32	2 | 33	1 | 35	1 | 36	1 | 33
		Small Volume™ HiBase						2 | 17							
		Small Volume™ LoBase					2 | 17	2 | 17							
	white	F-bottom			1 | 16				2 | 13	2 | 13	2 | 32	2 | 33	1 | 35		
		Small Volume™ HiBase			1 | 17				2 | 17		2 | 32				
		Small Volume™ LoBase			1 | 17				2 | 17						
	black	F-bottom			1 | 16				2 | 13	2 | 13	2 | 32	2 | 33			
		Small Volume™ HiBase			1 | 17				2 | 17		2 | 32		1 | 35		
		Small Volume™ LoBase			1 | 17				2 | 17						
optical	white	F-bottom	•		1 | 17	1 | 30			2 | 14	2 | 14	2 | 32		1 | 35		
		Small Volume™ LoBase	•		1 | 17	1 | 30			2 | 17						
	black	F-bottom	•		1 | 17	1 | 30			2 | 14	2 | 14	2 | 32		1 | 35	1 | 36	1 | 33
		Small Volume™ HiBase	•												
		Small Volume™ LoBase	•		1 | 17	1 | 30			2 | 17						
		F-bottom		•			2 | 35								
		Small Volume™ LoBase		•			2 | 35								
		F-bottom extra LoBase		•				2 | 35							
UV-Star®															
optical	clear	F-bottom	•					2 | 37							
	black	Small Volume™ LoBase	•					2 | 37							
Polypropylene															
solid, standard microplate	natural	F-bottom						2 | 15							
		V-bottom						2 | 15							
		Deep Well Small Volume™						2 | 18							
	white	F-bottom						2 | 15							
		V-bottom						2 | 15							
	black	F-bottom						2 | 15							
		V-bottom						2 | 15							
solid, MASTERBLOCK®	natural	V-bottom, Deep Well					2 | 26	2 | 26							
solid, deionised storage plate	natural	F-bottom						2 | 29							
Cycloolefin															
solid	clear	Small Volume™						2 | 29							

Technical appendix is subject to error and technical modifications.

1536 Well Microplates

Bottom	Colour	Well profile	Optical bottom base		Surface Quality						
			µClear® bottom base	glass bottom base	TC treated, sterile	sterile	non-sterile	med. binding	high binding, sterile	non-binding	Poly-D Lysine
Polystyrene											
solid	clear	F-bottom HiBase			1 I 18		2 I 20		2 I 20		
		F-bottom LoBase					2 I 21				
	white	F-bottom HiBase			1 I 18			2 I 20	2 I 20	2 I 32	
		F-bottom LoBase						2 I 21			
	black	F-bottom HiBase			1 I 18			2 I 20	2 I 20	2 I 32	
		F-bottom LoBase						2 I 21			
optical	white	F-bottom HiBase	•		1 I 18			2 I 20	2 I 20		
		F-bottom LoBase	•		1 I 19			2 I 21			
	black	F-bottom HiBase	•		1 I 18			2 I 20	2 I 20		1 I 35
		F-bottom LoBase	•		1 I 19			2 I 21			
		F-bottom HiBase		•		2 I 35					
		F-bottom LoBase		•		2 I 35					
		F-bottom extra LoBase		•			2 I 35				
Polypropylene											
solid	natural	V-bottom, Deep Well				2 I 27	2 I 27				
Cycloolefin											
solid	clear	F-bottom					2 I 29				
		F-bottom (Novartis Design)					2 I 29				
optical	black	F-bottom	CO film		1 I 20						

Technical appendix is subject to error and technical modifications.

General Information for the Lab

Chemical Resistance of Various Materials

	PS 20 °C	PS 50 °C	PP 20 °C	PP 50 °C	HDPE 20 °C	HDPE 50 °C	LDPE 20 °C	LDPE 50 °C
Acetic acid 10 %	1	1	1	1	1	1	1	1
Acetic acid 50 %	2	2	1	1	1	1	1	1
Acetic acid 90 %	4	4	1	2	1	1	1	2
Acetone	4	4	1	3	1	1	3	3
Acetonitrile	4	4	3	4	1	1	1	1
Ammonia 25 %	2	2	1	1	1	1	1	1
Ammonium acetate	1	1	1	1	1	1	1	1
Amyl alcohol	1	1	1	1	1	1	1	2
Ascorbic acid	-	-	1	1	1	-	1	-
Benzene	4	4	4	4	4	4	4	4
Benzyl alcohol	4	4	4	4	3	4	4	4
Boric acid 10 %	1	1	1	1	1	1	1	1
Carbon tetrachloride	4	4	4	4	3	4	4	4
Carbonic acid	1	1	1	1	1	3	1	1
Chloroform 100 %	4	4	3	4	3	-	3	-
Citric acid 10 %	1	1	1	1	1	1	1	1
Cyclohexanol	3	3	1	3	1	1	1	1
Detergents	-	-	1	1	-	-	-	-
Dichloroacetic acid	-	-	1	1	1	1	-	-
Diethyl ether	4	4	4	4	3	4	4	4
Dimethyl acetamide	4	4	1	1	1	1	3	4
Dimethylsulfoxide (DMSO)	1	2	1	1	1	1	1	1
Emulsifier	-	-	1	1	-	-	-	-
Ethanol 50 %	1	1	1	-	1	1	1	2
Ethanol 96 %	1	1	1	1	1	-	1	-
Ether	4	4	4	4	3	4	4	4
Formaldehyde 10 %	3	4	1	1	1	1	1	1
Formaldehyde 40 %	4	4	1	2	1	2	2	3
Formamide	1	1	1	1	1	1	1	1
Formic acid 50 %	3	3	1	2	1	1	1	2
Glucose	1	1	1	1	1	1	1	1
Glycerine	1	1	1	1	1	1	1	1
Heptane	4	4	3	3	2	3	3	4
Hexanol	-	-	1	-	1	-	1	-
Hydrochloric acid 20 %	1	1	1	1	1	1	1	1
Hydrochloric acid conc.	3	3	1	1	1	1	1	1
Hydrogen peroxide 3 %	1	1	1	1	1	1	1	1
Hydroquinone	4	4	1	-	-	-	1	3
Isoamyl alcohol	1	1	-	-	-	-	-	-
Isobutanol	2	2	1	1	1	1	1	1
Isopropanol	2	2	1	1	1	1	1	1
Isopropyl acetate	4	4	2	3	1	2	2	3
Isopropyl benzene	4	4	3	4	2	3	3	4
Isopropyl ether	4	4	4	4	4	4	4	4
Lactic acid 3 %	2	2	1	2	1	1	1	2
Lactic acid 85 %	2	2	1	2	1	1	1	1
Liquid paraffin	1	1	1	3	1	1	1	3
Methanol	3	4	1	1	1	1	1	1
Methyl propyl ketone	4	4	2	3	1	2	2	3
Methyl acetate	4	4	2	3	3	3	3	4

1 = resistant 2 = limited resistant 3 = moderate resistant 4 = no resistance
This table is a general guide only. As many factors can affect the chemical resistance of a given product, its suitability for a specific application should be tested.

