

# Multiwell plates

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June 2012



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- Filter Plates
- Collection/Storage Plates
- Speciality Plates
- MW Plate Accessories
- Appendices

# Multiwell plates aka Microtitre plates

Why were multiwell plates developed?

What is a Multiwell Plate?

What are they used for?

What are they made of?

How to choose the right plate?

# Why were multiwell plates developed

Increasing numbers of tests being run for diagnostics and screening. Single tube assays were awkward to set up for large numbers samples.

Arrays of reaction tubes (wells in plates) allowed for efficient assay set up with common reagents added manually, or later by automated dispensing platforms.

Many early assays used radioactivity. MW plates were used to increase throughput with multichannel readers. 6 or 12 wells could be read simultaneously.



Beckman FX workstation with 96 or 384 tip head and an 8 tip arm

# What is a multiwell plate?

- Solid base and filter base

- $24\text{well} = 6 \times 4$

- $48\text{well} = 8 \times 6$

- $96\text{well} = 12 \times 8$

- $384\text{well} = 24 \times 16$

- $864\text{well} = 36 \times 24$

- $1536\text{well} = 48 \times 32$



- SBS Industry standard LENGTH and DEPTH since ~2003

$127.76 \pm 0.25\text{mm} \times 85.48 \pm 0.25\text{mm}$   
(by  $14.35 \pm 0.25\text{mm}$  height)

# What are they used for?

Diagnostics Immuno or other assays, determining the presence or amount of a substance in a biological sample

Screening Assays to screen compound libraries against disease model in new drug discovery

Cell Culture Live cell culture for testing and functional assays for fundamental research and screening

Storage A convenient way to store, manage and handle lots of samples (compound libraries etc.)

Parallel processing of multiple samples

# What are they made of?

## Solid Plates

- Polystyrene (PS)-Aqueous uses
- Polypropylene (PP)-Solvent uses
- Multi-Chem (Whatman exclusive)-Combi-chem uses with organic solvents



## Filter Plates PS and PP body plus

- Barex- Scintillant/radioactive uses
- Glass Filled PP filtering samples with solvents

## Filters Various materials- application specific

## Speciality Plates- PS with Clear plastic or Glass bottom

# Polystyrene (PS) Plates

Widely used; plates are rigid and easily handled by automation. White, black and clear variants. Easily heat sealed

Predominantly used for setting up and running assays employing **aqueous buffers**.

Limited chemical compatibility;  
generally **Not** compatible with  
Organic solvents.



Hydrophobic surface- Proteins can adsorb to surfaces-  
good for immuno assays.



# Polypropylene (PP) plates

Not as rigid as PS; Feels soft! Good Chemical compatibility. Can be heated without affecting contents (used for PCR). Distortion can occur during heat sealing.

Relatively good compatibility with some organic solvents. Very widely used for compound library storage typically for samples dissolved in DMSO.

Low binding surface for proteins, nucleic acids and most chemical species.



# Multichem Plates- (Whatman exclusive material)

Co-polymer plates with excellent chemical compatibility designed for combi-chem applications

Very low binding for biomolecules

Long term storage

Available in 24, 96 and 384 well format



# Solvent Resistance of Plate Materials

Solvent	Polystyrene	Polypropylene	Multichem
Acetic Acid	R	R	R
Butyl Alcohol	R	R	R
Ethanol	R	R	R
Methanol	R	R	R
Acetonitrile	NR	R	R
Chloroform	NR	LR	R
Dichloromethane	NR	LR	R
DMSO	NR	R	R
Dioxane	NR	R	R
THF	NR	LR	R
Toluene	NR	LR	R

R= Recommended;  
 LR= Limited Resistance;  
 NR= Not recommended

# Glass Filled Polypropylene (GFPP)

Used in filter plates; Rigid like PS, so better than PP for automation has good general chemical compatibility (acids, bases and several organic solvents such as ethanol). Pale Grey in appearance.

## Barex-(Used in filter plates)

Acrylonitrile-methylacrylate co-polymer grafted onto nitrile. Very good chemical resistance including aromatic organic solvents as used with liquid scintillant cocktails for radioactive applications

# How to choose the right plate

- Application will dictate choice
- Aqueous buffer/ solvent based?
- What volumes will be used?
- Will filtration/ separation be carried out?
- Do I need to keep filtrate, retentate or both
- Do I want to process samples further/ seal/ store?

# FILTER PLATES

# UNIFILTER Filter plates

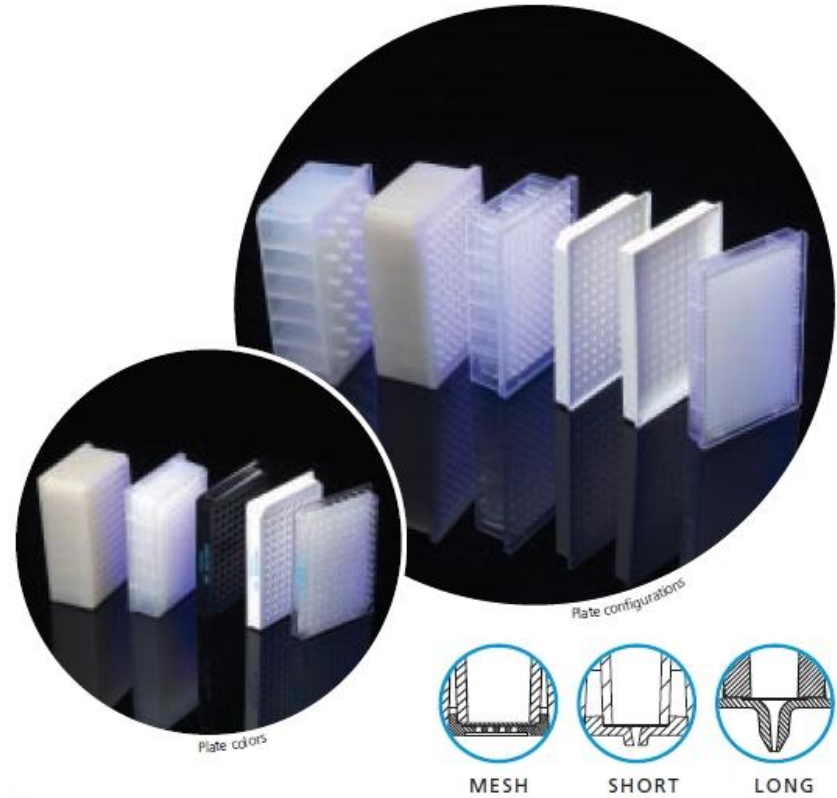
Plates with integral Filters;

Many different filter types

GF/B, GF/C, GF/D, GF/F,  
Polypropylene (PP),  
Meltblown PP (depth filter),  
PVDF, PTFE, CA, CN, P81  
(cation exchanger), DE81  
(anion exchanger)

## Depth/Pre-filters

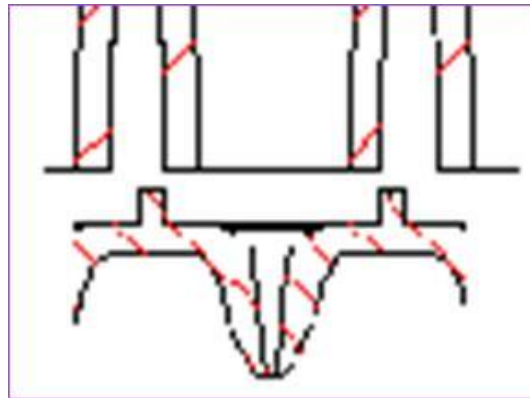
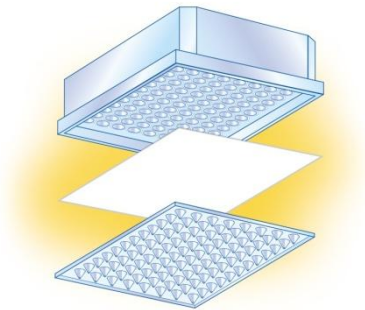
Can be used to collect/retain materials from liquid samples by filtration/binding onto filter media and optionally to collect/retain filtrate from liquid samples in collection plates.