Chemical Resistance of Various Materials

	PS 20 °C	PS 50 °C	PP 20 °C	PP 50 °C	HDPE 20 °C	HDPE 50 °C	LDPE 20 °C	LDPE 50 °C
Methyl phenyl ether 100 %	4	4	3	-	-	-	3	-
Methylamine 32 %	-	-	1	-	1	-	1	-
Methylene chloride	4	4	3	4	4	4	4	4
Naphthalene	-	-	1	-	1	3	-	-
Nitrobenzene	4	4	4	4	3	4	4	4
Oxalic acid	1	1	1	1	1	1	1	1
Ozone	3	3	1	2	1	1	1	2
Palmitic acid	1	1	3	4	3	-	2	-
Phenol 10 %	4	4	1	1	1	1	1	1
Phenol 100 %	4	4	1	1	2	3	3	3
Phosphoric acid 1 – 5 %	2	2	1	1	1	1	1	1
Phosphoric acid 85 %	1	1	1	2	1	1	1	1
Phthalic acid	1	1	1	1	1	1	1	1
Potassium carbonate	1	1	1	1	1	1	1	1
Potassium chromate	1	1	1	1	1	1	1	-
Potassium permanganate	2	3	1	1	1	1	1	1
Propanol	3	3	1	1	1	1	1	1
Sodium hypochloride	1	1	2	3	2	3	2	3
Sodium acetate	2	2	1	1	1	1	1	1
Sodium hydroxide 30 %	1	1	1	1	1	1	1	1
Sodium hydroxide 45 %	1	1	1	1	1	1	1	1
Sodium hydroxide 60 %	1	1	1	1	-	-	-	-
Sodium permanganate	2	3	1	1	1	1	1	1
Sodium thiosulfate	1	1	1	1	1	1	1	1
Sodium chloride	1	1	1	1	1	1	1	1
Stearic acid	1	2	1	1	1	1	1	1
Sulphuric acid 1 – 6 %	1	2	1	1	1	1	1	1
Sulphuric acid 60 %	2	4	1	3	1	3	1	3
Sulphuric acid conc.	4	4	4	4	4	4	4	4
Tannin acid	1	1	1	1	-	-	-	-
Terpentine oil	-	-	-	-	3	4	3	4
Tetrahydrofuran	4	4	3	4	3	4	4	4
Toluene	4	4	3	4	3	4	3	4
Trichloroacetic acid	4	4	3	4	3	3	3	4
Urea	1	2	1	1	1	1	1	1
Uric acid	-	-	1	-	1	-	1	-
Urine	3	3	1	1	1	1	1	1
Xylene	4	4	4	4	2	3	2	4

1 = resistant 2 = limited resistant 3 = moderate resistant 4 = no resistance
This table is a general guide only. As many factors can affect the chemical resistance of a given product, its suitability for a specific application should be tested.

Chemical Resistance of Cycloolefin Microplates

	Cycloolefin		Cycloolefin		Cycloolefin
Acetic acid 99 %	1	Detergents	1	Isopropanol	1
Acetone	1	DMSO	1	Methanol	1
Ammonia 33 %	1	Ethanol 50 %	1	Methylene chloride	4
Benzaldehyde	3	Ethanol 96 %	1	Nitric acid (HNO_3)	1
Benzine	4	Fatty acid	4	Pentane	4
Benzene	4	Heptane (n-Heptane)	4	Sodium hydroxide (NaOH 50 %)	1
Butanon	1	Hexane	4	Sulphuric acid (H_2SO_4) 40 %	1
Chloroform	4	Hydrochloric acid (HCl) 36 %	1		

1 = resistant 2 = limited resistant 3 = moderate resistant 4 = no resistance
This table is a general guide only. As many factors can affect the chemical resistance of a given product, its suitability for a specific application should be tested.

Chemical Resistance of UV-Star® Microplates

	UV-Star®		UV-Star®		UV-Star®
Acetic acid 99 %	1	Detergents	1	Isopropanol	1
Acetone	1	DMSO	1	Methanol	1
Ammonia 33 %	1	Ethanol 50 %	1	Methylene chloride	4
Benzaldehyde	3	Ethanol 96 %	1	Nitric acid (HNO_3)	1
Benzine	4	Fatty acid	4	Pentane	4
Benzene	4	Heptane (n-Heptane)	4	Sodium hydroxide (NaOH 50 %)	1
Butanon	1	Hexane	4	Sulphuric acid (H_2SO_4) 40 %	1
Chloroform	4	Hydrochloric acid (HCl) 36 %	1		

1 = resistant 2 = limited resistant 3 = moderate resistant 4 = no resistance
This table is a general guide only. As many factors can affect the chemical resistance of a given product, its suitability for a specific application should be tested.

Chemical Resistance of Polyethylene Terephthalate (PET) Capillary Pore Membranes (ThinCert™ Cell Culture Inserts)

Acetaldehyde	1	Ethanol	1	Monochlorbenzene	1
Acetic acid (10 %)	1	Ethyl acetate	1	Nitric acid (30 %)	1
Acetic acid (100 %)	3	Ethyl ether	1	Nitrobenzene	1
Acetone	1	Ethylendichloride	1	Nitropropane	1
Ammonium hydroxide (5 %)	1	Ethylene glycol	1	n-Propanol	1
Amyl acetate	1	Fluoric acid (35 %)	1	Pentane	1
Amyl alcohol	1	Formaldehyde	1	Perchlorethylene	1
Aniline	1	Formic acid (50 %)	1	Petroleum ether	1
Benzene	3	Freon	1	Phosphoric acid (85 %)	3
Benzyl alcohol	1	Glutaraldehyde	1	Potassium hydroxide	4
Benzyl benzoate	1	Glycerol	1	Propyl acetate	1
Boric acid (5 %)	1	H_2O_2 (30 %)	1	Pyridine	1
Butanol	1	Halogenated phenoles	4	Silicon oil	1
Butyl acetate	1	Hexane	1	Sodium hydroxide	4
Butyl cellusolve	1	Hydrochloric acid (20 %)	1	Sulphuric acid (25 %)	1
Carbon tetrachloride	1	i-Propanol	1	Terpentine oil	1
Chloroform	1	Isopropyl myristate	1	Tetrahydrofurane	1
Concentrated strong acids	4	Methanol	1	Tetraline	1
Cyclohexane	1	Methyl acetate	1	Toluene	3
Cyclohexanone	3	Methyl cellusolve	1	Trichlorbenzene	1
Dekaline	1	Methylenchloride	3	Trichlorethylene	1
Dimethylacetamide	1	Methylethylketone	1	Triethanolamin	1
Dimethylformamide	1	Methylglycol acetate	1	Trikresyl phosphate	1
Dimethylsulfoxide	1	Methylisobutylketone	1	Xylene	3
Dioxane	1	Mineral oils	1		

For the solvents effecting slight changes the user should test the compatibility under the specific application conditions. All tests have been performed at RT. Please be aware that ThinCert™ cell culture inserts are made of PET membranes sealed on polystyrene housings. Therefore, solvents shown compatible with PET membranes in the above table might be incompatible with the polystyrene housing. Please check solvent compatibility with polystyrene on page A I 6 f.

Resistance scale from 1 to 4

1 = resistant i.e. the plastics may be treated with the chemical compound at mentioned temperature over several years without any significant alterations in its physical, optical and chemical properties

2 = limited resistant i.e. the plastics may be treated with the chemical compound at mentioned temperature over several weeks without any significant alterations in its physical, optical and chemical properties

3 = moderate resistant i.e. the plastics may be treated with the chemical compound at mentioned temperature for short time only (several minutes to one hour) without any alterations in physical, optical and chemical properties (mixing and measuring is possible)

4 = no resistance i.e. treating the plastics with the substance named may cause alterations in physical, optical and chemical properties within seconds

Chemical Resistance of Sealers

	EASYseal™ (Cat.-No. 676 001)	VIEWseal™ (Cat.-No. 676 070)	AMPLIseal™ (Cat.-No. 676 040)	SILVERseal™ (Cat.-No. 676 090)
Acetone	4	4	4	3
Acetonitrile	3	3	4	1
Acetic acid 1 %	1	1	4	3
Glacial acetic acid	1	3	4	3
Chloroform	4	4	4	4
DMSO	3	3	3	1
Ethanol	3	1	1	1
Hydrochloric acid 32 %	3	1	3	4
Isopropanol	3	1	1	1
Methanol	3	1	4	1
Phenol	3	3	4	3
Sulphuric acid 0.5 M	1	1	1	1

1 = Stable no visible change in the sealer after one week's incubation
3 = Moderately stable after one week, optical and physical changes in the sealer (clouding tears on removal)
4 = Unstable adhesive and foil are dissolved, wells not leak-tight
This table can only be used as an orientation aid for the suitability of the respective sealers, since their behaviour against chemicals depends on the respective application. Tests under practical conditions are absolutely essential in many cases.

Temperature Stability of Sealers

	Temperature Stability
EASYseal™	-20 °C to + 60 °C
VIEWseal™	-80 °C to + 110 °C
AMPLIseal™	-80 °C to + 110 °C
SILVERseal™	-80 °C to + 110 °C
BREATHseal™	-80 °C to + 60 °C Evaporation rate 4200 g H_2O/m^2 in 24 h

This table can basically be used as an orientation aid for the temperature stability of the respective sealers, since the behaviour of the product depends on the respective application. Tests under practical conditions are absolutely essential in many cases.

Physical Properties of Various Materials

Material	Sterilisation by				Autoclavability	Thermal Stability [°C]	Transparency	Gas Permeability [cc x mm/m² x 24 h x Bar]			WVTR (at 37 °C, 90 % humidity) [g x mm/m² x 24 h x Bar]
	gamma irradiation	chemicals (formalin, ethanol)	dry heat	gas*				O_2	N_2	CO_2	
Polystyrene	yes	yes	no	yes	no	– 20 to + 60	clear	4.7	853	17.8	108 – 155
Poly-propylene	yes	yes	no	yes	yes	– 196 to + 121	translucent	3.7	744	12.4	3.9
HDPE	yes	yes	no	yes	no	– 50 to + 100	translucent	2.9	651	9	4.6 – 6.2
LDPE	yes	yes	no	yes	no	– 50 to + 80	translucent	7.8	2.8	41.9	15.5 – 23.3
UV-Star®	yes	-	no	yes	no	– 20 to + 40	clear	-	-	-	-
PETG	yes	yes	no	yes	no	– 40 to + 70	clear	388	155	1.2	62
PET	yes	some	no	yes	no	– 60 to + 150	clear	46.5	10.9	236	15 – 20
Cycloolefin	yes	-	no	yes	no	– 80 to + 100	clear	-	-	-	-

Exemptions are mentioned in the respective product data sheets.
* Ethylene oxide, formaldehyde

Material	Refractive Index
Polystyrene	1.59
UV-Star®	1.53
Cycloolefin	1.53
Glass	1.53

These tables are a general guide only. As many factors can affect the resistance of a given product, its suitability for a specific application should be tested.

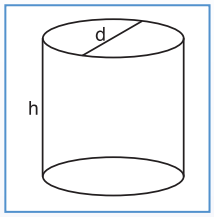
Manual Calculation
– Coefficient of Variation (CV)

The coefficient of variation compares the variability of several random samples with different means, taking into account the different dimensions of means:

$$CV\,\% = \frac{S}{I\,\overline{X}\,I} \cdot 100\,\%$$

where S is the standard deviation and
$I\,\overline{X}\,I$ is the absolute value of the arithmetic mean.

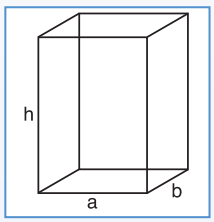
– Volume of Diverse Bodies



Volume of a cylinder:

$$= \frac{\pi \cdot d^2 \cdot h}{4} \qquad = \frac{4 \cdot V}{\pi}$$

This formula can be used for calculating the filling level in relation to the filling volume in a 96 well microplate with cylindrical wells.



Volume of a cuboid:

$$V = a \cdot b \cdot h \qquad = \frac{V}{a \cdot b}$$

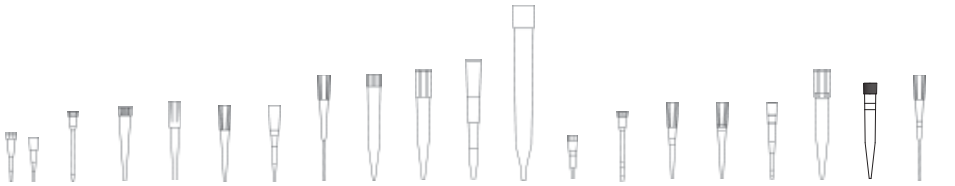
This formula can be used for calculating the filling level in relation to the filling volume in 384 and 1536 well microplates with rectangular wells.

Overview
– Metric prefixes

G	=	giga	=	10^{9}
M	=	mega	=	10^{6}
k	=	kilo	=	10^{3}
c	=	centi	=	10^{-2}
m	=	milli	=	10^{-3}
µ	=	micro	=	10^{-6}
n	=	nano	=	10^{-9}
p	=	pico	=	10^{-12}
f	=	femto	=	10^{-15}
a	=	atto	=	10^{-18}
z	=	zepto	=	10^{-21}

Laboratory Information for Liquid Handling

Table of Compatibility for Pipette Tips and Pipettors



Volume [µl]	0.5 – 10	0.5 – 10	10 – 100	10 – 200	10 – 200	10 – 200	10 – 200	100 – 1000	200 – 1000	200 – 1000	1 – 5 ml	10	10	20	100	200	1000	1000	Gel 20
Description	**771 290** natural **771 291** natural	**765 290** natural	**685 290** yellow	**728 290** natural	**739 290** yellow	**739 291** natural	**770 290** natural Gel	**686 290** blue **686 295** natural	**740 290** blue	**740 291** natural **740 296** blue	**745 290** natural	**771 288** natural	**765 288** natural	**774 288** natural	**772 288** natural	**739 288** natural	**740 288** natural	**750 288** natural	**775 288** natural
Single-channel Pipettors	**Standard Pipette Tips**											**Filter Pipette Tips (sterile)**							
Biohit® Proline (0.5 – 10 µl)	•	•										•	•						
Biohit® eLine (5 – 120 µl)				•	•	•	•							•	•				•
Biohit® eLine (50 – 1000 µl)								•	•	•								•	
Brand® Transferpette (2 – 20 µl)		•											•						
Brand® Transferpette (20 – 200 µl)			•	•	•	•	•							•	•	•			•
Brand® Transferpette (100 – 1000 µl)								•	•	•									
Eppendorf® Reference (0.5 – 10 µl)	•	•										•	•						
Eppendorf® Reference (2 – 20 µl)			•	•	•	•	•							•	•				•
Eppendorf® Reference (50 µl)			•	•	•	•	•								•				
Eppendorf® Reference (10 – 100 µl)			•	•	•	•	•							•	•				•
Eppendorf® Reference (100 µl)			•	•	•	•	•								•				
Eppendorf® Reference (50 – 200 µl)			•	•	•	•	•							•	•	•			•
Eppendorf® Reference (500 µl)								•	•	•								•	
Eppendorf® Reference (100 – 1000 µl)								•	•	•								•	
Eppendorf® Reference (1000 µl)								•	•	•								•	
Eppendorf® Research (20 – 200 µl)			•	•	•	•	•							•	•	•			•
Eppendorf® Research (100 – 1000 µl)								•	•	•								•	
Eppendorf® Research pro (0.5 – 10 µl)	•	•										•	•						
Eppendorf® Research pro (5 – 100 µl)			•	•	•	•	•							•	•				•
Eppendorf® Research pro (20 – 300 µl)			•	•	•	•	•							•	•	•			•
Eppendorf® Research pro (50 – 1000 µl)								•	•	•								•	
Finnpipette® Digital 4500 (200 – 1000 µl)								•	•	•							•	•	
Gilson® Pipetman P2 (0.5 – 2 µl)	•	•										•	•						
Gilson® Pipetman P10 (1 – 10 µl)	•	•										•	•						
Gilson® Pipetman P20 (2 – 20 µl)			•	•	•	•	•							•					•
Gilson® Pipetman P100 (20 – 100 µl)			•	•	•	•	•							•	•				•
Gilson® Pipetman P200 (50 – 200 µl)			•	•	•	•	•								•	•			
Gilson® Pipetman P1000 (200 – 1000 µl)								•	•	•							•	•	
Gilson® Pipetman P5000 (1 – 5 ml)											•								
Gilson® F5/F10/F20 (5/10/20 µl)			•	•	•	•	•							•					•
Gilson® F25/F50 (25/50 µl)			•	•	•	•	•								•				
Gilson® F100 (100 µl)			•			•													
Gilson® F200 (200 µl)			•	•	•	•	•									•			
Gilson® F250/F300 (250/300 µl)								•	•	•							•	•	
Gilson® F500/F1000 (500/1000 µl)								•	•	•							•	•	
Gilson® Pipetman U10 (1 – 10 µl)	•	•										•	•						
Gilson® Pipetman U200 (20 – 200 µl)			•	•	•	•	•							•	•	•			•
Gilson® Pipetman U1000 (200 – 1000 µl)								•	•	•							•	•	