# Filter plate construction

- Robust construction-with Ultrasonic welding; the Filter media is cut to well profile during manufacturing process
- Designed for minimal well to well cross talk



*Whatman provides ultrasonic plate welding technology. As the plate sections are welded together, the filter media is automatically cut by the plates to perfectly align with the wells and drip directors. This simplifies manufacturing and prevents well-to-well crosstalk.*

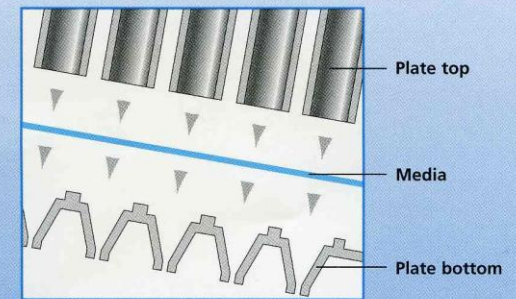


Figure 1. Components Before Assembly

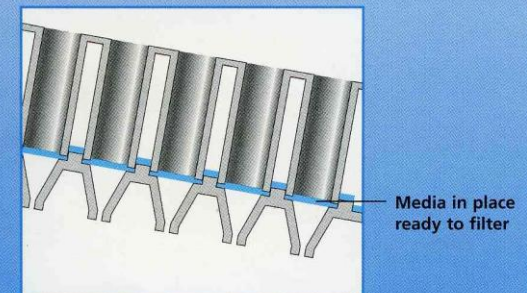
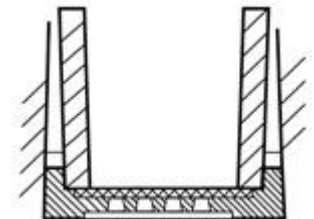
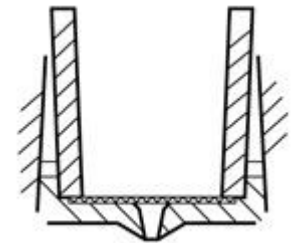
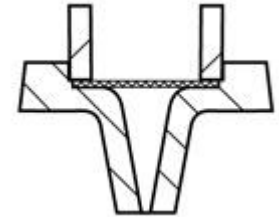


Figure 2. Plate with Media Cut into Disks and Sealed



# Filter Plates Drip directors

Director	USES	Equipment
Long (LDD)	Used when filtrate is needed, directed into wells of collection plate e.g. lysate clarification	Vacuum (Univac 3) or Centrifuge used with collection plate
Short (SDD)	When filtrate is not required, e.g. DNA binding plate formats. Good flow rate	Can be used with vacuum filtrate to waste system of centrifuge with collection plate
Mesh	When filtrate isn't needed, cell harvest, binding assays- good for fast capture and washing. Barex body plate used for radioactive kinase assays. Fast flow	Univac 1 filtrate to waste system



# Filter Media properties

Filter Media	Flow Rate*	Protein Binding	Hydrophilic	Solvent Resistance	Physical strength	Thermal resistance	General Comments
Glass Microfiber (GF)	5	Moderate	YES***	Very Good	Poor	High 500°C	Wide range, typically used as absorptive or wicking media and pre-filters. Excellent particle retention and clogging resistance. Used for DNA binding applications
Polypropylene (PP)	2	Very LOW	NO	Good	Good	<80°C	Typically used for pre-filtration. Very low extractables chemically inert
Cellulose Acetate (CA)	3	LOW	YES	Poor	OK	<120°C	Good strength, general purpose microbial filter with low protein binding
Cellulose Nitrate (CN)	4	HIGH	YES	Poor	OK	<125°C	Highly adsorptive membrane typically used for DNA/RNA/ Protein hybridisation and ELISA/ RIA assays
Polyvinylidene fluoride (PVDF) Hydrophilic**	4	LOW	YES	Good	Good	<135°C	Low protein binding media with good chemical resistance
P81 Cellulose based		HIGH Depends on pH	YES	OK		<120°C	Cationic exchange media contains cellulose phosphate
DE81 Cellulose based			YES	OK		<120°C	Anionic exchange media contains DEAE Cellulose

# Typical Applications for Filter plates

DNA binding/capture (Bind Genomic DNA, Plasmid, Cosmids, BACS, PACS etc.) Nucleic acid containing entities bind to Glass Fibre under chaotropic buffer conditions (usually high Molarity guanidine or urea salts and/or alcohol containing)

Lysate Clarification - removal of unwanted protein and other precipitates by filtration. The filtrate is collected for further processing

Dye terminator removal. Filter plates to which customers add size exclusion media such as Sephadex G50 resin to facilitate removal of labelled dye nucleotides and short primers from amplification reaction. Small species stay in resin and the large DNA is eluted first

Protein precipitation - acetonitrile precipitated proteins in plasma or serum samples are removed by filtration. The filter has an upper pre-filter to remove the larger particulates and a lower oleophobic membrane which allows for addition and mixing without liquid egress. Vacuuming allows the filtrate containing the desired materials to be collected

ELISA - Uses a cellulose nitrate membrane filter plate to immobilise First antibody (up to 40µg/well). Sample and then detection antibody conjugate are then applied. A stacked 96W 800µl plate is used together with a 300µl clear PS collection plate for filtrate

Kinase assays - Utilises P81 filter plates which bind peptides after acidification with phosphoric acid (peptides/proteins are positively charged after acidification and bind to negative phosphate groups in filter media). Historically used for radiolabelled assays with scintillant cocktail added to plates after capture of the radiolabelled peptides on filter. The excess radiolabelled ATP or phosphate does not stick to the filter and is removed with the filtrate

# Product Advice Card UNIFILTER Plates1

## 96 well Polystyrene body 350µl volume

Catalogue Number	Filter media	Plate Body	Drip Director	Quantity/ PACK
7700-1303	GF/B (1.0µm)	CLEAR PS	SHORT	50
7700-1305	0.45µm PP	CLEAR PS	SHORT	50
7700-1306	0.45µm PVDF hydrophilic	CLEAR PS	SHORT	50
7700-1308	0.45µm CA	CLEAR PS	SHORT	50
7700-3301	GF/C (1.2µm) (hydrophilic)	WHITE PS	SHORT	50
7700-3303	GF/B (1.0µm)	WHITE PS	SHORT	50
7700-3304	25-30µm PP	WHITE PS	SHORT	50
7700-3305	0.45µm PP	WHITE PS	SHORT	50
7700-3306	0.45µm PVDF	WHITE PS	SHORT	50
7700-3307	ELISA (0.45µm CN)	WHITE PS	SHORT	50
7700-3310	GF/F (0.7µm)	WHITE PS	SHORT	50
7700-3312	P81	WHITE PS	SHORT	50
7770-0006*	0.45µm PVDF+ 0.45µM PP	WHITE PS	SHORT	50



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7770-0006\* Supplied irradiated with lid ; recommended for ELISPOT assays

Multiwell Plates  
7/11/2012

# Product Advice Card UNIFILTER Plates 2 96 well Polystyrene body 800µl volume

Catalogue Number	Filter media	Plate Body	Drip Director	Quantity/ PACK
7700-1801	GF/C (1.2µm)	CLEAR PS	SHORT	25
7700-1804	20-25µm MBPP	CLEAR PS	SHORT	25
7700-1806	0.45µm PVDF hydrophilic	CLEAR PS	SHORT	25
7700-2801	Dye Terminator GF/C (1.2µm)	CLEAR PS	LONG	25
7700-2803	GF/B (1.0µm)	CLEAR PS	LONG	25
7700-2804	25-30µm MBPP	CLEAR PS	LONG	25
7700-2805	0.45µm PP	CLEAR PS	LONG	25
7700-2806	0.45µm PVDF	CLEAR PS	LONG	25
7700-2808	0.45µm CA	CLEAR PS	LONG	25
7700-2810	DNA binding	CLEAR PS	LONG	25
7700-2811	GF/D (2.7µm)	CLEAR PS	LONG	25
7720-2830	Lysate Clarification	CLEAR PS	LONG	25
7770-0062	25µm MBPP over 0.45µm PP	CLEAR PS	LONG	25

# Product Advice Card UNIFILTER Plates3

## 96 well Glass-filled PP 2ml volume

Catalogue Number	Filter media	Plate Body	Drip Director	Quantity/ PACK
7700-7201	GF/C (1.2µm)	Glass-filled PP	LONG	25
7700-7203	GF/B (1.0µm)	Glass-filled PP	LONG	25
7700-7204	25-30µm PP	Glass-filled PP	LONG	25
7700-7206	0.45µm PVDF	Glass-filled PP	LONG	25
7700-7211	GF/D (2.7µm)	Glass-filled PP	LONG	25
7700-7224	10µm PP	Glass-filled PP	LONG	25
7720-7236	Protein Precipitation FAST FLOW 2LAYER FILTER	Glass-filled PP	LONG	5
7720-7235	Protein Precipitation 2LAYER FILTER	Glass-filled PP	LONG	1

# Product Advice Card UNIFILTER Plates4 96 well MESH Bottom Plates

Catalogue Number	Filter media	Plate Body	Drip Director	Quantity/ PACK
7700-4301	GF/C (1.2µm) hydrophilic	WHITE PS	MESH	50
7700-4313	DE81	WHITE PS	MESH	50
7700-4303	GF/B (1.0µm)	WHITE PS	MESH	50
7700-4312	P81	WHITE PS	MESH	50
7700-0512	P81	BAREX	MESH	50