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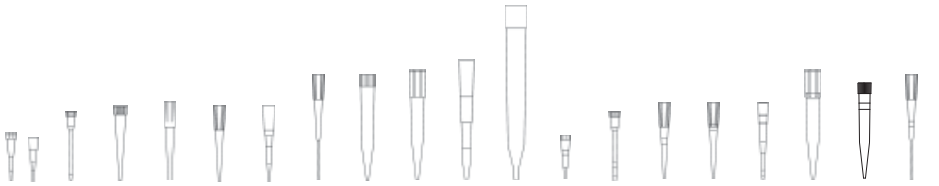
Technical appendix is subject to error and technical modifications.

Table of Compatibility for Pipette Tips and Pipettors



Volume [µl]	0.5 – 10	0.5 – 10	10 – 100	10 – 200	10 – 200	10 – 200	10 – 200	100 – 1000	200 – 1000	200 – 1000	1 – 5 ml	10	10	20	100	200	1000	1000	Gel 20
Description	**771 290** natural **771 291** natural	**765 290** natural	**685 290** yellow	**728 290** natural	**739 290** yellow	**739 291** natural	**770 290** natural Gel	**686 290** blue **686 295** natural	**740 290** blue	**740 291** natural **740 296** blue	**745 290** natural	**771 288** natural	**765 288** natural	**774 288** natural	**772 288** natural	**739 288** natural	**740 288** natural	**750 288** natural	**775 288** natural
Single-channel Pipettors	**Standard Pipette Tips**											**Filter Pipette Tips (sterile)**							
Socorex® Calibra 822 (1 – 10 µl)		•																	
Socorex® Calibra 822 (2 – 20 µl)			•	•	•	•	•							•					•
Socorex® Calibra 822 (10 – 100 µl)			•	•	•	•	•							•					•
Socorex® Calibra 822 (20 – 200 µl)			•	•	•	•	•							•	•				•
Socorex® Calibra 822 (100 – 1000 µl)									•	•								•	
Socorex® Acura 825 (0.5 – 10 µl)	•	•										•	•						
Socorex® Acura 825 (2 – 20 µl)			•	•	•	•	•												
Socorex® Acura 825 (5 – 50 µl)			•	•	•	•	•							•	•				•
Socorex® Acura 825 (10 – 100 µl)			•	•	•	•	•							•	•				•
Socorex® Acura 825 (20 – 200 µl)			•	•	•	•	•							•	•	•			•
Socorex® Acura 825 (100 – 1000 µl)								•	•	•								•	
Multi-channel Pipettors	**Standard Pipette Tips**											**Filter Pipette Tips (sterile)**							
8F Biohit® Proline (50 – 300 µl)			•	•	•	•									•	•			
8F Biohit® Proline (25 – 250 µl)			•	•	•	•									•	•			
8F Brand® Transferpette (20 – 200 µl)			•	•	•	•								•	•	•			
8F Eppendorf® Research (10 – 200 µl)			•	•	•	•								•	•				
8F Finnpipette® Digital 4510 (50 – 300 µl)			•	•	•	•									•	•			
8F Gilson® Pipetman (20 – 200 µl)			•	•	•	•								•	•	•			
8F Socorex® Calibra 852 (1 – 10 µl)	•	•										•	•						
8F Socorex® Acura (5 – 50 µl)			•	•	•	•								•	•				
8F Socorex® Calibra 852 (20 – 200 µl)			•	•	•	•								•	•				
12F Eppendorf® Research (0.5 – 10 µl)		•											•						
12F Socorex® Calibra 852 (10 – 100 µl)			•	•	•	•								•					

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Technical appendix is subject to error and technical modifications.

Table of Compatibility for Sapphire Pipette Tips and Pipettors

Volume [µl]	10	300	1250	10	20	300	1250
Cat.-No.	771 25X	738 25X	750 25X	771 26X	773 26X	738 26X	750 26X
Pipettors		**Standard Pipette Tips**			**Filter Pipette Tips (sterile)**		
Biohit® M100		•			•	•	
Biohit® M200		•			•	•	
Biohit® Proline (0.5 – 10 µl)	•			•			
Biohit® Proline (200 – 1000 µl)			•				•
Biohit® Proline Plus (10 – 100 µl)		•				•	
Biohit® Proline Plus (20 – 200 µl)		•			•	•	
Biohit® Proline Plus (200 µl)		•					
Brand® Transferpette S (0.5 – 10 µl)	•			•			
Brand® Transferpette S (2 – 20 µl)					•		
Brand® Transferpette S (10 – 100 µl)					•		
Brand® Transferpette S (20 – 200 µl)		•			•	•	
Brand® Transferpette S (100 – 1000 µl)			•				•
Brand® Transferpette Electronic (15 – 300 µl)		•				•	
Brand® Transferpette Electronic (20 – 200 µl)					•		
Capp® (0.5 – 10 µl)	•			•			
Capp® (5 – 50 µl)		•			•	•	
Capp® (10 – 100 µl)		•			•	•	
Capp® (30 – 300 µl)		•			•	•	
CLP Beta-Pette (0.1 – 2 µl)	•			•			
CLP Beta-Pette (0.5 – 10 µl)	•			•			
CLP Beta-Pette (2 – 20 µl)					•		
CLP Beta-Pette (10 – 100 µl)					•		
CLP Beta-Pette (20 – 200 µl)		•			•	•	
CLP Beta-Pette (100 – 1000 µl)			•				•
CLP Poseidon (0.2 – 2 µl)	•			•			
CLP Poseidon (0.5 – 10 µl)	•			•			
CLP Poseidon (5 – 50 µl)		•			•		
CLP Poseidon (10 – 100 µl)		•			•	•	
CLP Poseidon (20 – 200 µl)		•			•	•	
CLP Poseidon (30 – 300 µl)		•			•	•	
CLP Poseidon (100 – 1000 µl)			•				•
CLP Poseidon Electronic (2 – 20 µl)	•			•			
CLP Poseidon Electronic (10 – 200 µl)		•			•	•	
CLP Poseidon Electronic (100 – 1000 µl)			•				•
Eppendorf® Reference (0.1 – 2.5 µl)	•			•			
Eppendorf® Reference (0.5 – 10 µl)	•			•			
Eppendorf® Reference (2 – 20 µl)					•		
Eppendorf® Reference (10 – 100 µl)					•		
Eppendorf® Reference (50 – 200 µl)		•			•		
Eppendorf® Reference (100 – 1000 µl)			•				•
Eppendorf® Research (0.1 – 2.5 µl)	•			•			
Eppendorf® Research (0.5 – 10 µl)	•			•			
Eppendorf® Research (2 – 20 µl)					•		
Eppendorf® Research (10 – 100 µl)		•			•	•	
Eppendorf® Research (20 – 200 µl)		•			•	•	
Eppendorf® Research (30 – 300 µl)		•			•	•	
Eppendorf® Research (100 – 1000 µl)			•				•
Eppendorf® Research Plus (0.1 – 2.5 µl)	•			•			
Eppendorf® Research Plus (0.5 – 10 µl)	•			•			
Eppendorf® Research Plus (2 – 20 µl)					•		
Eppendorf® Research Plus (10 – 100 µl)					•		