# Product Advice Card UNIFILTER Plates

## 24 well 10ml PP Plates

Catalogue Number	Filter media	Plate Body	Drip Director	Quantity/ PACK
7700-9917	10-12µm MBPP	PP	Long	25
7700-9901	GF/C (1.2µm)	PP	Long	25
7700-9904	25-30µm MBPP	PP	Long	25
7700-9905	PTFE Laminate	PP	Long	25

## 384 Well 100ul PS plates

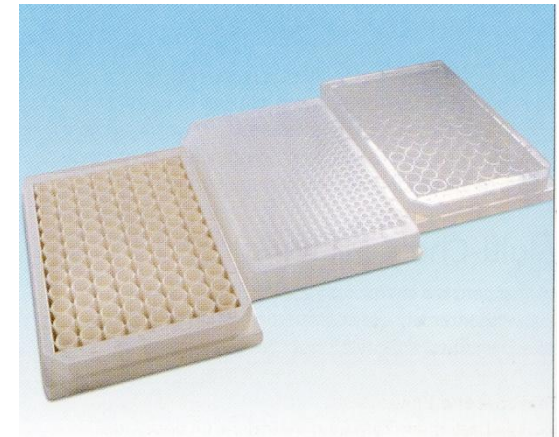
Catalogue Number	Filter media	Plate Body	Drip Director	Quantity/ PACK
7700-1101	Dye Terminator	Polystyrene	Long	50
7700-2110	DNA Binding Special GF	Polystyrene	Long	50
7700-2106	0.45µm PVDF hydrophilic	polystyrene	Long	50



# Collection/Storage Plates

# Collection/Storage Plates

- UNIPLATES- solid bottom plates
- Collection plates used with Filter plates
- Storage plates used with filter plates and as stand alone products



# Product Advice Card

## Collection and Storage Plates (PP)

Catalogue Number	Well Format	Well Volume	Plate Material	Well base profile	Irradiated with Lid	Quantity/ case
7701-5110	24well	10ml	Polypropylene	ROUND	YES	25
7701-5102	24well	10ml	Polypropylene	ROUND	NO	25
7701-5500	48well	5ml	Polypropylene	FLAT (RECTANGULAR)	NO	25
7701-5250*	96well	250µl	Polypropylene	V BOTTOM	NO	50
7701-5750	96well	750µl	Polypropylene	ROUND	NO	25
7701-5200	96well	2ml	Polypropylene	ROUND	NO	25
7701-5205	96well	2ml	Polypropylene	ROUND	YES	25
7701-5101	384well	80µl	Polypropylene	V BOTTOM	NO	50
7701-5400	384well	400µl	Polypropylene	ROUND (SQUARE WELL)	NO	25

# Product Advice Card

## Collection and Storage Plates (PS)

Catalogue Number	Well Format	Well Volume	Plate Material	Well base profile	Irradiated with Lid	Quantity/ case
7701-1250	96well	250µl	Clear PS	V BOTTOM	NO	50
7701-3250	96well	250µl	White PS	V BOTTOM	NO	50
7701-2250	96well	250µl	Black PS	V BOTTOM	NO	50
7701-2350	96well	300µl	Black PS	FLAT	NO	50
7701-1350	96well	300µl	Clear PS	FLAT	NO	50
7701-3350	96well	300µl	White PS	FLAT	NO	50
7701-1651	96well	650µl	Clear PS	FLAT (SQUARE WELL)	NO	50
7701-1750	96well	750µl	Clear PS	ROUND	NO	25
7701-1800	96well	800µl	Clear PS	FLAT	NO	25
7701-1100	384well	100µl	Clear PS	FLAT	NO	50

# Product Advice Card

## Collection/Storage Plates (MultiChem)

Catalogue Number	Well Format	Well Volume	Plate Material	Well base profile	Irradiated with Lid	Quantity/ case
7701-6102	24well	10ml	MultiChem	V BOTTOM	NO	10
7701-6250	96well	250µl	MultiChem	V BOTTOM	NO	10
7701-6750	96well	750µl	MultiChem	V BOTTOM	NO	10
7701-6200	96well	2ml	MultiChem	V BOTTOM	NO	10
7701-6101	384well	80µl	MultiChem	V BOTTOM	NO	10

# Speciality Plates

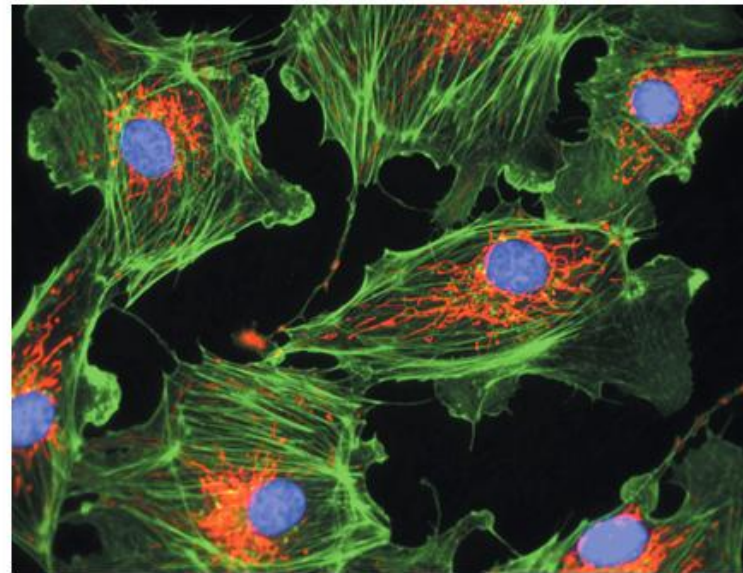
# Speciality Plates For Cell culture and Optical measurement

White plates for luminescence assays

Black plates for fluorescence assays

Thin (175 $\mu$ m) flat Glass bottom plates for high sensitivity microscopy and imaging applications (UV/Visible)

Clear view optically clear (visible spectrum > 360nm) polymer bottom plates for cell based assays. Tissue culture treated for cell attachment by plasma gas treatment; Sterilized by Gamma Irradiation



# Product Advice Card Speciality PLATES

## 96Well Clear base for Optical Applications

Catalogue Number	Well Format/ Volume	SKIRTED	Plate Material	Well base	Tissue Culture Treated/ Sterilized	Quantity/ case
7716-2375	96Well 300µl	YES	PS	Glass	YES Irradiated	5
7716-2370	96Well 300µl	NO	PS	Glass*	YES Irradiated	5
7706-1365	96Well 300µl	NO	Clear PS	Glass	NO	5
7706-2370	96Well 300µl	NO	Black PS	Glass*	NO Irradiated	5
7706-2375	96Well 300µl	YES	Black PS	Glass	NO Irradiated	5
7716-2380	96Well 300µl	YES	Clear PS	0.76mm Clear Polymer	YES Irradiated	50



# QC of MW plates

Solid MW Plates are manufactured and packed for GE in a clean environment. QC is by visual inspection.

Unifilter Plates are Manufactured at GE's Cardiff facilities and QC testing is by visual inspection for weld integrity, leak testing/ filtration testing under vacuum (of a sample number of plates), with a coloured dye solution, carried out at the start and during manufacturing runs

Glass bottom Speciality plates are visually inspected for scratches and tissue culture treatment effectiveness is tested for by water drop dispersion testing.



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# MW Plate Accessories

Plate Sealing Films

CapMats Flexible plate sealing mats

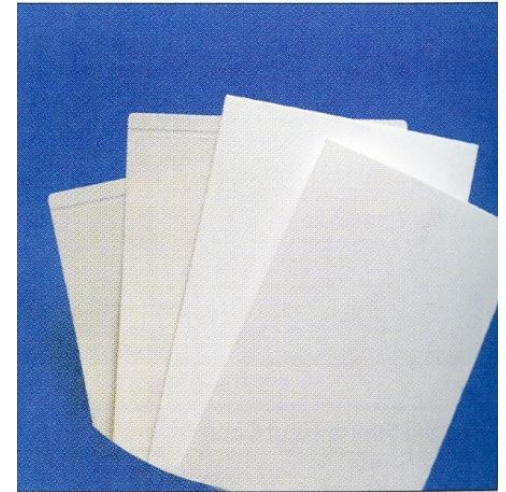
Plate Lids

Vacuum filtration Manifolds

# Plate Seals- stop loss of sample from MW plates by evaporation/spillage during storage and handling.

## Options for sealing MW plates.

- Cold sealing with adhesive backed films (PP or polyester, PE) -mainly for aqueous samples to -20 °C - can be used to seal any plate material. May be used for solvent containing samples for short term storage (solvent vapour may interact with adhesive)
- Heat sealing For PP plates - clear PP seal or aluminium backed (most secure, protects from light). Generally used for aqueous and solvents for longer term freezer storage to -80°C
- Alternatively use a Capmat



These plate seals are not pierceable

# Product Advice Card

## Plate Sealing Films +MW Plate Lid

Catalogue Number	Description	Quantity/pack
7704-0001	Clear Polyester Thin cold sealing film; adhesive backing 0.05mm thick	100
7704-0009	Clear Polypropylene cold sealing film; adhesive backing 0.05mm thick	100
7704-0002	Aluminium foil, applied with heat and pressure	100
7704-0003	Clear polypropylene Film applied with heat and pressure	100

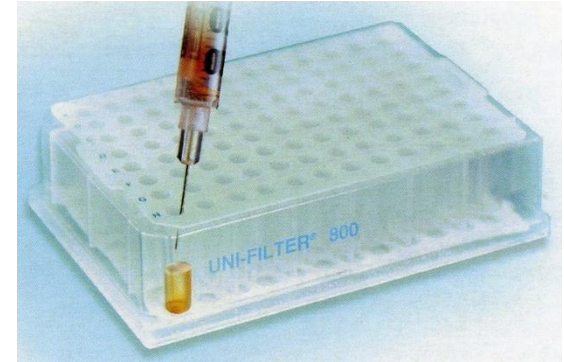
Catalogue Number	Description	Quantity/pack
7704-1001	Clear Polystyrene Universal Lid	100

# Capmats Push fit flexible plate sealing

Flexible 24 and 96 well dimpled sheets made of silicone or other inert materials for push sealing of MW plates. Suitable for long term cold temperature storage and applications requiring heating.

Non Pierceable EVA and Santoprene Capmats for aqueous and aqueous/solvent mixtures -20°C to 60°C (EVA) -20 to 95°C (Santoprene) EVA is not autoclavable, Santoprene mats are)

Pierceable Silicone Capmats usable with solvents; reseal after needle puncture usable to -80°C to 95°C (Silicone mats autoclavable at 120°C)



# Product Advice Card

## Sealing plate Options CapMats

Catalogue number	Well format	Capmat; Material	Microplate compatibility	Quantity per pack
7704-0004	96	Square format EVA	2ml microplates	100
7704-0005	96	Round format EVA	750 and 800 $\mu$ l microplates	100
7704-0006	48	Rectangular format EVA	5ml microplates	100
7704-0007	24	Square format Santoprene	10ml microplates	100
7704-0104	96	Square format Silicone	2ml microplates	50
7704-0105	96	Round format Silicone	350, 750 and 800 $\mu$ l microplates	50
7704-0014	24	BugStopper venting Silicone	10ml microplates	5



# Filtration accessories, vacuum setups, VacAssist Filtration Manifolds

- UniVac 1 the filtrate goes to waste sample on filter
- UniVac 3 collect the filtrate from each well into collection plate; (3 types, Black Anodised aluminium body for most applications, PTFE body for use with strong solvents (e.g. for combichem), Acrylic if filtrate needs to be observed)
- VacAssist placed on plate top- helps all wells to empty



# Product Advice Card

## Filtration Manifolds and accessories

Catalogue code	Description	Quantity/Pack
7705-0101	UNIVAC 1 MANIFOLD Polyurethane vacuum manifold for filtering to waste	1
7705-0102	UNIVAC 3 PTFE coated aluminium filter/collect vacuum manifold for volumes from 100µl to 10ml	1
7705-0106	UNIVAC 3 Solid PTFE filter/collect vacuum manifold for volumes from 100µl to 10ml	1
7705-0107	UNIVAC 3 Acrylic filter/collect vacuum manifold for volumes from 100µl to 10ml	1
7705-0109	Replacement Viton o-rings for filter/collect manifold	5
7705-0108	Replacement Viton gasket s for filter/collect manifold	5
7705-0112	Vacuum assist (PTFE film) with Frame	1



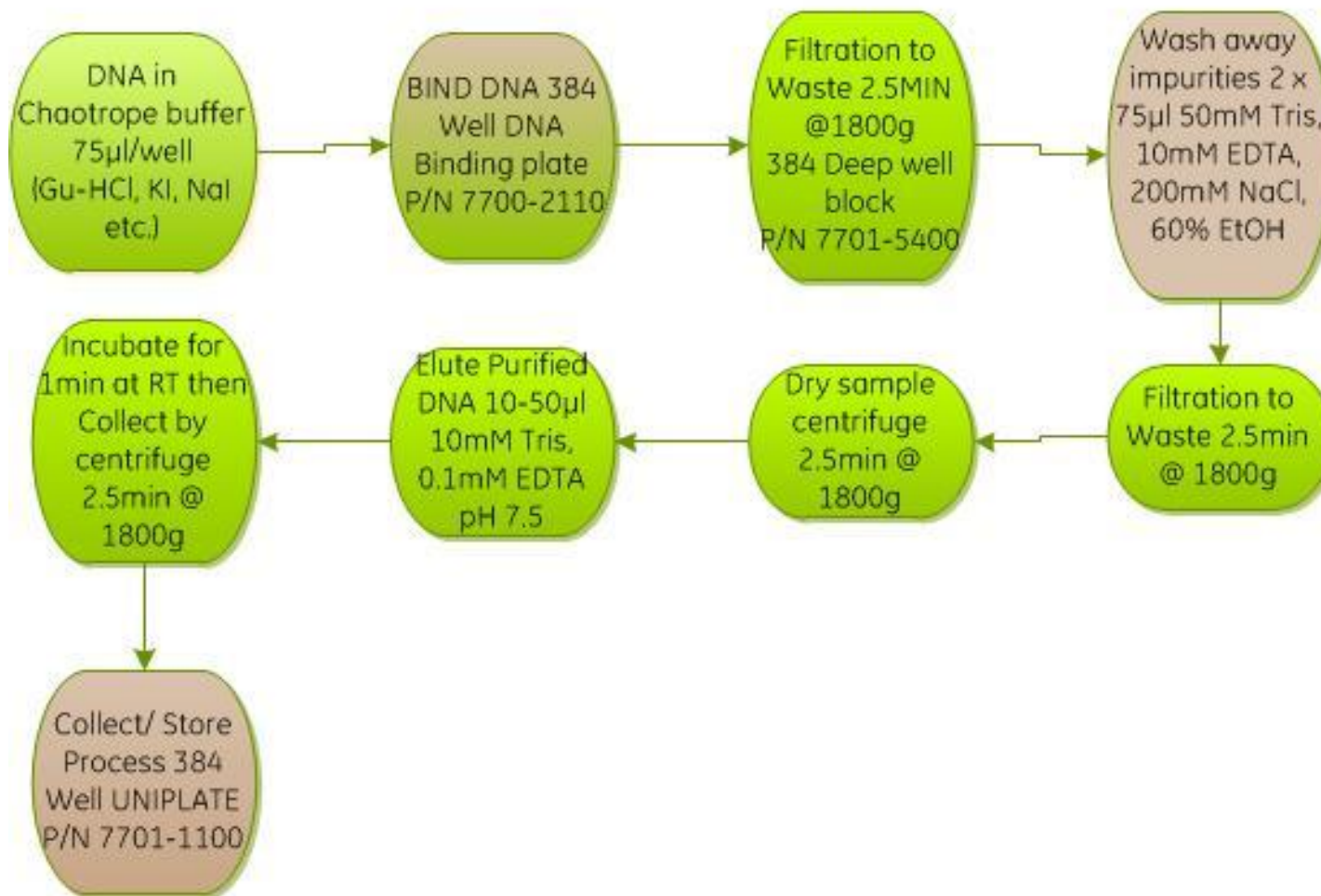
# Application Specific MW plates

# Application specific MW plates

- DNA Purification Binding Plates
- Kinase assays
- Protein Precipitation Plates
- ELISA Plates ELISPOT
- Bacterial Growth Plate
- Lysate Clarification Plates
- Dye Terminator Removal Plates

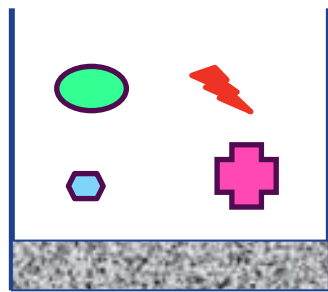
# DNA binding 384 well Typical Protocol

## 384 Well DNA Binding Microplate TYPICAL PROTOCOL

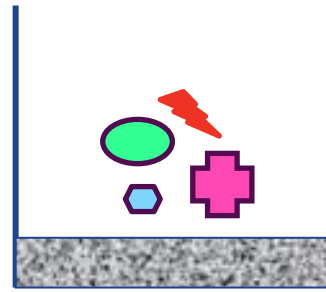


# Kinase assays (Radioactive format)

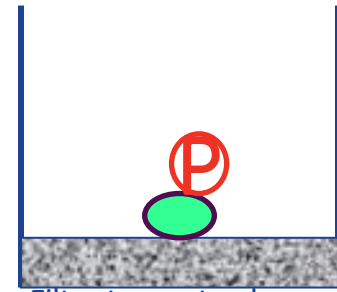
Assay Principle Radiolabelled phosphate is incorporated onto substrate by enzyme and then after adding acid the free negatively charged phosphate passes through negatively charged filter (P81 media) which captures the positively charged labelled substrate. Scintillant is added to the base sealed plate and the amount of bound  $^{33}\text{P}$  (or  $^{32}\text{P}$ ) is determined.