Table of Compatibility for Sapphire Pipette Tips and Pipettors

Volume [µl]	10	300	1250	10	20	300	1250
Cat.-No.	771 25X	738 25X	750 25X	771 26X	773 26X	738 26X	750 26X
Pipettors	**Standard Pipette Tips**			**Filter Pipette Tips (sterile)**			
Eppendorf® Research Plus (50 – 200 µl)						•	
Eppendorf® Research Plus (100 – 1000 µl)			•				•
Finnpette® (0.5 – 10 µl)	•			•			
Finnpette® (2 – 20 µl)					•		
Finnpette® (5 – 50 µl)	•	•		•	•	•	
Finnpette® (20 – 200 µl)		•			•	•	
Finnpette® (30 – 300 µl)		•			•	•	
Finnpette® (100 – 1000 µl)			•				•
Finnpette® (200 – 1000 µl)			•				•
Finnpette® (100 – 1200 µl)			•				•
Finnpette® Electronic (1 – 10 µl)	•			•			
Finnpette® Electronic (30 – 300 µl)		•			•	•	
Finnpette® F1 (1 – 10 µl)	•			•			
Gilson® Pipetman P10 (1 – 10 µl)	•			•			
Gilson® Pipetman P20 (2 – 20 µl)	•			•	•		
Gilson® Pipetman P100 (20 – 100 µl)					•		
Gilson® Pipetman P200 (50 – 200 µl)		•			•	•	
Gilson® Pipetman P1000 (200 – 1000 µl)			•				•
Gilson® Pipetman U20 (2 – 20 µl)					•		
Gilson® Pipetman U200 (20 – 200 µl)		•			•	•	
Hamilton (0.2 – 2 µl)	•			•			
Hamilton (1 – 10 µl)	•			•			
Hamilton (2.5 – 25 µl)		•			•	•	
Hamilton (10 – 100 µl)		•			•	•	
Hamilton (30 – 300 µl)		•			•	•	
Hamilton (100 – 1000 µl)			•				•
Labnet Biopette E (100 – 1200 µl)			•				•
Nichiryo Nichipet EX (0.5 – 10 µl)	•			•			
Nichiryo Nichipet EX (2 – 20 µl)					•		
Nichiryo Nichipet EX (10 – 100 µl)					•		
Nichiryo Nichipet EX (20 – 200 µl)		•			•	•	
Nichiryo Nichipet EX (100 – 1000 µl)			•				•
Nichiryo Oxford Benchmate (0.1 – 2 µl)	•			•			
Nichiryo Oxford Benchmate (2 – 20 µl)					•		
Nichiryo Oxford Benchmate (50 – 300 µl)		•				•	
Nichiryo Oxford Multimate (0.5 – 10 µl)	•			•			
Nichiryo Oxford Multimate (5 – 50 µl)					•		
Nichiryo Oxford Multimate (50 – 300 µl)		•			•	•	
Socorex® Calibra 822 (1 – 10 µl)	•			•			
Socorex® Calibra 822 (10 – 100 µl)					•		
Socorex® Calibra 822 (20 – 200 µl)		•			•	•	
Socorex® Calibra 822 (100 – 1000 µl)			•				•
VWR® Ergonomic High Performance (2 – 20 µl)		•			•	•	
VWR® Ergonomic High Performance (20 – 200 µl)		•			•	•	
VWR® Ergonomic High Performance (100 – 1000 µl)			•				•
VWR® Ultra High Performance (0.1 – 22 µl)	•			•			
VWR® Ultra High Performance (0.5 – 10 µl)	•			•			
VWR® Ultra High Performance (2 – 20 µl)		•				•	
VWR® Ultra High Performance (10 – 100 µl)		•			•	•	
VWR® Ultra High Performance (20 – 200 µl)		•			•	•	
VWR® Ultra High Performance (100 – 1000 µl)			•				•

Laboratory Information for Centrifugation

Centrifugation – Principle and Calculation of the RCF (Relative Centrifugal Force)

Sedimentation of particles in a gravitational field

If a mixture of sand and water is shaken thoroughly and then left to stand, the sedimentation of the solid particles takes place according to their size. As a result of gravitational acceleration (g = 9,81 m/s²), all of the particles are located in a gravitational field under the influence of which the coarse grains of sand collect at the bottom first and the smaller grains of sand are deposited later. After around 10 – 20 minutes, the following layering is produced (from bottom to top):
coarse grains of sand – fine grains of sand – water.

However, other particles (proteins, nucleic acids, viruses, pro- or eucaryotic cells) do not necessarily precipitate or only sediment out after they have been exposed to higher forces than the force of gravity resulting from the gravitational acceleration. If these forces exceed the counter-forces resulting from convection (heat circulation) and Brownian molecular motion, both of which cause constant mixing of solutions and suspensions, sedimentation takes place.

The sedimentation rate can be calculated on the basis of Stoke's law as follows:

$$v = \frac{d^2 (\rho_P - \rho_L)\, g}{18\mu}$$

where v = sedimentation rate, ρ_P = density of the particle, ρ_L = density of the liquid, g = 9,81 m/s², μ = viscosity of the liquid

However, a particle will only sediment out if $\rho_P > \rho_L$. If $\rho_P < \rho_L$, v becomes negative, consequently the particle floats rather than sedimenting out.