Add reagents and incubate



Add phosphoric acid to stop reaction and acidify



Filter to waste, dry, apply seal to base, add scintillant and count in LSC



Protein or peptide substrate



$^{33}\text{P}$  or  $^{32}\text{P}$  -ATP



Kinase Enzyme



Enzyme co-factors



Radiolabelled phosphate group



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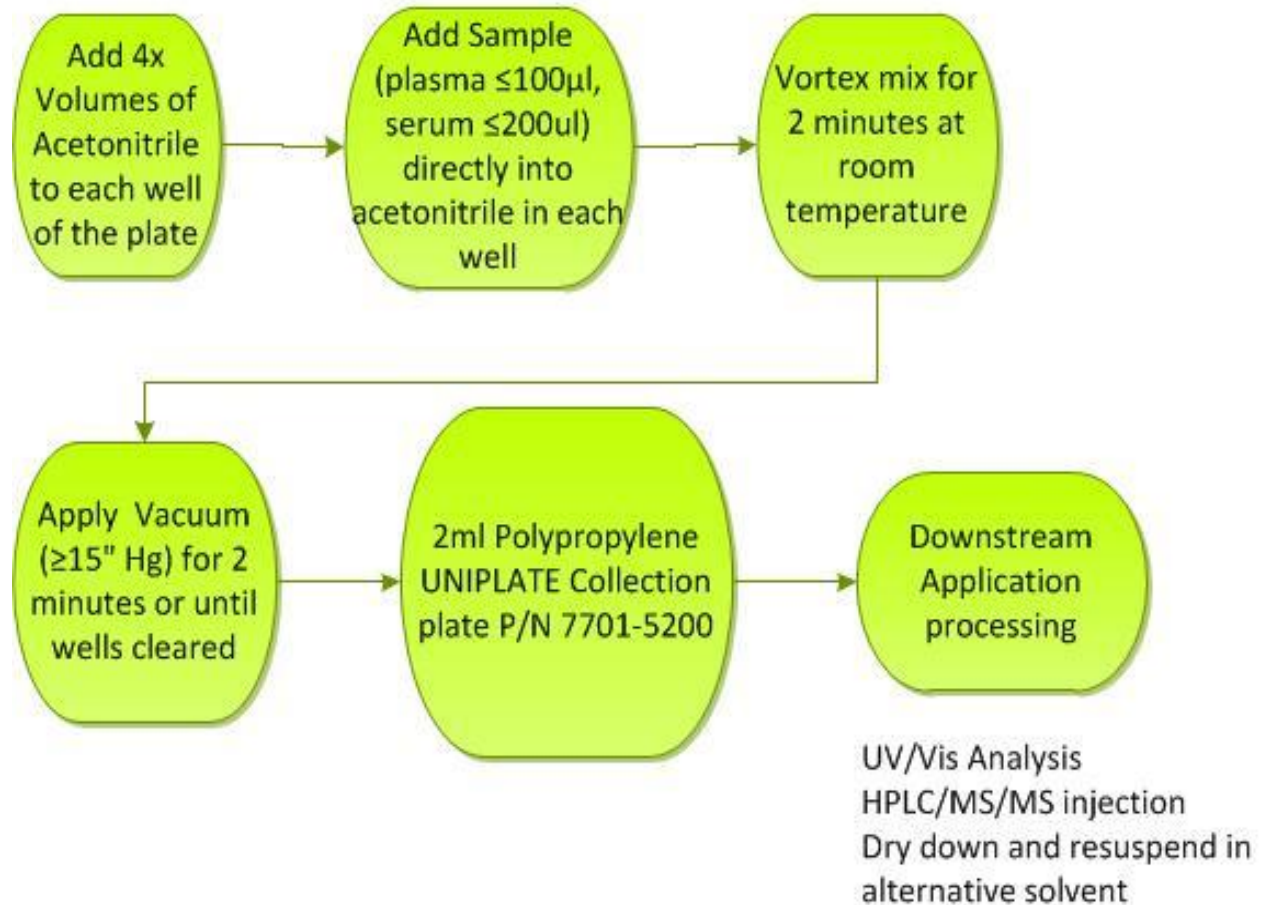
7700-4312 PS P81 or 7700-0512 Barex P81 Unifilter

Multiwell Plates  
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# Protein Precipitation

Fast Flow Protein Precipitation Protocol  
96 Well 2ML FF PPT Plate P/N 7720-7236

This is for the removal of proteins from samples, achieved by precipitating protein using acetonitrile and then filtering off. The filtrate is then taken for further processing minus unwanted protein



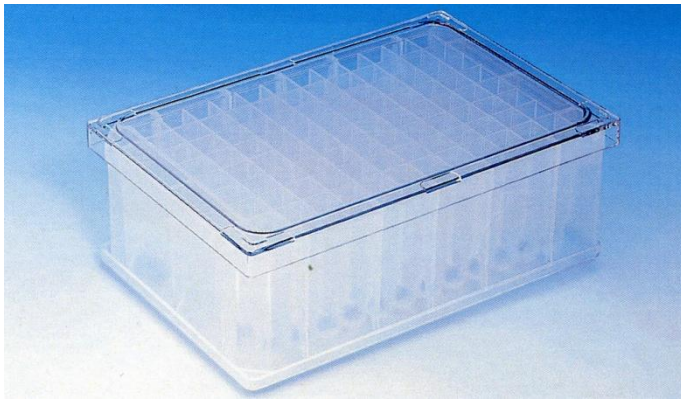
# Elispot Assay

7770-0006 Filter plate with PVDF (phobic) membrane + PP membrane. The membrane is good for immobilising proteins such as antibodies. The Plate is supplied, irradiated with a lid and is designed for coating with an antibody that is raised for example against a cell marker such as a cytokine. Cells are cultured in the plates and as the antigen is expressed it is bound to the Antibody and then subsequently detected in an ELISA format

# 96 well Bacterial Growth Plate

Medical grade Polypropylene plate used to maintain 96 individual bacterial cultures for overnight culture and then spin down of bacteria.

Gamma irradiated and supplied with a lid the plates can be used with lysate clarification UNIFILTER and then DNA binding UNIFILTER plates to isolate 96 DNA samples in parallel.

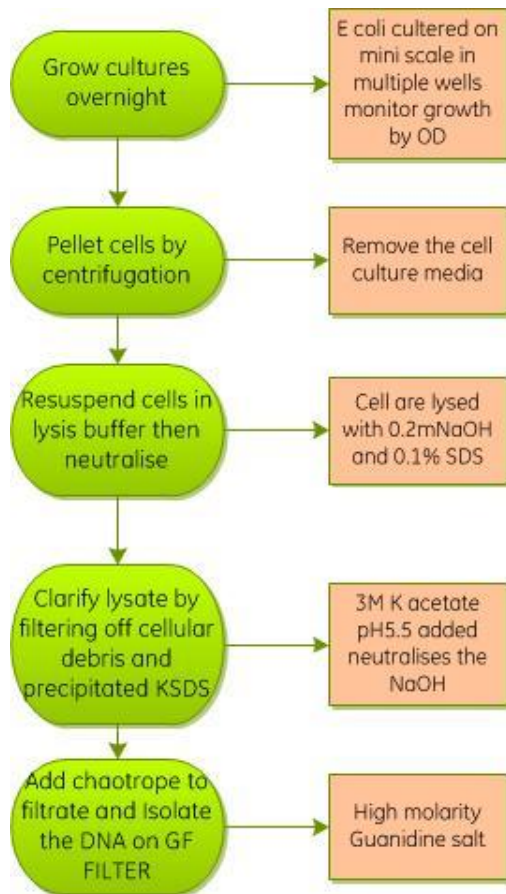


Alternative option is the 24 well 10ml UNIPLATE with the Sterile BugStopper venting pierceable Capmat





# Lysate Clarification (e.g. for Plasmid DNA isolation from Ecoli or GDNA isolation from biologicals)



Plasmid DNA is widely generated in molecular Biology Research. Cloning has allowed multiple small scale plasmid preparations to be carried out in parallel in mini cultures (in MW plates for example 2 ml 96 Well Growth Plate P/N 7701-5205.) Parallel semi automated processing by pelleting, cell lysis, lysate clarification then binding of liberated plasmid DNA onto for example plasmid binding plate P/N 7700-2810 following by elution and downstream processing has been accommodated by the use of GE Whatman filter/collection plates.



# Plasmid Isolation from Cell cultures

## Product Selection guide

Part number	Description	Quantity/ pack
7720-2830	96W 800 µl Lysate Clarification Plate	25
7770-0062	96W 800 µl Lysate Clarification Plate 2 0.45 µm PP filter	25
7701-5205	2 ml 96 Well Growth Plate, irradiated, lidded, individually bagged	25
7700-2810	800 µl Plasmid DNA Binding Plate	25
7701-5200	2 ml Collection Plate	25
7701-5750	750 µl Harvest Plate	25
7701-5250	250 µl Recovery Collection	25
7705-0102	800 µl UniVac 3 Vacuum/Collect Manifold	1

# Dye Terminator Removal



96-well, polystyrene + Sephadex G-50  
800 $\mu$ L GF/C (7700-2801)

Load 100 $\mu$ L of G-50 to each well  
Add 800 $\mu$ L diH<sub>2</sub>O Leave for 3 hours

↻ Centrifuge 750 x g, 2 min

Apply samples\* into each well \*Pre-treatment of  
↻ Centrifuge 750 x g, 2 min samples with  
SDS/heat reduces  
dye blobs

Collection and Process further

Generating plate plus media in-  
house >10 fold cheaper than ready  
made equivalent 96 well product

# Appendix

- FAQs MW plates/Accessories
- Properties of Glass fibre filters
- Unifilter Media Characteristics (3)
- Application/ Uses by Membrane type (4)
- Glossary of terms used in applications employing Multiwell plates

# FAQs MW plates

Q	A
What is the max centrifugal force that Unifilter plates can be spun at?	PS plates can be spun at up to 4000g. 1800-2000g would be recommended generally.
Can Unifilter plates be used in centrifuges and vacuum systems	Yes, both methods work with Unifilter plates
Which Vacuum manifolds accept Whatman Unifilter plates?	All except Millipore and Qiagen units
Which Univac Vacuum device should I use with Unifilter plates	Univac1 unit is suitable if the filtrate is not required. Univac3 vacuum units can be used when either/both the filtrate or the captured/filtered component is required
Which Uniplate collection plate is compatible with which Unifilter plate	The collection plates are suitable for use with any filter plate with the same number of wells. Users should consider the chemical compatibility of the sample with both the filter and collection plate. Polypropylene or Multichem plates are suitable for long term storage with solvents containing samples. PS collection plates are generally used for aqueous samples.
Which plates are SBS size compliant?	Most of the plates are manufactured to be compliant with size guidelines; however due to the differential shrinkage of plastics during moulding the actual dimensions may be slightly out. See actual typical Plate Dimensions pages.
What solvents are polypropylene plates resistant to?	Polypropylene plates have some resistance to most solvents and are resistant to alcohols, Methyl sulphoxide, dimethylformamide. Glass filled PP plates are used with acetonitrile for protein precipitation work. Not suitable for extended use with aromatic solvents such as benzene and toluene, chlorinated solvents, acetone or alkanes such as hexane.
What is the maximum temperature for using Polypropylene plate with organic solvents	It is advisable to keep temperature to 50°C when using solvents.
What solvents are polystyrene plates resistant to?	Polystyrene plates are not really suitable for use with organic solvents. They are generally used with aqueous buffer samples. They are suitable for use with simple alcohols such as methanol, ethanol and isopropanol/ Water mixtures
When should I use a Multichem plate	Multichem plates good for storage with low binding properties for biological and chemical materials; they are very resistant to organic solvents and should be considered if combinatorial chemical synthesis is to be carried out. They can be used at up to 60°C with most organic solvents including DMF, dichloromethane, THF and TFA.

# Properties of Glass Fiber filters

FilterPlate Media	Real Name	Characteristics	When to Use
GF	Glass Fiber Filter	<ul style="list-style-type: none"> <li>◆ 100% borosilicate glass, chemically inert, binder free</li> <li>◆ Depth filters</li> <li>◆ Fast flow rates</li> <li>◆ High loading capacity</li> <li>◆ Retention of fine particles</li> <li>◆ Withstand temperature to 500°C</li> <li>◆ Can absorb lots of water</li> <li>◆ Can be made transparent for later microscopic examination</li> <li>◆ Poor physical strength</li> <li>◆ Serve as good prefilters to remove junk</li> <li>◆ Low protein binding</li> <li>◆ Binds DNA in the presence of chaotropic salts</li> </ul>	
GF/B	GF subtype B	<ul style="list-style-type: none"> <li>◆ 1.0 µm</li> <li>◆ Has real "depth" 675 µm thick</li> <li>◆ High loading capacity</li> </ul>	<ul style="list-style-type: none"> <li>◆ Used to trap concentrated suspensions of small particles</li> <li>◆ Liquid scintillation counting (LSC)</li> <li>◆ Receptor Binding Assays</li> <li>◆ Can bind ~ 200 µg protein</li> </ul>
GF/C	GF subtype C	<ul style="list-style-type: none"> <li>◆ 1.2 µm</li> <li>◆ Good flow rate and fine particle retention</li> <li>◆ Not very thick 260 µm</li> </ul>	<ul style="list-style-type: none"> <li>◆ Collection of suspended solids in water and waste</li> <li>◆ Harvesting radiolabeled cultured cells (<math>2.5 \times 10^5</math> cells/well)</li> <li>◆ Collection of membrane fragments for protein binding assays</li> <li>◆ Clarification of protein solutions</li> <li>◆ Collection of protein precipitates</li> <li>◆ Clarification of tissue homogenates</li> </ul>
GF/C, hydrophobic	GF subtype C treated with silicone to be water repelling	<ul style="list-style-type: none"> <li>◆ Same characteristics of GF/C</li> <li>◆ Retains aqueous solution in plate in the absence of a vacuum</li> </ul>	<ul style="list-style-type: none"> <li>◆ Can run an assay that requires an incubation step of the cultured cells before harvesting the cells for scintillation counting</li> </ul>
GF/D	GF subtype D	<ul style="list-style-type: none"> <li>◆ 2.7 µm</li> <li>◆ Thick filter 675 µm</li> <li>◆ High loading capacity</li> </ul>	<ul style="list-style-type: none"> <li>◆ Used to trap suspensions of larger particles</li> </ul>
GF/F	GF subtype F	<ul style="list-style-type: none"> <li>◆ 0.7 µm</li> <li>◆ Intermediate thickness 470 µm</li> </ul>	<ul style="list-style-type: none"> <li>◆ Can trap very small particles and molecules</li> <li>◆ Clarifying protein solutions</li> <li>◆ Filter samples prior to HPLC</li> <li>◆ Recommended for DNA binding purification</li> </ul>

# UNIFILTER MEDIA CHARACTERISTICS1

FilterPlate Media	Real Name	Characteristics	When to Use
PVDF, hydrophilic	Polyvinylidene fluoride	<ul style="list-style-type: none"> <li>◆ Low protein binding</li> <li>◆ 0.45 µm pore</li> <li>◆ Good flow rate</li> <li>◆ Compatible with aqueous and organic solvents</li> <li>◆ Does not bind DNA</li> <li>◆ Max temp 100°C</li> </ul>	<ul style="list-style-type: none"> <li>◆ To remove particulates from solution prior to analysis</li> <li>◆ To retain and wash cell membranes for assay</li> <li>◆ Retaining acid precipitated proteins</li> <li>◆ Collect precipitated DNA</li> <li>◆ Protein sequencing reactions</li> </ul>
PVDF, hydrophobic	Polyvinylidene fluoride	<ul style="list-style-type: none"> <li>◆ High protein binding</li> <li>◆ Max temp 100°C</li> </ul>	<ul style="list-style-type: none"> <li>◆ To remove particulates and trap proteins prior to analysis</li> <li>◆ ELISPOT assays</li> </ul>
MBPP	Melt Blown Polypropylene	<ul style="list-style-type: none"> <li>◆ 5 - 7 µm pore</li> <li>◆ Low flow rate</li> <li>◆ No protein binding</li> <li>◆ Solvent resistant</li> <li>◆ Physically strong</li> <li>◆ Working temps &lt;80°C</li> <li>◆ Slow flow rates</li> </ul>	<ul style="list-style-type: none"> <li>◆ For clarifying aqueous and organic solutions with fine particulates with a controlled flow rate</li> <li>◆ Used with solvents</li> <li>◆ Bead assays</li> <li>◆ Combinatorial Chemistry synthesis</li> <li>◆ Drug synthesis</li> </ul>
MBPP	Melt Blown Polypropylene	<ul style="list-style-type: none"> <li>◆ 10 - 12 µm pore</li> <li>◆ Low flow rate</li> <li>◆ No protein binding</li> <li>◆ Solvent resistant</li> <li>◆ Physically strong</li> <li>◆ Working temps &lt;80°C</li> <li>◆ Slow flow rates</li> </ul>	<ul style="list-style-type: none"> <li>◆ For clarifying aqueous and organic solutions with medium particulates with a controlled flow rate</li> <li>◆ Used with solvents</li> <li>◆ Bead assays</li> <li>◆ Combinatorial Chemistry synthesis</li> <li>◆ Drug synthesis</li> </ul>
MBPP	Melt Blown Polypropylene	<ul style="list-style-type: none"> <li>◆ 25 - 30 µm pore</li> <li>◆ Low flow rate</li> <li>◆ No protein binding</li> <li>◆ Solvent resistant</li> <li>◆ Physically strong</li> <li>◆ Working temps &lt;80°C</li> <li>◆ Slow flow rates</li> </ul>	<ul style="list-style-type: none"> <li>◆ For clarifying aqueous and organic solutions with larger particulates with a controlled flow rate</li> <li>◆ Used with solvents</li> <li>◆ Bead assays</li> <li>◆ Combinatorial Chemistry synthesis</li> <li>◆ Drug synthesis</li> </ul>