Influence of the Centrifugation and Calculation of the RCF respectively RPM

A centrifuge can be used to create a transient gravitational field under the influence of which the sedimentation of cells, cellular components and macro-molecules takes place. In a centrifuge, a suspension located in a centrifuge tube rotates around a rotational axis. Each particle of the suspension is subject to centrifugal force, which moves it radially away from the rotational axis. The centrifugal force F_C is calculated as follows:

$$F_C = m_P \omega^2 r$$

where m_P = mass of the particle, ω = angular velocity (s^{-1}) and r = distance of the particle from the rotational axis

The force acting on a particle in a centrifugal field is stated relative to gravitational acceleration, usually as so-called *relative centrifugal force* (RCF) or *g-force* (x g). It is calculated as follows:

$$RCF = 11.18 r \left(\frac{R}{1000}\right)^2$$

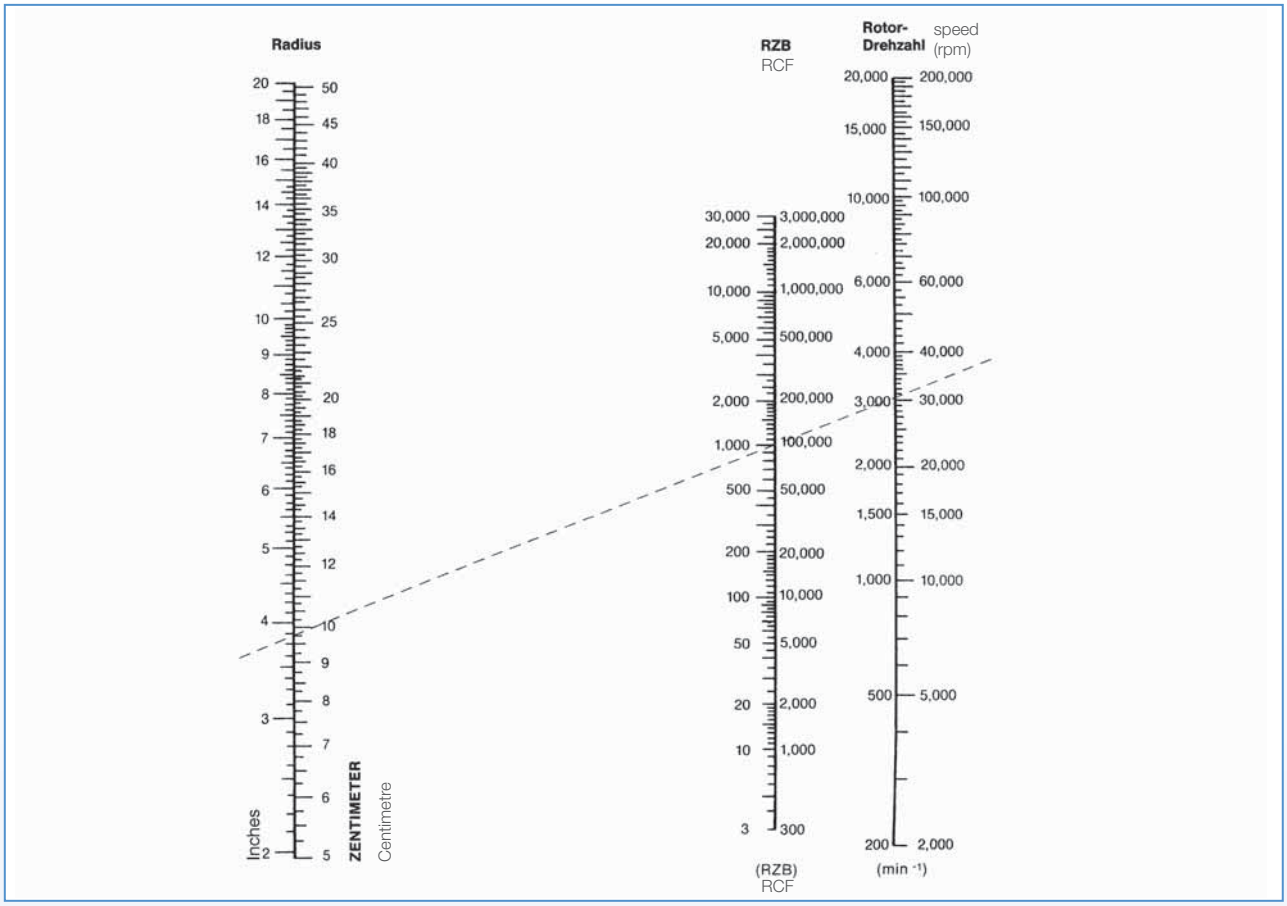
where R = rotor revolutions per min and r = distance of the particle from the rotational axis (cm)

For easier conversion of the RCF or *g-force* into revolutions per min, the equation can be transformed as follows:

$$R = 299 \sqrt{\frac{RCF}{r}}$$

Technical appendix is subject to error and technical modifications.

Alignment Chart



By use of a ruler, the third value relating to two known scale values can be read from the alignment chart.

Maximal Centrifuge Capacity of Tubes, Reaction Tubes and Microplates

The maximum centrifuge capacity for Greiner Bio-One tubes, reaction tubes and microplates is listed in the form of the RCF in the tables below.

Measuring method:
For centrifugation, all products were filled with water up to their maximum filling volume.

Determination of the maximum RCF in a swinging-bucket rotor was conducted in a Thermo Scientific Centrifuge (Heraeus Multifuge BSR Plus). Determination of the maximum RCF in a fixed-angle rotor was conducted in a Sorvall Centrifuge (Evolution RC). Therefore special rotor inserts for different vessel shapes and sizes were used for a stable fit.

Reaction Tubes

Cat.-No.	Volume [ml]	max. RCF [g] fixed-angle rotor
616 2XX	1.5	18000
623 2XX	2.2	16000
667 2XX	0.5	51400
693 2XX	0.5	18000
716 2XX	1.5	20000
717 2XX	1.5	20000
722 2XX	2.0	22000
742 2XX	0.7	28000

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Polystyrene Tubes

Cat.-No.	Dimensions ø [mm] x height [mm]	max. RCF [g] swinging-bucket rotor	max. RCF [g] fixed-angle rotor
103 1XX	10.5 x 40	5800	-[1]
106 1XX	11 x 63	5800	6200
109 1XX	11 x 70	5200	-[1]
112 1XX	12 x 55	5800	6200
115 1XX	12 x 75	5800	5800
116 1XX	12 x 75	5800	-[1]
120 1XX	12.4 x 75	4800	5000
125 1XX	13 x 100	4000	7500
136 1XX	14 x 100	4000	5200
160 1XX	16 x 100	5800	6200
163 1XX	16 x 100	3000	5000
164 1XX	16.8 x 100	5000	5000
166 1XX	16 x 110	2500	3200
172 1XX	16.5 x 103	4800	4800
186 1XX	17 x 120	2500	2800
187 1XX	17 x 100	5200	6600
188 1XX	17 x 120	2500	4500
191 1XX	18 x 95	4000	5500
201 1XX	24 x 90	1000	3500

[1] No fitting rotor inserts available.

Polypropylene Tubes

Cat.-No.	Dimensions ø [mm] x height [mm]	max. RCF [g] swinging-bucket rotor	max. RCF [g] fixed-angle rotor
102 2XX	8.5 x 44	5800	20000
112 2XX	12 x 55	5800	30000
115 2XX	12 x 75	5800	34000
121 2XX	12.5 x 48	5800	34000
122 2XX	12.5 x 48	5800	34000
123 2XX	12.5 x 42	5800	26000
124 2XX	12.5 x 86	5800	34000
126 2XX	12.4 x 47	5800	26000
127 2XX	12.4 x 83	5800	34000
160 2XX	16 x 100	5800	34000
160 297	16 x 100	3500	34000
163 2XX	16 x 100	5000	26000
184 261	17 x 77	4800	34000
187 201	17 x 100	4800	34000
187 261	18 x 95	4800	34000
188 2XX	17 x 120	4000	15000
191 2XX	18 x 95	4800	34000
210 2XX	30 x 115	2800	11500
227 2XX	30 x 115	3200	9500
227 28X	30 x 115	3200	9000

Polyethylene Tubes

Cat.-No.	Dimensions ø [mm] x height [mm]	max. RCF [g] swinging-bucket rotor	max. RCF [g] fixed-angle rotor
112 3XX	12 x 55	4200	22000
115 3XX	12 x 75	4200	20000
160 3XX	16 x 100	3500	30000
187 3XX	17 x 100	5800	20000

Technical appendix is subject to error and technical modifications.