# UNIFILTER MEDIA CHARACTERISTICS2

FilterPlate Media	Real Name	Characteristics	When to Use
PP	Polypropylene	<ul style="list-style-type: none"> <li>◆ 10 µm pore</li> <li>◆ No protein binding</li> <li>◆ Solvent resistant</li> <li>◆ Low flow rate</li> <li>◆ Physically Strong</li> <li>◆ Working temps &lt;80°C</li> </ul>	<ul style="list-style-type: none"> <li>◆ For clarifying aqueous and organic solutions with large particles</li> <li>◆ Used with solvents</li> <li>◆ Inert membrane</li> </ul>
PP	Polypropylene	<ul style="list-style-type: none"> <li>◆ 0.45 µm pore</li> <li>◆ No protein binding</li> <li>◆ Solvent resistant</li> <li>◆ Low flow rate</li> <li>◆ Physically Strong</li> <li>◆ Working temps &lt;80°C</li> </ul>	<ul style="list-style-type: none"> <li>◆ For clarifying aqueous and organic solutions with very small particles</li> </ul>
CA	Cellulose Acetate	<ul style="list-style-type: none"> <li>◆ 0.45 µm pore</li> <li>◆ Medium flow rate</li> <li>◆ Low protein binding</li> <li>◆ Not solvent resistant</li> <li>◆ Moderate physical strength</li> <li>◆ Working temps &lt;120°C</li> <li>◆ Biologically inert</li> <li>◆ Hydrophilic</li> </ul>	<ul style="list-style-type: none"> <li>◆ Clarifying aqueous solutions</li> <li>◆ Low protein binding applications</li> <li>◆ To analyze retained particulates</li> <li>◆ Biological assays (receptor binding, recovering acid precipitated proteins)</li> <li>◆ Sterile filtering</li> </ul>
CN	Cellulose Nitrate	<ul style="list-style-type: none"> <li>◆ 0.45 µm pore</li> <li>◆ Good flow rate</li> <li>◆ High protein binding</li> <li>◆ Not solvent resistant</li> <li>◆ Not physically strong</li> <li>◆ Working temps &lt;125°C</li> <li>◆ Hydrophilic</li> </ul>	<ul style="list-style-type: none"> <li>◆ Clarifying aqueous solutions</li> <li>◆ For protein binding</li> <li>◆ ELISA assays</li> <li>◆ Immunoassays</li> <li>◆ Protein binding assays</li> <li>◆ RNA polymerase assay</li> </ul>
Nylon, Positive	Nylon, Positive	<ul style="list-style-type: none"> <li>◆ 0.45 µm pore</li> <li>◆ High protein binding</li> <li>◆ Physically strong and flexible</li> <li>◆ Hydrophilic</li> <li>◆ Temp max 135°C</li> <li>◆ Resistant to weak acid, strong and weak base, most hydrocarbons</li> </ul>	<ul style="list-style-type: none"> <li>◆ Protein binding assays</li> <li>◆ DNA assays</li> </ul>

# UNIFILTER MEDIA CHARACTERISTICS3

FilterPlate Media	Real Name	Characteristics	When to Use
<b>P-81</b>	Cellulose Phosphate	<ul style="list-style-type: none"> <li>◆ 0.23 mm thick</li> <li>◆ Strong cation exchanger</li> <li>◆ High capacity</li> </ul>	<ul style="list-style-type: none"> <li>◆ Protein kinase assay with peptide substrates</li> <li>◆ Enzyme assays</li> <li>◆ Membrane binds positively charged molecules</li> </ul>
<b>DE-81</b>	DEAE cellulose paper	<ul style="list-style-type: none"> <li>◆ 0.20 mm thick</li> <li>◆ Weak basic anion exchanger</li> </ul>	<ul style="list-style-type: none"> <li>◆ Reverse Transcriptase assays</li> <li>◆ DNA Polymerase Removal</li> <li>◆ Membrane binds negatively charged particles</li> </ul>
<b>PKP</b>	Oleophobic filter	<ul style="list-style-type: none"> <li>◆ When plate has organic liquids, it doesn't drip until vacuum is applied</li> </ul>	<ul style="list-style-type: none"> <li>◆ Clarifying strong organic liquids prior to analysis</li> <li>◆ Phase separation</li> </ul>
<b>Whatman 1 PS</b>	Phase Separation Plate	<ul style="list-style-type: none"> <li>◆ High grade filter paper impregnated with silicone making paper hydrophobic</li> <li>◆ Lets organic phase pass through quickly and traps aqueous layer</li> </ul>	<ul style="list-style-type: none"> <li>◆ For separating organic and aqueous phases during an extraction</li> <li>◆ Phenol:chloroform DNA extractions of small quantities of biomaterial</li> </ul>
<b>GF Pre filter Oleophobic filter</b>	Protein Precipitation	<ul style="list-style-type: none"> <li>◆ Prefilter removes coarse particles</li> <li>◆ Oleophobic layer retains organic layer without dripping</li> </ul>	<ul style="list-style-type: none"> <li>◆ Removing acetonitrile precipitated proteins from organic solution prior to analyzing</li> <li>◆ Phase separation</li> </ul>
<b>PS/PES</b>	Polysulfone	<ul style="list-style-type: none"> <li>◆ No protein binding</li> <li>◆ Naturally hydrophobic</li> <li>◆ Can be treated to be hydrophilic</li> <li>◆ Max temp 100oC</li> <li>◆ Resistant to acids &amp; bases</li> <li>◆ Limited resistant to solvents</li> </ul>	<ul style="list-style-type: none"> <li>◆ Ultrafiltration</li> <li>◆ Plasmid prep</li> <li>◆ PCR cleanup</li> <li>◆ Sequencing reaction cleanup</li> <li>◆ Peptide recovery</li> <li>◆ Protein concentration</li> <li>◆ Albumin removal</li> </ul>
<b>Polycarbonate</b>	UniCell 24 Microplate	<ul style="list-style-type: none"> <li>◆ Visually transparent</li> <li>◆ Low background staining</li> <li>◆ Membrane with controlled pore size</li> <li>◆ Cells can grow on membrane</li> <li>◆ Nutrients/metabolites move freely through the membrane pores</li> <li>◆ Very low protein binding</li> <li>◆ Max temp 140oC</li> <li>◆ Not solvent resistant</li> <li>◆ Limited resistance to acids &amp; bases</li> </ul>	<ul style="list-style-type: none"> <li>◆ Cell culture</li> <li>◆ Bioassays</li> <li>◆ Cytotoxicity assays</li> <li>◆ Cell migration assays</li> <li>◆ Caco-2 assays, ADMETox assays</li> </ul>



# Application/ Uses by Membrane Type1

Uses	Membrane
Sample prep Protein kinase/phosphatase assays Enzyme assays Membrane receptor binding assays Dye terminator removal Cell based immunoassays Bead cleavage assays Chemical synthesis & separations	PVDF phil
Protein binding assay ELISA ELISPOT Avidin-Biotin affinity assays DNA-binding protein assays Protein interaction assays	PVDF phob
Sample prep Protein kinase/phosphatase assays Enzyme assays Membrane receptor binding assays Dye terminator removal Cell based immunoassays Bead cleavage assays Chemical synthesis & separations Support for Sephadex, Sepharose, affinity, immunoaffinity resins Cell and bacterial lysate clarification	MBPP/PP