Polycarbonate Tubes

Cat.-No.	Dimensions ø [mm] x height [mm]	max. RCF [g] swinging-bucket rotor	max. RCF [g] fixed-angle rotor
160 501	16 x 100	5800	34000

Multiwell Plates

Cat.-No.	Multiwell Plate	max. RCF [g] swinging-bucket rotor
657 160	6 well, PS, clear	4800
665 102	12 well, PS, clear	4800
662 160	24 well, PS, clear	4800
677 180	48 well, PS, clear	4800

Microplates

Cat.-No.	Microplate	max. RCF [g] swinging-bucket rotor
650 101	96 well, PS, U-bottom, clear	1000
651 101	96 well, PS, V-bottom, clear	4800
655 101	96 well, PS, F-bottom, clear	4800
650 201	96 well, PP, U-bottom, natural	4800
651 201	96 well, PP, V-bottom, natural	4800
655 201	96 well, PP, F-bottom, natural	4800
655 209	96 well, PP, U-bottom, black	4800
655 074	96 well, PS, F-bottom, white	4800
655 076	96 well, PS, F-bottom, black	4800
655 094	96 well, PS, µClear®, white	4800
655 096	96 well, PS, µClear®, black	4800
655 801	96 well, PS, UV-Star®	4800
780 201	96 well, PP, MASTERBLOCK® 1 ml	4800
780 270	96 well, PP, MASTERBLOCK® 2 ml	4800
786 201	96 well, PP, MASTERBLOCK® 0.5 ml	4800
781 101	384 well, PS, clear	4800
781 073	384 well, PS, white	4800
781 077	384 well, PS, black	4800
781 094	384 well, PS, µClear®, white	4000
781 096	384 well, PS, µClear®, black	3000
781 201	384 well, PP, F-bottom, natural	4800
781 280	384 well, PP, V-bottom, natural	4800
781 270	384 well, PP, V-bottom, Deep Well, natural	4800
781 801	384 well, PS, UV-Star®	4800
784 101	384 well, PS, Small Volume™, clear	800
784 075	384 well, PS, Small Volume™, white	800
784 076	384 well, PS, Small Volume™, black	800
784 201	384 well, PP, Small Volume™, natural	4800

Microplates

Cat.-No.	Microplate	max. RCF [g] swinging-bucket rotor
782 101	1536 well, PS, HiBase, clear	1800
782 074	1536 well, PS, HiBase, white	1500
782 077	1536 well, PS, HiBase, black	1500
782 094	1536 well, PS, µClear®, HiBase, white	1000
782 096	1536 well, PS, µClear®, HiBase, black	1500
782 270	1536 well, PP, V-bottom, Deep Well, natural	4800
783 101	1536 well, PS, LoBase, clear	4800
783 075	1536 well, PS, LoBase, white	4800
783 076	1536 well, PS, LoBase, black	4800
783 094	1536 well, PS, µClear®, LoBase, white	4800
783 096	1536 well, PS, µClear®, LoBase, black	4800

PCR Plates

Cat.-No.	PCR Plate	max. RCF [g] swinging-bucket rotor
652 270	96 well, PP, natural, full-skirt	4800
652 280	96 well, PP, natural, half-skirt	4800
652 290	96 well, PP, natural, half-skirt, suitable for ABI	4800
785 201	384 well, PP, natural, full-skirt	4800
785 290	384 well, PP, natural, full-skirt, suitable for ABI	4800

For centrifugation the plates were filled with water as follows:

96 well	300 µl
384 well	50 µl
1536 well	5 µl

Laboratory Information for Sample Storage

Freezing protocol

1. Wash the cells with warm PBS solution, aspirate the solution and cover the cells with a solution containing trypsin and EDTA (a thin liquid film is enough; the concentration should be evaluated for each cell line).
2. Incubate the cells for max. 3 - 5 min at 37 °C.
3. Once the cells detach from the bottom, stop incubation by adding cell culture medium supplemented with serum and slightly suspend cells using a pipette.
4. Spin down the suspension (500 x g, 5 min) and resuspend the pellet with medium containing serum.
5. Determine the cell number (using a Neubauer chamber).
6. Spin down the cells for 5 min at 500 x g and discard the supernatant. Resuspend the pellet with an adequate volume of cell culture medium containing serum.
7. Mix the cell suspension 1:1 with freezing medium (60 % medium, 20 % FCS, 20 % DMSO) and transfer it in Cryo.s™. For freezing in Cryo.s™ the concentration of cells should be 1 – 5 x 10^6 cells/ml.
8. Cryo.s™ containing cells should be frozen at a cooling rate of -1 K/min. This can be achieved by placing them into an isopropanol-filled chamber at -70 °C. If other types of samples are contained, Cryo.s™ may be frozen directly at -20 °C, -70 °C or in the gas phase of liquid nitrogen. In order to assure even freezing of the sample, 4 and 5 ml Cryo.s™ should be frozen at -20 °C overnight before transferring them to -70 °C or to the gas phase of liquid nitrogen.
9. Then transfer the Cryo.s™ into the nitrogen tank. To avoid contamination (e.g. mycoplasma) and due to safety precautions it is recommended to store the Cryo.s™ in the **gas phase** above and not in the liquid nitrogen.

Thawing protocol

1. Immediately after removing them out of the nitrogen tank the frozen cells are thawed in about 1-2 min brandishing the Cryo.s™ in a water bath at 37 °C. The thawing process should be performed as fast as possible.
2. Transfer the thawed cell suspension into a 15 ml tube and mix it immediately with copious amounts of cell culture medium containing serum.
3. After spinning down the cells (500 x g, 5 min) discard the supernatant and resuspend the pellet in an appropriate cell culture medium supplemented with serum and transfer it into one or more cell culture flasks.
4. Follow the recommended cell concentration for seeding.
5. During the next 12 hours cells should rest.
6. A change of medium is recommended after 24 resp. 48 hours.

Safety advisory for working with Cryo.s™

Cryo.s™ tubes are intended for sample storage exclusively in the gas phase over liquid nitrogen or in freezers! If Cryo.s™ are stored in the liquid phase, nitrogen can seep into the tubes. Then upon thawing the vaporising nitrogen can generate high pressure, ultimately resulting in an explosion, as well as the release of any infectious material.
Always take appropriate personal safety measures when working with Cryo.s™, including wearing safety clothing, using goggles and working at a safety laboratory bench.
When undertaking cryogenic preservation, Cryo.s™ must be evenly exposed to freezing temperatures. Uneven temperature exposures can cause formation of ice plugs (i.e. at tube top) that inhibit the expansion of freezing liquid (i.e. at tube bottom), resulting in dangerous high pressure and subsequent harm or damage of tubes.

Never exceed maximum working volumes as specified in → chapter 11.