# Application/ Uses by Membrane Type2

Uses	Membrane
Sample prep Membrane receptor binding assays Receptor ligand binding assays Assays with protein or nucleic acid precipitation DNA binding	GF/B
Cell proliferation assays Cell harvesting assays Receptor ligand binding assays Sample prep Protein precipitation assays	GF/C
Sample prep Protein kinase/phosphatase assays Enzyme assays Membrane receptor binding assays Cell based immunoassays Bead cleavage assays Antimicrobial drug screening assay Chemical synthesis & separations Support for Sephadex, Sepharose, affinity, immunoaffinity resins Phase separation Liquid-liquid extraction of biological samples for LC/MS	GF/C phobic

# Application/ Uses by Membrane Type3

Uses	Membrane
Sample prep Solution clarification Support for sorbent resins (SPE)	GF/D
DNA binding Filtering before HPLC Clarifying solutions	GF/F
Sample prep Separation of large particles and organisms	Lysate clarification
Sample prep Enzyme assays Receptor binding assays BAC, Fosmid, Cosmid prep Lysate clarification Aqueous liquid clarification	CA
ELISA Protein coating assays Solid-phase radioimmuno assay (RIA) Protein binding assays	CN
Protein kinase assay with peptides Enzyme assays Sample prep Binding positively charged molecules	P-81 Phosphocellulose

# Application/ Uses by Membrane Type4

Uses	Membrane
Reverse transcriptase assay DNA polymerase removal Binding negatively charged molecules	DE-81
Incubation assays Phase separation Organic extractions	PKP
Incubation assays Protein precipitation Sample prep for HPLC, MS Phase separation	GF/PKP Protein Precipitation
Organic extractions Liquid-liquid extractions Sample prep for HPLC, MS	1PS Phase Separation
Cell migration, invasion, chemotaxis Caco-2 assays Permeability assays Cell based assays	Polycarbonate

# Actual Typical plate dimensions

Plates are manufactured by injection moulding

The Moulding tools define the desired dimensions however different material shrink to different amounts during cooling.

Plates from several batches of each of our current plate product range were physically measured and the average results are given on the next few slides.

There are some plates that do not conform to SBS but this does not mean they cannot be used

# Actual Typical plate dimensions by code Filter Plates

SBS		127.76 +/- 0.25 127.51to128.01	85.48 +/- 0.25 85.23to85.73	14.35 +/-0.25 14.10to14.60			SBS compliant? L+W
PLATE TYPE	Product codes	Length (mm)	Width (mm)	Height (mm)	Skirt height (mm)	Skirt to drip director (mm)	
96WELL CLEAR POLYSTYRENE BODY 350µl volume Short Drip director UNIFILTER plates	7700-1303, 7700-1305, 7700-1306, 7700-1308	127.46	85.24	14.33	2.72	1.27	N
96WELL WHITE POLYSTYRENE BODY 350µl volume Short Drip director UNIFILTER plates	7700-3301, 7700-3303, 7700-3304, 7700-3305, 7700-3306, 7700-3307, 7700-3310, 7700-3312, 7770-0006, 7770-0062	125.35	85.12	14.58	2.72	1.24	<u>N</u>
96WELL CLEAR POLYSTYRENE BODY 800µl volume Short Drip director UNIFILTER plates	7700-1801, 7700-1804, 7700-1806	127.64	85.45	30.66	6.2	0.25	<u>Y</u>
96WELL CLEAR POLYSTYRENE BODY 800µl volume Long Drip director UNIFILTER plates	7700-2801, 7700-2803, 7700-2804, 7700-2805, 7700-2806, 7700-2808, 7700-2810, 7700-2811, 7720-2830	127.69	85.52	30.71	6.2	3.61	<u>Y</u>
96WELL glass-filled PP BODY 2ml volume Long drip director UNIPLATE plates	7700-7201, 7700-7203, 7700-7204, 7700-7206, 7700-7211, 7700-7224, 7720-7236, 7720-7235	127.48	85.17	45.69	4.93	3.28	N
96WELL WHITE POLYSTYRENE BODY 350µl volume MESH Bottom UNIFILTER plates	7700-4301, 7700-4313, 7700-4303, 7700-4312,	127.36	85.14	14.61	2.67	n/a	N
96WELL BAREX BODY 350µl volume MESH Bottom UNIFILTER plates	7700-0512						Y
24WELL PP BODY 10ml Long Drip Director	7700-9901, 7700-9904, 7700-9905, 7700-9917	127.76	85.09	44.4	3.51	5.28	N
384WELL	7700-1101, 7700-2106, 7700-2110	127.89	85.67	14.86	3.23	3.84	Y

# Actual Typical plate dimensions by code Collection plates

SBS		127.76 +/- 0.25 127.51to128.01	85.48 +/- 0.25 85.23to85.73	14.35 +/-0.25 14.10to14.60		SBS compliant? L+W
PLATE TYPE	Product codes	Length (mm)	Width (mm)	Height (mm)	Skirt height (mm)	
24 well 10 ml Round bottom Multichem	7701-6102	128.42	86.21	44.22	3.48	N
96 Well 250µl V bottom Multichem	7701-6250	127.03	85.22	14.36	7.01	N
96 Well 750µl Round bottom Multichem	7701-6750	127.53	85.45	30.43	6.63	Y
96 Well 2ml Round Bottom Multichem	7701-6200	127.2	85.09	44.15	3.61	N
384 Well 80µl V bottom Multichem	7701-6101	128.35	85.8	14.33	2.84	N
96 Well 250µl Clear PS V bottom	7701-1250	127.56	85.45	14.71	6.91	Y
97 Well 250µl White PS V bottom	7701-3250	127.56	85.45	14.71	6.91	Y
98 Well 250µl Black PS V bottom	7701-2250	127.56	85.45	14.71	6.91	Y
96 Well 300µl Clear PS V bottom	7701-1350	127.56	85.45	14.71	6.55	Y
96 Well 300µl White PS V bottom	7701-3350	127.56	85.45	14.71	6.55	Y
98 Well 300µl Black PS V bottom	7701-2350	127.56	85.45	14.71	6.55	Y
96 Well 650µl Clear PS Round Bottom	7701-1651	127.66	85.47	14.61	6.02	Y
96 Well 750µl Clear PS Round Bottom	7701-1750	127.58	85.52	30.4	6.71	Y
96 Well 800µl Clear PS Round Bottom	7701-1800	127.61	85.5	30.66	6.65	Y
96 Well 2ml PP Round Bottom	7701-5200, 7701-5205	127.64	85.27	43.79	3.56	Y
384 Well 100µl Clear PS Flat Bottom	7701-1100	127.64	85.47	14.58	2.82	Y
24 Well 10ml PP Round Bottom	7701-5102, 7701-5110	128.22	85.45	44.27	3.43	N
48 Well 5ml PP Rectangular FLAT	7701-5500	127.61	85.17	43.71	3.56	N
96 Well 250µl PP V bottom	7701-5250	126.39	84.63	14.38	6.91	N
96 Well 750µl PP Round Bottom	7701-5750	127.64	85.42	30.28	7.14	Y
96 Well 2ml PP Round Bottom	7701-5200	127.64	85.27	43.79	3.56	Y
384 Well 80µl PP V bottom	7701-5101	127.3	84.94	14.38	2.67	N
384 Well 400µl PP Round Bottom	7701-5400	127.58	85.29	43.89	3	Y

# Actual Typical plate dimensions by code Speciality Plates and Lids

SBS		127.76 +/- 0.25 127.51to128.01	85.48 +/- 0.25 85.23to85.73	14.35 +/-0.25 14.10to14.60			SBS compliant? L+W
PLATE TYPE	Product codes	Length (mm)	Width (mm)	Height (mm)	Skirt height (mm)	Skirt to glass bottom base (mm)	
96well PS BODY Glass bottom, Skirted	7706-2375, 7716-237	127.71	85.32	14.2	6.25	-3.25	Y
96Well PS Glass bottom No Skirt	7706-1365, 7706-2370, 7716-2370	127.81	85.65	11.02	3.18	-0.33	Y
96Well PS Body Clear Polymer Base	7716-2380	127.89	85.39	14.2	6.25	n/a	Y

	EXTERNAL		INTERNAL	
Material	LENGTH (mm)	WIDTH (mm)	LENGTH (mm)	WIDTH (mm)
POLYSTYRENE	127.69	85.34	124.99	82.78
POLYPROPYLENE*	125.98	84.07	123.32	81.56
*NO LONGER AVAILABLE				



# Glossary of terms used in Applications employing Multiwell plates



Adobe Acrobat  
Document