Laboratory Information for Immunology

Volume-Dependent Wetting of Immunological Products

Liquid volume [µl]	Covered area [mm²]	Liquid height [mm]	Area / volume ratio [cm²/cm³]
96 Well ELISA Microplate, U-Bottom			
25	34	1.7	13.6
50	52	2.6	10.4
75	68	3.4	9.1
100	84.6	4.2	8.5
125	99	4.9	7.9
150	115.5	5.7	7.7
175	130	6.4	7.4
200	145	7.1	7.3
225	160	7.8	7.1
250	174.7	8.5	7.0
275	190	9.2	6.9
300	205	9.9	6.8
96 Well ELISA Microplate, V-Bottom			
25	35	2.3	14.0
50	54.6	3.4	10.9
75	72.4	4.4	9.7
100	88.6	5.3	8.9
125	105	6.2	8.4
150	123.8	7.2	8.3
175	140.8	8.1	8.0
200	156	8.9	7.8
96 Well ELISA Microplate, F-Bottom/Standard			
25	47	0.8	18.8
50	62	1.55	12.4
75	77.5	2.3	10.3
100	92	3.0	9.2
125	108	3.8	8.6
150	123	4.5	8.2
175	137.6	5.2	7.9
200	152.3	5.9	7.6
225	168	6.65	7.5
250	183	7.35	7.3
275	197	8.0	7.2
300	212	8.7	7.1
96 Well ELISA Microplate, F-Bottom/Chimney Well			
25	47	0.7	18.8
50	64	1.5	12.8
75	78.5	2.2	10.5
100	93	2.9	9.3
125	108	3.6	8.6
150	122.6	4.3	8.2
175	137.5	5.0	7.9
200	152	5.7	7.6
225	167	6.4	7.4
250	182	7.1	7.3
275	197	7.8	7.2
300	212	8.4	7.1
96 Well ELISA Microplate, F-Bottom, Half Area			
25	38	1.65	15.2
50	60	3.2	12.0
75	81.5	4.7	10.9
100	103.6	6.2	10.4
125	124.5	7.6	10.0
150	144	8.9	9.6
175	165.8	10.3	9.5
200	181.7	11.5	9.1
C8 Strip Plate			
25	39	1.0	15.6
50	56	1.9	11.2
75	73	2.8	9.7
100	88.6	3.6	8.9
125	104.3	4.4	8.3
150	120	5.2	8.0
175	136.5	6.0	7.8
200	150.8	6.7	7.5
225	165.4	7.4	7.4
250	181	8.15	7.2
275	196	8.85	7.1
300	211	9.55	7.0
F8 Strip Plate			
25	50.4	0.8	20.2
50	64	1.45	12.8
75	79.7	2.2	10.6
100	93.5	2.85	9.4
125	108.3	3.55	8.7
150	123	4.25	8.2
175	138	4.95	7.9
200	153	5.65	7.7
225	167	6.3	7.4
250	182	7.0	7.3
275	196	7.65	7.1
300	211.5	8.35	7.1
U8 Strip Plate			
25	34	1.7	13.6
50	52	2.6	10.4
75	68	3.4	9.1
100	84	4.2	8.4
125	99.6	4.95	8.0
150	115	5.75	7.7
175	129.6	6.45	7.4
200	144	7.15	7.2
225	159	7.85	7.1
250	174	8.55	7.0
275	189	9.25	6.9
300	204	9.95	6.8
F12 Strip Plate			
25	43.8	0.95	17.5
50	60.6	1.85	12.1
75	76.8	2.7	10.2
100	93.3	3.55	9.3
125	109	4.35	8.7

Liquid volume [µl]	Covered area [mm²]	Liquid height [mm]	Area / volume ratio [cm²/cm³]
150	125	5.15	8.3
175	141.2	5.9	8.1
200	155.6	6.65	7.8
225	171	7.4	7.6
250	185	8.1	7.4
275	200	8.8	7.3
300	215	9.5	7.2
U16 Strip Plate			
25	35	1.75	14.0
50	52	2.6	10.4
75	68	3.4	9.1
100	84	4.2	8.4
125	98.6	4.9	7.9
150	115	5.7	7.7
175	129.6	6.4	7.4
200	144	7.1	7.2
225	159	7.8	7.1
250	174	8.5	7.0
275	189	9.2	6.9
300	204	9.9	6.8

Liquid volume [µl]	Covered area [mm²]	Liquid height [mm]	Area / volume ratio [cm²/cm³]
F16 Strip Plate			
25	49	0.8	19.6
50	63	1.5	12.6
75	79.8	2.3	10.6
100	94.3	3.0	9.4
125	108	3.7	8.6
150	123.5	4.4	8.2
175	138	5.1	7.9
200	153	5.8	7.7
225	168	6.5	7.5
250	183	7.2	7.3
275	198	7.9	7.2
300	213	8.6	7.1
384 Well Microplate, F-Bottom			
25	39.07	2.50	15.6
50	66.60	4.8	13.3
75	94.03	7.00	12.5
100	119.63	9.05	12.0
125	145.6	11.05	11.6
132	152.6	11.50	11.6

Abbreviations

AB	Antibody
AB1	Primary Antibody
AB2	Secondary Antibody
AG	Antigen
AG-AB	Antigen-Antibody Complex
ANSI	American National Standards Institute
BHK-21 cells	Hamster Kidney Cells
cDNA	Complementary DNA
CHO cells	Chinese Hamster Ovary Cells
COC	Cycloolefins
CV	Coefficient of Variation
DMSO	Dimethyl Sulphoxide
DNA	Deoxyribonucleic Acid
DNase	Deoxyribonuclease
ECM	Extracellular Matrix
EIA	Enzyme Immuno Assay
EL-Rack	EasyLoad® Rack
ELISA	Enzyme Linked Immuno Sorbent Assay
EVA	Ethyl Vinyl Acetate
FDA	Food and Drug Administration
FIA	Fluorescence Immuno Assay
F-Rack	Filter Tip Rack
HDPE	High Density Polyethylene
HEK-293 Cells	Human Embryonic Kidney Cells
HLA	Human Leucocyte Antigen
HTS	High-Throughput Screening
HUVEC	Human Umbilical Cord-endothelial Cells
IgG	Immunoglobulin G
ID-Card	Identity Card
LAL	Limulus Amoebocyte Lysate
LIA	Luminescence Immuno Assay
med.	Medium
NIH-3T3 Cells	Mouse Fibroblast Cells
NMWCO	Nominal Molecular Weight Cut-Offs
PAGE	Polyacrylamide Gel Electrophoresis
PC	Polycarbonate
PC 12 Cells	Rat Adrenal Pheochromocytoma Cells
PCR	Polymerase Chain Reaction
PDL	Poly-D-Lysine
PET	Polyethylene Terephthalate
PETG	Polyethylene Terephthalate Copolymer
pH	pH Value
PLA	Polylactate
PLL	Poly-L-Lysine
PP	Polypropylene
PS	Polystyrene
PTFE	Polytetrafluoroethylene
RCG Cells	Rat Cerebellar Granule Cells
RIA	Radio Immuno Assay
RNA	Ribonucleic Acid
RNase	Ribonuclease
rRNA	Ribosomal RNA
RT	Room Temperature
SBS	Society for Biomolecular Sciences
SDS	Sodium Dodecyl Sulphate
SPA	Scintillation Proximity Assays
ST-Rack	Standard Rack
TC	Tissue Culture
USP	United States Pharmacopoeia
UV Spectrum	Ultraviolet Spectrum
VIS Spectrum	Visible Spectrum

Units	
°C	Degree Centigrade
Da	Dalton, the unit of molecular mass
g	Gram or Gravitational Acceleration (about 9.81 m/s²)
Gy	Gray, Radiation Unit
h	Hour
l	Liter
M	Molarity, moles of solute per litre of solution
m	Meter
min	Minute
Mol	Absolute Amount of Substance
s	Second